1894 MANUAL OF SURVEYING INSTRUCTIONS FOR THE SURVEY OF THE PUBLIC LANDS OF THE UNITED STATES AND PRIVATE LAND CLAIMS.

Prepared in conformity with law under the direction of THE COMMISSIONER OF THE GENERAL LAND OFFICE.

JUNE 30, 1894.

WASHINGTON: GOVERNMENT PRINTING OFFICE. 1894.
DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D. C., June 30, 1894.

GENTLEMEN:
The following instructions, including full and minute
directions for the execution of surveys in the field, are issued
under the authority given me by sections 453, 456, and 2398,
United States Revised Statutes, and must be strictly com-
plied with by yourselves, your office assistants, and deputy
surveyors.
All directions in conflict with these instructions are hereby
abrogated.
In all official communications, this edition will be known
and referred to as the Manual of 1894.
Very respectfully,

S. W. LAMOREUX,
Commissioner.

To SURVEYORS GENERAL OF THE UNITED STATES.

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MANUAL OF SURVEYING
INSTRUCTIONS.

HISTORY OF LEGISLATION FOR SURVEYS.

The present system of survey of the public lands was inau-
gurated by a committee appointed by the Continental Con-
gress, consisting of the following delegates:

Hon. THOS. JEFFERSON, Chairman .......... Virginia.
Hon. HUGH WILLIAMSON .............. North Carolina.
Hon. DAVID HOWELL .................. Rhode Island.
Hon. ELBRIDGE GERRY .............. Massachusetts.
Hon. JACOB READ .................... South Carolina.

On the 7th of May, 1784, this committee reported “An
ordinance for ascertaining the mode of locating and disposing
of lands in the western territory, and for other purposes
therein mentioned.” This ordinance required the public lands
to be divided into “hundreds” of ten geographical miles
square, and those again to be subdivided into lots of one mile
square each, to be numbered from 1 to 100, commencing in
the north-western corner, and continuing from west to east
and from east to west consecutively. This ordinance was
considered, debated, and amended, and reported to Congress
April 26, 1785, and required the surveyors “to divide the said
territory into townships of 7 miles square, by lines running
due north and south, and others crossing these at right
angles.”

The plats of the townships, respectively, shall be marked
by subdivisions into sections of 1 mile square, or 640
acres, in the same direction as the external lines, and num-
bered from 1 to 49. These sections shall be subdivi-
ded into lots of 320 acres.” This is the first record of the use
of the terms “township” and “section.”

May 3, 1785, on motion of Hon. William Grayson, of Vir-
ginia, seconded by Hon. James Monroe, of Virginia, the sec-
tion respecting the extent of townships was amended by
striking out the words “seven miles square” and substituting
the words “six miles square.” The records of these early
sessions of Congress are not very full or complete; but it does
not seem to have occurred to the members until the 6th of
May, 1785, that a township six miles square could not contain
49 sections of 1 mile square. At that date a motion to amend
was made, which provided, among other changes, that a
township should contain 36 sections; and the amendment
was lost. The ordinance as finally passed, however, on the
20th of May, 1785, provided for townships 6 miles square,
containing 36 sections of 1 mile square. The first public
surveys were made under this ordinance. The townships,
6 miles square, were laid out in ranges, extending northward
from the Ohio River, the townships being numbered from
south to north, and the ranges from east to west. The region
embraced by the surveys under this law forms a part of the
present State of Ohio, and is usually styled “The

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Seven Ranges.” In these initial surveys only the exterior lines
of the townships were surveyed, but the plats were marked
by subdivisions into sections of 1 mile square, and mile corners
were established on the township lines. The sections were
numbered from 1 to 36, commencing with No. 1 in the south-
east corner of the township, and running from south to north
in each tier to No. 36 in the northwest corner of the township,
as shown in the following diagram:

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The surveys were made under the direction of the Geog-
rapher of the United States.
The act of Congress approved May 18, 1796, provided for
the appointment of a surveyor general, and directed the sur-
vey of the lands northwest of the Ohio River, and above the
mouth of the Kentucky River, “in which the titles of the
Indian tribes have been extinguished.” Under this law one
half of the townships surveyed were subdivided into sections
“by running through the same, each way, parallel lines at the
end of every two miles, and by making a corner on each of said
lines at the end of every mile,” and it further provided that
“the sections shall be numbered, respectively, beginning
with the number one in the northeast section and proceeding
west and east alternately, through the township, with pro-
gressive numbers till the thirty-sixth be completed.” This
method of numbering sections, as shown by the following
diagram, is still in use:
The act of Congress approved May 10, 1800, required the township west of the Muskingum, which are directed to be sold in quarter townships, to be subdivided into half sections of three hundred acres each, as nearly as may be, by running parallel lines through the same from east to west, and from south to north, at the distance of one mile from each other, and marking corners, at the distance of each half mile, on the lines running from east to west, and at the distance of each mile on those running from south to north. And the interior lines of townships intersected by the Muskingum, and of all the townships lying east of that river, which have not been heretofore actually subdivided into sections, shall also be run and marked. And in all cases where the exterior lines of the townships thus to be subdivided into sections or half sections shall exceed, or shall not extend, six miles, the excess or deficiency shall be specially noted, and added to or deducted from the western and northern ranges of sections or half sections in such townships, according as the error may be in running the lines from east to west or from south to north.

The act of Congress approved February 11, 1805, directs the subdivision of the public lands into quarter sections, and provides that all the corners marked in the public surveys shall be established as the proper corners of sections, or subdivisions of sections, which they were intended to designate, and that corners of half and quarter sections not marked shall be placed, as nearly as possible, "equidistant from those two corners which stand on the same line." This act further provides that "The boundary lines actually run and marked shall be established as the proper boundary lines of the sections or subdivisions for which they were intended; and the length of such lines as returned by the surveyors shall be held and considered as the true length thereof, and the boundary lines which shall not have been actually run and marked as aforesaid shall be ascertained by running straight lines from the established corners to the opposite corresponding corners; but in those portions of the fractional townships, where no such opposite or corresponding corners have been or can be fixed, the said boundary line shall be ascertained by running from the established corners due north and south or east and west lines, as the case may be, to the external boundary of such fractional township."

The act of Congress approved April 25, 1812, provided "That there shall be established in the Department of the Treasury an office to be denominated the General Land Office, the chief officer of which shall be called the Commissioner of the General Land Office, whose duty it shall be, under the direction of the head of the Department, to superintend, execute, and perform all such acts and things touching or respecting the public lands of the United States, and other lands patented or granted by the United States, as have heretofore been directed by law to be done or performed in the office of the Secretary of State, of the Secretary and Register of the Treasury, and of the Secretary of War, or which shall hereafter by law be assigned to the said office."

The act of Congress approved April 24, 1820, provides for the sale of public lands in half quarter sections, and requires that "in every case of the division of a quarter section the line for the division thereof shall run north and south and fractional sections, containing 160 acres and upward, shall, in like manner, as nearly as practicable, be subdivided into half quarter sections, under such rules and regulations as may be prescribed by the Secretary of the Treasury; but fractional sections containing less than 160 acres shall not be divided."

The act of Congress approved May 24, 1824, provides "That whenever, in the opinion of the President of the United States, a departure from the ordinary mode of surveying land on any river, lake, bayou, or water course would promote the public interest, he may direct the surveyor general in whose district such land is situated, and where the change is intended to be made, under such rules and regulations as the President may prescribe, to cause the lands thus situated to be surveyed in tracts of two acres in width, fronting on any river, bayou, lake, or water course, and running back the depth of forty acres."

The act of Congress approved May 29, 1830 (secs. 2412, 2413, R. S.), provides for the fine and imprisonment of any person obstructing the survey of the public lands, and for the protection of surveyors, in the discharge of their official duties, by the United States marshal, with sufficient force, whenever necessary.

The act of Congress approved April 5, 1832, directed the subdivision of the public lands into quarter quarters; that in every case of the division of a half quarter section the dividing line should run east and west; and that fractional sections should be subdivided under rules and regulations prescribed by the Secretary of the Treasury. Under the latter provision the Secretary directed that fractional sections containing less than 160 acres, or the residuary portion of a fractional section, after the subdivision into as many quarter quarter sections as it is susceptible of, may be subdivided into lots, each containing the quantity of a quarter quarter section, as nearly as practicable, by so laying down the line of subdivision that they shall be 20 chains wide, which distances are to be marked on the plat of subdivision, as are also the areas of the quarter quarters and residuary fractions.

The last two acts above mentioned provided that the corners and contents of half-quarter and quarter-quarter sections should be ascertained, as nearly as possible, in the manner and on the principles directed and prescribed in the act of Congress approved February 11, 1805.
SYSTEM OF RECTANGULAR SURVEYING.

[See Plates I, III, and IV.]

1. Existing law requires that in general the public lands of the United States “shall be divided by north and south lines run according to the true meridian, and by others crossing them at right angles so as to form townships six miles square,” and that the corners of the townships thus surveyed “must be marked with progressive numbers from the beginning.”

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Also, that the townships shall be subdivided into thirty-six sections, each of which shall contain six hundred and forty acres, as nearly as may be, by a system of two sets of parallel lines, one governed by true meridians and the other by parallels of latitude, the latter intersecting the former at right angles, at intervals of a mile.

2. In the execution of the public surveys under existing law, it is apparent that the requirements that the lines of survey shall conform to true meridians, and that the townships shall be 6 miles square, taken together, involve a mathematical impossibility due to the convergence of the meridians.

Therefore, to conform the meridional township lines to the true meridians produces townships of a trapezoidal form which do not contain the precise area of 23,040 acres required by law, and which discrepancy increases with the increase in the convergency of the meridians, as the surveys attain the higher latitudes.

In view of these facts, and under the provisions of section 2 of the act of May 18, 1796, that sections of a mile square shall contain 640 acres, as nearly as may be, and also under those of section 3 of the act of May 10, 1800, that “in all cases where the exterior lines of the townships, thus to be subdivided into sections and half sections, shall exceed, or shall not extend 6 miles, the excess or deficiency shall be specially noted, and added to or deducted from the western or northern ranges of sections or half sections in such township, according as the error may be in running lines from east to west, or from south to north; the sections and half sections bounded on the northern and western lines of such townships shall be sold as containing only the quantity expressed in the returns and plats, respectively, and all others as containing the complete legal quantity,” the public lands of the United States shall be surveyed under the methods of the system of rectangular surveying, which harmonizes the incompatibilities of the requirements of law and practice, as follows:

First. The establishment of a principal meridian conforming to the true meridian, and, at right angles to it, a base line conforming to a parallel of latitude.

Second. The establishment of standard parallels conforming to parallels of latitude, initiated from the principal meridian at intervals of 24 miles and extended east and west of the same.

Third. The establishment of guide meridians conforming to true meridians, initiated upon the base line and successive standard parallels at intervals of 24 miles, resulting in tracts of land 24 miles square, as nearly as may be, which shall be

(The remainder of page 9, all of pages 10 through 16 and most of page 17 are deleted. They contain the pertinent Revised Statutes, and forms of contracts.)
subsequently divided into tracts of land 6 miles square by two sets of lines, one conforming to true meridians, crossed by others conforming to parallels of latitude at intervals of 6 miles, containing 23,040 acres, as nearly as may be, and designated townships.

Such townships shall be subdivided into thirty-six tracts, called sections, each of which shall contain 640 acres, as nearly as may be, by two sets of parallel lines, one set parallel to a true meridian and the other conforming to parallels of latitude, mutually intersecting at intervals of 1 mile and at right angles, as nearly as may be.

Any series of contiguous townships situated north and south of each other constitutes a range, while such a series situated in an east and west direction constitutes a tier.

The accompanying diagram (Plate III), and the specimen field notes (page 142), pertaining to the same, will serve to illustrate the method of running lines to form tracts of land 24 miles square, as well as the method of running out the exterior lines of townships, and the order and mode of subdividing townships will be found illustrated in the accompanying specimen field notes (page 172), conforming with the township plat (Plate IV). The method here presented is designed to insure as full a compliance with all the requirements, meaning, and intent of the surveying laws as practicable.

The section lines are surveyed from south to north and from east to west, in order to throw the excessor deficiency in measurement on the north and west sides of the township, as required by law. In case where a township has been partially surveyed, and it is necessary to complete the survey of the same, or where the character of the land is such that only the north or west portions of the township can be surveyed, this rule can not be strictly adhered to, but, in such cases, it will be departed from only so far as is absolutely necessary. It will also be necessary to depart from this rule where surveys close upon State or Territorial boundaries, or upon surveys extending from different meridians.

3. The tiers of townships will be numbered, to the north or south, commencing with No. 1, at the base line; and the ranges of the townships, to the east or west, beginning with No. 1, at the principal meridian of the system.

4. The thirty-six sections into which a township is subdivided are numbered, commencing with number one at the northeast angle of the township, and proceeding west to number six, and then east to number twelve, and so on alternately, to number thirty-six in the southeast angle. In all cases of surveys of fractional townships, the sections will bear the same numbers they would have if the township was full.

5. Standard parallels shall be established at intervals of every 24 miles, north and south of the base line, and guide meridians at intervals of every 24 miles, east and west of the principal meridian; thus confining the errors resulting from convergence of meridians and inaccuracies in measurement within comparatively small areas.


6. The surveys of the public lands of the United States, embracing the establishment of base lines, principal meridians, standard parallels, meander lines, and the subdivisions of townships, will be made with instruments provided with the accessories necessary to determine a direction with reference to the true meridian, independently of the magnetic needle.

Burt's improved solar compass, or a transit of approved construction, with or without solar attachment, will be used in all cases. When a transit without solar attachment is employed, Polaris observations and the retracements necessary to execute the work in accordance with existing law and the requirements of these instructions will be insisted upon.

7. Deputies using instruments with solar apparatus will be required to make observations on the star Polaris at the beginning of every survey, and, whenever necessary, to test the accuracy of the solar apparatus.

The observations required to test the adjustments of the solar apparatus will be made at the corner where the survey begins, or at the camp of the deputy surveyor nearest said corner; and in all cases the deputy will fully state in the field notes the exact location of the observing station.

Deputy surveyors will examine the adjustments of their instruments, and take the latitude daily, weather permitting, while running all lines of the public surveys. They will make complete records in their field notes, under proper dates, of the making of all observations in compliance with these instructions, showing the character and condition of the instrument in use, and the precision attained in the survey, by comparing the direction of the line run with the meridian determined by observation.

On every survey executed with solar instruments, the deputy will, at least once on each working day, record in his field notes the proper reading of the latitude arc; the declination of the sun, corrected for refraction, set off on the declination arc; and note the correct local mean time of his observation, which, for the record, will be taken at least two hours from apparent noon.

8. The construction and adjustments of all surveying instruments used in surveying the public lands of the United States will be tested at least once a year, and oftener, if necessary, on the true meridian, established under the direction of the surveyor general of the district; and if found defective, the instruments shall undergo such repairs or modifications as may be found necessary to secure the closest possible approximation to accuracy and uniformity in all field work controlled by such instruments.

A record will be made of such examinations, showing the number and character of the instrument, name of the maker, the quantity of instrumental error discovered by comparison, in either solar or magnetic apparatus, or both, and means taken to correct the same. The surveyor general will allow no

2. The adjustments should be verified daily when the instrument is in use.
surveys to be made until the instruments to be used therefor have been approved by him.

9. The township and subdivision lines will usually be measured by a two-pole chain of 33 feet in length, consisting of 50 links, each link being seven and ninety-two hundredths inches long. On uniform and level ground, however, the four-pole chain may be used. The measurements will, however, always be expressed in terms of the four-pole chain of 100 links. The deputy surveyor shall provide himself with a measure of the standard chain kept at the office of the surveyor general, to be used by him as a field standard. The chain in use will be compared and adjusted with this standard each working day, and such field standard will be returned to the surveyor general’s office for examination when the work is completed.

Deputy surveyors will use eleven tally pins made of steel, not exceeding 14 inches in length, weighty enough toward the point to make them drop perpendicularly, and having a ring at the top, in which will be fixed a piece of red cloth, or something else of conspicuous color, to make them readily seen when stuck in the ground.

**PROCESS OF CHAINING.**

In measuring lines with a two-pole chain, five chains are called a “tally,” and in measuring lines with a four-pole chain, ten chains are called a “tally,” because at that distance the last of the ten tally pins with which the forward chainman sets out will have been stuck. He then cries “tally,” which cry is repeated by the other chainman, and each registers the distance by slipping a thimble, button, or ring of leather, or something of the kind, on a belt worn for that purpose, or by some other convenient method. The hind chainman then comes up, and having counted in the presence of his fellow the tally pins which he has taken up, so that both may be assured that none of the pins have been lost, he then takes the forward end of the chain, and proceeds to set the pins. Thus the chainmen alternately change places, each setting the pins that he has taken up, so that one is forward in all the odd, and the other in all the even tallies. Such procedure, it is believed, tends to insure accuracy in measurement, facilitates the recollection of the distances to objects on the line, and renders a mistally almost impossible.

**LEVELING THE CHAIN AND PLUMBING THE PINS.**

1. The length of every surveyed line will be ascertained by precise horizontal measurement, as nearly approximating to an air line as is possible in practice on the earth’s surface. This all-important object can only be attained by a rigid adherence to the three following observances:

First. Ever keeping the chain drawn to its utmost degree of tension on even ground.

Second. On uneven ground, keeping the chain not only stretched as aforesaid, but leveled. And when ascending and descending steep ground, hills or mountains, the chain will have to be shortened to one-half or one-fourth its length (and sometimes more), in order accurately to obtain the true horizontal measure.

Third. The careful plumbing of the tally pins, so as to attain precisely the spot where they should be stuck. The more uneven the surface, the greater the caution needed to set the pins.

**MARKING LINES.**

1. All lines on which are to be established the legal corner boundaries will be marked after this method, viz. Those trees which may be intersected by the line will have two chops or notches cut on the sides facing the line, without any other marks whatever. These are called “sight trees” or “line trees.” A sufficient number of other trees standing within 50 links of the line, on either side of it, will be blazed on two sides diagonally or quartering toward the line, in order to render the line conspicuous, and readily to be traced, the blazes to be opposite each other, coinciding in direction with the line where the trees stand very near it, and to approach nearer each other toward the line, the farther the line passes from the blazed trees. Due care will be ever taken to have the lines so well marked as to be readily followed, and to cut the blazes deep enough to leave recognizable scars as long as the trees stand.

Where trees 2 inches or more in diameter are found, the required blazes will not be omitted. Bushes on or near the line should be bent at right angles therewith, and receive a blow of the ax at about the usual height of blazes from the ground sufficient to leave them in a bent position, but not to prevent their growth.

2. On trial or random lines, the trees will not be blazed, unless occasionally, from indispensable necessity, and then it will be done so guardedly as to prevent the possibility of confounding the marks of the trial line with the true. But bushes and limbs of trees may be lopped, and stakes set on the trial or random line, at every ten chains, to enable the surveyor on his return to follow and correct the trial line and establish therefrom the true line. To prevent confusion, the temporary stakes set on the trial or random line will be pulled up when the surveyor returns to establish the true line.

**INSUPERABLE OBJECTS ON LINE—WITNESS POINTS.**

1. Under circumstances where the survey of a township or section line is obstructed by an impassable obstacle, such as a pond, swamp, or marsh (not meandable), the line will be prolonged across such obstruction by making the necessary right-angle offsets (Plate IV, sec. 22); or, if such proceeding is impracticable, a traverse line will be run, or some proper trigonometrical operation will be employed to locate the line on the opposite side of the obstruction; and in case the line, either meridional or latitudinal, thus regained, is recovered beyond the intervening obstacle, said line will be surveyed back to the margin of the obstruction and all the particulars,
in relation to the field operations, will be fully stated in the field notes.

2. As a guide in alignment and measurement, at each point where the line intersects the margin of an obstacle, a witness point will be established, except when such point is less than 20 chains distant from the true point for a legal corner which falls in the obstruction, in which case a witness corner will be established at the intersection. (See Plate IV, section 22.)

3. In a case where all the points of intersection with the obstacle to measurement fall more than 20 chains from the proper place for a legal corner in the obstruction, and a witness corner can be placed on the offset line within 20 chains of the inaccessible corner point, such “witness corner” will be established. (See Plate IV, south boundary of section 16.)

ESTABLISHING CORNERS.

1. To procure the faithful execution of this part of a surveyor’s duty, is a matter of the utmost importance. After true coursing and most exact measurements, the establishment of corners is the consummation of the field work. Therefore, if the corners be not perpetuated in a permanent and workmanlike manner, the principal object of surveying operations will not have been attained.

2. The points at which corners will be established are fully stated in the several articles: “Base Lines,” “Principal Meridians,” “Standard Parallels,” etc., following the title “Initial Points,” page 50.

3. The best marking tools adapted to the purpose will be provided for marking neatly, distinctly, and durably. All the letters and figures required to be made at corners, Arabic figures being used exclusively; and the deputy will always have at hand the necessary implements for keeping his marking iron in perfect order.

DESCRIPTIONS OF CORNERS.

1. The formal language used in the following articles, in describing, for each one of the thirteen classes of corners, eight specific constructions, and markings, with the stated modifications in certain cases, will be carefully followed by deputy surveyors in their field notes; and their field work will strictly comply with the requirements of the descriptions.

2. When pits and mounds of earth are made accessories to corners, the pits will always have a rectangular plan; while the mounds will have a conical form, with circular base; and in all cases both pits and mounds will have dimensions at least as great as those specified in the descriptions. Deputy surveyors will strictly adhere to these provisions, and no departure from the stated requirements will be permitted, either in instructions or practice in the field. (See Plates V and VI.)

3. Referring to the numbered paragraphs, the corners described in “3” will be preferred to those described in either “1” or “2”, when corners are established in loose, sandy soil, and good bearing trees are available; under similar conditions, the corners described in “5” and “6” will be preferred to those described in “4” and “7”, respectively.

4. The selection of the particular construction to be adopted in any case will be left, as a matter of course, to the judgment and discretion of the deputy, who will assign the greatest weight to the durability of the corner materials and permanency of the finished corners.

5. The following abbreviations and contractions will be used in the descriptions of corners, viz:

A. M. C. for auxiliary meander corner.

N. for north.

bdy. for boundary.

bdr. for boundaries.

bet. for between.

C. C. for closing corner.

cor. for corner, corners.

dist. for distance.

E. for east.

ft. for foot or feet.

frac. for fractional.

ins. for inches.

diam. for diameter.

lbs. for links.

M. C. for meander corner.

1/4 sec. cor. for quarter section corner.

Rs. for ranges.

sec., secs. for section, sections.

S. M. C. for special meander corner.

s. c. for standard corner.

sq. for square.

S. for south.

T. or Tp. for township.

Ts. or Tps. for townships.

W. for west.

W. C. for witness corner.

W. P. for witness point.

For “18 inches long, 7 inches wide, 6 inches thick,” in describing a corner stone, write “18 x 7 x 6 ins.”, being particular to always preserve the same order of length, width, and thickness (or depth), and use a similar form when describing pits.

STANDARD TOWNSHIP CORNERS.

[See Plates III and V.]

When more than one-half of all the standard township and section corners on any 6 miles of a base line or standard parallel are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified as follows: Strike out “S. C., on N.” After “marked”, insert the words:

“S. C., 13 N. on N., 22 E. on E., and 21 E. on W. faces;”

When under the conditions above specified the corner described in paragraph 1 is established, a stake may be driven in the east and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 80.

(See Specimen Field Notes, pages 145 and 149.)

1. Stone, with Pits and Mound of Earth.

Set a _____ stone, ___ x ___ x ___ ins., ___ ins. in the ground, for standard cor. of (e. g.) Tps. 13 N., Rs. 21 and 22 E., marked S. C. on N.; with 6 grooves on N., E., and W. faces; dug pits 30 x 24 x 12 ins., crosswise on each line, E. and W., 4 ft., and N. of stone, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, N. of cor.
2. Stone, with Mound of Stone.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for standard cor. of (e.g.) Tps. 13 N., Rs. 21 and 22 E., marked S.C., on N.; with 6 grooves on N., E., and W. faces; and raised amount of stone, 2 ft. base, 1½ ft. high, N. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for standard cor. of (e.g.) Tps. 13 N., Rs. 21 and 22 E., marked S.C., on N.; with 6 grooves on N., E., and W. faces; from which A ______, _____ ins. diam., bears N. _____° E., _____ lks. dist., marked
   T. 13 N., R. 22 E., S. 31., B. T.
A ______, _____ ins. diam., bears N. _____° W., _____ lks. dist., marked
   T. 13 N., R. 21 E., S. 36., B. T.

4. Post, with Pits and Mound of Earth.

Set a _____ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quartz of charcoal), 24 ins. in the ground, for standard cor. of (e.g.) Tps. 13 N., Rs. 22 and 23 E., marked S.C., T. 13 N. on N., R. 23 E., S. 31 on E., and R. 22 E., S. 36 on W. faces; with 6 grooves on N., E., and W. faces; dug pits, 30 x 24 x 12 ins., crosswise on each line, E. and W., 4 ft., and N. of post, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a _____ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for standard cor. of (e.g.) Tps. 13 N., Rs. 22 and 23 E., marked S.C., T. 13 N. on N., R. 23 E., S. 31 on E., and R. 22 E., S. 36 on W. faces; with 6 grooves on N., E., and W. faces; from which A ______, _____ ins. diam., bears N. _____° E., _____ lks. dist., marked
   T. 13 N., R. 23 E., S. 31., B. T.
A ______, _____ ins. diam., bears N. _____° W., _____ lks. dist., marked
   T. 13 N., R. 22 E., S. 36., B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quartz of charcoal) 12 ins. in the ground, for standard cor. of (e.g.) Tps. 13 N., Rs. 22 and 23 E.; dug pits, 30 x 24 x 12 ins., crosswise on each line, E., N., and W. of cor., 5 ft. dist.; and raised a mound of earth, 5 ft base, 2½ ft. high, over deposit.

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In E. pit drove a _____ stake, 2 ft. long, 2 ins. sq., 12 ins.

7. Mound of stone will consist of not less than four stones, and will be at least 1½ ft. high, with 2 ft. base.

8. All bearing trees, except those referring to quarter section corners, will be marked with the township, range, and section in which they stand.

in the ground, marked

7. Tree Corner, with Pits and Mound of Earth.

A ______, _____ ins. diam., for standard cor. of (e.g.) Tps. 13 N., Rs. 22 and 23 E., I marked

9. Tree Corner, with Bearing Trees.

A ______, _____ ins. diam., for standard cor. of (e.g.) Tps. 13 N., Rs. 22 and 23 E., I marked

CLOSING TOWNSHIP CORNERS.

[See Plates V and VI.]

When more than one-half of all the township corners are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified, as follows: Strike out "C. C., on S.,". After "marked," insert the words
"C. C., 3 N. on S.,
2 W. on E., and
3 W. on W. faces."

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the east pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 26.

1. Stone, with Pits and Mound of Earth.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., marked C. C., on S.; with 6 grooves on S., E., and W. faces; dug pits, 30 x 24 x 12 ins., crosswise on each line, E. and W., 4 ft., and S. of stone, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., marked C. C., on S.; with 6 grooves on S., E., and W. faces; and raised a mound of stone, 2 ft. base, 1½ ft. high, S. of cor. Pits impracticable.
3. Stone, with Bearing Trees.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., marked C. C., on S.; with 6 grooves on S., E., and W. faces; from which:

A ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
    T. 4 N., R. 2 W., S. 6, B. T.

A ______ ins. diam., bears S. ______° W., ______ lks. dist., marked
    T. 4 N., R. 3 W., S. 1 B. T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., marked C. C., T. 4 N. on S.,
    R. 2 W., S. 6 on E., and
    R. 3 W., S. 1 on W. faces; with 6 grooves on S., E., and W. faces; dug pits, 30 x 24 x 12 ins., crosswise on each line, E. and W., 4 ft. and S. of post 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ feet high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., marked C. C., T. 4 N. on S.,
    R. 2 W., S. 6 on E., and
    R. 3 W., S. 1 on W. faces; with 6 grooves on S., E., and W. faces; from which:

A ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
    T. 4 N., R. 2 W., S. 6, B. T.

A ______ ins. diam., bears S. ______° W., ______ lks. dist., marked
    T. 4 N., R. 3 W., S. 1 B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for standard cor. of (e.g.) Tps 4 N., Rs. 2 and 3 W.; dug pits, 30 x 24 x 12 ins., crosswise on each line, S., E., and W. of cor., 5 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ feet high, over deposit.

In E. pit, drove a ______ stake 2 ft. long, 2 ins. sq., 12 ins.

in the ground, marked
    C. C., T. 4 N. on S.,
    R. 2 W., S. 6 on E., and
    R. 3 W., S. 1 on W. faces; with 6 grooves on S., E., and W. faces.

7. Tree Corner, with Pits and Mound of Earth.

A ______ ins. diam., for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., I marked
    C. C., T. 4 N. on S.,
    R. 2 W., S. 6 on E., and
    R. 3 W., S. 1 on W. sides; with 6 notches on S., E., and W.

8. Tree Corner, with Bearing Trees.

A ______ ins. diam., for closing cor. of (e.g.) Tps. 4 N., Rs. 2 and 3 W., I marked

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C. C., T. 4 N. on S.,
    R. 2 W., S. 6 on E., and
    R. 3 W., S. 1 on W. sides; with 6 notches on S., E., and W. sides; from which:

A ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
    T. 4 N., R. 2 W., S. 6, B. T.

A ______ ins. diam., bears S. ______° W., ______ lks. dist., marked
    T. 4 N., R. 3 W., S. 1 B. T.

9. Connecting lines.

All closing township corners on base lines or standard parallels, will be connected, by course and distance, with the nearest standard corner thereon; closing corners on all other lines, will be connected, in a similar manner, with the nearest township, section, or quarter section corner, or mile or half-mile monument, as existing conditions may require.

10. Relative positions of Closing Corners, Pits, Mounds, and Bearing Trees.

Any line, which by intersection with another surveyed line, determines the place for a closing corner, will be called a closing line; then in general, the mound and one pit of a closing corner will be placed on such “closing line,” N., S., E., or W. of the closing corner, as prevailing conditions may require; while said mound and pit, with the two bearing trees (if used), will always be located on the same side of the line closed upon, and on which the other pits will be established, as directed in the foregoing descriptions, and illustrated on Plate VI.

11. Positions and dimensions of Pits of Closing Corners on irregular boundaries.

When a closing line intersects an irregular boundary at an angle less than 75°, and stone or post closing corners are established, the pit on the boundary adjoining the acute angle will be omitted, and the pit on the opposite side of the closing corner will have its dimensions increased, as follows:

For a closing township corner, the enlarged pit will measure 42 x 36 x 12 ins.; for a closing section corner it will be 30 x 24 x 12 ins. (See Plate VI, figs. 2 and 3.)

12. Township or Section interfering Closing Corners.

When two closing lines, at right angle to each other, intersect an irregular boundary at points less than 8 feet apart, and stone or post corners are established, the pits, that under ordinary circumstances would be placed on the boundary,
will be omitted, and the pits on the closing lines will have their dimensions increased to 36 x 36 x 12 ins. (See Plate VI, fig. 4, at a and b.)

13. Positions and dimensions of Pits and Mounds of interfering Closing Corners.

When, under the conditions stated in paragraphs 11 and 12, the corners "Mound of Earth, with Deposit and Stake in Pit" are established, the pits on the boundary line will be omitted when the distance between the closing corners is less than 10 feet and greater than 4 feet, and the dimensions of the pits on the closing lines will be increased as directed in said paragraphs.

In case the distance between the closing corners is less than 4 feet, one mound, 5 ft. base, 2½ ft. high, will cover the deposits of both closing corners. (See Plate VI, fig. 4, at c, d, and e.)

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CORNERS COMMON TO FOUR TOWNSHIPS.

[See Plate V.]

When more than one-half of all the corners of a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified, as follows: After "marked", insert the words "3 N. on N. E., 2 E. on S. E., 2 N. on S. W., and 3 E. on N. W. faces;"

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge; dug pits, 24 x 24 x 12 ins., on each line, N., E., and W., 4 ft., and S. of stone, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge, and raised a mound of stone, 2 ft. base, 1½ ft. high, S. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge; from which A ______ ______ ins. diam., bears N. ______° E., ______ lks. dist., marked T. 3 N., R. 2 W., S. 31, B. T.

A ______ ______ ins. diam., bears S. ______° E., ______ lks. dist., marked T. 2 N., R. 2 W., S. 6, B. T.

A ______ ______ ins. diam., bears S. ______° W., ______ lks. dist., marked T. 2 N., R. 3 W., S. 1, B. T.

T. 2 N., R. 3 W., S. 1, B. T.
A ______ ______ ins. diam., bears N. ______° W., ______ lks. dist., marked T. 3 N., R. 3 W., S. 36, B. T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., marked T. 3 N., S. 31 on N. E., R. 2 W., S. 6 on S. E., T. 2 N., S. 1 on S. W., and R. 3 W., S. 36 on N. W. faces; with 6 notches on each edge; dug pits, 24 x 24 x 12 ins., on each line, N., E., and W., 4 ft., and S. of post, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ feet high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., marked T. 3 N., S. 31 on N. E., R. 2 W., S. 6 on S. E., T. 2 N., S. 1 on S. W., and R. 3 W., S. 36 on N. W. faces; with 6 notches on each edge; from which A ______ ______ ins. diam., bears N. ______° E., ______ lks. dist., marked T. 3 N., R. 2 W., S. 31, B. T.

A ______ ______ ins. diam., bears S. ______° E., ______ lks. dist., marked T. 2 N., R. 2 W., S. 6, B. T.

A ______ ______ ins. diam., bears S. ______° W., ______ lks. dist., marked T. 3 N., R. 3 W., S. 36, B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

 Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W.; dug pits 24 x 24 x 12 ins., on each line, N., S., E., and W. of cor., 5 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, over deposit. In E. pit drove a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked T. 3 N., S. 31 on N. E., R. 2 W., S. 6 on S. E., T. 2 N., S. 1 on S. W., and R. 3 W., S. 36 on N. W. faces; with 6 notches on each edge.

7. Tree Corner, with Pits and Mound of Earth.

A ______ ______ ins. diam., for cor. of (e.g.) Tps. 2 and 3 N., Rs. 2 and 3 W., 1 marked T. 3 N., S. 31 on N. E., R. 2 W., S. 6 on S. E.,
3. Stone, with Bearing Trees.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 5 and 6 W., on N. bdy. Tp. 2 N., R. 6 W., with 6 notches on N. and W. edges; from which A ______ ins. diam., bears N. ______° E., ______ lks. dist., marked

    T. 2 N., R. 5 W., S. 6, B.T.

A ______ ins. diam., bears N. ______° W., ______ lks. dist., marked

    T. 3 N., R. 6 W., S. 36, B.T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., Rs. 5 and 6 W., on N. bdy. Tp. 2 N., R. 6 W., marked

    T. 2 N., R. 5 W., S. 6, B.T.

A ______ ins. diam., bears S. ______° E., ______ lks. dist., marked

    T. 2 N., R. 2 W., S. 31, B.T.

A ______ ins. diam., bears S. ______° W., ______ lks. dist., marked

    T. 2 N., R. 3 W., S. 36, B.T.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., R. 7 W., on N. bdy. Tp. 3 N., R. 6 W., marked

    T. 2 N., R. 7 W., S. 1 on S. W., and

    T. 3 N., R. 7 W., S. 36 on N. W. faces; with 6 notches on N. and W. edges; from which A ______ ins. diam., bears S. ______° W., lks. dist., marked

    T. 2 N., R. 7 W., S. 1, B.T.

A ______ ins. diam., bears N. ______° W., ______ lks. dist., marked

    T. 3 N., R. 7 W., S. 36, B.T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of (e.g.) Tps. 2 and 3 N., R. 7 W., on W. bdy. Tp. 3 N., R. 6 W.; dug pits, 30 x 24 x 12 ins., on each line, N., E., and W. of cor., 5 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, over deposit. In S. pit drove a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

    T. 2 N., R. 7 W., S. 1 on S. W., and

    T. 2 N., R. 7 W., S. 36 on N. W. faces; with 6 notches on N. and W. edges.

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7. Tree Corner, with Pits and Mound of Earth.

A ______ ins. diam., for cor. of (e.g.) Tps. 2 and 3 N., Rs. 5 and 6 W., on N. bdy. Tp. 2 N., R. 6 W., marked

    T. 2 N., R. 5 W. on N. E., and

    T. 3 N., R. 6 W. on N. W. sides; with 6 notches facing N. and W.; dug pits 24 x 18 x 12 ins., crosswise on each line, N., E., and W. of cor., 5 ft. dist.; and raised a mound of earth, around tree.
8. Tree Corner, with Bearing Trees.

A _______ _______ ins. diam., for cor. of (e.g.) Tps. 2 and 3
N., R. 7 W., on W. bdy. Tp. 3 N., R. 6 W., I marked
T. 2 N., R. 7 W., S. 1 on S. W., and
T. 3 N., R. 7 W., S. 36 on N. W., sides; with 6 notches facing
N. and W.; from which
A _______ _______ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T. 2 N., R. 7 W., S. 1, B. T.

A _______ _______ ins. diam., bears N. ______° W.,
______ lks. dist., marked
T. 3 N., R. 7 W., S. 36, B.T.

CORNERS REFERRING TO ONE TOWNSHIP ONLY.

[See Plates V and IX.]

When more than one-half of all corners of a township are
stone corners, the descriptions in paragraphs 1 and 2, if the
corners therein described are established, will be modified, as
follows: After "marked", insert the words:
"2 N., 6 W. on S. W. face."

When, under the conditions above specified, the corner
described in paragraph 1 is established, a stake may be driven in
the south pit, and marked instead of the stone, and described
as exemplified in the last clause of paragraph 6, page 32.

1. Stone, with Pits and Mound of Earth.

Set a _______ stone, ______ x ______ x ______ ins.,
______ ins. in the ground, for N. E. cor. of (e.g.) Tp. 2 N., R. 6
W., marked with 6 notches on S. and W. edges; dug pits, 36 x
36 x 12 ins., on each line, S. and W. of stone, 8 ft. dist.; and
raised a mound of earth, 5 ft. base, 2½ ft. high, S. W. of cor.

2. Stone, with Mound of Stone.

Set a _______ stone, ______ x ______ x ______ ins.,
______ ins. in the ground, for N. E. cor. of (e.g.) Tp. 2 N., R. 6
W., marked with 6 notches on S. and W. edges; raised a
mound of stone, 2 ft. base, 1½ ft. high, S. W. of cor. Pits
impracticable.

3. Stone, with Bearing Tree.

Set a _______ stone, ______ x ______ x ______ ins.,
______ ins. in the ground for N. E. cor. of (e.g.) Tp. 2 N., R. 6
W., marked with 6 notches on S. and W. edges; from which
A _______ _______ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T. 2 N., R. 6 W., S. 1, B. T.

4. Post, with Pits and Mound of Earth.

Set a _______ post, 3 ft. long, 4 ins. sq., with marked stone
(charred stake or quart of charcoal), 24 ins. in the ground, for
N. E. cor. of (e.g.) Tp. 2 N., R. 6 W., marked
T. 2 N., R. 5 W., S. 6 on N. E.,
S. 6 on S. E.,

T. 2 N., R. 6 W., S. 1 on S. W., and
S. 6 on N. W. faces; with 6 notches on S. and W. edges; dug
pits, 36 x 36 x 12 ins., on each line, S. and W. of post, 8 ft. dist.;
and raised a mound of earth, 5 ft. base, 2½ ft. high, S. W. of cor.

5. Post, with Bearing Tree.

Set a _______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground,
for S. W. cor. of (e.g.) Tp. 3 N., R. 6 W., marked
T. 3 N., R. 6 W., S. 31 on N. E.,
S. 1 on S. E.,
T. 2 N., R. 7 W., S. 1 on S. W., and
S. 1 on N. W. faces; with 6 notches on N. and E. edges; from
which
A _______ _______ ins. diam., bears N. ______° E.,
______ lks. dist., marked
T. 3 N., R. 6 W., S. 31, B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked ston (charred stake or quart of charcoal), 12 ins. in the ground, for S. W. cor. of (e.g.) Tp. 3 N., R. 6
W.; dug pits, 36 x 36 x 12 ins., on each line, N. and E. of cor., 5
ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, over
deposit.

In E. pit drove a _______ stake, 2 ft. long, 2 ins. sq., 12 ins.
in the ground, marked
T. 3 N., R. 6 W., S. 31 on N. E.,
S. 1 on S. E.,
T. 2 N., R. 7 W., S. 1 on S. W., and
S. 1 on N. W. faces; with 6 notches on N. and E. edges.

7. Tree Corner, with Pits and Mound of Earth.

A _______ _______ ins. diam., for S. W. cor. of (e.g.) Tp. 3
N., R. 6 W., I marked
T. 2 N., R. 6 W., S. 31 on N. E.,
S. 1 on S. E.,
T. 2 N., R. 7 W., S. 1 on S. W., and
S. 1 on N. W. sides; with 6 notches facing N. and E.; dug
pits, 30 x 24 x 12 ins., crosswise on each line, N. and E. of cor.,
5 ft. dist.; and raised a mound of earth, around tree.

8. Tree Corner, with Bearing Tree.

A _______ _______ ins. diam., for S. E. cor. of (e.g.) Tp. 4
N., R. 6 W., I marked
S. 6 on N. E.,
T. 3 N., R. 5 W., S. 6 on S. E.,
S. 6 on S. W., and
T. 4 N., R. 6 W., S. 36 on N. W. sides; with 6 notches facing
N. and W.; from which
A _______ _______ ins. diam., bears N. ______° W., lks.
dist., marked
T. 2 N., R. 6 W., S. 36, B. T.

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STANDARD SECTION CORNERS.

[See Plates III and V.]

1. Stone, with Pits and Mound of Earth.

Set a stone, __________ x __________ x __________ ins. in the ground, for standard cor. of (e.g.) secs. 31 and 32, marked S. C., on N., with 5 grooves on E., and 1 groove on W. faces; dug pits, 24 x 18 x 12 ins., crosswise on each line, E., and W. of cor., 5 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, N. of cor. Pits impracticable.

2. Stone, with Mound of Stone.

Set a stone, __________ x __________ x __________ ins., __________ ins. in the ground, for standard cor. of (e.g.) secs. 35 and 36, marked S. C., on N.; with 1 groove on E., and 5 grooves on W. faces; and raised a mound of stone, 2 ft. base, 1 1/2 ft. high, N. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a stone, __________ x __________ x __________ ins., __________ ins. in the ground, for standard cor. of (e.g.) secs. 33 and 34, marked S. C., on N.; with 3 grooves on E. and W. faces; from which

A __________ ins. diam., bears N. __________° E., __________ lks. dist., marked
T. 13 N., R. 21 E., S. 34, B. T.

A __________ ins. diam., bears N. __________° W., __________ lks. dist., marked
T. 13 N., R. 21 E., S. 33, B. T.

4. Post, with Pits and Mound of Earth.

Set a post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for standard cor. of (e.g.) secs. 33 and 34, marked S. C., T. 13 N., R. 21 E. on N., S. 33 on E., and S. 32 on W. faces; with 4 grooves on E., and 2 grooves on W. faces; dug pits, 24 x 18 x 12 ins., crosswise on each line, E. and W., 3 ft., and N. of post, 7 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for standard cor. of (e.g.) secs. 34 and 35, marked S. C., T. 13 N., R. 21 N., S. 35 on E., and S. 34 on W. faces; with two grooves on E., and 4 grooves on W. faces; from which

A __________ ins. diam., bears N. __________° E., __________ lks. dist., marked
T. 13 N., R. 21 E., S. 35, B. T.

A __________ ins. diam., bears N. __________° W., __________ lks. dist., marked
T. 13 N., R. 21 E., S. 35, B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for standard cor. of (e.g.) secs. 33 and 34; dug pits, 24 x 18 x 12 ins., crosswise on each line, N., E., and W. of cor., 5 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, over deposit.

In E. pit drove a __________ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

7. Tree Corner, with Pits and Mound of Earth.

A __________ ins. diam., for standard cor. of (e.g.) secs. 31 and 32, marked S. C., T. 13 N., R. 22 E. on N., S. 32 on E., and S. 31 on W. sides; with 5 notches on E., and 1 notch on W. sides;

T. 13 N., R. 21 E., S. 34, B. T.

8. Tree Corner, with Bearing Trees.

A __________ ins. diam., for standard cor. of (e.g.) secs. 35 and 36, marked S. C., T. 13 N., R. 22 E. on N., S. 36 on E., and S. 35 on W. sides; with 1 notch on E., and 5 notches on W. sides; from which

A __________ ins. diam., bears N. __________° E., __________ lks. dist., marked
T. 13 N., R. 22 E., S. 36, B. T.

A __________ ins. diam., bears N. __________° W., __________ lks. dist., marked
T. 13 N., R. 22 E., S. 35, B. T.

CLOSING SECTION CORNERS.

[See Plates V and VI.]

1. Stone, with Pits and Mound of Earth.

Set a stone, __________ x __________ x __________ ins., __________ ins. in the ground, for closing cor., of (e.g.) secs. 1 and 2, marked C. C., on S.; with 1 groove on E., and 5 grooves on W. faces; dug pits, 24 x 18 x 12 ins., crosswise on each line, E. and W., 3 ft., and S. of stone, 7 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a stone, __________ x __________ x __________ ins., __________ ins. in the ground, for closing cor. of (e.g.) secs. 3 and 4, marked C. C., on S.; with 3 grooves on E. and W. faces; and raised a mound of stone, 2 ft. base, 1 1/2 ft. high, S. of cor. Pits impracticable.
3. Stone, with Bearing Trees.

Set a ______ stone, ______ x ______ x ______ ins. ______ ins. in the ground, for closing cor. of (e.g.) secs. 1 and 2, marked C. C., on S.; with 1 groove on E., and 5 grooves on W. faces; from which, A ______ ins. diam., bears S. _____° E., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 1, B. T.

A ______ ins. diam., bears S. _____° W., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 2, B. T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stave or quarts of charcoal), 24 ins. in the ground, for closing cor. of (e.g.) secs. 1 and 2, marked C. C., T. 4 N., R. 3 W. on S., S. 1 on E., and S. 2 on W. faces; with 1 groove on E., and 5 grooves on W. faces; dug pits, 24 x 18 x 12 ins., crosswise on each line, E. and W., 3 ft., and S. 7 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for closing cor. of (e.g.) secs. 1 and 2, marked

C. C., T. 4 N., R. 3 W. on S., S. 1 on E., and

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S. 2 on W. faces; with 1 groove on E., and 5 grooves on W. faces; from which

A ______ ins. diam., bears S. _____° E., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 1, B. T.

A ______ ins. diam., bears S. _____° W., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 2, B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stave or quarts of charcoal), 12 ins. in the ground, for closing cor. of (e.g.) secs. 3 and 4; dug pits, 24 x 18 x 12 ins., crosswise on each line, S., E., and W. of cor., 4 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, over deposit.

In E. pit drove a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked


7. Tree Corner, with Pits and Mound of Earth

A ______ ins. diam., for closing cor. of (e.g.) secs. 1 and 2, marked

C. C., T. 4 N., R. 3 W. on S., S. 1 on E., and S. 2 on W. sides; with 1 notch on E., and 5 notches on W. sides; dug pits, 18 x 18 x 12 ins., S., E., and W. of cor., 5 ft. dist.; and raised a mound of earth around tree.

8. Tree Corner, with Bearing Trees

A ______ ins. diam., for closing cor. of (e.g.) secs. 1 and 2, marked

C. C., T. 4 N., R. 3 W. on S., S. 1 on E., and S. 2 on W. sides; with 1 notch on E., and 5 notches on W. sides; from which

A ______ ins. diam., bears S. _____° E., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 1, B. T.

A ______ ins. diam., bears S. _____° W., ______ lks. dist., marked

T. 4 N., R. 3 W., S. 2, B. T.

9. All closing section corners, or base lines or standard parallels, will be connected by course and distant with the nearest standard corner thereon. (See paragraphs 5 and 9, page 38.)

CORNERS COMMON TO FOUR SECTIONS.

[See Plates V and IX.]

When more than one-half of all the corners in a township are stone corners, the descriptions in paragraphs 1 and corners thereindescribed are established for cor. of (e.g.) secs. 15, 16, 21 and 22, will be modified as follows: after "marked," insert the words "4 N. on N.E., and 3 W. on S.E. face."

When, under the conditions above specified, the corner described in paragraph 1 is established a stake may be driven in the southeast pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 37.

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) secs. 14, 15, 22, and 23 [T. 4 N., R. 3 W.], marked with 3 notches on S.

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and E. edges; dug pits, 18 x 18 x 12 ins., in each sec. 5½ ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) secs. 14, 15, 22, and 23 [T. 4 N., R. 3 W.], marked with 3 notches on S. and E. edges; and raised a mound of stone, 2 ft. base, 1½ ft. high, W. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

9. When writing these descriptions in the field notes, the angular brackets and the enclosed letters and figures will be omitted.
Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) secs. 9, 10, 15, and 16, marked with 4 notches on S., and 3 notches on E. edges; from which
A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 10, B. T.
A ______, ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 15, B. T.
A ______, ______ ins. diam., bears S. ______° W., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 16, B. T.
A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 9, B. T.

4. Post, with Pit and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of (e.g.) secs. 15, 16, 21, and 22, marked
T. 2 N., S. 15 on N. E., R. 2 W., S. 22 on S. E., S. 21 on S. W., and S. 16 on N. W. faces with 3 notches on S. and E. edges; dug pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground for cor. of (e.g.) secs. 25, 26, 35 and 36, marked
T. 2 N., S. 25 on N. E., R. 2 W., S. 36 on S. E., S. 35 on S. W., and S. 26 on N. W. faces; with 1 notch on S. and E. edges; from which
A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 25, B. T.
A ______, ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 26, B. T.

6. Mound, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of (e.g.) secs. 25, 26, 35 and 36, dug pits, 18 x 18 x 12 ins., in each sec., 4 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, over deposit.

7. Tree Corner, with Pits and Mound of Earth.

A ______ ins. diam., for cor. of (e.g.) secs. 29, 30, 31, and 32, 1 marked
T. 2 N., S. 29 on N. E., R. 2 W., S. 32 on S. E., S. 31 on S. W., and S. 30 on N. W. sides; with 1 notch on S., and 5 notches on E. sides; dug pits, 18 x 18 x 12 ins., in each sec., 5 ft. dist.; and raised a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

A ______ ins. diam., for cor. of (e.g.) secs. 5, 6, 7, and 8, 1 marked
T. 2 N., S. 5 on N. E., R. 2 W., S. 8 on S. E., S. 7 on S. W., and S. 6 on N. W. sides; with 5 notches on S. and E. sides; from which
A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 5, B. T.
A ______ ins. diam., bears S. ______° E., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 8, B. T.
A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 7, B. T.
A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked
T. 2 N., R. 2 W., S. 6, B. T.

SECTION CORNERS COMMON TO TWO SECTIONS ONLY.

[See Plates V and VI.]

When more than one-half of all the corners in a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established near cor. of secs. 15, 16, 21, and 22, will be modified, as follows:

After “marked”, insert the words
“3 N. on S. W., and 7 W. on N. W. faces;”.

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the southwest pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 38.

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for cor. of (e.g.) secs. 25 and 36 [Tp. N., R. 7 W.], 1 marked with 5 notches on N., and 1 notch on S. edges; dug pits, 24 x 24 x 12 ins. in each sec., 6 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, W. of cor.
2. Stone, with Mound of Stone.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for cor. of (e.g.) 12 secs. 15 and 22 [Tp. 3 N., R. 7 W.], marked with 3 notches on N., and S. edges; and raised a mound of stone, 2 ft. base, 1½ ft. high, W. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for cor. of (e.g.) 13 secs. 28 and 29, marked with 4 notches on E. edge; from which

A _____ ins. diam., bears N. _____° E., _____ lks. dist., marked

T. 3 N., R. 7 W., S. 28, B. T.

A _____ ins. diam., bears N. _____° W., _____ lks. dist., marked

T. 3 N., R. 7 W., S. 29, B. T.

4. Post, with Pits and Mound of Earth.

Set a _____ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of (e.g.) 33 and 34, marked

T. 2 N., S. 34 on N. E., and

R. 6 W., S. 33 on N. W. faces; with three notches on E. and W. edges; dug pits, 24 x 24 x 12 ins., in each sec., 6 ft. dist. and raised a mound of earth, 4 ft. base, 2 ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a _____ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of (e.g.) secs. 24 and 25, marked

T. 3 N., S. 25 on S. W., and

R. 5 W., S. 24 on N. W. faces; with 4 notches on N., and 2 notches on S. edges; from which

A _____ ins. diam., bears S. _____° W., _____ lks. dist., marked

T. 3 N., R. 5 W., S. 25, B. T.

A _____ ins. diam., bears N. _____° W., _____ lks. dist., marked

T. 3 N., R. 5 W., S. 24, B. T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of (e.g.) secs. 13 and 24, marked

T. 2 N., S. 24 on S. W., and

R. 6 W., S. 13 on N. W. faces, with 3 notches on N. and S. edges.

7. Tree Corner, with Pits and Mound of Earth.

A _____ ins. diam., for cor. of (e.g.) secs. 24 and 25, marked

T. 3 N., S. 25 on S. W. and

R. 6 W., S. 24 on N. W. sides; with 4 notches on N. and S.

8. Tree Corner, with Bearing Trees.

A _____ ins. diam., for cor. of (e.g.) secs. 22 and 27, marked

T. 3 N., S. 27 on S. W., and

R. 7 W., S. 22 on N. W. sides; with 4 notches on N., and 2 notches on S. sides; from which

A _____ ins. diam., bears S. _____° W., _____ lks. dist., marked

T. 3 N., R. 7 W., S. 27, B. T.

A _____ ins. diam., bears N. _____° W., _____ lks. dist., marked

T. 3 N., R. 7 W., S. 22, B. T.

SECTION CORNERS REFERRING TO ONE SECTION ONLY.

When more than one-half of all corners in a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described, are established near the place for cor. of secs. 13, 16, 21, and 22, will be modified, as follows: After "marked", insert the words: "2 N., 5 W. on N. E. face;"

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 40.

1. Stone, with Pit and Mound of Earth.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for S.W. cor. of (e.g.) sec. 12 [Tp. 2 N., R. 5 W.], marked with 1 notch on E. edge; dug a pit, 36 x 36 x 12 ins., in the sec., 8 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, N. E. of cor.

2. Stone, with Mound of Stone.

Set a _____ stone, _____ x _____ x _____ ins., _____ ins. in the ground, for S.W. cor. of (e.g.) sec. 12 [Tp. 2 N., R. 5 W.], marked with 1 notch on E. edge; dug a pit, 36 x 36 x 12 ins., in the sec., 8 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, N. E. of cor.
N., R. 5 W.,)\textsuperscript{19} marked with 1 notch on E. edge; and raised a mound of stone, 2 ft. base, 1½ ft. high, N. E. of cor.

3. Stone, with Bearing Tree.

Set a ______ stone, ______ x ______ x ______ ins., ______ ins. in the ground, for S. W. cor. of (e. g.) sec. 12, marked with 1 notch on E. edge; from which A___________ ins. diam., bears N. ______° E., ______ lks. dist., marked
T. 2 N., R. 5 W., S. 12, B. T.

4. Post, with Pit and Mound of Earth.

Set a_______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for N. W. cor. of (e. g.) sec. 10,\textsuperscript{20} marked
T. 3 N., S. 9 on N. E.,
R. 5 W., S. 10 on S. E.,
S. 9 on S. W., and
S. 9 on N. W. faces; with 5 notches on S. and 3 notches on E. edges; dug a pit, 36 x 36 x 12 ins., in the sec., 8 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, S. E. of cor.

5. Post, with Bearing Tree.

Set a_______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for S. W. cor. of (e. g.) sec. 12,\textsuperscript{21} marked
T. 2 N., S. 12 on N. E.,
R. 5 W., S. 13 on S. E.,
S. 13 on S. W., and
S. 13 on N. W. faces; with 1 notch on E. edge; from which A___________ ins. diam., bears N. ______° E., ______ lks. dist., marked
T. 2 N., R. 5 W., S. 12, B. T.

6. Mound of Earth, with Deposit and Stake in pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for N. W. cor. of (e. g.) sec. 10,\textsuperscript{18} dug a pit, 36 x 36 x 12 ins. in the sec., 5 ft. dist.; and raised a mound of earth, 4 ft. base, 2 ft. high, over deposit. In the pit drove a_______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
T. 3 N., S. 9 on N. E.,
R. 5 W., S. 10 on S. E.,
S. 9 on S. W., and
S. 9 on N. W. faces; with 5 notches on S., and 3 notches on E. edges.

7. Tree Corner, with Pits and Mound of Earth.

A___________ ins. diam., for S. W. cor. of (e. g.) sec. 12,\textsuperscript{21} I marked
T. 2 N., S. 12 on N. E.,
R. 5 W., S. 13 on S. E.,
S. 13 on S. W., and
S. 13 on N. W. sides, with 1 notch on E. side; dug a pit, 24 x 24 x 12 ins., in the sec., 5 ft. dist.; and raised a mound of earth around tree.

8. Tree Corner, with Bearing Trees.
Set a _____ post, 3 ft. long, 3 ins. sq., 24 ins. in the ground, for sec. cor. [e. g.] bet. secs. 21 and 22], marked ¼ S., on W. face; from which

A _____ ins. diam., bears S. _____° E., ______
lks. dist., marked

S., B. T.

A _____ ins. diam., bears S. _____° W.,
_______ lks. dist., marked

S., B. T.

6. Mound, with Deposit and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for ¼ sec. cor. [e. g.] bet. secs. 21 and 28]; 22 dug pits, 18 x 18 x 12 ins., E. and W. of cor., 4 ft. dist.; and raised a mound of earth, 3½ ft. base, 1½ ft. high, over deposit.

In E. pit drove a _____ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

S. on N. face.

7. Tree Corner, with Pits and Mound of Earth.

A _____ ins. diam., for ¼ sec. cor. [e. g.] bet. secs. 7 and 8]; 22 I marked ¼ S., on W. side; dug pits, 18 x 18 x 12 ins., N. and S. of cor., 4 ft. dist.; and raised a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

A _____ ins. diam., for ¼ sec. cor. [e. g.] bet. secs. 20 and 29]; 22 I marked ¼ S., on N. side; from which

A _____ ins. diam., bears N. _____° W.,
_______ lks. dist., marked

¼ S., B. T.

A _____ ins. diam., bears S. _____° W.,
_______ lks. dist., marked

¼ S., B. T.

9. Pits and Mounds of Quarter Section Corners.

On meridional lines, the pits will be dug N. and S., and the mound will be placed on the west side of the corner; on latitudinal lines, the pits will be located E. and W., and the mound will be built on the north side of the corner. See Plate VI.

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10. Markings on Quarter Section Corners.

On meridional lines, the markings will be placed on the west side and on latitudinal lines, on the north side of the stone, post, or other corner.

11. Stakes in Pits of Quarter Section Corners.

On meridional lines the stakes will be driven in the S. pit, and on latitudinal lines, in the E. pit.

STANDARD QUARTER SECTION CORNERS.

[See Plate V and VI.]

All standard quarter section corners, on base lines or standard parallels, will have the letters S. C. (for standard corner), precede the marking "½" or "S.," as the case may be; such corners will be established in all other respects like other quarter section corners.

When bearing trees are described for standard quarter section corners, each tree will be marked, S. C., S. B. T.

QUARTER SECTION CORNERS COMMON TO TWO QUARTERS OF ONE SECTION.

These corners will be similar in all respects to those that are common to four quarters of two sections. See notes on Plates VII and VIII.

MEANDER CORNERS.

[See Plates V and VI.]

1. Stone, with Pit and Mound of Earth.

Set a _____ stone, _____ x _____ x _____ ins.
______ ins. in the ground for meander cor. of (e. g.) frac. secs. 26 and 35, 23 marked

M. C. on E. face; with 1 groove on S. face; dug a pit, 23 x 36 x 12 ins., 8 ft. W. of stone; and raised a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

2. Stone, with Mound of Stone.

Set a _____ stone, _____ x _____ x _____ ins.,
______ ins. in the ground, for meander cor. of (e. g.) frac. secs. 17 and 18, 24 marked

M. C. on S. face; with 5 grooves on E. face; and raised a mound of stone, 2 ft. base, 1½ ft. high, N. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _____ stone _____ x _____ x _____ ins.,
______ ins. in the ground, for meander cor. of (e. g.) frac. secs. 26 and 35, with 1 groove on S. face, 24 marked:

M. C. on W. face; from which

A _____ ins. diam., bears N. _____° E.,
_______ lks. dist., marked

T. 15 N., R. 20 E., S. 26, M. C. B. T.

A _____ ins. diam., bears S. _____° C.,
_______ lks. dist., marked

T. 15 M., R. 20 E., S. 35, M. C. B. T.

4. Post, with Pit and Mound of Earth.

Set a _____ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for meander cor. of (e. g.) frac. secs. 19 and 20, 24 marked

M. C. on N.,

22. When writing descriptions of ¼ section corners, the angular brackets and the letters and figures they enclose, will be omitted. See paragraphs 9, 10, and 11, pages 41, 42.

