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(This copy of the 1902 Manual is taken from an original volume now in the possession of the BLM, Oregon State Office, Portland.)

**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.

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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.

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(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."

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.

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

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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 interval 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 II), 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.

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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 arc; the declination of the sun, corrected

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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 hillsides, 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 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 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 alinement 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 scribing 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.

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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 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 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,

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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:

A.	for acres.	mag.	" magnetic.
a. m.	" forenoon.	M. C.	" Meander corner.
A. M. C.	" aux. meander corner.	mer.	" meridian.
asc.	" ascend.	mkd.	" marked.
astron.	" astronomical.	N.	" north.
bdy.	" boundary.	NE.	" northeast.
bdrs.	" boundaries.	NW.	" northwest.
bet.	" between.	obs.	" observe.
B. O.	" bearing object.	obsn.	" observation.
B. T.	" bearing tree.	p. m.	" afternoon.
C. C.	" closing corner.	Pol.	" Polaris.
chs.	" chains.	Pr. Mer.	" principal meridian.
cor., cors.	" corner, corners.	Pt. of Tr.	" point of triangulation.
corr.	" correction.	¼ sec.	" quarter section.
decl.	" declination.	R., Rs.	" range, ranges.
dep.	" departure.	red.	" reduce, reduction.
desc.	" descend.	S.	" south.
dia.	" diameter.	S. C.	" standard corner.
diff.	" difference.	SE.	" southeast.
dist.	" distance.	sec., secs.	" section, sections.
D. S.	" deputy surveyor.	S. M. C.	" special meander corner.
E.	" east.	sq.	" square.
elong.	" elongation.	St. Par.	" standard parallel.
frac.	" fractional.	SW.	" southwest.

ft. " foot, feet.
 G. M. " guide meridian.
 h., hrs. " hour, hours.
 ins. " inches.
 lat. " latitude.
 L. C. " lower culmination.
 lks. " links.
 l. m. t. " local mean time.
 long. " longitude.
 m. " minutes.

T., or Tp. " township.
 Ts., or Tps. " townships.
 temp. " temporary.
 U. C. " upper culmination.
 var. " variation.
 W. " west.
 W. C. " witness corner.
 w. corr. " watch correction.
 W. P. " witness point.
 w. t. " watch time.

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 earth.

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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; dig pits, 30 X 24 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, 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 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 stone¹, 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., marked²

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 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.

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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 1½ ft. high, with 2 ft. base.

2. All bearing trees will be marked with the township, range, and section in which they stand.

R 22 E S 36 on W. face; with 6 grooves on N., E., and W. faces.

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

S C T 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

S C T 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 3 N on S.,

2 W on E., and

3 W on W. face."

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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 cause of paragraph 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, E. and W., 4 ft., and S. of stone, 8 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 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; 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 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; 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.*

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

C C T 4 N on S.,
 R 2 W S 6 on E., and
 R 3 W S 1 on W. side, with 6 notches on S., E., and W. sides;
 dig pits, 24 X 18 X 12 ins., crosswise on each line, 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. of Tps. 4 N.,
 Rs. 2 and 3 W., I mark
 C C T 4 N on S.,
 R 2 W S 6 on E., and
 R 3 W S 1 on W. side, 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.

66. *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 conditons may require.

67. *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 V.

68. *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 V, figs. 2 and 3.)

69. *Township or Section interfering Closing Corners.*

When two closing lines, at right angles 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 cir-
 cumstances 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 V, fig. 4, at a and b.)

70. *Positions and Dimensions of Pits and Mounds of in-
 terfering 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 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, 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 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.

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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 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 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., I 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.

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8. *Tree Corner, with Bearing Trees.*

A _____, _____ ins. diam., for cor. of Tps. 2 and 3 N., Rs. 2 and 3 W., I 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. and 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 Tps. 2 and 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), 12 ins. 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 south pit, 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 1 on SE.,

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

S 1 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 T. 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 1 on SE.,

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

S 1 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 1 on SE.,

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

S 1 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, 2 ft. high, N. of cor.

2. *Stone, with Mound of Stone.*

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for stand. 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 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.

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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 21 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, 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 secs. 34 and 35, marked

S C T 13 N R 21 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 21 E S 35 B T.

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

T 13 N R 21 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, 2 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, I 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, I 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, I 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, I 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. 5½ 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, 1½ 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., 5½ 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. _____° E., _____ lks. dist., marked

T 2 N R 2 W S 36 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, I 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, I 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 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 S. _____° 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 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 36³ 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.,

3. The corner established on the range line and described in paragraph 1, will have notches to indicate the distances to the NE. and SE. corners of the township. See Plate IV, fig. 18; and Plate VIII, Tp. 3 N., R. 7 W.

_____ 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 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; dig 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; dig 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, I 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; 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.* (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.,

_____ 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.

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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.

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

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 13 on SE.,

S 13 on SW., and

S 13 on NW. side, with 1 notch on E. side; dig a pit, 24 X 24 X 12 ins., in the sec., 5 ft. dist.; and raise a mound of earth around tree.

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 ft. high, N. of cor.

2. *Stone, with Mound of Stone.*

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for $\frac{1}{4}$ sec. cor. marked $\frac{1}{4}$ on W. face; and raise a mound of stone, 2 ft. base, $1\frac{1}{2}$ ft. high, W. of cor. Pits impracticable.

3. *Stone, with Bearing Trees.*

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground, for $\frac{1}{4}$ sec. cor. marked $\frac{1}{4}$ on W. face; from which

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

$\frac{1}{4}$ S 16 B T.

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

$\frac{1}{4}$ S 17 B T.

4. *Post, with Pits and Mound of Earth.*

Set a _____ post, 3 ft. long, 3 ins. sq., with marked stone (charred stake or quart of charcoal), 24 ins. in the ground, for $\frac{1}{4}$ sec. cor. marked $\frac{1}{4}$ S 4 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, $3\frac{1}{2}$ ft. base, $1\frac{1}{2}$ ft. high, N. of cor.

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5. *Post, with Bearing Trees.*

Set a _____ post, 3 ft. long, 3 ins. sq., 24 ins. in the ground, for $\frac{1}{4}$ sec. cor., marked $\frac{1}{4}$ S 21 on W. face and 22 on E. face; from which

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

$\frac{1}{4}$ S 22 B T.

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

$\frac{1}{4}$ 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 $\frac{1}{4}$ sec. cor.; dig pits, 18 X 18 X 12 ins., E. and W. of cor., 4 ft. dist.; and raise a mound of earth, $3\frac{1}{2}$ ft. base, $1\frac{1}{2}$ ft. high, over deposit.

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

$\frac{1}{4}$ S 21 on N. face and 28 on S. face.

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

A _____, _____ ins. diam., for $\frac{1}{4}$ sec. cor. I mark $\frac{1}{4}$ 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 $\frac{1}{4}$ sec. cor. I mark $\frac{1}{4}$ S 20 on N. side and 29 on S. side; from which

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

$\frac{1}{4}$ S 20 B T.

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

$\frac{1}{4}$ S 29 B T.

80. *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 V.

81. *Markings on Quarter Section Corners.*

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

82. *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 Plates IV and V.]

83. All standard quarter-section corners, on base lines or standard parallels, will have the letters S C (for standard corner), precede the marking $\frac{1}{4}$ or $\frac{1}{4}$ 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 $\frac{1}{4}$ S B T.

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QUARTER SECTION CORNERS COMMON TO TWO QUARTERS OF ONLY ONE SECTION.

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

MEANDER CORNERS.

[See Plates III, IV, and V.]

85. 1. *Stone, with Pit and Mound of Earth.*

Set a _____ stone, _____ X _____ X _____ ins., _____ ins. in the ground for meander cor. of fracl. secs. 26 and 35, marked

M C on E. face, with 1 groove on S. face; dig a pit 36 X 36 X 12 ins., 8 ft. W. of stone; 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 meander cor. of fracl. secs. 17 and 18, marked

M C on S. face. with 5 grooves on E. 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 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, I mark

M C on W.,

T 15 N on E.,

R 20 E S 17 on N., and

S 20 on S. side; dig a pit, 36 X 36 X 12 ins., 8 ft. E. of tree; and raise 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 fracl. E. and W. halves of sec. 33, I mark

S M C on N.,

T 15 Non S.,

R 20 E S 33 on E., and

S 33 on W. side; 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 T.

86. *Pits and Mounds of Meander Corners.*

When a pit is dug as an accessory to a meander corner, it will be located on line and 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.

87. *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 further marked S C on 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 and section numbers will be marked on the sides facing

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the north and south cardinal points; while the range numbers will be placed on the side opposite the marking M C.

In all the markings provided for in this paragraph, the numbers indicating township, range, and section, will be preceded by the initial letters T R and S, respectively.

88. *Descriptions will be modified in certain cases.*

When a tree is marked for a regular meander corner, the descriptions in paragraph 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.

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.

