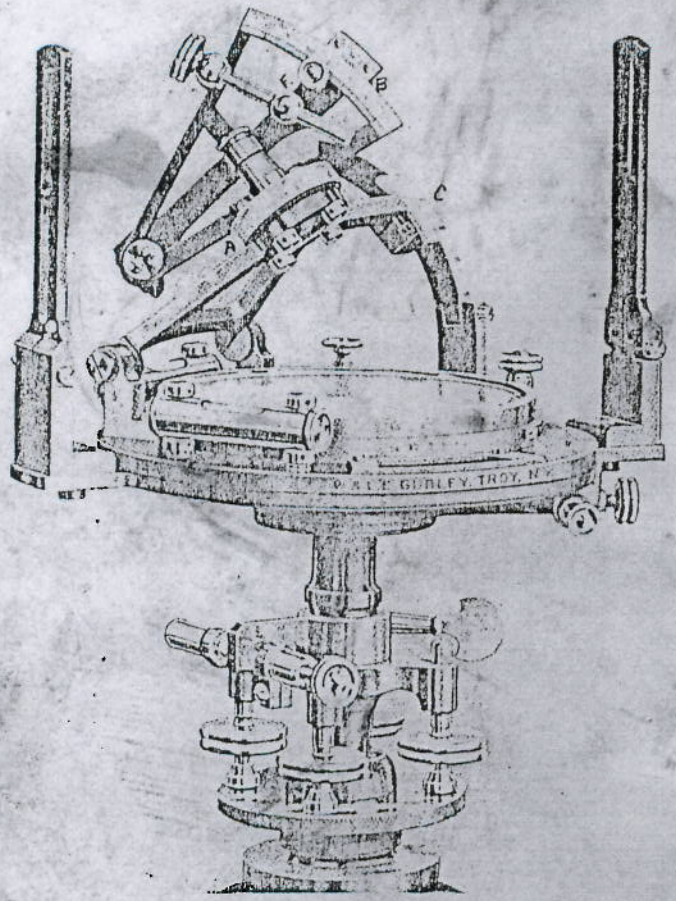
Bob



Courtesy W. & L. E. Gurley.

FIGURE 7. A Modern Burt's Solar Compass. The line of collimation FF is defined by a lens at the upper end and a screen or plate at the lower end of the bar which carries them. An hour circle A surrounds the polar axis. The polar axis is given the proper inclination from the horizontal (the latitude) by means of the latitude arc C. The line of collimation is inclined from a perpendicular to the polar axis, by an amount equal to the sun's declination, by means of the declination arc B.

MANUAL OF SURVEYING INSTRUCTIONS OF 1855

EVOLUTION OF SECTION CORNERS

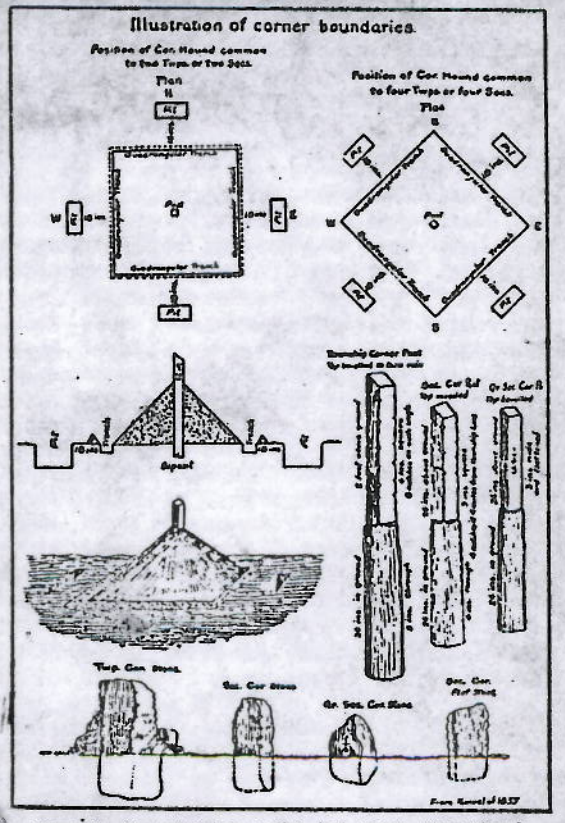


FIGURE 11. Corner boundaries used in land surveys. (from Manual of 1855)