23. See page 66, and paragraphs 9 and 10, pages 43, 44.

5. Post, with Bearing Trees.

Set a post, 3 ft. long, 6 ins. sq., 24 ins. in the ground, for meander cor. of (e. g.) frac. secs. 25 and 26, Marked M. C. on N.,
T. 15 N, R. 20 E, S. 25 on E, and
S. 26 on W. faces; from which
, A __________ ins. diam., bears S. __________° E, _______
lks. dist., marked
 T. 15 N, R. 20 E, S. 25, M. C. B. T.
A __________ ins. diam., bears S. __________° W.,
______ lks. dist., marked
 T. 15 N, R. 20 E, S. 26, M. C. B. T.

6. Mound with Deposit, and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal) 12 ins. in the ground, for meander cor. of (e. g.) frac. secs. 25 and 26, Dug a pit, 36 x 36 x 12 ins., 5 ft. N. of cor.; and raised a mound of earth, 4 ft. base, 2 ft. high, over deposit. In the pit drove a stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
M. C. on S.,
T. 15 N. on N.,
R. 20 E, S. 26 on W., and
S. 25 on E. faces.

7. Tree Corner, with Pits and Mound of Earth.

A __________ ins. diam., for meander cor. of (e. g.) frac. secs. 17 and 20, Marked M. C. on W.,
T. 15 N. on E.,
R. 20 E, S. 17 on N., and
S. 20 on S. sides dug a pit, 36 x 36 x 12 ins., 8 ft. E. of tree; and raised a mound of earth, 4 ft. base, 2 ft. high, E. of cor.

8. Tree Corner, with Bearing Trees.

A __________ ins. diam., for a special meander cor. of (e. g.) frac. E. and W. halves of sec. 33, Marked S. M. C. on N.,
T. 15 N. on S.,
R. 20 E, S. 33 on E., and
S. 33 on W. sides; from which
A __________ ins. diam., bears S. __________° E. _______
lks. dist., marked
 T. 15 N, R. 20 E, S. 33, S. M. C. B. T.
A __________ ins. diam., bears S. __________° W.,
______ lks. dist., marked
 T. 15 N, R. 20 E, S. 33, S. M. C. B. T.

9. Pits and Mounds of Meander Corners.

When a pit is dug as an accessory to a meander corner, it will be located 8 feet from such corner (except as otherwise provided for in paragraph 6), on the side opposite the stream or lake meandered;

while the mound will be placed midway between the corner and nearest side of the pit.

10. Markings on Meander Corners.

On all meander corners, the letters “M. C.” (for meander corner) will be cut into the side facing the stream or lake to be meandered. On post or tree meander corners, within township exteriors, additional marks will be placed, as follows: the township number will be marked on the side opposite “M. C.”; the proper range and section number will be placed on the right-hand side (when looking along line toward the stream or lake), and the appropriate section number on the opposite side.

All meander corners on base lines or standard parallels will be marked S. C. on the north side or face.

On principal or guide meridians, and on meridional township lines, the letters “M. C.” will be placed as above directed; the township number will be marked on the opposite side; while the proper range and section numbers will be marked on the sides facing the east and west cardinal points.

On base lines or standard parallels and on latitudinal township lines, the township numbers will be marked on the sides facing the north and south cardinal points; while the range and section numbers will be placed on the side opposite the marking “M. C.”

In all the markings provided for in this paragraph, the numbers indicating townships, ranges, and sections, will be preceded by the initial letters “T.” “R.” and “S.”, respectively.

11. Descriptions will be modified in certain cases.

When a tree is marked for a regular meander corner, the descriptions in paragraphs 8 will be modified, as follows: strike out “special”; in place of “E. and W. halves of sec. 33,” write “secs. _______ and _______”; and omit the letter “S.”, preceding “M. C.”, in the marking on corner and bearing trees.

The descriptions in paragraphs 1 to 7, inclusive, will be modified to describe special meander corners, as illustrated in paragraph 8, by writing “special” before meander cor. and “S.” before “M. C.”, when conditions require the change.

12. Special Meander Corners and Auxiliary Meander Corners.

Regular meander corners are those established on standard, township, or section lines. See Plate V, for plans of meander corners, and the specimen plat, Plate IV, sections 17, 18, 19, 20, 25, 26, and 35, for locations of the meander corners described in Specimen Field Notes, pages 208 to 210. The meander corners, on lines of legal subdivisions, other

25. See Plate IV and page 188.
than standard, township, or section lines, will be designated special meander corners, (e.g.) those located on the Specimen Plat, Plate IV, in section 33.

Meander corners, not on a line belonging to the system of rectangular surveying, will be called auxiliary meander corners, (e.g.) the meander corner on Diamond Rock, in section 18.

13. Meander Corners on unsafe ground will be witnessed.

When a Meander Corner falls at a point where prevailing conditions would insure its destruction by natural causes, a witness corner to such meander corner will be established, as provided for in the article "Witness Corners", page 47.

CORNERS ON RESERVATION OR OTHER BOUNDARIES NOT CONFORMING TO THE SYSTEM OF RECTANGULAR SURVEYING.

[See Plate VI.]

1. Stone, with Mound of Earth.

Set a ______ stone, ______ x ______ x ______ ins.,[27] ______ ins. in the ground, for the (e.g.) 17 mile cor., marked 17 M. on S., N. P. on E., and P. L. on W. faces; dug pits, 36 x 36 x 12 ins., E. and W. of stone, 4 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ x ______ x ______ ins.,[27] ______ ins. in the ground, for the (e.g.) 38 mile cor., marked 38 M. on N. E., N. P. on N. W., and P. L. on S. E. faces; and raised a mound of stone, 3 ft. base, 2 ft. high,[28] N. E. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a ______ stone, ______ x ______ x ______ ins.,[27] ______ ins. in the ground, for the (e.g.) 35 mile cor., marked 35 M. on E., N. P. on N., and 8 W on S. faces; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked N. P. I. R., 35 M. B. T.


4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 5 ins. sq.,[30] with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for the (e.g.) 17 mile cor., marked 17 M. on S., N. P. I. R. on E., and P. L. on W. faces; dug pits, 36 x 36 x 12 ins., E. and W. of post, 4 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 5 ins. sq.,[30] 24 ins. in the ground, for the (e.g.) 35 mile cor., marked 35 M. on E., N. P. I. R. on N., and T. 6 N., R. 8 W., S. 9 on S.; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked N. P. I. R., 35 M. B. T.


6. Mound, with Deposit and Stake in Pit.

Deposited a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for the (e.g.) 33 mile cor.; dug pits, 36 x 36 x 12 ins., N. E. and S. W. of cor., 5 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In N. E. pit drove a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked 33 M. on S. E.; N. P. I. R. on N. E., and T. 6 N., R. 8 W., S. 15 on S. W. faces.

7. Tree Corner, with Pits and Mound of Earth.

A ______, ______ ins. diam., for the (e.g.) 29 mile cor., I mark 29 M. on E., N. P. I. R. on N., and T. 5 N., R. 7 W., S. 8 on S. sides; dug pits, 36 x 36 x 12 ins., N.

27. Stones for corners on Indian Reservation or other boundaries will not be less than 20 ins. long, or less than 6 ins. thick, and will measure at least one cubic foot in volume; consequently, a stone 20 x 14 x 6 ins., will be about minimum size, and 3 x 9 x 6 ins., represents satisfactory proportions. "P. N." for "Public Land" (Indian Reservation), on the east, and "F. L." for "Federal Land" (unsurveyed), on the west, applies to paragraph 1 only.

28. The above are minimum dimensions for mounds of stone on reservation boundaries.

29. The bearing trees, "S. ______° E." and "S. ______° W." from the corner, are supposed to stand on surveyed land, near the line between sections 8 and 9.

30. The stated dimensions of posts are minimum; if posts are longer than 3 feet, the extra length will be placed in the ground; the posts will in no case project more than 12 ins. above the natural surface of the earth.
and S. of tree, 5 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, E. of cor.

8. Tree Corner, with Bearing Trees.\textsuperscript{29}

A ——— ——— ins. diam., for the (e. g.) 35 mile cor., I mark
35 M. on E.,
N. P. I. R. on N., and
T. 6 N., R. 8 W., S. 9 on S. sides; from which
A ——— ——— ins. diam., bears N. ———° E.,
——— lks. dist., marked
N. P. I. R., 35 M., B. T.
A ——— ——— ins. diam., bears S. ———° E., ——— lks. dist., marked
T. 6 N., R. 8 W., S. 9, 35 M., B. T.
A ——— ——— ins. diam., bears S. ———° W.,
——— lks. dist., marked
T. 6 N., R. 8 W., S. 8, 35 M., B. T.
A ——— ——— ins. diam., bears N. ———° W.,
——— lks. dist., marked
N. P. I. R., 35 M., B. T.

9. Corner Monument of Stone, with Deposit.

Deposited a marked stone (charred stake, quart of charcoal, or vial with record\textsuperscript{31} inclosed), 12 ins. in the ground, for the S. W. cor. of

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(e. g.) the Nez Perces Indian Reservation; and built a monument of stone, 3 ft. sq. at base, 2 ft. sq. on top, 3 ft. high, over deposit; marked
S. W. cor., N. P. I. R. on N. E.,
P. L., ——— M. ——— chs. on S. E.,
P. L., ——— on S. W., and
P. L. on N. W. faces.

10. A Post for Corner Monument, with Pits and Mound of Earth.

Set a ——— post, 3 ft. long, 5 ins. sq., 24 ins. in the ground, for the N. W. cor. of (e. g.) the Nez Perces Indian Reservation, marked
P. L. on S. E.,
N. W. cor. N. P. I. R. on S. E.,
P. L. ——— M. ——— chs. on S. W., and
P. L. ——— on N. W. faces; dug pits 36 × 36 × 12 ins., S. and N. E. of post, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. E. of cor.

11. A Stone for Corner Monument, with Pits and Mound of Earth.

Set a ——— stone, 36 × 10 × 7 ins., 27 ins. in the ground, for the N. E. cor. of (e. g.) the Nez Perces Indian Reservation; marked
P. L. on N. E.,
P. L. on S. E.,
N. E. cor., N. P. I. R. on S. W., and
P. L. on N. W. faces; dug pits 36 × 36 × 12 ins., S. and W. of

stone, 8 ft. dist.; and raised a mound of earth, 5 ft. base, 2½ ft. high, S. W. of cor.

12. Modifications of descriptions.

When a stone or post is established for a corner monument (i.e.) at a corner of a reservation, and four (4) bearing trees are available, the descriptions in paragraph 10 and 11 will be modified, as follows: Replace all that refers to pits and mound of earth, by correct descriptions of four properly marked bearing trees, for each corner. (See paragraphs 3 and 5, pages 47, 48.)

The dimensions and arrangement of pits and mounds, described in the last two paragraphs, are similar to those described for "Corners referring to one township only." (See paragraphs 1 and 4, page 31.)

WITNESS CORNERS.\textsuperscript{35}

1. Witness Corners will be established in certain cases.

When the true point for any corner described in these instructions falls where prevailing conditions would insure its destruction by natural causes, a witness corner will be established in a secure position, on a surveyed line if possible, and within twenty chains of the corner point thus witnessed.


A witness corner will bear the same marks that would be placed upon the corner for which it is a witness, and in addition, will have the letters "W. C." (for witness corner), conspicuously displayed above the

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regular markings; such witness corners will be established, in all other respects, like a regular corner.


When bearing trees are described as accessories to a witness corner, the prescribed markings on each tree will be preceded by the letters "W. C.,” distinctly cut into the wood.

The true bearing and distance of witness corners, from the true point for the corner, will always be clearly stated in the field notes.

4. Witness Corners to corner points falling in roads, etc.

The point for a corner falling on a railroad, street, or wagon road, will be perpetuated by a marked stone (charred stake or quart of charcoal), deposited 24 inches in the ground,\textsuperscript{36} and

29. The bearing trees, "S———° E." and "S———° W." from the corer, are supposed to stand on surveyed land, near the line between sections 8 and 9.
30. The "record" will consist of a brief description of the corner, with the date of its construction.
31. The markings will be cut into large stones, inserted in the middle of the lowest course on each side of the monument.
32. The proper number of miles and chains, from the initial point, will be stated.
33. The year in which the monument is established will be placed in the blank.
34. See page 56.
35. The deposit will not be practicable in the case of railroads; but the witness corners will be established on the lines limiting the right of way. See pages 198, 209, and Plate IV.
witnessed by two witness corners, one of which will be established on each limiting line of the highway.

In case the point for any regular corner falls at the intersection of two or more streets or roads, it will be perpetuated by a marked stone (charred stake or quart of charcoal), deposited 24 inches in the ground, and witnessed by two witness corners established on opposite sides of the corner point, and at the mutual intersections of the lines limiting the roads or streets, as the case may be.

WITNESS POINTS.

Witness points will be perpetuated by corners similar to those described for quarter section corners, with the marking "W. P." (for witness point), in place of "\(1/4\)" or "\(1/4\) s.\), as the case may be.

If bearing trees are available as accessories to witness points, each tree will be marked W. P. B. T. (See “Insuperable objects on line—Witness Points,” page 22.)

MISCELLANEOUS.

1. Corners on Rockin place, or on Boulders.

When a corner falls on rock in place, or on a boulder, a cross (x), will be made at the exact corner point, and witnessed by the proper number of bearing trees, if they are available; in the absence of suitable trees, a mound of earth will be raised, if size of the boulder or form of the rock in place permits the excavation of pits. As a last resort, a mound of stone will be built to attract attention to the point, if loose rock can be obtained in the vicinity.

2. Location of Mounds.

When mounds of earth or other material are raised as accessories to corners, they will be placed as specified in the foregoing Description of Corners, and in every case the direction of the mound from the corner will be carefully stated. The use of the indefinite description “alongside” will be discontinued.

In case the character of the land is such that the mound can not be placed as hereinbefore described, the deputy will state in his notes, by bearing and distance, exactly where the mound is located with reference to the corner, and will give his reasons for placing it as described.

3. Mounds of Stone, covered with Earth.

In a case where pits are practicable and the deputy prefers raising a mound of stone, or a mound of stone covered with earth, he will use the form given for “Stone with mound of stone,” when the corner thus described is established; but when the corner “Stone with mound of stone covered with earth,” is constructed, the description will be modified as follows: Strike out the words “Pits impracticable”; in place of “mound of stone, 2 ft. base, 1½ ft. high,” write “mound of stone covered with earth, ______ ft. base, ______ ft. high,” inserting in the blank spaces the dimensions of the mound given in paragraph 1, following the designation of each class of corners, pages 24 to 45.


Bearing trees marked as accessories to standard corners, either township, section, or quarter section, will be selected on the north side of base lines or standard parallels, and bearing trees referring to the closing corners on said lines, will be located on the south side; in general, the bearing trees referring to any particular closing corner, together with one pit and the mound belonging to such corner, will be located on the same side of the line closed upon, and on the side from which the surveys have been closed.

When the requisite number of trees can be found within 300 links of the corner point, two (2) bearing trees will be marked and described for every standard or closing township or section corner, or corner common to two townships or sections, only; four (4) for every corner common to four townships or four sections; one (1) for a corner referring to one township or one section, only; two (2) for every quarter section corner or meander corner, and four (4) for each mile or half mile corner, or corner monument on a reservation or other boundary, not conforming to the system of rectangular surveying.

In case the prescribed number of trees can not be found within limits, the deputy will state in his field notes, after describing those marked, “no other trees within limits,” and add “dug pits ______ x ______ x ______ ins.,” etc., or “raised a mound of stone, ______ ft. base, ______ ft. high, ______ of cor.,” as prevailing conditions may require.

Bearing trees, being the most important accessories to the corners, will have their exact bearings from the true meridian taken with the instrument used in running lines of survey; and the distance from the middle of each bearing tree to the middle point of the corner will be carefully measured, and recorded in the field notes.

A plain blaze will be made at the usual or most convenient height, on each bearing tree, on the side facing the corner. The height of all other markings on the tree will in no case exceed the limit of two and one-half feet above the ground.

5. Stones for corners.

Stones 18 ins. long, or less, will be set with two-thirds of their length in the ground, and those more than 18 ins. long will have three-fourths of their length in the ground.

No stones measuring less than 504 cubic inches, or less than 12 ins. in length, will be used for corners.

6. Objects to be noted.

Particular attention is directed to the “Summary of objects and data required to be noted.” See page 58 of these instructions; and the deputy will thoroughly comply with the same in his work and field notes.

37. See pages 145, 157, and 164
38. The base and height of a “mound of stone, covered with earth,” will be the same as prescribed for mound of earth. The dimensions of “mound of stone” on reservation boundaries will conform to those prescribed in paragraph 2, page 45. The direction of the mound from the corner will be stated.
7. Lines discontinued at Legal Corners.

No mountainous lands, or lands not classed as surveyable, will be meandered, and all lines approaching such lands will be discontinued at the section or quarter-section corner nearest the unsurveyed land.

8. Marks to be cut.

All letters and figures on posts, trees, or stones, etc., will be cut into the object upon which they are placed. Arabic figures and plain letters will be used for all markings.


Corners referring to one, two, or four townships or sections, not identical with standard or closing corners, will be set with their faces directed NE. and SW., and NW. and SE., while all other corners will be set with their sides facing the cardinal points; except corners on boundaries of reservations and private land claims, which will be set squarely on line.

10. Size of Posts, Mounds, etc.

The sizes of wooden posts, mounds, and pits, noted in the foregoing descriptions, will be regarded as minimum, and their dimensions will be increased whenever practicable.


In establishing corners, durable stones will be used when obtainable; then, posts; and lastly, mounds, with stake in pit.

Wood of a perishable nature will not be used for posts or stakes.

12. Instructions will be examined.

Deputy surveyors will carefully read, study, and familiarize themselves with all instructions contained in this volume, and will instruct their assistants as to their duties before commencing work. An extra copy of this Manual may be furnished each deputy, for the use of his assistants.

INITIAL POINTS.

Initial points from which the lines of the public surveys are to be extended will be established whenever necessary, under such special instructions as may be prescribed in each case by the Commissioner of the General Land Office. The locus of such initial points will be selected with great care and due consideration for their prominence and easy identification, and must be established astronomically.

The lines of the public surveys are classified as follows:

- Class 1. Base lines and standard parallels.
- Class 2. Principal and guide meridians.
- Class 3. Township exteriors (or meridional and latitudinal township boundaries).
- Class 4. Subdivision and meander lines.

The initial point having been established, the line of the public surveys will be extended therefrom, as follows:

BASE LINE.

1. From the initial point the base line will be extended east and west on a parallel of latitude, by the use of transit or solar instruments, as may be directed by the surveyor general in his written special instructions. The transit should be designated for the alignment of all important lines.

2. The direction of base lines will conform to parallels of latitude and will be controlled by true meridians; consequently the correct determination of true meridians by observations on Polaris at elongation is a matter of prime importance.

3. When transits are employed, certain reference lines having a known position and relation to the required parallel of latitude will be prolonged as straight lines, by two back and two fore sights at each setting of the instrument, the horizontal limb being revolved 180° in azimuth between the observations.

4. Where solar apparatus is used, the deputy will test the instrument, whenever practicable, by comparing its indications with a meridian determined by Polaris observations, and in all cases where error is discovered he will make the necessary corrections of his line before proceeding with the survey. All operations will be fully described in the field notes.

5. The proper township, section, and quarter section corners will be established at lawful intervals, and meander corners at the intersection of the line with all meanderable streams, lakes, or bayous.

6. In order to detect errors and insure accuracy in measurement, two sets of chainmen will be employed; one to note distances to intermediate points and to locate topographical features, the other to act as a check. Each will measure 40 chains, and the proper corner will be placed midway between the ending points of the two measurements.

The deputy will be present when said corner is thus established, and will record in the body of his field notes the distances to the same, according to the measurement by each set of chainmen.

To obviate collusion between the sets of chainmen, the second set should commence at a point in advance of the beginning corner of the first set, the initial difference in measurement thus obtained being known only to the deputy.

PRINCIPAL MERIDIAN.

1. This line shall conform to a true meridian and will be extended from the initial point, either north or south, or in both directions, as the conditions may require, by the use of transit or solar instruments, as may be directed by the surveyor general in his special written instructions.

2. The methods used for determination of directions, and the precautions to be observed to secure accuracy in measurement, are fully stated above under the title "Base Line", and will be complied with in every particular.

39. See page 105.
40. For details see pages 120 to 127.
41. See specimen field notes, page 127, of the range line, if the same is west of north, but subtract when it bears east of north.
42. See pages 142 to 167.
3. In addition to the above general instructions, it is required that

in all cases where the establishment of a new principal meridian seems to be necessary to the surveyor general, he shall submit the matter, together with his reasons therefor, to the Commissioner of the General Land Office, and the survey of such principal meridian shall not be commenced until written authority, together with such special instructions as he may deem necessary, shall have been received from the Commissioner.

STANDARD PARALLELS.

1. Standard parallels, which are also called correction lines, shall be extended east and west from the principal meridian, at intervals of every 24 miles north and south of the base line, in the manner prescribed for running said line, and all requirements under the title "Base Line" will be carefully observed. (See page 51.)

2. Where standard parallels have been placed at intervals of 30 or 36 miles, regardless of existing instructions, and where gross irregularities require additional standard lines, from which to initiate new, or upon which to close old surveys, an intermediate correction line should be established to which a local name may be given, (e.g.) "Cedar Creek Correction Line," and the same will be run, in all respects, like the regular standard parallels.

GUIDE MERIDIANS.

1. Guide meridians shall be extended north from the base line, or standard parallels, at intervals of every 24 miles east and west from the principal meridian, in the manner prescribed for running the principal meridian, and all the provisions for securing accuracy of alignment and measurement found, or referred to under the title "Principal Meridian," will apply to the survey of said guide meridians. (See page 51.)

2. When existing conditions require that such guide meridians shall be run south from the base or correction lines, they will be initiated at properly established closing corners on such lines.

3. Where guide meridians have been improperly placed at intervals greatly exceeding the authorized distance of 24 miles, and standard lines are required to limit errors of old, or govern new surveys, a new guide meridian may be run from a standard, or properly established closing corner, and a local name may be assigned to the same, (e.g.) "Grass Valley Guide Meridian". These additional guide meridians will be surveyed in all respects like the regular guide meridians.

TOWNSHIP EXTERIORS.

1. Whenever practicable, the township exteriors in a tract of land 24 miles square, bounded by standard lines, will be surveyed successively through the block, beginning with those of the southwestern township.

2. The meridional boundaries of townships will have precedence in the order of survey and will be run from south to north on true meridians, with permanent corners at lawful distances; the latitudinal boundaries will be run from east to west on random or trial lines, and corrected back on true lines.

The falling of a random, north or south of the township corner to be closed upon, will be carefully measured, and, with the resulting true return course, will be duly recorded in the field notes.

Should it happen, however, that such random intersects the meridian of the objective corner, north or south of said corner, or falls short of, or overruns the length of the south boundary of the township by more than three chains (due allowance being made for convergency), said random, and, if necessary, all the exterior boundaries of the township, will be retraced and remeasured to discover and correct the error.

When running random lines from east to west, temporary corners will be set at intervals of 40.00 chains, and proper permanent corners will be established upon the true line, corrected back in accordance with these instructions, thereby throwing the excess or deficiency against the west boundary of the township, as required by law.

3. Whenever practicable, the exterior boundaries of townships belonging to the west range, in a tract or block 24 miles square, will first be surveyed in succession, through the range, from south to north; and in a similar manner, the other three ranges will be surveyed in regular sequence.

4. In cases where impassable objects occur and the foregoing rules cannot be complied with, township corners will be established as follows:

In extending the south or north boundaries of a township to the west, where the southwest or northwest corners cannot be established in the regular way by running a north and south line, such boundaries will be run west on a true line, allowing for convergency on the west half mile; and from the township corner established at the end of such boundary, the west boundary will be run north or south, as the case may be. In extending south or north boundaries of a township to the east, where the southeast or northeast corner cannot be established in the regular way, the same rule will be observed, except that such boundaries will be run east on a true line, and the east boundary run north or south, as the case may be.

5. Allowance for the convergency of meridians will be made whenever necessary.

METHOD OF SUBDIVIDING.

1. The exterior boundaries of a full township having been properly established, the subdivision thereof will be made as follows:

At or near the southeast corner of the township, a true meridian will be determined by Polaris or solar observations, and the deputy's instrument will be tested thereon; then from said corner the first mile of the east and south boundaries will be retraced, if subdivisions and survey of the exteriors have been provided for in separate contracts; but, if the survey of the exterior and subdivisional lines are included in the same contract, the retracements referred to will be omitted. All discrepancies resulting from disagreement of bearings or measurements will be carefully stated in the field notes.

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2. After testing his instrument on the true meridian thus determined, the deputy will commence the corner to sections 35 and 36, on the south boundary, and run a line parallel to the range line, establishing at 40.00 chains, the quarter section corner between sections 35 and 36, and at 80.00 chains the corner for sections 25, 26, 35, and 36.

3. From the last-named corner, a random line will be run eastward, without blazing, parallel to the south boundary of section 36, to its inter-

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section with the east boundary of the township, placing at 40.00 chains from the point of beginning, a post for temporary quarter section corner. If the random line intersects said township boundary exactly at the corner for sections 25 and 36, it will be blazed back and established as the true line, the permanent quarter section corner being established thereon, midway between the initial and terminal section corners.

If, however, the random line intersects said township boundary to the north or south of said corner, the falling will be carefully measured, and from the data thus obtained, the true return course will be calculated, and the true line blazed and established, and the position of the quarter section corner determined, as directed above.

The details of the entire operation will be recorded in the field notes.

4. Having thus established the line between sections 25 and 36; from the corner for sections 25, 26, 35, and 36, the west and north boundaries of sections 25, 24, 18, and 12, will be established as directed for those of section 36; with the exception that the random lines of said north boundaries will be run parallel to the established south boundaries of the sections to which they belong, instead of the south boundary of section 36; e.g., the random line between sections 24 and 25 will be run parallel to the established south boundary of section 25, etc.

5. Then, from the last established section corner, i.e., the corner for sections 1, 2, 11, and 12, the line between sections 1 and 2, will be projected northward, on a random line, parallel to the east boundary of the township, setting a post for temporary quarter section corner at 40.00 chains, to its intersection with the north boundary of the township. If the random intersects said north boundary exactly at corner for sections 1 and 2, it will be blazed back and established as the true line, the temporary quarter section corner being established permanently in its original position, and the fractional measurement thrown into that portion of the line between said corner and the north boundary of the township.

If however, said random intersects the north boundary of the township, to the east or west of the corner for sections 1 and 2, the consequent falling will be carefully measured, and from the data thus obtained the true return course will be calculated and the true line established, the permanent quarter section corner being placed upon the same at 40.00 chains from the initial corner of the random line, thereby throwing the fractional measurement in that portion lying

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between the quarter section corner and the north boundary of the township.

When the north boundary of a township is a base line or standard parallel, the line between sections 1 and 2 will be run parallel to the range line as a true line, the quarter section corner will be placed at 40.00 chains, and a closing corner will be established at the point of intersection with such base or standard line; and in such case, the distance from said closing corner, to the nearest standard corner on such base or standard line, will be carefully measured and noted as a connection line.

6. Each successive range of sections progressing to the west, until the fifth range is attained, will be surveyed in a similar manner; then, from the section corners established on the west boundary of said range of sections, random lines will be projected to their intersection with the west boundary of the township, and the true return lines established as prescribed for the survey of the first or most eastern range of sections, with the exception that on the true lines thus established the quarter section corners will be established at 40.00 chains from the initial corners of the randoms, the frac-

43. The meridional section lines will be made parallel to the range line or east boundary of the township, by applying to the bearing of the latter a small correction, dependent on the latitude, taken from the following table, which gives, to the nearest whole minute, the convergence of meridians 6 miles long, and from 1 to 5 miles apart; and supplies directly the deviation of meridional section lines west of north, when the range line is a true meridian. Add the correction to the bearing of the range line, if the same is west of north, but subtract when it bears east of north.

44. See "Prescribed Limits," page 39.

45. See Table VII, and rules, page 128. Random bearings, determined as directed above, are actually the true bearings of fractional true lines and are used for running them. Any deviation from random bearings, derived from the application of the falling (Table VII), changes the random bearing by an amount due to unavoidable errors, and should give for a final result a bearing as near the true bearing as the field work will permit. A true bearing means the angular deviation from the true meridian in contradistinction to the magnetic bearing, or angle made with the magnetic meridian. A true line will be understood to refer to the line upon which the corners are established.

46. See Table VII and rules, page 128

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tional measurements being thereby thrown into those portions of the lines situated between said quarter section corners and the west boundary of the township.

7. The following general requirements are reiterated for emphasis:

The random of a latitudinal section line will always be run parallel to the south boundary of the section to which it belongs, and with the true bearing of said boundary; and when a section has no linear south boundary, the random will be run parallel to the south boundary of the range of sections in which it is situated, and fractional true lines will be run in a similar manner. 47

8. The deputy is not required to complete the survey of the first range of sections from south to north before commencing the survey of the second or any subsequent range of sections, but the corner on which any random line closes shall have been previously established by running the line which determines its position, except as follows: Where it is impracticable to establish such section corner in the regular manner, it will be established by running the latitudinal section line as a true line, with a true bearing, determined as above directed for random lines, setting the quarter section corner at 40.00 chains and the section corner at 80.00 chains. 48

9. Quarter section corners, both upon meridional and latitudinal section lines, will be established at points equidistant from the corresponding section corners, except upon the lines closing on the north and west boundaries of the township, and in those situations the quarter section corners will always be established at precisely forty chains to the north or west (as the case may be) of the respective section corners from which those lines respectively start, by which procedure the excess or deficiency in the measurements will be thrown, according to law, on the extreme tier or range of quarter sections, as the case may be.

10. Where by reason of impassable objects only a portion of the south boundary of a township can be established, an auxiliary base line (or lines), 49 as the casemay require, will be run through the portion which has no linear south boundary, first random, then corrected, connecting properly established corresponding section corners (either interior or exterior) and as far south as possible, and from such line or lines, the section lines will be extended northwardly in the usual manner, and any fractionsouth of said line will be surveyed in the opposite direction from the section corners on the auxiliary base thus established. (See Plate I, figs. 3, 4, and 5.)

11. Where by reason of impassable objects no portion of the south boundary of a township can be regularly established, the subdivision thereof will proceed from north to south and from east to west, thereby throwing all fractional measurements and areas against the west boundary, and the meanderable stream or other boundary limiting the township on the south.

If the east boundary is without regular section corners and the north boundary has been run eastwardly as a true line, with section corners at regular intervals of 80.00 chains, the subdivision of the township will be made from west to east, and fractional measurements and areas will be thrown against the irregular east boundary.

12. When the proper point for the establishment of a township or section corner is inaccessible, and a witness corner can be erected upon each of the two lines which approach the same, at distances not exceeding twenty chains therefrom, said witness corners 5 will be properly established, and the half miles upon which they stand will be recognized as surveyed lines.

The witness corner will be marked as conspicuously as a section corner, and bearing trees will be used wherever possible.

The deputy will be required to furnish good evidence that the section corner is actually inaccessible.

MEANDERING.

1. Proceeding down stream, the bank on the left hand is termed the left bank and that on the right hand the right bank. These terms will be universally used to distinguish the two banks of a river or stream.

2. Navigable rivers, as well as all rivers not embraced in the class denominated "navigable," the right-angle width of which is three chains and upwards, will be meandered on both banks, at the ordinary mean high water mark, by taking the general courses and distances of their sinuosities, and the same will be entered in the field book. Rivers not classed as navigable will not be meandered above the point where the average right-angle width is less than three chains. Shallow streams, without any well-defined channel or permanent banks, will not be meandered; except tide-water streams, whether more or less than three chains wide, which should be meandered at ordinary high-water mark, as far as tide-water extends.

At every point where either standard, township, or section lines intersect the bank of a navigable stream, or any meanderable line, corners will be established at the time of running these lines. Such corners are called meander corners, 50 and the deputy will commence at one of these corners, follow the bank or boundary line, and measure the length of each course from the beginning corner to the next "meander corner." Compasscourses, by the needle or solar, will be used in meanders. Transit angles are not allowed.

The crossing distance between meander corners on same line and the true bearing and distance between corresponding meander corners will be ascertained by triangulation, or direct measurement, in order that the river may be protracted with entire accuracy. The particulars will be given in the field notes.

5. See "Witness Corners," page 47.

47. See Plate IV, between sections 7 and 10, and 17 and 20.

48. See Plate IV, between sections 8 and 11.

49. Section corners will be established by correct alignment and measurement of meridional sectional lines whenever practicable.

50. These corners are the regular meander corners, and designated "meander corners;" they are distinguished from special and auxiliary meander corners; see paragraphs 11 and 12, page 47, and pages 42 and 43.
In meandering water courses or lakes, where a distance is more than ten chains between successive stations, whole chains only should be taken; but if the distance is less than ten chains, and it is found convenient to employ chains and links, the number of links should be a multiple of ten, thereby saving time and labor in testing the closings, both in the field and office.

3. The meanders of all lakes, navigable bayous, and deep ponds, of the area of twenty-five acres and upwards, will be commenced at a meander corner and continued, as above directed for navigable streams; from said corner, the courses and distances of the entire margin of the same, and the intersections with all meander corners established thereon, will be note.

All streams falling into the river, lake, or bayou will be noted, and the width at their mouths stated; also, the position, size, and depth of springs, whether the water be pure or mineral; also, the heads and mouths of all bayous; all islands, rapids, and bars will be noted, with intersections, to their upper and lower ends, to establish their exact situation. The elevation of the banks of lakes, bayous, and streams, the height of falls and cascades, and the length and fall of rapids will be recorded in the field notes.

To meander a lake or deep pond lying entirely within the boundaries of a section, two lines will be run from the two nearest corners on different sides of such lake or pond, the courses and length of which will be recorded, and if coincident with unsurveyed lines of legal subdivisions, that fact will also be stated in the field notes, and at each of the points where said lines intersect the margin of the pond or lake, a special meander corner will be established as above directed. (See example, page 201.)

The relative position of these points being thus definitely fixed in the section, the meandering will commence at one of them and be continued to the other, noting the intersection, and thence to the beginning. The proceedings are to be fully entered in the field notes.

4. Meander lines will not be established at the segregation line between dry and swamp or overflowed land, but at the ordinary high-water mark of the actual margin of the rivers or lakes on which such swamp or overflowed lands border.

5. The precise relative position of an island, in a township made fractional by a river or lake in which the island is situated, will be determined by triangulation from a special and carefully measured base line, initiated upon the surveyed lines, on or near the lake or river bank on the main land, so as to connect by course and distance on a direct line, the meander corner on the mainland with the corresponding point on the island, where the proper meander corner will be established.

6. In making the connection of an island lying entirely within a section, with the mainland, a special base will be measured from the most convenient meander corner, and from such base, the location of an auxiliary meander corner will be determined by triangulation, at which the meanders of the island will be initiated.

7. In the survey of lands bordering on tide water, "meander corners" will be established at the points where surveyed lines intersect high-water mark, and the meanders will follow the high-water line.

8. The field notes of meanders will show the dates on which the work was performed, as illustrated in the specimen notes, page 216. The field notes of meanders will state and describe the corner from which the meanders commenced, and upon which they closed, and will exhibit the meanders of each fractional section separately; following, and composing a part of such notes, will be given a description of the land, timber, depth of inundation to which the bottom is subject, and the banks, current, and bottom of the stream or body of water meandered. The utmost care will be taken to pass no object of topography, or change therein, without giving a particular description thereof in its proper place in the notes of the meanders.

**SUMMARY OF OBJECTS AND DATA REQUIRED TO BE NOTED.**

1. The precise length of every line run, noting all necessary offsets therefrom, with the reason for making them, and method employed.

2. The kind and diameter of all bearing trees, with the course and distance of the same from their respective corners; and the precise relative position of witness corners to the true corners.

3. The kind of materials of which corners are constructed.

4. Trees on line. The name, diameter, and distance on line to all trees which it intersects.

5. Intersections by line of land objects. The distance at which the line intersects the boundary lines of every reservation, settler's claim, improvement, or rancho; prairie, bottom land, swamp, marsh, grove, and windfall, with the course of the same at all points of intersection; also, the distances at which the line begins to ascend, arrives at the top, begins to descend, and reaches the foot of all remarkable hills and ridges, with their courses, and estimated height above the level land of the surrounding country, or above the bottom lands, ravines, or waters near which they are situated. Also, distance to and across large ravines, their depth and course.

6. Intersections by line of water objects. All rivers, creeks, and smaller streams of water which the line crosses; the distances measured on the true line to the bank first arrived at, the course down stream at points of intersection, and their widths on line. In cases of navigable streams, their width will be ascertained between the meander corners, as set forth under the proper head.

7. The land's surface — whether level, rolling, broken, hilly, or mountainous.

8. The soil — whether first, second, third, or fourth rate.

9. Timber — these various kinds of timber and undergrowth, in the order in which they predominate.

51. A "Special Meander Corner" is one established on a line of legal subdivision, not a standard, township, or section line. See pages 201 and 202.

52. An "auxiliary meander corner" is one not on a line belonging to the system of rectangular surveying. See page 212.

10. Bottom lands—to be described as wet or dry, and if subject to inundation, state to what depth.

11. Springs of water—whether fresh, saline, or mineral, with the course of the streams flowing from them.

12. Lakes and ponds—describing their banks and giving their height, and also depth of water, and whether it be pure or stagnant.

13. Improvements. Towns and villages, houses or cabins, fields, or other improvements with owners' names; mill sites, forges, and factories, mineral monuments, and all corners not belonging to the system of rectangular surveying; will be located by bearing and distance, or by intersecting bearings from given points.

14. Coal banks or beds; peat or turf grounds; minerals and ores; with particular description of the same as to quality and extent, and all diggings therefor; also salt springs and licks. All reliable information that can be obtained respecting these objects, whether they be on the line or not, will appear in the general description.

15. Roads and trails, with their directions, whence and whither.

16. Rapids, cataracts, cascades, or falls of water, with the estimated height of their fall in feet.

17. Precipices, caves, sink holes, ravines, stone quarries, ledges of rocks, with the kind of stone they afford.

18. Natural curiosities, interesting fossils, petrifications, organic remains, etc.; also all ancient works of art, such as mounds, fortifications, embankments, ditches, or objects of like nature.

19. The magnetic declination will be incidentally noted at all points of the lines being surveyed, where any material change in the same indicates the probable presence of iron ores; and the position of such points will be perfectly identified in the field notes.

PRESCRIBED LIMITS FOR CLOSINGS AND LENGTHS OF LINES.

1. If in running a random township exterior, such random falls short of or exceeds its proper length by more than three chains, or falls more than three chains north or south of its objective corner, it will be re-run, and if found correct, so much of the remaining boundaries of the township will be retraced or resurveyed, as may be found necessary to locate the error.

2. Every meridional section line, except those terminating in the north boundary of the township, shall be eighty chains in length.

3. The random meridional section lines through the north tier of sections shall fall within fifty links east or west of the section corners established on the north boundary of the township, except when closing on a base line or standard parallel.

4. The actual length of meridional section lines through the north tier of sections shall be within one hundred and fifty links of their theoretical length. The latter will be determined from the meridional boundaries of the north tier of sections.

5. All random latitudinal section lines shall fall within fifty links north or south of their objective section corners.

In any range of sections, the difference between the true bearing of a latitudinal section line and that of the south boundary of the range, shall not exceed 21 minutes of arc.

The latitudinal section lines, except those terminating in the west boundary of the township, shall be within fifty links of the actual distance established on the south boundary line of the township for the width of the range of sections to which they belong.

6. The north boundary and the south boundary of any one section,

except in the extreme western range of sections, shall be within fifty links of equal length.

7. The meanders within each fractional section, or between any two successive meander corners, or of an island in the interior of a section, should close within a limit to be determined by allowing five-eighths of a link for each chain of said meander line. Where the meander corners marking the ends of a meander line in a fractional section are located on standard, township, or section lines, the above limit, increased by one-fourth of the regular perimeter of the fractional section, expressed in miles, multiplied by 71 links, will be allowed.

The extreme limit, however, will in no case be permitted to exceed one hundred and fifty links.

FIELD NOTES.

1. The proper blank books for original field notes will be furnished by the surveyor general, and in such books the deputy surveyor will make a faithful, distinct, and minute record of everything done and observed by himself and his assistants, pursuant to instructions, in relation to running, measuring, and marking lines, establishing corners, etc., and present, as far as possible, full and complete topographical sketches of all standard and exterior lines, drawn to the usual scale for township exteriors. These "original field notes" are not necessarily the entries made in the field, in the deputy's pocket notebooks called tablets; but they are to be fully and correctly written out in ink, from such tablets, for the permanent record of the work. Tablets should be so fully written as to verify the "original field notes" whenever the surveyor general requires them for inspection.

2. A full description of all corners belonging to old surveys, from which the lines of new surveys start, or upon which they close, will in all cases be furnished the deputy from the surveyor general's office, when authority is given for commencing work; then, if the old corners are found to agree with said descriptions, the deputy will describe any one of them in this form, "which is a stone firmly set, marked, and witnessed, as described by the surveyor general"; but, should a corner not answer the description supplied, the deputy will give a full description of such corner and its accessories, following the proper approved form given in these instructions.

54. See "Explanations," p. 71 to 78.

55. See exception on p. 76.

56. See Plate I, figs. 8, 9, 10, 11, and 12.
A full description of each corner established under any one contract will be given once only; subsequent reference to such corner will be made in the form, "herefore described," or (e. g.) "the corner for sections 2, 3, 10, and 11," as the case may require.

In all cases where a corner is reestablished, the original field notes will describe fully the manner in which it is done.

3. The original field notes of the survey of base, standard, and meridian lines will describe all corners established thereon, how established, the crossings of streams, ravines, hills, and mountains; character of soil, timber, minerals, etc.; and after the description of each township corner established in running such lines, the deputy will note particularly in the "general description" the character of townships on each side of the lines run.

4. The original field notes of the survey of exterior boundaries of townships will describe the corners and topography, as above required, and the "general description" at the end of such notes will describe the townships as fully as possible, and also state whether or not they should be subdivided.

5. The original field notes of the subdivisional survey of townships will describe the corners and topography as above required, and the "general description" at the end of such notes will state minutely the character of the land, soil, timber, etc., found in such townships.

The topography will be given on the true line in all cases, and will be taken correctly, not estimated or approximated.

6. With the original field notes of the survey of base lines and standard parallels, and principal and guide meridians forming a tract 24 miles square, including those of the township exteriors therein, the deputy will submit a diagram of the lines surveyed, drawn to a scale of half an inch to one mile, upon which will be written the true bearings and lengths of all surveyed lines, except the lengths of those which are actually 40.00 or 80.00 chains. These diagrams will exhibit all water courses, with the direction of each indicated by an arrow head pointing down stream; also, the intersection of the lines with all prairies, marshes, swamps, ravines, lakes, ponds, mountains, hills, and all other natural or artificial topographical features mentioned in the original field notes, to the fullest extent possible.

7. With the special instructions for making subdivisional surveys of townships into sections, the deputy will be furnished by the surveyor general with blank township diagrams drawn to a scale of one inch to forty chains, upon which the true bearings and lengths of the township and section lines, from which the surveys are to be projected, or upon which they are to close, will be carefully marked; and on such diagrams the deputy who subdivides will make appropriate sketches of the various objects of topography as they occur on his lines, so as to exhibit not only the points of intersection therewith, but also the directions and relative positions of such objects between the lines, or within each section, as far as practicable, so that every topographical feature may be properly completed and connected in the showing.

8. Triangulations, offsets, or traverses, made to determine distances that can not be directly measured, such as those over (e. g.) deep streams, lakes, impassable swamps, canons, etc., will be made on the random lines, when random lines are run. All particulars will be fully stated in the field notes.

The exhibition of every mile of surveying, whether on standard, township, or subdivision lines, and the meanders in each section, will be complete in itself, and will be separated from other records by a black line drawn across that part of the page containing the body of notes. The description of the surface, soil, minerals, timber, undergrowth, etc., on each mile of line will follow the notes of survey of such line, and not be mingled with them.

Particular care will be taken to record at the end of each mile the number of chains of mountainous land, heavily timbered land, or land covered with dense undergrowth. (See page 224.)

The date of each day's work will immediately follow the notes thereof.

9. Near the end of the original field notes and immediately before the "general description," the deputy surveyor will add, in the form shown in specimen field notes (page 177), a tabular statement of the latitude and departure of all boundary lines of the township, derived from a traverse table, and will give the totals, and the errors in latitude and departure; said errors shall in no case exceed three chains, the prescribed limit for the falling of the random northerly boundary of a township. If a part or the whole of one or more boundaries is made up of meander lines, the northings, southings, eastings, and westings of the full section lines, nearest said meanders, will replace the missing N., S., E., or W. township lines, as the case may require, thereby presenting the errors of said boundaries of a closed survey.

If all the exterior lines have been surveyed by the deputy, the bearings and distances for the table will be taken from his own notes. In a case where some of the boundaries have been surveyed under another contract, the deputy will use the bearings and distances supplied by the surveyor general, in connection with those of his own lines; and, if errors exceed the allowance of three chains, specified in paragraph 1 of the "Prescribed Limits," the deputy will determine where the error occurs, correct the same before he leaves the field, and place the table in his original field notes.

Besides the ordinary notes taken on line (and which will always be written down on the spot, leaving nothing to be supplied by memory), the deputy will subjoin, at the conclusion of his book, such further description or information touching any matter or thing connected with the township (or other) survey which he may be able to afford, and may deem useful or necessary to be known—with a general description of the township in the aggregate, as respects the face of the country, its soil and geological features, timber, minerals, waters, etc.

10. Following the general description of the township will be placed "A list of the names of the individuals employed to assist in running, measuring, and marking the lines and

57. See page 52 and Plate III.
58. See pages 136 and 188.
59. See page 59, and retracement article, page 72.
corners described in the foregoing field notes of township No. ______ of the base line of range No. ______ of the ______ meridian, showing the respective capacities in which they acted."

AFFIDAVITS TO FIELD NOTES.

The following are the forms of official oaths to be taken by deputy surveyors and their assistants. The original oaths will be affixed to the original field notes forwarded to the surveyor general by the deputy surveyor; the preliminary oaths being placed on the page following the index of the first book, and the final oaths at the end of the last book of field notes of the survey of each class of lines60 to which they refer:

PRELIMINARY OATHS OF ASSISTANTS.

We, _______ and _______, do solemnly swear that we will well and faithfully execute the duties of chainmen; that we will level the chain upon even and uneven ground and plumb the tally pins, either by sticking or dropping the same; that we will report the true distance to all notable objects, and the true length of all lines that we assist in measuring, to the best of our skill and ability, and in accordance with instructions given us, in the survey of the _______.

_______, Chainman.
_______, Chainman.

Subscribed and sworn to before me this _______ day of _______, 189____.
[SEAL.]

We, _______ and _______, do solemnly swear that we will well and truly perform the duties of moundsmen in the establishment of corners, according to the instructions given us, to the best of our skill and ability, in the survey of _______.

_______, Moundsman.
_______, Moundsman.

Subscribed and sworn to before me this _______ day of _______, 189____.
[SEAL.]

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We, _______ and _______, do solemnly swear that we will well and truly perform the duties of axmen, in the establishment of corners and other duties, according to instructions given us, to the best of our skill and ability, in the survey of _______.

_______, Axman.
_______, Axman.

FINAL OATHS OF DEPUTY SURVEYORS AND THEIR ASSISTANTS.

A list of the names of the individuals employed by _______ _______., United States deputy surveyor, to assist in running, measuring, and marking the lines and corners described in the foregoing field notes of the survey of _______, showing the respective capacities in which they acted.

_______, Chainman.
_______, Chainman.
_______, Chainman.
_______, Chainman.
_______, Moundsman.
_______, Moundsman.
_______, Axman.
_______, Axman.
_______, Flagman.

FINAL OATHS OF ASSISTANTS.

We hereby certify that we assisted __________., United States deputy surveyor, in surveying all those parts or portions of the _______ of the _______ base and _______ meridian, _______ of _______, which are represented in the foregoing field notes as having been surveyed by him and under his direction; and that said survey has been in all respects, to the best of our knowledge and belief, well and faithfully surveyed, and the corner monuments established according to the instructions furnished by the United States surveyor general for _______.

_______, Chainman.
_______, Chainman.
_______, Chainman.
_______, Chainman.
_______, Moundsman.
_______, Moundsman.
_______, Axman.
_______, Axman.
_______, Flagman.

60. See page 50, and par. 13 (a) page 64.
Subscribed and sworn to before me this ______ day of ______, 189____.
[SEAL.]

FINAL OATH OF UNITED STATES DEPUTY SURVEYOR.

I, _______ , United States deputy surveyor, do solemnly swear that in pursuance of instructions received from ________, United States surveyor general for ________, bearing date of the______ day of ______, 189____, I have well, faithfully, and truly, in my own proper person, and in strict conformity with the instructions furnished by the United States surveyor general for ________, the Manual of Surveying Instructions, and the laws of the United States, surveyed all those parts or portions of ________.

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______ of the ______ base and ______ meridian in the ______ of ______, which are represented in the foregoing field notes as having been surveyed by me and under my directions; and I do further solemnly swear that all the corners of said survey have been established and perpetuated in strict accordance with the Manual of Surveying Instructions, and the special written instructions of the United States surveyor general for ________, and in the specific manner described in the field notes, and that the foregoing are the true field notes of such survey; and should any fraud be detected, I will suffer the penalty of perjury, under the provisions of an act of Congress approved August 6, 1846.

______

United States Deputy Surveyor.

Subscribed by said ________, U. S. deputy surveyor, and sworn to before me this ______ day of ______, 189____.
[SEAL.]

11. The final oath of the deputy surveyor will be taken before the U. S. Surveyor General for the State or Territory in which the survey is executed, or before any officer authorized by the laws of the United States or by the municipal authorities, to administer land oaths, except notaries public.

It is preferable that both preliminary and final oaths of assistants should be taken before some officer duly authorized to administer oaths other than the deputy surveyor. In cases, however, where great delay, expense, or inconvenience would result from a strict compliance with this rule, the deputy surveyor is authorized to administer the necessary oaths to his assistants, but in each case where this is done, he will submit to the proper surveyor general, a full written report of the circumstances which required his stated action.

12. The deputy will transmit the original field notes and the required sketches to the survey or general at the earliest practicable date after completion of his work in the field. Said original field notes will be filed in the office of the surveyor general as a part of its permanent records, subject only to the direction of the Commissioner of the General Land Office; and no changes whatever will be made in said original field notes, after they have been filed in the surveyor general's office.

13. The original field notes, each bearing the written approval of the surveyor general, will be substantially bound in volumes of suitable size and retained in the surveyor general's office. Certified transcripts of said original field notes will be prepared at the earliest practicable date, as follows:

(a) The field notes of the survey of base lines and standard parallels, of principal and guide meridians, of township exteriors, and of subdivision and meander lines will be written in separate books. A complete set of preliminary and final oaths will be attached to the field notes of each class of lines. At no adhesive material of any kind will be used to fasten leaves or covers. Cut or mutilated leaves, or slips, will not be inserted.

(b) The field notes of subdivisions will be written in a separate book for each township; the preliminary oaths of the assistants employed in making said subdivisions will be prefixed to the first book, and their final oaths will be attached to the last book of the series, arranged in the order of dates.

(c) The first or title page of each book of field notes will describe the subject matter of the same, the location of the survey, by whom surveyed, number and date of contract, and the dates of commencement and completion of the work.

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(d) The second page of each book of field notes will contain the names and duties of the assistants employed on the surveys recorded therein; the index will be placed on the same or following page.

(e) Whenever a new assistant is employed, or the duties of any one of them changed, such fact will be stated in an appropriate entry immediately preceding the notes taken under such changed arrangements.

(f) No abbreviations or contractions of words are allowable, except such words as are constantly occurring, and a few others, additional to those enumerated on page 23, as follows:

astron. for astronomical. I. m. t. for local mean time.
chrs. for chains. long. for longitude.
corr. for correction. m. for minutes.
decl. for declination. mag. decl. for magnetic declination.
diff. lat. for difference of latitude. red. for reduce or reduction.
dep. for departure. temp. for temporary.
h. for hours. U. C. for upper culmination.
lat. for latitude. w. corr. for watch correction.
L. C. for lower culmination. w. t. for watch time.

Proper names will never be abbreviated, however often they recur.

(g) All transcripts of field notes, made out as herein directed, will be written on official field-note paper, foolscap size (pages 13½ x 8½ inches), in a bold, legible hand, or typewritten, and as nearly as possible without erasures or interlineations; such transcripts of any series of surveys, included in one account forwarded to the General Land Office, will be securely put up in one package, at the office of the surveyor general, prior to transmission.

61. See classification of lines, page 50
SPECIAL INSTRUCTIONS ISSUED BY UNITED STATES SURVEYORS GENERAL TO UNITED STATES DEPUTY SURVEYORS.

One of the most important duties to be performed by the surveyor general is to provide the deputy surveyor with Special Instructions, in connection with the contract, prepared in accordance with law, which instructions will not consist of directing attention to certain paragraphs in this Manual, reiteration of its requirements, and printed directions of a general nature; but they will in all cases be specific in character, with all necessary detailed statements setting forth what the deputy is to do and how the work is to be performed. Before making out special instructions, the surveyor general will cause a thorough examination to be made of the field notes and plats of older surveys of standard and township lines upon which the deputy is to base his work, and give him full information—both written and graphic—of the exact condition of adjoining surveys, with all irregularities that may be found, carefully and clearly noted; with all necessary instructions for his guidance if he finds everything as it should be, and, in addition, full advice as far as practicable what to do in case the surveys on the ground are not as represented in the old notes.

If the contract includes exterior lines, the surveyor general will specify in detail where the deputy is to commence, in what order and in what direction he is to run the lines, and provide for his use a diagram, drawn to a scale of one inch to one mile, giving full and accurate information in regard to lengths and bearings of all lines of old surveys, from which he is to work, or upon which he is to close. The diagrams will be made in triplicate, one copy for the General Land Office, one for the deputy, and one to be retained; they may be either original drawings, or blue prints or tracings therefrom. In no case must the deputy be sent into the field without full and accurate information in regards to all irregularities on the records which will affect the extent or accuracy of his survey.

SPECIMEN FIELD NOTES.

[See Plates III and IV.]

Specimen field notes Nos. 1, 2, 3, 4, and 5, illustrate, respectively, the method and order to be followed in the survey of standard parallels, guide meridians, and township exteriors; resurvey of township exteriors; and the subdivision of a township into sections and quarter sections.

The attention of every deputy surveyor is particularly directed to these specimens, as indicating not only the method by which his work will be conducted, but also the form, order, language, etc., in which his field notes will be prepared for the office of the surveyor general, and such specimens will be deemed a part of these instructions; and any departure from their details, in cases where the circumstances are analogous in practice, will be regarded as a violation of his contract and oath.

DIAGRAM OF TOWNSHIP EXTERIORS.

[See Plate III.]

The title, certificate, and remarks on Plate III, with the specimen field notes Nos. 1, 2, and 3, will fully explain the drawing designated "Township Exteriors."

In all cases the true bearing and length of each township boundary will be clearly stated on the diagram; and, when any township boundary entered on the diagram, surveyed under the current contract, or a prior contract, departs from the true meridian, or proper latitude curve (as the case may be), or falls short of or overrun its proper length, by an amount in excess of the prescribed limits of three chains (page 59, paragraph 1), the actual position and extent of said township boundary will be graphically exhibited on the diagram, as well as by bearing and length recorded in the field notes.

SPECIMEN TOWNSHIP PLAT.

[See Plate IV.]

Plate IV illustrates the subdivision of a town ship into sections and quarter sections; the record of said subdivision being given in detail in specimen field notes No. 5.

The subdivision of fractional sections into forty-acre lots (as near as may be) will be so laid down on the official township plat in broken black lines as to admit of giving to each a specific designation by word description, if possible, according to its relative position in the fractional section, as per examples on Plate IV; or by a number, in all cases where the lot cannot properly be designated as a quarter quarter. Those fractional lots which are not susceptible of being described according to relative local position will be numbered in a regular series; those bordering on the north boundary of a township to be numbered progressively from east to west, and those bordering on the west boundary of a township to be numbered progressively from north to south, in each regular section. As section 6 borders on both the north and west boundaries of the township, the fractional lots in the same will be numbered as follows: commencing with No. 1 in the northeast, thence progressively west to No. 4 in the northwest, and south to No. 7 in the southwest corner of the section.

To secure a uniform system for numbering lots of fractional sections, including those above specified, imagine the section divided by three equidistant parallel latitudinal lines into four strips or tiers, 1 numbered from north to south; then, beginning with the eastern lot of the north tier, call it No. 1, and continue the numbering west through the tier, then east in the second, west in the third, and east in the fourth tier. A lot extending north and south through two, or part of two tiers, will be numbered in the tier containing it a greater area. In case any tier is without numbered lots, the numbering will be continued in the next tier to the south. (Plate IV, section 18.)

This method of numbering will apply to any part of a section, regardless of the relative situation of a part or parts.
surveyed and lotted under a prior contract; in this case the lot numbers will be a continuation of the series already initiated.

Interior lots will be, as nearly as possible, 20.00 chains long by 20.00 chains wide; and the excess or deficiency of measurement will always be thrown against the northern or western boundary of the section, or meander line, or irregular boundary, as the case may be.

When, by reason of irregular surveys or from other causes, the length of a township from south to north exceeds the lawful length of 480.00 chains, or the width from east to west exceeds 480.00 chains minus the proper convergency, to such extent as to require two or more tiers of lots along the north boundary, or two or more ranges of lots along the west boundary, as the case may be, the entire north or west halves of said sections will be properly lotted, and to each lot will be assigned its proper number; and in such cases the area of each lot will be stated on the plat.

In case the length or width of the township falls so far short of legal dimensions as to eliminate the north or west half of any section situated as above specified, that part of the section remaining will be treated in a similar manner.

In a regular township (Plate IV) the southeast quarter of the northwest quarter of section 6 will have its proper area in acres (40) inserted in all cases. The half quarter sections in the north tier and west range of sections will exhibit their proper areas in acres (80); while the areas of quarter sections will be omitted, except as follows:

When two lines of legal subdivision of either 160, 80, or 40 acre tracts intersect each other on or near a meander or boundary line that the ordinary inaccuracies of drawing would leave the areas of said tracts in doubt, the plats will, for the sake of clearness and a full showing of the facts, exhibit the proper areas of such quarter, half quarter, and quarter quarter sections. See examples, Plate IV, in sections 13, 17, 25, and 35.

Plats shall not be trimmed. A margin of three inches for binding will be preserved on the left-hand side of each plat. Each plat will be certified by the surveyor general, with table annexed, according to the form on Plate IV, and will exhibit the area of public land, water surface, townsite, private land claims, and mineral claims, with the total area of the township.

Each township plat will be prepared in triplicate: one for the General Land Office, one for the United States district land office, and the third will be retained as the record in the office of the surveyor general.

The plat for the local land office will not be forwarded until notice is received by the surveyor general from the Commissioner of the General Land Office that the survey represented on said plat has been accepted, and that he is authorized to file the triplicate plat.

The plats will be prepared as nearly as possible in accordance with the specimen plat designated "Plate IV." The use of all fluids, except a preparation of India ink of good quality, must be avoided by the draughtsman in delineations relating to the public surveys. All lines, figures, etc., will be sharply defined. All lettering on the plats must be clear and sharp in outline and design, and black; ornamentation of any kind is prohibited. These requirements are necessary in order that everything shown upon original plats may be fairly reproduced in making photolithographic copies of the same.

All towns, settlements, permanent buildings, private claims, reservations, water courses, ditches, lakes, islands, mountains, buttes, canons, roads, railroads, telegraph lines, canals, etc., will be shown upon the plats and designated by proper names where such are known.