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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,⁴ N. 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.,⁵ _____ lks. dist., marked
T 6 N R 8 W S 9 35 M B T.
A _____, _____ ins. diam., bears S. _____° W.,⁵ _____ 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.

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 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
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.

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.

Kind of corner.	Distance of pits at—			Mounds.		
	Post corner.	Mound of earth corner.	Tree corner.	Size (in feet).		Position from corner.
				Stone.	Earth.	
Standard tp. cor.	E. and W. 4 feet, N. 8 feet.	Feet. 6	Feet. 5	2 x 1½	5 x 2½	N.
Closing tp. cor.	E. and W. 4 feet, S. 8 feet.	5	5	2 x 1½	5 x 2½	S.
Cor. of 4 tps	N., E., and W. 4 feet, S. 8 feet	5	5	2 x 1½	5 x 2½	S.
Cor. of 2 tps	E. and W. 4 feet, N. 8 feet.	5	5	2 x 1½	5 x 2½	Various.
Cor. of 1 tp	8 feet	5	5	2 x 1½	5 x 2½	Do.
Standard sec. cor.	E. and W. 3 feet, N. 7 feet.	5	4	2 x 1½	4 x 2	N.
Closing sec. cor.	E. and W. 3 feet, S. 7 feet.	4	5	2 x 1½	4 x 2	S.
Cor. of 4 secs	5½ feet	4	5	2 x 1½	4 x 2	W.
Cor. of 2 secs	6 feet	4	5	2 x 1½	4 x 2	W.
Cor. of 1 sec	8 feet	5	5	2 x 1½	4 x 2	Various.
Quarter sec. cor.	3 feet	4	4	2 x 1½	3½ x 1½	Do.
Meander cor	8 feet	5	8	2 x 1½	4 x 2	With pit.
On res'n line.	4 feet	5	5	3 x 2	5 x 2½	Various.

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WITNESS CORNERS.

94. *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.

95. *Markings on Witness Corners.*

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 regular markings on the NE. face when witnessing a township or section corner; such witness corners will be established, in all other respects, like a regular corner, marking bearing trees with the proper numbers for the sections in which they stand.

96. *Markings on Bearing Trees of Witness Corners.*

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.

97. *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, and 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.

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 ¼, or ¼ 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 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 identify-

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ing 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, 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 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.

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In case the prescribed number of trees can not be found within practicable distance, the deputy will state in his field notes, after describing those marked, "no other trees within limits," and add "dig pits _____ X _____ X _____ ins.," etc., or "raise a mound of stone, _____ ft. base, _____ ft. high, _____ of cor.," as prevailing conditions may require.

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 as 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.

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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

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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 irreg-

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ularities 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 can 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 can 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 can 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 when it bears east of north.

TABLE II.—*Corrections for Convergency within a Township.*

Latitude.	Correction to be applied to bearing of range lines at a distance of—				
	1 mile.	2 miles.	3 miles.	4 miles.	5 miles.
° °	'	'	'	'	'
30 to 35	1	1	2	2	3
35 to 40	1	1	2	3	3
40 to 45	1	2	2	3	4
45 to 50	1	2	3	4	5
50 to 55	1	2	3	5	6
55 to 60	1	3	4	5	7
60 to 65	2	3	5	7	8
65 to 70	2	4	6	8	10

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 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 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 calculated¹⁰ 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 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.*¹¹

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.¹²

10. See Table XI and rules, pages 118 and 119.

11. See Plate III, between sections 7 and 18, 17 and 20.

12. See Plate III, between sections 8 and 17.

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

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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, deputies 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 with-

in 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 deputies, 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, as in case 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,

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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. All meanders should be traversed before leaving the vicinity, and if misclosure is found, indicating error in measurement or in reading courses, the lines must be re-meandered.

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

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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.

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

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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.

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 south 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 misclosure 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 new rectangular 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, 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.

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 retracement where the error occurs, correct the same before he leaves the field, and place the table in his original field notes.

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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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The delivery of the field notes and sketches to the surveyor general's office for examination, constitutes the filing of the

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.]

211. 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.

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SPECIMAN 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, cañons, 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

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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 diluted 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.

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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 protracting line can be connected.

229. When the land forms part of a fractional section where areas can not 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, thence progressively west to No. 4 in the northwest, and south to No. 7 in the southwest corner of the section.

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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 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 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 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 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.

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:

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 $\frac{1}{4}$ difference of latitudinal boundaries is 0.03 $\frac{3}{4}$ chains; consequently, "d" is .04 chains; then,

18.35 × 2	+ .04 =	36.74 acres,	the area of lot 1;
18.50 × 2	- .04 =	36.96 acres,	the area of lot 4;
18.50 + 18.35	- .04 =	36.81 acres,	the area of lot 2;
18.50 + 18.35	+ .04 =	36.89 acres,	the area of lot 3;

Check: [18.35 + 18.50] × 4 = 147.40 acres, the area of the four lots.

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, 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:

N. bdy. sec. 6.: diff. of meridional bdrs. sec. 6.: 60 chs.: q;
then will E. bdy. lot 4 = E. bdy. lot 1 ± q; in which, "q" 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.

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:

chs.	chs.	chs.	chs.	chs.	
77.75	: 0.05	:: 60.00	: 0.0386	= q; 1/3 q =	0.0129
chs.	chs.	chs.			
20.0500	-	0.0386	=	20.01,	the E. bdy. of lot 4;
20.0114	+	0.0129	=	20.02,	the E. bdy. of lot 3;
20.0243	+	0.0129	=	20.04,	the E. bdy. of lot 2;

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

chs.	chs.	acres.	
20.05	+ 20.04 =	40.09, the area of lot 1;
20.04	+ 20.02 =	40.06, the area of lot 2;
20.02	+ 20.01 =	40.03, the area of lot 3;
<u>20.00 + 20.01</u>	<u>×</u>	<u><u>17.75 + 17.78</u></u>	= 35.54, the area of lot 4.
2		2	
Also [17.78 + 17.87] × 3 = 106.95, the area of lots 5, 6, and 7.			
Area of regular subdivisions =		360.00	
Total.....		<u>622.67</u> ,	the area of sec. 6.
chs.	chs.		
77.87	+ 77.75	× 4 =	622.48
77.75	× 0.025	=	0.19, the area of triangle C A B (fig 6).
Total		= 622.67,	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. 1/4 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 + 17.81] × 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 + 17.87] × 3 = 106.95 acres. (See example 2.)

The area in acres of quarter sections adjoining north and west township boundaries (excluding NW. 1/4 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. 1/4 sec. 6 (fig. 6), is [37.87 + 37.81] × 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 + 79.77] × 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 alinement, 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 alinement, 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 1 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-

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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 misclosure 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 misclosure. 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 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 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 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 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 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 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.)

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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 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 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 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 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-

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cable, the amount of reiterative verbal explanation; 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 VI exhibit only the positions of township and section corners after rectification, while in actual practice the quarter section corners will also be properly affected.

266. 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, section 256, 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.

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 east to west, 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;

while the subdivisions will be executed from north to south, and from west to east, commencing at the corner of 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.

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; 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 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.

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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 if 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.

HIATUSES 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 conditions to be dealt with are either hiatuses or overlaps, the former possessing three characteristic features, which are named as follows:

Simple hatu. 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

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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 subdivisional 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 subdivisional 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 subdivisional and other lines (see section 257), 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 subdivisional 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.

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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 "Ellicott's line," in longitude $80^{\circ} 32' 20''$ 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 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.

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 de-

pends 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^h, astronomical time; and January 9, 2 o'clock a. m., civil time, is January 8, 14^h, 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*

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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^h 15^m, astronomical time, and April 23, 4.15 a. m., civil time, is April 22, 16^h 15^m, 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.

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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 the 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.)

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FIELD EXAMINATION OF SURVEYS.

368. To insure 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 retracement 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 Speciman Field Notes and Index, identical in vein and content to the Manual of 1894.]

Fig. 1.