All township plats are to be drawn to a uniform scale of 1 inch to 40 chains, United States standard, and diagrams of exteriors to a scale of 1 inch to 160 chains.

Surveyors general will require that the specimen plat shall be closely followed, in order that uniformity of appearance and expression of drawing representing the public land surveys may be attained.

With the copy of each township plat furnished to a district land office, the surveyor general is required by law to furnish descriptive notes of the character and quality of the soil and timber found on and in the vicinity of each surveyed line, and to give a description of each corner.

Printed blank forms of such notes are furnished by the General Land Office. The forms provide eighteen spaces for meander corners, which, in most cases, will be sufficient; but when the number shall exceed eighteen, the residue will have to be inserted on the supplemental blank form.

A series of meander corners are shown on Plate IV, viz: From No. 1 to No. 8, on Yellowstone River; No. 9 to No. 10, on Clear Lake; No. 11 to No. 15, on Lin's Lake; No. 16 to No. 17, on Ivy Island; and No. 18, on Diamond Rock.

COMPUTATION OF THE AREAS OF LOTS ADJOINING THE NORTH AND WEST BOUNDARIES OF REGULAR TOWNSHIPS.

1. In regular townships, the tracts of land in each section adjoining the north and west boundaries of such townships, in excess of the regularly subdivided 480 acres (except in section 6), will, in general, be in the form of trapezoids, 80.00 chains in length by about 20 chains in width.

On the plats of such townships, each of said tracts will be divided into four lots, by drawing broken lines at intervals of 20.00 chains, parallel to the ends of the tracts, which will be regarded as parallel to each other.

With the exception of section 6, the south boundaries of sections of the north tier, when within prescribed limits, will be called 80.00 chains.

When the above-named conditions obtain, the areas of the lots in any one tract (except in section 6) may be determined, as follows:

Divide the difference between the widths of the ends of the tract by 4; if 3 remains, increase the hundredth figure of the quotient by a unit; in all other cases disregard the fraction; call the quotient thus obtained, "d"; then, taking the end widths of the tract in chains and decimals of a chain, the areas of the lots, in acres, will be:

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Of the smallest lot: twice the width of the lesser end, plus "d";

Of the largest lot: twice the width of the greater end, minus "d";

Of the smaller middle lot: sum of the widths of the ends, minus "d";

Of the larger middle lot: sum of the widths of the ends, plus "d".

A check on the computation may be had by multiplying the sum of the widths of the ends of the tract by 4; the product should agree exactly with the total area of the four lots.

The proper application of the above rules will always give areas correct to the nearest hundredth of an acre; and, as the use of fractions is entirely avoided, the method is recommended for its simplicity and accuracy.

Example 1. (See Plate IV, section 31.)

The difference of latitudinal boundaries is 0.034 chains; consequently, "d" is .04 chains; then,

\[
\begin{align*}
18.35 \times 2 & = 36.70 \text{ acres, the area of lot 1;} \\
18.50 \times 2 & = 38.96 \text{ acres, the area of lot 4;} \\
18.50 + 18.35 - 0.04 & = 36.81 \text{ acres, the area of lot 2;} \\
18.50 + 18.35 + 0.04 & = 36.99 \text{ acres, the area of lot 3;} \\
\text{Check: } (18.35 + 18.50) \times 4 & = 147.40 \text{ acres, the area of the four lots.}
\end{align*}
\]

The arithmetical operations are here written in detail, for the purpose of illustration; but the practical computer will perform all the work mentally.

2. Section 6. (See Plate I, figs. 6 and 7; and Plate IV.) The areas of lots 5, 6, and 7 may be obtained by the foregoing rules in all cases, except when the township closes on a base line or standard parallel; also, the area of lot 4, provided both meridional boundaries are 80.00 chains in length; when the last condition obtains, the areas of lots 1, 2, and 3 will be equal, and each will contain .40.00 acres.

In any case where the west boundary of sec. 6, is 80.00 chains, and the east boundary either greater or less than 80.00 chains, the areas of lots 1, 2, 3, and 4 will be computed as follows:

Refer to figures 6 and 7 and determine the difference,"q", between the east boundaries of lots 1 and 4 by the following proportion:

\[
\text{N. bdy. sec. 6: diff. of meridional bdr. sec. 6: } 60 \text{ chs. : q; then will E. bdy. lot 4 = E. bdy. lot 1 - q; in which } \text{"q"} \text{ will be added when the east boundary of sec. 6 is less than } 80.00 \text{ chains (fig. 7); but subtracted when said east boundary is greater than } 80.00 \text{ chains (fig. 6).}
\]

Now, take one third of "q", and add it to the shorter east boundary of lots 1 or 4, as conditions may require, and thereby determine the length of one of the meridional boundaries of lot 2; to which, again add "one third of q," and thus obtain the length of the opposite side of lot 2. The areas of lots 1, 2, and 3, in acres, will be found by taking the sum of their respective meridional boundaries, expressed in chains and decimals of a chain.

The area of lot 4 may be had by multiplying its mean width by its mean length.

Finally, to test the entire work, multiply the sum of the latitudinal boundaries by 4, and to the product add the area of the small triangle C A B, if the east boundary is greater than 80.00 chains (fig. 6); but subtract the area of said small triangle if the east boundary is less than 80.00 chains (fig. 7). These operations, correctly performed,

will give the true area of the section, which should agree exactly with the total area of its legal subdivisions, obtained as directed in the preceding paragraphs.

Example 2. (See Plate I, figs. 6 and 7, and Plate IV.)

Compute areas of lots 5, 6, and 7 of sec. 6, as directed in paragraph 1, and illustrated by the example; then write:

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.75</td>
<td>.05</td>
<td>60.00</td>
<td>0.0386</td>
<td>q : \frac{q}{4} = 0.0129</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0500</td>
<td>-0.0386</td>
<td>20.01</td>
</tr>
<tr>
<td>20.0114</td>
<td>+0.0129</td>
<td>20.02</td>
</tr>
<tr>
<td>20.0243</td>
<td>+0.0129</td>
<td>20.04</td>
</tr>
</tbody>
</table>

Then, for the areas of lots 1, 2, 3, and 4, we have:

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
<th>acres.</th>
</tr>
</thead>
</table>
| 20.05 + 20.04 | \ldots | = 40.09, \text{ the area of lot 1;}
| 20.04 + 20.02 | \ldots | = 40.03, \text{ the area of lot 2;}
| 20.02 + 20.01 | \ldots | = 40.03, \text{ the area of lot 3;}
| 20.00 + 20.01 \times 17.75 + 17.78 | = 35.54, \text{ the area of lot 4.}

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
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</table>
| 17.78 + 17.871 | \times 3 | = 106.95, \text{ the area of lots 5, 6, and 7.}

Area of regular subdivisions = 360.00

Total. \ldots = 622.67, \text{ The area of Sec. 6.}

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
</table>
| 77.75 \times 0.025 | = 0.19, \text{ the area of triangle C A B (fig. 6).}

Total. \ldots = 622.67, \text{ which agrees with the area of section 6, before determined.}

3. The area in acres of a tract 40.00 chains long, adjoining north or west township boundaries (except in N. W. \frac{1}{4} \text{ sec. 6}, is equal to the sum of its parallel boundaries (expressed in chains and decimals thereof) multiplied by 2; (e.g.) the area of lots 6 and 7 (Plate 1, fig. 6), is 17.87 + 17.811 \times 2 = 71.36 acres.

The area in acres of a tract 60.00 chains long, situated as above described (excluding lot 4, of sec. 6., may be found by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 3; (e.g.) fig. 6; south boundary lot 4 = 17.78 chs.; area of lots 5, 6, and 7 is 17.87 + 17.871 \times 3 = 106.95 acres. (See example 2.)

The area in acres of quarter sections adjoining north and west township boundaries (excluding N. W. \frac{1}{4} \text{ sec. 6}, may be obtained by multiplying the sum of their parallel boundaries (taken in chains and decimals of a chain) by 3; (e.g.) the area of S. W. \frac{1}{4} \text{ sec. 6 (fig. 6), is } 37.87 + 37.811 \times 2 = 151.36 acres.

The area in acres of any section along the north and west boundaries of regular townships (except sec. 6) may be had by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 4; (e.g.) the area of sec. 1 (Plate IV) is 60.00 + 79.771 \times 4 = 639.08 acres.

The area in acres of a theoretical township may be obtained

62. These measures are taken to the nearest hundredth only.
by multiplying the sum of its latitudinal boundaries (expressed in chains and
-71-
decimals of a chain) by 24; (c. g.) the area of the township represented by Plate I, fig. 1 is \(480.00 + 479.341 \times 24 = 23,024.16 \) acres.

EXPLANATIONS OF ARTICLES ON PAGES 72 TO 78, WITH GENERAL DEFINITIONS OF A "RETRACEMENT" AND A "RESURVEY."

When new surveys are to be initiated from, or closed upon the lines of old surveys, which although reported to have been executed correctly, are found to be actually defective in alignment, measurement, or position, it is manifest that the employment of the regular methods prescribed for surveying normal township exteriors and subdivisions would result in extending the imperfections of the old surveys into the new, thereby producing irregular townships bounded by exterior lines not in conformity with true meridians or parallels of latitude, and containing trapezoid-shaped sections which may or may not contain 640 acres each, as required by law.

Therefore, in order to extend such new surveys without incorporating therein the defects of prior erroneous work, special methods, in harmony as far as practicable with the following requirements, should be employed, viz:

The establishment of township boundaries conformable to true meridian and latitude lines.

The establishment of section boundaries by running two sets of parallel lines governed respectively by true meridians and parallels of latitude, and intersecting each other approximately at right angles at such intervals as to produce tracts of square form containing 640 acres each.

The reduction to a minimum of the number of fractional lots in a township, and consequently of the amount of field and office work.

Such special methods are based upon certain limits of allowable error in the alignment, measurement, and position of old township boundaries, as prescribed in the following article entitled "DEFINITIONS OF DEFECTIVE TOWNSHIP BOUNDARIES," page 72, which will be determined and rectifications made, if necessary, under the provisions of the article entitled "RETRACEMENT OR RESURVEY OF TOWNSHIP LINES AND LINEAR BOUNDARIES NOT ESTABLISHED IN CONFORMITY WITH THE RECTANGULAR SYSTEM OF SURVEYING," page 72, prior to the execution of new surveys under the methods prescribed by the article entitled "METHODS OF EXECUTING NEW SURVEYS, WHEN INITIATED FROM OR CLOSED UPON DEFECTIVE OLD SURVEYS," page 75, and illustrated on Plate VII, by figures 1 to 15; on Plate VIII, figures 1 to 7, and on Plate IX.

In order to prevent any misunderstanding relative to the modus operandi indicated by the terms "retracement" and "resurvey," the following definitions of the same are here presented:

The retracement of a township boundary, or other line of survey, consists in the determination of the true bearings and distances between the successive corners along the entire length of such a line; and the data thus obtained will be embodied in the field notes together with detailed particulars of the methods employed.

The resurvey of a township boundary or other line of survey consists of a retracement of such a line accompanied by the reconstruction of defective original corners and the establishment thereon of all the necessary new corners, and the detailed particulars of the entire operation will be embodied in the field notes.

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DEFINITIONS OF DEFECTIVE TOWNSHIP BOUNDARIES.

1. Upon retracement thereof, an old township boundary may be found to be defective in one or all of three qualifications, viz: alignment, measurement, and position, as follows:

2. In alignment, when any portion thereof deviates more than twenty-one minutes of arc from a true meridian or latitude line.

3. In measurement, in the case of a meridional line, or a latitudinal line which is identical with a standard parallel; when its length is greater or less than six miles by more than three chains; or when the length of any portion thereof between two successive corners, is greater or less than forty chains; excepting that portion between the last established corner and the limiting line, which may be greater or less than forty chains, when such a boundary has been closed upon the bank of a meanderable body of water, a military or Indian reservation, or State boundary, etc., as the case may be.

4. In measurement, in the case of a latitudinal line not identical with a portion of a standard parallel; when its length is greater or less than six miles minus the proper correction for convergency, by more than three chains; or when the length of any portion thereof between two successive corners is greater or less than forty chains; except, when such a boundary has been run as a true line at an intersection with any line of limitation, that portion thereof, between the last established subdivisional corner and the limiting line, may be greater or less than forty chains; and also, when it has been established in the regular manner, i.e. by random and true lines, that portion thereof in which the fractional measurement was originally allowed for may be greater or less than forty chains.

5. In position, when the corners originally established on such a boundary can not be connected with the corners on the opposite regularly established boundary, by lines which do not deviate more than twenty-one minutes of arc from true meridian or latitude lines.

6. The limits prescribed in the foregoing paragraphs are to be considered only in determining the necessity of resurveying old township boundaries when new surveys are to be initiated from or closed upon the same, and will not be construed in any way as establishing limits of allowable error in the execution of new surveys.
RETRACEMENT OR RESURVEY OF TOWNSHIP LINES AND LINEAR BOUNDARIES NOT ESTABLISHED IN CONFORMITY WITH THE RECTANGULAR SYSTEM OF SURVEYING.63

If in subdividing a township, it is found that any boundary thereof is defective in excess of the limits of allowable error prescribed in the article entitled "Definitions of Defective Township Boundaries," above, or that the corners originally established thereon had been incorrectly marked, or have been obliterated, the deputy surveyor will resurvey so much of said boundaries as may be necessary, as follows:

1. When subdivisional lines have not been closed upon either side of, or mineral claims tied to, a township boundary, it will be corrected (if necessary), in point of alinement, as well as measurement, by establishing regular new corners at lawful distances (minus the northing or plus the southing of the south boundary; or minus the westing or plus the easting of the east boundary), from said boundaries respectively (as the case may be), upon a right line connecting the proper township corners,

provided said line does not deviate more than twenty-one minutes of arc from a true meridian or latitude line (as the case may be). (See Plate VII, figs. 1, 2, 3.)

But, if the bearing of said line exceeds the limit prescribed above, the new corners will be placed on a line run due north or west, from the southeast corner of the township, to intersection with the township or range line (as the case may be), where a closing corner will be established, and the old township corner properly changed to a corner common to two townships.

The old corners on all township boundaries rectified under the provisions of this paragraph will be destroyed. (See Plate VII, figs. 4 and 5.)

2. When subdivisional lines have been closed upon one side of, or mineral claims tied to, a township boundary prior to the subdivision of the township on the other side, its alinement will not be changed; all obliterated old corners will be reestablished in their original places; new regular corners common to two townships, sections, or quarter sections, will be established upon it at lawful distances, minus the northing or plus the southing of the south boundary; or minus the westing or plus the easting of the east boundary, from said boundaries respectively (as the case may be), marked with reference to the township being subdivided, and the marks on the old corners upon such boundary which refer to the new work will be effaced.

Marks on bearing trees will be corrected (if necessary) to indicate the township, range, and section in which they stand, but the pits and mounds will remain as originally established. (See Plate VII, figs. 6 and 7.)

3. Where subdivisional lines have been closed upon one side of, or mineral claims tied to, the northern portion of a range line prior to the subdivision of the township on the other side (see paragraph 2), while upon the southern portion of the same such attachments have not been made on either side (see paragraph 1), said southern portion will be resurveyed and proper new corners established thereon, at lawful distances from the south boundary, as follows:

If the bearing of said southern portion does not deviate more than twenty-one minutes of arc from a true meridian line, it will be rectified under the provisions of the first clause of paragraph 1, and the rectifications will be continued on the northern portion under the provisions of paragraph 2. (See Plate VII, fig. 8.)

If, however, said bearing exceeds the specified limit, from the northern terminal corner of said southern portion, the range line will be extended due south on a random to its intersection with the south boundary where a corner common to two townships will be established, all the necessary changes made in the markings on the original corner common to four townships situated in its immediate vicinity, and regular new corners placed upon the respective portions of the entire range line as specified in the foregoing clause. (See Plate VII, fig. 9.)

Similar cases involving the rectification of the northern portion of a range line when the southern portion of the same can not be rectified in bearing, will be treated in conformity with the rules prescribed in the foregoing clauses, with the exception, that where such northern portion deviates more than twenty-one minutes of arc from a true meridian line, its alinement will be rectified by extending the same from its southern terminal corner, due north on a true line to its intersection with the north boundary, where a proper closing corner will be established and the necessary corrections applied to the old corner common to four townships in its immediate vicinity, so as to change it to a corner common to two townships. (See Plate VII, figs. 10, 11, and 12.)

In the treatment of latitudinal township lines the rule prescribed in the foregoing clauses will be applied, observing, however, that the stated designations north or south will correspond in such cases to west or east, respectively.

4. When subdivisional lines have been closed upon one or both sides of, or mineral claims tied to, the northern and southern portions of a range line, while the middle portion thereof is free from such attachments, said portion will be resurveyed and new regular corners will be established thereon at intervals of forty chains from its southern terminal corner, upon a right line connecting the original terminal corners thereof, the fractional measurement being thrown against the northern terminal corner. (See Plate VII, figs. 13, 14, and 15.)

In such cases all the original corners, excepting the terminal corners, of the portion of the lines thus resurveyed, will be destroyed.

The rectification of the middle portions of latitudinal township lines, on which the conditions specified above obtain, will be executed in a similar manner, observing, however, that the designations north or south in the foregoing clauses will in such cases correspond to west or east, respectively.

5. Under the foregoing paragraphs, the fact that mineral claims have been tied to a defective township boundary as

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63. Regarding permission to resurvey, see page 224.

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therein specified, will act as a bar to the rectification of such a boundary in alinement, only when the number of claims involved is great; while in cases where a few such claims have been connected with a few of the corners on such a boundary, said boundary will be rectified in alinement and new corners placed thereon, care being taken, however, to perpetuate in a proper manner such old corners as are found to be connected with the claims; and the methods employed to accomplish the same, together with the bearings and distances of such old corner from the new, will be briefly and accurately recorded in the field notes.

New corners on defective township boundaries must be established by an actual survey of such lines, and in no case will such corners be established from data acquired in running lines closing upon the same.

In the retracement or resurvey of base lines, standard parallels, principal meridians and guide meridians, two sets of chainmen will be employed, while for similar work on township lines, not of the character specified above, only one set of chainmen is required, and in cases where conditions such as specified in paragraph 2 obtain, the bearings and distances between successive old corners and the connections of all new corners with the nearest old corners will be carefully determined and recorded in the field notes.

When township or subdivisional lines intersect the boundaries of confirmed private land claims, or any other linear boundaries established at variance with the rectangular system of surveying, as much of said boundaries will be retraced as may be necessary, temporary stakes being set at intervals of ten chains thereon, and also at each angle formed by a change in the direction of the same.

All obliterated boundary corners will be reestablished in their original places, and the regular surveys will be closed upon the retraced line as prescribed for "closings" in the last clause of par. 5, page 55.

NOTE.—Regarding restoration of lost corners, by private and county surveyors, see page 224.

METHODS OF EXECUTING NEW SURVEYS, WHEN INITIATED FROM OR CLOSED UPON OLD SURVEYS, AND EXPLANATION OF FIGURES ON PLATE VII.

Such methods are illustrated by the several figures on Plate VII, the rectification of the lines of old surveys, and the establishment of new township exterior and subdivisional lines connected with such old lines, being based upon the rules prescribed in the article entitled "Retraction or Resurvey of Township Lines," &c., page 72.

In considering the several cases, the probable obtaining conditions relative to a range line have been adopted in order to reduce the number of figures on said plate, and, to curtail also as much as practicable, the amount of reiterated verbal explanations; it being definitely understood, however, that whatever conditions may obtain relative to a latitudinal line similar to those illustrated and explained in extenso in the cases relative to the range line, the necessary rectifications will be made by the application of similar methods, subject, however, to the proper modifications due to the difference in the direction of the respective lines.

The character of such modifications, when not obvious, are expressed in detail under the various clauses of the several paragraphs of the article on retracements referred to above.

It will also be clearly understood that, in order to avoid unnecessary structural complications, the figures on Plate VII exhibit only the positions of township and section corners after rectification, while in actual practice the quarter section corners will also be properly affected.

Fig. 1. The east boundary is assumed as irregular in bearing and defective in measurement; the township corners on the same, however, being susceptible of connection by a line not deviating more than twenty-one minutes of arc from a true meridian line.

It will be rectified under the rules prescribed by clause 1, paragraph 1, while from the proper corners the west and north boundaries will be established in the regular manner, as well as the subdivisions within the exteriors thus rectified and established.

Fig. 2. The east boundary defective in measurement. It will be rectified under clause 1, paragraph 1, while the west and north boundaries will be established, and the subdivisions executed in the regular manner.

Fig. 3. The east boundary defective in position. Since the south boundary deviates from a true east and west line by more than twenty-one minutes of arc, said east boundary will be rectified under clause 1, paragraph 1; the west and north boundaries will be established in the regular manner; and the subdivisions will be executed from north to south, and from east to west, commencing at the corner to sections 1, 2, 35, and 36, and closing the fractional measurements on the south and west boundaries, as such closings are made in regular subdivisions on the north and west boundaries.

Fig. 4. The east boundary defective in alinement. It will be rectified under clause 2, paragraph 1; while the west and north boundaries will be established, and the subdivisions executed, in the regular manner.

Fig. 5. The east boundary defective in alinement and measurement. It will be rectified under clause 2, paragraph 1; the west boundary will be rectified in the regular manner, while from the corner common to two townships on the rectified east boundary, the north boundary will be run west on random and east on true line, permanent corners

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common to sections and quarter sections of the township to be subdivided being established on the same.

The subdivisions will be executed in the regular manner.

Fig. 6. The south and east boundaries being defective in alinement, measurement, and position, will be rectified under clause 1, paragraph 2; the west boundary will be established in the regular manner, and the north boundary by east on random, and west on true line, throwing the fractional measurement against the old east boundary; while the subdivisions will be executed from north to south, and from west to east, commencing at the corner to sections 5, 6, 31, and 32, and closing the fractional measurements on the old south and east boundaries, as such closings are made in regular subdivisions on the north and west boundaries.

Fig. 7. The north, south, east and west boundaries being defective in alinement, measurement, and position. The south
and east boundaries will be rectified under clause 1, paragraph 2; while the west and north boundaries will be retraced for length and bearing, any obliterated old corners being reestablished in their original places.

The subdivisions will be executed as follows:

From the corners to sections 35 and 36, and 25 and 36, the lines between said sections will be extended due north and west, respectively, to their mutual intersection, where the corner to sections 25, 26, 35 and 36, will be established.

From said corner, the line between sections 26 and 35, 27 and 34, 28 and 33, 29 and 32, and 30 and 31 will be projected due west on a true line to its intersection with the west boundary of the township, where a closing corner will be established.

A line thus established is termed a Sectional Correction Line; and when such an auxiliary line, thus projected, intersects its objective limiting line in such proximity to its objective corner that the accessories of the two corners would interfere, that portion of the auxiliary line situated between the last established section corner and the limiting line will be changed in alinement to close upon the corner found, thus avoiding placing two corners in close proximity.

From the initial point of the sectional correction line, which, in this case, is the corner to sections 25, 26, 35, and 36, the line between sections 25 and 26, 23 and 24, 13 and 14, 11 and 12, and 1 and 2, will be projected north on a true line to its intersection with the north boundary, where a closing corner will be established. A line thus established is termed a SECTIONAL GUIDE MERIDIAN.

South of the sectional correction line, and east of the sectional guide meridian, the subdivisions will be closed upon the south and east boundaries by random and true lines, throwing the fractional measurements against the same, as such closings are made in regular surveys on the north and west boundaries; while that portion of the township situated to the north and west respectively, of said auxiliary lines, will be subdivided in the regular manner, the parallelism of the latitudinal section lines being referred to the sectional correction line, and that of the meridional section lines to the sectional guide meridian.

Closings on the west and north boundaries will be made by random and true lines, when the fallings are less than 50 links per mile, and by true lines run to closing corners when the fallings exceed said limit.

Fig. 8. The east boundary defective in measurement, the northern portion of the same being unchangeable, while the southern portion admits of rectification.

The east boundary will be rectified under clause 2, paragraph 2, the

west and north boundaries will be established, and the subdivisions executed, in the regular manner.

Fig. 9. The east boundary defective in alinement and measurement, the northern portion thereof being unchangeable, while the southern portion of the same admits of rectification.

The east boundary will be rectified under clause 3, paragraph 3, the south boundary, under clause 1, paragraph 2; the west boundary will be established in the regular manner; while the north boundary will be run east on random, and west on true line, throwing the fractional measurement against the east boundary.

The subdivisions will be executed from south to north, and from west to east, closing the fractional measurements on the north and east boundaries, as such closings are made in regular surveys, on the north and west boundaries.

Fig. 10. The east boundary defective in measurement, the southern portion thereof being unchangeable, while the northern portion admits of rectification.

The east boundary will be rectified under clause 4, paragraph 3; while the west and north boundaries will be established, and the subdivisions executed in the regular manner.

Fig. 11. The east boundary defective in alinement and measurement, the southern portion thereof being unchangeable, while the northern portion admits of rectification.

The east boundary will be rectified under clause 4, paragraph 3; the west boundary will be established in the regular manner; the north boundary by east on true line to closing corner, the fractional measurement being thrown against the old east boundary; while the subdivisions will be executed from north to south, and from west to east, the fractional measurements being thrown against the old south and east boundaries, as such closings are made in regular surveys against the north and west boundaries.

Fig. 12. The east boundary defective in measurement; the northern and southern portions thereof being unchangeable; while the middle portion admits of rectification.

The east boundary will be rectified under clause 1, paragraph 4, the west and north boundaries will be established, and the subdivisions executed in the regular manner.

Fig. 13. The east boundary defective in alinement and measurement; the northern and southern portions thereof being unchangeable; while the middle portion admits of rectification.

The east boundary will be rectified under clause 1, paragraph 4; the west boundary will be established in the regular manner; the north boundary by east on random and west on true line, the fractional measurement being thrown against the old east boundary; while the subdivisions will be executed from north to south, and from west to east, closing the fractional measurements against the old south and east boundaries, as such closings are made in regular surveys against the north and west boundaries.

Fig. 14. The east boundary defective in alinement and measurement; the northern and southern portions thereof not admitting of rectification in any way, since subdivisional surveys have been closed upon both sides of the same; while the middle portion admits of rectification in measurement.

The east boundary will be rectified under clause 1, paragraph 4; the west boundary will be established in the regular manner, the township corner at the end of six miles thereon being temporarily established.

From said temporary corner, the fractional north boundary will be run east on random to the nearest old established corner on the same, at which point if the falling of the random is within 50 links per mile, said boundary will be corrected westward on true line, setting corners commonto the sections...
and quarter sections on the north, at regular intervals from the initial point of the true line, and throwing the consequent fractional measurement in its normal place against the new west boundary, while the temporary township corner previously established therein will be made permanent.

If, however, the falling defined above exceeds the stated limit from the last established corner of the old surveys, the fractional north boundary will be projected due west to its intersection with the west boundary, at which point the proper township corner will be permanently established, and the temporary corner destroyed.

In establishing the corners on said north boundary under the latter procedure, the requirements prescribed in the former relative to the allowance for fractional measurement will be strictly observed.

In subdividing, the methods prescribed under Fig. 6 will be applied as far as practicable. The details of the case under consideration are clearly exhibited by fig. 14.

Fig. 15. All of the boundaries are assumed to be defective in alignment, measurement, and position, also portions of each as being closed upon by subdivisional surveys and consequently unchangeable relative to the old surveys, while other portions of the same being free from such attachments, admit of rectification.

This figure is constructed on a larger scale than those explained in the preceding paragraphs, in order to illustrate in detail the modus operandi to be pursued in rectification, under the rules of the article on retracements applicable to each of the obtaining conditions, and also in subdividing within the rectified exteriors.

**HIATUSES AND OVERLAPS.**

[Plate VIII.]

The several figures on Plate VIII illustrate in detail the methods to be employed in connecting the unsurveyed portions of two or more township boundaries, when four of such fractional lines, upon being projected towards each other in the direction of the cardinal points by lines not deviating more than twenty-one minutes of arc from true meridian or latitudinal lines, do not form a common intersection.

Said methods, in addition to the reasons embodied in the article entitled "Explanations of Articles," etc., page 71, are based upon the following desiderata, viz:

1. The adjustment of such township boundaries as to maintain section 36 in a condition theoretically and practically perfect, according to the requirements of the rectangular system of surveying.

2. That in accomplishing the above, the resultant fractional excess or deficiency (which for brevity of explanation is termed "the rectangular fraction") will be thrown into, or taken out of section 6, whenever practicable.

3. That all incidental fractional measurements developed in the establishment of township boundaries or subdivisional lines by such methods shall be thrown against the old surveys whenever practicable.

In considering said methods it will be observed that the conditions to be dealt with are either hiatuses or overlaps, the former possessing three characteristic features, which are named as follows:

Simple hiatus. See figures 1 and 2.

Meridional hiatus. See figure 3.

Latitudinal hiatus. See figure 4, while overlaps are shown by figure 5.

As the application of said methods, when the conditions exhibited obtain, gives similar results with but a few exceptions, which will be specifically detailed hereafter, the condition represented by A, figure 3, will be considered and the method of connection described as an example, upon the following assumptions, viz:

That, of the boundaries of townships 1 and 2 north, ranges 3 and 4 west, those portions indicated by broken lines are unsurveyed;

That it is required to connect said portions in order to complete the subdivisions in one or more of the townships.

Beginning at the established terminal corners on the south and east boundaries of T. 2 N., R. 4 W., blank lines will be projected due east and due south, respectively, with temporary stakes at intervals of ten chains, to an intersection, which point will be marked by a temporary stake;

Then, from the established terminal corners on the west and north boundaries of T. 1 N., R. 3 W., true lines will be projected due north and due west, respectively, with regular corners for two sections and quarter sections, to an intersection, which point will be marked by a temporary stake;

Then, by proper measurements, the character of the resulting condition will be determined, and by comparison with diagrams A, of the figures on Plate VIII, the particular method of connection will be obtained and applied.

Said condition in the case under consideration, it will be observed, is a "meridional hiatus"; therefore, from the temporary stake marking the intersection of the extended south and east boundaries of T. 2 N., R. 4 W., which will be replaced by a permanent corner (common to two townships) for T. 1 N., R. 3 W., and T. 2 N., R. 4 W., the south boundary of the latter will be extended due east to its intersection with the west boundary of the former, where a corner for (one township only) T. 1 N., R. 4 W., will be permanently established;

Then, from the corner for T. 1 N., R. 3 W., and T. 2 N., R. 4 W., the south and east boundaries of the latter will be corrected back west and north, respectively, on true lines, establishing regular corners common to two quarter sections and sections of said township, to the initial points of the blank lines, against which the resulting fractional measurements will be thrown, while the stakes temporarily established on the blank lines at intervals of ten chains will be destroyed;

Then, from the stake temporarily marking the intersection of the north and west boundaries of T. 1 N., R. 3 W., which will be destroyed, the former boundary will be extended due west to its intersection with the east boundary of T. 2 N., R. 4 W., where a proper closing corner will be established, the resulting fractional measurement thrown against the same, and the distance to the nearest corner on said boundary carefully determined and recorded in the field notes.

Thus section 36 is made full, serving as a perfect base from which to initiate the subdivisinal work in T. 2 N., R. 4 W.;
the "rectangular fraction," which in this case indirectly represents an excess, is incorporated in section 6, which being lotted on two sides in its normal con-

dition, absorbs the excess without deranging materially those portions of the same usually defined as regular subdivisions; while the unsurveyed portions of the entire group of townships are arranged in such a manner as to admit of completing the subdivisonal work therein on the approved rectangular basis.

Relative to incorporating an excess in, or supplying a deficiency from, section 6, *simple hiatuses* are noted as exceptions to the general rule; therefore, when such hiatuses are square, or longer meridionally (see 1, diagrams A, fig. 1), the "rectangular fraction" will be taken out of section 31, and incorporated in section 1; but if the length thereof (see 1, diag. A, fig. 2) lie in a latitudinal direction, said "rectangular fraction" will be taken out of section 1 and incorporated in section 31.

If the surveys contemplated, within a group of four townships, consist of the completion of the southeast unsurveyed portion of the north-west township only, the method detailed in the foregoing paragraphs will be employed in all particulars, with the exception that the extension of the north and west boundaries of the southeast township will be omitted; but the completion of the unsurveyed portions of any of the other three demands of the deputy surveyor the performance of the whole operation, and the complete connection of all the boundaries.

When, of four township boundaries whose directions tend to an approximate common point, two of the same have been carried to a mutual intersection, and are closed upon by subdivisonal and other lines (see paragraph 2, article on "Retracesments," etc.), the unsurveyed portion of the remaining boundaries will be connected with them by the application of these methods, sufficiently modified to preserve intact the prior subdivisonal surveys.

**FRAGMENTARY SUBDIVISION.**

Plate IX illustrates the general methods to be employed in the execution of fragmentary subdivisions withing townships, portions of which have been subdivided from fractional township boundaries extended from various directions and not connected with each other.

These conditions obtain to a large extent in mountainous regions, where in accordance with the existing provisions, relative to the survey of agricultural lands, in the acts of Congress making appropriations for public land surveys, such surveys are extended along the valley and bottom lands, leaving the mountainous areas unsurveyed at the time of the execution of the original work; but which, at a later date, in view of other considerations are placed under contract for survey.

It is obvious that the number and character of such cases would be too great and varied to be considered in detail; therefore, when the deputy surveyor meets with a case which is not covered exactly by these instructions, or the special instructions from the surveyor general, his thorough under-

standing of the preceding articles on this subject, and of the conditions illustrated on Plates VI and VIII, it is expected will point out to him the proper method to be employed.

It is possible, however, that cases may arise so complex in their character as to produce a feeling of doubt relative to the proper solution of the problem; in which case he will at once communicate with this office through the surveyor general, submitting information, by letter and diagrams, of the exact condition as found by him, and the necessary instructions will be forwarded as soon as practicable.

NOTE.—A quarter section is held to be surveyed only when three of its corners have been officially established.

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**GEOGRAPHICAL POSITIONS OF BASE LINES AND PRINCIPAL MERIDIANS GOVERNING THE PUBLIC SURVEYS.**

The system of rectangular surveying, authorized by law May 20, 1785, was first employed in the survey of United States public lands in the State of Ohio.

The boundary line between the States of Pennsylvania and Ohio, known as "Ellicott's line," in longitude 80° 32' 2 0 west from Greenwich, is the meridian to which the first surveys are referred. The *townships* east of the Scioto River, in the State of Ohio, are numbered from south to north, commencing with No. 1 *on the Ohio River, while the ranges* are numbered from east to west, beginning with No. 1 on the east boundary of the State, except in the tract designated "U. S. military land," in which the townships and ranges are numbered, respectively, from the south and east boundaries of said tract.

During the period of one hundred and nine years since the organization of the system of rectangular surveying, numbered and locally named principal meridians and base lines have been established, as follows:

The first principal meridian begins at the junction of the Ohio and Big Miami rivers, extends north on the boundary line between the States of Ohio and Indiana, and roughly approximates to the meridian of longitude 84° 48' 5 0 west from Greenwich. The ranges of the public surveys in the State of Ohio, west of the Scioto River, are, in part, numbered from this meridian. For further information in regard to numbering of townships and ranges of the early surveys in Ohio, the reader is referred to the State map prepared in the General Land Office.

The second principal meridian coincides with 86° 28' of longitude west from Greenwich, starts from a point two and one half miles west of the confluence of the Little Blue and Ohio rivers, runs north to the northern boundary of Indiana, and, with the base line in latitude 38° 28' 20", governs the surveys in Indiana and part of those in Illinois.

The third principal meridian begins at the mouth of the Ohio River and extends north to the northern boundary of the State of Illinois, and with the base line in latitude 38° 28' 20", governs the surveys in the State east of the third principal meridian, with the exception of those projected from the second principal meridian, and the surveys on the west, to the Illinois River. This meridian is nearly coincident with 89° 10' 15" of west longitude from Greenwich.

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The fourth principal meridian begins at a point on the right bank of the Illinois River, in latitude 40°00' 30" north, and longitude 90°28' 45" west from Greenwich, and with the base line running west from the initial point, governs the surveys in Illinois west of the Illinois River and west of that part of the third principal meridian which lies north of the river.

The fourth principal meridian also extends north through Wisconsin and northeastern Minnesota, and, with the south boundary of Wisconsin as its base line, governs all the surveys in the former and those in the latter State lying east of the Mississippi River, and the third guide meridian west of the fifth principal meridian system, north of the river.

The fifth principal meridian starts from the old mouth of the Arkansas River, and with the base line running west from the old mouth of the St. Francis River, governs the surveys in Arkansas, Missouri, Iowa, North Dakota; those in Minnesota, west of the Mississippi River and west of the third guide meridian north of the river; and in South Dakota.

all east of the Missouri River, and the surveys on the west side of the river to a limiting line following the third guide meridian (of the sixth principal meridian system), White River, and the west and north boundaries of the Lower Brule Indian Reservation. This meridian is nearly coincident with 91°03' 42" longitude west from Greenwich.

The sixth principal meridian, which is approximately the meridian of 97°23' west longitude from Greenwich, extends from the base line coincident with the north boundary of Kansas in latitude 40° north, south through the State to its south boundary, in latitude 37° north, and north through Nebraska to the Missouri River; and governs the surveys in Kansas and Nebraska; the surveys in Wyoming, except those referred to the Wind River meridian and base line, which intersect in latitude 43°01' 20" north, and longitude 108°48' 40" west from Greenwich; the surveys in Colorado, except those projected from the New Mexico and Ute meridians, the latter intersecting its base line in latitude 39°06' 40" north and longitude 108°33' 20" west from Greenwich; and the surveys in South Dakota extended, or to be extended, over the tract embracing the Pine Ridge and Rosebud Indian reservations.

In addition to the above mentioned numbered principal meridians, other principal meridians with local names have been established, as follows:

The Michigan meridian, in longitude 84°22'2 4" west from Greenwich, with a base line in latitude 42°26' 30" north (eight miles north of Detroit), governs the surveys in Michigan.

The Tallahassee meridian, in longitude 84°16' 42" west from Greenwich, runs north and south from the initial point on the base line at Tallahassee, in latitude 30°28' north, and governs the surveys in Florida.

The Saint Stephens meridian, in longitude 88°02' west from Greenwich, begins at the initial point (Elliot's corner), on the base line, in latitude 31° north, extends south to Mobile Bay and north to latitude 33°06' 20", and governs the surveys in the southern district of Alabama, and in Pearl River district lying east of the river and south of the Choctaw base line, in latitude 31°52' 40" north, in the State of Mississippi.

The Huntsville meridian begins on the northern boundary of Alabama, in latitude 34°59' north, longitude 86°34' 45" west from Greenwich, extends south to latitude 33°6' 20" north, and governs the surveys in the northern district of Alabama.

The Choctaw meridian begins on the Choctaw base line, latitude 31°54' 40" north, longitude 90°14' 45" west from Greenwich, runs north to the south boundary of the Chickasaw cession, in latitude 34°19' 40" north, and governs the surveys east and west of the meridian, and north of the base line.

The Chickasaw meridian begins on the north boundary of Mississippi in latitude 34°59' north, longitude 89°15' west from Greenwich, extends south to latitude 33°48' 45" north, and governs the surveys in north Mississippi.

The Washington meridian begins on the base line in latitude 31° north, longitude 91°9' 15" west from Greenwich, extends north to the Mississippi River, and governs the surveys in the southwestern angle of the State of Mississippi.

The Saint Helena meridian begins at the initial point of the Washington meridian, in latitude 31° north, and longitude 91°09' 15" west of Greenwich, extends south to the Mississippi River, and governs the surveys in the Greensburg and southeastern districts of Louisiana, east of the Mississippi River.

The Louisiana meridian, in longitude 92°24' 15" west of Greenwich, extends from the Gulf of Mexico to the north boundary of Louisiana, and, with the base line through the initial point, conforming to the parallel of 31° north latitude, governs all the surveys in the state west of the Mississippi River.

The New Mexico meridian, in longitude 106°53' 40" west from Greenwich, extends through the Territory, and with the base line, in latitude 34°15' 25" north, governs the surveys in New Mexico, except those in the northwest corner of the territory, referred to Navajo meridian and base line, which have their initial point in latitude 35°45' north, longitude 106°32' 45" west from Greenwich.

The Salt Lake meridian, in longitude 111°54' 00" west from Greenwich, has its initial point at the corner of Temple Block, in Salt Lake City, Utah, extends north and south through the Territory, and, with the base line, through the initial, and coincident with the parallel of 40°46' 0 4 north latitude, governs the surveys in the Territory, except those referred to the Uintah meridian and base line projected from an initial point in latitude 40°26' 2 0 north, longitude 109°57'30" west from Greenwich.

The Boise meridian, longitude 116°24' 15" west from Greenwich, passes through the initial point established south 29°30' west, nineteen miles distant from Boise City, extends north and south through the State, and, with the base line in latitude 43°46' north, governs the surveys in the State of Idaho.

The Mount Diablo meridian, California, coincides with the meridian of 121°55'48" west from Greenwich, intersects the base line on the summit of the mountain from which it takes
its name, in latitude 37° 51' 30" north, and governs the
surveys in the State of Nevada, and the surveys of all central
and northern California, except those belonging to the Hum-
boldt meridian system.

The Humboldt meridian, longitude 124° 8' west from
Greenwich, intersects the base line on the summit of Mount
Pierce, in latitude 40° 25' 12" north, and governs the surveys
in the northwestern corner of California, lying west of the
Coast range of mountains, and north of township 5 south, of
the Humboldt meridian system.

The San Bernardino meridian, California, longitude 116°
56' 15" west from Greenwich, intersects the base line on
Mount San Bernardino, latitude 34° 07' 10" north, and gov-
erns the surveys in southern California, lying east of the
meridian, and that part of the surveys situated west of it
which is south of the eighth standard parallel south, of the
Mountain Diablo meridian system.

The Willamette meridian, which is coincident with the
meridian of 122° 44' 20" west from Greenwich, extends south
from the base line, in latitude 45° 31' north, to the north
boundary of California, and north to the international bound-
ary, and governs all the public surveys in the States of Ore-
go and Washington.

The Black Hills meridian, longitude 104° 03' west from
Greenwich, with the base line in latitude 44° north, governs
the surveys in the State of South Dakota, north and west of
White River, and west of the Missouri River (between lati-
dudes 45° 55' 20" and 44° 17' 30"), the north and west bound-
aries of the Lower Brule Indian Reservation, and the west
boundary of range 79 west, of the fifth principal meridian
system.

The Montana meridian extends north and south from the
initial

monument on the summit of a limestone hill, eight hundred
feet high, longitude 111° 38' 50" west from Greenwich, and
with the base line on the parallel of 45° 46' 48" north latitude,
governs the surveys in the State of Montana.

The Gila and Salt River meridian intersects the base line
on the south side of Gila River, opposite the mouth of Salt
River, in latitude 33° 22' 40" north, longitude 112° 17' 25"
west from Greenwich, and governs the surveys the Territory
of Arizona.

The Indian meridian, in longitude 97° 14' 30" west from
Greenwich, extends from Red River to the south boundary of
Kansas, and with the base line in latitude 34° 30' north,
governs the surveys in the Indian Territory, and in Oklahoma
Territory all surveys east of 100° west longitude from
Greenwich.

The Cimarron meridian in longitude 103° west from
Greenwich, extends from latitude 36° 30' 37" north, and with
the base line in latitude 36° 30' north, governs the surveys in
Oklahoma Territory west of 100° west longitude from Green-
wich.

DECLINATION OF THE MAGNETIC NEEDLE

For the following article, with tables, charts, and their
explanation, relating to the use of the compass in surveying,
the Commissioner of the General Land Office is indebted to
Dr. T. C. Mendenhall, Superintendent of the U. S. Coast and
Geodetic Survey. It was furnished at the request of the Com-
missioner.

The paper, originally written in 1878 by Assistant C. A.
Schott, chief of the computing division, has been revised and
enlarged by him in order to present the latest information on
the subject in possession of the C. and G. Survey, June, 1893.
It is also accompanied by three charts taken from the C. and
G. Survey report for 1889 and amended to date; they show the
distribution of the magnetic declination for the year 1890,
and in connection with the tables, for any year within their
range.

This paper takes the place of the chapter commencing at
the foot of page 25 and ending in the middle of page 29 of the
"Manual of Instructions to Surveyors General of the United
States" printed in 1871, part of which in the course of time
had become obsolete. The present article will be found of
great interest and value as an aid in the prosecution of the
surveys of the public lands.

AN ACCOUNT OF THE PRESENT GEOGRAPHICAL
DISTRIBUTION AND OF THE ANNUAL CHANGE
OF THE MAGNETIC DECLINATION 64 WITHIN THE
LIMITS OF THE UNITED STATES.

Introductory remarks.—The magnetic declination at any
place is the angle contained between two vertical planes, one
being that of the astronomical or true meridian of the place
and the other the plane in which the axis of a freely sus-
pended horizontal magnetic needle lies at the time. The form-
er is a fixed plane, the latter is variable, as is shown by the
regular or irregular, and the greater or less oscillations of a
needle when delicately suspended; these fluctuations are
subject to different laws depending on geographical position.
Since the magnetic

declination is found to vary with respect to place and time, it
is necessary on the part of the observer to give with his
statement of the declination the geographical position or the
latitude and longitude 66 of his station (expressed to the
nearest minute of arc will suffice in general), and to accom-
pany the record by the local time when the observation was
made; the nearest hour (or quarter of an hour) should be
stated, also whether sidereal time, mean time, local, or stan-
dard time is used.

The declination is called "west" when the north-seeking
end of the magnet or needle points to the westward of the true
meridian, and is called "east" when the same end points to
the eastward. Roughly speaking, the north end of a needle
tends approximately towards the geographical north, or,
rather towards a region which surrounds the magnetic pole,
situated in the vicinity of King William Land, and supposed
to be in about latitude 70° 30' and longitude 100° W. Here the

64. Commonly known as the variation of the compass; in scientific treatises on terrest-
rial magnetism the term magnetic declination is always employed in order to avoid any
confusion which would arise when treating of such motions of the needle as the diurnal,
annual, and secular variations.

65. Reckoned from Greenwich westward to 180°.
horizontal needle has lost its directive force, and the dip needle will point vertically up and down; in other words, at the pole the magnetic and gravitational forces agree in direction. The magnetic declination presents great extremes in value within the limits of the United States; thus for the year 1893, we have at Eastport, Me., 19° W.; at the north-eastern end of Lake Michigan, at the west end of Lake Erie, and in St. Helena Sound, S.C., 0° (needle pointing due north); at Galveston, Tex., 7%° E.; at San Diego, Cal., 13½° E.; at Cape Flattery, Wash., 23° E.; at Sitka, Alaska, 29° E.; the maximum of 43½° E. is reached at the mouth of Firth River, near where the meridional boundary line of 141° strikes the Arctic Ocean; at Bering Strait, the declination has diminished to 21° E., and at the extreme western point of our territory, at Attu Island, it is but 8½° E. The general distribution of the declination (for the given epoch, 1890), is shown by the isogonic charts appended to this manual, taken from the Coast and Geodetic Survey Report for 1889, Appendix No. 11; they are reproduced and amended to bring them up to the present state of our knowledge, and appear here transferred to the new base map of 1893 (scale 1/500,000). The third chart referred to appears for the first time in the manual, it represents the magnetic meridians, i.e., lines which show directly the direction of the needle, this being a tangent to the curve at any point in it. These curves, therefore, may be said to represent a physical fact, while the isogonic curves are wholly artificial, but better adapted for practical application. The meridional system converges toward the magnetic pole without any special relation to the geographical pole, whereas in the isogonic system all curves must pass through the latter pole as well. It is a matter of great importance for surveyors to recognize the fact of the local deviations from the general trend of the isogonic lines; these local irregularities of the distribution are more conspicuous in regions of igneous rocks, but they appear also in regions of sedimentary deposits, the intensity of the disturbance depending on that of the local cause and its depth below the surface. The disturbing local poles or ridges are in general of the same polarity as that of the north magnetic pole. Disturbed regions may range from a fraction of a square mile to hundreds of square miles, but as yet little has been done in this inviting field for research.

In consequence of the secular variation of the declination the magnetic charts require to be reconstructed from time to time, though for a few years from the date of an isogonic chart the declination for any

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position can readily be assigned by means of our knowledge of the annual change, which is sufficiently constant for a few years to produce no appreciable error. The secular variation is by far the greatest of the great number of changes in the direction of the needle. Thus at Albany, N.Y., the declination changed from 12° W. in the year 1650 to nearly 5½° W. about the year 1795, and is now again about 10¾° W.; at New York the change was similar; at Baltimore, Md., the declination changed from nearly 6° W. about 1680 to nearly 4½° W. in 1802, the present value being near 5° W.; at San Diego, Cal., the declination was about 7½° E. in 1710, and is now a little over 13° E.; at Chamisso Island, Kotzebue Sound, Alaska, the declination was 33½° E. in 1750, but is now only 26½° E. The results of the latest investigation of this subject published by the Survey are contained in Appendix No. 7, Coast and Geodetic Survey Report for 1888. What is known as the annual change of the declination is nothing else than the effect of the secular variation during one year, and must be carefully distinguished from the annual variation, which has but a small range and depends on the season of the year.

The isogonic and magnetic meridian charts.—Referring to the two isogonic charts appended to this article, the larger comprises the compact area of the United States and the smaller one the territory of Alaska. If for any selected epoch we connect by curves all positions at which the needle was observed to have the same given declination, we trace out an isogonic curve for that value of declination. On the charts they are laid down for the equal difference of 1, with every fifth curve drawn heavier for better distinction, and they answer to the epoch January 1, 1890. For their construction more than 3,200 observed declinations (reduced to epoch) were employed, the latest observation only being used at stations occupied more than once. The isogonic curve of zero declination, also called the agonic line, at which the needle points due north and south, is seen to pass from the island of Michipicoten to the extreme west end of Lake Erie and close to Charleston, S.C., where it leaves the coast and turns toward the Bahama Islands. This curve has been conveniently used as a representative line to mark out the changes which in the course of time the magnetic system in its vicinity undergoes.

On the Atlantic coast it reached its highest position near Cape Henry, Va., about the year 1800 and has since been moving southward. All localities to the northeast of this line have west declination, indicated by a + sign to the index number; localities to the westward of it and comprising the greater part of the United States have now east declination, as marked by a negative index. To take up the declination for any given position on this chart, we resort to simple graphical interpolation; it is best done by dropping a perpendicular (curved) from the position to the nearest isogonic on either side of it and measuring the length of the shorter one, also that of the two together; the proportion of the distance with respect to the whole difference of 60° is readily ascertained. The result answers to the year 1890 (January), and by applying the effect of the annual change, as tabulated further on, the declination may be had for any time before or after that epoch. This annual change is at present manifested by the apparent movement of the isogonic lines to the southward or downward along the Atlantic coast and to the westward or left on the Gulf coast and in the interior to the north of it; on the Pacific coast this movement has

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either ceased or is very inconspicuous at present. The charts show two shaded bands, one crossing the northern part of Maine where the direction of the needle has reached a limiting westerly position and is about ready to reverse its secular motion; the other band skirts the Pacific coast from Washington to Point Conception, Cal., where it passes out to sea. Here

66. See Plate No. 25, Appendix No. 7, Coast and Geodetic Survey Report for 1888.
the needle is about stationary at the easterly limit of its grand secular swing. For intermediate points this same condition was reached at corresponding times during the present century.

It will be seen that the irregularities in the local distribution of magnetism can only be brought out and specially delineated by a large addition to the observations so far accumulated.

The degree of accuracy of the charts depends in the first place on that of the original observation, secondly on that of the change in the interval between observation and epoch, and lastly on the density of observations about the locality or the degree of generalization required in the construction of the curves. The meridional chart has already been sufficiently explained and the additional dip and intensity curves shown on it do not come within the scope of this paper.

**The secular variation of the magnetic declination. — This**

variation, as already pointed out, is a matter of great importance to the surveyor who is frequently called upon to recover or re-run old compass lines or to decide between conflicting claims as to position of old boundary lines originally traced out by compass but lost or obliterated in the course of time. As its name implies, this angular motion extends over so long a period and is so utterly unknown as to its origin that the recognition of its law is a matter of much difficulty and uncertainty. To represent it a periodic function is employed; but from this it should not be inferred that the motion is repeated at stated intervals; on the contrary we are fully aware of the complexity of the phenomenon and of the necessity of continually watching year by year the changes resulting from observations and correcting or remodeling our analytical representations accordingly. It should be fully understood that this process is a wholly tentative one and that the mathematical inferences due to the form of the function are not meant thereby to represent or become a physical reality. Thus we are forced to reconstruct our secular change tables at suitable intervals. The period found most in accord with observations is about 250 years with variations of about 50 years longer or shorter, at various stations. This holds only for the United States. The earlier setting in of the secular variation phases in the east and spreading westward over the country has already been referred to; for instance the easternmost position or eastern elongation occurred at places in eastern Maine about the year 1760, this phase reached the Hudson River about 1790, the Mississippi River about 1820, Salt Lake about 1870, and the west coast, as at San Francisco Bay, probably next year or not far from it. Whether this phenomenon will be repeated with the present incoming opposite phase in northern Maine remains to be seen. The results from a discussion of 1,062 observations at 94 stations are given in the following table of decennial values, and after 1850 for 5-year intervals. The average number of observations for each station is 11.

**Table of the secular variation of the magnetic declination** at stations in the United States, computed by means of periodic functions and based upon all available observations from the earliest to the present time.—The table is subdivided into three groups, viz: Group I comprises the stations located east of the Appalachian Range, and the Atlantic coast from Maine to Florida, inclusive; Group II, the stations situated between the Rocky Mountains and the Appalachian Range, from Canada to the Gulf; Group III contains the stations located between the Rocky Mountains and the Pacific coast, from California to Washington, also those in Alaska. Within each group the stations are arranged in the order of their latitudes.

The tabular values are of various degrees of accuracy, as is indicated by the entry, giving either whole degrees, or degrees and tenths, or degrees, tenths, and hundredths — the latter relatively the most reliable. The results, dating back to the seventeenth century, are in many cases but approximations more or less reliable. West declination is indicated by the sign + prefixed, east declination by the sign − prefixed. All values for 1900 are mere rough predictions and depend upon the precarious supposition of a continuation of the law implied by the formulae.

(The remainder of page 88 and pages 89 through 137 are deleted. They contain the following Tables and technical information.)

**Pages 88-95:** Tables B, C, D; Secular Variation of Magnetic Declination.

**Pages 96 and 97:** Table E, Latitude and Longitude of places of Magnetic Observation.

**Pages 98-101:** Table F; Approximate average Annual Change of Magnetic Declination Table G; finding mean Declination; and the use of these tables.

**Pages 102-119:** Tables H, J, K, l and II; are tables for Polaris observations. Instructions are given for their use in observing the star to determine a true meridian.

**Pages 120-137:** Table III, Aximuths of the Secant; Table IV, Aximuths of the Tangent; Table V and VI, Offsets from the Tangent to the Parallel; Table VII, Correction of Random Lines; Tables VIII and IX, Length of a Degree of Latitude and Degree of Longitude. Table X, Convergence of Meridians. Instructions for use of these tables and related subject matter is discussed.)

67. The results of any new and satisfactory observation sent to the Superintendent of the Coast and Geodetic Survey will be duly credited in a subsequent publication.
SPECIMEN FIELD NOTES.

NO. 1.

TITLE PAGE.

[See Plate 11.1

FIELD NOTES
OF THE SURVEY OF THE
THIRD STANDARD PARALLEL NORTH
THROUGH
Ranges Nos. 21, 22, 23, and 24 East
OF THE
PRINCIPAL BASE AND MERIDIAN
IN THE
STATE OF MONTANA,
AS SURVEYED BY
RICHARD ROODS,
U. S. DEPUTY SURVEYOR,
UNDER HIS CONTRACT NO. 97,
DATED JULY 10, 1890.

Survey commenced August 22, 1890.
Survey completed August 29, 1890.

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[ Second page. ]

NAMES AND DUTIES OF ASSISTANTS.

PETER LONG ......................... Chainman.
JOHN SHORT ......................... Chainman.
ELI MARKER ......................... Chainman.
WILLIAM TALLY ..................... Chainman.
LEWIS LINK ......................... Chainman.
HENRY CLAY ........................ Moundman.
WILLIAM STONE .................... Moundman.
ADAM DULL ......................... Axman.
JAMES BANNER ..................... Flagman.

PRELIMINARY OATHS OF ASSISTANTS.

We, Peter Long, John Short, Eli Marker, and William Tally, do solemnly swear that we will well and faithfully execute the duties of chainmen; that we will level the chain upon even and uneven ground, and plumb the tally pins, either by sticking or dropping the same; that we will report the true distances to all notable objects, and the true lengths of all lines that we assist in measuring, to the best of our skill and ability, and in accordance with instructions given us, in the survey of the Third Standard Parallel North, through Ranges Nos. 21, 22, 23, and 24 East, of the Principal Base and Meridian, in the State of Montana.

PETER LONG, Chainman
JOHN SHORT, Chainman
ELI MARKER, Chainman.
WILLIAM TALLY, Chainman.

Subscribed and sworn to before me this second day of August, 1890.
WILLIAM MARTIN, Notary Public.

We, Henry Clay and William Stone, do solemnly swear that we will well and truly perform the duties of mounndmen, in the establishment of corners, according to the instructions given us, to the best of our skill and ability, in the survey of the Third Standard Parallel North, through Ranges Nos. 21, 22, 23, and 24 East, of the Principal Base and Meridian, in the State of Montana.

HENRY CLAY, Moundman
WILLIAM STONE, Moundman.

Subscribed and sworn to before me this second day of August, 1890.
WILLIAM MARTIN, Notary Public.

We, George Sharp and Adam Dull, do solemnly swear that we will well and truly perform the duties of axmen, in the establishment of corners and other duties, according to instructions given us, and to the best of our skill and ability, in the survey of the Third Standard Parallel North, through Ranges Nos. 21, 22, 23, and 24 East, of the Principal Base and Meridian, in the State of Montana.

GEORGE SHARP, Axman
ADAM DULL, Axman.

Subscribed and sworn to before me this second day of August, 1890.
WILLIAM MARTIN, Notary Public.

I, James Banner, do solemnly swear that I will well and truly perform the duties of flagman, according to instructions given me, to the best of my skill and ability, in the survey of the Third Standard Parallel North, through Ranges Nos. 21, 22, 23, and 24 East, of the Principal Base and Meridian, in the State of Montana.

JAMES BANNER, Flagman.
I, Lewis Link, do solemnly swear that I will well and faithfully execute the duties of chainman; that I will level the chain upon even and uneven ground, and plumb the tally pins, either by sticking or dropping the same; that I will report the true distances to all notable objects, and the true length of all lines that I assist in measuring, to the best of my skill and ability, and in accordance with instructions given me, in the survey of the Third Standard Parallel North, through Ranges Nos. 23 and 24 East, of the Principal Base and Meridian, in the State of Montana.

LEWIS LINK, Chainman.

Subscribed and sworn to before me this twenty-seventh day of August, 1890.

RICHARD ROODS,
U. S. Deputy Surveyor.

Third Standard Parallel North, through Range 21 East—Continued.

| Chains | Survey commenced August 22, 1890, and executed with a W. & L. E. Gurley light mountain transit, No. ; the horizontal line having two double verniers placed opposite to each other and reading to 30" of arc. The instrument was examined, tested on the true meridian at Helena, found correct, and was approved by the surveyor general for Montana, August 1, 1890. I begin at the standard corner of townships 13 north, ranges 20 and 21 east, which is a sandstone, 8 x 7 x 5 ins. above ground, firmly set, and marked and witnessed as described by the surveyor general. At a point 3.39 ft. south of said standard corner, in latitude 45°34'5" N., longitude 107°44' W., 90 at 9.19 p.m., by my watch, which is 2 minutes fast of local mean time, I observe Polaris at eastern elongation, in accordance with instructions in the Manual, and mark the line thus determined, by a tack driven in a wooden plug set in the ground, five chains north of my station. August 22, 1890. August 23, 1890: At 6 a.m., I lay off the azimuth of Polaris, 1°49'5" to the west, and mark the TRUE MERIDIAN thus determined, by cutting a mark on a stone firmly set in the ground, west of the point established last night; the magnetic bearing of said true meridian is N. 18°13' W., which I also reduced by the table on page 100 of the Manual, gives the mean magnetic declination, 18° 09' east. At this station (i.e., the point 3.39 ft. S. of the standard cor.), I turn off from the true meridian, an angle of 89° 57' 20.9" toward the east, and run N. 89° 57" E. on the secant, S. 31. Over gently rolling prairie.

28.10 | Indian trail, bears N. 28° E. and S. 28° W.

Differences between measurements of 40.00 chs., by two sets of chains, are 4.00 ft.; position of middle point

40.00 | By 1st set, 40.02 chs.

B: 2nd set, 39.98 chs.; the mean of which is

N. 1.53 ft. from the secant.

Set a lime stone, 26 x 8 x 5 ins., 15 ins. in the ground, for standard 1/4 sec. cor., marked S.C. 1/4 on N. face, dig pits 18 x 18 x 12 ins., E. and W. of stone, 3 ft.

54.10

71.55

80.00

68. Interpolated by simple proportion for the given latitude, from the second column of Table III, page 121.

69. The latitude and longitude will be given by the surveyor general, in his special written instructions.

70. See directions for making the observation, page 106.

71. This angle is interpolated by simple proportion, for the given latitude, from the columns headed "5 miles" in Table IV. But hereafter the exact angle required will be changed to the nearest angle that can be set off or read on the instrument used.

72. The measurements are counted from the beginning of the mile: 40.00 chs. are measured from the last 1/4 sec. cor., see "Base Line," p. 6, page 51.

73. At this point, the secant intersects the standard parallel. See Plate 11, figs. 1 and 2.
Set a granite stone, 20 x 8 x 4 ins., 15 ins. in the ground, for Standard Cor. of secs. 32 and 33, marked S. C., on N., with 4 grooves on E. and 2 grooves on W. faces; and raise a mound of stone, 2 ft. base, 19 ft. high, N. of cor. Pits impracticable.

NOTE.—Set a signal a foot from the cor. for a test sight from one of the high points visible to the east.

Land, mountainous.

Soil, stony; 4th rate.

Timber, pine and fir.

Mountainous or heavily timbered land, 60.60 chs.

August 22, 1890.

NOTE.—The sky was overcast during the entire night. Polaris not visible.

N. 69° 58’ E. on the secant, through sec. 33.

8.10

Begin descent on rocky ground, sloping S. E.

Difference between measurements of 40.00 chs., by two sets of chains, is 181 ks.; position of middle point

By 1st set, 39.91 chs.

By 2nd set, 40.09 chs.; the mean of which is

40.00

Set a granite stone, 19 x 8 x 7 ins., 14 ins. in the ground, for standard sec., marked S. C., in ¼ on N. face, and raise a mound of stone, 2 ft. base, 1½ ft. high, N. of cor. Pits impracticable.

This cor. is 40 ft. below top of ridge.

76.30

Enter scattering, stunted cedars, bearing N. and S.

Difference between measurements of 80.00 chs., by two sets of chains, is 161 ks.; position of middle point

By 1st set, 80.08 chs.

By 2nd set, 79.92 chs.; the mean of which is

80.00

Set a granite stone, 19 x 8 x 6 ins., 15 ins. in the ground, for standard cor. of secs. 33 and 34, marked S. C. on N., with 3 grooves on E. and W. faces; from which

Acedar, 6 ins. diam., bears N. 23¼° E., 92 lks.

dist., marked T. 13N., R. 21E., S. 34B., T.

Acedar, 8 ins. diam., bears N. 41¼° W., 45.1 ks.

dist., marked T. 13N., R. 21E., S. 33B., T.

This cor. is on top of a ridge, about 300 ft. above Black River.

Land, mountainous.

Soil, rocky; 4th rate.

Timber, scattering cedars.

Mountainous land, 80.00 chs.

Third Standard Parallel North, through Range 21 East—Continued.

Chains.

This cor. is 100 ft. below top of ridge.

Land, mountainous.

Soil, rocky; 4th rate.

Timber, scattering cedars.

Mountainous land, 80.00 chs.

August 23, 1890.

NOTE.—Continuous rain since afternoon of August 23; observations on Polaris not possible.

August 23, 1890, 7 a.m.

N. 69° 59’ E. on the secant, through sec. 35.

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Third Standard Parallel North, through Range 21 East—Continued.

Chains.

Descend over rough, stony ground sloping S.

Difference between measurements of 40.00 chs., by two sets of chains, is 141 ks.; position of middle point

By 1st set, 40.07 chs.

By 2nd set, 39.93 chs.; the mean of which is

40.00

Set a granite stone, 15 x 8 x 5 ins., 10 ins. in the ground, for standard sec., marked S. C. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of stone, 3 ft. dist.; and raise a mound of earth 3½ ft. base, 1½ ft. high, N. of cor.

This cor. is about 280 ft. below top of ridge.

Descend abruptly, 90 ft.

50.10

Bottom of ravine, 101 ks. wide, course S. 20° W.; water in holes; thence, steep ascent over ground sloping W.

74. These distances may be found by taking the mean of the offsets at the preceding sec. and following ¼ sec. cor.
Enter pine timber, bears N. E. and S. W.
A pine, 16 ins. diam., on line, 1 mark with 2 notches on
E. and W. sides.
Leave pine timber, bears N. E. and S. W.
Alexander Selkirk's house, bears S., $, 40 chs. dist.
Road, bears N. and S.
Difference between measurements of 80.00 chs., by two sets
of chainmen, is 161 ks.; position of middle point
By 1st set, 79.52 chs.
By 2nd set, 80.08 chs.; the mean of which is
80.00

Set a limestone, 29 x 8 x 6 ins., 15 ins. in the
ground, for standard cor. of secs. 35 and 36, marked
S. C. on N., with 1 groove on E. and 5 grooves on W. faces;
dig pits, 24 x 18 x 12 ins., crosswise on each line,
E. and W., 3 ft., and N. of stone, 7 ft. dist., and raise
a mound of earth, 4 ft. base, 2 ft. high, N. of cor. This
cor. is about 60 ft. above ravine.
Land, mountainous.
Soil, stony; 4th rate.
Timber, pine.
Mountainous land, 80.00 chs.

S. 89°58' E. on the secant, S. of sec. 36.
Ascend over ground sloping W.
12.70
Enter heavy oak timber, bears N. and S.
28.30
Top of ridge, 80 ft. abovelast cor., bears N. and S.
38.50
Leave heavy oak timber, bears N. and S.
Difference between measurements of 40.00 chs., by two sets
of chainmen is 141 ks.; position of middle point
By 1st set, 40.07 chs.
By 2nd set, 39.93 chs.; the mean of which is
40.00
N. 1.53 ft. from the secant.
Set a limestone, 16 x 7 x 5 ins., 11 ins. in the ground,
for standard % sec. cor., marked S. C. % on N. face;
dig pits, 18 x 18 x 12 ins., E. and W. of stone, 3 ft.
dist.; and raise a mound of earth, 3 ft. base, 1 ft.
high, N. of cor.
52.20
Road, bears N. 70° E. and S. 60° W.
68.10
Creek, 200 ft. wide, course S. 50° W.; ascend over ground
sloping W., about 90 ft.
Difference between measurements of 80.00 chs., by two sets
of chainmen, is 181 ks.; position of middle point
By 1st set, 79.91 chs.
By second set, 80.09 chs.; the mean of which is
80.00
N. 3.39 ft. from the secant.
Set a granite stone, 20 x 7 x 67 ins., 15 ins. in the
ground, for standard cor. of Tpa. 13 N., Rs. 21 and 22
E., marked 75
S. C., 13 N. of N.,
22 E. on E., and
21 E. on W. facing, with 6 grooves on N. E., and W.
facing; dig pits, 30 x 24 x 1 ft. dist., crosswise on
each line, E. and W., 4 ft., and N. of stone, 8
ft. dist.; and raise a mound of earth, 5 ft.
base, 2½ ft. high, N. of cor.
Land, mountainous.

(Pages 146 through 160 deleted. They contain field notes and
final oaths for the survey of the Third Standard Parallel
North, through Ranges 22, 23 and 24 East by Secant, Tangent
offset and Solar transit methods. The vein and style of notes
are the same.)

75. The secant intersects the standard parallel 1 mile from end of secant, and at the
paint for the corner of secs. 35 and 36. See Plat II, figs. 1 and 2.
76. See "STANDARD TOWNSHIP CORNERS," page 23

SPECIMEN FIELD NOTES.

No. 2.

TITLE PAGE.

(See Plate 111.)

FIELD NOTES

OF THE SURVEY OF THE

SIXTH GUIDE MERIDIAN EAST

THROUGH

Townships No. 13 North
Between Ranges Nos. 24 and 25 East

OF THE

PRINCIPAL BASE AND MERIDIAN

IN THE

STATE OF MONTANA,

AS SURVEYED BY

RICHARD ROODS,

U. S. DEPUTY SURVEYOR,
UNDER HIS CONTRACT No. 97,
DATED JULY 10, 1890.

Survey commenced August 29, 1890.
Survey completed August 30, 1890.

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(Pages 162 and 163 deleted. They contain the sample index
and the preliminary oaths of assistants.)

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Chain
Survey commenced August 29, 1890, and executed with W. &
L. E. Gurley light mountain transit, No. ________, the
horizontal limb being provided with two opposite
verniers reading to 30' of arc.
I begin at the Standard Corner of Township 13 North,
Ranges 24 and 25 East, which I established August 29,
1890. 77 Latitude 45°34'.5 N., longitude 107°24'. W.

77. See footnote, page 154.
At this corner, at 8:54 p.m., by my watch, which is 5°49' fast of local mean time, I observe Polaris 1,497.5 to the west, and mark the TRUE MERIDIAN thus determined by a cross on a stone firmly set in the ground, west of the point established last night. The magnetic bearing of the true meridian is N. 18°05' W., which reduced by the table on page 100 of the Manual gives the mean mag. decl. 18°02' E.

From the standard cor. I run North, bet. Secs. 31 and 36.

Descend over ground sloping N. W.

August 30: At 8:30 a.m., I lay off the azimuth of Polaris, 1,497.5 to the west, and mark the TRUE MERIDIAN thus determined by a cross on a stone firmly set in the ground, west of the point established last night. The magnetic bearing of the true meridian is N. 18°05' W., which reduced by the table on page 100 of the Manual gives the mean mag. decl. 18°02' E.

From the standard cor. I run North, bet. Secs. 31 and 36.

Descend over ground sloping N. W.

2.60 Creek 10lks. wide in ravine, 45 ft. below the Tp. cor., course N. 32° W.

7.50 To edge of table land, bears N. E. and S. W.; thence over level land.

17.40 Bluffbank, bears N. 58° W. and S. 58° E.; descend abruptly 40 ft.

19.00 Bottom of ravine, course S. 58° E.; ascend 50 feet to

22.00 Edge of table land, bears S. 69° W. and N. 58° W.; thence over level land.

Distance between measurements of 40.00 chs., by two sets of chains, is 181 lks.; position of middle point
By 1st set, 40.09 chs. By 2nd set, 39.91 chs.; the mean of which is 40.00

Set a limestone 16 ft. 7 in. 5 in., 1 lns. in the ground, for ¼ sec. cor., marked ¼ on W. face, and raise a mound of stone, 2½ ft. base, 1½ ft. high, W. of cor.

42.60 Stream, 6 lks. wide, in ravine 15½ ft. deep, course N. 60° W.

47.00 Enter heavy oak timber, bears E. and W.

53.00 An oak, 30 lns. diam., on line, I mark with 2 notches on E. and W. sides.

55.20 Creek, 20 lks. wide, 1½ ft. deep, course N. 88° W.

55.40 Right bank of creek, begin very steep rockly ascent.

60.00 Top of ridge, 250 ft. above creek, bears N. 80° W. and S. 80° E.

64.00 Begin descent.

Distance between measurements of 80.00 chs., by two chains, is 22 lks.; position of middle point
By 1st set, 79.89 chs. By 2nd set, 80.11 chs.; the mean of which is 80.00

The point for sec. cor., 150 ft. below top of ridge, falls on flatrockinplace, 10 ft. E. and W. by 6 ft. N. and S., on which I cut a cross (x) at the exactor. point for cor. of secs. 28, 30, 31, and 32, marked with 5 grooves on N and 1 groove on S. sides; from which

An oak, 10 lns. diam., bears N. 22° E., 54 lks. dist., marked T. 13 N., R. 25 E., S. 30, B. T.

A dogwood, 5 lns. diam., bears N. 64° E., 40 lks. dist., marked T. 13 N., R. 25 E., S. 31 B. T.

An ash, 13 lns. diam., bears S. 51° W., 37 lns. dist., marked T. 13 N., R. 34 E., S. 36, B. T.

An oak, 9 lns. diam., bears N. 34° W., 42 lks. dist., marked T. 13 N., R. 24 E., S. 25, B. T.

Land, level and mountainous.

Soil, gravel and rock; 4th rate.

Timber, oak.

Mountainous or heavily timbered land, 33.00 chs.

August 29, 1890.

6th Guide Meridian East, through Tps. 13 N., etc.—Continued.

Chains.

North, bet. secs. 25 and 30.

Descend through heavy oak timber.

2.00 Precipitous descent of 80 ft. down which I can not chain; set a flag on a line at foot of precipice; measure a base east 4 chs. to a point, from which the flag bears N. 68° W.; which gives for the distance (by traverse table) 1.50 chs., which, added to 2.00 chs., makes

3.50 To foot of precipice, bears E. and W.; thence, descend.

8.50 Leave heavy oak timber, bears E. and W.

13.00 Begin abrupt descent.

17.10 To creek, 10 lks. wide, pure water, course N. 70° W.; 240 ft. below top of ridge. Ascend 20 ft.

20.90 Edge of level plain, bears N. 80° W. and S. 80° E.

Distance between measurements of 60.00 chs., by two sets of chains, is 20 lks.; position of middle point
By 1st set, 39.90 chs. By 2nd set, 40.10 chs.; the mean of which is 40.00

Set a cedar post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for ¼ sec. cor., marked ¼ on W. face, dig pits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.

54.00 Diff. between measurements of 80. 00 chs., by two sets of chains, is 6 lks.; position of middle point
By 1st set, 80.03 chs. By 2nd set, 79.97 chs.; the mean of which is 80.00

Set a cedar post, 3 ft. long, 4 ins. sq., with marked stone, 24 ins. in the ground, for cor. of secs. 19, 24, 25, and 30, marked T. 13 N., S. 130 N., E. R. 25 E., S. 30 on S. E. S. 25 on S. W. and R. 24 E. S. 24 on N. W. faces; with 4 notches on N. and 2 notches on S. edges; dig pits, 18 x 18 x 12 ins., in each sec., 6½ ft. dist.; and raise a mound of earth, 4 ft. base, 2½ ft. high, W. of cor.

Land, mountainous and level.

Soil, stony and sandy; 4th rate.

Timber, oak.

Mountainous or heavily timbered land, 20.90 chs.

North, bet. secs. 19 and 24.

Over descending ground.

Ravine, 20 ft. wide, 8 ft. deep, course E.

Difference between measurements of 40.00 chs., by two sets of chains, is 6 lks.; position of middle point
By 1st set, 39.97 chs. By 2nd set, 40.01 chs.; the mean of which is 40.00

Set a cedar post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S., on W. face, dig pits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.

Enter willow brush, bears E. and W.

Leave willow brush, bears E. and W.; Ford's Creek, 22 lks. wide, banks, 3 ft. high, pure water, gentle current; course E.

Ford's Creek, 24 lks. wide, course W.

Ford's Creek, 26 lks. wide, course N. 70° E.

Ravine, 15 ft. wide, 6 ft. deep, course E.

Difference between measurements of 80.00 chs., by two sets of chains, is 12 lks.; position of middle point
By 1st set, 80.06 chs. By 2nd set, 79.94 chs.; the mean of which is 80.00

Deposit a quart of charcoal, 12 ins. in the ground, for cor. of secs. 13, 16, 19, and 24; dig pits, 18 x 18 x 12 ins., in each sec., 4 ft. dist.; and raise a mound of

78 See footnote, page 106.
<table>
<thead>
<tr>
<th>Chains.</th>
<th>Land, nearly all level.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soil, sandy loam and clay; 1st stand 4th rate.</td>
</tr>
<tr>
<td></td>
<td>No timber.</td>
</tr>
</tbody>
</table>

**North, bet. secs. 13 and 18.**
Over nearly level plain; gradually ascend.

- **29.00** Begin ascent to ridge; bears E. and W.
- **34.10** Top of ridge, 60 ft. above plain, bears E. and W.
- **35.20** Begin descent from ridge.
- **37.50** Foot of descent; branch, 1010 lbs. wide in ravine 5 ft. deep; course E. ascend.

**Difference between measurements of 40.00 chs., by two sets of chainmen, is 16 lbs.; position of middle point.**
By 1st set, 39.92 chs.
By 2nd set, 40.08 chs.; the mean of which is 39.99 chs.

- **40.00** Set a granite stone, 15 x 8 x 5 ins., 10 ins. in the ground, for 1/4 sec. cor., marked 1/4 on W. face; and raise a mound of stone, 2 ft. base, 1 1/4 ft. high, W. of cor. Pits impracticable.

- **47.00** Begin ascent of ridge; bears E. and W.
- **56.50** Top of ridge, 400 ft. above plain, bears E. and W.
- **63.00** Begin descent.

**Difference between measurements of 80.00 chs., by two sets of chainmen, is 22 lbs.; position of middle point.**
By 1st set, 80.11 chs.
By 2nd set, 79.89 chs.; the mean of which is 80.00 chs.

- **80.00** Set a granite stone, 15 x 8 x 6 ins., 10 ins. in the ground, for cor. of secs. 7, 12, 13, and 18, marked with 2 notches on N. and 4 notches on S. edges; and raise a mound of stone, 2 ft. base, 1 1/4 ft. high, W. of cor. Pits impracticable.

This cor. stands on a bench, about 350 ft. below top of ridge.
Land, level and mountainous.
Soil, sandy loam and rocky; 2nd and 4th rate.
No timber.
Mountainous land, 11.50 chs.

North, bet. secs. 7 and 12.
Over level land.

- **2.00** Begin ascent, bears E. and W.
- **7.50** Top of low ridge, 20 ft. above sec. cor., bears E. and W.; thence, descend gradually.
- **37.00** Branch, 610 lbs. wide in ravine, 10 ft. deep, course E.

**Difference between measurements of 40.00 chs., by two sets of chainmen, is 12 lbs.; position of middle point.**
By 1st set, 39.94 chs.
By 2nd set, 40.06 chs.; the mean of which is 40.00 chs.

- **40.00** Set a cedar post, 3 ft. long, 3 ins. sq., with a marked stone, 24 ins. in the ground, for 1/4 sec. cor., marked 1/4 S. on W. face; diggits, 18 x 18 x 12 ins., N. and S. of post; 3 ft. dist.; and raise a mound of earth, 3 1/4 ft. base, 1 1/4 ft. high, W. of cor.
Thence over plain gradually ascending.

- **71.00** Begin descent to creek, bears E. and W.
- **74.00** Foot of descent; creek, 1210 lbs. wide, course E. Ascend.
- **79.50** To top of ascent and edge of level plain, bears E. and N. 75° W.

**Difference between measurements of 80.00 chs., by two sets of chainmen, is 14 lbs.; position of middle point.**
By 1st set, 80.07 chs.
By 2nd set, 79.93 chs.; the mean of which is 80.00 chs.

Set a cedar post, 3 ft. long, 11 ins. sq., with marked stone, 24 ins. in the ground, for cor. of secs. 7, 12, 13, and 18, marked:
- **T. 13 N., S. 18 on N. E.,**
- **R. 25 E., S. 19 on S. E.,**
- **S. 24 on E. W., and**
- **R. 24 E., S. 13 on N. W. faces; with 3 notches on N. and S. edges.**

**GENERAL DESCRIPTION.**

Townships 13 N, Ranges 24 and 25 E, are generally rolling table-lands, producing an abundant growth of grass, and there is some good land along Ford's Creek and its tributaries. About two miles east of the corner of Tps. 13 and 14 N., Rs. 24 and 25 E., is a lake some two and half miles long by two miles wide, lying in Tps. 13 and 14 N., R. 25 E.

**RICHARD ROODS,**
**U. S. Deputy Surveyor.**

**AUGUST 30, 1890.**

(Page 168 deleted. Contains final oaths.)
SPECIMEN FIELD NOTES.

No. 3.

TITLE PAGE.

[See Plate 111.1

FIELD NOTES

OF THE SURVEY OF THE

EAST AND NORTH BOUNDARIES

OF

TOWNSHIP NO. 13 NORTH, RANGE NO. 21 EAST

OF THE

PRINCIPAL BASE AND MERIDIAN

IN THE

STATE OF MONTANA,

AS SURVEYED BY

RICHARD ROODS,

U. S. DEPUTY SURVEYOR,

UNDER HIS CONTRACT No. 97,

DATED JULY 10, 1890.

---169---

Survey commenced September 8, 1890.

Survey completed September 13, 1890.

---172---

(Pages 170 and 171 deleted. They contain the sample index and preliminary oaths of assistants.)

---172---

Chains. Survey commenced September 8, 1890, and executed with a Young & Sons'sight mountain transit, No. , with solar attachment. The horizontal limb is provided with two double verniers placed opposite to each other, reading to single minutes of arc, which is also the least count of the verniers of the latitude and declination arcs. The instrument was examined, tested on the true meridian at Helena, found correct, and was approved by the surveyor general for Montana, September 1, 1890. I examine the adjustments of the transit, and correct the level and collimation errors; then, to test the solar apparatus by comparing its indications, resulting from solar observations made during a.m. and p. m. hours, with a true meridian determined by observations on Polaris, I proceed as follows:

September 8: At the standard corner of Tps. 13 N., Rs. 21 and 22 E., latitude 45° 34'. 5 N., longitude 107° 46'. 1 W., at 4<sup>1</sup> 47<sup>1</sup> of p. m., I set off 45° 35' on the lat. arc; 8° 29' on the decl. arc (these settings being the nearest practicable to the true minutes and fractions thereof required); determine with the solar a true meridian; and mark a point thereon on a stone set firmly in the ground, 50.00 chs. N. of the cor.

At 8<sup>1</sup> 16<sup>1</sup> of p. m., by my watch, which is 4<sup>1</sup> 25' fast off m. t., I observe Polaris at eastern elongation, in accordance with Manual of Instructions, and mark a point on the line thus determined on a plug driven in the ground, 50.00 chs. N. of my station.

September 9: At 6<sup>1</sup> 30<sup>1</sup> a. m., I lay off the azimuth of Polaris, 1<sup>1</sup> 49<sup>1</sup> of the true meridian determined by the solar apparatus by p. m. and a. m. observations, and mark the true meridian as surveyed by me. At 6<sup>1</sup> 55<sup>1</sup> a. m., I set off 45° 35' on the lat. arc; 5° 17' on the decl. arc; and mark a point in the true meridian determined with the solar, by a cross on the stone already set 50.00 chs. N. of my station; this mark falls 0.3 ins. west of the true meridian established by the Polaris observation. The solar apparatus, by p. m. and a. m. observations, defines positions for true meridians, respectively about 1<sup>1</sup> 1 East and 1<sup>1</sup> 1 West of the true meridian established by the Polaris observations; therefore, I conclude the adjustments of the instrument are satisfactory.

The magnetic bearing of the true meridian, measured at a. m., is N. 18° 10' W.; the angle thus determined, reduced by the table, page 100, gives the mean mag. decl. 18<sup>1</sup> 07' E.

I begin at the standard corner of Tps. 13 N., Rs. 21 and 22 E., which I established August 25, 1890.

Thence I run

North, bet. secs. 31 and 36.

7.00

Descend abruptly over stony ground, sloping N. W.

Creek, 80 ft. below Tp. cor., 151 chs. wide, clear water, course S. 75<sup>1</sup> W.; ascend.

10.00

Road, bears N. 60<sup>1</sup> E. and S. 60<sup>1</sup> W.

19.00

Top of ridge, 200 ft. above creek, bears E. and W.

24.50

Begin descent.

31.00

Foot of descent, 150 ft. below top of ridge, bears E. and W. Branch 2 chs. wide, clear water, course E. Thence over level land.

34.00

Begin descent.

39.50

Foot of descent, 30 ft. below bench, bears E. and W. Thence over level land.

40.00

Set a sandstone, 15 x 8 x 6 ins., 10 lbs. in the ground, for 1/4 sec. cor., marked W on W. face; dig roots, 18 x 18 x 12 ins., N. and S. of stone, 3 ft. distant; and raise a mound of earth, 3 1/4 ft. base, 1 1/4 ft. high, W. of cor.

Creek 10 ft. wide, pure water, 8 ins. deep, course E.

43.00

Begin ascent.

49.50

Top of ridge, bears N. 70<sup>1</sup> E. and N. 80<sup>1</sup> W., 50 ft. above creek.

50.00

Begin descent.

79. See footnotes, pages 106 and 142.
East boundary of T. 13 N., R. 21 E. — Continued.

Chains.  
54.00 ranch 6 lks. wide, in ravine chs. wide, 30 ft. deep, course S., thence over level land.  
62.50 reek 12 lks. wide, 1 ft. deep, pure water, course S. 60° E.  
73.00 niter cedar timber, bears E. and W.  
74.79 cedar, 10 ins. diam., on line, 1 mark with 2 notches on N. and S. sides.  
80.00 cedar, 8 ins. diam., for cor. of secs. 25, 30, 31, and 36, 1 mark  
T. 13 N., S. 30 on N. E., R. 22 E., S. 21 on S. E., S. 36 on S. W. and R. 21 E., S. 25 on N. W. sides; with 5 notches on N. and 1 notch on S. sides; from which  
A cedar, 7 ins. diam., bears N. 50° W., 20 lks. dist., marked T. 13 N., R. 22 E., S. 30, B. T.  
A cedar, 6 ins. diam., bears S. 63° 30' E., 18 lks. dist., marked T. 13 N., R. 22 E., S. 31, B. T.  
A cedar, 9 ins. diam., bears S. 23° W., 21 lks. dist., marked T. 13 N., R. 21 E., S. 36, B. T.  
A cedar, 8 ins. diam., bears N. 64° W., 19 lks. dist., marked T. 13 N., R. 21 E., S. 25, B. T.  
and, mountainous and level.  
ill, stony and loam; 2nd and 4th rate.  
timber, cedar.  
mountainous land, 54.00 chs.  
9.00 orth, bet. secs. 25 and 30.  
Level land, through cedar timber.  
20.40 reek 15 lks. wide, pure water, 2 ft. deep, gentle current, course S. 70° E.  
27.50 have cedar timber, begin ascent, bears S. 70° E. and N. 70° W.  
39.50 on of ascent of 40 ft., enter level plain, bears E. and W.  
40.00 at a cedar post, 3 ft. long, 3 ins. sq., with charred stake, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; dig pits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.  
spember 9: At this ¼ sec. cor. I set off 5° 9' N. on the decl. arc; and at 11° 56' 11. m. t., observe the sun on the meridian: the resulting lat. is 45° 36.0' which is about 0.2' greater than the proper lat.  
75.00 reek 12 lks. wide, pure water, 1 ft. deep, gentle current, course S. 60° E.  
80.00 at a cedar post, 3 ft. long, 4 ins. sq., with quart of charcoal, 24 ins. in the ground, for cor. of secs. 19, 24, 25, and 30; marked T. 13 N., S. 19 on N. E., R. 22 E., S. 30 on S. E., S. 25 on S. W., and R. 21 E., S. 24 on N. W. faces; with 4 notches on N. and 2 notches on S. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.  
end, level.  
ill, sandy loam; 2nd rate.  
timber, cedar.  
9.00 orth, bet. secs. 19 and 24.  
Level land.  
6.00 ranch 4 lks. wide, course S. 70° E.; ascend.  
17.00 top of ridge, 40 ft. high, bears E. and W.  
22.00 again descent.  
36.50 on of descent, bears E. and W.; thence over level land.  
40.00 Set a sandstone, 15 x 8 x 6 ins., 10 ins. in the ground, for ¼ sec. cor., marked ¼ on W. face; dig pits, 18 x 18 x 12 ins., N. and S. of stone, 3 ft. dist., and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.  
47.50 Creek 15 lks. wide, pure water, low banks, course N. 70° W.  
64.00 Creek 16 lks. wide, pure water, low banks, course S. 65° E.  

East boundary of T 13 N., R. 21 E. — Concluded.

Chains.  
80.00 Set a cedar post, 3 ft. long, 4 ins. sq., with charred stake, 24 ins. in the ground, for cor. of secs. 13, 18, 19, and 24, marked T. 13 N., S. 18 on N. E., R. 20 E., S. 19 on S. E., S. 24 on S. W. and R. 21 E., S. 13 on N. W. faces; with 5 notches on N. and S. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.  
4.00 Land, level.  
Soil, sandy loam; 1st rate.  
No timber.  
September 9, 1890.  

North, bet. secs. 13 and 18.  
4.00 Set a cedar post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; dig pits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.  
80.00 Set a limestone, 20 x 8 x 4 ins., 15 ins. in the ground, for cor. of secs. 7, 12, 13, and 18, marked with 2 notches on N. and 4 notches on S. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.  
Land, level.  
Soil, sandy loam; 1st rate.  
No timber.

North, bet. secs. 7 and 12.  
Over level land.  
40.00 Set a cedar post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; dig pits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor.  
55.00 Creek, 8 lks. wide, in ravine 1 ch. wide, 20 ft. deep, course N. 60° E.  
80.00 Set a limestone, 19 x 8 x 6 ins., 15 ins. in the ground, for cor. of secs. 1. 6, 7, and 12, marked with 1 notch on N. and 5 notches on S. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.  
Land, level.  
Soil, sandy loam; 1st rate.  
No timber.

September 10: At this cor. I set off 4° 44' N. on the decl. arc; and at 11° 56' 51. m. t., observe the sun on the meridian: the resulting lat. is 45° 39', which is about 0.1 more than the proper lat.  

North, bet. secs. 1 and 6.  
32.50 Creek, 15 lks. wide, impure water, sluggish current, low muddy banks, course E.
40.00  Set a last post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for 3/4 sec. cor., marked 3/4 S. on W. face; 24 x 18 x 21 ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, W. of cor.

80.00  Set a limestone, 15 x 8 x 7 ins., 10 ins. in the ground, for cor. of Tps. 13 and 14 N., R. 21 and 22 E., marked with 6 notches on each edge; 24 x 24 x 12 ins., on each line; N., E., and W., 4 ft., and S. of stone, 8 ft. dist., and raise a mound of earth, 5 ft. base, 2 1/2 ft. high, S. of cor.

September 10, 1890.

North boundary of T. 13 N., R. 21 E.

Chains.

September 11: At 8° 56' 41" a.m., I set off 45° 40' on the lat. arc; 4° 25' N., on the decl. arc; and determine a true meridian with the solar, at the cor. of Tps. 13 and 14 N., R. 21 and 22 E.

Thence I run

Weston ran line, along the N. bdy. of Tp 13 N., R. 21 E., setting temp. 3/4 sec. and sec. cor. at intervals of 40.00. Ch.; and, at 479.25 ch., intersect the 5th Guide Meridian, 42.16 N. of the cor. of Tps. 13 and 14 N., R. 20 and 21 E., which is a limestone, 5 x 8 x 6 ins. above ground, marked and described as described by the surveyor general. The falling answers to a correction of 0° 03', or 7 ch. S. per mile.

Counting from the N. E. cor. of the Tp; therefore I run N. 88° 57' E., bet. secs. 6 and 31.

Over level land.

September 11, 1890.

39.25  Set a cedar post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for 3/4 sec. cor., marked 3/4 S. on N. face; 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, N. of cor.

79.25  Set a limestone, 20 x 8 x 4 ins., 15 ins. in the ground, for cor. of secs. 6, 8, 31, and 32, marked with 5 notches on E. and 1 notch on W. edges; 18 x 18 x 21 ins., in each sec., 3/4 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Land, level.

Soil, sandy loam; 1 strate.

No timber.

September 12: At 8° 56' 41", I set off 45° 40' on the lat. arc; 4° 25' N., on the decl. arc; and determine a true meridian with the solar, at the cor. of secs. 3, 4, 33, and 34.

Thence I run

N. 89° 57' E., bet. secs. 3 and 32.

40.00  Set a juniper post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for 3/4 sec. cor., marked 4 S. on N. face; 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, N. of cor.

47.00  Creek 150 ins. wide, good water, sluggish current, course S. E. 63.00

80.00  Deposit a quart of charcoal, 12 ins. in the ground, for cor. of secs. 4, 5, 8, 12, and 33; 18 x 18 x 12 ins., in each sec., 4 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, over deposit.

In S. E. pit a cedar stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked T. 14 N., S. 30 on N. E., R. 21 E., S. on S. E., T. 13 N., S. 30 on S. W., and S. 32 on N. W. faces; with 4 notches on E. and 2 notches on W. edges.

Land, level.

Soil, sandy loam; 1 strate.

No timber.

September 12: At this cor., I set off 4° 53' N., on the decl. arc, and, at 11° 5' 1", I set off the sun on the meridian; the resulting lat. is 45° 40', which is about 0° 3' greater than the proper line.

September 12, 1890.

N. 89° 57' E., bet. secs. 3 and 33.

Branch, 4 lbs. wide, course S. 35° W.

40.00  Set a limestone, 15 x 8 x 5 ins., 10 ins. in the ground, for 3/4 sec. cor. marked 4 S. on N. face; 18 x 18 x 12 ins., E. and W., of stone, 3 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, N. of cor.

57.13  Enter heavy oak timber, bears N. and S.

68.00  Branch, 3 lbs. wide, course N. 30° E.

North boundary of T. 13 N., R. 21 E. — Continued.

Chains.

September 13: At 8° 56' 41", I set off 45° 40' on the lat. arc; 4° 25' N., on the decl. arc; and determine a true meridian with the solar, at the cor. of secs. 3, 4, 33, and 34.

Thence I run

N. 88° 57' E., bet. secs. 3 and 34.

Over level land, through heavy oak timber.

Branch, 4 lbs. wide, course S. 10° E.

An oak, 18 lbs. diam., for 3/4 sec. cor., marked 4 S.; on N. side; from which An oak, 14 lbs. diam., bears S. 48° E., 27 lbs. dist., marked T. 14 N., R. 21 E., S. 34 B. T.


A dogwood, 7 ins. diam., bears N. 26° W., 32 lbs. dist., marked T. 14 N., R. 21 E., S. 33 B. T.

Land, level.

Soil, sandy loam; 1 strate.

Timber, oak.

Heavily timbered land, 25.00 chs.
N. 89° 57' E., bet. secs. 2 and 36.

Over level land.

30.00 South fork of Spring Creek, 22 lbs. wide, pure water, gentle current, low banks, course N. 38° E.

40.00 Set a locust post, 3 ft. long, 3 in. sq., with marked stone, 24 m., in the ground, for ¼ sec. cor., marked ¼ S. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist., and raise a mound of earth, 3½ ft. base, 1½ ft. high, N. of cor.

80.00 Set limestone, 15 x 8 x 6 ins., 10 ins. in the ground, for cor. of secs. 1, 2, 3, 5, and 36, marked with 1 notch on E. and 5 notches on W. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Land, level.

Soil, sandy loam; 1 strate.

No timber.

September 13: At this corre., I set off ______________ N, on the decl. arc, and at ______________ E. m.t., observe the sun on the meridian; the resulting lat. is 45° 30', which is about 0.7 less than the proper lat.

N. 89° 57' E., bet. secs. 1 and 36.

Over level land.

40.00 Set limestone, 18 x 18 x 12 ins., 12 ins. in the ground, for ¼ sec. cor.,

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North boundary of T. 13 N., R. 21 E.—Concluded.

Chains. marked ¼ on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of stone, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, N. of cor.

58.00 Branch 4 lbs. wide, course N. 30° E.

70.00 Same branch, 6 lbs. wide, course S.

80.00 The cor. of Tps. 13 and 14 N., Rs. 21 and 22 E.

Land, level.

Soil, sandy loam; 1 strate.

No timber.

September 13, 1890.

Boundaries of T. 13 N., R. 21 E.

Latitudes, departures, and closing errors.

<table>
<thead>
<tr>
<th>Line designated</th>
<th>True bearing</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Lat.</td>
<td>W. Deg.</td>
<td>W. Min.</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>1st Standard 1st Parallel...</td>
<td>490.00</td>
<td>490.00</td>
</tr>
<tr>
<td>2nd Standard 2nd Parallel...</td>
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<td>490.00</td>
</tr>
<tr>
<td>3rd Standard 3rd Parallel...</td>
<td>479.25</td>
<td>479.25</td>
</tr>
<tr>
<td>4th Standard 4th Parallel...</td>
<td>480.00</td>
<td>480.00</td>
</tr>
<tr>
<td>Total...</td>
<td>490.42</td>
<td>490.42</td>
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<td>0.42</td>
</tr>
<tr>
<td>Error in dep.</td>
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<td>0.01</td>
</tr>
</tbody>
</table>

This township is rough and mountainous in the southern part, rolling in the interior, and nearly level in the northern and east. While prairie land is found in the vicinity of the south-west corner. The township is well watered, and well timbered in the interior; and the soil along the south fork of Spring Creek and its tributaries is very fertile. The township should be subdivided.

RICHARD ROODS,

U. S. Deputy Surveyor.

September 13, 1890.

(Remainder of page 177 and all of page 178 deleted. They contain the final oaths.)

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SPECIMEN FIELD NOTES.—NO. 4.

Resurvey of the E. bdy. of T. 25 N., R. 2 W., Willamette Meridian.

Chains:

NOTE.—Field notes of retracements and resurveys will be incorporated with the field notes of the subdivisions to which they are directly related, and will be covered by the preliminary and final oaths of said subdivisions. (See page 71.)

In the case of the deed, which does not come from direct observation that this instrument is in adjustment, he will make the observations prescribed at the beginning of specimen field notes No. 2, or No. 5, as the character of the instrument employed may require.

A transit with solar attachment is the instrument employed for this resurvey.

Preliminary to commencing the subdivision of this township, I run north on a blank line, on the east boundary of sec. 36, at 40.00 chs. I find the ¼ sec. cor., N. 89° E., 30 lbs. dist., and at 80.00 chs. I find the cor. of secs. 24, 30, 31 and 36, E. 58 lbs. dist.; therefore, I continue my line north, find no part of the E. bdy. in alignment, and that many of the corners are nearly obliterated. At 5 miles 79.83 chs., intersect E. and W. line, 42 lbs. E. of the cor. of Tps. 25 and 36 N., Rs. 1 and 2 W., and as these townships have not been subdivided, I resurvey the range line between them as follows:

The old standard cor. of Tps. 25 N., Rs. 1 and 2 W., was a post greatly decayed, and the marks are nearly obliterated. I destroy all traces of the old corner and reestablish it at the same point, as follows:

Set a sandstone, 18 x 8 x 5 ins., 12 ins. in the ground, for the cor. of Tps. 25 N., Rs. 1 and 2 W. marked S. C., on N. face, with 6 grooves on N., E., and W. faces; dig pits, 18 x 18 x 12 ins., crosswise on each line, E. and W. 4 ft., and N. of stone, 8 ft. dist.; and raise a mound of earth, 5½ ft. base, 2½ ft. high, N. of cor.

Then cut Iron N. 0° 3' W., bet. secs. 31 and 36.

Fourth timber. Ascend.

Top of ridge, about 40 ft. high, bears E. and W.

Set a sandstone, 20 x 8 x 4 ins., 15 ins. in the ground, for ¼ sec. cor. marked ¼ on W. face; from which A pine 20 ins. diam., bears N. 20° E., 24 lbs. dist. marked ¼ S. B. T.

An oak, 16 ins. diam., bears N. 68° W., 27 lbs. dist. marked ¼ S. B. T.

From this point, the old ¼ sec. cor., which is a decayed stake, with marks almost obliterated, bears N. 80° E., 33 lbs. dist. I destroy this stake and the marks on the stump of a beech tree, described as a bearing tree in the field notes of the original survey. No trace can be found of apoplar, described as a bearing tree.

An oak, 14 ins. diam., on line, I mark with 2 notches on E. and W. sides. Descend.

52.74
Foot of ridge, bears E. and W.; enter rich level land.

Leave timber, bears N. E. and S. W.

Set a cedar post, 3 ft. long, 4 ins. sq., with marked stone, 24 ins. in the ground, for corner of secs. 25, 30, 31, and 36, marked T. 26 N., S. 30, on N. E., R. 1 W., S. 31, on S. E., S. 36 on S. W., and R. 2 W., S. 25 on N. W. faces; with 5 notches on N. and 1 notch on S. edges, digpits, 18 x 18 x 12 ins. in each sec., 5 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

From this cor., the old cor., a decayed post, bears E. 65 lks. 1 destroy all traces of the old cor.

Land, rolling and level.

Soil, N. and S. parts, rich loam; 1 strate, middle part, sandy; 2nd rate.

Timber, pine and oak.

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Resurvey of the E. bdy. of T. 25 N., R. 2 W., etc.—Continued.

<table>
<thead>
<tr>
<th>Chains</th>
<th>N. 0' 3' W., bet. secs. 25 and 30.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over level land.</td>
<td></td>
</tr>
<tr>
<td>40.00</td>
<td>Set a locust post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; digpits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3¼ ft. base, 1½ ft. high, W. of cor.</td>
</tr>
<tr>
<td>All indications of the old cor. have disappeared.</td>
<td></td>
</tr>
<tr>
<td>80.00</td>
<td>Set a granite stone, 15 x 8 x 7 ins., 10 ins. in the ground, for cor. of secs. 19, 24, 25 and 30, marked with 4 notches on N. and 2 notches on S. edges; digpits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.</td>
</tr>
<tr>
<td>From this point, the old cor., a post, bears N. 50° E., 4 lks. dist. Destroy the cor.</td>
<td></td>
</tr>
<tr>
<td>Land, level prairie.</td>
<td></td>
</tr>
<tr>
<td>Soil, rich loam; 1 strate.</td>
<td></td>
</tr>
<tr>
<td>No timber.</td>
<td></td>
</tr>
<tr>
<td>N. 0' 3' W., bet. secs. 19 and 24.</td>
<td></td>
</tr>
<tr>
<td>Over level prairie.</td>
<td></td>
</tr>
<tr>
<td>40.00</td>
<td>Set an oak post, 3 ft. long, 3 ins. sq., with charred stake, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; digpits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3¼ ft. base, 1½ ft. high, W. of cor.</td>
</tr>
<tr>
<td>From this point, the old ¼ sec. cor., a decayed post, bears N. 51½° E., 47 lks. dist. Destroy this post, and marks on old bearing trees.</td>
<td></td>
</tr>
<tr>
<td>50.00</td>
<td>Elk Creek, 130 lks. wide, shallow at this point, good water, gentle current, course N. W.</td>
</tr>
<tr>
<td>80.00</td>
<td>Set a limestone, 18 x 8 x 5 ins., 12 ins. in the ground, for cor. of secs. 13, 18, 19 and 24, marked with 3 notches on N. and S. edges; digpits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.</td>
</tr>
<tr>
<td>After diligent search no signs of the old cor. can be found.</td>
<td></td>
</tr>
<tr>
<td>Land, level prairie.</td>
<td></td>
</tr>
<tr>
<td>Soil, rich loam; 1 strate.</td>
<td></td>
</tr>
<tr>
<td>No timber.</td>
<td></td>
</tr>
<tr>
<td>N. 0' 3' W., bet. secs. 13 and 18.</td>
<td></td>
</tr>
<tr>
<td>Over prairie land.</td>
<td></td>
</tr>
<tr>
<td>16.50</td>
<td>Coon Creek, 60 lks. wide, 2 ft. deep, good water, course W.</td>
</tr>
<tr>
<td>40.00</td>
<td>Set a cedar post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; digpits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3¼ ft. base, 1½ ft. high, W. of cor.</td>
</tr>
</tbody>
</table>

---181---

Resurvey of the E. bdy. of T. 25 N., R. 2 W., etc.—Continued.

| Chains | Set a cedar post, 3 ft. long, 3 ins. sq., with charred stake, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; digpits, 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist., and raise a mound of earth, 3¼ ft. base, 1½ ft. high, W. of cor. |
| 80.00  | Set a limestone, 22 x 8 x 4 ins., 17 ins. in the ground, for cor. of secs. 7, 12, 13 and 18, marked with 2 notches on N. and 4 notches on S. edges; digpits, 18 x 18 x 12 ins., in each sec., 5½ ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor. |
| The old cor. which was a post, has disappeared, but indistinct remains of the pits, nearly in their proper places, still remain. The new pits sufficiently obliterate the old ones. |
| Land, gently rolling prairie. |
| Soil, rich loam; 1 strate. |
| No timber. |
| April 12, 1892: I set off 15° 6' N., on the decl. arc; and at 12° 0' 30" p.m., I m. 1, observe the sun on the meridian; the resulting lat. is 47° 35' N. |
| N. 0' 3' W., bet. secs. 7 and 12. |
| Over prairie land. |
| 17.50  | Maple Creek, 10 lks. wide; 1 ft. deep, good water, gentle current, course S. W. |

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SPECIMEN FIELD NOTES.

NO. 5
TITLE PAGE.
(See Plate IV.)

FIELD NOTES
OF THE SURVEY OF THE
SUBDIVISION AND MEANDER LINES
OF
TOWNSHIP NO. 15 NORTH, RANGE NO. 20 EAST,
of the
PRINCIPAL BASE AND MERIDIAN
IN THE
STATE OF MONTANA,
AS SURVEYED BY
ROBERT ACRES,
U. S. DEPUTY SURVEYOR,
UNDER HIS CONTRACT, No. 207,
DATED MARCH 22, 1893.

Survey commenced August 4, 1893.
Survey completed August 19, 1893.

(Pages 184 and 185 deleted. They contain the sample index and preliminary oaths of assistants.)

(Pages 186 and 187 were missing from this text.)

Subdivision of T. 15 N., R. 20 E. — Continued.

| Chains | Leave heavy timber, bears N. W. and S. E. |
| 32.50  | Deposit a quart of charcoal, 12 ins. in the ground, for ½ sec. cor.; dig pits, 18 in. 18 in. 12 ins., &c. and W. of cor., 4 ft. dist., and raise mound of earth, 3% ft. base, ¼ ft. high, over deposit. In E. pit drive a cedar stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked ¼ S. on N. face. |
| 39.98  | Enter heavy timber, bears N. and S. |
| 46.50  | Leave heavy, enter scattering timber, bears N. 25° E. and S. 25° w. |
| 76.00  |  |
| 79.96  | The cor. of secs. 25, 26, 38, and 36. |
Land nearly level; mostly subject to overflow 2 to 5 ft. deep. Heavily timbered land, 41.50 chs.

25.36

N. 0° 1' W., bet. secs. 25 and 26. Over level bottom land, through scattering timber.

Right bank of Yellowstone River.

Set a locust post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for meander cor. off acl. secs. 25 and 26, marked.


Enter shallow channel, 110 ft. deep.

26.00

Across shallow channel, 64 lks. wide, to sandbar parallel to river bank; thence on sandbar.

32.12

To right bank of main channel, course E.; point for triangulation.

40.00

Point for 4/8 sec. cor. fallsin river.

To determine the dist. across, I set a flag on line, on left bank; then measure a base, N. 89° 59' E., 20.00 chs. to a point, from which the flag bears N. 49° 06' W.; from the flag B. end of base S. 49° 06' E.; therefore, the dist. is tan. 49° 55' x base, or 0.867 x 20.00 = 17.34 chs. 1/4 th of the distance from meander cor. 0.64 + 6.12 + 17.34 = 24.10 chs., which added to 25.36, makes 49.46

To left bank of Yellowstone River, bank, 12 ft. high.

Deposit a marked stone, 12 ins. in the ground for meander cor. off acl. secs. 25 and 26, dig a pit, 36 x 36 x 12 ins., 8 ft. N.of cor. and raise mound of earth, 4 ft. base, 2 ft. high, over deposit.

In the pit drive a cedar stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked M. C. on S., T. 15 N. on N., R. 20 E., S. 26 on W., and S. 25 on E. faces.

Thence over level bottom land. Some small cottonwoods, none within limits suitable for bearing trees.

52.60

Leave bottom, begin ascent, bears E. and W.

53.60

Top of ascent and end of sandy plain, 40 ft. above river, bears E. and W.

55.70

Wire fence, bears E. and W.

62.80

Telegraph line, bears E. and W.

80.00

Set a cedar post, 3 ft. long, 4 ins. sq., with marked stone, 24 ins. in the ground, for cor. of secs. 23, 24, 25, and 26, marked.

T. 15 N., R. 20 E., S. 24 on N. E., R. 20 E., S. 25 on S. E., and S. 26 on S. W., and S. 23 on N. W. faces, with 2 notches on S. and 1 notch on E. edges; dig pits, 18 x 18 x 12 ins. in each sec. 3/4 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Land, level.

August 5. At this cor. I set off 16° 47' N., on the decl. arc. and, a 10° 6' p. m., I. m. t., observe the sun on the meridian; the resulting lat. is 45° 47' 0'.0 or about 0.5 greater than the proper lat.

S. 89° 56' E., on a random line between secs. 24 and 25. Set temp. 1/4 sec. cor.

Intersect E. bdy. of Tp. 31 N., S. of cor. secs. 19, 24, 25, and 30, which is a sandstone, 5 x 9 x 4 ins. above ground, marked and witnessed as described by the surveyor general.

Thence I run N. 89° 55' W., on a true line between secs. 24 and 25. Over level land.

Fletcher's Station bears S. 64° W.

Set a cedar post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for 1/4 sec. cor., marked 4/5S. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. 3 ft. dist.; and raise a mound of earth, 3 ft. base, 1/4 ft. high, N. of cor.

Fletcher's Station bears S. 7° E.

Short Creek, 31 N. wide, alkali water, 8 ins. deep, course S.20° E.


N. 0° 1' W., bet. secs. 23 and 24. Over level land.

Enter alkali flat, bears N. 70° W. and S. 70° E.

Set a sandstone, 16 x 8 x 16 ins., 11 ins. in the ground, for 1/4 sec. cor., marked 4/5W. on W. face; dig pits, 18 x 18 x 12 ins., E. and W. 12 ins. dist.; and raise a mound of earth, 3 ft. base, 1 1/4 ft. high, W. of cor.

Alkali flat extends about 65.00 chs. E. and 35.00 chs. W. Leave alkali flat, bears E. and W.

Alkali creek (dry), course E.

Set a sandstone, 20 x 7 x 5 ins., 15 ins. in the ground, for cor. of secs. 13, 14, 23, and 24, marked with 3 notches 1/4 sec. on S. and 1/4 on E. edges; dig pits, 18 x 18 x 12 ins. in each sec., 5 1/2 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Land, level. Soil, sandy and alkali; 4th rate. Not timber.

S. 89° 55' E., on a random line between secs. 13 and 24. Over level land.

Set temp. 1/4 sec. cor.

Intersect E. bdy. of Tp. 31 N. at the cor. of secs. 13, 18, 19, and 24, which is a locust post 1 ft. above ground, 4 ins. sq., marked and witnessed as described by the surveyor general.

Thence I run N. 89° 55' W., on a true line between secs. 13 and 24. Over sandy alkali land.

Set a juniper post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for 1/4 sec. cor. marked 1/4S. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist.; and raise a mound of earth, 3 1/4 ft. base, 1 1/4 ft. high, N. of cor.

The cor. of secs. 13, 14, 23, and 24.

Alkali creek (now dry), runs eastward about 4.00 chs. south of this line.

Land, level. Soil, alkali sand; 4th rate. Not timber.

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Subdivision of T. 15 N., R. 20 E.—Continued.

Chains. Soil, alluvia land sand; 1 stand 2nd rate. Timber, cottonwood and sycamore.

61. See page 136.
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Subdivision of T. 15 N., R. 20 E. — Continued.

Chains.  
N. 0° 1' W., bet. secs. 13 and 14.  
Over level land.

40.00  
Set an oak post 3 ft. long, 3 in. sq., with quart of charcoal, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on W. face; dig pits 18 x 18 x 12 ins. N. and S. of post, 3 ft. dist., and raise a mound of earth, 3½ ft. base, ½ ft. high, W. of cor.  
Thence gradually ascending.

58.00  
Begin steep ascent, sloping S. W.; broken stony ground.

80.00  
Set a limestone, 20 x 8 x 6 ins., 15 ins. in the ground, for cor. of secs. 11, 12, 13, and 14, marked with 4 notches on S., and 1 notch on E. edge, and raise a mound of stone, 2 ft. base, 1½ ft. high, W. of cor.  
Pits impracticable.

This cor. is about 150 ft. above last ¼ sec. cor.  
Land, level and mountainous.

40.00  
Soil, sandy and rocky; 3rd and 4th rate.

44.32  
No timber.

Mountainous land, 22.00 chs.  

S. 89° 55' E., on a random line, bet. secs. 12 and 13.

40.00  
Point for ¼ sec. cor. falls in Rancho San Blas.

80.03  
Intersect E. bdy. of Tp. 71.ks. N. of the cor. of secs. 7, 12, 13, and 18, which is a sandstone 5 x 6 x 6 ins. above ground, marked and witnessed as described by the surveyor general.  
Thence, I run.

N. 89° 52' W., on a true line bet. secs. 12 and 13.

Over level land.

31.49  
Intersect E. bdy. of Rancho San Blas, at a point, from which the 5 mile post on the rancho bdy. bears S. 33° E.  
7.00 chs. dist.

59.50  
Set a limestone, 15 x 8 x 5 ins., 10 ins. in the ground, for closing cor. of frac. secs. 12 and 13, marked C. C. on E. and S. B., on W. faces; dig pits, crosswise on each line, 30 x 24 x 12 ins., N. 33° W., 3 ft., and 24 x 18 x 12 ins., E. of stone, 7 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, E. of cor.  
Thence, across the rancho on a blank line.

67.07  
Intersect W. bdy. of Rancho San Blas at a point, from which the 3½ mile post on the rancho bdy., bears N. 19° W., 12.20 chs. dist.

Set a granite stone, 15 x 7 x 6 ins., 10 ins. in the ground, for closing cor. of frac. secs. 12 and 13, marked S. B. on E., with 4 grooves on S. and C. C. on W. faces; and raise a mound of stone 2 ft. base, ½ ft. high, W. of cor.  
Pits impracticable.

This cor. is on a granite ridge 220 ft. above closing cor. on E. bdy. of the rancho. Thence, over rough stony ground.

76.00  
Begin descent of rocky slope, bears N. and S.  
80.03  
The cor. of secs. 11, 12, 13, and 14.

This cor. is 40 ft. below top of ridge.  
Land, level and mountainous.

40.00  
Soil, sandy loam and stony; 3rd and 4th rate.

80.04  
No timber.

Across Rancho San Blas, 35.58 chs. of blank line.

Mountainous land, 12.96 chs.  

August: 5 At 4° 35'30" p.m., l.m., 1 set off 45° 49" on the lat. arc; 16° 45' N., on the decl. arc; and determine a true meridian with the solar, at the corner of secs. 11, 12, 13, and 14.

Thence I run.

N. 0° 1' W., bet. secs. 11 and 12.

11.00  
Top of ascent, bears about N. 50° W., and S. 50° E.  
Thence over level land.

36.60  
Intersect W. bdy. of Rancho San Blas at a point from which the N. W. cor. of the rancho bears N. 19° 46' W., 7.40 chs. dist.

Chains.

Set a cedar post, 3 ft. long, 4 in. sq., with marked stone, 24 ins. in the ground, for closing cor. of frac. secs. 11 and 12, marked S. B. on E., C. C. T. 15 N., 20 E. on S., and S. 11 on W. faces; dig pits, crosswise on each line, 30 x 24 x 12 ins., N. 19° W., 3 ft., and 24 x 18 x 12 ins., S. of stone, 7 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, S. of cor.  
Thence, across the rancho on a blank line.  
The point for ¼ sec. cor. falls in the rancho.

Inters ect N. bdy. of Rancho San Blas at a point from which the N. W. cor. of the rancho bears S. 73° W., 2.58 chs. dist.

Set a juniper post 3 ft. long, 4 ins. sq., with a quart of charcoal, 24 ins. in the ground, for closing cor. of frac. secs. 11 and 12, marked S. B. on S., and S. 11 on W. faces; dig pits, crosswise on each line, 30 x 24 x 12 ins., S. 73° W., 3 ft., and 24 x 18 x 12 ins., N. of stone, 7 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, N. of cor.  
Leave rancho, enter public land; thence, over rolling ground.

Branch, 61ks. wide, course S. E.  
Deposit a marked stone, 12 ins. in the ground, for cor. of secs. 1, 2, 11, and 12, dig pits, 18 x 18 x 12 ins. in each sec., 4 ft. dist. and raise a mound of earth, 4 ft. base, 2 ft. high, over deposit. In S. E. pit, drive a cedar stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked T. 16 N., S. 1. on N. E., R. 20 E., S. 12 on S. E., S. 11 on S. W. and S. 2 on W. faces; with 5 notches on S. and 1 notch on E. edges.

Land, mountainous and level.

Soil stony, clay, and loam; 3rd and 4th rate.

No timber.

Across Rancho San Blas, 7.72 chs. of blank line.

Mountainous land, 11.00 chs.  

S. 89° 52' E., on a random line bet. secs. 1 and 12.

S. 89° 52' E., on a random line bet. secs. 1 and 12.

Set temp. 4½ sec. cor.

Inters ect E. bdy. of Tp. 71.ks. N. of cor. of secs. 1, 6, 7, and 12 which is a juniper post, 18 ft. high, 4 ins. sq., marked and witnessed as described by the surveyor general.

Thence I run.

N. 89° 49' W., on a true line bet. secs. 1 and 12.

Over rolling land.

Enter oak timber, bears N. 20° E. and S. 20° W.  
Begin ascent of ridge, bears N. 27° E. and S. 27° W.

Top of ridge, 50 ft. high, bears N. 27° E. and S. 27° W.  
Begin descent, bears N. 30° E. and S. 30° W.

Foot of descent, bears N. 33° E. and S. 33° W.

An oak, 12 ins. diam., on line, mark with 2 notches on E. and W. sides.

Set a cedar post, with charred stake, 24 ins. in the ground for ¼ sec. cor., marked ¼ S. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist.;
Subdivision of T. 15 N., R. 20 E.—Continued.

Chains. N. 0° 1’ W., on a random line bet. secs. 1 and 2. 40.00 Set temp. Va. sec. cor. 79.77 Intersect N. bdy. of Tp. aec. of secs. 1, 2, 35, and 36, which is a limestone, 6 x 6 & 5 ins. above ground, marked and witnessed as described by the surveyor general. Thence run S. 0° 1’ E. on a true line bet. secs. 1and 2. Overrolling land. 30.50 Ravine, 3.50 chs. wide, 30 ft. deep, course N. 70° E. 39.77 Deposita marked stone, 12ins. in the ground, for ¼ sec. cor.; digits, 18 x 18 x 12ins. N. and S. of cor., 4 ft. dist. and raise amount of earth, 3¾ ft. base, 1½ ft. high, over deposit. In S. pit drive a cedar stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground marked ¼ S. on W. face. 79.77 The cor. of secs. 1, 2, 11, and 12. Land, rolling. Soil, clay and loam; 3rd and 4th rate. No timber. Aug. 5, 1893.

Subdivision of T. 15 N., R. 20 E.—Continued.

Chains. Over level bottom land, through scattering timber. 13.74 To right bank of Yellowstone River. Set alinement, 19x 7 x 5ins., 15ins. in the ground, for meander cor. off. sec. 26 and 35, marked M. C. T. on W. face, with 1 groove on S. face, from which Asycamore, 15ins. diam., bears N. 45° W., 26 ins. dist., marked T. 15N., R. 20E., S. 26M. C. B. T. 31.93 To left bank of Yellowstone River. A sycamore, 13ins. diam., corner meander cor. off. sec. 26 and 35, 1 mark M. C. B. T., T. 15N. on W., R. 20E. on S., and S. 26M. on N. sides; digit pit, 36 x 36 x 12ins. 8 ft. W. of tree, and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor. 37.50 Leave scattering timber, bears N. W. and S. E. 40.03 Set a cedar post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for ¼ sec. cor. marked ¼ S., on W. face; digits, 18 x 18 x 12ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. of cor. 42.00 Begin ascent of sandhills, bears N. 70° E. and S. 70° W. 46.50 Top of sandhills, 35 ft. high, bears N. 65° E. and S. 65° W., beg. descent. 50.50 Foot of descent, bears N. 70° E. and S. 70° W.; thence, over sandy plain, gently ascending. 80.00 Set a log post, 3 ft. long, 4 ins. sq., with quartz of charcoal, 24 ins. in the ground, for cor. of sec. 26, 27, 34 and 35, marked T. 15N., S. 26M. on N. E., R. 20E., S. 25M. on S. E., S. 34M. on S. W., and S. 27M. on W. faces; with 1 notch on S. and 2 notches on E. edges; digits, 15 x 15 x 12 ins., in earths, 6½ ft. dist. and raise a mound of earth, 4½ ft. base, 2 ft. high, W. of cor. Land, level. Soil, alluvial and sandy; 1st and 3rd rate. Timber, sycamore and cottonwood. Aug. 5, 1893.