SECANT METH

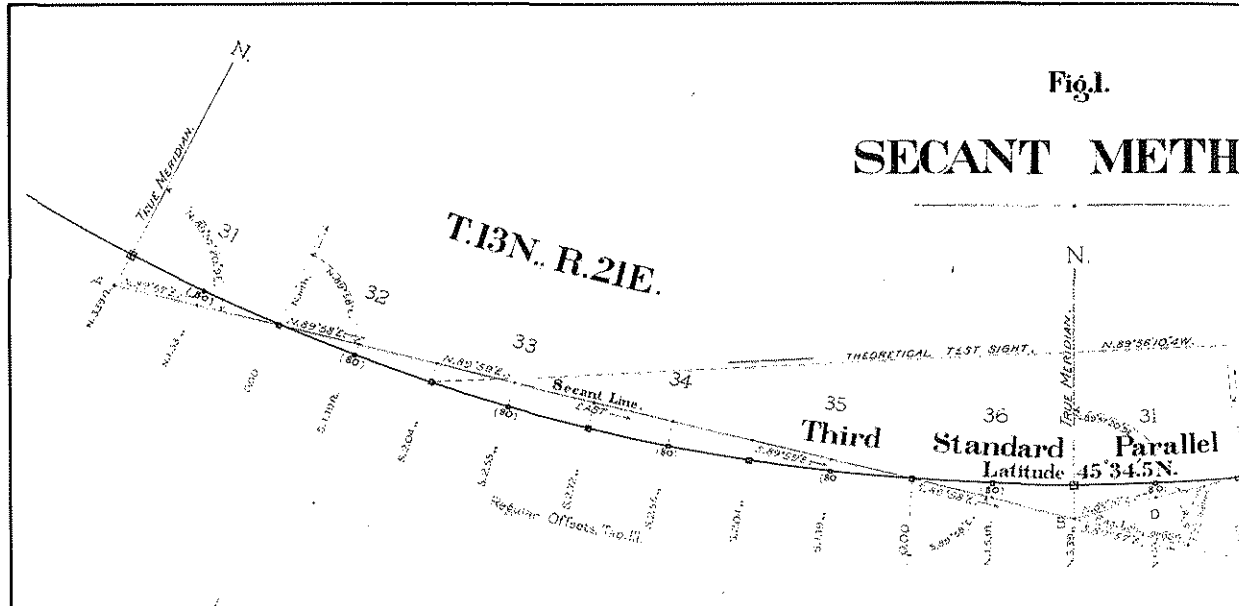


Fig. 2.

Illustrating the Recovery of the Theoretical Position from the Established Position when the latter deviates from by less than One Minute of Arc as determined by Regular Offsets Table III.

Distance from Secant to True Parallel	Secant	True	Secant	True
0.000	0.000	0.000	0.000	0.000
0.001	0.001	0.001	0.001	0.001
0.002	0.002	0.002	0.002	0.002
0.003	0.003	0.003	0.003	0.003
0.004	0.004	0.004	0.004	0.004
0.005	0.005	0.005	0.005	0.005
0.006	0.006	0.006	0.006	0.006
0.007	0.007	0.007	0.007	0.007
0.008	0.008	0.008	0.008	0.008
0.009	0.009	0.009	0.009	0.009
0.010	0.010	0.010	0.010	0.010

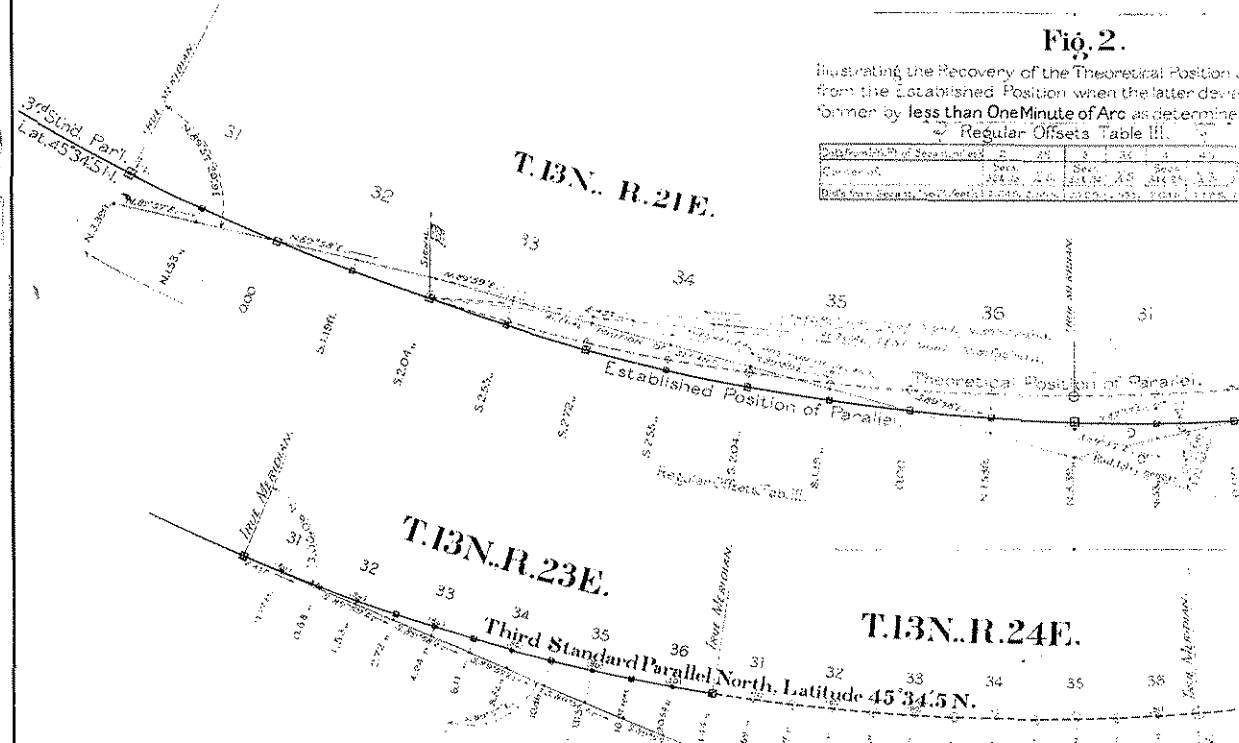


Fig. 3.

TANGENT METHOD.

Fig. 1.

SECANT METHOD.

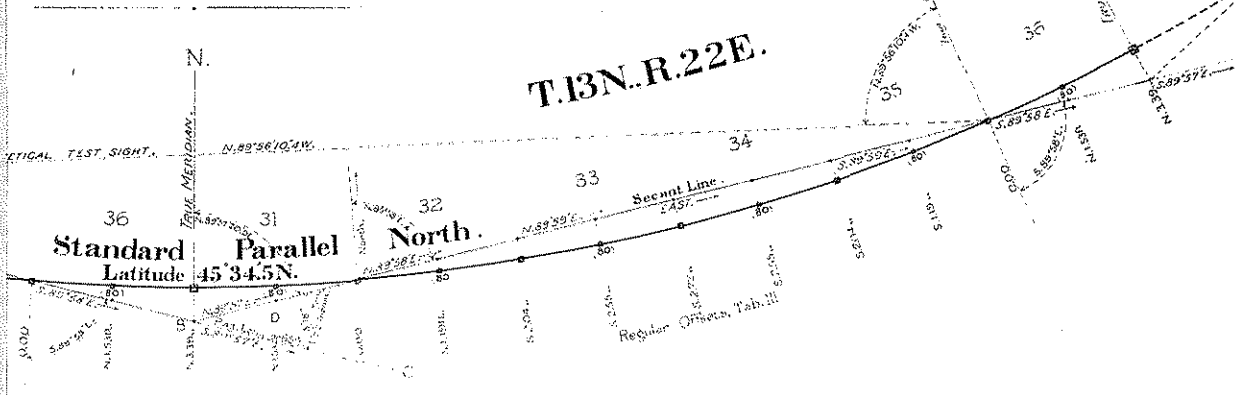


Fig. 2.

of the Recovery of the Theoretical Position of the Parallel Established Position when the latter deviates from the by less than One Minute of Arc as determined by Polar's Ob. Regular Offsets Table !!!

Dist. from Parallel	Offset
100	1.0000
200	4.0000
300	9.0000
400	16.0000
500	25.0000
600	36.0000
700	49.0000
800	64.0000
900	81.0000
1000	100.0000

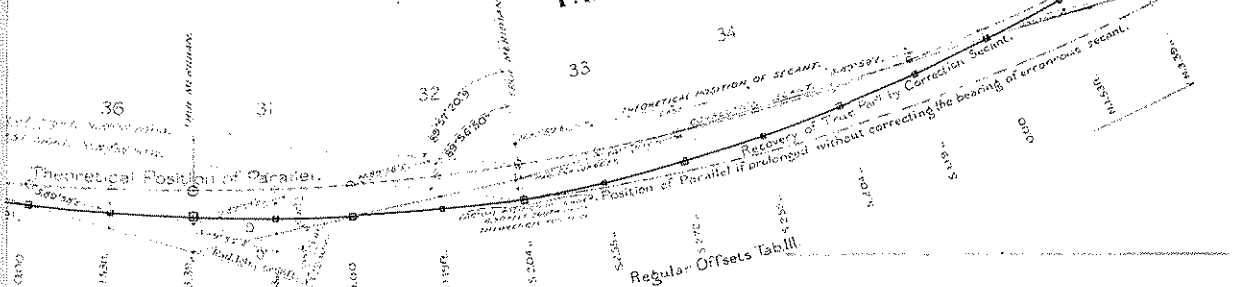
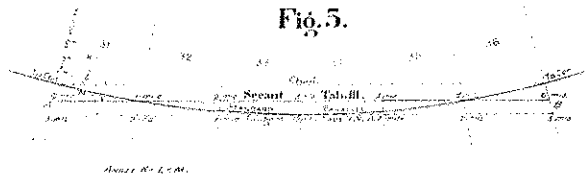


Fig. 5.