82. The triangulation will always be made on the random line when a random line is run. See page 61 and Plate II, fig. 4.
edges; dig pits, 18 x 18 x 12 ins., in each sec.,
5½ ft. dist.; and raise a mound of earth, 4 ft. base, 2½ ft. high, W. ofcor.
Land, level.
Soil, sandy loam; 1 stand 2nd rate.
No timber.

S. 89° 58' E., on a random line bet. secs. 23 and 26.
40.00
Settemp. ¾ sec. cor.
80.01 Intersect N. and S.line, 5½ks. N.of cor. of secs. 23, 24, 25, and 26.
Thence I run
N. 89° 56' E., on a true line bet. secs. 23 and 26.
40.00
Over level land.
40.00% Deposit a quart of charcoal, 12ins. in the ground, for ¼ sec. cor.; digpits, 18 x 18 x 12 ins., E. and W. of cor., 4½ ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, over deposit in E. pit drive a cedar stake, 2½ ft. long, 2 ins. sq., 12ins. in the ground, marked ¼ S. on N. face.
66.00
53.00 Road from Mound City to Lake City, bears N. 50° E. and S. 50° W.; wire fence bears S. 65° E.
80.00
80.01 Thecor. offsecs. 22, 23, 25, and 27.

(Pages 194 through 203 deleted. They contain sample field notes in the same vein and style.)

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Subdivision of T. 15 N., R. 20 E.—Continued.

<table>
<thead>
<tr>
<th>Chains.</th>
<th>N. 0° 4' W., bet. secs. 16 and 17.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over level land.</td>
</tr>
<tr>
<td>34.00</td>
<td>S.E. cor. of James Wilkie's field, extends W., 18,000 chs., and along line.</td>
</tr>
<tr>
<td>40.00</td>
<td>Set a cedar post, 3 ft. long, 3 ins. sq., with quart of charcoal, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S., on W. face; digpits 18 x 18 x 12 ins., N. and S. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, W. ofcor.</td>
</tr>
<tr>
<td>46.00</td>
<td>Old Military Road, bears N. 65° W. and S. 65° E.</td>
</tr>
<tr>
<td>47.00</td>
<td>Branch, 4½ks. wide, pure water, swift current, course S. 40° W.</td>
</tr>
<tr>
<td></td>
<td>This branch is the outlet of the pond in sec. 16, fed by numerous fine springs in sec. 9.</td>
</tr>
<tr>
<td>50.20</td>
<td>Acqua, 8½ks. wide, course N. 86° W. Thence gradually ascending.</td>
</tr>
<tr>
<td>80.00</td>
<td>Set a limestone, 2½ x 7½ x 5½ ins., 16½ ins. in the ground, for cor. of secs. 8, 9, 10, and 17, marked with 4 notches on S. and E. edges; digpits 18 x 18 x 12 ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4½ ft. base, 2½ ft. high, W. ofcor.</td>
</tr>
<tr>
<td></td>
<td>Land, level and rolling.</td>
</tr>
<tr>
<td></td>
<td>Soil, rich loam; 1st rate.</td>
</tr>
<tr>
<td></td>
<td>No timber.</td>
</tr>
</tbody>
</table>

S. 89° 59' E., on a random line bet. secs. 9 and 16.
40.00
Settemp. ¼ sec. cor.
79.90 Intersect N. and S.line 9½ks. N.ofcor. of secs. 9, 10, 16, and 16.
Thence I run
N. 89° 55' W., on a true line bet. secs. 9 and 16.
40.00
Over rolling land.
31.40 Spring branch, 3½ks. wide, course S.; enters pond about 600 chs. S.
39.95 Set a cedar post, 3½ ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S. on N. face; digpits 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, N. ofcor.

49.20 Spring branch, 3½ks. wide, course S.; enters pond about 800 chs. S.

The branches crossing this line are fed by numerous large springs. 4½ to 10,000 chs. N. of the line. Thecor. of secs. 8, 9, 16, and 17.
Land, rolling.
Soil, gravelly loam; 2nd rate.
No timber.

N. 0° 4' W., bet. secs. 8 and 9.
40.00
Over rolling land.
To S. bank of limestone quarry, bears E. and W. To pass the quarry, 1ft offset 2½ chs. E., then, N. 0° 4' W., on the offline.

The point for ¼ sec. cor. falls in quarry. Continue offline to 40.60 chs.; then, W., 200 chs, to true line.
Set a limestone, 15½ x 9½ x 5 ins., 10½ ins. in the ground, for witness cor. to ¼ sec. cor. marked W. C. ¼ on W. face; and raise a mound of stone, 2½ ft. base, 1½ ft. high, N. ofcor.
Pits impracticable.
Middle of single track of the Montana and Manitoba Railroad, bears N. 42° E. and S. 42° W.

Telegraph line, bears N. 42° E. and S. 42° W.
Seta limestone, 17½ x 9½ x 5½ ins., 12½ ins. in the ground, for cor. of secs. 4, 5, 8, and 9, marked with 5 notches on S. and 4 notches on E. edges; digpits, 18 x 18 x 12½ ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4½ ft. base, 2½ ft. high, W. ofcor.

From this cor. the U.S. mineral monument in sec. 5 bears N. 59° W.
Soil, thin, and gravelly, with many limestone outcrops; 3rd and 4th rate.
No timber.

August 14 at 4½° 30' p.m. 1 m. 11. I set off 45° 49' on the lat. arc, 14°' G' N. on the decl. arc; and determine a true meridian with the solar, at the cor. of secs. 4, 5, 8, and 9.
Thence I run
S. 89° 55' E., on a random line bet. secs. 4 and 9.

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Subdivision of T. 15 N., R. 20 E.—Continued.

<table>
<thead>
<tr>
<th>Chains.</th>
<th>Settemp. ¾ sec. cor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.00</td>
<td>Intersect N. and S.line, 5½ks. N.ofcor. of secs. 3, 4, 9, and 10.</td>
</tr>
<tr>
<td>79.90</td>
<td>Thence I run</td>
</tr>
<tr>
<td>N. 89° 57' W., on a true line bet. secs. 4 and 9.</td>
<td></td>
</tr>
<tr>
<td>20.00</td>
<td>Descend through heavy pine timber.</td>
</tr>
<tr>
<td>39.50</td>
<td>Foot of spur, 300 ft. below sec. cor.; leave heavy pine timber, bears N. and S.</td>
</tr>
<tr>
<td>39.97</td>
<td>Wood road, bears N. 20° E. and 20° W.</td>
</tr>
<tr>
<td>68.50</td>
<td>Set a limestone, 18 x 18 x 6½ ins., 12½ ins. in the ground, for ¼ sec. cor., marked ¼ on N. face; digpits, 18 x 18 x 12½ ins., E. and W. of stone, 5½ ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ ft. high, N. ofcor.</td>
</tr>
<tr>
<td></td>
<td>Middle of single track of the Montana and Manitoba Railroad bears N. 38° E. and S. 38° W.</td>
</tr>
<tr>
<td>70.20</td>
<td>Telegraph line bears N. 38° E. and S. 38° W.</td>
</tr>
<tr>
<td>79.94</td>
<td>Thecor. of secs. 4, 5, 8, and 9.</td>
</tr>
<tr>
<td></td>
<td>Land, mountainous.</td>
</tr>
<tr>
<td></td>
<td>Soil, thin and gravelly; 3rd and 4th rate.</td>
</tr>
<tr>
<td></td>
<td>Timber, Pine.</td>
</tr>
<tr>
<td></td>
<td>Mountainous or heavily timbered land, 20.00 chs.</td>
</tr>
</tbody>
</table>

N. 0° 4' W., on a random line bet. secs. 4 and 5.
40.00
Settemp. ¾ sec. cor.
79.96 Intersect N. bdy. of the Tp. 2½ks. W. of cor. of secs. 4, 5, 32, and 33.
Thence I run
S. 0° 3' E., on a true line bet. secs. 4 and 5.
<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00</td>
<td>Top of spur, bears E. and W.; descend.</td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td>Ragine 20 ft. deep, course E.; ascend.</td>
<td></td>
</tr>
<tr>
<td>16.00</td>
<td>Top of spur, 40 ft. above ravine, bears S. 70° E. and N. 70° W.; descend.</td>
<td></td>
</tr>
<tr>
<td>27.00</td>
<td>Ravine, 30 ft. deep, course S. 80° E.; ascend.</td>
<td></td>
</tr>
<tr>
<td>32.00</td>
<td>Top of spur, bears S. 85° E. and N. 85° W.; descend.</td>
<td></td>
</tr>
<tr>
<td>37.00</td>
<td>Ravine, 25 ft. deep, course S. 65° E.; ascend.</td>
<td></td>
</tr>
<tr>
<td>39.96</td>
<td>Set a limestone, 15x6x6 ins., 10 ins. in the ground, for ¼ sec. cor., marked ¼ on W. face, and raise a mound of stone, 2 ft. base, ½ ft. high, W. of cor. Pits impracticable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This cor. stands on the N. E. slope of a spur descending southeastly; descend.</td>
<td></td>
</tr>
<tr>
<td>50.00</td>
<td>Top of spur, bears E. and W., about 35 ft. above ¼ sec. cor., bears E. and W.; descend.</td>
<td></td>
</tr>
<tr>
<td>55.00</td>
<td>Ravine, 20 ft. deep, course N. 55° E.; ascend.</td>
<td></td>
</tr>
<tr>
<td>62.00</td>
<td>Top of low spur, bears E. and W.; descend.</td>
<td></td>
</tr>
<tr>
<td>74.00</td>
<td>Foot of slope, bears N. 40° E. and S. 88° W.</td>
<td></td>
</tr>
<tr>
<td>79.96</td>
<td>The cor. of secs. 4, 5, 8, and 9.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land, mountainous.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil, rocky; 4th rate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No timber.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mountainous land, 74.00 chs.</td>
<td></td>
</tr>
</tbody>
</table>

August 15: At 7th 30' a.m., I set off 45° 45' on the lat. arc; 15° 54' N., on the decl. arc; and determine true meridian with the solar, at the cor. of sec. 5, 6, 31, and 32; which is a limestone, 5 x 8 x 6 ins., above ground; marked and witnessed as described by the surveyor general. Thence I run N. 0° 5' W., bet. secs. 31 and 32. Over level land.

6.50 Trail, bears E. and W. The S. W. cor. of James Parker's Desert Land Claim, which is a round pipe post, 3 ft. high, 6 ins. diam., marked J. P. D. L. C. 3, bears N. 49° 46' W. The S. E. cor. of the same claim, which is a round pipe post, 3 ft. high, 6 ins. diam., marked J. P. D. L. C. 4, bears N. 66° E.

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**Subdivision of T. 15 N., R. 20 E. — Continued.**

<table>
<thead>
<tr>
<th>Chains</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.00</td>
</tr>
</tbody>
</table>

80.00 Set a limestone, 20 x 7 x 5 ins., 15 ins. in the ground, for cor. of secs. 28, 30, 31, and 32, marked with 1 notch on S. and 5 notches on E. edges; dig pita, 18 x 18 x 15 ins., in each sec., 5½ ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor. From this cor. the above described S. W. cor. of James Parker's Desert Land Claim bears S. 29° 14' W. The N. W. cor., which is a post 3 ft. long, 5 ins. sq., marked J. P. D. L. C. 2, bears N. 42° W. Land, level. Soil, sand; 4th rate. No timber.

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**Subdivision of T. 15 N., R. 20 E. — Continued.**

<table>
<thead>
<tr>
<th>Chains</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.00</td>
</tr>
</tbody>
</table>

80.00 Telegraph line, bears E. and W. Road leading to Lake City and Mound City, bears E. and W. Begin descent over rocky ground, bears E. and W. Set a sandstone, 15x8x6 ins., 10 ins. in the ground, for cor. of secs. 19, 20, 29, and 30, marked with 2 notches on S. and 5 notches on E. edges; and raise a mound of stone, 2 ft. base, 1½ ft. high, W. of cor. Pits impracticable. This cor. stands on stony ground sloping N., about 25 ft. below level of the plain.
Road leading to Lake City, bears N. and S. 39.96%s
Set a cedar post, 3 feet long, 3 ins. sq., with quart of charcoal, 24ins. in the ground, for ¼ sec. cor. marked ¼ S., on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist. and raise a mound of earth, 3½ ft. base, ½ ft. high, N. of cor.
16.40
20.50
30.00
Begin descent from plain, bears N. and S. 63.00
Foot of descent, 35 ft. below plain, bears N. and S.; thence over broken ground to
79.53
The cor. of secs. 18, 20, 29, and 30.
Land, level.
Soil, sand and stony; 4th rate.
No timber.
36.50
40.00
N. 89° 57' W., on a random line bet. secs. 19 and 30.
Over rough stony ground.
40.00
Set Temp. ¼ sec. cor.
78.21
Intersect W. bdy. of the Tp. 3 lks. N. of the cor. of secs. 19, 24, 25, and 30, which is a juniper post, 18 ins. above ground, 4 ins. sq., marked and witnessed as described by the surveyor general.
Thence I run
S89° 58' E., on a true line bet. secs. 19 and 30.
Over level land.
43.20
38.21
Set a maple post, 3 ft. long, 3 ins. sq., with charred stake, 24 ins. in the ground, for ¼ sec. cor. marked ¼ S., on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist. and raise a mound of earth, 3½ ft. base, ½ ft. high, N. of cor.
Begin ascent over stony ground.
72.21
The cor. of secs. 18, 20, 29, and 30.
Land, level.
Soil, sandy loam; 3rd and 4th rate.
No timber.
78.21
N 0° 5' W., bet. secs. 19 and 20.
Descend over stony ground.
2.00
Foot of descent, 100 ft. below sec. cor., and 35 ft. below the sandy plain, bears E. and W. Thence gradual descent toward Lin's Lake.
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Subdivision of T. 15 N., R. 20 E. — Continued.

<table>
<thead>
<tr>
<th>Chains</th>
<th>32.50</th>
<th>Enter scattering timber, bears E. and W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.00</td>
<td>Enter a maple post, 3 ft. long, 3 ins. sq., 24 ins. in the ground, for ¼ sec. cor. marked ¼ S., on N. face; from which A maple, 22 ins. diam., bears N. 22° W., 191.ks. dist., marked ¼ S., B.T.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An ash, 12 ins. diam., bears N. 70° 4° E., 28 lks. dist., marked ¼ S., B.T.</td>
<td></td>
</tr>
<tr>
<td>44.50</td>
<td>To bank of Lin's Lake.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set a cedar post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for meander cor. of sec. 19 and 20, marked M.C. on N., T. 15N. on S., R. 20E. on W., and S. 19 on W. face; from which A maple, 8 ins. diam., bears S. 22° 4° E., 211.ks. dist., marked T. 15N., R. 20E., S. 20W., M.C. B.T.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land, gently rolling.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil, mostly rich loam; 1st rate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Timber, maple, ash, and oak.</td>
<td></td>
</tr>
</tbody>
</table>

Subdivision of T. 15 N., R. 20 E. — Continued.

<table>
<thead>
<tr>
<th>Chains</th>
<th>55.00</th>
<th>Old Military Road, bears N. W. and S. E. The road branches about 2.00 chs. S. E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.00</td>
<td>Enter road, leading to Lake City, bears W., thence, along middle of road.</td>
<td></td>
</tr>
<tr>
<td>61.00</td>
<td>Middle of single track of the Montana and Manitoba Railroad, bears N. 60° 1° E. and S. 60° W.</td>
<td></td>
</tr>
<tr>
<td>63.50</td>
<td>Telegraph line, bears N. 60° E. and S. 60° W.</td>
<td></td>
</tr>
<tr>
<td>80.00</td>
<td>The point for sec. cor. falls in the road; therefore Deposit a marked stone, 24 ins. in the ground, for cor. of secs. 7, 8, 17 and 18.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land, rolling.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil, sandy loam; 3rd rate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No timber.</td>
<td></td>
</tr>
</tbody>
</table>

August 15, 1893.

August 16: At 7° 44' a.m., I. m. t., I set off 48° 48' on the lat. sec. 13° 36' N., on the decl. arc. and determine a true meridian at the cor. of secs. 16, 17, 20 and 21, described on page 203; thence I run
N. 89° 57' W., on a true line, bet. secs. 17 and 20. Over gently rolling land, descending toward Lin's Lake.
Telegraph line, bears N. and S. Road to Lake City, bears N. and S. Irrigating ditch, 81 ins. wide, course S. 60° W. Enter field cultivated by irrigation; extends N., 500 chs. and S. about 1000 chs.
Leave field, enter scattering timber, bears N. 65° E. and S. 5° W. Set a cedar post, 3 ft. long, 3 ins. sq., 24 ins. in the ground, for ¼ sec. cor., marked ¼ S., on N. face; from which A sycamore, 22 ins. diam., bears N. 22° W., 191 lks. dist., marked ¼ S., B. T. An ash, 13 ins. diam., bears S. 70° 4° W., 28 lks., dist., marked ¼ S., B. T. To bank of Lin's Lake. A sycamore, 18 ins. diam., for meander cor. of sec. 17 and 20, I mark M.C. on W., T. 15N. on E., R. 20E. on S., 17 on N., and S. 20 on S. sides; from which An ash, 10 ins. diam., bears N. 40° 4° E., 200 lks. dist., marked T. 15N., R. 20E., S. 17W., M.C. B.T. A maple, 9 ins. diam., bears S. 49° 4° E., 23 lks. dist., marked T. 15N., R. 20E., S. 20W., M.C. B.T. Land, gently rolling. Soil, rich loam; 1st rate. Timber, ash, maple, and sycamore. From the cor. of secs. 8, 9, 16, and 17, described on page 204. Run N. 89° 67' W., on a true line, bet. secs. 8 and 17. Over rolling land. Telegraph line, bears N. 28° W. and S. 28° E. Set a cedar post, 3 ft. long, 3 ins. sq., with charred stake, 24 ins. in the ground, for ¼ sec. cor., marked ¼ S., on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of post, 3 ft. dist. and raise a mound of earth, 3½ ft. base, ½ ft. high, N. of cor.
2.00

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83. See paragraph 8, page 55
84. A Witness Corner to the section corner will always have the letters W.C. conspicuously displayed on the northeast face.

657
and 5 notches on E. edges; dig pits, 18 x 18 x 12 ins., N. E., S., E., S. W., and N. W. of cor., 0.5 ft. dist.; and raise mound of earth, 4 ft. base, 2 ft. high, W. of cor.

4.00 Telegraph line, bears N. 84° E. and S. 84° W.

5.20 Middle of the single track of the Montana and Manitoba Railroad, bears N. 84° and S. 84° W.

26.19 Tobank of Linn's Lake. Set a limestone, 15 x 9 x 6 ins., 10 ins. in the ground, for meander cor. O. Trac. sects. 17 and 18, marked M. C. on S. face, with 5 grooves on E. face; and raise a mound of stone, 2 ft. base, 1.5 ft. high, N. of cor. Pits impracticable.

Limestone outcrops near the lake.

Land, rolling.

Soil, rocky; 4th rate.

No timber.

August 16. At this meander cor. 1 set off 10° 31' 11" N. on the decl. arc; and at 0° 4" p.m., 1 m. t., observe the sun on the meridian; the resulting lat. is 45° 48'.

From the cor. of sects. 7, 8, 17 and 18, established this day, I run N. 89° 57' W., on a random line bet. sects. 7 and 18.

40.00 Settemp. 4 sec. cor.

77.90 Intersect W. bdy. of the Tp., 3 lks. S. of the cor. of sects. 7, 12, 13, and 18, which is a limestone, 6 x 8 x 6 ins. above ground, marked and witnessed as described by the surveyor general.

Then I run S. 80° 56' E., on a true line bet. sects. 7 and 18.

32.00 Over gently rolling ground.

40.00

17.90 Intersect the W. bdy. of Lake City.

The N. W. cor., which is an oak post, 2 ft. above ground, 12 ins. sq., marked N. W. cor. L. C., bears N. 0° 5' W., 40.00 chs. dist. The S. W. cor., which is a limestone, 8 x 8 x 6 ins. above ground, marked S. W. cor. L. C., bears S. 0° 5' E., 29.50 chs. dist.

Methodist church bears S. 33° E.

80.00

18.29 Middle of West street, 40 ft. wide, bears N. 0° 5' W. and S. 0° 5' E.

Thence along middle of Fourth street, 60 ft. wide.

23.70 Middle of Cedar street, 60 ft. wide, bears N. 0° 5' W. and S. 0° 5' E.

27.00 Baptist church bears N., 3.00 chs. dist.

29.20 Middle of Pine street, 60 ft. wide, bears N. 0° 5' W. and S. 0° 5' E. Methodist church bears S. 43° W.

35.00 Middle of Main street, 100 ft. wide, bears N. 0° 5' W. and S. 0° 5' E. Court house bears N. 4° W., 22.00 chs. dist. Wharf bears S. 0° 5' E., 1.50 chs. dist.

Catholic church bears N. 39° E.

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Subdivision of T. 15 N., R. 20 E.—Continued.

Chains.

37.90 Deposit allimestone, 12 x 8 x 6 ins., 24 ins. in the ground, for 4 sec. cor. marked x 4'; from which A granite stone, 16 x 8 x 7 ins., set 11 ins. in the ground, marked W. C. 4', on N. face, bears N., 45 ins. dist. A granite stone 20 x 9 x 6 ins., set 15 ins. in the ground, marked W. C. 4', on N. face, bears S., 45 ins. dist. Pits impracticable.

No natural bearing objects available.

40.80 Middle of Elm street, 60 ft. wide, bears N. 0° 5' W. and S. 0° 5' E.

46.30 Middle of Walnut street, 60 ft. wide, bears N. 0° 5' W. and S. 0° 5' E. Railroad station bears S. 14° E., 6.00 chs. dist.

51.80 Middle of East street, 40 ft. wide, bears N. 0° 5' W. and S. 0° 5' E. Catholic church bears N. 21° W.

4.00 Intersect E. bdy. of Lake City. The N. E. cor., which is a limestone, 14 x 9 x 7 ins. above ground, marked N. E. cor. L. C., bears N. 0° 5' W., 40.00 chs. dist. The S. W. cor., which is a limestone, 9 x 6 x 6 ins. above ground, S. W. cor. L. C., bears S. 0° 5' E., 7.53 chs. dist.

Thence along the middle of the Mound City road.

Revised sects. 8, 7, 17, and 18.

Land, gently rolling.

Soil, sandy loam; 1st rate.

No timber.

August 16, 1893.

August 17. At 0° 4' a.m., 1 m. t., I set off 46° 49' on the lat. arc; 13° 17' N., on the decl. arc, and determine a true meridian with the solar, at the point for cor. of sects. 7, 8, 17 and 18, which falls in the road, and is described on page 209.

Then I run N. 0° 5' W., bet. sects. 7 and 8.

Over rolling land.

Set a limestone, 15 x 8 x 7 ins., 10 ins. in the ground, for witness cor. toor. of sects. 7, 8, 17 and 18, marked W. C., on N. E. face, with 4 notches on S. and 5 notches on E. edges; dig pits, 18 x 18 x 12 ins., N. E., S. E., S. W., and N. W. of cor., 5 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Road to Lake City, bears N. 75° W. and S. 75° E.

Old Military Road, bears N. 35° W. and S. 35° E.

Set a juniper post, 3 ft. long, 3 ins. sq., with marked stone, 24 ins. in the ground, for 4 sec. cor. marked N. S., on W. face; dig pits, 18 x 18 x 12 ins., and S. of post, 31 dist.; and raise a mound of earth, 3 ft. base, 1½ ft. high, W. of cor.

S. E. cor. of cemetery bears W., 5.00 chs. dist.

N. E. cor. of cemetery bears W., 5.00 chs. dist.

Set a limestone, 20 x 8 x 4 ins., 15 ins. in the ground, for cor. of sects. 6, 7, 8, and 9, marked with 5 notches on S. and E. edges; dig pits, 18 x 18 x 12 ins., in each sec., 5 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

Land, rolling.

Soil, gravelly loam; 2nd and 3rd rate.

No timber.

S. 89° 57' E., on a random line bet. sects. 5 and 8.

Settemp. 4 sec. cor.

Intersect N. and S. line 2 lks. S. of the cor. of sects. 4, 5, 8 and 9.

Thence I run N. 89° 58' W., on a true line bet. sects. 5 and 8.

Over rolling land.

Begin at a point in S. W. cor. S. 5' of the cor. of sects. 5, and 8.

Foot of descent, N. 35° W. and S. 35° E.

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Chains.

39.98 Set a limestone, 14 x 8 x 6 ins., 10 ins. in the ground, for 4 sec. cor. marked N. S. on N. face; dig pits, 18 x 18 x 12 ins., E. and W. of stone, 3 ft. dist.; and raise a mound of earth, 3 ft. base, 1¼ ft. high, N. of cor.

From this 4 sec. cor. the U. S. mineral monument in sec. 5 bears N. 37° 30' E.

85. See page 48 and footnotes.
5.27 In place of the flag,
Setalimestone, 15x 8 x 6 ins., 10 in. in the ground,
for meander cor. Offract. secs. 18 and 19, marked M. C.
on E. face, with 3 grooves on S. face; dig a pit, 36 x
35 x 12 ins., 8 ft. W of stone, and raise a mound of
earth, 4 ft. base, 2 ft. high, W. of cor.
Thence I run
N. 89° 57' W., on a true line bet. secs. 18 and 19.
Over level land.
Intersect W. shore of island.
Setalimestone, 18 x 8 x 5 ins., 12 ins. in the ground,
for meander cor. Offract. secs. 18 and 19, marked M. C.
on W. face; dig a pit, 36 x 36 x 12 ins., 8 ft. E. of
stone, and raise a mound of earth, 4 ft. base, 2 ft.
high. E. of cor.

August 17, 1893.

To locate a small island called Diamond Rock, in Lin's
Lake, sec. 19, I proceed as follows:
From the meander cor. Offract. 19 and 24, on the W. bdy.
of the township, I set a flag on the south point of the
island, which bears N. 71° 30' E.; then measure a base
S. 48° 01' E., 23.14 chs., to a point from which the
flag bears N. 8° E.; which gives for the distance to flag
sin. 60° 29' x 23.14 chs. 0.87 x 23.14 = 22.50 chs., the
sin. 63° 30' 0.8949 required distance.

22.50 In place of the flag,
Setalimestone, 15x 8 x 6 ins., 12 ins. in the ground,
for an auxiliary meander cor. in sec. 19, marked A.
M. C., on S. face; dig a pit, 36 x 36 x 12 ins., 8 ft.
N. of stone, and raise a mound of earth, 4 ft. base, 2 ft.
high, N. of cor.

August 17, 1893.

Meanders, T. 15 N., R. 20 E.

Meanders at the right bank of Yellowstone River, up stream.
I commence at the meander cor. Offract. secs. 25 and 30,
on the E. bdy. of the Tp., which is a sandstone, 6 x 9 x
7 ins. above ground, marked and witnessed as described
by the surveyor general.
At this cor., August 8, I set of 45° 46' on the lat. arc,
16° 11' N., on the decl. arc; and at 7° 35' 11. m. m. 1.
m. t., determine a true meridian with the solar
Thence I run with meanders in sec. 25.
Through heavy timber.
S. 85° W. 13.00 chs.
S. 72° W. 7.10 chs.
S. 64° W. 13.00 chs.
S. 40° W. 5.40 chs.
Low bank 5 ft. high. Head of course,
leave heavy timber,
enter dense willow and
cottonwood undergrowth, bears S.
S. 77° W. 7.00 chs.
At 3.20 chs., mouth of Cherry
Creek, 14 ft. wide, course N.
N. 76° W. 7.50 chs.
Bank 7 ft. high. At 2.00 chs.,
leave dense undergrowth, enter
heavy timber, bears S.
S. 80° W. 12.00 chs.
At end of course, lower end of
sand bar, bears N., 2.00 chs.
dist.
S. 81° W. 19.39 chs.
Bank 4 ft. high. At 5.00 chs.,
leave heavy, enter scattering
timber, bears S. To the
meander cor. Offract. secs.
25 and 26.

86. For other methods of computing the distance, see page 136.

87. See pages 44 and 58.

Chains.
36.80 The point for cor. Offract. secs. 17, 18, 19, and 20 falls in
the lake; thence N. 89° 57' W. bet. secs. 18 and 19.

Subdivision of T. 15 N., R. 20 E.—Continued.

Meanders at the right bank of Yellowstone River, up stream — Continued.

Land, river bottom.
Soil, alluvial; 1 strate. Timber, cottonwood, yacanmore, ash, and walnut. Heavily timbered land or land covered with dense undergrowth, 70.00 chs.

Through scattering timber.
S. 81° W. 8.70 chs. Bank 8 ft. high.
S. 70°44' W. 4.90 chs. At 2.30 chs., upper end of bar, bears N. about 2.90 chs. dist.
S. 44°4 W. 3.60 chs.
S. 21° W. 3.50 chs.
S. 5°4 W. 4.20 chs.
South. 4.30 chs.
S. 9°4 E. 3.80 chs.
S. 34°4 E. 5.27 chs. Torameander cor. off. sects. 26 and 35.
Land, level.
Soil, alluvial; 1 strate. Timber, scattering ash, hickory, walnut, and cottonwood.

Thence in sec. 35.
August 8: At the meander cor. offract. sects. 26 and 35, 1 set of 15° 57' N., on the decl. arc; and, at 10° 5° m. p.m., I.M.T., observe the sun on the meridian; the resulting lat. is 45° 46'.
Through scattering timber.
S. 28° E. 8.80 chs. Bank 8 ft. high.
S. 6°4 W. 7.70 chs. At 14.30 chs., leave scattering timber, enter dense cottonwood and willow undergrowth, bears N. 60° E.
S. 6°5 W. 10.00 chs. Low bank 4 ft. high. At end of course, road to Mound City, bears S. 70° E. Ferry, and road to Lake City, bears N. 90° W.
S. 31° W. 12.00 chs. At 5.50 chs. leave dense undergrowth, bears N. 65° E.; enter Pat Curren's field, bears E. At end of course, house bears S. 62° E., 5.00 chs. dist.
S. 38° W. 5.50 chs. Bank 13 ft. high. At 5.10 chs., leave Pat Curren's field, fence bears E. At 5.30 chs. middle of road, bears E.
S. 43°4 W. 7.70 chs. At 1.50 chs., N. W. cor. of Alexander's field, bears E., 0.50 chs. dist.
S. 47°4 W. 6.50 chs.
S. 37° W. 2.00 chs.
S. 58° W. 2.10 chs.
S. 49°4 W. 5.40 chs. At 3.30 chs., wire fence, bears S.E.
S. 47° W. 4.80 chs.
S. 50° W. 4.90 chs.
S. 57° W. 9.50 chs.
S. 45°4 W. 16.68 chs. Tormeander cor. offract. sects. 2 and 35, on S. bdy. of the 1p., which is a limestone 5 x 8 x 6 ins. above ground, marked and witnessed as described by the surveyor general.
Land, nearly level.
Soil, alluvial; 1 strate. North of Curren's field subject to inundation, 2 to 5 ft. deep.
Timber, scattering ash, walnut, and cottonwood.
Dense undergrowth, 18.90 chs.

August 8, 1893.

(Pages 214 through 220 deleted. They contain the remainder of the meanders in the township, general description and final oaths.)

PRIVATE LAND CLAIM SURVEYS.

1. Before ordering any survey of a private land claim the surveyor general will receive full instructions from this office, by which he will be governed in issuing his instructions to the deputy. The instructions to the deputy must be entered in full at the commencement of the field notes of such survey.

2. The instruments used in the survey of private land claims must be the same as those required for the survey of public lands, and must be registered and tested in like manner at the surveyor general's office previous to the deputy's commencing work; and the instructions for the survey of public lands must, as far as applicable, be strictly observed in the survey of private land claims.

3. The true magnetic variation must be noted at the beginning point of each survey, and wherever the variation of the needle is observed to change along the line the same must be noted and the reasons thereof stated, if known.

4. At the end of each mile along a boundary, the character of the soil and amount of timber, grass, etc., will be stated; and the date of each day's work in the field must be noted at the end of the record thereof.

5. The requirements in the "Summary of objects and data required to be noted," as set forth in the instructions for the survey of public lands, must be observed by the deputy in the survey of private land claims. Where practicable, bearings must be taken from at least two points on the line to all prominent or otherwise notable objects in the vicinity, and where only one bearing can be taken the estimated distance must be noted.

6. At the beginning point upon the boundaries of each grant survey, a corner must be established of the same character, size, and materials as prescribed for township corners upon the lines of the survey of public lands, except that only two pits will be dug, one on each side of the corner, on the line. Upon the side of such corner facing the claim, the initial letters of the name of the grant, and immediately under the same the letters "Beg. Cor. 1" (for beginning corner one) must be neatly cut or chiseled.

7. Each of the mile corners or stations of survey must be established in the manner prescribed for the establishment of section corners upon the lines of public surveys, except that they will be marked on the side facing the grant with the initials of the grant and the number of the station or mile, as the case may be; and only two pits will be dug, one on each side of the corner, on the line.

8. Where mile corners are established, except upon meandered portions of the line, half-mile corners will also be estab-
lished in the manner prescribed for the establishment of quarter-section corners upon the lines of public surveys, except that they will be marked upon the side facing the grant with the initials of the grant.

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9. Such other marks, in addition to those above described, will be placed upon the corners as may be required by the surveyor general in his special written instructions.

10. As far as practicable, bearings and distances must be taken from each of the corners or stations to two or more trees, or prominent natural objects, if any, within a convenient distance, in the same manner as required in the instructions for the survey of public lands, and such trees or objects must be marked with the initials of the grant, and under the same the letters “B.T.” or “B.O.,” as the case may be.

11. Witness corners will be established, where necessary, in the same manner as required in the instructions for the survey of public lands.

12. In all cases where the lines of the grant boundary surveys intersect established lines of survey of public lands or private land claims, the course and distance from such point of intersection to the nearest corner on the line of the prior survey must be carefully run, measured, and noted, and whenever necessary such corner must be reestablished.

13. The survey of a private land claim must always be connected by a line actually run and measured in the field with some corner of the public surveys, if any such have been established within a distance not exceeding two miles from any point on the boundary lines of the private land claim.

14. Boundaries or portions of boundaries of previously established grant surveys, which also form a portion of the boundaries of the claim to be surveyed, will be adopted so far as common to both grants, but no payment will be made for such common boundaries unless it is necessary to reestablish the same.

15. The field notes must embrace a full, clear, and concise statement of the deputy's reasons for his location and establishment of each boundary.

16. A general description of each tract must be given at the end of the field notes of the survey of same, which description must embrace a brief statement of the main features of the tract surveyed, character of the land, timber, and other natural growth, kinds of mineral, if any, population of towns and settlements, characteristics of mountains, streams, springs, etc., and such other data as may be of importance.

17. The deputy must particularly note all facts relative to present inhabitation of the land and designate all tracts occupied by actual settlers or residents.

18. The deputy surveyor must return with the field notes a topographical map or plat of the survey. As far as practicable all objects described in field notes, and the main features of the tract surveyed, including towns, streams, mountains, roads, etc., must be protracted on such plat as accurately as possible.

19. The field-note books must embrace a list of assistants, and preliminary and final oaths, as required in the instructions for the survey of public lands.

20. The deputy will note all objections to his survey that may be brought to his knowledge, and the surveyor general will promptly report to the Commissioner of the General Land Office all complaints made to him, and send up all protests filed in his office, together with a full report thereon.

21. Official plats of the survey of private land claims will not be furnished to any person until the cost of surveying and platting the same shall have been paid to the United States.

APPENDIX RELATIVE TO ACCOUNTS FOR SURVEYING AND EXAMINATION.

U.S. surveyors general and deputy surveyors are required to comply strictly with the following instructions:

All surveying accounts transmitted to the General Land Office for adjustment must be in duplicate and in a separate letter from that forwarding the plats and field notes of the survey. The name of the deputy surveyor, date and number of the contract, the amount of the estimated liability, and whether said liability is limited or not, should be noted on the face of the deputy's account.

The amount of the account and the appropriation from which it is to be paid shall be stated both in the letter of transmittal and in the account rendered. The deputy's affidavit that the survey was executed by him, and that it was just and correct, should be attached to the account.

The date of the surveyor general's approval should appear in the certificate thereto, and the destination of the draft or drafts, the name of the payee or payees, with the post-office address, should be added.

When the survey is chargeable to "Deposits by individuals for surveying the public lands," it should be so stated, and the deposit to which the field work is chargeable should be listed by number and date of certificate of deposit, with number of township and range for which the deposit is made, and the amount of each certificate.

When the amount of an account is in excess of the liability of the contract, a copy of office letter authorizing the excess must always accompany the account.

When stating an expense account for examination in the field or office on surveys, the number of the contract under which the survey was made, the name of the surveyor, with the number of township and range examined, should be inserted in the account, accompanied by a copy of letter of authorization, said account and vouchers to be furnished in duplicate and to have the affidavit of the examiner as to the correctness of the charges and the approval of the surveyor general attached.

When surveys are continued and executed beyond the time limited in the contract and the contract has expired, and there has been no properly-granted extension of time thereto, the compensation of the deputy surveyor for the lines of survey executed after the expiration of the contract will be reduced, and said lines completed at such rates as the Commissioner of the General Land Office may in his judgment determine to be proper, taking into consideration the value of the work and the limitations of the appropriation from which the account must be paid.

The field notes of a U. S. deputy surveyor, which are the
data upon which his surveying account is stated by the
surveyor general, and

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subsequently adjusted by the Commissioner of the General
Land Office, should describe the surface, soil, etc., at the end
of each mile or fractional mile of survey, and should state the
number of chains and links which are “mountainous,”
“heavily timbered,” or covered with “dense undergrowth,”
using always the exact phraseology of the appropriation act
which establishes the rates for said lines of surveys.

By dense undergrowth is meant thick bushes, boughs, or
other vegetable growth of such height as to obstruct the use of
the transit, and require cutting away to obtain sights along
line; also bushes, brush, vines or other vegetation which is of
such tangled and difficult character as to seriously impede
the work of chaining the line.

Connecting lines, showing closing distances to closing cor-
ers, will be paid for at the minimum rate allowed in the
contract for that class of line which is run to the closing cor-
er, unless otherwise specially provided in the contract.

The practice of allowing deputies to retrace any and all
lines which they may deem necessary in connection with their
work, and compensating them therefor, has been dis-
continued.

If it becomes necessary to retrace any of the exterior lines
in order to properly close their lines of survey it must be done
at the deputy’s own expense as a legitimate contingent in
executing the contract. If it should be found to be absolutely
necessary to resurvey and retrace any portion of the exterior
township lines, except such as are clearly provided for in the
article on pages 72, 73, and 74, the deputy should report the
facts immediately to the surveyor general and await further
instructions. The facts as reported to him will be promptly
laid before the Commissioner of the General Land Office.
specifying the number of miles of retracement required, and, if
such resurvey is authorized, the deputy will be immediate-
ly notified. In no other case will any resurvey be paid for
which is not specifically authorized by the Commissioner.

PROCEDURE OF COUNTY AND PRIVATE
SURVEYORS IN RESTORING LOST AND
OBLITERATED CORNERS AND SUBDIVIDING
SECTIONS.

The General Land Office assumes no control or direction
over the acts of local and county surveyors in the reestab-
lishment of extinct corners of original surveys. It follows the
general rule that disputes, arising from uncertain or
erroneous location of original corners, are to be settled by the
proper local authorities or by amicable adjustment; and to aid
in this result it furnishes a circular pamphlet which is merely
advisory and explanatory of the principles which should pre-
vail in performing such duties.

Surveyors who have been United States deputies should
bear in mind that in their private capacity they must act
under somewhat different rules of law from those governing
original surveys. and should carefully distinguish between
the provisions of the statute which guide a Government depu-
ty and those which apply to retracement of lines once sur-
veyed. The failure to observe this distinction has been prolific
of erroneous work and injustice to land owners.

The circular on “Restoration of lost and obliterated cor-
ers,” dated March 13, 1883, and the circular on subdividing
a section, dated June 2, 1887, are furnished to applicants.

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(Pages 226 through 236 deleted. They contain the remainder of the Index.)

[Ed. Note: The 1894 Manual was the first Manual to contain a detailed Index.]
The above plot represents a theoretical town with subdivisions, contingent to the north standard parallel, in assumed latitude and longitude 100°00'W of St. Ana 25.
Table of Mileage.

<table>
<thead>
<tr>
<th>Station</th>
<th>Distance North</th>
<th>Distance East</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>00.00</td>
<td>00.00</td>
</tr>
<tr>
<td>10</td>
<td>10.00</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explanations:
- Old Survey
- Surveyed under current contract
- Unsurveyed

Scale: 1 inch = 100 chains.
SHIP EXTERIORS.
Scale: 1 inch to 160 chains.

STANDARD PARALLEL NORTH.

This Plat of the 3d Standard Parallel North through Ranges 21, 22, 23 & 24 E:
East Boundary of T.33 N., R.21 E.
North " " " "
and the 6th Guide Meridian East through Township 19 North, Montana Principal Meridian.

This Plat is strictly conformable to the field notes of the survey thereof
by
dated July 10th 1890,
which have been examined
and filed in this office.

[Signature]
[Date of Approval]

[Stamp]
[Stamp]

Latitude S. 36° N.
Longitude W. 127° 24' West.
Mean May, Date. 18 02 East.
PLATE IV.

Range No. 20 East of the Principal Meridian Mont.

Survey Map of Sections No. 7 and No. 8, 6th Range, No. 20 East of the Principal Meridian, Montana, is strictly conformable to the field notes of the survey thereof on file in this Office, which have been examined and approved.

Surveyor General's Office.

[Scale information and survey details]
ANS OF CORNERS.

EXPLANATIONS.

AND TYP., with Closing TYP., in the distance.

Perspective.
NS OF CORNERS.

EXPLANATIONS:

Fig. 3. Closing Section Corners.

Fig. 4. Intersections high apart.

Fig. 5. Intersections less than high apart.

Fig. 6. Quarter Section Corner.

Fig. 7. S.E. Corner of Reserv.

Fig. 8. Closing Township Corners.

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Perspective.

View Looking West.

View Looking West.

View Looking West.

View Looking West.

View Looking West.
CIRCULAR
ON
RESTORATION
OF
LOST OR OBLITERATED CORNERS
AND
SUBDIVISION OF SECTIONS.

GENERAL LAND OFFICE,
October 16, 1896.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

[Revised March 14, 1901. Pages, etc., exactly the same
except signed by Binger Hermann, and has penalty
statement in front.]
RESTORATION OF LOST AND OBLITERATED CORNERS.

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D. C., October 16, 1896.

The increasing number of letters from county and local surveyors received at this office making inquiry as to the proper method of restoring to their original position lost or obliterated corners marking the survey of the public lands of the United States, or such as have been willfully or accidentally moved from their original position, have rendered the preparation of the following general rules necessary, particularly as in a very large number of cases the immediate facts necessary to a thorough and intelligent understanding are omitted. Moreover, surveys having been made under the authority of different acts of Congress, different results have been obtained, and no special law has been enacted by that authority covering and regulating the subject of the above-named inquiries. Hence, the general rule here given must be considered merely as an expression of the opinion of this office on the subject, based, however, upon the spirit of the several acts of Congress authorizing the surveys, as construed by this office, and by United States court decisions. When cases arise which are not covered by these rules, and the advice of this office is desired, the letter of inquiry should always contain a description of the particular corner, with reference to the township, range, and section of the public surveys, to enable this office to consult the record.

An obliterated corner is one where no visible evidence remains of the work of the original surveyor in establishing it. Its location may, however, have been preserved beyond all question by acts of landowners, and by the memory of those who knew and recollect the true situs of the original monument. In such cases it is not a lost corner.

A lost corner is one whose position can not be determined, beyond reasonable doubt, either from original marks or reliable external evidence.

Surveyors sometimes err in their decision whether a corner is to be treated as lost or only obliterated.

Surveyors who have been United States deputies should bear in mind that in their private capacity they must act under somewhat different rules of law from those governing original surveys, and should carefully distinguish between the provisions of the statute which guide a Government deputy and those which apply to retracement of lines once surveyed. The failure to observe this distinction has been prolific of erroneous work and injustice to landowners.

To restore extinct boundaries of the public lands correctly, the surveyor must have some knowledge of the manner in which townships were subdivided by the several methods authorized by Congress. Without this knowledge he may be greatly embarrassed in the field, and is liable to make mistakes invalidating his work, and leading

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eventually to serious litigation. It is believed that the following synopsis of the several acts of Congress regulating the surveys of the public lands will be of service to county surveyors and others, and will help to explain many of the difficulties encountered by them in the settlement of such questions.

Compliance with the provisions of Congressional legislation at different periods has resulted in two sets of corners being established on township lines at one time; at other times three sets of corners have been established on range lines; while the system now in operation makes but one set of corners on township boundaries, except on standard lines—i.e., base and correction lines, and in some exceptional cases. The following brief explanation of the modes which have been practiced will be of service to all who may be called upon to restore obliterated boundaries of the public land surveys:

Where two sets of corners were established on township boundaries, one set was planted at the time the exteriors were run, those on the north boundary belonging to the sections and quarter sections north of said line, and those on the west boundary belonging to the sections and quarter sections west of that line. The other set of corners was established when the township was subdivided. This method, as stated, resulted in the establishment of two sets of corners on all four sides of the townships.

Where three sets of corners were established on the range lines, the subdivisional surveys were made in the above manner, except that the east and west section lines, instead of being closed upon the corners previously established on the east boundary of the township, were run due east from the last interior section corner, and new corners were erected at the points of intersection with the range line.

The method now in practice requires section lines to be initiated from the corners on the south boundary of the township, and to close on existing corners on the east, north, and west boundaries of the township, except when the north boundary is a base line or standard parallel.

But in some cases, for special reasons, an opposite course of procedure has been followed, and subdivisional work has been begun on the north boundary and has been extended southward and eastward or southward and westward.

In the more recent general instructions, greater care has been exercised to secure rectangular subdivisions by fixing a strict limitation that no new township exteriors or section lines shall depart from a true meridian or east and west line more than twenty-one minutes of arc; and that where a random line is found liable to correction beyond this limit, a true line on a cardinal course must be run, setting a corner on the line to which it closes.

This produces, in new surveys closing to irregular old work, a great number of exteriors marked by a double set of corners. All retracing surveyors should proceed under these new conditions with full knowledge of the field notes and exceptional methods of subdivision.

SYNOPSIS OF ACTS OF CONGRESS.

The first enactment in regard to the surveying of the public lands was an ordinance passed by the Congress of the Confederation May 20, 1785, prescribing the mode for the survey of the “Western Territory,” and which provided that said territory should be divided into “townships of six miles square, by
lines running due north and south, and others crossing them at right angles as near as might be.

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It further provided that the first line running north and south should begin on the Ohio River, at a point due north from the western terminus of a line run as the south boundary of the State of Pennsylvania, and the first line running east and west should begin at the same point and extend through the whole territory. In these initial surveys only the exterior lines of the townships were surveyed, but the plats were marked by subdivisions into sections 1 mile square, numbered from 1 to 36, commencing with No. 1 in the southwest corner of the township, and running from south to north in each tier to No. 36 in the northwest corner of the township; mile corners were established on the township lines. The region embraced by the surveys under this law forms a part of the present State of Ohio, and is generally known as "the Seven Ranges."

The Federal Congress passed a law, approved May 18, 1796, in regard to surveying the public domain, which applied to "the territory northwest of the River Ohio, and above the mouth of the Kentucky River."

Section 2 of said act provided for dividing such lands as had not been already surveyed or disposed of "by north and south lines running according to the true meridian, and by others crossing them at right angles, so as to form townships of 6 miles square," etc. It also provided that "one-half of said townships, taking them alternately, should be subdivided into sections containing, as nearly as may be, 640 acres each, by running through the same each way parallel lines at the end of every two miles; and by marking a corner on each of said lines at the end of every mile." The act also provided that "the sections shall be numbered, respectively, beginning with the number one in the northeast section, and proceeding west and east alternately through the township, with progressive numbers till the thirty-sixth be completed." This method of numbering sections is still in use.

An act amendatory of the foregoing, approved May 10, 1800, required the "townships west of the Muskingum, which are directed to be sold in quarter townships, to be subdivided into half sections of 320 acres each, as nearly as may be, by running parallel lines through the same from east to west, and from south to north, at the distance of one mile from each other, and marking corners, at the distance of each mile on the lines running from east to west, and at the distance of each mile on those running from south to north. And the interior lines of townships intersected by the Muskingum, and of all townships lying east of that river, which have not been heretofore actually subdivided into sections, shall also be run and marked.

And in all cases where the exterior lines of the townships thus to be subdivided into sections or half sections, shall exceed or shall not extend six miles, the excess or deficiency shall be specially noted, and added to or deducted from the western or northern ranges of sections or half sections in such townships, according as the error may be in running the lines from east to west or from south to north." Said act also provided that the northern and western tiers of sections should be sold as containing only the quantity expressed on the plats, and all others as containing the complete legal quantity.

The act approved June 1, 1796, "regulating the grants of land appropriated for military services," etc., provided for dividing the "United States Military Tract," in the State of Ohio, into townships 5 miles square, each to be subdivided into quarter townships containing 4,000 acres.

Section 6 of the act approved March 1, 1800, amendatory of the foregoing act, enacted that the Secretary of the Treasury was authorized to subdivide the quarter townships into lots of 100 acres, bounded as nearly as practicable by parallel lines 160 perches in length by 100 perches in width. These subdivisions into lots, however, were made upon the plats in the office of the Secretary of the Treasury, and the actual survey was only made at a subsequent time when a sufficient number of such lots had been located to warrant the survey. It thus happened, in some instances, that when the survey came to be made the plat and survey could not be made to agree, and that fractional lots on plats were entirely crowded out. A knowledge of this fact may explain some of the difficulties met with in the district thus subdivided.

The act of Congress approved February 11, 1805, directs the subdivision of the public lands into quarter sections, and provides that all corners marked in the field shall be established as the proper corners of the sections or quarter sections which they were intended to designate, and that corners of half and quarter sections not marked shall be placed as nearly as possible "equidistant from those two corners which stand on the same line." This act further provides that "the boundary lines actually run and marked" (in the field) "shall be established as the proper boundary lines of the sections, or subdivisions, for which they were intended, and the length of such lines as returned by either of the surveyors aforesaid shall be held and considered as the true length thereof. And the boundary lines which shall not have been actually run and marked as aforesaid shall be ascertained by running straight lines from the established corners to the opposite corresponding corners, but in those portions of the fractional townships where no such opposite or corresponding corners have ever been or can be fixed, the said boundary lines shall be ascertained by running from the established corners due north and south, or east and west lines, as the case may be, to the water course, Indian boundary line, or other external boundary of such fractional township.

The act of Congress approved April 24, 1820, provides for the sale of public lands in half-quarter sections, and requires that "in every case of the division of a quarter section the line

for the division thereof shall run north and south," "and fractional sections, containing 160 acres and upwards, shall in like manner, as nearly as practicable, be subdivided into half quarter sections, under such rules and regulations as may be prescribed by the Secretary of the Treasury; but fractional sections containing less than 160 acres shall not be divided."

The act of Congress approved May 24, 1824, provides "that whenever, in the opinion of the President of the United States, a departure from the ordinary mode of surveying land on any river, lake, bayou, or water course would promote the public interest, he may direct the surveyor-general in whose district such land is situated, and where the change is intended to be made, under such rules and regulations as the President may prescribe, to cause the lands thus situated to be surveyed in tracts of two acres in width, fronting on any river, bayou, lake, or water course, and running back the depth of forty acres."

The act of Congress approved April 5, 1832, directed the subdivision of the public lands into quarter-quarter sections; that in every case of the division of a half-quarter section the dividing line should run east and west, and that fractional sections should be subdivided, under rules and regulations prescribed by the Secretary of the Treasury. Under the latter provision the Secretary directed that fractional sections containing less than 160 acres, or the residuary portion of a fractional section, after the subdivision into as many quarter-quarter sections as it is susceptible of, may be subdivided into lots, each containing the quantity of a quarter-quarter section as nearly as practicable, by so laying down the line of subdivision that they shall be 20 chains wide, which distances are to be marked on the plat of subdivision, as are also the areas of the quarter quarters and residuary fractions.

These two acts last mentioned provided that the corners and contents of half-quarter and quarter-quarter sections should be ascertained as nearly as possible in the manner and on the principles prescribed in the act of Congress approved February 11, 1805.

GENERAL RULES.

From the foregoing synopsis of Congressional legislation it is evident—

1st. That the boundaries of the public lands established and returned by the duly appointed Government surveyors, when approved by the surveyors general and accepted by the Government, are unchangeable.

2d. That the original township, section, and quarter-section corners established by the Government surveyors must stand as the true corners which they were intended to represent, whether the corners be in place or not.

3d. That quarter-quarter corners not established by the Government surveyors must be placed on the straight lines joining the section and quarter-section corners and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on other lines between fractional sections.

4th. That all subdivisions of a section running between corners established in the original survey of a township must be straight lines, running from the proper corner in one section line to its opposite corresponding corner in the opposite section line.

5th. That in a fractional section where no opposite corresponding corner has been or can be established, any required subdivision line of such section must be run from the proper original corner in the boundary line due east and west, or north and south, as the case may be, to the water course, Indian reservation, or other boundary of such section, with due parallelism to section lines.

From the foregoing it will be plain that extinct corners of the Government surveys must be restored to their original locations, whenever it is possible to do so; and hence resort should always be first had to the marks of the survey in the field. The locus of the missing corner should be first identified on the ground by the aid of the mound, pits, line trees, bearing trees, etc., described in the field notes of the original survey.

The identification of mounds, pits, and witness trees, or other permanent objects noted in the field notes of survey, affords the best means of relocating the missing corner in its original position. If this can not be done, clear and convincing testimony of citizens as to the locality it originally occupied should be taken, if such can be obtained. In any event, whether the locus of the corner be fixed by the one means or the other, such locus should always be tested and confirmed by measurements to known corners. No definite rule can be laid down as to what shall be sufficient evidence in such cases, and much must be left to the skill, fidelity, and good judgment of the surveyor in the performance of his work.

EXCEPTIONAL CASES.

When new measurements are made on a single line to determine the position thereon for a restored lost corner (for example, a quarter-section corner on line between two original section corners), or when new measurements are made between original corners on two lines for the purpose of fixing by their intersection the position of a restored missing corner (for example, a corner common to four sections or four townships), it will almost invariably happen that discrepancies will be developed between the new measurements and the original measurements in the field notes. When these differences occur the surveyor will in all cases establish the missing corner by proportionate measurements on lines conforming to the original field notes and by the method followed in the original survey. From this rule there can be no departure, since it is the basis upon which the whole operation depends for accuracy and truth.

In cases where the relocated corner can not be made to harmonize with the field notes in all directions, and unexplained error in the first survey is apparent, it sometimes
becomes the task of the surveyor to place it according to the requirements of one line and against the calls of another line. For instance, if the line between sections 30 and 31, reported 78 chains long, would draw the missing corner on range line 1 chain eastward out of range with the other exterior corners, the presumption would be strong that the range line had been run straight and the length of the section line wrongly reported, because experience shows that west random lines are regarded as less important than range lines and more liable to error.

Again, where a corner on a standard parallel has been obliterated, it is proper to assume that it was placed in line with other corners, and if an anomalous length of line reported between sections 3 and 4 would throw the closing corner into the northern township, a surveyor would properly assume that the older survey of the standard line is to control the length of the later and minor line. The marks or corners found on such a line closing to a standard parallel fix its location, but its length should be limited by its actual intersection, at which point the lost closing corner may be placed.

The strict rule of the law that "all corners marked in the field shall be established as the corners which they were intended to designate," and the further rule that "the length of lines returned by the surveyors shall be held and considered as the true length thereof," are found in cases to be impossible of fulfillment in all directions at once, and a surveyor is obliged to choose, in his own discretion, which of two or more lines must yield, in order to permit the rules to be applied at all.

In a case of an erroneous but existing closing corner, which was set some distance out of the true State boundary of Missouri and Kansas, it was held by this office that a surveyor subdividing the fractional section should preserve the boundary as a straight line, and should not regard said closing corner as the proper corner of the adjacent fractional lots. The said corner was considered as fixing the position of the line between two fractional sections, but that its length extended to a new corner to be set on the true boundary line. The surveyor should therefore preserve such an original corner as evidence of the line; but its erroneous position cannot be allowed to cause a crook between mile corners of the original State boundary.

It is only in cases where it is manifestly impossible to carry out the literal terms of the law, that a surveyor can be justified in making such a decision.

TO RESTORE LOST OR OBLITERATED CORNERS

1. To restore corners on base lines and standard parallels.—Lost or obliterated standard corners will be restored to their original positions on a base line, standard parallel, or correction line, by proportionate measurements on the line, conforming as nearly as practicable to the original field notes and joining the nearest identified original standard corners on opposite sides of the missing corner or corners, as the case may be.

   (a) The term "standard corners" will be understood to designate standard township, section, quarter-section, and meander corners; and, in addition, closing corners, as follows: Closing corners used in the original survey to determine the position of a standard parallel, or established during the survey of the same, will, with the standard corners, govern the alinement and measurements made to restore lost or obliterated standard corners; but no other closing corners will control in any manner the restoration of standard corners on a base line or standard parallel.

   (b) A lost or obliterated closing corner from which a standard parallel has been initiated or to which it has been directed will be reestablished in its original place by proportionate measurement from the corners used in the original survey to determine its position. Measurements from corners on the opposite side of the parallel will not control in any manner the relocation of said corner.

   (c) A missing closing corner originally established during the survey of a standard parallel as a corner from which to project surveys south will be restored to its original position by considering it a standard corner and treating it accordingly.

   (d) Therefore, paying attention to the preceding explanations, we have for the restoration of one or several corners on a standard parallel, and for general application to all other surveyed lines, the following proportion:

   As the original field-note distance between the selected known corners is to the new measure of said distance, so is the original field-note length of any part of the line to the required new measure thereof.

   The sum of the computed lengths of the several parts of a line must be equal to the new measure of the whole distance.

   (e) As has been observed, existing original corners can not be disturbed; consequently, discrepancies between the new and the original field-note measurements of the line joining the selected original corners will not in any manner affect measurements beyond said corners, but the differences will be distributed proportionately to the several intervals embraced in the line in question.

   (f) After having checked each new location by measurement to the nearest known corners, new corners will be established permanently and new bearings and measurements taken to prominent objects, which should be of as permanent a character as possible, and the same recorded for future reference.

2. Restoration of township corners common to four townships.—Two cases should be clearly recognized: 1st. Where the position of the original township corner has been
made to depend upon measurements on two lines at right angles to each other. 2d. Where the original corner has been located by measurements on one line only; for example, on a guide meridian.

(a) For restoration of a township corner originally subject to the first condition: A line will first be run connecting the nearest identified original corners on the meridional township lines, north and south of the missing corner, and a temporary corner will be placed at the proper proportionate distance. This will determine the corner in a north and south direction only.

Next, the nearest original corners on the latitudinal township lines will be connected and a point thereon will be determined in a similar manner, independent of the temporary corner on the meridional line. Then through the first temporary corner run a line east (or west) and through the second temporary corner a line north (or south), as relative situations may suggest. The intersection of these two lines last run will define the position of the restored township corner, which may be permanently established.

(b) The restoration of a lost or obliterated township corner established under the second condition, i.e., by measurements, on a single line, will be effected by proportionate measurements on said line, between the nearest identified original corners on opposite sides of the missing township corner, as before described.

3. Reestablishment of corners common to two townships.—

The two nearest known corners on the township line, the same not being a base or a correction line, will be connected as in case No. 1, by a right line, and the missing corner established by proportionate distance as directed in that case; the location thus found will be checked upon by measurements to nearest known section or quarter-section corners north and south, or east and west, of the township line, as the case may be.

4. Reestablishment of closing corners.—Measure from the quarter-section, section, or township corner east or west, as the case may be, to the next preceding or succeeding corner in the order of original establishment, and reestablish the missing closing corner by proportionate measurement. The line upon which the closing corner was originally established should always be remeasured, in order to check upon the correctness of the new location. See pages 8, 12, and 13 for details.

5. Reestablishment of interior section corners.—This class of corners should be reestablished in the same manner as corners common to four townships. In such cases, when a number of corners are missing on all sides of the one sought to be reestablished, the entire distance must, of course, be remeasured between the nearest existing recognized corners both north and south, and east and west, in accordance with the rule laid down, and the new corner reestablished by proportionate measurement. The mere measurement in any one of the required directions will not suffice, since the direction of the several section lines running north and south through a township, or running east and west, are only in the most exceptional cases true prolongations of the alinement of the section lines initiated on the south boundary of the township; while the east and west lines running through the township, and theoretically supposed to be at right angles with the former, are seldom in that condition, and the alinements of the closing lines on the east and west boundaries of the township, in connection with the interior section lines, are even less often in accord. Moreover, the alinements of the section line itself from corner to corner, in point of fact, also very frequently diverges from a right line, although presumed to be such from the record contained in the field notes and so designated on the plats, and becomes either a broken or a curved line. This fact will be determined, in a timbered country, by the blazes which may be found upon trees on either side of the line, and although such blazed line will not strictly govern as to the absolute direction assumed by such line, it will assist very materially in determining its approximate direction, and should never be neglected in retracements for the reestablishment of lost corners of any description. Sight trees described in the field notes, together with the recorded distances to same, when fully identified, will, it has been held, in one or more States, govern the line itself, even when not in a direct or straight line between established corners, which line is then necessarily a broken line by passing through said sight trees. Such trees, when in existence and properly identified beyond a question of doubt, will very materially assist in evidencing the correct relocation of a missing corner. It is greatly to be regretted that the earlier field notes of survey are so very meager in the notation of the topography found on the original line, which might in very many instances materially lessen a surveyor's labors in retracement of lines and reestablishment of the required missing corner. In the absence of such sight trees and other evidence regarding the line, as in an open country, or where such evidence has been destroyed by time, the elements, or the progress of improvement, the line connecting the known corners should be run straight from corner to corner.

6. Reestablishment of quarter-section corners on township boundaries.—Only one set of quarter-section corners are actually marked in the field on township lines, and they are established at the time when the township exteriors are run. When double section corners are found, the quarter-section corners are considered generally as standing midway between the corners of their respective sections, and when required to be established or reestablished, as the case may be, they should be generally so placed; but great care should be exercised not to mistake the corners belonging to one township for those of another. After determining the proper section corners marking the line upon which the missing quarter-section corner is to be reestablished, and measuring said line, the missing quarter-section corner will be reestablished in accordance with the requirements of the original field notes of survey, by proportionate measurement between the section corners marking the line.

Where there are double sets of section corners on township and range lines, and the quarter-section corners for sections south of the township or east of the range lines are required to be established in the field, the said quarter-section corners should be so placed as to suit the calculation of areas of the quarter sections adjoining the township boundaries as expressed upon the official township plat, adopting proportionate measurements when the present measurement of the
north and west boundaries of the section differ from the original measurements.

7. Reestablishment of quarter-section corners on closing section lines between fractional sections.—This class of corners must be reestablished according to the original measurement of 40 chains from the last interior section corner. If the measurements do not agree with the original survey, the excess or deficiency must be divided proportionately between the two distances, as expressed in the field notes of the original survey. The section corner started from and the corner closed upon should be connected by a right line, unless the retracement should develop the fact that the section line is either a broken or curved line, as is sometimes the case.

8. Reestablishment of interior quarter-section corners.—In some of the older surveys these corners are placed at variable distances, in which case the field notes of the original survey must be consulted, and the quarter-section corner reestablished at proportionate distances between the corresponding section corners, in accordance therewith. The later surveys being more uniform and in stricter accordance with law, the missing quarter-section corner must be reestablished equidistant between the section corners marking the line, according to the field notes of the original survey. The remarks made under section 5, in relation to section lines, apply with full force here also; the caution there given not to neglect sight trees is equally applicable, since the proper reestablishment of the quarter-section corner may in some instances very largely depend upon its observance, and avoid one of the many sources of litigation.

9. Where double corners were originally established, one of which is standing, to reestablish the other.—It being remembered that the corners established when the exterior township lines were run, belong to the sections in the townships north and west of those lines, the surveyor must first determine beyond a doubt to which sections the existing corner belongs. This may be done by testing the courses and distances to witness trees or other objects noted in the original field notes of survey, and by remeasuring distances to known corners. Having determined to which township the existing corner belongs, the missing corner may be reestablished in line north or south of the existing corner, as the case may be, at the distance stated in the field notes of the original survey, by proportionate measurement, and tested by retracement to the opposite corresponding corner of the section to which the missing section corner belongs. These double corners being generally not more than a few chains apart, the distance between them can be more accurately laid off, and it is considered preferable to first establish the missing corner as above, and check upon the corresponding interior corner, than to reverse the proceeding; since the result obtained is every way more accurate and satisfactory.

10. Where double corners were originally established, and both are missing, to reestablish the one established when the township line was run.—The surveyor will connect the nearest known corners on the township line by a right line, being careful to distinguish the section from the closing corners, and reestablish the missing corner at the point indicated by the field notes of the original survey by proportionate measurement. The corner thus restored will be common to two sections either north or west of the township boundary, and the section north or west, as the case may be, should be carefully retraced, thus checking upon the reestablished corner, and testing the accuracy of the result. It can not be too much impressed upon the surveyor that any measurements to objects on line noted in the original survey are means of determining and testing the correctness of the operation.

11. Where double corners were originally established, and both are missing, to reestablish the one established when the township was subdivided.—The corner to be reestablished being common to two sections south or east of the township line, the section line closing on the missing section corner should be first retraced to an intersection with the township line in the manner previously indicated, and a temporary corner established at the point of intersection. The township line will of course have been previously carefully retraced in accordance with the requirements of the original field notes of survey, and marked in such a manner as to be readily identified when reaching the same with the retraced section line. The location of the temporary corner planted at the point of intersection will then be carefully tested and verified by remeasurements to objects and known corners on the township line, as noted in the original field notes of survey, and the necessary corrections made in such relocation. A permanent corner will then be erected at the corrected location on the township line, properly marked and witnessed, and recorded for future requirements.

12. Where triple corners were originally established on range lines, one or two of which have become obliterated, to reestablish either of them.—It will be borne in mind that only two corners were established as actual corners of sections, those established on the range line not corresponding with the subdivisional survey east or west of said range line. The surveyor will, therefore, first proceed to identify the existing corner or corners, as the case may be, and then reestablish the missing corner or corners in line north or south, according to the distances stated in the original field notes of survey in the manner indicated for the reestablishment of double corners, testing the accuracy of the result obtained, as hereinafore directed in other cases. If, however, the distances between the triple corners are not stated in the original field notes of survey, as is frequently the case in the returns of older surveys, the range line should be first carefully retraced, and marked in a manner sufficiently clear to admit of easy identification upon reaching same during the subsequent proceeding. The section lines closing upon the missing corners must then be retraced in accordance with the original field notes of survey, in the manner previously indicated and directed, and the corners reestablished in the manner directed in the case of double corners. The surveyor can not be too careful, in the matter of retracement, in following closely all the recorded indications of the original line, and nothing, however slight, should be neglected to insure the correctness of the retracement of the original line; since there is no other check upon the accuracy of the reestablishment of the missing corners, unless the entire corresponding section lines are
15. Fractional sections.-County and local surveyors being sometimes called upon to restore fractional sections lines closing upon Indian, military, or other reservations, private grants, etc., such lines should be restored upon the same principles as directed in the foregoing pages, and checked whenever possible upon such corners or monuments as have been placed to mark such boundary lines.

In some instances corners have been moved from their original position, either by accident or design, and county surveyors are called upon to restore such corners to their original positions, but, owing to the absence of any and all means of identification of such location, are unable to make the result of their work acceptable to the owners of the lands affected by such corner. In such cases the advice of this office has invariably been to the effect that the relocation of such corner must be made in accordance with the orders of a court of competent jurisdiction, the United States having no longer any authority to order any changes where the lands affected by such corner have been disposed of.

RECORDS.

The original evidences of the public-land surveys in the following States have been transferred, under the provisions of sections 2218, 2219, and 2220, United States Revised Statutes, to the State authorities, to whom application should be made for such copies of the original plats and field notes as may be desired, viz:

Alabama: Secretary of State, Montgomery.
Arkansas: Commissioner of State Lands, Little Rock.
Illinois: Auditor of State, Springfield.
Indiana: Auditor of State, Indianapolis.
Iowa: Secretary of State, Des Moines.
Kansas: Auditor of State and Register of State Lands, Topeka.

Mississippi: Commissioner of State Lands, Jackson.
Missouri: Secretary of State, Jefferson City.
Nebraska: Commissioner of Public Lands and Buildings, Lincoln.
Ohio: Auditor of State, Columbus.
Wisconsin: Commissioners of Public Lands, Madison.

In other public-land States the original field notes and plats are retained in the offices of the United States surveyors general.

16.

SUBDIVISION OF SECTIONS.

This office being in receipt of many letters making inquiry in regard to the proper method of subdividing sections of the public lands, the following general rules have been prepared as a reply to such inquiries. The rules for subdivision are based upon the laws governing the survey of the public lands. When cases arise which are not covered by these rules, and the advice of this office in the matter is desired, the letter of inquiry should, in every instance, contain a description of the particular tract or corner, with reference to township, range, and section of the public surveys, to enable the office to consult the record; also a diagram showing conditions found:
1. Subdivision of sections into quarter sections.—Under the provisions of the act of Congress approved February 11, 1805, the course to be pursued in the subdivision of sections into quarter sections is to run straight lines from the established quarter-section corners, United States surveys, to the opposite corresponding corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or, in other words, the legal center of the section.

(a) Upon the lines closing on the north and west boundaries of a township, the quarter-section corners are established by the United States deputy surveyors at 40 chains to the north or west of the last interior section corners, and the excess or deficiency in the measurement is thrown into the half mile next to the township or range line, as the case may be.

(b) Where there are double sets of section corners on township and range lines, the quarter corners for the sections south of the township lines and east of the range lines are not established in the field by the United States deputy surveyors, but in subdividing such sections said quarter corners should be so placed as to suit the calculations of the areas of the quarter sections adjoining the township boundaries as expressed upon the official plat, adopting proportionate measurements where the new measurements of the north or west boundaries of the section differ from the original measurements.

2. Subdivision of fractional sections.—Where opposite corresponding corners have not been or can not be fixed, the subdivision lines should be ascertained by running from the established corners due north, south, east, or west lines, as the case may be, to the water course, Indian boundary line, or other boundary of such fractional section.

(a) The law presumes the section lines surveyed and marked in the field by the United States deputy surveyors to be due north and south or east and west lines, but in actual experience this is not always the case. Hence, in order to carry out the spirit of the law, it will be necessary in running the subdivisinal lines through fractional sections to adopt mean courses where the section lines are not due lines, or to run the subdivision line parallel to the east, south, west, or north boundary of the section, as conditions may require, where there is no opposite section line.

3. Subdivision of quarter sections into quarter quarters.—Preliminary to the subdivision of quarter sections, the quarter-quarter corners will be established at points midway between the section and quarter-section corners, and between quarter corners and the center of the section, except on the last half mile of the lines closing on the north or west boundaries of a township, where they should be placed at 20 chains, proportionate measurement, to the north or west of the quarter-section corner.

(a) The quarter-quarter section corners having been established as directed above, the subdivision lines of the quarter section will be run straight between opposite corresponding quarter-quarter section corners on the quarter section boundaries. The intersection of the lines thus run will determine the place for the corner common to the four quarter-quarter sections.

4. Subdivision of fractional quarter sections.—The subdivision lines of fractional quarter sections will be run from properly established quarter-quarter section corners (paragraph 3) due north, south, east, or west, to the lake, water course, or reservation which renders such tracts fractional, or parallel to the east, south, west, or north boundary of the quarter section, as conditions may require. (See paragraph 2 (a).)

5. Proportionate measurement.—By “proportionate measurement,” as used in this circular, is meant a measurement having the same ratio to that recorded in the original field notes as the length of chain used in the new measurement has to the length of chain used in the original survey, assuming that the original and new measurements have been correctly made.

For example: The length of the line from the quarter-section corner on the west side of sec. 2, T. 24 N., R. 14 E., Wisconsin, to the north line of the township, by the United States deputy surveyor’s chain, was reported as 45.40 chains, and by the county surveyor’s measure is reported as 42.90 chains; then the distance which the quarter-quarter section corner should be located north of the quarter-section corner would be determined as follows:

As 45.40 chains, the Government measure of the whole distance, is to 42.90 chains, the county surveyor’s measure of the same distance, so is 20.00 chains, original measurement, to 18.90 chains by the county surveyor’s measure, showing that by proportionate measurement in this case the quarter-quarter section corner should be set at 18.90 chains north of the quarter-section corner, instead of 20.00 chains north of such corner, as represented on the official plat. In this manner the discrepancies between original and new measurements are equitably distributed.

S. W. LAMOREUX,
Commissioner.

DEPARTMENT OF THE INTERIOR,
October 16, 1896.

Approved:

DAVID R. FRANCIS,
Secretary.
MANUAL
OF
SURVEYING INSTRUCTIONS
FOR THE
SURVEY OF THE PUBLIC LANDS
OF THE
UNITED STATES
AND
PRIVATE LAND CLAIMS.

Prepared in conformity with law under the direction of
THE COMMISSIONER OF THE GENERAL LAND OFFICE.

JANUARY 1, 1902.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1902.
DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D.C., January 1, 1902.

GENTLEMEN:
The following instructions, including full and minute directions for the execution of surveys in the field, are issued under the authority given me by sections 453, 456, and 2398, United States Revised Statutes, and must be strictly complied with by yourselves, your office assistants, and deputy surveyors.

All directions in conflict with these instructions are hereby abrogated.

In all official communications, this edition will be known and referred to as the Manual of 1902.

Very respectfully,

BINGER HERMANN,
Commissioner.

To SURVEYORS GENERAL OF THE UNITED STATES.

(Pages 5 through 18 and half of page 19 are deleted. They contain the "History of Legislation" and Revised Statutes, identical to the 1894 Manual in content.)

SYSTEM OF RECTANGULAR SURVEYING.

[See Plates II and III.]

24. Existing law requires that in general the public lands of the United States "shall be divided by north and south lines run according to the true meridian, and by others crossing them at right angles so as to form townships six miles square," and that the corners of the townships thus surveyed "must be marked with progressive numbers from the beginning."

25. In the execution of the public surveys under existing law, it is apparent that the requirements that the lines of survey shall conform to true meridians, and that the townships shall be 6 miles square, taken together, involve a mathematical impossibility due to the convergency of the meridians.

Therefore, to conform the meridional township lines to the true meridians produces townships of a trapezoidal form which do not contain the precise area of 23,040 acres required by law, and which discrepancy increases with the increase in the convergency of the meridians, as the surveys attain the higher latitudes.

26. In view of these facts, and under the provisions of section 2 of the act of May 18, 1796, that sections of a mile square shall contain 640 acres, as nearly as may be, and also under those of section 3 of the act of May 10, 1800, that "in all cases where the exterior lines of the townships, thus to be subdivided into sections and half sections, shall exceed, or shall not extend 6 miles, the excess or deficiency shall be specially noted, and added to or deducted from the western or northern ranges of sections or half sections in such township, according as the error may be in running lines from east to west, or from south to north; the sections and half sections bounded on the northern and western lines of such townships shall be sold as containing only the quantity expressed in the returns and plats, respectively, and all others as containing the complete legal quantity," the public lands of the United States shall be surveyed under the methods of the system of rectangular surveying, which harmonizes the incompatibilities of the requirements of law and practice, as follows:

First. The establishment of a principal meridian conforming to the true meridian, and, at right angles to it, a base line conforming to a parallel of latitude.

Second. The establishment of standard parallels conforming to parallels of latitude, initiated from the principal meridian at intervals of 24 miles and extended east and west of the same.

Third. The establishment of guide meridians conforming to true meridians, initiated upon the base line and successive standard parallels at intervals of 24 miles, resulting in tracts of land 24 miles square, as nearly as may be, which shall be subsequently divided into tracts of land 6 miles square by two sets of lines, one conforming to true meridians, crossed by others conforming to parallels of latitude at intervals of 6 miles, containing 23,040 acres, as nearly as may be, and designated townships.

Such townships shall be subdivided into thirty-six tracts, called sections, each of which shall contain 640 acres, as nearly as may be, by two sets of parallel lines, one set parallel to a true meridian and the other conforming to parallels of latitude, mutually intersecting at intervals of 1 mile and at right angles, as nearly as may be.

27. Any series of contiguous townships or sections situated north and south of each other constitutes a RANGE, while such a series situated in an east and west direction constitutes a TIER.

The accompanying diagram (Plate 11), and the specimen field notes (page 147), pertaining to the same, will serve to illustrate the method of running lines to form tracts of land 24 miles square, as well as the method of running the exterior lines of townships, and the order and mode of subdividing townships will be found illustrated in the accompanying specimen field notes (page 159), conforming with the township plat (Plate III). The method here presented is designed to insure a full compliance with every practicable requirement, meaning, and intent of the surveying laws.

28. By the terms of the original law and by general practice, section lines were surveyed from south to north and from east to west, in order to uniformly place excess or deficiency of measurement on the north and west sides of the townships. But under modern conditions many cases arise in which a departure from this method is necessary. Where the west or the north boundary is sufficiently correct as to course, to
serve as a basis for rectangular subdivision, and the opposite line is defective, the section lines should be run by a reversed method.

For convenience the well-surveyed lines on which subdivisions are to be based, will be called governing boundaries of the township. The rules provided for thus securing rectangular work are given on pages 55 to 61.

29. The tiers of townships will be numbered, to the north or south, commencing with No. 1, at the base line; and the ranges of the townships, to the east or west, beginning with No. 1, at the principal meridian of the system.

30. The thirty-six sections in to which a township is subdivided are numbered, commencing with number one at the northeast angle of the township, and proceeding west to number six, and thence proceeding east to number twelve, and so on, alternately, to number thirty-six in the southeast angle. In all cases of surveys of fractional townships, the sections will bear the same numbers they would have if the township was full; and where doubt arises as to which section numbers should be omitted, the proper section numbers will be used on the side or sides which are governing boundaries, leaving any deficiency to fall on the opposite sides.

31. Standard parallels (formerly called correction lines) shall be established at intervals of 24 miles, north and south of the baseline, guide meridians at intervals of 24 miles, east and west of the principal meridian; thus confining the errors resulting from convergence of meridians and inaccuracies in measurement within comparatively small areas.

INSTRUMENTS AND THEIR ADJUSTMENTS.

32. The surveys of the public lands of the United States, embracing the establishment of base lines, principal meridians, standard parallels, meander lines, and the subdivisions of townships, will be made with instruments provided with the accessories necessary to determine a direction with reference to the true meridian, independently of the magnetic needle.

33. Burt's improved solar compass, or a transit of approved construction, with or without solar attachment, will be used in all cases. When a transit without solar attachment is employed, Polaris observations and the retracements necessary to execute the work in accordance with existing law and the requirements of these instructions will be insisted upon. Observations every clear night will be necessary to secure accuracy in the direction of transit reference lines, when solar apparatus is not used. The method of connecting surveys with the stellar meridian should distinctly appear in the field notes, as evidence that the courses were not derived from the magnetic needle.

34. Deputies using instruments with solar apparatus will be required to make observations on the star Polaris at the beginning of every survey, and whenever necessary to test the accuracy of the solar apparatus.

Observations required to test the adjustments of the solar apparatus will be made at the corner where the survey begins, or at the camp of the deputy surveyor nearest said corner; and in all cases the deputy will fully state in the field notes the exact location of the observing station.

35. Deputy surveyors will examine the adjustments of their instruments, and take the latitude daily, weather permitting, while running all lines of the public surveys. (For directions see page 153.) They will make complete records in their field notes, under proper dates, of the making of all observations in compliance with these instructions, showing the character and condition of the instrument in use, and the precision attained in the survey, by comparing the direction of the line run with the meridian determined by observation.

36. On every survey executed with solar instruments, the deputy will, at least once on each working day, record in his field notes the proper reading of the latitude and; the declination of the sun, corrected for refraction, set off on the declination arc; and note the correct local mean time of his observation, which, for the record, will be taken at least two hours from apparent noon.

In field inspection of contract surveys, the examiners are required to obtain the meridian, both by solar and stellar observations, testing their instruments fully before reporting on the courses of the deputy's lines. Hence no deputy should incur risk by omitting any of the safeguards here required as essential to accurate work.

37. The construction and adjustments of all surveying instruments used in surveying the public lands of the United States will be tested at least once a year, and oftener, if necessary, on the true meridian, established under the direction of the surveyor general of the district; and if found defective, the instruments shall undergo such repairs or modifications as may be found necessary to secure the closest possible approximation to accuracy and uniformity in all field work controlled by such instruments.

38. The instruments for measuring lines are the chain and pins. Each deputy will be provided with a standard steel chain or steel tape of approved style, precisely adjusted to the standard measures kept by the surveyor general. The deputy's standard measure will not be used on the field work, but be carefully preserved in camp and used for purposes of frequent comparison with his field chains or steel tapes, in order that changes due to constant use may be discovered at the beginning of each day's work. All his returns of distance will be made in miles, chains, and links, a chain of 100 links being equal to 66 feet. Engineers' chains reading by feet only are not to be used in public-land surveys. Distances of height or depth may be given in feet or inches. In these details the specimen field notes are to be observed.

39. The simple conditions imperatively demanded for all accurate measurements are specified in the chainman's oath, promising that he will level the chain upon even and uneven ground, will plumb the pins, either by sticking or dropping them, and will report the true distances. These brief rules, faithfully observed, will render chaining sufficiently exact to stand the test of inspection by strict examiners.

40. Before chainmen are entrusted with their actual duties, they should be exercised for practice and thoroughly instructed, under the eye of their employer, by chaining two or three times over one or more trial lines of hilly or moun-
tainous surface, to ascertain the accuracy and uniformity of the results. The methods used by competent surveyors to obtain true horizontal distance over steep slopes, are too important to be disregarded, yet too elementary to be given here. When using only a portion of the chain, on steep hill-sides, especially in a strong wind, accuracy requires a plumb-line or some equivalent means, to mark the vertical. The dropping of flag pins not loaded, too often in such cases leads to repeated and serious error, which may be avoided by dropping a more suitable object, such as a piece of metal carried in the pocket.

If any other methods of obtaining measurements up or down hills or across ravines be resorted to, except that here authorized, the facts will be stated in the returns, and the distances must well sustain the tests of the field examiner.

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MARKING LINES BETWEEN CORNERS.

41. The marking of trees and brush along lines was required by law as positively as the erection of monuments, by the act of 1796, which is still in force. The old rules therefor are unchanged.

42. All lines on which are to be established the legal corner boundaries will be marked after this method, viz: Those trees which may be intersected by the line will have two chops or notches cut on the sides facing the line, without any other marks whatever. These are called sight trees or line trees. A sufficient number of other trees standing within 50 links of the line, on either side of it, will be blazed on two sides diagonally or quartering toward the line, in order to render the line conspicuous, and readily to be traced in either direction, the blazes to be opposite each other, coinciding in direction with the line where the trees stand very near it, and to approach nearer each other toward the line, the farther the line passes from the blazed trees. In early surveys, an opposite practice prevailed.

43. Due care will ever be taken to have the lines so well marked as to be readily followed, and to cut the blazes deep enough to leave recognizable scars as long as the trees stand. This can be attained only by blazing through the bark to the wood. Trees marked less thoroughly will not be considered sufficiently blazed. Where trees two inches or more in diameter occur along a line, the required blazes will not be omitted.

44. Lines are also to be marked by cutting away enough of the undergrowth of bushes or other vegetation to facilitate correct sighting of instruments. Where lines cross deep wooded valleys, by sighting over the tops, the usual blazing of trees in the low ground when accessible will be performed, that settlers may find their proper limits of land and timber without resurvey.

45. The practice of blazing a random line to a point some distance away from an objective corner, and leaving through timber a marked line which is not the true boundary, is unlawful, and no such surveys are acceptable. The decisions of some State courts make the marked trees valid evidence of the place of the legal boundary, even if such line is crooked, and has the quarter-section corner far off the blazed line.

46. On trial or random lines, therefore, the trees will not be blazed, unless occasionally, from indispensable necessity, and then it will be done so guarded as to prevent the possibility of confusing the marks of the trial line with the true. But bushes and limbs of trees may be lopped, and stakes set on the trial or random line, at every ten chains, to enable the surveyor on his return to follow and correct the trial line and establish therefrom the true line. To prevent confusion, the temporary stakes set on the trial or random line will be removed when the surveyor returns to establish the true line.

47. The terms of each act making appropriation for compensation of surveys, allow increased pay for lines passing through lands “covered with dense undergrowth.” The evident purpose of the increase is to compensate the surveyor for the additional labor and delay of cutting away brush and trees which obstruct the proper survey of the line, and also of blazing the line as required by law.

By dense undergrowth is meant thick bushes, boughs, or other vegetable growth of such height as to obstruct the use of the transit and

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require cutting away to obtain sights along line; also bushes, brush, or vines, that are of such character as to seriously impede the work of traversing and chaining the line.

48. Increased rates for heavy timber or dense undergrowth will not be allowed for lines on which no cutting away of brush is done or is necessary, or where blazing of timber is generally neglected, if these conditions shall be shown by field inspection.

INSUPERABLE OBJECTS ON LINE—WITNESS POINTS.

49. Under circumstances where the survey of a township or section line is obstructed by an impassable obstacle, such as a pond, swamp, or marsh (not meanderable), the line will be prolonged across such obstruction by making the necessary right-angle offsets (Plate III, sec. 22) or, if such proceeding be impracticable, a traverse line will be run, or some proper trigonometrical operation employed to locate the line on the opposite side of the obstruction; and in case the line, either meridional or latitudinal, thus regained, is recovered beyond the intervening obstacle, said line will be surveyed back to the margin of the obstruction and all the particulars, in relation to the field operations, will be fully stated in the field notes.

50. As a guide in alignment and measurement, at each point where the line intersects the margin of an obstacle, a witness point will be established, except when such point is less than 20 chains distant from the true point for a legal corner which falls in the obstruction, in which case a witness will be established at the intersection. (See Plate III, section 22; also Witness Points and Witness Corners, page 52.)

51. In a case where all the points of intersection with the obstacle to measurement fall more than 20 chains from the proper place for a legal corner in the obstruction, and a witness corner can be placed on the offset line within 20 chains of the inaccessible corner point, such witness corner will be established. (See Plate III, south boundary of section 16.)
ESTABLISHING CORNERS.

52. To procure the faithful execution of this part of a surveyor's duty is a matter of the utmost importance. After true coursing and most exact measurements, the establishment of corners is the consummation of the field work. Therefore, if the corners be not perpetuated in a permanent and workmanlike manner, the principal object of surveying operations will not have been attained.

The points at which corners will be established are fully stated in the several articles: "Base Lines," "Principal Meridians," "Standard Parallels," etc., following the title "Initial Points," page 55.

53. All marking of letters and figures should be done neatly, distinctly, and durably, using the tools best adapted to the purpose, and keeping them in good order. These tools are the chisel and hammer for marking stones, and the scribbling tool or gouge for surfaces of wood. Since the greatest permanency requires stone corner monuments, and the perishable nature of wood prohibits its use where stones can be found or brought, the deputy should be provided with good chisels, to enable him to mark neatly and expeditiously, using Arabic figures for all numbers.

SURVEYING MONUMENTS.

54. These consist of what is called the corner, and its accessories. The corner itself should be durable and firmly imbedded. It may consist of an iron monument, rod, or pipe, a cross cut on a ledge, or a marked stone; or in case these can not be obtained, then a post of durable timber. Where a stone corner has to be set upon a ledge of surface rock, it should be of large size and supported in a well-built stone mound, with its marks well shown; in addition to which, the usual witness mound will be separately built.

55. The accessories are needed to witness and identify the corner as a monument of public survey, and may consist of the following, mentioned in the order of their value and desirability:

Bearing objects, such as notable cliffs, rocks, boulders, etc., marked with a cross, the letters B. O., and a section number.
Memorials, buried 12 to 24 inches under the surface at the corner, such as glass or stone ware, potsherds, marked stones, cast iron, charcoal, or charred stake.
Pits of proper size and arrangement.
Mound of stones, at proper position and distance from the corner.
Bearing trees, blazed and marked as required.
Stake in pit, with letters and figures necessary.
Mound of earth, which in many regions is the least durable and useful of all accessories.

DESCRIPTIONS OF CORNERS.

56. The form and language used in the following articles, in describing, for each one of the thirteen classes of corners, eight specific constructions and markings, with the stated modifications in certain cases, will be carefully followed by deputy surveyors in their field notes; and their field work will strictly comply with the requirements of the descriptions.

57. When pits and mounds of earth are made accessory to corners, the pits will always have a rectangular plan; while the mounds will have a conical form, with circular base; and in all cases both pits and mounds will have dimensions at least as great as those specified in the descriptions. Deputy surveyors will strictly adhere to these provisions, and no departure from the stated requirements will be permitted, either in instructions or practice in the field. (See Plates IV and V.)

58. Referring to the numbered paragraphs, the corners described in "3" will be preferred to those described in either "1" or "2," when corners are established in loose, sandy soil, and good bearing trees are available; under similar conditions, the corners described in "5" and "8" will be preferred to those described in "4" and "7," respectively.

59. The selection of the particular construction to be adopted in any class will be left, as a matter of course, to the judgment and discretion of the deputy, who will assign the greatest weight to the durability of the corner materials and permanency of the monuments.

ABBREVIATIONS ALLOWED IN RETURNS.

60. Dimensions of stones, posts, and pits should for brevity be expressed in a regular manner, in consecutive order of length, breadth, and thickness, as shown in specimens; for instance, "a stone 23 x 10 x 8 ins." To describe a mound, the material, the altitude, and diameter of base will be given, as "mound of earth 4 ft. base, 2½ ft. high."

The following contractions are authorized to be used in the preparation of field notes, transcripts, inspection reports and similar records, and no others should be introduced. The arrangement of lines, blanks, spaces, numbers, and the general form of the specimen notes should be observed:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
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<tbody>
<tr>
<td>A.</td>
<td>for acres</td>
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<tr>
<td>a. m.</td>
<td>for 4 corners</td>
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<tr>
<td>A. M. C.</td>
<td>aux. meander corner.</td>
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<tr>
<td>asc.</td>
<td>asc.</td>
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<tr>
<td>astronom.</td>
<td>astronomic</td>
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<td>bdy.</td>
<td>boundary</td>
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<td>bdrs.</td>
<td>boundaries</td>
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<tr>
<td>bet.</td>
<td>between</td>
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<tr>
<td>B. 0.</td>
<td>bearing object</td>
</tr>
<tr>
<td>B. T.</td>
<td>bearing tree</td>
</tr>
<tr>
<td>C. C.</td>
<td>closing corner</td>
</tr>
<tr>
<td>chs.</td>
<td>chains</td>
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<tr>
<td>cor. cor.</td>
<td>corner, corners.</td>
</tr>
<tr>
<td>corr.</td>
<td>correction</td>
</tr>
<tr>
<td>dec.</td>
<td>declination</td>
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<tr>
<td>dep.</td>
<td>departure</td>
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<td>desc.</td>
<td>descend</td>
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<tr>
<td>dia.</td>
<td>diameter</td>
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<tr>
<td>diff.</td>
<td>difference</td>
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<tr>
<td>dist.</td>
<td>distance</td>
</tr>
<tr>
<td>D. S.</td>
<td>deputy surveyor.</td>
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<tr>
<td>E.</td>
<td>east</td>
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<tr>
<td>elong.</td>
<td>elongation</td>
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<tr>
<td>frac.</td>
<td>fractional</td>
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<tr>
<td>mag.</td>
<td>magnetic</td>
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<tr>
<td>M. C.</td>
<td>Meander corner.</td>
</tr>
<tr>
<td>mer.</td>
<td>meridian</td>
</tr>
<tr>
<td>mkt.</td>
<td>marked</td>
</tr>
<tr>
<td>N.</td>
<td>north</td>
</tr>
<tr>
<td>N.E.</td>
<td>northeast</td>
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<tr>
<td>N.W.</td>
<td>northwest</td>
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<tr>
<td>obs.</td>
<td>observe</td>
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<tr>
<td>obser.</td>
<td>observation</td>
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<tr>
<td>p. m.</td>
<td>afternoon</td>
</tr>
<tr>
<td>Pol.</td>
<td>Polaris</td>
</tr>
<tr>
<td>Pr. Mer.</td>
<td>principal meridian</td>
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<tr>
<td>Pt. of Tr.</td>
<td>point of triangulation</td>
</tr>
<tr>
<td>¼ sec.</td>
<td>quarter section</td>
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<tr>
<td>R. Rs.</td>
<td>range, ranges</td>
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<tr>
<td>red.</td>
<td>reduce, reduction</td>
</tr>
<tr>
<td>S.</td>
<td>south</td>
</tr>
<tr>
<td>S. C.</td>
<td>standard corner</td>
</tr>
<tr>
<td>S.E.</td>
<td>southeast</td>
</tr>
<tr>
<td>sec., secs.</td>
<td>section, sections</td>
</tr>
<tr>
<td>S. M. C.</td>
<td>special meander corner</td>
</tr>
<tr>
<td>sq.</td>
<td>square</td>
</tr>
<tr>
<td>St. Par.</td>
<td>standard parallel</td>
</tr>
<tr>
<td>s w.</td>
<td>southwest</td>
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</table>

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AUTHORIZED FORM AND DESCRIPTIONS OF CORNERS.

61. The forms given below will guide the surveyor in the choice and erection of monuments and accessories, and the same forms will be followed in preparing field notes. In case a deputy is compelled to choose another style of corner, he should state in his notes the reasons that made it necessary to depart from the rules, and should erect a monument of equal or greater permanence than the one prescribed.

62. The punctuation marks heretofore shown in former editions, to be used with letters and figures on stones, posts, and trees, are now omitted, for the reason that they are neither made, nor desired to be made, in the actual field work, and hence should not be inserted in the official returns.

63. The stated dimensions of posts are minimum; if posts are longer than 3 feet, the extra length will be placed in the ground; the posts will in no case project more than 12 ins. above the natural surface of the ground.

STANDARD TOWNSHIP CORNERS.

[See Plates II and IV.]

64. When more than one-half of all the standard township and section corners on any 6 miles of a base line or standard parallel are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified as follows: Strike out "S C on N." After "marked," insert the words:

"S C 13 N on N.,
22 E on E., and
21 E on W. face."

When under the conditions above specified the corner described in paragraph 1 is established, a stake may be driven in the east pit and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 28.

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for standard cor. of Tps. 13 N., Rs. 21 and 22 E., marked S C on N.; with 6 grooves on N., E., and W. faces; and raise a mound of stone, 2 ft. base, 1½ ft. high, N. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for standard cor. of Tps. 13 N., Rs. 21 and 22 E., marked S C on N.; with 6 grooves on N., E., and W. faces; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked

T 13 N R 22 E S 31 B T.

A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked

T 13 N R 21 E S 30 B T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for standard cor. of Tps. 13 N., Rs. 22 and 23 E., marked S C T 13 N on N., R 23 E S 31 on E., and R 22 E S 36 on W. face; with 6 grooves on N., E., and W. faces; dig pits, 30 X 24 X 12 ins., crosswise on each line, E. and W., 4 ft., and N. of post, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins sq., 24 ins. in the ground, for standard cor. of Tps. 13 N., Rs. 22 and 23 E., marked S C T 13 N on N., R 23 E S 31 on E., and R 22 E S 36 on W. face; with 6 grooves on N., E., and W. faces, from which

A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked

T 13 N R 23 E S 31 B T.

A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked

T 13 N R 22 E S 36 B T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal) 12 ins. in the ground, for standard cor. of Tps. 13 N., Rs. 22 and 23 E.; dig pits, 30 X 24 X 12 ins., crosswise on each line, N., E., and W. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In E. pit drive a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked S C T 13 N on N., R 23 E S 31 on E., and

1. Mound of stone will consist of not less than four stones, and will be at least 1% ft. high, with 2 ft. base.

2. All bearing trees will be marked with the township, range, and section in which they stand.
7. **Tree Corner, with Pits and Mound of Earth.**

A ______ ins. diam., for standard cor. of Tps. 13 N., Rs. 22 and 23 E., I mark
SCT 13 N. on N.,
R 23 E S 31 on E., and
R 22 E S 36 on W. side, with 6 notches on N., E., and W. sides; dig pits, 24 X 18 X 12 ins., crosswise on each line, N., E., and W. of cor., 5 ft. dist.; and raise a mound of earth around tree.

8. **Tree Corner, with Bearing Trees.**

A ______ ins. diam., for standard cor. of Tps. 13 N., Rs. 22 and 23 E., I mark
SCT 13 N. on N.,
R 23 E S 31 on E., and
R 22 E S 36 on W. side, with 6 notches on N., E., and W. sides; from which
A ______ ins. diam., bears N. ______° E.,
______ lks. dist., marked
T 13 N R 23 E S 31 B T.
A ______ ins. diam., bears N. ______° W.,
______ lks. dist., marked
T 13 N R 22 E S 36 B T.

**CLOSING TOWNSHIP CORNERS.**

[See Plates IV and V.]

65. When more than one-half of all the township corners are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified, as follows: Strike out "C C on S.;" After "marked," insert the words
"C C on S.,
2 W on E., and
3 W on W. face."

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70. When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the eastpit, and marked instead of the stone, and described as exemplified in the last paragraph of section 6, below.

1. **Stone, with Pits and Mound of Earth.**

Set a ______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W., marked C C on S.; with 6 grooves on S., E., and W. faces; dig pits, 30 X 24 X 12 ins., crosswise on each line, S., E., and W. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

2. **Stone, with Mound of Stone.**

Set a ______ stone, ______ X ______ X ______ ins.,
______ is. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W., marked C C on S.; with 6 grooves on S., E., and W. faces; and raise a mound of stone. 2 ft. base, 1½ ft. high, S. of cor. Pits impracticable.

3. **Stone, with Bearing Trees.**

Set a ______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W., marked C C on S.; with 6 grooves on S., E., and W. faces; from which
A ______ ins. diam., bears S. ______° E.,
______ lks. dist., marked
T 4 N R 2 W S 6 B T.
A ______________ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T 4 N R 3 W S 1 B T.

4. **Post, with Pits and Mound of Earth.**

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W., marked C C on S.,
R 2 W S 6 on E., and
R 3 W S 1 on W. face; with 6 grooves on S., E., and W. faces;
dig pits, 30 X 24 X 12 ins., crosswise on each line, E. and W., 4 ft., and S. of post 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ feet high, S. of cor.

5. **Post, with Bearing Trees.**

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W., marked C C on S.,
R 2 W S 6 on E., and
R 3 W S 1 on W. face; with 6 grooves on S., E., and W. faces;
dig pits, 30 X 24 X 12 ins., crosswise on each line, E. and W., 4 ft., and S. of post 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

6. **Mound of Earth, with Deposit, and Stake in Pit.**

Deposit a marked stone (charred stake or quart of charcoal) 12 ins. in the ground, for closing cor. of Tps. 4 N., Rs. 2 and 3 W.; dig pits, 30 X 24 X 12 ins., crosswise on each line, S., E., and W. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

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In E. pit, drive a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
C C T 4 N on S.,
R 2 W S 6 on E., and
R 3 W S 1 on W. face; with 6 grooves on S., E., and W. faces.

7. **Tree Corner, with Pits and Mound of Earth.**

A ______ ins. diam., for closing cor. of Tps. 4 N.,
Rs. 2 and 3 W., I mark
corners are established, the pits, that under ordinary circumstances would be placed on the boundary, will be omitted, and the pits on the closing lines will have their dimensions increased to $36 \times 36 \times 12$ ins. (See Plate V, fig. 4, at a and b.)

70. Positions and Dimensions of Pits and Mounds of Interfering Closing Corners.

When, under the conditions stated in paragraphs 68 and 69, the corners "Mound of Earth, with Deposit and Stake in Pit" are established, the pits on the boundary line will be omitted when the distance between the closing corners is less than 10 feet and greater than 4 feet, and the dimensions of the pits on the closing lines will be increased as directed in said paragraphs.

In case the distance between the closing corners is less than 4 feet, one mound, 5 ft. base, 2½ ft. high, will cover the deposits of both closing corners. (See Plate V, fig. 4, at c, d, and e.)

CORNERS COMMON TO FOUR TOWNSHIPS.

[See Plate IV.]

71. When more than one-half of all the corners of a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified as follows: After "marked", insert the words "3 N on NE.,
2 W on SE.,
2 N on SW., and
3 W on NW. face;"

1. Stone, with Pits and Mound of Earth.

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge; dig pits, $24 \times 24 \times 12$ ins., on each line, N., E., and W., 4 ft. dist.; and raise a mound of stone, 5 ft. base, 2½ ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge, and raise a mound of stone, 2 ft. base, 1½ ft. high, S. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., marked with 6 notches on each edge, from which A _____, _____ ins. diam., bears N. _____° E., _____ lks. dist., marked
t $3 \times 3 \times 12$ ins. (See Plate V, figs. 2 and 3.)
4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., marked

T 3 N S 31 on NE.,
R 2 W S 6 on SE.,
T 2 N S 1 on SW., and
R 3 W S 36 on NW. face, with 6 notches on each edge; dig pits, 24 X 24 X 12 ins., on each line, N., E., and W., 4 ft., and S. of post, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., marked

T 3 N S 31 on NE.,
R 2 W S 6 on SE.,
T 2 N S 1 on SW., and
R 3 W S 36 on NW. face, with 6 notches on each edge; from which

A ______, ______ ins. diam., bears N. ______° E.,
______ lks. dist., marked
T 3 N R 2 W S 31 B T.

A ______ ins. diam., bears S. ______° E.,
______ lks. dist., marked
T 3 N R 2 W S 31 B T.

A ______, ______ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T 2 N R 2 W S 6 B T.

A ______, ______ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T 2 N R 3 W S 1 B T.

A ______, ______ ins. diam., bears N. ______° W.,
______ lks. dist., marked
T 3 N R 3 W S 36 B T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal) 12 ins. in the ground, for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W.; dig pits 24 X 24 X 12 ins., on each line, N., S., E., and W. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In E. pit drive a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

T 3 N S 31 on NE.,
R 2 W S 6 on SE.,
T 2 N S 1 on SW., and
R 3 W S 36 on NW. face, with 6 notches on each edge.

7. Tree Corner, with Pits and Mound of Earth.

A ______ ins. diam., for cor. of Tps. 2 and 3 N., Rs.
2 and 3 W., 1 mark

T 3 N S 31 on NE.,
R 2 W S 6 on SE.,
T 2 N S 1 on SW., and
R 3 W S 36 on NW. side, with 6 notches facing each cardinal point; dig pits, 24 X 18 X 12 ins., on each line, N., S., E., and W. of cor., 5 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

A ______ ins. diam., for cor. of Tps. 2 and 3 N., Rs.
2 and 3 W., 1 mark

T 3 N S 31 on NE.,
R 2 W S 6 on SE.,
T 2 N S 1 on SW., and
R 3 W S 36 on NW. side, with 6 notches facing each cardinal point; from which

A ______, ______ ins. diam., bears N. ______° E.,
______ lks. dist., marked
T 3 N R 2 W S 31 B T.

A ______ ins. diam., bears S. ______° E.,
______ lks. dist., marked
T 2 N R 2 W S 6 B T.

A ______ ins. diam., bears S. ______° w.,
______ lks. dist., marked
T 2 N R 3 W S 1 B T.

A ______ ins. diam., bears N. ______° W.,
______ lks. dist., marked
T 3 N R 3 W S 36 B T.

CORNERS COMMON TO TWO TOWNSHIPS ONLY.

[See Plates IV and VIII.]

72. When more than one-half of all the corners of a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified as follows:

After "marked," insert the words:
"2 N on SW., and
7 W on NW. face."

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the south pit and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 34.

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for cor. of Tps. 2 and 3 N., R. 7 W.,
on W. bdy. Tp. 3 N., R. 6 W., marked with 6 notches on N. and W. edges; dig pits 30 X 24 X 12 ins., on each line, N., S., 4 ft., and W. of stone, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, W. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for cor. of Tps. 2 and 3 N., R. 7 W.,
on W. bdy. Tp. 3 N., R. 6 W., marked with 6 notches on N. and W. edges; and raise a mound of stone, 2 ft. base, 1½ ft. high, W. of cor. Pits impracticable.
3. Stone, with Bearing Trees.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for cor. of Tp. 2 N., R. 5 W., and Tp. 3 N., R. 6 W., on N. bdy. Tp. 2 N., R. 6 W., marked with 6 notches on N. and W. edges; from which

A ______, ins. diam., bears N. ______° E., ______ lks. dist., marked

T 2 N R 5 W S 6 B T.

A ______, ins. diam., bears N. ______° W., ______ lks. dist., marked

T 3 N R 6 W S 36 B T.

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4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of Tp. 2 N., R. 5 W., and Tp. 3 N., R. 6 W., on N. bdy. Tp. 2 N., R. 6 W., marked

T 2 N R 5 W S 6 on NE., and

T 3 N R 6 W S 36 on NW. face, with 6 notches on N. and W. edges; dig pits 30 X 24 X 12 ins., on each line, E. and W., 4 ft., and N. of post, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of Tp. 2 N., R. 7 W., on W. bdy. Tp. 3 N., R. 6 W., marked

T 2 N R 7 W S 1 on SW., and

T 3 N R 7 W S 36 on NW. face, with 6 notches on N. and W. edges; from which

A ______, ins. diam. bears S. ______° w., ______ lks. dist., marked

T 2 N R 7 W S 1 B T.

A ______, ins. diam., bears N. ______° W., ______ lks. dist., marked

T 3 N R 7 W S 36 B T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal), 12ins. in the ground, for cor. of Tps. 2 and 3 N., R. 7 W., on W. bdy. Tp. 3 N., R. 6 W.; dig pits, 30 X 24 X 12 ins., on each line, N. and W. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In W. pit drive a ______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

T 2 N R 7 W S 1 on SW., and

T 3 N R 7 W S 36 on NW. face, with 6 notches on N. and W. edges.

7. Tree Corner, with Pits and Mound of Earth.

A ______ ______ ins. diam., for cor. of Tps. 3 and 4 N., R. 5 W., on E. bdy. Tp. 4 N., R. 6 W., I mark

T 4 N R 5 W S 31 on NE., and

T 3 N R 5 W S 6 on SE. side; with 6 notches facing N. and E.; dig pits 24 X 18 X 12 ins., crosswise on each line, N. and E. of cor., 5 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

A ______ ______ ins. diam., for cor. of Tps. 2 and 3 N., R. 7 W., on W. bdy. Tp. 3 N., R. 6 W., I mark

T 2 N R 7 W S 1 on SW., and

T 3 N R 7 W S 36 on NW. side, with 6 notches facing N. and W.; from which

A ______, ______ ins. diam., bears S. ______° w., ______ lks. dist., marked

T 2 N R 7 W S 1 B T.

A ______, ins. diam., bears N. ______° W., ______ lks. dist., marked

T 3 N R 7 W S 36 B T.

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CORNERS REFERRING TO ONE TOWNSHIP ONLY

[See Plates IV and VIII.]

73. When more than one-half of all corners of a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established, will be modified as follows: After "marked" insert the words:

"2 N 6 W. on SW. face."

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the southpit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 36.

1. Stone, with Pits and Mound of Earth.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for NE. cor. of Tp. 2 N., R. 6 W., marked with 6 notches on S. and W. edges; dig pits, 36 X 36 X 12 ins., on each line, S. and W. of stone, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, SW. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for NE. cor. of Tp. 2 N., R. 6 W., marked with 6 notches on S. and W. edges; and raise a mound of stone, 2 ft. base, 1½ ft. high, SW. of cor. Pits impracticable.

3. Stone, with Bearing Tree.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground for NE. cor. of Tp. 2 N., R. 6 W., marked with 6 notches on S. and W. edges; from which

A ______, ______ ins. diam., bears S. ______° W., ______ lks. dist., marked

T 2 N R 6 W S 1 B T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for NE. cor. of Tp. 2 N., R. 6 W., marked

T 2 N R 5 W S 6 on NE.,

S 6 on SE.,

T 2 N R 6 W S 1 on SW., and

S 6 on NW. face, with 6 notches on S. and W. edges; dig pits,
36 X 36 X 12 ins., on each line, S. and W. of post, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, SW. of cor.

5. Post, with Bearing Trees.

Set a _______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for SW. cor. of Tp. 3 N., R. 6 W., marked
T 3 N R 6 W S 31 on NE.,
S I on SE.,
T 2 N R 7 W S 1 on SW., and
S I on NW. face, with 6 notches on N. and E. edges; from which
A _______ ins. diam., bears N. ______° E.,
_____ lks. dist., marked
T 3 N R 6 W S 31 B T.

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6. Mound of Earth, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for SW. cor. of Tp. 3 N., R. 6 W.; dig pits, 36 X 36 X 12 ins., on each line, N. and E. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In E. pit drive a _______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
T 3 N R 6 W S 31 on NE.,
S I on SE.,
T 2 N R 7 W S 1 on SW., and
S I on NW. face, with 6 notches on N. and E. edges.

7. Tree Corner, with Pits and Mound of Earth.

A _______ ins. diam., for SW. cor. of Tp. 3 N., R. 6 W., I mark
T 3 N R 6 W S 31 on NE.,
S I on SE.,
T 2 N R 7 W S 1 on SW., and
S I on NW. side, with 6 notches facing N. and E.; dig pits, 30 X 24 X 12 ins., crosswise on each line, N. and E. of cor., 5 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

A _______ ins. diam., for SE. cor. of Tp. 4 N., R. 6 W., I mark
S 6 on NE.,
T 3 N R 5 W S 6 on SE.,
S 6 on SW., and
T 4 N R 6 W S 36 on NW. side, with 6 notches facing N. and W.; from which
A _______ ins. diam., bears N. ______° W.,
_____ lks. dist., marked
T 4 N R 6 W S 36 B T.

STANDARD SECTION CORNERS.

[See Plates II and IV.]

74. 1. Stone, with Pits and Mound of Earth.

Set a _______ stone, ______ X ______ X ______ ins.,
_____ ins. in the ground, for standard cor. of secs. 31 and 32, marked S C on N.; with 5 grooves on E., and 1 groove on W. face; dig pits, 24 X 18 X 12 ins., crosswise on each line, E. and W., 3 ft., and N. of stone, 7 ft. dist.; and raise a mound of earth, 4 ft. base, 2½ ft. high, N. of cor. Pits impracticable.

2. Stone, with Mound of Stone.

Set a _______ stone, ______ X ______ X ______ ins.,
_____ ins. in the ground, for standard cor. of secs. 35 and 36, marked S C on N.; with 1 groove on E. and 5 grooves on W. face; and raise a mound of stone, 2 ft. base 1½ ft. high, N. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _______ stone, ______ X ______ X ______ ins.,
_____ ins. in the ground, for standard cor. of secs. 33 and 34, marked S C on N.; with 3 grooves on E. and W. faces; from which
A _______ ins. diam., bears N. ______° E.,
_____ lks. dist., marked
T 13 N R 2 1 E S 34 B T.
A _______ ins. diam., bears N. ______° W.,
_____ lks. dist., marked
T 13 N R 2 1 E S 33 B T.

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4. Post, with Pits and Mound of Earth.

Set a _______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for standard cor. of secs. 32 and 33, marked S C T 13 N R 2 1 E on N.,
S 33 on E., and
S 32 on W. face, with 4 grooves on E., and 2 grooves on W. face; dig pits, 24 X 18 X 12 ins., crosswise on each line, E. and W. 3 ft., and N. of post, 7 ft. dist.; and raise a mound of earth, 4 ft. base, 2½ ft. high, N. of cor.

5. Post, with Bearing Trees.

Set a _______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for standard cor. of secs. 34 and 35, marked S C T 13 N R 2 1 E on N.,
S 35 on E., and
S 34 on W. face, with two grooves on E., and 4 grooves on W. face; from which
A _______ ins. diam., bears N. ______° E.,
_____ lks. dist. marked
T 13 N R 2 1 E S 35 B T.
A _______ ins. diam., bears N. ______° W.,
_____ lks. dist. marked
T 13 N R 2 1 E S 34 B T.

6. Mound of Earth, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for standard cor. of secs. 33 and 34; dig pits, 24 X 18 X 12 ins., crosswise on each line, N., E., and W. of cor., 5 ft. dist.; and raise a mound of earth, 4 ft. base, 2½ ft. high, over deposit.
In E. pit drive a _______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
S C T 13 N R 22 E on N.,
S 34 on E., and
S 33 on W. face; with 3 grooves on E. and W. faces.

7. Tree Corner, with Pits and Mound of Earth.
A _______ ins. diam., for standard cor. of secs. 31 and 32, 1 mark
S C T 13 N R 22 E on N.,
S 32 on E., and S 31 on W. side, with 5 notches on E., and 1 notch on W. side; dig pits, 18 X 18 X 12 ins., N., E., and W. of cor., 4 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.
A _______ ins. diam., for standard cor. of secs. 35 and 36, 1 mark
S C T 13 N R 22 E on N.,
S 36 on E., and
S 35 on W. side, with 1 notch on E., and 5 notches on W. side; from which
A _______ ins. diam., bears N. ______ ° E.,
______ lks. dist., marked
T 13 N R 22 E S 36 B T.
A _______ ins. diam., bears N. ______ ° W.,
______ lks. dist., marked
T 13 N R 22 E S 35 B T.

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CLOSING SECTION CORNERS.

[See Plates IV and V.]

75. 1. Stone, with Pits and Mound of Earth.
Set a _______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for closing cor. of secs. 1 and 2, marked C C on S.; with 1 groove on E., and 5 grooves on W. face; dig pits, 24 X 18 X 12 ins. crosswise on each line, E. and W., 3 ft., and S. of stone, 7 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, S. of cor.

2. Stone, with Mound of Stone.
Set a _______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for closing cor. of secs. 3 and 4, marked C C on S.; with 3 grooves on E. and W. faces; and raise a mound of stone, 2 ft. base, 1½ ft. high, S. of cor. Pits impracticable.

3. Stone, with Bearing Trees.
Set a _______ stone, ______ X ______ X ______ ins.,
______ ins. in the ground, for closing cor. of secs. 1 and 2, marked C C on S.; with 1 groove on E., and 5 grooves on W. face; from which
A _______ ins. diam., bears S. ______ ° E.,
______ lks. dist., marked
T 4 N R 3 W S 1 B T.
A _______ ins. diam., bears S. ______ ° W.,
______ lks. dist., marked
T 4 N R 3 W S 2 B T.

4. Post, with Pits and Mound of Earth.
Set a _______ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for closing cor. of secs. 1 and 2, marked
C C T 4 N R 3 W on S.,
S 1 on E., and
S 2 on W. face, with 1 groove on E., and 5 grooves on W. face; dig pits, 24 X 18 X 12 ins., crosswise on each line, E. and W., 3 ft., and S. of post, 7 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, S. of cor.

5. Post, with Bearing Trees.
Set a _______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for closing cor. of secs. 1 and 2, marked
C C T 4 N R 3 W on S.,
S 1 on E., and
S 2 on W. face, with 1 groove on E., and 5 grooves on W. face; from which
A _______ ins. diam., bears S. ______ ° E.,
______ lks. dist., marked
T 4 N R 3 W S 1 B T.
A _______ ins. diam., bears S. ______ ° W.,
______ lks. dist., marked
T 4 N R 3 W S 2 B T.

6. Mound of Earth, with Deposit, and Stake in Pit.
Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for closing cor. of secs. 3 and 4; dig pits, 24 X 18 X 12 ins., crosswise on each line, S., E., and W. of cor., 4 ft. dist; and raise a mound of earth, 4 ft. base, 2 ft. high, over deposit.

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In E. pit drive a _______ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
C C T 4 N R 3 W on S.,
S 3 on E., and
S 4 on W. face, with 3 grooves on E. and W. faces.

7. Tree Corner, with Pits and Mound of Earth.
A _______ ins. diam., for closing cor. of secs. 1 and 2, 1 mark
C C T 4 N R 3 W on S.,
S 1 on E., and
S 2 on W. side, with 1 notch on E., and 5 notches on W. side; dig pits, 18 X 18 X 12 ins., S., E., and W. of cor., 5 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.
A _______ ins. diam., for closing cor. secs. 1 and 2, 1 mark
C C T 4 N R 3 W on S.,
S 1 on E., and
S 2 on W. side, with 1 notch on E., and 5 notches on W. side; from which
A———— ins. diam., bears S.————°E.,———— lks. dist., marked

T 4 N R 3 W S 1 B T.

A———— ins. diam., bears S.————° W.,———— lks. dist., marked

T 4 N R 3 W S 2 B T.

9. All closing section corners, on base lines or standard parallels, will be connected by course and distance with the nearest standard corner thereon. (See section 143.)

CORNERS COMMON TO FOUR SECTIONS.

[See Plates IV and V.]

76. When more than one-half of all the corners in a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established for cor. of secs. 15, 16, 21 and 22, will be modified as follows: after "marked," insert the words

"4 N on NE., and
3 W on SE. face."

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the southeast pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 40.

1. Stone, with Pits and Mound of Earth.

Set a———— stone,———— X———— X———— ins.,———— ins. in the ground, for cor. of secs. 14, 15, 22, and 23, marked with 3 notches on S. and 2 notches on E. edge; dig pits, 18 X 18 X 12 ins., in each sec. 5 1/2 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

2. Stone, with Mound of Stone.

Set a———— stone,———— X———— X———— ins.,———— ins. in the ground, for cor. of secs. 14, 15, 22, and 23, marked with 3 notches on S. and 2 notches on E. edge; and raise a mound of stone, 2 ft. base, 1 1/2 ft. high, W. of cor. Pits impracticable.

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3. Stone, with Bearing Trees.

Set a———— stone,———— X———— X———— ins.,———— ins. in the ground, for cor. of secs. 9, 10, 15, and 16, marked with 4 notches on S., and 3 notches on E.; edge; from which

A———— ins. diam., bears N.————°E.,———— lks. dist., marked

T 2 N R 2 W S 10 B T.

A———— ins. diam., bears S.————°E.,———— lks. dist., marked

T 2 N R 2 W S 15 B T.

A———— ins. diam., bears S.————° W.,———— lks. dist., marked

T 2 N R 2 W S 16 B T.

A———— ins. diam., bears N.————° W.,———— lks. dist., marked

T 2 N R 2 W S 9 B T.

4. Post, with Pits and Mound of Earth.

Set a———— post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of secs. 15, 16, 21, and 22, marked

T 2 N S 15 on NE.,
R 2 W S 22 on SE.,
S 21 on SW., and
S 16 on NW., face with 3 notches on S. and E. edges; dig pits, 18 X 18 X 12 ins., in each sec. 5 1/2 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

5. Post, with Bearing Trees.

Set a———— post, 3 ft. long, 4 ins. sq., 24 ins. in the ground for cor. of secs. 25, 26, 35 and 36, marked

T 2 N S 25 on NE.,
R 2 W S 36 on SE.,
S 35 on SW., and
S 26 on NW., face, with 1 notch on S. and E. edges; from which

A———— ins. diam., bears N.————° E.,———— lks. dist., marked

T 2 N R 2 W S 25 B T.

A———— ins. diam., bears S.————° W.,———— lks. dist., marked

T 2 N R 2 W S 35 B T.

A———— ins. diam., bears N.————° W.,———— lks. dist., marked

T 2 N R 2 W S 26 B T.

6. Mound, with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of secs. 25, 26, 35 and 36; dig pits, 18 X 18 X 12 ins., in each sec. 4 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, over deposit. In SE. pit drive a———— stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

T 2 N S 25 on NE.,
R 2 W S 36 on SE.,
S 35 on SW., and
S 26 on NW. face, with 1 notch on S. and E. edges.

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7. Tree Corner, with Pits and Mound of Earth.

A———— ins. diam., for cor. of secs. 29, 30, 31, and 32, 1 mark

T 2 N S 29 on NE.,
R 2 W S 32 on SE.,
S 31 on SW., and
S 30 on NW. side, with 1 notch on S., and 5 notches on E. side; dig pits 18 X 18 X 12 ins., in each sec., 5 ft. dist.; and raise a mound of earth around tree.
8. Tree Corner, with Bearing Trees.