T.13N. R. 24E.

Latitude 45° 34.5' N.

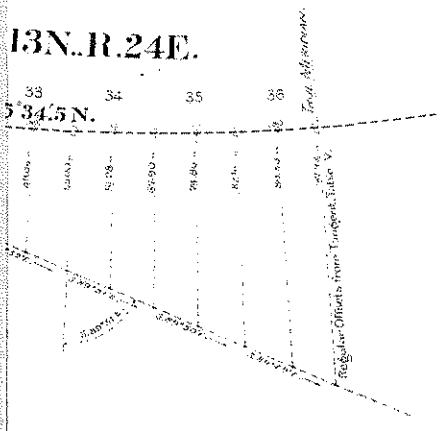
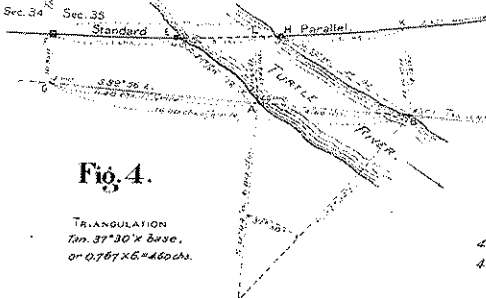


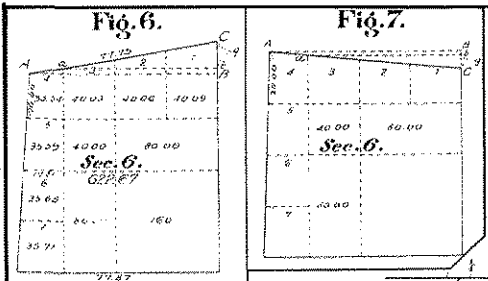
Fig. 4.



AL = diff lat of course AE;
EL = departure of AE;
practically, AG = FL;
then, EF = AG - EL;

HK = departure of BF;
and, FH = GB - HK.

For the distances AL and BK
42 : (47)² :: 10.86 : 11.65 ch. = AL.
42 : (47)² :: 10.86 : 11.97 ch. = BK.



TOWNSHIP EXTERIOR

Scale: 1 inch to 160 chains.

FOURTH STANDARD PARALLEL
East

Note:
 AB and CD, the given distance to S. cor. of the sec.
 then CA = CB = Co. = CD
 N. cor. sec. 6. (four dimensions) = 60 ch. = 4 s.
 Then will 1. cor. of lot 6 = 6. cor. of lot 7 & 8, as in
 the plat under title "AREAS OF LOTS" &c.

Old Surveys.

33 34
 Surveyed under
 current contract.

Unsurveyed.

T.16N. T.16N. T.16N.
 R.21E. R.22E. R.23E.

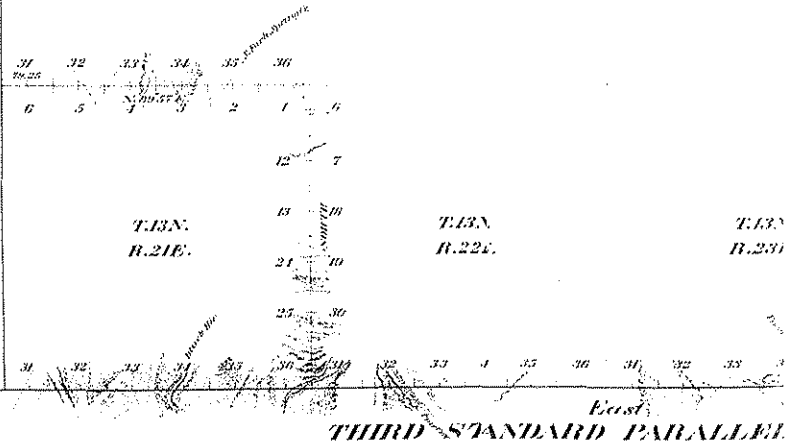
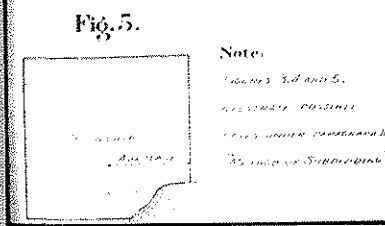
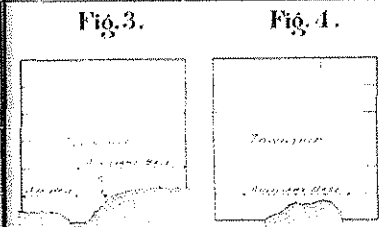
T.15N. T.15N. T.15N.
 R.21E. R.22E. R.23E.

T.14N. T.14N. T.14N.
 R.21E. R.22E. R.23E.

Table of Mileage.

Secs. Designated	Amount	When Surveyed.
30 to 36	00 00	Aug. 22 to 30, 1890.
Township	11 79 25	Sept. 5 to 13, 1890.
Connecting		

FIFTH GUIDE MERIDIAN EAST.



THIRD STANDARD PARALLEL
East

SHIP EXTERIORS.

Scale: 1 inch to 160 chains.

STANDARD PARALLEL NORTH.
East

T.16N. R.22E. T.16N. R.23E. T.16N. R.24E.

T.15N. R.22E. T.15N. R.23E. T.15N. R.24E.

T.14N. R.22E. T.14N. R.23E. T.14N. R.24E.

T.13N. R.22E. T.13N. R.23E. T.13N. R.24E.

This Plat.
of the
3^d Standard Parallel North
through Ranges 21, 22, 23 & 24 E.;
East Boundary of T. 13, N. 21 E.;
North " " " "

and the
North-South Meridian East
through Township 13 North,
Montana District. Meridian
is strictly conformable to the
field notes of the survey thereof
by
Richard Woods, U. S. Dep. Surv.
under his
Contract, No. 57,
dated July 10th 1890,
which have been examined,
approved and filed in this office
U. S. Surv. Genl's Office,
Helena, Montana.

NORTH-SOUTH MERIDIAN EAST.

1 6
12 7
18 10
24 13
30 16
36 19

30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

STANDARD PARALLEL NORTH.

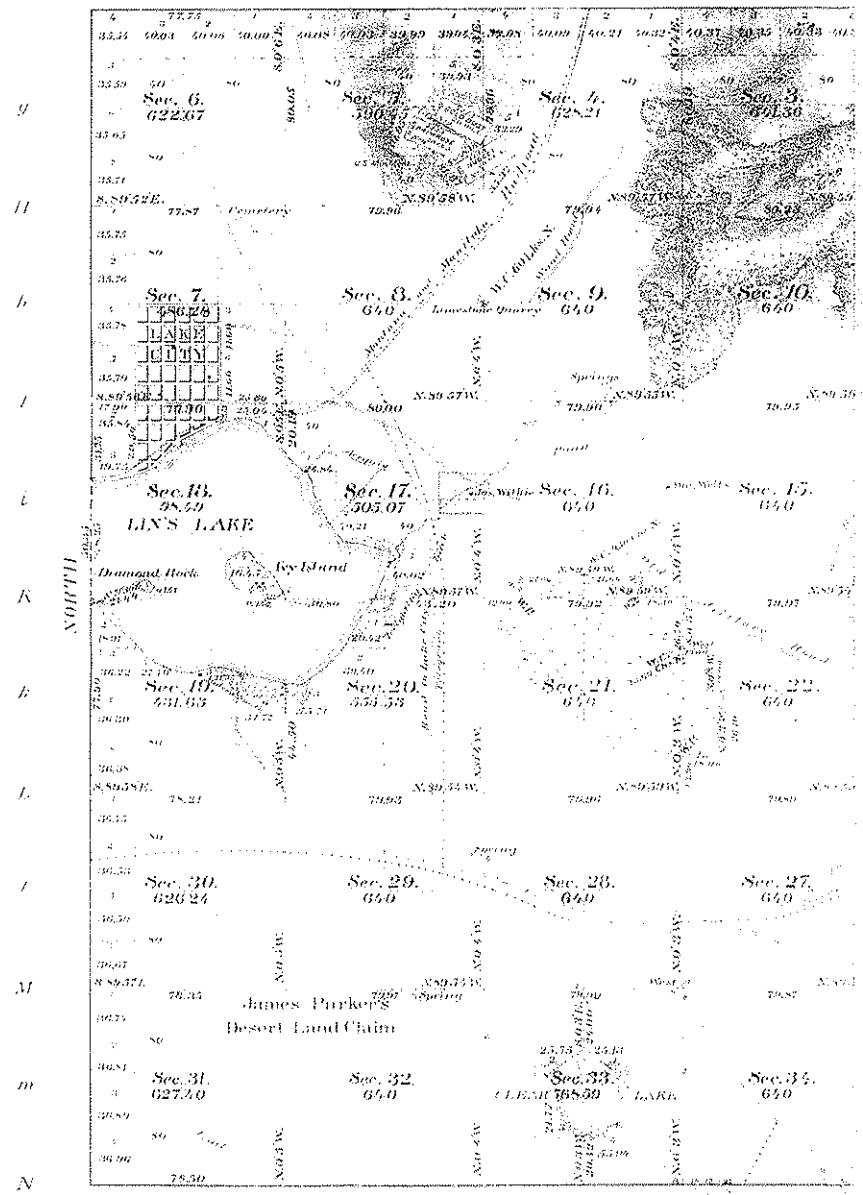
Latitude 45 34.5 N.
Longitude 107 21 W. of G.
Mean Mag. Decl. 13 02 East.