A _______ _____ ins. diam., for cor. of secs. 5, 6, 7, and 8, 1 mark
T 2 N S 5 on NE.,
R 2 W S 8 on SE.,
S 7 on SW., and
S 6 on NW. side, with 5 notches on S. and E. sides; from which
A __________ ins. diam. bears N. ______° E., ______ lks. dist., marked
T 2 N R 2 W 5 B T.
A __________ ins. diam., bears S. ______° E. ______ lks. dist., marked
T 2 N R 2 W 8 B T.
A __________ ins. diam., bears S. ______° W. ______ lks. dist., marked
T 2 N R 2 W 7 B T.
A __________ ins. diam., bears N. ______° W. ______ lks. dist., marked
T 2 N R 2 W 6 B T.

SECTION CORNERS COMMON TO TWO SECTIONS ONLY.

[See Plates IV and VIII.]

77. When more than one-half of all the corners in a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described are established near cor. of secs. 15, 16, 21, and 22, will be modified, as follows:

After "marked", insert the words
"3 N on SW., and
7 W on NW. face."

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the southwest pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 42.

1. Stone, with Pits and Mound of Earth. (Tp. 3 N., R. 7 W.)

Set a stone, _____ X _____ X _____ ins., _____ ins. in the ground for cor. of secs. 25 and 38° marked with 5 notches on N., and 1 notch on S. edge; digs 24 X 24 X 12 ins., in each sec., 6 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, W. of cor.

2. Stone, with Mound of Stone. (Tp. 3 N., R. 7 W.)

Set a stone, _____ X _____ X _____ ins., _____ ins. in the ground, for cor. of secs. 15 and 22 marked with 3 notches on N. and S. edges; and raise a mound of stone, 2 ft. base, 1½ ft. high, W. of cor. Pits impracticable.

3. Stone, with Bearing Trees. (Tp. 3 N., R. 7 W.)

Set a stone, _____ X _____ X _____ ins., ______ ins. in the ground, for cor. of secs. 28 and 29, marked with 4 notches on E. edge; from which
A _____ _____ ins. diam., bears N. ______° E., ______ lks. dist., marked
T 3 N R 7 W S 28 B T.
A _____ _____ ins. diam., bears N. ______° W., ______ lks. dist., marked
T 3 N R 7 W S 29 B T.

4. Post, with Pits and Mound of Earth. (Tp. 2 N., R. 6 W.)

Set a _____ post, 3 ft. long, 4 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for cor. of secs. 33 and 34 marked
T 2 N S 34 on NE., and
R 6 W S 33 on NW. face, with three notches on E. and W. edges; digs pits 24 X 24 X 12 ins., in each sec., 6 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, N. of cor.

5. Post, with Bearing Trees. (Tp. 3 N., R. 5 W.)

Set a _____ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for cor. of secs. 24 and 25, marked
T 3 N S 25 on SW., and
R 5 W S 24 on NW. face, with 4 notches on N., and 2 notches on S. edge; from which
A _____ _____ ins. diam., bears S. ______° w., ______ lks. dist., marked
T 3 N R 5 W S 25 B T.
A __________ ins. diam., bears N. ______° W., ______ lks. dist., marked
T 3 N R 5 W S 24 B T.

6. Mound of Earth with Deposit and Stake in Pit. (Tp. 2 N., R. 6 W.)

Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for cor. of secs. 13 and 24; digs pits 24 X 24 X 12 ins., in each sec., 4 ft. dist., and raise a mound of earth, 4 ft. base, 2 ft. high, over deposit in SW. pit drive a _____ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked
T 2 N S 24 on SW., and
R 6 W S 13 on NW. face, with 3 notches on N. and S. edges.

7. Tree Corner with Pits and Mound of Earth. (Tp. 3 N., R. 6 W.)

A __________ ins. diam., for cor. of secs. 24 and 25, 1 mark
T 3 N S 25 on SW. and
R 6 W S 24 on NW. side, with 4 notches on N. and 2 notches on S. side; digs pits, 18 X 18 X 12 ins., in each sec., 5 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner with Bearing Trees. (Tp. 3 N., R. 7 W.)

A _______ _____ ins. diam., for cor. of secs. 22 and 27 I mark
T 3 N S 27 on SW. and
R 7 W S 22 on NW. side, with 4 notches on N. and 2 notches on S. side; from which
A _______ _____ ins. diam., bears S. ______° W.,
SECTION CORNERS REFERRING TO ONE SECTION ONLY.

[See Plates IV and VIII.]

78. When more than one-half of all corners in a township are stone corners, the descriptions in paragraphs 1 and 2, if the corners therein described, are established near the place for cor. of secs. 15, 16, 21, and 22, will be modified, as follows: After "marked" insert the words:

"2 N 5 W on NE. face;"

When, under the conditions above specified, the corner described in paragraph 1 is established, a stake may be driven in the pit, and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, below.

1. Stone, with Pit and Mound of Earth. (Tp. 2 N., R. 5 W.)
Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for SW. cor. of sec. 12, marked with 1 notch on E. edge; dig a pit, 36 X 36 X 12 ins., in the sec., 8 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, NE. of cor.

2. Stone, with Mound of Stone.
Set a ______ stone, ______ X ______ X ______ ins. in the ground, for SW. cor. of sec. 12, marked with one notch on E. edge; and raise a mound of stone, 2 ft. base, 1½ ft. high, NE. of cor.

3. Stone, with Bearing Tree.
Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for SW. cor. of sec. 12, marked with 1 notch on E. edge; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked

T 2 N R 5 W S 12 B T.

4. Post, with Pit and Mound of Earth. (Tp. 3 N., R. 5 W.)
Set a ______ post, 4 ft. long, 3 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for NW. cor. of sec. 10; marked T 3 N S 9 on NE., R 5 W S 10 on SE., S 9 on SW., and S 9 on NW. face, with 5 notches on S. and 3 notches on E. edge; dig a pit, 36 X 36 X 12 ins., in the sec., 8 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high, SE. of cor.

5. Post, with Bearing Tree. (T. 2 N., R. 5 W.)
Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground, for SW. cor. of sec. 12; marked T 2 N S 12 on NE., R 5 W S 13 on SE., S 13 on SW., and S 13 on NW. face, with 1 notch on E. edge; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked

T 2 N R 5 W S 12 B T.

6. Mound of Earth, with Deposit, and Stake in Pit. (Tp. 3 N., R. 5 W.)
Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for NW. cor. of sec. 10; dig a pit, 36 X 36 X 12 ins. in the sec., 5 ft. dist.; and raise a mound of earth, 4 ft. base, 2 ft. high over deposit.

7. Tree Corner, with Pit and Mound of Earth. (Tp. 2 N., R. 5 W.)
A ______ ins. diam., for SW. cor. of sec. 12, I mark T 2 N S 12 on NE., R 5 W S 10 on SE., S 13 on SW., and S 9 on NW. face, with 5 notches on S. and 3 notches on E. edge.

8. Tree Corner, with Bearing Trees. (Tp. 3 N., R. 5 W.)
A ______ ins. diam., for NW. cor. of sec. 10, I mark T 3 N S 9 on NE., R 5 W S 10 on SE., S 9 on SW., and S 9 on NW., side, with 5 notches on S., and 3 notches on E. side; from which A______, ______ ins. diam., bears S. ______° E., ______ lks. dist., marked

T 3 N R 5 W S 10 B T.

QUARTER SECTION CORNERS.

[See Plates IV and V.]

79. 1. Stone, with Pits and Mound of Earth.
Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for ¼ sec. cor. marked ¼ on N. face; dig pits, 18 X 18 X 12 ins., E. and W. of stone, 3 ft. dist.; and raise a mound of earth, 3½ ft. base, 1½ 2 ft. high, N. of cor.
2. Stone, with Mound of Stone.

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for 1 1/4 sec. cor. marked 1/4 on W. face; and raise a mound of stone, 2 ft. base, 1 1/2 ft. high, W. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for 1/4 sec. cor. marked 1/4 on W. face; from which

A _____, _____ ins. diam., bears N. _____° E., _____ lks. dist., marked

1/4 S 16 B T.

A _____, _____ ins. diam., bears N. _____° W., _____ lks. dist., marked

1/4 S 17 B T.

4. Post, with Pits and Mound of Earth.

Set a _____ post, 3 ft. long, 5 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for 1/4 sec. cor. marked 1/4 S 54 on N. face and 9 on S. face; dig pits 18 X 18 X 12 ins., E. and W. of post, 3 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, N. of cor.

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5. Post, with Bearing Trees.

Set a _____ post, 3 ft. long, 5 ins. sq., 24 ins. in the ground, for 1/4 sec. cor., marked 1/4 S 21 on W. face and 22 on E. face; from which

A _____, _____ ins. diam., bears S. _____° E., _____ lks. dist., marked

1/4 S 22 B T.

A _____, _____ ins. diam., bears S. _____° W., _____ lks. dist., marked

1/4 S 21 B T.

6. Mound, with Deposit and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for 1/4 sec. cor.; dig pits, 18 X 18 X 12 ins., E. and W. of cor., 4 ft. dist.; and raise a mound of earth, 3 1/2 ft. base, 1 1/2 ft. high, over deposit.

In E. pit drive a _____ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

1/4 S 21 on N. face and 28 on S. face.

7. Tree Corner, with Pits and Mound of Earth.

A _____, _____ ins. diam., for 1/4 sec. cor. I mark 1/4 S 7 on W. side and 8 on E. side; dig pits, 18 X 18 X 12 ins., N. and S. of cor., 4 ft. dist.; and raise a mound of earth around tree.

8. Tree Corner, with Bearing Trees.

, A _____, _____ ins. diam., for 1/4 sec. cor. I mark 1/4 S 20 on N. side and 29 on S. side; from which

A _____, _____ ins. diam., bears N. _____° W., _____ lks. dist., marked

1/4 S 20 B T.
3. Stone, with Bearing Trees.

Set a ______ stone ______ X ______ X ______ ins.,
______ ins. in the ground, for meander cor. of fracl. secs. 26
and 35, with 1 groove on S. face, marked
M C on W. face; from which
A ______, ______ ins. diam., bears N. ______° E.,
______ lks. dist., marked
T 15 N R 20 E S 26 M C B T.
A ______, ______ ins. diam., bears S. ______° E.,
______ lks. dist., marked
T 15 N R 20 E S 35 M C B T.

4. Post, with Pit and Mound of Earth.

Set a ______ post, 3 ft. long, 4 ins. sq., with marked stone
(charred stake or quart of charcoal),24 ins. in the ground for
meander cor. of fracl. secs. 19 and 20, marked
M C on N.,
T 15 N on S.,
R 20 E S 20 on E., and
S 19 on W. face, dig a pit, 36 X 36 X 12 ins., 8 ft. S. of post;
and raise a mound of earth, 4 ft. base, 2 ft. high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 4 ins. sq., 24 ins. in the ground,
for meander cor. of fracl. secs. 25 and 26, marked
M C on N.,
T 15 N on S.,
R 20 E S 25 on E., and
S 26 on W. face; from which
A ______, ______ ins. diam., bears S. ______° E.,
______ lks. dist., marked
T 15 N R 20 E S 25 M C B T.
A ______, ______ ins. diam., bears S. ______° W.,
______ lks. dist., marked
T 15 N R 20 E S 26 M C B T.

6. Mound with Deposit, and Stake in Pit.

Deposit a marked stone (charred stake or quart of charcoal)
12 ins. in the ground, for meander cor. of fracl. secs. 25 and 26;
dig a
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pit, 36 X 36 X 12 ins., 5 ft. N. of cor.; and raise a mound of
earth, 4 ft. base, 2 ft. high, over deposit.

In the pit drive a ______ stake, 2 ft. long, 2 ins. sq., 12 ins.
in the ground, marked
M C on S.,
T 15 N on N.,
R 20 E S 26 on W., and
S 25 on E. face.

7. Tree Corner, with Pits and Mound of Earth.

A ______, ______ ins. diam., for meander cor. of fracl.
secs. 17 and 20, 1 mark
M C on W.,
strike out "special"; in place of "E. and W. halves of sec. 38", write "sees. ______ and _______"; and omit the letter S, preceding M C, in the marking on corner and bearing trees.

The descriptions in paragraphs 1 to 7, inclusive, will be modified to describe special meander corners, as illustrated in paragraph 8, by writing "special" before meander cor. and S before M C when conditions require the change.

89. Special Meander Corners and Auxiliary Meander Corners.

Regular meander corners are those established on standard, township, or section lines. See Plate IV, for plans of meander corners, and the specimen plat, Plate III, sections 17, 18, 19, 20, 25, 26, and 35, for locations of meander corners described in Specimen Field Notes, pages 179 and 180.

The meander corners on lines of legal subdivisions, other than standard, township, or section lines, will be designated special meander corners, e.g., those located on the Specimen Plat, Plate III, in section 33.

Meander corners, not on a line belonging to the system of rectangular surveying, will be called auxiliary meander corners, e.g., the meander corner on Diamond Rock, in section 18.

90. Meander Corners on unsafe ground will be witnessed.

When a Meander Corner falls at a point where prevailing conditions would threaten its destruction by natural causes, a witness corner to such meander corner will be established, as provided for in the article Witness Corners, page 52.

91. CORNERS ON RESERVATION OR OTHER BOUNDARIES NOT CONFORMING TO THE RECTANGULAR SYSTEM.

[See Plate V.]

Stones for corners on Indian Reservation or other boundaries will not be less than 20 ins. long, or less than 6 ins. thick, and will measure at least one cubic foot in volume; consequently, a stone 20 X 14½ X 6 ins., will be about minimum size, and 32 X 9 X 6 ins., represents satisfactory proportions. N. P. for Nez Perces (Indian Reservation), on the east, and P. L. for Public Land (unsurveyed), on the west, applies to paragraph 1 only.

1. Stone, with Mound of Earth.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for the 17-mile cor., marked 17 M on S., N P on E., and P L on W. face; dig pits 36 X 36 X 12 ins., E. and W. of stone, 4 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

2. Stone, with Mound of Stone.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for the 38-mile cor., marked 38 M on NE., N P on NW., and P L on SE. face; and raise a mound of stone, 3 ft. base, 2 ft. high, S. E. of cor. Pits impracticable.

3. Stone, with Bearing Trees.

Set a ______ stone, ______ X ______ X ______ ins., ______ ins. in the ground, for the 35-mile cor., marked 35 M on E., N P on N. and 8 W on S. face; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked N P I R 35 M B T.

A ______, ______ ins. diam., bears S. ______° E., ______ lks. dist., marked A T 6 N R 8 W S 9 35 M B T.

A ______, ______ ins. diam., bears S. ______° W., ______ lks. dist., marked A T 6 N R 8 W S 8 35 M B T.

A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked N P I R 35 M B T.

4. Post, with Pits and Mound of Earth.

Set a ______ post, 3 ft. long, 5 ins. sq., with marked stone (charred stake or quarts of charcoal), 24 ins. in the ground, for the 17 mile cor., marked 17 M on S., N P I R on E., and P L on W. face; dig pits, 36 X 36 X 12 ins., E. and W. of post, 4 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. of cor.

5. Post, with Bearing Trees.

Set a ______ post, 3 ft. long, 5 ins. sq., 24 ins. in the ground, for the 35-mile cor., marked 35 M on E., N P I R on N., and T 6 N R 8 W S 9 on S.; from which A ______, ______ ins. diam., bears N. ______° E., ______ lks. dist., marked N P I R 35 M B T.

A ______, ______ ins. diam., bears S. ______° E., ______ lks. dist., marked A T 6 N R 8 W S 9 35 M B T.

A ______, ______ ins. diam., bears S. ______° W., ______ lks. dist., marked A T 6 N R 8 W S 8 35 M B T.

A ______, ______ ins. diam., bears N. ______° W., ______ lks. dist., marked N P I R 35 M B T.

6. Mound, with Deposit and Stake in Pit.

4. The above are minimum dimensions for mounds of stone on reservation boundaries.

5. The bearing trees, "S. ______° E." and "S. ______° W." from the corner, are supposed to stand on surveyed land, near the line between sections 8 and 9.
Deposit a marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for the 33-mile cor.; dig pits, 36 X 36 X 12 ins., NE. and

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SW. of cor., 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, over deposit.

In NE. pit drive a _____ stake, 2 ft. long, 2 ins. sq., 12 ins. in the ground, marked

33 M on SE.,
N P I R on NE., and
T 6 N R 8 W S 15 on SW. face.

7. Tree Corner, with Pits and Mound of Earth.

A _____ ins. diam., for the 29-mile cor., I mark

29 M on E.,
N P I R on N., and
T 5 N R 7 W S 8 on S. side; dig pits, 36 X 36 X 12 ins., N. and S. of tree, 5 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, E. of cor.

8. Tree Corner, with Bearing Trees.

A _____ ins. diam., for the 35-mile cor., I mark

35 M on E.,
N P I R on N., and
T 6 N R 8 W S 9 on S. side; from which

A _____ ins. diam., bears N. _____° E.,
N P I R 35 M B T.
A _____ ins. diam., bears S. _____° E.,
3 lks. dist., marked
T 6 N R 8 W S 9 35 M B T.
A _____ ins. diam., bears S. _____° W.,
3 lks. dist., marked
T 6 N R 8 W S 8 35 M B T.
A _____ ins. diam., bears N. _____° W.,
3 lks. dist., marked
N P I R 35 M B T.

9. Corner Monument of Stone, with Deposit.

Deposit a marked stone (charred stake, quart of charcoal, or vial with record enclosed), 12 ins. in the ground, for the SW. cor. of the Nez Perce Indian Reservation; and build a monument of stone, 3 ft. sq. at base, 2 ft. sq. on top, 3 ft. high, over deposit; marked

SW cor N P I R on NE.,
P L _____ M _____ chs on SE.,
P L _____ on SW., and
P L on NW. face.

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11. A Stone for Corner Monument, with Pits and Mound of Earth.

Set a _____ stone, 36 X 10 X 7 ins., 27 ins. in the ground, for the NE. cor. of the Nez Perce Indian Reservation, marked

P L on NE.,
P L on SE.,
NE cor N P I R on SW., and
P L on NW. face; dig pits 36 X 36 X 12 ins., S. and W. of stone, 8 ft. dist.; and raise a mound of earth, 5 ft. base, 2½ ft. high, S. W. of cor.

92. Modifications of descriptions.

When a stone or post is established for a corner monument, i.e., at a corner of a reservation, and four bearing trees are available, the descriptions of paragraphs 10 and 11 will be modified, as follows: Replace all that refers to pit and mound of earth, by correct descriptions of four properly marked bearing trees, for each corner.

The dimensions and arrangement of pits and mounds, described in the last two paragraphs, are similar to those described for "corners referring to one township only."

93. The following table will be convenient for reference to the rules of the above descriptions, so far as they apply to pits and mounds.

**TABLE 1.—Size, position, and distance of pits and mounds.**

<table>
<thead>
<tr>
<th>Part 1.—Requirements as to size and position of pits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind of corner.</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Standard tp. cor.</td>
</tr>
<tr>
<td>Closing tp. cor.</td>
</tr>
<tr>
<td>Cor. of 4 tps</td>
</tr>
<tr>
<td>Cor. of 2 tps</td>
</tr>
<tr>
<td>Cor. of 1 tp</td>
</tr>
<tr>
<td>Standard sec. cor.</td>
</tr>
<tr>
<td>Closing sec. cor.</td>
</tr>
<tr>
<td>Cor. of 4 secs</td>
</tr>
<tr>
<td>Cor. of 2 secs</td>
</tr>
<tr>
<td>Cor. of 1 sec</td>
</tr>
<tr>
<td>Quarter sec. cor</td>
</tr>
<tr>
<td>Meander cor.</td>
</tr>
<tr>
<td>On res line</td>
</tr>
</tbody>
</table>

6. The record will consist of a brief description of the corner, with the date of its construction.

7. The markings will be cut into large stones, inserted in the middle of the lowest course of each side of the monument.

8. The proper number of miles and chains, from the initial point, will be stated.

9. The year in which the monument is established will be placed in the blank.
### Part 2.—Distance of pits and requirements as to mounds.

<table>
<thead>
<tr>
<th>Kind of corner</th>
<th>Post corner</th>
<th>Mound of earth corner</th>
<th>True corner</th>
<th>Size (in feet)</th>
<th>Positions from corner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard sq. m.</td>
<td>E. and W 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cheek sq. m.</td>
<td>E. and W 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 4 tps.</td>
<td>N. E., and W. 4 feet, S. 4 ft.</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 2 tps.</td>
<td>E. and W. 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 1 t pond</td>
<td>8 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Stamped sq. m.</td>
<td>E. and W. 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cheek sq. m.</td>
<td>E. and W. 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 4 tps.</td>
<td>N. E., and W. 4 feet, S. 4 ft.</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 2 tps.</td>
<td>E. and W. 4 feet, N. 8 feet</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 1 t pond</td>
<td>8 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 1 1 t pond</td>
<td>6 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 1 2 t pond</td>
<td>8 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
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<tr>
<td>Cor. of 1 3 t pond</td>
<td>8 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
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<td>2 x 10</td>
<td>5 x 10</td>
</tr>
<tr>
<td>Cor. of 1 4 t pond</td>
<td>8 feet . . . . . . . . . . . . .</td>
<td>Feet</td>
<td>Feet</td>
<td>2 x 10</td>
<td>5 x 10</td>
</tr>
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</table>

### WITNESS POINTS.

98. Witness points will be perpetuated by corners similar to those described for quarter section corners, with the marking W P (for witness point), in place of 1/4 or 1/4 S, as the case may be.

If bearing trees are available as accessories to witness points, each tree will be marked W P B T. (See "Inssuperable objects on line—Witness Points," page 24.)

### MISCELLANEOUS.

99. Corners on Rock in place, or on Boulders.

When a corner falls on rock in place, or on a boulder, a cross (X), will be made at the exact corner point, and witnessed by the proper number of bearing trees, if they are available; in the absence of suitable trees, a mound of stones will be raised, or of earth if stones are not found and pits are available. Owing to the difficulty of identifying the corner coming upon a flat rock in place, when only a cross is cut thereon, it is imperative that some adequate witness be used and marked.

100. Location of Mounds.

When mounds of earth or other material are raised as accessories to corners, they will be placed as specified in the foregoing Description of Corners, and in every case the direction of the mound from the corner will be carefully stated. The use of the indefinite description "alongside" will not be approved.

In case the character of the land is such that the mound can not be placed as hereinbefore described, the deputy will state in his notes, by bearing and distance, exactly where the mound is located with reference to the corner, and will give his reasons for placing it as described.

101. Mounds of Stone, covered with Earth.

In a case where pits are practicable and the deputy prefers raising a mound of stone, or a mound of stone covered with earth, he will use the form given for "Stone with mound of stone," omitting "pits impracticable," when the corner thus described is established; but when the corner "Stone, with mound of stone covered with earth," is constructed, the description will be modified as follows: strike out the words "Pits impracticable"; in place of "mound of stone, 2 ft. base, 1/2 ft. high," write "mound of stone covered with earth, ______ ft. base, ______ ft. high," inserting in the blank spaces the dimensions of the mound given in paragraph 1, following the designation of each class of corners, pages 27 to 50. Mounds of stone, or of stone covered with earth must never be built around the corner stone, but separate. When stones are necessary to hold the corner stone upright and firm, they should be in addition to the witness mound, and not a part of it.
102. Bearing Trees.

Bearing trees marked as accessories to standard corners, either township, section, or quarter section, will be selected on the north side of base lines or standard parallels, and bearing trees referring to the closing corners on said lines, will be located on the south side; in general, the bearing trees referring to any particular closing corner, together with one pit and the mound belonging to such corner, will be located on the same side of the line closed upon, and on the side from which the surveys have been closed.

When the requisite number of trees can be found within 300 links of the corner point, two bearing trees will be marked and described for every standard or closing township or section corner, or corner common to two townships or sections, only; four for every corner common to four townships or four sections; one for a corner referring to one township or one section, only; two for every quarter section corner or meander corner, and four for each mile or half mile corner, or corner monument on a reservation or other boundary, not conforming to the system of rectangular surveying.

103. The limit of 300 links will not be held to prohibit the use of bearing trees or rocks beyond that distance. Where such objects are few but accessible, they are too useful as evidences of corners to be disregarded by a faithful deputy, even when several chains distant. In the surveys of 50 or 60 years ago, corners were often witnessed by trees 8 or 10 chains distant, with great advantage to subsequent retracements.

104. Bearing trees, being important accessories to the corners, will have their exact bearings from the true meridian taken with the instrument used in running the lines of survey; and the distance from the middle of each bearing tree to the middle point of the corner will be carefully measured, and recorded in the field notes.

105. As to the height or position of marks placed on bearing trees, practice differs in various localities. The custom of placing these important evidences high enough to insure their destruction when some woodman, ignorant or careless of the penalty of the law, cuts down the tree, is a direct violation of rules. A tree will be so marked that if inadvertently cut down its stump will retain evidence of its importance. Many surveyors have adopted the plan of placing all the marks at the height of 4 or 5 feet, except the letters B T, which are made on another blaze about one foot above the ground. The intent is commendable; but a better rule, applicable to trees of every size, the following is now adopted: Place all figures and letters on that part of the tree which would probably remain as the stump; and make one plain blaze high on the same side, to attract notice in case of snow or dense undergrowth.

106. No tree less than 4 inches in diameter should be chosen for a witness, if larger ones are convenient; and if none over 3 inches are found, pits will be dug to witness the corner.

107. Stones for corners.

Stones 18 ins. long, or less, will be set with two-thirds of their length in the ground, and those more than 18 ins. long will have three-fourths of their length in the ground.

No stones measuring less than 504 cubic inches, or less than 12 ins. in length or three inches in thickness will be used for corners.

108. Lines discontinued at Legal Corners.

No mountainous lands, or lands not classed as surveyable, will be meandered, and all lines approaching such lands will be discontinued at the section or quarter-section corner nearest the unsurveyed land.

109. Marks to be cut.

All letters and figures on posts, trees, or stones, etc., will be cut into the object upon which they are placed. Arabic figures and plain letters will be used for all markings.

110. Orientation of Corners.

Corners referring to one, two, or four townships or sections, not identical with standard or closing corners, will be set with their faces directed NE. and SW., and NW. and SE., while all other corners will be set with their sides facing the cardinal points; except corners on boundaries of reservations and private land claims, which will be set squarely on line.

111. Size of Posts, Mounds, etc.

The sizes of wooden posts, mounds, and pits, noted in the foregoing descriptions, will be regarded as minimum, and their dimensions will be increased whenever practicable, except as to height of posts out of ground.

112. Corner Materials.

In establishing corners, the first preference will be given to durable stones when obtainable; then, posts; and lastly, mounds with stake in pit.

Wood of a perishable nature will not be used for posts or stakes.

113. Instructions to be studied.

Deputy surveyors will carefully read, study, and familiarize themselves with all instructions contained in this volume, and will instruct their assistants as to their duties before commencing work. An extra copy of this Manual may be furnished each deputy, for the use of his assistants.

INITIAL POINTS.

114. Initial points from which the lines of the public surveys are to be extended will be established whenever necessary, under such special instructions as may be prescribed in
each case by the Commissioner of the General Land Office. The locus of such initial points will be selected with great care and due consideration for their prominence and easy identification, and must be established astronomically.

An initial point should have a conspicuous location, visible from distant points on lines; it should be perpetuated by an indestructible monument, preferably a copper bolt firmly set in a rock ledge; and it should be witnessed by rock bearings, without relying on anything perishable like wood.

115. The initial point having been established the lines of public-land surveys will be extended therefrom. They are classified as follows:

Class 1. Base lines and standard parallels.
Class 2. Principal and guide meridians.
Class 3. Township exteriors (or meridional and latitudinal township boundaries).
Class 4. Subdivision and meander lines.

Only the base line and principal meridian can pass through the initial point.

BASE LINE.

116. From the initial point the base line will be extended east and west on a true parallel of latitude, by the use of transit or solar instruments, as may be directed by the surveyor general in his written special instructions. The transit will be used for the alinement of all important lines.

117. The direction of base lines will conform to parallels of latitude and will be controlled by true meridians; consequently the correct determination of true meridians by observations on Polaris at elongation is a matter of prime importance.

118. Certain reference lines, called tangents and secants, having a known position and relation to the required parallel of latitude, will be prolonged as straight lines. Two back and two fore sights are taken at each setting of the instrument, the horizontal limb being revolved 180° in azimuth between the observations, in one method, taking the mean of observations. Another method, called double back and fore sights, is still more exact, and therefore preferable. In this process the vertical cross-wire is fixed upon two transit points at some distance apart, in the rear, and then reversed to set one or two new points in advance. This not only insures a straight line, if the transit is leveled, but also detects the least error of collimation.

119. Where solar apparatus is used in connection with a transit, the deputy will test the instrument, whenever practicable, by comparing its indications with a meridian determined by Polaris observations; and in all cases where error is discovered he will make the necessary corrections of his line before proceeding with the survey. All operations will be fully described in the field notes.

120. The proper township, section, and quarter-section corners will be established at lawful intervals, and meander corners at the intersection of the line with all meanderable streams, lakes, or bayous.

121. In order to detect errors and insure accuracy in measurement, two sets of chainmen will be employed; one to note distances to intermediate points and to locate topographical features, the other to act as a check. Each will measure 40 chains, and in case the difference is inconsiderable, the proper corner will be placed midway between the ending points of the two measurements; but if the discrepancy exceed 8 links on even ground, or 25 links on mountainous surface, the true distance will be found by careful re-chaining by one party or both.

122. The deputy will be present when each corner is thus established, and will record in the body of his field notes the distances to the same, according to the measurement by each set of chainmen.

To obviate collusion between the sets of chainmen, the second set should commence at a point in advance of the beginning corner of the first set, the initial difference in measurement thus obtained being known only to the deputy.

PRINCIPAL MERIDIAN.

123. This line shall conform to a true meridian and will be extended from the initial point, either north or south, or in both directions, as the conditions may require, by the use of transit or solar instruments, as may be directed by the surveyor general in his special written instructions. The methods used for determination of directions, and the precautions to be observed to secure accuracy in measurement, are fully stated above under the title "Base Line," and will be complied with in every particular.

124. In addition to the above general instructions, it is required that in all cases where the establishment of a new principal meridian seems to be necessary to the surveyor general, he shall submit the matter, together with his reasons therefor, to the Commissioner of the General Land Office, and the survey of such principal meridian shall not be commenced until written authority, together with such special instructions as he may deem necessary, shall have been received from the Commissioner.

STANDARD PARALLELS.

125. Standard parallels, which are also called correction lines, shall be extended east and west from the principal meridian, at intervals of 24 miles north and south of the base line, in the manner prescribed for running said line, and all requirements under the title "Base Line" will be carefully observed. (See page 55.)

126. Where standard parallels have been placed at intervals of 30 or 36 miles, regardless of existing instructions, and where gross irregularities require additional standard lines, from which to initiate new, or upon which to close old surveys, an intermediate correction line should be established to which a local name may be given, e. g., "Cedar Creek Correction Line;" and the same will be run, in all respects, like the regular standard parallels.
GUIDE MERIDIANS.

127. Guide meridians shall be extended north from the base line, or standard parallels, at interval of 24 miles east and west from the principal meridian, in the manner prescribed for running the principal meridian, and all the provisions for securing accuracy of alinement and measurement, found or referred to under the titles Base Line and Principal Meridian, will apply to the survey of said guide meridians. (See page 55.)

128. When existing conditions require that such guide meridians shall be run south from the base or correction lines, they will be initiated at properly established corners on such lines, marked as closing corners.

129. Where guide meridians have been improperly placed at intervals greatly exceeding the authorized distance of 24 miles, and standard lines are required to limit errors of old, or govern new surveys, a new guide meridian may be run from a standard, or properly established closing corner, and a local name may be assigned to the same, e.g., “Grass Valley Guide Meridian”. These additional guide meridians will be surveyed in all respects like regular guide meridians.

TOWNSHIP EXTERIORS.

130. Whenever practicable, the township exteriors in a block of land 24 miles square, bounded by standard lines, will be surveyed successively through the block, beginning with those of the southwestern township.

131. The meridional boundaries of townships will have precedence in the order of survey and will be run from south to north on true meridians, with permanent corners at lawful distances; the latitudinal boundaries will be run from east to west on random or trial lines, and corrected back on true lines.

The falling of a random, north or south of the township corner to be closed upon, will be carefully measured, and, with the resulting true return course, will be duly recorded in the field notes.

132. Should it happen, however, that such random intersects the meridian of the objective corner, north or south of said corner, or falls short of, or overruns the length of the south boundary of the township by more than three chains (due allowance being made for convergency), said random, and, if necessary, all the exterior boundaries of the township, will be retraced and remeasured to discover and correct the error.

When running random lines from east to west, temporary corners will be set at intervals of 40.00 chains, and proper permanent corners will be established upon the true line, corrected back in accordance with these instructions, thereby throwing the excess or deficiency against the west boundary of the township, as required by law.

133. Whenever practicable, the exterior boundaries of townships belonging to the west range, in a tract or block 24 miles square, will

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first be surveyed in succession, through the range, from south to north; and in a similar manner, the other three ranges will be surveyed in regular sequence.

134. In cases where impassable obstacles occur and the foregoing rules cannot not be complied with, township corners will be established as follows:

In extending the south or north boundaries of a township to the west, where the southwest or northwest corners cannot not be established in the regular way by running a north and south line, such boundaries will be run west on a true line, allowing for convergency on the west half mile; and from the township corner established at the end of such boundary, the west boundary will be run north or south, as the case may be. In extending south or north boundaries of a township to the east, where the southeast or northeast corner cannot not be established in the regular way, the same rule will be observed, except that such boundaries will be run east on a true line, and the east boundary run north or south, as the case may be. Allowance for the convergency of meridians will be made whenever necessary.

METHOD OF SUBDIVIDING.

135. The exterior boundaries of a full township having been properly established so far as possible, the subdivision thereof will be made as follows:

At or near the southeast corner of the township, a true meridian will be determined by Polaris or solar observations, and the deputy’s instrument will be tested thereon; then from said corner the first mile of the east and south boundaries will be retraced, if subdivisions and survey of the exteriors have been provided for in separate contracts; but, if the survey of the exterior and subdivisional lines are included in the same contract, the retracements from disagreement of bearings or measurements will be carefully stated in the field notes.

136. The meridional sectional lines will be made parallel to the range line or east boundary of the township, by applying to the bearing of the latter a small correction, dependent on the latitude, taken from the following table, which gives, to the nearest whole minute, the convergency of two meridians 6 miles long and from 1 to 5 miles apart; and supplies directly the deviation of meridional section lines west of north, when the range line is a true meridian. Add the correction to the bearing of the range line, if the same is west of north, but subtract it when east of north.

<table>
<thead>
<tr>
<th>TABLE II.—Corrections for Convergency within a Township.</th>
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<tbody>
<tr>
<td>Latitude</td>
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<td>30 to 35</td>
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<td>60 to 65</td>
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<td>65 to 70</td>
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</table>

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Example.—Latitude, 47°. Range line bears N. 0° 2' E.; then parallel meridional section lines will be run as follows:

From the corner for sections—
35 and 36, N. 0° 1' E.
34 and 35, north.
33 and 34, N. 0° 1' W.
32 and 33, N. 0° 2' W.
31 and 32, N. 0° 3' W.

137. After testing his instrument on the true meridian thus determined, the deputy will commence at the corner to sections 35 and 36, on the south boundary, and run a line parallel to the range line, establishing at 40.00 chains, the quarter-section corner between sections 35 and 36, and at 80.00 chains the corner for sections 25, 26, 35, and 36.

138. From the last-named corner, a random line will be run eastward, with out blazing, parallel to the south boundary of section 36, to its intersection with the east boundary of the township, placing at 40.00 chains from the point of beginning, a post for temporary quarter-section corner. If the random line intersects said township boundary exactly at the corner for sections 25 and 36, it will be blazed back and established as the true line, the permanent quarter-section corner being established thereon, midway between the initial and terminal section corners.

139. When the objective corner is in sight from the starting corner, or the deputy has evidence of its location to prove that a different random course would fall closer to the corner, he may use such changed course for his random. A line may be run as a "random for distance only," when the course is certain.

140. If the random line intersects said township boundary to the north or south of said corner, the falling (see "Limits," page 66) will be carefully measured, and from the data thus obtained, the true return course will be calculated, and the true line blazed and established and the position of the quarter-section corner determined, as directed above.

The details of the entire operation will be recorded in the field notes.

141. Having thus established the line between sections 25 and 36, from the corner from sections 25, 26, 35, and 36, the west and north boundaries of sections 25, 24, 13, and 12, will be established as directed for those of section 36; with the exception that the random lines of said north boundaries will be run parallel to the established south boundaries of the sections to which they belong, instead of the south boundary of section 36; e. g., the random line between sections 24 and 25 will be run parallel to the established south boundary of section 25, etc.

142. Then, from the last established section corner, i. e., the corner of sections 1, 2, 11, and 12, the line between sections 1 and 2 will be projected northward, on a random line, parallel to the east boundary of the township, setting a post for temporary quarter-section corner at 40.00 chains, to its intersection with the north boundary of the township. If the random line intersects said north boundary exactly at corner for sections 1 and 2, it will be blazed back and established as the true line, the temporary quarter-section corner being established permanently in its original position, and the fractional measurement thrown into that portion of the line between said corner and the north boundary of the township.

If however, said random intersects the north boundary of the town-

ship, to the east or west of the corner for sections 1 and 2, the consequent falling will be carefully measured, and from the data thus obtained the true return course will be calculated and the true line established, the permanent quarter-section corner being placed upon the same at 40.00 chains from the initial corner of the random line, whereby throwing the fractional measurement in that portion lying between the quarter-section corner and the north boundary of the township.

143. When the north boundary of a township is a base line or standard parallel, the line between sections 1 and 2 will be run parallel to the range line as a true line, the quarter-section corner will be placed at 40.00 chains, and a closing corner will be established at the point of intersection with such base or standard line; and in such case, the distance from said closing corner, to the nearest standard corner on such base or standard line, will be carefully measured and noted as a connection line.

144. Each successive range of sections progressing to the west, until the fifth range is attained, will be surveyed in a similar manner; then, from the section corners established on the west boundary of said range of sections, random lines will be projected to their intersection with the west boundary of the township, and the true return lines established as prescribed for the survey of the first or most eastern range of sections, with the exception that on the true lines thus established the quarter-section corners will be established at 40.00 chains from the initial corners of randoms, the fractional measurements being thereby thrown into those portions of the lines situated between said quarter-section corners and the west boundary of the township.

145. The following general requirements are reiterated for emphasis:

The random of a latitudinal section line will always be run parallel to the south boundary of the section to which it belongs, and with the true bearing of said boundary; and when a section has no linear south boundary, the random will be run parallel to the south boundary of the range of sections in which it is situated, and fractional true lines will be run in a similar manner.

146. The deputy is not required to complete the survey of the first range of sections from south to north before commencing the survey of the second or any subsequent range of sections, but the corner on which any random line closes shall have been previously established by running the line which determines its position, except as follows: Where it is impracticable to establish such section corner in the regular manner, it will be established by running the latitudinal section line as a true line, with a true bearing, determined as above directed for random lines, setting the quarter section corner at 40.00 chains and the section corner at 80.00 chains.**
147. Quarter-section corners, both upon meridional and latitudinal section lines, will be established at points equidistant from the corresponding section corners, except upon the lines closing on the north and west boundaries of the township, and in those situations the quarter-section corners will always be established at precisely forty chains to the north or west (as the case may be) of the respective section corners from which those lines respectively start, by which procedure the excess or deficiency in the measurements will be thrown, according to law, on the extreme tier or range of quarter sections, as the case may be.

148. Where by reason of impassable objects only a portion of the south boundary of a township can be established, an auxiliary base line (or lines, as the case may require) will be run through the portion which has no linear south boundary, first random, then corrected, connecting properly-established corresponding section corners (either interior or exterior) and as far south as possible; and from such line or lines, the section lines will be extended northwardly in the usual manner, and any fraction south of said line will be surveyed in the opposite direction from the section corners on the auxiliary base thus established. (See Plate II, figs. 3, 4, and 5.)

149. Where by reason of impassable objects or other reasons no part of the south boundary of a township can be regularly established, the subdivision thereof will proceed from north to south and from east to west, thereby throwing all fractional measurements and areas against the west boundary, and the meanderable stream or other boundary limiting the township on the south.

If the east boundary is without regular section corners and the north boundary has been run eastwardly as a true line, with section corners at regular intervals of 80.00 chains, the subdivision of the township will be made from west to east, and fractional measurements and areas will be thrown against the irregular east boundary.

150. When the proper point for the establishment of a township or section corner is inaccessible, and a witness corner can be erected upon each of the two lines which approach the same, at distances not exceeding twenty chains therefrom, said witness corners will be properly established, and the half miles upon which they stand will be recognized as surveyed lines.

The witness corner will be marked as conspicuously as a section corner, and bearing trees will be used wherever possible.

The deputy will be required to furnish good evidence that the section corner is actually inaccessible.

151. Where impassable precipices, deep canyons, or lands otherwise quite unsurveyable, prevent the extension of regular lines, deputys are not authorized to set meander corners, nor to meander the line separating lands that can be traversed from those that can not. In place of meandering, they are to set witness corners on line, near the intersection of section lines with the brink or foot of the impassable cliffs, or at the margin of the impracticable marsh, to represent an inaccessible regular section or quarter-section corner if within twenty chains. Such quarter sections thus marked may be platted as surveyed.

152. Where a large or desirable tract is found to have its accessible section lines too short to justify the erection of such witness corners, and to render it regularly surveyed, offset lines may be run on lines of legal subdivision, far enough to show, by necessary witness corners, the 40-acre tracts that would otherwise have been excluded from survey.

The topographic sketches of mesas and impassable canyon regions, returned by deputys, will show as nearly as practicable the location of these features and their margins; and where possible the corners on opposite sides of a canyon should be connected by triangulation at least once in each township.

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MEANDERING.

153. The running of meander lines has always been authorized in the survey of public lands fronting on large streams and other bodies of water, but does not appear to have been proper in other cases. The mere fact that an irregular or sinuous line must be run, in ease of a reservation boundary, does not entitle it to be called a meander line except where it closely follows a stream or lake shore. The legal riparian rights connected with meandered lines do not apply in case of other irregular lines, as the latter are strict boundaries.

154. Lands bounded by waters are to be meandered at mean high-water mark. This term has been defined in a State decision (47 Iowa, 370) in substance as follows: High water mark in the Mississippi River is to be determined from the river bed; and that only is river bed which the river occupies long enough to wrest it from vegetation.

In another case (14 Penn. St. 59) a bank is defined as the continuous margin where vegetation ceases, and the shore is the sandy space between it and low-water mark.

Numerous decisions in State and U. S. Supreme Courts, assert the principle that meander lines are not boundaries defining the area of ownership of tracts adjacent to waters. The general rule is well set forth (10 Iowa, 549) by saying that in a navigable stream, as the Des Moines River in Iowa, high-water mark is the boundary line. When by action of the water the river bed changes, high-watermark changes and ownership of adjoining land changes with it. The location of meander lines does not affect the question.

155. Inasmuch as it is not practicable in public-land surveys to meander in such a way as to follow and reproduce all the minute windings of the high-water line, the U. S. Supreme Court has given the principles governing the use and purpose of meandering shores, in its decision in a noted case (R. R. Co. v. Schurmeier, 7 Wallace, 286-7) as follows:

Meander lines are run in surveying fractional portions of the public lands bordering on navigable rivers, not as boundaries of the tract, but for the purpose of defining the sinuosities of the banks of the stream, and as the means of ascertaining the quantity of land in the fraction subject to sale, which is to be paid for by the purchaser. In preparing the official plat from the field notes, the meander line is represented as the border line of the stream, and shows to a demonstration that the water-course, and not the meander line as actually run on the land, is the boundary.
In cases where the deputy finds it impossible to carry his meander line along mean high-water mark, his notes should state the distance therefrom, and the obstacles which justify the deviation.

156. Proceeding down stream, the bank on the left hand is termed the left bank and that on the right hand the right bank. These terms will be universally used to distinguish the two banks of a river or stream.

157. Navigable rivers, as well as all rivers not embraced in the class denominated "navigable," the right-angle width of which is three chains and upwards, will be meandered on both banks, at the ordinary mean high-water mark, by taking the general courses and distances of their sinuosities, and the same will be entered in the field book. Rivers not classed as navigable will not be meandered above the point where the average right-angle width is less than three chains, except that streams which are less than three chains wide and which are so deep, swift and dangerous as to be impassable through the agricultural season, may be meandered, where good agricultural lands along the shores require their separation into fractional lots for the benefit of settlers. But such meander surveys shall be subject to rejection if proved unnecessary by field inspection.

158. Shallow streams, without any well-defined channel or permanent banks, will not be meandered; except tide-water streams, whether more or less than three chains wide, which should be meandered at ordinary high-water mark, as far as tide-water extends.

At every point where either standard, township, or section lines intersect the bank of a navigable stream, or any meanderable shore, corners will be established at the time of running these lines. Such corners are called meander corners, and the deputy will commence at one of these corners, follow the bank or boundary line, and take the bearing and measure the length of each course, from the beginning corner to the next meander corner.

159. All courses reported are to be compass courses, taken or counted from the meridian, and not from a latitudinal line; and "transit angles" showing only the amount of deviation from the preceding course, are not allowed in field notes of meanders.

160. For convenience of testing by traverse, the courses of meander lines should be given by the nearest quarter degree. As meandered lines are not strict boundaries, this method will give results with approximate accuracy for good closings within the limits of a section. Meander lines will be examined in the field as well as rectangular lines, before acceptance.

161. Meanders should be traversed before leaving the vicinity, and if miscarriage is found, indicating error in measurement or in reading courses, the lines must be retraced.

162. The crossing distance between meander corners on same line, and the true bearing and distance between corresponding meander corners, will be ascertained by triangulation or direct measurement, in order that both shores may be protracted. The particulars will be given in the field notes.

163. For convenience of platting and computation, the deputy is required to use in meanders distances having whole chains, or multiples of ten links, with odd links only in closing distances.

164. The meanders of all lakes, navigable bayous, and deep ponds of the area of twenty-five acres and upwards, will be commenced at a meander corner and continued, as above directed for navigable streams; from said corner, the courses and distances of the entire margin of the same, and the intersections with all meander corners established thereon, will be noted.

165. All streams falling into the river, lake, or bayou will be noted, and the width at their mouths stated; also, the position, size, and depth of springs, whether the water be pure or mineral; also, the heads and mouths of all bayous; all islands, rapids, and bars will be noted, with intersections to their upper and lower ends, to establish their exact situation. The elevation of the banks of lakes, bayous, and streams, the height of falls and cascades, and the length and fall of rapids will be recorded in the field notes.

166. To meander a lake or deep pond lying entirely within the boundaries of a section, two line will be run from the two nearest corners on different sides of such lake or pond, the courses and lengths of which will be recorded, and if coincident with unsurveyed lines of legal subdivisions, that fact will also be stated in the field notes, and at each of the points where said lines intersect the margin of the pond or lake, a special meander corner will be established as above directed.

A special meander corner is one established on a line of legal subdivision, not a standard, township, or section line.

167. The relative position of these points being thus definitely fixed in the section, the meandering will commence at one of them and be continued to the other, noting the intersection, and thence to the beginning. The proceedings are to be fully entered in the field notes.

168. Meander lines will not be established at the segregation line between dry and swamp or overflowed land, but at the ordinary high-water mark of the actual margin of the rivers or lakes on which such swamp or overflowed lands border.

169. The precise relative position of an island, in a township made fractional by a river or lake in which the island is situated, will be determined by triangulation from a special and carefully measured base line, initiated upon the surveyed lines, on or near the lake or river bank on the mainland, so as to connect by course and distance on a direct line, the meander corner on the mainland with the corresponding point on the island, where the proper meander corner will be established.

170. In making the connection of an island lying entirely within a section, with the mainland, a special base will be measured from the most convenient meander corner, and from such base, the location of an auxiliary meander corner (that is, one not on a line belonging to the system of rectangular surveying; see page 48) will be determined by triangulation, at which the meanders of the island will be initiated.

171. In the survey of lands bordering on tide waters, meander corners may be temporarily set at the intersection.
of the surveyed lines with the line of mean high tide, but no monument should be placed in a position exposed to the beating of waves and the action of ice in severe weather. In all such cases, the rule given in section 90 must be observed, by establishing a witness corner on line at a secure point near the true point for the meander corner.

172. The field notes of meanders will show the dates on which the work was performed, as illustrated in the specimen notes, page 186. The field notes of meanders will state and describe the corner from which the meanders commenced, and upon which they closed, and will exhibit the meanders of each fractional section separately; following, and composing a part of such notes, will be given a description of the land, timber, depth of inundation to which the bottom is subject, and the banks, current, and bottom of the stream or body of water meandered. The utmost care will be taken to pass no object of topography, or change therein, without giving a particular description thereof in its proper place in the notes of the meanders.

**SUMMARY OF OBJECTS AND DATA INTERSECTED BY THE LINE OR IN ITS VICINITY, TO BE NOTED.**

173. 1. The precise course and length of every line run, noting all necessary offsets therefrom, with the reason for making them, and method employed.

2. The kind and diameter of all bearing trees, with the course and distance of the same from their respective corners; and the precise relative position of witness corners to the true corners.

3. The kind of materials of which corners are constructed.

4. Trees on line. The name, diameter, and distance on line to all trees which it intersects.

5. Intersections by line of land objects. The distance at which the line intersects the boundary lines of every reservation, town site, donation claim, Indian allotment, settler's claim, improvement, or rancho; prairie, bottom lands, swamp, marsh, grove, and windfall, with the course of the same at all points of intersection; also, the distances at which the line begins to ascend, arrives at the top, begins to descend, and reaches the foot of all remarkable hills and ridges, with their courses, and estimated height in feet, above the level land of the surrounding country, or above the bottom lands, ravines, or waters near which they are situated. Also, distance to and across large ravines, their depth and course.

6. Intersections by line of water objects. All rivers, creeks, and smaller streams of water which the line crosses; the distances measured on the true line to the bank first arrived at, the course down stream at points of intersection, and their widths on line. In cases of navigable streams, their width will be ascertained between the meander corners, as set forth under the proper head.

7. The land's surface—whether level, rolling, broken, hilly, or mountainous.

8. The soil—whether rocky, stony, sandy, clay, etc., and also whether first, second, third, or fourth rate.

9. Timber—the several kinds of timber and undergrowth, in the order in which they predominate.

10. Bottom lands—to be described as wet or dry, and if subject in inundation, state to what depth.

11. Springs of water—whether fresh, saline, or mineral, with the course of the streams flowing from them.

12. Lakes and ponds—describing their banks and giving their height, and whether it be pure and stagnant, deep or shallow.

13. Improvements. Towns and villages; houses or cabins, fields, or other improvements with owners' names; mill sites, forges, and factories, U. S. mineral monuments, and all corners not belonging to the system of rectangular surveying; will be located by bearing and distance, or by intersecting bearings from given points.

14. Coal banks or beds; peat or turf grounds; minerals and ores; with particular description of the same as to quality and extent, and all diggings therefor; also salt springs and licks. All reliable information that can be obtained respecting these objects, whether they be on the line or not, will appear in the general description.

15. Roads and trails, with their directions, whence and whither.

16. Rapids, cataracts, cascades, or falls of water, with the estimated height of their fall in feet.

17. Precipices, caves, sink holes, ravines, remarkable crags, stone quarries, ledges of rocks, with the kind of stone they afford.

18. Natural curiosities, interesting fossils, petrifactions, organic remains, etc.; also all ancient works of art, such as mounds, fortifications, embankments, ditches, or objects of like nature.

**PRESCRIBED LIMITS FOR CLOSINGS AND LENGTHS OF LINES.**

174. If in running a random township exterior, such random exceeds or falls short of its proper length by more than three chains, allowing for convergency, or falls more than three chains to the right or left of the objective point (or shows a proportionate error for lines of greater or less length than six miles), it will be re-run, and if found correctly run, so much of the remaining boundaries of the township will be retraced, or resurveyed, as may be found necessary to locate cause of misclosure.

175. Every meridional section line, except those which terminate upon a fractional side of a township, will be 80 chains in length, without allowance of 50 links per mile for difference or measure, or any other allowance beyond a small reasonable discrepancy according to the nature of the surface, to be determined after examination.

176. The random meridional or latitudinal lines through a tier or range of fractional sections shall fall within 50 links of
the objective corners, and a greater falling will indicate negligence or error.

177. The actual lengths of meridional section lines through a fractional north or south tier of sections shall be within 150 links of their theoretical length. The latter will be determined from the given lengths of meridional boundaries on the east and the west range lines.

178. Each latitudinal section line, except in a fractional east or west range of sections, shall be within 50 links of the actual distance established on the governing north or southern boundary of the township for the width of the same range of sections.

179. The north boundary and the south boundary of any section, except in a fractional range, shall be within 50 links of equal length.

180. The meanders within each fractional section or between any two successive meander corners, or of an island or lake in the interior of a section, should close by traverse within a limit to be determined by allowing five-eighths of a link for each chain of such meander line. This rule does not apply to irregular boundaries of reservations or private claims, except as far as the same are natural water boundaries. The total disclosure of meanders will not be permitted to exceed 150 links, except in large private land claims, which are governed by a different rule and limit. (See section 153.)

181. In closing upon accepted surveys, when irregularities beyond the allowable limits are developed, either in the length or direction of the closing lines, closing corners will be set, with quarter-section corners at 40 chains from the last interior section corner.

182. And, in general, when conditions are met which result in a random line being defective, either in length or direction, such procedure will be adopted as will secure the greatest number of complete legal subdivisions, without disturbing the condition of accepted surveys.

FIELD NOTES.

183. The proper blank books for original field notes will be furnished by the surveyor general, and in such books the deputy surveyor

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will make a faithful, distinct, and minute record of everything done and observed by himself and his assistants, pursuant to instructions, in relation to running, measuring, and marking lines, establishing corners, etc., and present, as far as possible, full and complete topographical sketches of all standard and exterior lines, drawn to the usual scale for township exteriors. These "original field notes" are not necessarily the entries made in the field, in the deputy's pocket note books called tablets; but they are to be fully and correctly written out in ink, from such tablets, for the permanent record of the work. Tablets should be so fully written as to verify the original field notes whenever the surveyor general requires them for inspection.

184. A full description of all corners belonging to old surveys, from which the lines of new surveys start, or upon which they close, will in all cases be furnished the deputy from the surveyor general's office, when authority is given for commencing work; then, if the old corners are found to agree with said descriptions, the deputy will describe any one of them in this form, "which is a ______ firmly set, marked and witnessed as described by the surveyor general;" but, should a corner not answer the description supplied, the deputy will give a full description of such corner and its accessories, following the proper approved form given in these instructions.

185. A full description of each corner established under any one contract will be given once only; subsequent reference to such corner will be made in the form, "heretofore described," or the "corner of sections 2, 3, 10, and 11," as the case may require.

In all cases where a corner is reestablished, the field notes will describe fully the manner in which it is done.

186. The field notes of the survey of base, standard, and meridian lines will describe all corners established thereon, how established, the crossings of streams, ravines, hills, and mountains; character of soil, timber, minerals, etc.; and after the description of each township corner established in running such lines, the deputy will note particularly in the "general description" the character of townships on each side of the lines run.

187. The field notes of the survey of exterior boundaries of townships will describe the corners and topography, as above required, and the "general description" at the end of such notes will describe the townships as fully as possible, and also state whether or not they should be subdivided.

188. The field notes of the subdivisional survey of townships will describe the corners and topography as above required, and the "general description" at the end of such notes will state minutely the character of the land, soil, timber, etc., found in such townships.

The topography will be given on the true line in all cases, and will be taken correctly, not estimated or approximated.

189. With the field notes of the survey of base lines and standard parallels, and principal and guide meridians forming a tract 24 miles square (see page 20 and Plate II), including those of the township exteriors therein, the deputy will submit a diagram of the lines surveyed, drawn to a scale of half an inch to one mile, upon which will be written the true bearings and lengths of all surveyed lines, except the lengths of those which are actually 40.00 or 80.00 chains. These diagrams will exhibit all water courses, with the direction of each

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indicated by an arrow head pointing down stream; also, the intersection of the lines with all prairies, marshes, swamps, ravines, lakes, ponds, mountains, hills, and all other natural or artificial topographical features mentioned in the field notes, to the fullest extent possible.

190. With the special instructions for making subdivisional surveys of townships into sections, the deputy will be furnished by the surveyor general with blank township diagrams drawn to a scale of one inch to forty chains, upon which the true bearings and lengths of the township and section lines, from which the surveys are to be projected, or upon which they are to close, will be carefully marked; and on such
diagrams the deputy who subdivides will make appropriate sketches of the various objects of topography as they occur on his lines, so as to exhibit not only the points of intersection therewith, but also the directions and relative positions of such objects between the lines, or within each section, as far as practicable, so that every topographical feature may be properly completed and connected in the showing.

191. Triangulations, offsets, or traverses, made to determine distances that can not be directly measured, such as those over deep streams, lakes, impassable swamps, canons, etc., will be made on the random lines (see pages 24 and 121), when random lines are run. All particulars will be fully stated in the field notes.

192. The exhibition of every mile of surveying, whether on standard, township, or subdivision lines, and the meanders in each section, will be complete in itself, and will be separated from other records by a black line drawn across that part of the page containing the body of notes. The description of the surface, soil, minerals, timber, undergrowth, etc., on each mile of line will follow the notes of survey of such line, and not be mingled with them.

Particular care will be taken to record at the end of each mile the number of chains of mountainous land, heavily timbered land, or land covered with dense undergrowth. (See section 395.)

The date of each day’s work will immediately follow the notes thereof.

193. Near the end of the field notes of exteriors and immediately before the “general description,” the deputy surveyor will add, in the form shown in specimen field notes (page 155), a tabular statement of the latitude and departure of all boundary lines of the township, derived from a traverse table, and will give the totals, and the errors in latitude and departure; said errors shall in no case exceed three chains, the prescribed limit for the falling of the random north boundary of a township. If a part or the whole of one or more boundaries is made up of meander lines, the northings, southerings, castings, and westings of the full section lines, nearest said meanders, will replace the missing N., S., E., or W. township lines, as the case may require, thereby presenting the errors of said boundaries of a closed survey.

194. If all the exterior lines have been surveyed by the deputy, the bearings and distances of the table will be taken from his own notes. In a case where some of the boundaries have been surveyed under another contract, the deputy will use the bearings and distances supplied by the surveyor general, in connection with those of his own lines; and, if errors exceed the allowance of three chains, specified in paragraph 1 of the “Prescribed Limits,” the deputy will determine by retraction where the error occurs, correct the same before he leaves the field, and place the table in his original field notes.

195. Besides the ordinary notes taken on line (and which will always be written down on the spot, leaving nothing to be supplied by memory), the deputy will subjoin, at the conclusion of his book, such further description of information touching any matter or thing connected with the township (or other) survey which he may be able to afford, and may deem useful or necessary to be known—with a general description of the township in the aggregate, as respects the face of the country, its soil and geological features, timber, minerals, waters, settlements, etc.

196. Following the general description of the township will be placed “A list of the names of the individuals employed to assist in running, measuring, and marking the lines and corners described in the foregoing field notes of township No. ________ of the base line of range No. ________ of the ________ meridian, showing the respective capacities in which they acted.”

AFFIDAVITS TO FIELD NOTES.

197. The forms of official oaths required to be taken by deputy surveyors and assistants, and attached to their field notes, are exemplified in the specimen field notes, pages 144 and 145.

There may be several books of one class of lines covered by one set of oaths, which must distinctly specify the work they are intended to cover. When the contract comprises several books of returns, they, as well as transcripts of the same, are to be lettered in proper sequence, A, B, etc., on the title pages. Any book not containing the affidavits must show by a final note where to find the oaths covering that portion of the contract, as “Final affidavits in book D.”

198. When the work of two deputies is recorded in the returns under one contract, each book must show clearly what lines were surveyed by each deputy. Wherever one deputy’s work ceases and another begins in the same book, the name of the former must be inserted at the end of his part of the notes.

199. The final oath of the deputy surveyor will be taken before the U. S. survey or general for the State or Territory in which the survey is executed, or before any other officer authorized by the laws of the United States or by the municipal authorities, to administer land oaths, except notaries public.

It is preferable that both preliminary and final oaths of assistants should be taken before some officer duly authorized to administer oaths other than the deputy surveyor. In cases, however, where great delay, expense, or inconvenience would result from a strict compliance with this rule, the deputy surveyor is authorized to administer the necessary oaths to his assistants, but in each case where this is done, he will submit to the property surveyor general, a full written report of the circumstances which required his stated action.

200. The deputy will transmit the field notes duly attested and the required sketches to the surveyor general at the earliest practicable date after completion of his work in the field. Said original field notes will be filed in the office of the surveyor general as a part of its permanent records, subject only to the direction of the Commissioner of the General Land Office; and no changes whatever will be made in said original field notes, after they have been filed in the surveyor general’s office, without permission of the Commissioner.

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deputy's returns, which must at that time include his final oath. The surveyor general will record the date of such filing. (See page 15.)

201. The field notes, each book bearing the written approval of the surveyor general, will be substantially bound in volumes of suitable size and retained in the surveyor general's office. Certified transcripts of said field notes will be prepared at the earliest practicable date, as follows:

202. The field notes of the survey of base lines and standard parallels, of principal and guide meridians, of township exteriors, and of subdivision and meander lines, will be written in separate books. A complete set of preliminary and final oaths will be attached to the field notes of each class of lines. (See page 55.) No adhesive material of any kind will be used to fasten leaves or covers. Cut or mutilated leaves, or slips, will not be inserted.

203. The field notes of subdivisions will be written in a separate book for each township; the preliminary oaths of the assistants employed in making said subdivisions will be prefixed to the first book, and their final oaths will be attached to the last book of the series, arranged in the order of dates.

204. The first or title page of each book of field notes will describe the subject matter of the same, the locus of the survey, by whom surveyed, number and date of contract, and the dates of commencement and completion of the work.

205. The second page of each book of field notes will contain the names and duties of the assistants employed on the surveys recorded therein; the index will be placed on the same or following page.

206. Whenever a new assistant is employed, or the duties of any one of them changed, such fact will be stated in an appropriate entry immediately preceding the notes taken under such changed arrangements.

207. No abbreviations or contractions of words are allowable, except as enumerated on page 26 or as shown in the specimen field notes.

208. All transcripts of field notes, made out as herein directed, will be written on official field-note paper, foolscap size (pages 13½ X 8½ inches), in a bold, legible hand, or type-written, preserving the marginal spaces intact for binding, and as nearly as possible without erasures or interlineations; such transcripts of any series of surveys, included in one account forwarded to the General Land Office, will be securely put up for mailing, at the office of the surveyor general, prior to transmission.

SPECIAL INSTRUCTIONS TO DEPUTY SURVEYORS.

209. One of the most important duties to be performed by the surveyor general is to provide the deputy surveyor with Special Instructions, in connection with the contract, prepared in accordance with law, which instructions will not consist of directing attention to certain paragraphs in this Manual, reiteration of its requirements, and printed directions of a general nature; but they will in all cases be specific in character, with all necessary detailed statements setting forth what the deputy is to do and how the work is to be performed. Before making out special instructions, the surveyor general will cause a thorough examination to be made of the field notes and plats of older surveys of standard and township lines upon which the deputy is to base his work, and give him full information—both written and graphic—of the exact condition of adjoining surveys, with all irregularities that may be found, carefully and clearly noted; with all necessary instructions for his guidance if he finds everything as it should be, and, in addition, full advice as far as practicable what to do in case the surveys on the ground are not as represented in the old notes.

210. If the contract includes exterior lines, the surveyor general will specify in detail where the deputy is to commence, in what order and in what direction he is to run the lines, and provide for his use one or more diagrams, drawn to a scale of one inch or one-half inch to one mile, giving full and accurate information in regard to lengths and bearings of all lines of old surveys, from which he is to work, or upon which he is to close. The diagrams will be made in triplicate, one copy for the General Land Office, one for the deputy, and one to be retained; they may be either original drawings, or blue prints or tracings therefrom. In no case must the deputy be sent into the field without full and accurate information in regard to all irregularities on the records which will affect the extent or accuracy of his survey.

SPECIMEN FIELD NOTES.

[See Plates II and III] 111. Specimen field notes Nos. 1, 2, 3, 4, and 5, illustrate, respectively, the method and order to be followed in the survey of standard parallels, guide meridians, and township exteriors; resurvey of township exteriors; and the subdivision of a township into sections and quarter sections.

The attention of every deputy surveyor is particularly directed to these specimens, as indicating not only the method by which his work will be conducted, but also the form, order, language, etc., in which his field notes will be prepared for the office of the surveyor general, and such specimens will be deemed a part of these instructions; and any departure from their details, in cases where the circumstances are analogous in practice, will be regarded as a violation of his contract and oath.

DIAGRAM OF TOWNSHIP EXTERIORS.

212. The title, certificate, and remarks on Plate II, with the specimen field notes Nos. 1, 2, and 3, will fully explain the drawing designated "Township Exteriors."

In all cases the course and length of each township boundary will be clearly stated on the diagram of exteriors; and when any township boundary entered on the diagram, surveyed under the current contract or a prior one, departs from the true meridian or proper latitude curve, or falls short or exceeds its proper length, by an amount in excess of the prescribed limits of 21' of arc and three chains to six miles, the actual position and extent of such township boundary will be graphically exhibited on the diagram, as well as by bearing and length recorded in the field notes. Where exteriors
are surveyed or resurveyed in connection with subdivision work, a separate diagram of such exteriors is required.

SPECIMEN TOWNSHIP PLAT.

213. Plate III illustrates the subdivision of a township into sections and quarter sections; the record of said subdivision being given in detail in specimen field notes No. 5.

214. Each township plat will be prepared in triplicate. One plat, considered the original, will be retained as the record in the office of the surveyor general; the duplicate will be transmitted to the General Land Office; and the triplicate, after acceptance and permission given by the Commissioner, will be filed in the United States land office of the proper district. These plats will not be altered or added to, and any changes (beyond correction of clerical errors) authorized by the Commissioner, will be shown upon a supplemental plat or diagram, prepared in triplicate.

215. The plats will be prepared as nearly as possible in accordance with the specimen plat designated, "Plate III." The use of all fluids, except a preparation of India ink of good quality, will be avoided by the draughtsman in delineations relating to the public surveys. All lines, figures, etc., will be sharply defined. All lettering on the plats will be clear and sharp in outline and design, and black; ornamentation of any kind is prohibited. These requirements are necessary in order that everything shown upon original plats may be fairly reproduced in making photolithographic copies of the same.

Surveyors general will require that the specimen plat shall be closely followed, in order that uniformity of appearance and expression of drawing representing the public land surveys may be attained.

All township plats are to be drawn to a uniform scale of 1 inch to 40 chains, United States standard, and diagrams of exteriors to a scale of 1 inch to 160 chains. Size of sheet to be 19 x 24 inches.

216. Plats will not be trimmed. A margin of three inches for binding will be preserved on the left-hand side of each plat. Each plat will be certified by the surveyor general, with table annexed, according to the form on Plate III, and will exhibit the area of public land, water surface, townsite, private land claims, and mineral claims, with the total area of the township.

All towns, settlements, permanent buildings, private claims, reservations, water courses, ditches, lakes, islands, mountains, buttes, canyons, roads, railroads, telegraph lines, canals, etc., will be shown upon the plats and designated by proper names where such are known.

The names of natural features will be correctly give according to accepted usage. Surveyors are not authorized to report names of their own selection, but will give those in use, or leave the lake, stream, or peak unnamed. The "U. S. Geographic Board" is the authority upon these matters.

217. Topography, such as ridges, valleys, streams, dry runs, acequias, trails, plateaus, marshes, etc., will if possible be connected across sections. All water ditches or acequias will be shown and designated as such, without reference to ownership. Timbered areas, large or small, will not be left blank like open country.

218. Dry runs will be shown by broken or dotted lines, and actual water courses by continuous lines. Where it is difficult for the deputy to decide whether to consider it a water course or not, the words "dry run," "water in holes," or other explanation may be inserted, as the location of water in a dry country is an important feature. The former

practice of representing dry swales by full black lines like those for running streams will not be continued.

219. Where heavy topographical details are to be drawn, first insert the figures and letters, and avoid obscuring them by subsequent marks.

Draftsmen should not lose sight of the fact that their work is to be reproduced at this office in the form of photolithographic copies for all future applicants; and that imperfect characters, weak lines, and dilute India ink are not compatible with good copying by that process. Use dense black ink in all instances, and avoid brush shading.

220. Where a surveyed line between sections is broken into two or more portions by intervening corners, the fractional distances will be fully given. Leave no such distance to be computed by the reader. This need not, however, apply where a connection distance is shown at a closing corner on township line.

221. The table at bottom of plat will be filled out, so as to show how and when each exterior line was surveyed, as well as the subdivisions, thus: "S. Boundary," "W. Boundary," and "N. and E. Boundary," may fill three lines describing work under three separate contracts.

The number of the contract will always be conspicuously shown on the plat, and on the title page of transcripts. Its frequent omission is a source of annoyance. See table in Plate III.

Lines not actually run, but extended by offsetting around impassable obstacles, are to be dotted or broken lines, as shown on sections 16, 21, and 22, in the specimen plat.

222. Township plats will show the complete condition of all their exteriors, including all closing and standard corners, connecting distances, offsets, and topography. A line common to two townships will be drawn with equal completeness for both, as far as approved surveys permit.

A township rendered fractional by an adjacent reservation or private land grant, will have the intervening boundary properly lettered, and the mile posts and connecting distances shown. The blank area will show its proper designation.

223. Where a fractional portion of a township is newly surveyed, the condition of adjacent areas will be clearly shown by words lettered thereon, such as these: "Unsurveyed," "U. S. National Forest," "Rancho San Luis," "Surveyed by James Jones, 1877," "Lava Bed," or other explanation.

On such supplementary plats, areas previously surveyed will have the sections and lots drawn in blank, to show the contact of old and new work.

224. The line of demarcation, between areas previously counted in total acreage surveyed and the new surveys, will
be distinctly shown. A light diagonal shading with black ink is recommended, to distinguish such a line.

225. Meanders will not be left without any index whatever in field notes and transcripts. They should be traced on the index diagram, and properly marked with page numbers. See note on page 160.

226. The use of small circles on plats, at any of the angles of surveyed lines, has been prohibited, and will not be permitted. Although distinctive marks of that sort are shown on some of the explanatory diagrams of this Manual, yet they are not desired in any kind of plats for official record, under the general rule forbidding useless ornamentation.

227. The meander corners within any township were formerly all numbered consecutively on the plat. The lists of meanders, formerly placed in the margin, made such numbering useful for convenient reference. These lists not being now used, the consecutive numbers are no longer required.

228. As a general rule, a quarter section is returned as surveyed land when three of its regular corners have been legally established. The following exceptions are made to this rule:

When no authority had been given for the subdivision of that township or part of township, as in the case of the extreme quarter sections at the corners.

Where there is no corner opposite one of the three corners to which the prolongating line can be connected.

229. When the land forms part of a fractional section where areas cannot be accurately computed without the survey of other boundaries of the section, as in section 2 when it has its north and east but not its west line established.

When undetermined corners of the sections are in mountainous regions pronounced unsurveyable in the returns, or where witness corners have been substituted for true corners of the tract, at a distance greater than 10 chains.

FRACTIONAL LOTS.

230. The subdivision of fractional sections into lots is performed in the drafting division of the several offices, and not by the surveyor. Skill and judgment are required, to produce these lots in the most convenient and equitable form for both the purchaser and the Government. In addition to former rules, the following are now given:

231. Avoid needlessly small subdivisions.

Avoid giving to lots a long shore line with small width. Therefore apportion the privileges of water front among as many lots as regular division lines will permit, and let the longer direction extend back from the shore rather than along the water.

232. Instead of making as many full forty-acre tracts as possible, leaving small fractions of a few acres along the shore or other boundary, attach such marginal strips to the forties, making tracts of 45, 50, or 55 acres. But when the area of a fractional lot would equal or exceed 60 acres, it should be divided. No lot should lie partly in two sections.

233. The subdivision of fractional sections into regular lots (as near as may be) will be so laid down on the official township plat in broken black lines as to admit of giving to each a specific designation by word description, if possible, according to its relative position in the fractional section, as per examples on Plate III; or by a number, in all cases where the lot can not properly be designated as a quarter quarter. Those fractional lots which are not susceptible of being described according to relative local position will be numbered in a regular series; those bordering on the closing boundaries of a township to be numbered progressively from east to west or from north to south, in each regular section. As section 6 borders on both the north and west boundaries of the township, the fractional lots in the same will be numbered as follows: commencing with No. 1 in the northeast, whence progressively west to No. 4 in the northwest, and south to No. 7 in the southwest corner of the section.

234. To secure a uniform system for numbering lots of fractional sections, including those above specified, imagine the section divided by three equidistant parallel latitudinal lines into four strips or tiers, numbered from north to south; then, beginning with the eastern lot of the north tier, call it No. 1, and continue the numbering west through the tier, then cast in the second, west in the third, and east in the fourth tier. A lot extending north and south through two, or part of two tiers, will be numbered in the tier containing its greater area. In case any tier is without numbered lots, the numbering will be continued in the next tier to the south. (Plate III, section 18.)

This method of numbering will apply to any part of a section, regardless of the relative situation of a part or parts surveyed and lotted under a prior contract; in this case the lot numbers will be a continuation of the series already initiated.

A section that has been partly surveyed at different times should have no duplication of lot numbers.

235. When, by reason of irregular surveys or from other causes, the length of a township from south to north exceeds the lawful length of 480.00 chains, or the width from east to west exceeds 480.00 chains minus the proper convergence, to such extent as to require two or more tiers of lots along the north boundary, or two or more ranges of lots along the west boundary, as the case may be, the entire north or west portions of said sections beyond the quarter corner will be properly lotted, and to each lot will be assigned its proper number, and in such cases the area of each lot will be stated on the plat.

In case the length or width of the township falls so far short of legal dimensions as to eliminate the north or west half of any section situated as above specified, that part of the section remaining will be treated in a similar manner.

236. In a regular township (Plate III) the southeast quarter of the northwest quarter of section 6 will have its proper area in acres (40) inserted in all cases. The half quarter sections in north tier and west range of sections will exhibit their proper areas in acres (80); while the areas of quarter sections will be omitted, except as follows:

237. When two lines of legal subdivision of either 160, 80, or 40 acre tracts intersect each other on or so near a meander or boundary line that the ordinary inaccuracies of drawing would leave the areas of said tracts in doubt, the plats will, for
the sake of clearness and a full showing of the facts, exhibit the proper areas of such quarter, half-quarter, and quarter-quarter sections. See examples, Plate III, in sections 13, 17, 25, and 35.

**TRANSCRIPTS.**

238. Transcripts of field notes should have a proper heading on each page. Instead of the perplexing title, "Exterior Boundaries of T. 12 N., R. 4 W.,” specify on each page thus: "West Boundary," or "N. Bdy. of T. 12 N., R. 4 W."

239. The index diagram of exteriors will show lines drawn in their true directions, as on page 152; thus, range lines will not be shown horizontally.

240. Where corrections in the field have been permitted, care will be exercised that field notes thereof be added to former field notes with proper dates, explanations, and additional oaths.

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241. The sheets of each book are to be firmly bound together. But eyelets or clasps which prevent separating sheets without injury, are not to be used in documents or official correspondence.

A series of books under one contract should be lettered on the title page, A, B, etc., in their proper and consecutive order of dates; and in subsequent correspondence it will be convenient to refer to each book by its letter.

242. With the copy of each township plat furnished to a district land office, the surveyor general is required by law to furnish descriptive notes of the character and quality of the soil and timber found on and in the vicinity of each surveyed line, and to give a description of each corner.

Printed blank forms of such notes are furnished by the General Land Office. The forms provide eighteen spaces for meander corners, which, in most cases, will be sufficient; but when the number shall exceed eighteen, the residue will have to be inserted on the supplemental blank form.

**COMPUTATION OF THE AREAS OF LOTS ADJOINING THE BOUNDARIES OF TOWNSHIPS.**

243. In regular townships, the tracts of land in each section adjoining the north and west boundaries of such townships, in excess of the regularly subdivided 480 acres (except in section 6), will, in general, be in the form of trapezoids, 80.00 chains in length by about 20 chains in width.

Of the plats of such townships, each of said tracts will be divided into four lots, by drawing broken lines at intervals of 20.00 chains, parallel to the ends of the tracts, which will be regarded as parallel to each other.

With the exception of section 6, the south boundaries of sections of the north tier, when within prescribed limits, will be called 80.00 chains.

When the above-named conditions obtain, the areas of the lots in any one tract (except in section 6) may be determined, as follows:

Divide the difference between the widths of the ends of the tract by 4; if 3 remains, increase the hundredth figure of the quotient by a unit; in all other cases disregard the fraction; call the quotient thus obtained, "d”; then, taking the end widths of the tract in chains and decimals of a chain, the areas of the lots, in acres, will be:

Of the smallest lot: twice the width of the lesser end, plus "d”.

Of the largest lot: twice the width of the greater end, minus "d”.

Of the smaller middle lot: sum of the widths of the ends, minus "d”.

Of the larger middle lot: sum of the widths of the ends, plus "d”.

A check on the computation may be had by multiplying the sum of the widths of the ends of the tract by 4; the product should agree exactly with the total area of the four lots.

The proper application of the above rules will always give areas correct to the nearest hundredth of an acre; and, as the use of fractions is entirely avoided, the method is recommended for its simplicity and accuracy.

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Example 1. (See Plate III, section 31.)

The 1/4 difference of latitudinal boundaries is 0.034 chains; consequently, "d" is .04 chains; then,

\[
\begin{align*}
18.35 \times 2 &= +.04 = 36.74 \text{ acres, the area of lot 1;} \\
18.50 \times 2 &= -.04 = 36.96 \text{ acres, the area of lot 4;} \\
18.35 + 18.35 &= .04 = 36.81 \text{ acres, the area of lot 2;} \\
18.50 + 18.35 &= .04 = 36.89 \text{ acres, the area of lot 3.} \\
\text{Check:} (18.35 + 18.50) \times 4 &= 147.40 \text{ acres, the area of the four lots.}
\end{align*}
\]

The arithmetical operations are here written in detail, for the purpose of illustration; but the practical computer will perform all the work mentally.

244. Section 6. (See Plate II, figs. 6 and 7; and Plate III.)

The areas of lots 5, 6, and 7 may be obtained by the foregoing rules in all cases, except when the township closes on a base line or standard parallel; also, the area of lot 4, provided both meridional boundaries are 80.00 chains in length; when the last condition obtains, the areas of lots 1, 2, and 3 will be equal, and each will contain 40.00 acres.

In any case where the west boundary of sec. 6, is 80.00 chains, and the east boundary either greater or less than 80.00 chains, the areas of lots 1, 2, and 3 will be computed as follows:

Refer to figures 6 and 7 and determine the difference, "q", between the east boundaries of lots 1 and 4 by the following proportion:

\[
\text{N. bdy. sec. 6.: diff. of meridional bdry. sec. 6.: 60 chs.: q; then will E. bdy. lot 4 = E. bdy. lot 1 ± q; in which, } "q" \text{ will be added when the east boundary of sec. 6 is less than 80.00 chains (fig. 7); but subtracted when said east boundary is greater than 80.00 chains (fig. 6). }
\]

Now take one third of "q,” and add it to the shorter east boundary of lots 1 or 4, as conditions may require, and thereby determine the length of one of the meridional boundaries of lot 2; to which, again add "one third of q,” and thus obtain the length of the opposite side of lot 2. The areas of lots 1, 2, and 3, in acres, will be found by taking the sum of their respective meridional boundaries, expressed in chains and decimals of a chain.

725
The area of lot 4 may be had by multiplying its mean width by its mean length.

Finally, to test the entire work, multiply the sum of the latitudinal boundaries by 4, and to the product add the area of the small triangle C A B, if the east boundary is greater than 80.00 chains (fig. 6); but subtract the area of said small triangle if the east boundary is less than 80.00 chains (fig. 7). These operations, correctly performed, will give the true area of the section, which should agree exactly with the total area of its legal subdivisions, obtained as directed in the preceding paragraphs.

Example 2. (See Plate II, figs. 6 and 7, and Plate III.)

Compute areas of lots 5, 6, and 7 of sec. 6, as directed in paragraph 1, and illustrated by the example; then write:

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>77.75</td>
<td>0.05</td>
<td>00.00</td>
<td>0.0386</td>
<td>0.0129</td>
</tr>
<tr>
<td>20.0500</td>
<td>0.0386</td>
<td>20.02</td>
<td>E. bdy. of lot 4;</td>
<td></td>
</tr>
<tr>
<td>20.0114</td>
<td>0.0129</td>
<td>20.02</td>
<td>E. bdy. of lot 3;</td>
<td></td>
</tr>
<tr>
<td>20.0243</td>
<td>0.0129</td>
<td>20.04</td>
<td>E. bdy. of lot 2;</td>
<td></td>
</tr>
</tbody>
</table>

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Then, for the areas of lots 1, 2, 3, and 4, we have:

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.05 + 20.04</td>
<td>40.09, the area of lot 1;</td>
</tr>
<tr>
<td>20.04 + 20.02</td>
<td>40.06, the area of lot 2;</td>
</tr>
<tr>
<td>20.02 + 20.01</td>
<td>40.03, the area of lot 3;</td>
</tr>
<tr>
<td>20.00 + 20.01 x 17.76 + 17.78</td>
<td>35.54, the area of lot 4.</td>
</tr>
</tbody>
</table>

Then, for the area of lots 1, 2, 3, and 4, we have:

<table>
<thead>
<tr>
<th>chs.</th>
<th>chs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.05 + 20.04</td>
<td>40.09, the area of lot 1;</td>
</tr>
<tr>
<td>20.04 + 20.02</td>
<td>40.06, the area of lot 2;</td>
</tr>
<tr>
<td>20.02 + 20.01</td>
<td>40.03, the area of lot 3;</td>
</tr>
<tr>
<td>20.00 + 20.01 x 17.76 + 17.78</td>
<td>35.54, the area of lot 4.</td>
</tr>
</tbody>
</table>

Area of regular subdivisions = 360.00

Total = 622.87, the area of sec. 6.

Check: 171.78 + 77.751 x 4 = 622.48, the area of triangle C A B (fig. 6).

Total = 622.87, which agrees with the area of section 6, before determined.

245. The area in acres of a tract 40.00 chains long, adjoining north or west township boundaries (except in NW. ¼ sec. 6), is equal to the sum of its parallel boundaries (expressed in chains and decimals thereof) multiplied by 2; e. g., the area of lots 6 and 7 (Plate II, fig. 6), is [17.87 + 17.811 x 2 = 71.36 acres.

The area in acres of a tract 60.00 chains long, situated as above described (excluding lot 4, of sec. 6), may be found by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 3; e. g., fig. 6; south boundary lot 4 = 17.78 chs.; area of lots 5, 6, 7 is [17.78 + 17.811 x 3 = 106.95 acres. (See example 2.)

The area in acres of quarter sections adjoining north and west township boundaries (excluding NW. ¼ sec. 6), may be obtained by multiplying the sum of their parallel boundaries (taken in chains and decimals of a chain), by 2; e. g., the area of SW. ¼ sec. 6 (fig. 6), is [37.87 + 37.81] x 2 = 151.36 acres.

The area in acres of any section along the north and west boundaries of regular townships (except sec. 6) may be had by multiplying the sum of its parallel boundaries (expressed in chains and decimals of a chain) by 4; e. g., the area of sec. 1 (Plate III) is [80.00 + 79.771 x 4 = 639.08 acres.

Subdivisions closing irregularly to the south or east exterior boundary are to be computed by similar methods.

EXPLANATIONS OF ARTICLES ON PAGES 80 to 86, WITH GENERAL DEFINITIONS OF A "RETRACEMENT" AND A "RESURVEY."

246. When new surveys are to be initiated or closed upon the lines of old surveys, which although reported to have been executed correctly, are found to be actually defective in alignment, measurement, or position, it is manifest that the employment of the regular methods prescribed for surveying normal township exteriors and subdivisions would result in extending the imperfections of the old surveys into the new, thereby producing irregular townships bounded by exterior lines not in conformity with true meridians or parallels of latitude, and containing trapezium-shaped sections which may or may not contain 640 acres each, as required by law.

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247. Therefore, in order to extend such new surveys without incorporating therein the defects of prior erroneous work, special methods, in harmony as far as practicable with the following requirements, should be employed, viz:

The establishment of township boundaries conformable to true meridian and latitude lines.

The establishment of section boundaries by running two sets of parallel lines governed respectively by true meridians and parallels of latitude, and intersecting each other approximately at right angles at such intervals as to produce tracts of square form containing 640 acres each.

The reduction to a minimum of the number of fractional sections in a township, and consequently of the amount of field and office work.

248. Such special methods are based upon certain limits of allowable error in the alignment, measurement, and position of old township boundaries, as prescribed in the following article entitled "Definitions of Defective Township Boundaries," which will be carefully determined and rectifications made, if necessary, under the provisions of the article entitled "Retracement or Resurvey of Township Lines and Linear Boundaries not Established in Conformity with the Rectangular System of Surveying," page 80, prior to the execution of new surveys under the methods prescribed by the article entitled "Methods of Executing New Surveys, when Initiated or closed upon Defective old Surveys," page 82, and illustrated on Plate VI, by figures 1 to 15; on Plate VII, figures 11 to 7, and on Plate VIII.

249. In order to prevent any misunderstanding relative to the modus operandi indicated by the terms "retracement" and "resurvey," the following definitions of the same are here presented:

The retracement of a township boundary, or other line of survey, consists in the determination of the true bearings and distances between the successive corners along the entire length of such a line; and the data thus obtained will be
embodied in the field notes together with detailed particulars of the methods employed.

The resurvey of a township boundary or other line of survey consists of a retracement of such a line accompanied by the reconstruction of defective original corners and the establishment thereon of all the necessary new corners; and the detailed particulars of the entire operations will be embodied in the field notes.

DEFINITIONS OF DEFECTIVE TOWNSHIP BOUNDARIES.

250. Upon retracement thereof, an old township boundary may be found to be defective in one or all of three qualifications, viz.: alinement, measurement, and position, as follows:
   In alinement: when any portion thereof deviates more than twenty-one minutes of arc from a true meridian or latitude line.
251. In measurement: when the length of the whole boundary or some portion thereof, between two successive corners, is proved to be greater or less than the distance certified in the preceding survey, at a rate exceeding 25 links to the half mile.
252. In position: when the corners originally established on such a boundary can not be connected with the corners on the opposite regu-

larly established boundary, by lines which do not deviate more than twenty-one minutes of arc from true meridian or latitude lines.

253. The limits prescribed in the foregoing paragraph are to be considered only in determining the necessity of resurveying old township boundaries when new surveys are to be initiated or closed upon the same, and will not be construed in any way as establishing limits of allowable error in the execution of new surveys.

RETRACEMENT OR RESURVEY OF TOWNSHIP LINES AND LINEAR BOUNDARIES NOT ESTABLISHED IN CONFORMITY WITH THE RECTANGULAR SYSTEM OF SURVEYING.

254. If in subdividing a township, it is found that any boundary thereof is defective in excess of the limits of allowable error prescribed in the article entitled "Definitions of Defective Township Boundaries," above, or that the corners originally established thereon had been incorrectly marked, or have been obliterated, the deputy surveyor will resurvey so much of said boundaries as may be necessary.

255. Such necessity is often doubtful until proved by retracement. In connecting new surveys with accepted lines, when mislosure appears, the presumption is in favor of accepted work instead of new lines. A deputy must first examine and remeasure his own lines for possible error; and if he finds them accurate, and is willing to confide the result to a strict inspection thereof, he is to retrace the older work to find the cause of the mislosure. Such retracements and resurveys receive special attention in the inspection; and if their necessity and accuracy are corroborated by the examin-

er, and approved by the Commissioner, the deputy will be allowed compensation. (See 27 L. D. 79.)

256. When subdivisional lines have not been closed upon either side of, or mineral claims tied to, a township boundary, it will be corrected (if necessary), in point of alinement, as well as measurement, by establishing regular new corners at lawful distances (minus the northings or plus the southings of the south boundary; or minus the westings or plus the eastings of the east boundary), from said boundaries respectively (as the case may be), upon a right line connecting the proper township corners, provided said line does not deviate more than twenty-one minutes of arc from a true meridian or latitude line (as the case may be). (See Plate VI, figs. 1, 2, 3.)

But, if the bearing of said line exceeds the limit prescribed above, the new corners will be placed on a line run due north or west, from the southeast corner of the township, to intersection with the township or range line (as the case may be), where a closing corner will be established, and the old township corner properly changed to a corner common to two townships.

The old corners on all township boundaries rectified under the provisions of this paragraph will be destroyed. (See Plate VI, figs. 4 and 5.)

257. Where subdivisional lines have been closed upon one side of, or mineral claims tied to, a township boundary prior to the subdivision of the township on the other side, its alinement will not be changed; all obliterated old corners will be reestablished in their original places; new regular corners common to two townships, sections, or quarter sec-

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tions, will be established upon it at lawful distances (minus the northings or plus the southings of the south boundary; or minus the westings or plus the eastings of the east boundary), from said boundaries respectively (as the case may be), marked with reference to the township being subdivided, and the marks on the old corners upon such boundary which refer to the new work will be effaced.

Marks on bearing trees will be corrected (if necessary) to indicate the township, range, and section in which they stand, but the mounds will remain as originally established. (See Plate VI, figs 6 and 7.)

258. Where subdivisional lines have been closed upon one side of, or mineral claims tied to, the northern portion of a range line prior to the subdivision of the township on the other side (see section 257), while upon the southern portion of the same such attachments have not been made on either side (see section 256), said southern portion will be resurveyed and proper new corners established thereon, at lawful distances from the south boundary, as follows:

If the bearing of said southern portion does not deviate more than twenty-one minutes of arc from a true meridian line, it will be rectified under the provisions of the first clause of section 256, and the rectifications will be continued on the northern portion under the provisions of section 257. (See Plate VI, fig. 8.)

If, however, said bearing exceeds the specified limit, from the northern terminal corner of said southern portion, the range line will be extended due south on a random to its intersection with the south boundary, where a corner com-
mon to two townships will be established, all the necessary changes made in the markings on the original corner common to four townships situated in its immediate vicinity, and regular new corners placed upon the respective portions of the entire range line as specified in the foregoing clause. (See Plate VI, fig. 9.)

259. Similar cases involving the rectification of the northern portion of a range line when the southern portion of the same can not be rectified in bearing, will be treated in conformity with the rules prescribed in the foregoing clauses, with the exception, that where such northern portion deviates more than twenty-one minutes of arc from a true meridian line, its alignment will be rectified by extending the same from its southern terminal corner, due north on a true line to its intersection with the north boundary, where a proper closing corner will be established and the necessary corrections applied to the old corner common to four townships in its immediate vicinity, so as to change it to a corner common to two townships. (See Plate VI, figs. 10, 11, and 12.)

In the treatment of latitudinal township lines the rule prescribed in the foregoing clauses will be applied, observing, however, that the stated designations north or south will correspond in such cases to west or east, respectively.

260. When subdivisional lines have been closed upon one or both sides of, or mineral claims tied to, the northern and southern portions of a range line, while the middle portion thereof is free from such attachments, said portion will be resurveyed and new regular corners will be established thereon at intervals of forty chains from its southern terminal corner, upon a right line connecting the original terminal corners thereof, the fractional measurement being thrown against the northern terminal corner. (See Plate VI, figs. 13, 14, and 15.)

In such cases all the original corners, excepting the terminal corners, of the portion of the lines thus resurveyed, will be destroyed.

The rectification of the middle portions of latitudinal township lines, on which the conditions specified above obtain, will be executed in a similar manner, observing, however, that the designations north or south in the foregoing clauses will in such cases correspond to west or east, respectively.

261. Under the foregoing paragraphs, the fact that mineral claims have been tied to a defective township boundary as therein specified, will act as a bar to the rectification of such a boundary in alignment, only when the number of claims involved is great; while in cases where a few such claims have been connected with a few of the corners on such a boundary, said boundary will be rectified in alignment and new corners placed thereon, care being taken, however, to perpetuate in a proper manner such old corners as are found to be connected with the claims; and the methods employed to accomplish the same, together with the bearings and distances of such old corner from the new, will be briefly recorded in the field notes.

262. New corners on defective township boundaries must be established by an actual survey of such lines, and in no case will such corners be established from data acquired in running lines closing upon the same.

263. In the retracement or resurvey of base lines, standard parallels, principal meridians and guide meridians, two sets of chainmen will be employed, while for similar work on township lines, not of the character specified above, only one set of chainmen is required, and in cases where conditions such as specified in section 257 obtain, the bearings and distances between successive old corners and the connections of all new corners with the nearest old corners, will be carefully determined and recorded in the field notes.

Regarding restoration of lost corners, by private and county surveyors, see page 191.

264. When township or subdivisional lines intersect the boundaries of confirmed private land claims, or any other linear boundaries established at variance with the rectangular system of surveying, as much of said boundaries will be retraced as may be necessary, temporary stakes being set at intervals often chains thereon, and also at each angle formed by a change in the direction of the same.

All obliterated boundary corners will be reestablished in their original places, and the regular surveys will be closed upon the retraced line as prescribed for "closings" in page 60.

METHODS OF EXECUTING NEW SURVEYS, WHEN INITIATED OR CLOSED UPON OLD SURVEYS, AND EXPLANATION OF FIGURES ON PLATE VI.

265. Such methods are illustrated by the several figures on Plate VI, the rectification of the lines of old surveys, and the establishment of new township exterior and subdivisional lines connected with such old lines, being based upon the rules prescribed in the article entitled "Retracement or Resurvey of Township Lines," etc., page 80.

In considering the several cases, the probable obtaining conditions relative to a range line have been adopted in order to reduce the number of figures on said plate, and, to curtail also as much as practi-
line not deviating more than twenty-one minutes of arc from a true meridian line.

It will be rectified under the rules prescribed by clause 1, section 256, from the proper corners the west and north boundaries will be established in the regular manner, as well as the subdivisions within the exteriors thus rectified and established.

267. Fig. 2. The east boundary defective in measurement. It will be rectified under clause 1, section 256, while the west and north boundaries will be established, and the subdivisions executed in the regular manner.

268. Fig. 3. The east boundary defective in position. Since the south boundary deviates from a true east and west line by more than twenty-one minutes of arc, said east boundary will be rectified under clause 1, section 256; the west and north boundaries will be established in the regular manner, and the subdivisions will be executed from north to south, and from west to east, commencing at the corner of sections 1, 2, 35, and 36, and closing the fractional measurements on the south and west boundaries, as such closings are made in regular subdivisions on the north and west boundaries.

269. Fig. 4. The east boundary defective in alinement. It will be rectified under clause 2, section 256; while the west and north boundaries will be established, and the subdivisions executed, in the regular manner.

270. Fig. 5. The east boundary defective in alinement and measurement. It will be rectified under clause 2, section 256; the west boundary will be established in the regular manner, while from the corner common to two townships on the rectified east boundary, the north boundary will be run west on random and east on true line, permanent corners common to sections and quarter sections of the township to be subdivided being established on the same.

The subdivisions will be executed in the regular manner.

271. Fig. 6. The south and east boundaries being defective in alinement, measurement, and position, will be rectified under clause 1, section 257; the west boundary will be established in the regular manner, and the north boundary by east on random, and west on true line, throwing the fractional measurement against the old east boundary;

272. Fig. 7. The north, south, east, and west boundaries being defective in alinement, measurement, and position. The south and east boundaries will be rectified under clause 1, section 257; while the west and north boundaries will be retraced for length and bearing, any obliterated old corners being reestablished in their original places.

273. The subdivisions will be executed as follows:
From the corners of sections 35 and 36, and 25 and 36, the lines between said sections will be extended due north and west, respectively, to their mutual intersection, where the corner of sections 25, 26, 35 and 36, will be established.
From said corner, the line between sections 26 and 35, 27 and 34, 28 and 33, 29 and 32, and 30 and 31 will be projected due west on a true line to its intersection with the west boundary of the township, where a closing corner will be established. A line thus run is termed a

SECTIONAL CORRECTION LINES;

and when such an auxiliary line, thus projected, intersects its objective limiting line in such proximity to its objective corner that the accessories of the two corners would interfere, that portion of the auxiliary line situated between the last-established section corner and the limiting line will be changed in alinement to close upon the corner found, thus avoiding placing two corners in close proximity.

274. From the initial point of the sectional correction line, which, in this case, is the corner of sections 25, 26, 35, and 36, the line between sections 25 and 26, 23 and 24, 13 and 14, 11 and 12, and 1 and 2, will be projected north on a true line to its intersection with the north boundary, where a closing corner will be established. A line thus established is termed a

SECTIONAL GUIDE MERIDIAN.

South of the sectional correction line, and east of the sectional guide meridian, the subdivisions will be closed upon the south and east boundaries by random and true lines, throwing the fractional measurements against the same, as such closings are made in regular surveys on the north and west boundaries; while that portion of the township situated to the north and west respectively, of said auxiliary lines, will be subdivided in the regular manner, the parallelism of the latitudinal section lines being referred to the sectional correction line, and that of the meridional section lines to the sectional guide meridian.

Closings on the west and north boundaries will be made by random and true lines, when the fallings are less than 50 links per mile, and by true lines run to closing corners when the fallings exceed said limit.

275. Fig. 8. The east boundary defective in measurement, the northern portion of the same being unchangeable, while the southern portion admits of rectification.

The east boundary will be rectified under clause 2, section 257, the west and north boundaries will be established, and the subdivisions executed, in the regular manner.

276. Fig. 9. The east boundary defective in alinement and measurement, the northern portion thereof being unchangeable, while the southern portion of the same admits of rectification.

The east boundary will be rectified under clause 3, section 258, the south boundary, under clause 1, section 257; the west boundary will be established in the regular manner; while the north boundary will be run east on random, and west on true line, throwing the fractional measurement against the east boundary.

The subdivisions will be executed from south to north, and from west to east, closing the fractional measurements on the north and east boundaries, as such closings are made in regular surveys on the north and west boundaries.

277. Fig. 10. The east boundary defective in measure-
ment, the southern portion thereof being unchangeable, while the northern portion admits of rectification.

The east boundary will be rectified under clause 4, section 258; while the west and north boundaries will be established, and the subdivisions executed in the regular manner.

278. Fig. 11. The east boundary defective in alinement and measurement, the southern portion thereof being unchangeable, while the northern portion admits of rectification.

The east boundary will be rectified under clause 1, section 259; the west boundary will be established in the regular manner; the north boundary by east on true line to closing corner, the fractional measurement being thrown against the old east boundary; while the subdivisions will be executed from south to north, and from west to east, the fractional measurements being thrown against the old north and east boundaries, as such closings are made in regular surveys against the north and west boundaries.

279. Fig. 12. The east boundary defective in measurement; the northern and southern portions thereof being unchangeable, while the middle portion admits of rectification.

The east boundary will be rectified under clause 1, section 260, the west and north boundaries will be established, and the subdivisions executed in the regular manner.

280. Fig. 13. The east boundary defective in alinement and measurement; the northern and southern portions thereof being unchangeable; while the middle portion admits of rectification.

The east boundary will be rectified under clause 1, section 260; the west boundary will be established in the regular manner; the north boundary by west on random and east on true line, the fractional measurement being thrown against the old east boundary; while the subdivisions will be executed from south to north and from east to west, closing the fractional measurements against the east, north and west boundaries.

281. Fig. 14. The east boundary defective in alinement and measurement; the northern and southern portions thereof admitting of rectification in any way, since subdivisional surveys have been closed upon both sides of the same; while the middle portion admits of rectification in measurement.

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The east boundary will be rectified under clause 1, section 260; the west boundary will be established in the regular manner, the township corner at the end of six miles thereon being temporarily established.

From said temporary corner, the fractional north boundary will be run east on random to the nearest old established corner on the same, at which point the falling of the random is within 50 links per mile, said boundary will be corrected westward on true line, setting corners common to the sections and quarter sections on the north, at regular intervals from the initial point of the true line, and throwing the consequent fractional measurement in its normal place against the new west boundary, while the temporary township corner previously established thereon will be made permanent.

If, however, the falling defined above exceeds the stated limit from the last established corner of the old surveys, the fractional north boundary will be projected due west to its intersection with the west boundary, at which point the proper township corner will be permanently established, and the temporary corner destroyed.

In establishing the corners on said north boundary under the latter procedure, the requirements prescribed in the former relative to the allowance for fractional measurement will be strictly observed.

In subdividing, the methods prescribed under Fig. 6 will be applied as far as practicable. The details of the case under consideration are clearly exhibited by fig. 14.

282. Fig. 15. All of the boundaries are assumed to be defective in alinement, measurement, and position; also portions of each as being closed upon by subdivisional surveys and consequently unchangeable relative to the old surveys, while other portions of the same being free from such attachments, admit of rectification.

This figure is constructed on a larger scale than those explained in the preceding paragraphs, in order to illustrate in detail the modus operandi to be pursued in rectification, under the rules of the article on retracements applicable to each of the obtaining conditions, and also in subdividing within the rectified exteriors.

HIATURES AND OVERLAPS.

283. The several figures on Plate VII illustrate in detail the methods to be employed in connecting the unsurveyed portions of two or more township boundaries, when four of such fractional lines, upon being projected toward each other in the direction of the cardinal points by lines not deviating more than 21 minutes of arc from true meridian or latitudinal lines, do not form a common intersection.

Said methods, in addition to the reasons embodied in the article entitled "Explanations of Articles," etc., page 78, are based upon the following desiderata, viz:

1. The adjustment of such township boundaries so as to maintain section 36 in a condition theoretically and practically perfect, according to the requirements of the rectangular system of surveying.

2. That in accomplishing the above, the resultant fractional excess or deficiency (which for brevity of explanation is termed "the rectangular fraction") will be thrown into, or taken out of section 6, whenever practicable.

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3. That all incidental fractional measurements developed in the establishment of township boundaries or subdivisional lines by such methods shall be thrown against the old surveys whenever practicable.

284. In considering said methods it will be observed that the condition to be dealt with are either hiatures or overlaps, the former possessing three characteristic features, which are named as follows:

Simple hiatus. See figures 1 and 2, Plate VII.

Meridional hiatus. See figure 3.

Latitudinal hiatus. See figure 4; while overlaps are shown by figure 5.

As the application of said methods, when the conditions exhibited obtain, gives similar results with but few excep-
tions, which will be specifically detailed hereafter, the condition represented by A, figure 3, will be considered and the method of connection described as an example, upon the following assumptions, viz:

That of the boundaries of townships 1 and 2 north, ranges 3 and 4 west, those portions indicated by broken lines are unsurveyed;

That it is required to connect said portions in order to complete the subdivisions in one or more of the townships.

Beginning at the established terminal corners on the south and east boundaries of T. 2 N., R. 4 W., blank lines will be projected due east and due south, respectively, with temporary stakes at intervals of ten chains, to an intersection, which point will be marked by a temporary stake;

Then, from the established terminal corners on the west and north boundaries of T. 1 N., R. 3 W., true lines will be projected due north and due west, respectively, with regular corners for two sections and quarter sections, to an intersection, which point will be marked by a temporary stake;

Then, by proper measurements, the character of the resulting condition will be determined, and by comparison with diagrams A, of the figures on Plate VII, the particular method of connection will be obtained and applied.

285. Said condition in the case under consideration, it will be observed, is a meridional hiatus; therefore, from the temporary stake marking the intersection of the extended south and east boundaries of T. 2 N., R. 4 W., which will be replaced by a permanent corner (common to two townships) for T. 1 N., R. 3 W., and T. 2 N., R. 4 W., the south boundary of the latter will be extended due east to its intersection with the west boundary of the former, where a corner for (one township only) T. 1 N., R. 4 W., will be permanently established;

Then, from the corner for T. 1 N., R. 3 W., and T. 2 N., R. 4 W., the south and east boundaries of the latter will be corrected back west and north, respectively, on true lines, establishing regular corners common to two quarter sections and sections of said township, to the initial points of the blank lines, against which the resulting fractional measurements will be thrown, while the stakes temporarily established on the blank lines at intervals of ten chains will be destroyed;

Then, from the stake temporarily marking the intersection of the north and west boundaries of T. 1 N., R. 3 W., which will be destroyed, the former boundary will be extended due west to its intersection with the east boundary of T. 2 N., R. 4 W., where a proper closing corner will be established, the resulting fractional measurement thrown against the same, and the distance to the nearest corner on said boundary carefully determined and recorded in the field notes.

Thus section 36 is made full, serving as a perfect base on which to initiate the subdivisinal work in T. 2 N., R. 4 W.; the rectangular fraction, which in this case indirectly represents an excess, is incorporated in section 6, which being lotted on two sides in its normal condition, absorbs the excess without deranging materially those portions of the same usually defined as regular subdivisions; while the unsurveyed portions of the entire group of townships are arranged in such a manner as to admit of completing the subdivisinal work therein on the approved rectangular basis.

Relative to incorporating an excess in, or supplying a deficiency from, section 6, simple hiatuses are noted as exceptions to the general rule; therefore, when such hiatuses are square, or longer meridionally (see 1, diagrams A, fig. 1), the rectangular fraction will be taken out of section 31, and incorporated in section 1; but if the length thereof (see 1, diag. A, fig. 2) lie in a latitudinal direction, said rectangular fraction will be taken out of section 1 and incorporated in section 31.

286. If the surveys contemplated, within a group of four townships, consist of the completion of the southeast unsurveyed portion of the northwest township only, the method detailed in the foregoing paragraphs will be employed in all particulars, with the exception that the extension of the north and west boundaries of the southeast township will be omitted; but the completion of the unsurveyed portions of any of the other three demands of the deputy surveyor the performance of the whole operation, and the complete connection of all the boundaries.

When, of four township boundaries whose directions tend to an approximate common point, two of the same have been carried to a mutual intersection, and are closed upon by subdivisinal and other lines (see section 287), the unsurveyed portion of the remaining boundaries will be connected with them by the application of these methods, sufficiently modified to preserve intact the prior subdivisinal surveys.

FRAGMENTARY SUBDIVISION.

287. Plate VIII illustrates the general methods to be employed in the execution of fragmentary subdivisions within townships, portions of which have been subdivided from fractional township boundaries extended from various directions and not connected with each other.

These conditions obtain to a large extent in mountainous regions, where in accordance with the existing provisions, relative to the survey of agricultural lands, in the acts of Congress making appropriations for public-land surveys, such surveys are extended along the valley and bottom lands, leaving the mountainous areas unsurveyed at the time of the execution of the original work; but which, at a later date, in view of other considerations are placed under contract for survey.

288. It is obvious that the number and character of such cases would be too great and varied to be considered in detail; therefore, when the deputy surveyor meets with a case which is not covered exactly by these instructions, or the special instructions from the surveyor general, his thorough understanding of the preceding articles on this subject, and of the conditions illustrated on Plates V and VII, it is expected will point out to him the proper method to be employed.

It is possible, however, that cases may arise so complex in their character as to produce a feeling of doubt relative to the proper solution of the problem; in which case he will at once communicate with this office through the surveyor general, submitting information, by letter and diagrams, of the exact
condition as found by him, and the necessary instructions will be forwarded as soon as practicable.

**GEOGRAPHICAL POSITIONS OF BASE LINES AND PRINCIPAL MERIDIANS GOVERNING THE PUBLIC SURVEYS.**

289. The system of rectangular surveying, authorized by law May 20, 1785, was first employed in the survey of United States public lands in the State of Ohio.

The boundary line between the States of Pennsylvania and Ohio, known as "Elliot's line," in longitude 80° 32' 20" west from Greenwich, is the meridian to which the first surveys are referred. The townships east of the Scioto River, in the State of Ohio, are numbered from north to south, commencing with No. 1 on the Ohio River, while the ranges are numbered from east to west, beginning with No. 1 on the east boundary of the State, except in the tract designated "U. S. military land," in which the townships and ranges are numbered, respectively, from the south and east boundaries of said tract.

290. During the period of one hundred and seventeen years since the organization of the system of rectangular surveying, numbered and locally-named principal meridians and base lines have been established, as shown by the following tabular exhibit. These bases and meridians may all be found by examining the large wall map of the United States, published by the General Land Office. They are also severally shown upon the various official State maps.

(Table III, page 90. deleted. The table contains a list of the Principal Meridians of the contiguous 48 States.)

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**DISUSE OF MAGNETIC NEEDLE SURVEYS.**

291. The strict requirement that all lines of public surveys must be run by courses derived from the true local meridian, independently of the magnetic needle, and subject to close tests by field inspection, renders the data and discussion of magnetic declinations no longer necessary in the Manual. The scientific information heretofore published had apparent value to surveyors required to restore ancient lines; but even in such work there is often wide opportunity for error, from lack of full understanding of the former customs.

292. While some of the early surveyors were exact and faithful men, competent to observe Polaris with the plain compass and note the correct local variation, others probably obtained the figures for declination by hearsay and from distant places; hence implicit reliance can not be placed on calculations based on the presumed change of variation.

An additional reason for considering these matters of magnetic declination less important in old surveys, is that the rules for restoring lost lines and corners place chief importance upon the finding and identification of material evidence in the field, with less regard to theoretical courses.

**METHODS OF OBTAINING A TRUE MERIDIAN.**

293. The work of every deputy surveyor or examiner depends for its correctness upon his using a correct meridian, which can be obtained only by careful observance of the following instructions. They include astronomical tables, adapted from data heretofore supplied by the Coast and Geodetic Survey, and brought down to dates in the twentieth century.

The accuracy with which the meridian may be determined depends chiefly upon the instruments at command and upon the ability and care of the observer in using them. It rests with him to select the proper instrument, the proper method and time for observing. The instruments ordinarily in the hands of the surveyor are sufficiently described in books on surveying or in catalogues of instrument makers. The method to be followed will depend greatly upon circumstances. Thus the sun or the pole star may be observed for azimuth; local time may be had by the method of equal altitudes of the sun, for which the latitude of the place need only to be known roughly. Observations of the pole star for the true azimuth are generally preferred, since no great precision in the local time is required. Tables and explanatory remarks have been inserted to facilitate the use of this method, and will serve for the period 1901 to 1910.

294. The table given in the Manual of 1894 for times of elongation and culmination at 24 dates of the year 1893, with a system of corrections for other years and dates, is now omitted. All the necessary data therein given can now be obtained from the upper culmination table on page 101 in the form already familiar but revised and extended for the present decade.

295. For correct and rapid use of these tables, it is indispensable that the surveyor have clear comprehension of the outlines of the astronomical facts involved, and the term used in dealing with them, such as the following:

The earth's annual motion around the sun.
Its diurnal motion upon its axis.

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The apparent opposite motion of Polaris and other circumpolar stars about the north-polar point in the heavens. (See figure 1 on page 97.)

Mean solar time, derived from successive apparent passages of the sun across the local meridian, and averaged or equalized for the year to remove irregularities caused by the earth's varying distances from the sun, often shown in almanacs under the head, "sun fast" or "sun slow."

Equation of time, as tabulated in the ephemeris.

Sidereal time, measured by the astronomical day of 23 hrs. 56.1 min., the interval between two successive passages of a fixed star across the local meridian.

The civil day, beginning at midnight, and its relation to the astronomical day which begins at noon. The former counts twelve hours twice over, the latter numbers the hours up to 24, and lasts twelve hours after the civil day of the same date is ended.

The culminations of Polaris.
The elongations of Polaris.
The azimuth of Polaris or its apparent distance east or west from the polar point, measured by a horizontal angle at the place of observation.
The hour-angle azimuth of Polaris, at those times when it is neither at elongation nor culmination.

The meridian of any locality. Since any line not coinciding with the true meridian is not a meridian, the use of the word true is superfluous, and generally avoided.

Reduction of standard time to local mean time by difference of longitude.

296. These essentials are presumed to have been acquired in preparatory studies; therefore it is the purpose of the Manual to simplify the work, omit all technicalities requiring a full knowledge of astronomy, and present the method, with two new and compact tables adapted to common clock time, with such plain directions for use that any person of ordinary intelligence can understand and apply them.

297. As the surveyor should have a perfectly clear idea of what is meant by Astronomical Time (used to simplify computations), and the Hour Angle of Polaris, these terms will now be explained.

298. The Civil Day, according to the customs of society, commences at midnight and comprises twenty-four hours from one midnight to the next following. The hours are counted from 12 to 12 from midnight to noon, after which they are again reckoned from 12 to 12 from noon to midnight. Thus the day is divided into two periods of 12 hours each; the first of which is marked a. m., the last p. m.

299. The Astronomical Day commences at noon on the civil day of the same date. It also comprises twenty-four hours; but they are reckoned from 0 to 24, and from the noon of one day to that of the next following.

The civil day begins twelve hours before the astronomical day; therefore the first period of the civil day answers to the last part of the preceding astronomical day, and the last part of the civil day corresponds to the first part of the astronomical day. Thus, January 9, 2 o'clock p. m., civil time, is also January 9, 2, astronomical time; and January 9, 2 o'clock a. m., civil time, is January 8, 14, astronomical time.

300. The rule then for the transformation of civil time into astronomical time is this: If the civil time is marked p. m., take away the designation p. m., and the astronomical time is had without further change; if the civil time is marked a. m., take one from the day and add twelve to the hours, remove the initials a. m., and the result is the astronomical time wanted.

The substance of the above rule may be otherwise stated, as follows: when the surveyor takes an observation during p. m. hours, civil time, he can say; the astronomical time is the hours and minutes passed since the noon of this day; and when observing in the a. m. hours he can say the astronomical time is the hours and minutes elapsed since the noon of yesterday, in either case omitting the designation a. m. or p. m., and writing for the day of the month, that civil date on which the noon falls, from which the time is reckoned. Finally, the astronomical time may be called the hours and minutes elapsed since the noon last past, the astronomical date being that of the civil day to which the noon belongs. Thus, April 23, 4.15 p. m., civil time, is April 23, 4.15, astronomical time, and April 23, 4.15 a. m., civil time, is April 22, 16.15, astronomical time.

The surveyor should thoroughly master this transformation of the civil time into astronomical time, as it will be the first duty he will have to perform after observing Polaris out of the meridian.

The change can be made mentally, no written work being required. Table V might be easily altered to give the times by the civil count marked a. m. and p. m., but such an arrangement would greatly extend and complicate the rules and examples, and correspondingly increase the chances for error.

301. The general use of telescopic instruments makes it far easier to determine a meridian, than formerly when the open-sight compass was almost the only obtainable instrument. In those days it was required that the deputy ascertain for himself by observation what was the true north line, and then observe and record the "variation" of his needle from the north. Instructions for the process have been an important part of the early manuals, and surveyors of integrity faithfully observed them. Similar directions are here given.

TO DETERMINE A MERIDIAN WITHOUT A TELESCOPE.

302. Attach a plumb line to a support situated as far above the ground as practicable, such as the limb of a tree, a piece of board nailed or otherwise fastened to a telegraph pole, a house, barn, or other building, affording a clear view north and south.

The plumb bob may consist of some weighty material, such as a brick, a piece of iron or stone, weighing four to five pounds, which will hold the plumb line vertical, fully as well as one of finished metal.

Strongly illuminate the plumb line just below its support by a lamp or candle, care being taken to obscure the source of light from the view of the observer by a screen.

For a peep sight, cut a slot about one-sixteenth of an inch wide in a thin piece of board, or nail two strips of tin, with straight edges, to a square block of wood, so arranged that they will stand vertical when the block is placed flat on its base upon a smooth horizontal rest, which will be placed at a convenient height south of the plumb line and firmly secured in an east and west direction, in such a position that, when viewed through the peep sight, Polaris will appear about a foot below the support of the plumb line.

The position may be practically determined by trial, the night preceding that set for the observation.

About thirty minutes before the time of elongation, as obtained from the table, bring the peep sight into the same line of sight with the plumb line and Polaris.

To reach elongation, the star will move off the plumb line to the east for eastern elongation, or to the west for western elongation, therefore by moving the peep sight in the proper direction, east or west, as the case may be, keep the star on the plumb line until it appears to remain stationary, thus indicating that it has reached its point of elongation.

The peep sight will now be secured in place by a clamp or weight, with its exact position marked on the rest, and all further operations will be deferred until the next morning.
By daylight, place a slender rod at a distance of two or three hundred feet from the peep sight, and exactly in range with it and the plumb line; carefully measure this distance.

Take from the table on page 95 the azimuth of Polaris corresponding to the latitude of the station and year of observation; find the natural tangent of said azimuth and multiply it by the distance from the peep sight to the rod; the product will express the distance to be laid off from the rod exactly at right angles to the direction already determined (to the west for eastern elongation or to the east for western elongation), to a point, which with the peep sight, will define the direction of the meridian with sufficient accuracy for the needs of local surveyors.

**TO ESTABLISH A MERIDIAN AT ELONGATION BY TELESCOPIC INSTRUMENT.**

303. Set a stone, or drive a wooden peg, firmly in the ground, and upon the top thereof make a small distinct mark.

About thirty minutes before the time of the eastern or western elongation of Polaris, obtained from the table, set up the transit firmly, with its vertical axis exactly over the mark, and carefully level the instrument.

Illuminate the cross wires by the light from a suitable lantern, the rays being directed into the object end of the telescope by an assistant; while great care will be taken, by perfect leveling, to insure that the line of collimation describe a truly vertical plane.

Place the vertical wire upon the star, which, if it has not reached its elongation, will move to the right for eastern, or to the left for western elongation.

While the star moves toward its point of elongation, by means of the tangent screw of the vernier plate it will be repeatedly covered by the vertical wire, until a point is reached where it will appear to remain on the wire for some time, then leave it in a direction contrary to its former motion; thus indicating the time of elongation.

Then while the star appears to thread the vertical wire, depress the telescope to a horizontal position; five chains north of the place of observation, set a stone or drive a firm peg, upon which by a strongly illuminated pencil or other slender object, exactly coincident with the vertical wire, mark a point and drive a tack in the line of sight thus determined; then, to eliminate possible errors of collimation or imperfect verticality of the motion of the telescope, quickly revolve the vernier plate 180°, direct the glass at Polaris and repeat the observation; if it gives a different result, find and mark the middle point between the two results. This middle point, with the point marked

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by the plumb bob of the transit, will define on the ground the trace of the vertical plane through Polaris at its eastern or western elongation, as the case may be.

By daylight, lay off to east or west, as the case may require, the proper azimuth taken from the following table; the instrument will then define the meridian, which may be permanently marked for future reference.

The magnetic declination may be obtained from a true meridian, as follows: Take the magnetic bearing of the true meridian; then the angle expressed by said magnetic bearing will be the observed magnetic declination, named like the departure if the bearing is taken from the south needle-point, but the reverse if from the north.

(The remainder of page 95 and pages 96 through 128 are deleted. They contain instructions and tables for Polaris observations, offsets from the secant and tangent to the parallel, etc. All are technical in character.)

**FIELD EXAMINATION OF SURVEYS.**

368. To insuire the faithful and accurate execution of surveys of Government lands, the Department has found it necessary to adopt a uniform rule requiring all work to be inspected in the field, before its acceptance will be considered. The details of this process are governed by instructions issued by the General Land Office to those serving as examiners of surveys. The rules are subject to such modifications as the good of the service may demand.

369. For several years past, it has been required that 10 per cent of all lines run by a deputy in each township, must be carefully retraced. A full report of all courses, distances, topography, and descriptions of corner monuments and accessories, upon lines examined, must be returned under oath to the Commissioner, for comparison with the returns of the deputy. The examiner's returns must show all distances across lands that are mountainous, heavily timbered, or covered with dense undergrowth.

370. If the examiner finds erroneous or negligent work which in his opinion deserves correction or rejection, he has been instructed to continue his work by extending the retraction to 20 or 30 per cent of the lines, in order to make his evidence conclusive.

371. Examiners are required to observe the rules of the Manual in the technical and professional details, to use instruments of the best construction and adaptation, and to exercise special care that their courses and measurements are precise and free from all error, that no injustice may be done to a deputy. In case a serious error is found, they may repeat the chaining or observation, to guard against possible mistake on their part. They are required, whenever practicable, to make a closed survey around one or several sections, which should close by traverse within limits; also to extend the examination into remote and difficult parts, as well as those easily accessible. Whatever future regulations may be adopted will seek the same purpose of preventing error, negligence or fraud.

[The remainder of this Manual, pages 131 through 203 are deleted. They contain Specimen Field Notes and Index, identical in vein and content to the Manual of 1894.]
SECANT METHOD

Fig. 1.

T.13N. R.21E.

Fig. 2.

Illustrating the Recovery of the Theoretical Portions from the Established Position when the Intersection is shown by less than One Minute of Arc or One Hundredths of a Second, Reg. Officer's Table III.

T.13N. R.21E.

Fig. 3.

TANGENT METHOD.
PLANS OF CORNEI

EXPLANATIONS.

S, 31st, 30th, 29th, 28th

PERSPECTIVE.

of Standard Tp Cor., with Closing Tp Cornei.

Corners, referring to 1 Township, only.