W. S. S. Co.

Township N^o 15 North, Range N^o 20 East of the

G I F e E d D e

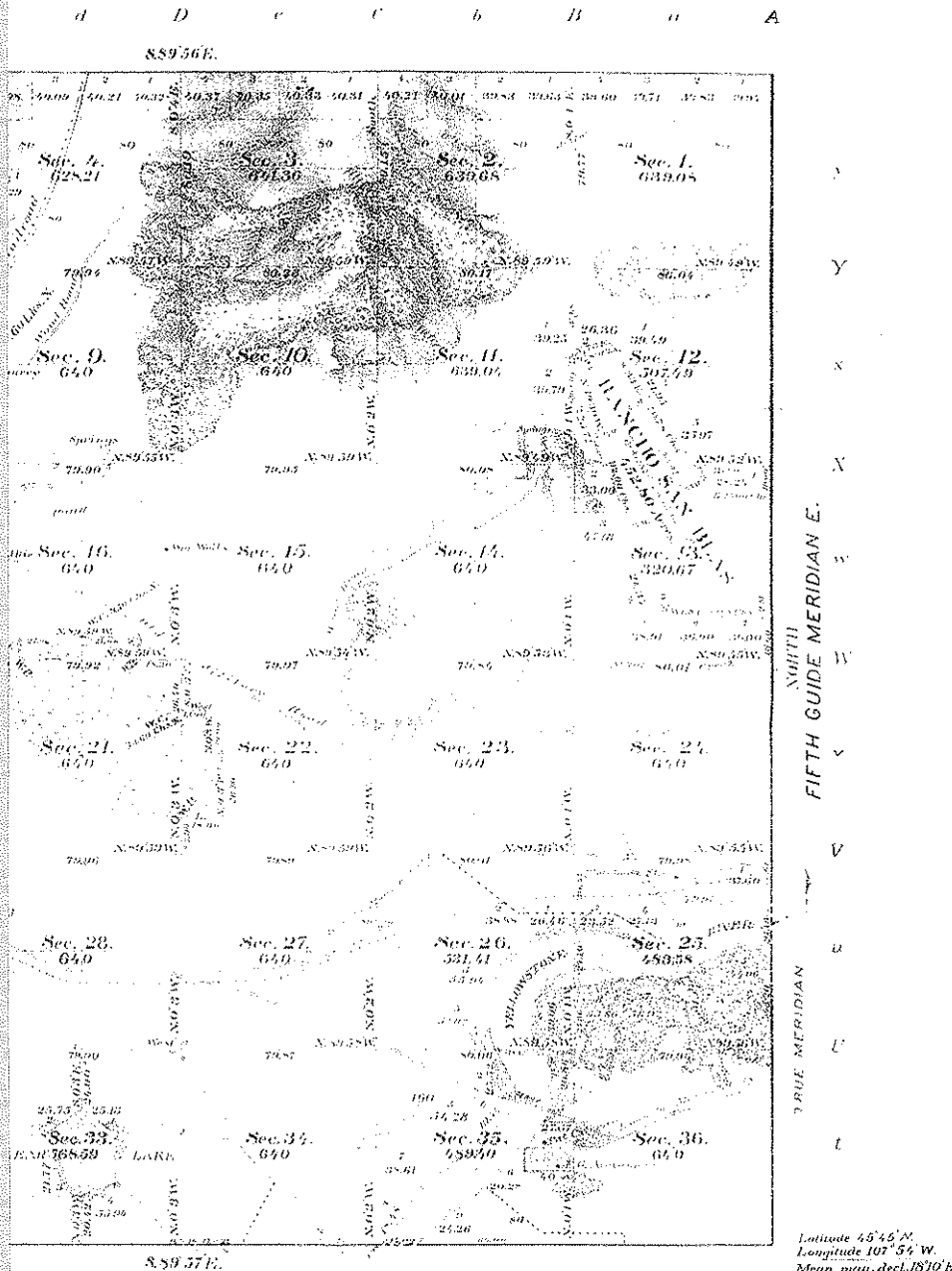
S. 59 56 E.



S. 59 57 E.

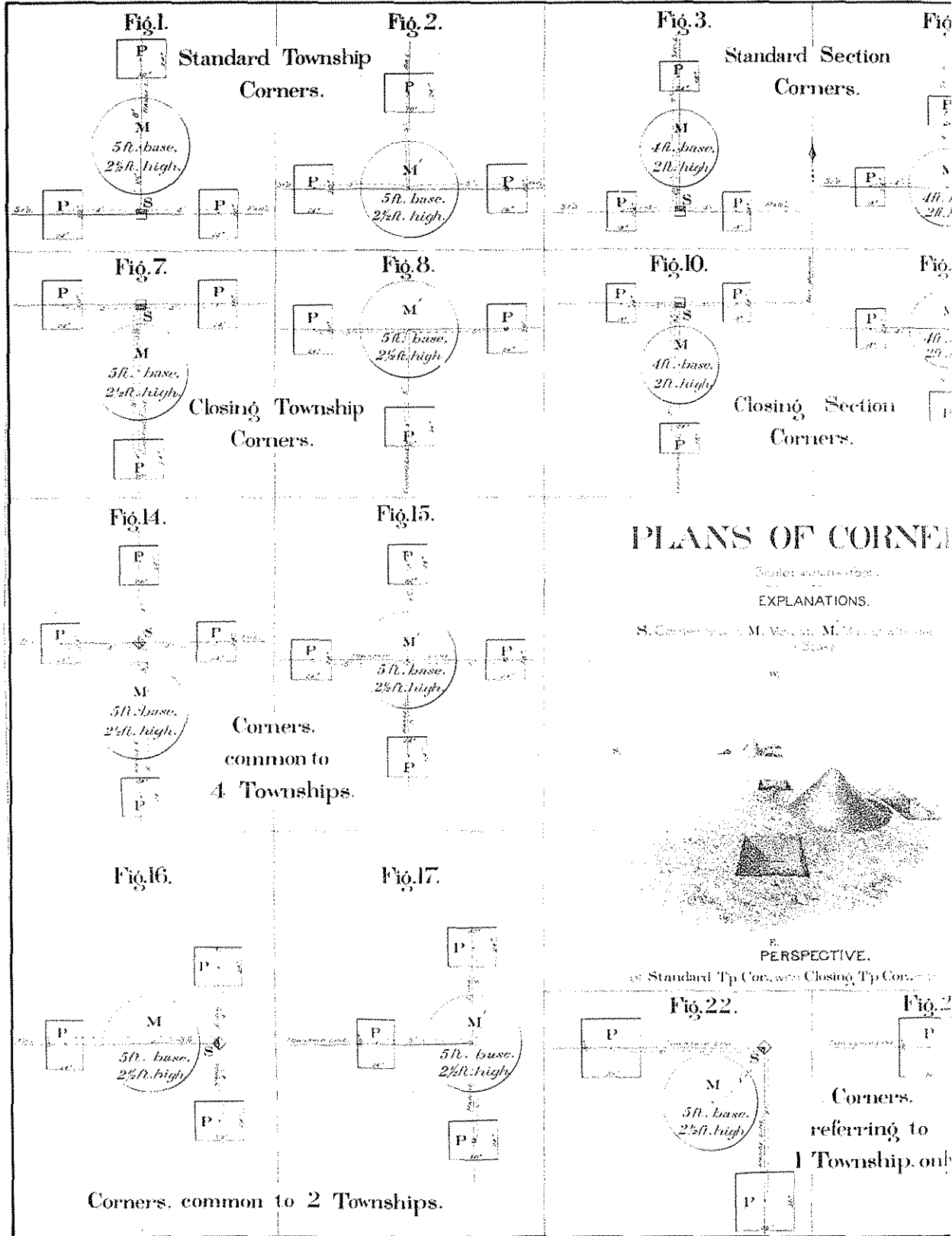
Area in acres:	n		o		j		p		q		
	Public Land	20872.27	Township	199.01	Private Land Claim	472.80	Water surface	1362.99	Mineral Claims	619.8	Total Area
Surveys Designated	By Whom Surveyed	No.	Contract Date	Amount of Surveys	Ms.	Chs.	Lhs.	When Surveyed			
Subdivisions	Robert Arees	207	March 22 nd 1893	56	60	72		Aug. 5 th to 19 th 1893.			
Connections	"	"	"		73	60		"			
Menders	"	"	"	12	19	26		"			

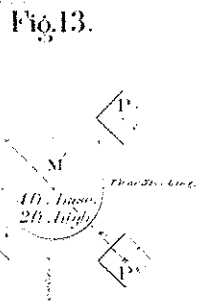
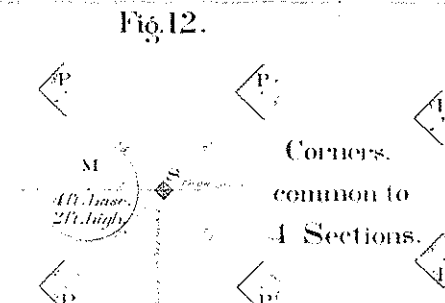
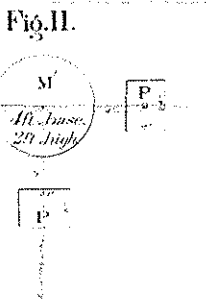
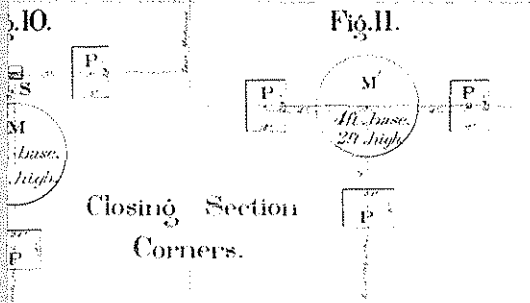
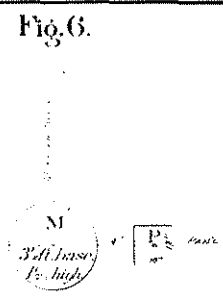
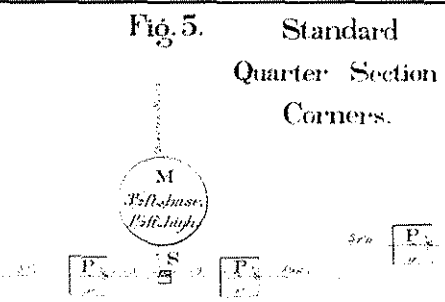
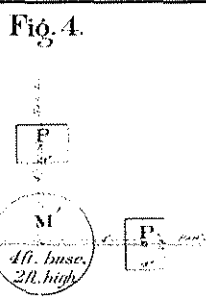
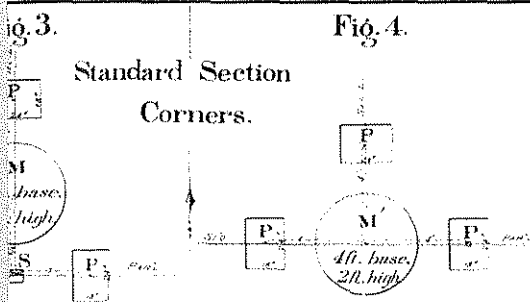
Range No 20 East of the Principal Meridian Montana.



p		Q	q	R	r	S	s	T
Private Land Claim, 472.80.								
Total Area, 22949.95 Acres.								
Year of Surveys	Chs.	Lks.	When Surveyed					
60	72		Aug 4 th to 19 th 1853.					
73	60		..					
19	26		..					

The above Map of Township No. 15 North, of 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.
 Geo. S. ...

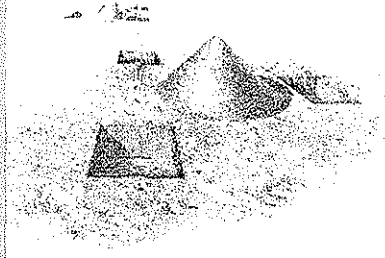




PLANS OF CORNERS.

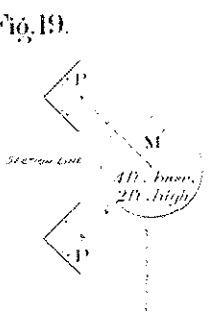
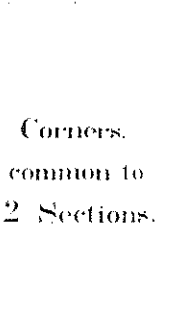
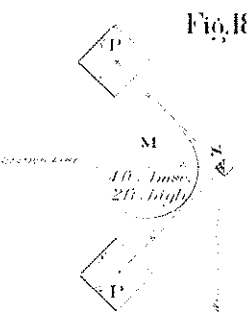
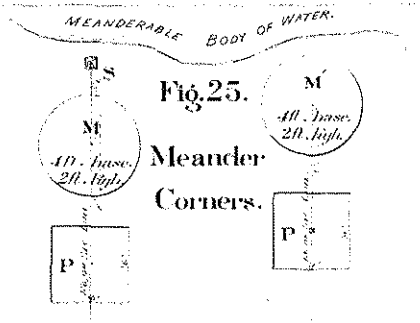
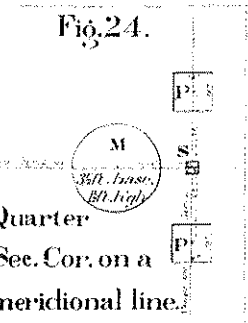
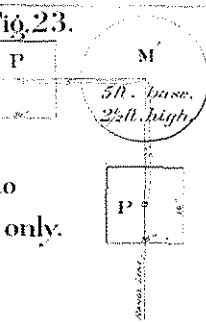
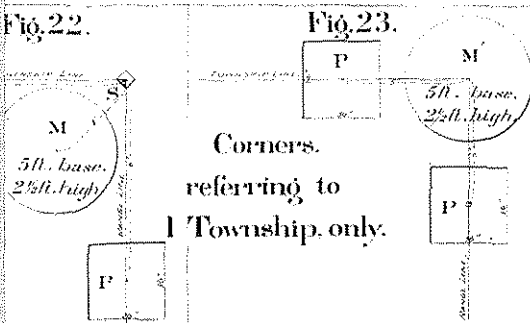
EXPLANATIONS.

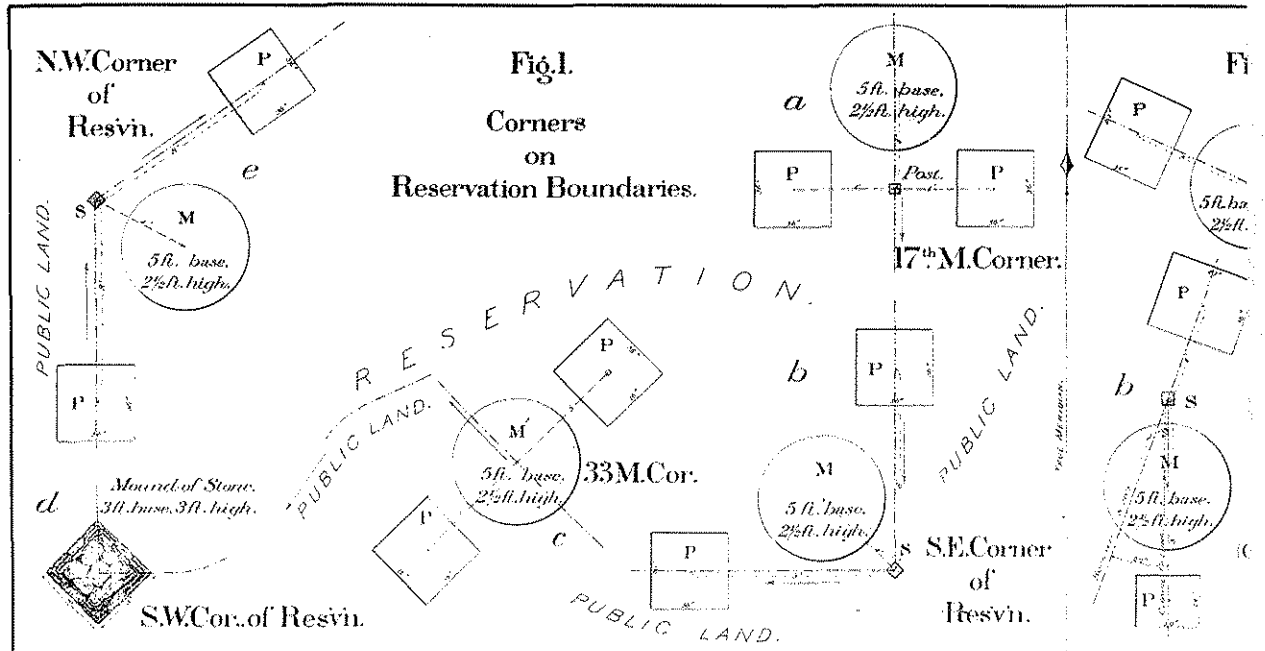
M, Monument; P, Section Corner; S, Section Line; T, Township Line.



PERSPECTIVE.

Standard Tp. Cor. with Closing Tp. Cor. at the distance.





Convergency of Meridians.

Fig. 5.



TABLE X. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 TABLE Y. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 North. Meridian. 4-1000-000 4750000
 For Convergence of 1' in 1000000 47.5' and 1/2"
 in 1000000 47.5' and 1/2" in 1000000

Fig. 6.



TABLE X. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 TABLE Y. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 North. Meridian. 4-1000-000 4750000
 For Convergence of 1' in 1000000 47.5' and 1/2"
 in 1000000 47.5' and 1/2" in 1000000

Fig. 7.

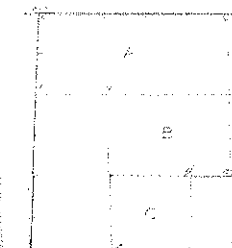


TABLE X. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 TABLE Y. CONVERGENCY OF THE PARALLELS
 AND THE ANGLE OF CONVERGENCY
 North. Meridian. 4-1000-000 4750000
 For Convergence of 1' in 1000000 47.5' and 1/2"
 in 1000000 47.5' and 1/2" in 1000000

PLANS OF CORNER

(Scale 1/4" = 1' 0")
 AND
 Miscellaneous Diagrams.
 EXPLANATIONS.

S. Corner Stone. M. Mound. M. Mound with deposit
 of 2 1/2 ft.

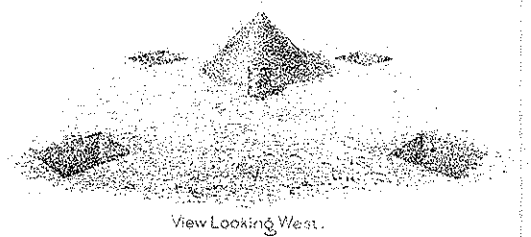
Fig. 8.

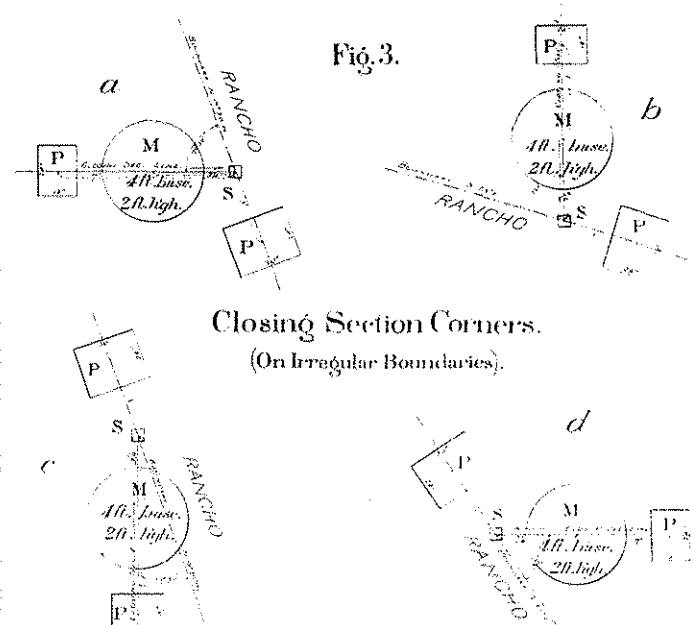
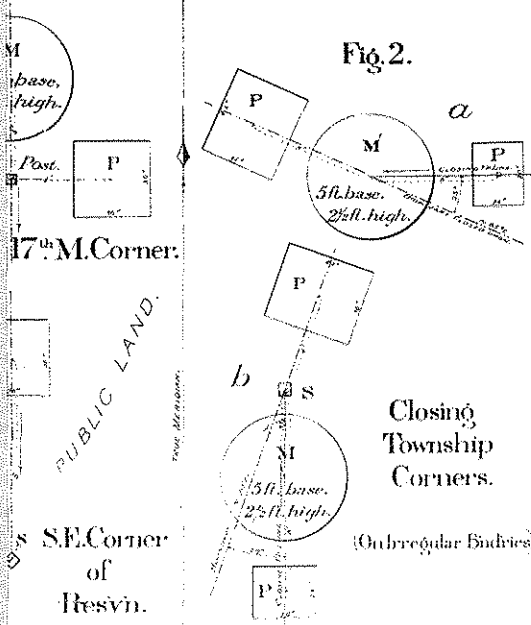
Meridian Corner. PERSPECTIVE. Corner common to Four Sections.



Fig. 10.

Corner common to Four Sections.





WAYS OF CORNERS.

(Stones from 1 foot.)
 AND
 Miscellaneous Diagrams.

EXPLANATIONS.

Stone, M. Mound, M. Mound with deposit, P. P. P.

PERSPECTIVE.

Fig. 8.

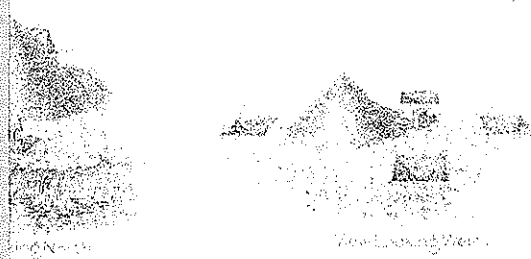


Fig. 10.

Common to Four Sections.



View Looking West.

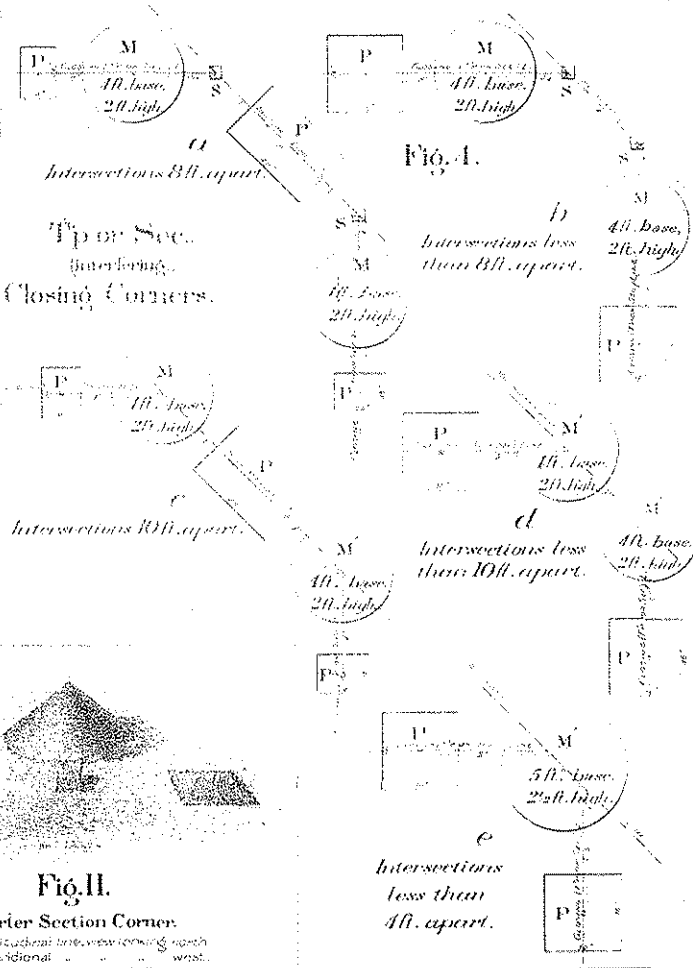
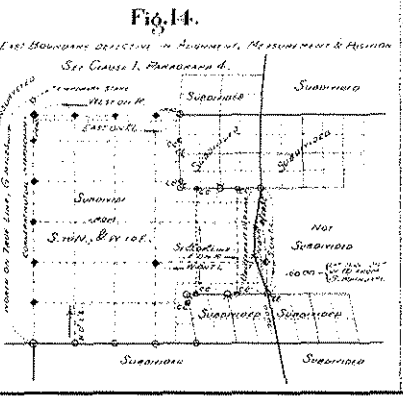
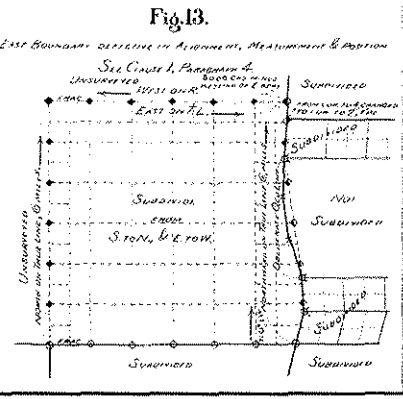
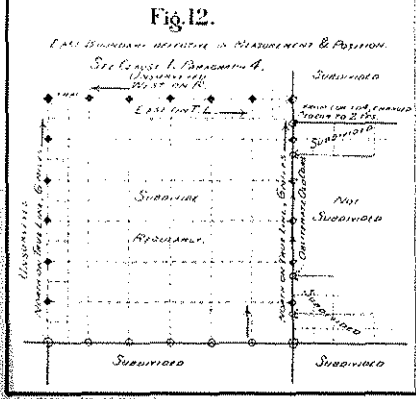
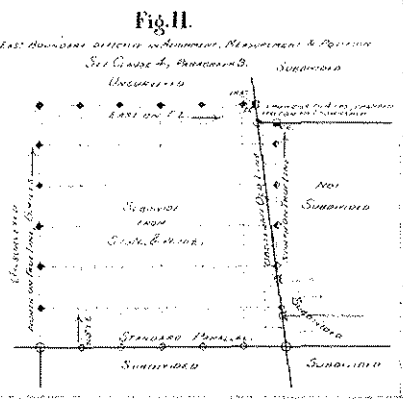
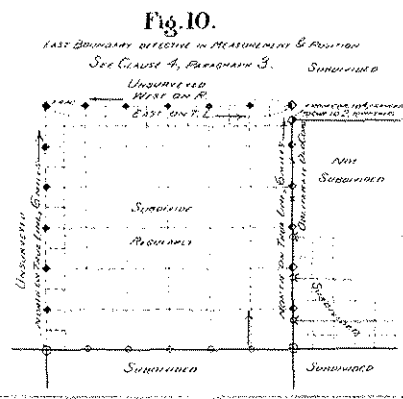
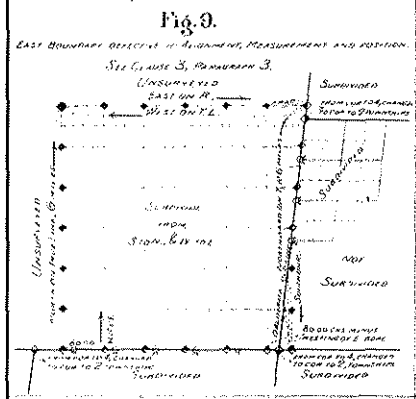
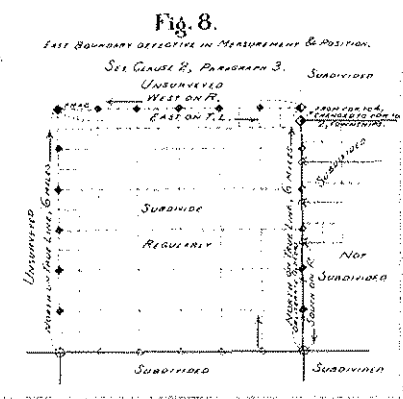
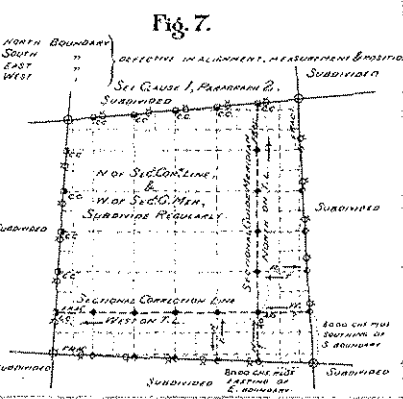
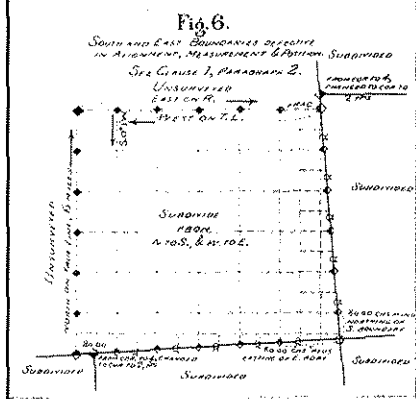
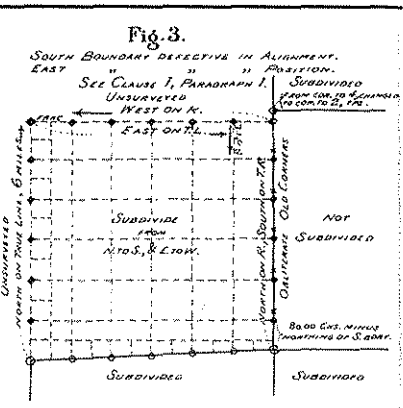
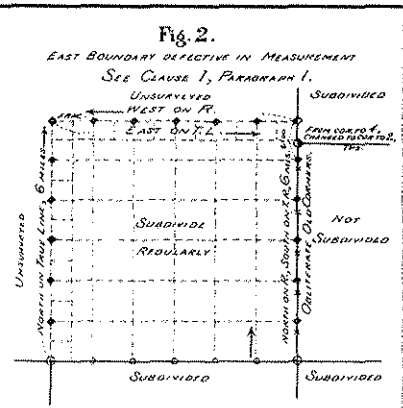
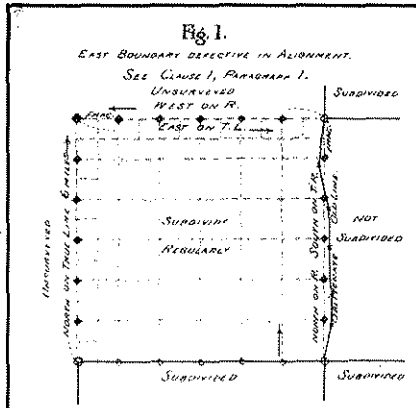


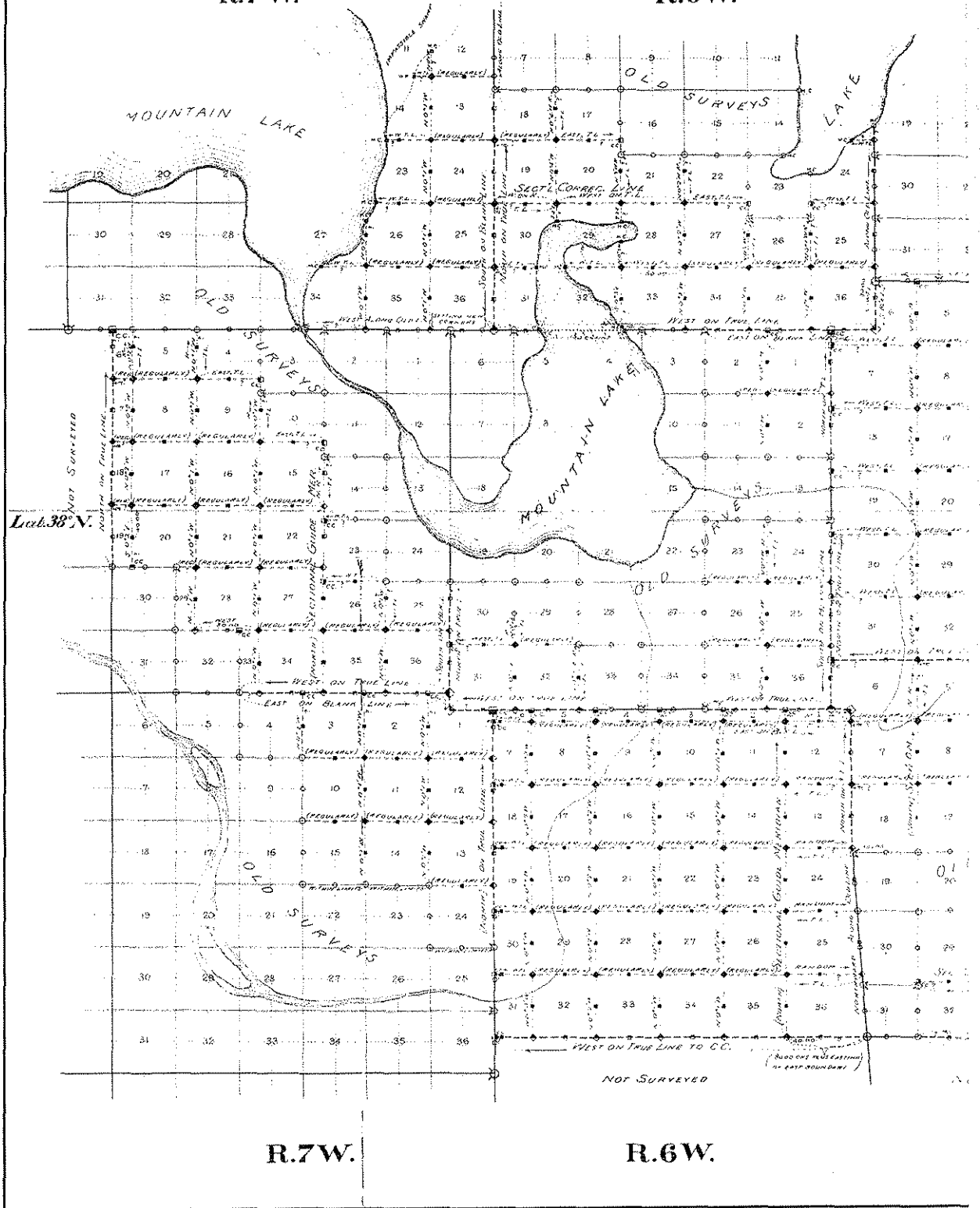
Fig. 11.

Quarter Section Corner.
 On this section line, view looking north
 ... meridional ... west.



R.7W.

R.6W.



R.7W.

R.6W.