Progress of the Public Land Surveys

State	Year surveys began	Fract'n complete ¼	½	¾	Year active period closed and area completed in 1000 Acres	Area surveyed to 1910 (1000 A.)	Area surveyed to 1932 (1000 A.)	Total area of state (1000 A.)
Alabama	1802	1815	1820	1829	1850-32,000	32,819	32,819	32,819
Arizona	1867	1900	1921			21,132	44,012	72,838
Arkansas	1817	1825	1837	1843	1849-33,200	33,616	33,616	33,616
California	1851	1865	1879	1898		78,295	83,149	99,617
Colorado	1861	1874	1880	1883		62,784	64,294	66,341
Florida	1822	1837	1846	1863	1880-30,200	30,913	35,111	35,111
Idaho	1867	1895	1910	1932		26,196	40,312	53,347
Illinois	1813	1820	1823	1825	1849-35,400	35,841	35,868	35,868
Indiana	1807	1815	1820	1827	1849-21,500	22,966	23,069	23,069
Iowa	1836	1843	1848	1851	1858-35,300	35,575	35,575	35,575
Kansas	1854	1861	1869	1872	1877-51,770	52,335	52,335	52,335
Louisiana	1806	1836	1845	1865	1880-25,300	27,177	29,062	29,062
Michigan	1803	1829	1836	1846	1860-36,000	36,787	36,787	36,787
Minnesota	1848	1852	1869	1876	1900-47,200	49,487	51,749	51,749
Mississippi	1802	1825	1832	1848	1860-29,500	29,672	29,672	29,672
Missouri	1810	1820	1825	1839	1850-42,600	43,985	43,985	43,985
Montana	1867	1892	1906	1916		55,597	81,908	93,569
Nebraska	1854	1864	1872	1876	1895-48,000	49,157	49,157	49,157
Nevada	1860	1881	1894			39,595	47,584	70,285
New Mexico	1854	1881	1885	1916		53,487	66,304	78,402
North Dakota	*	*	1889	1897	1910-42,600	42,554	44,917	44,917
Ohio	1785	1810	1820	1828	1843-26,000	26,074	26,074	26,074
Oklahoma	1871	1873	1874	1894	1900-44,400	44,425	44,425	44,425
Oregon	1850	1874	1882	1901		49,052	55,671	61,188
South Dakota	1861	1879	1889	1894	1900-49,000	49,110	49,136	49,136
Utah	1855	1884	1911	1932		25,901	38,404	52,598
Washington	1854	1874	1888	1911		32,022	36,354	42,775
Wisconsin	1833	1837	1852	1855	1865-34,500	35,364	35,364	35,364
Wyoming	1869	1882	1885	1889		56,829	59,262	62,460
Alaska	1899					15	1,970	378,166

* North Dakota and South Dakota combined.

This table has been devised by the author from tabulations in the annual reports of the Commissioner of the General Land Office, and from other sources. Its purpose is to enable the reader to estimate the progress of the surveys, and to show the states to which the various instructions of Chapter VIII would apply.

Instructions for Deputy Surveyors by E. Tiffin

Surveyor General United States, 1815

(From Sherman's *Ohio Land Subdivision*, p. 193.)

Instructions for Subdividing Townships

1. When the township lines are completed, you must begin the survey of sections at the southeast corner of the township, and move on in continued progression from east to west and from south to north in order that the excess or defect of the township as to complete sections may fall on the west and north sides of the township, according to the provisions of the Act of the 10th of May 1800.

2. Each side of a section must be made one mile in measure by the chain, and quarter section corners are to be established at every half mile, except, when in the closing of a section if the measure of the closing side should vary from 80 chains or one mile, you are in that case to place the quarter section corners equidistant, or at an average distance from the corners of the section, but in running out the sectional lines on the west or north side of the township you will establish your quarter section posts or corners at the distance of half a mile from the last corner and leave the remaining excess or defect on the west or north tier of quarter sections, which balance or remainder you will carefully measure and put down in your field notes in order to calculate the remaining or fractional quarter section on the north and west side of the township; also in running to the western boundary, unless your sectional lines fall in with the posts established there for the corners of sections in the adjacent townships, you must set posts and mark bearing trees at the points of intersection of your line with the town boundaries, and take the distances of your corners from the corners of the sections of the adjacent townships, and note that and the side on which it varies in chains, or links or both.

3. The sections must be made to close by running a random line from one corner to another except on the north and west ranges of sections, and the true line between them is to be established by means of offsets.

4. In fractional townships on rivers it will be necessary to vary from the foregoing rules; and the lines must be continued from rectilinear boundaries of the township which may be parallel to the river, perpendicularly to those boundaries until they meet the river; the sections, however, must be made complete on the sides of the township bounded by straight lines, and all excess or defect of measure must be thrown into the fractional sections on the river; the measure of the lines from the last entire sectional corner should be made very exact in order to calculate the fractional section with exactness.

5. Great care must be taken that the north and south lines be run according to the true meridian as required by law, and the east and west lines be run at right angles to them as far as is practicable in closing, but if on running on a true east and west line you find the post you are running for lies very much to the north or south of the lines, you are then to mistrust the measure by the chain, and if possible, the line on which the posts are established must be remeasured; also in running a meridional line by the compass, if you find the measurement of the closing line of the sections, that is a uniform convergency or diagonally (sic) of these lines; you may then reasonably mistrust the accuracy of the direction of your lines by the needle. In this case it will be well to endeavor to run parallel to the meridian adjacent on which section closes, in order that it may contain a just or legal quantity, viz., 640 acres or one mile square.

6. As the measurement by the chain is the principal source of errors in surveying you will be careful to attend to your chainmen that they carry the chain horizontally, and to prevent their losing a tally rod, you must be provided with a set of them pointed with iron or steel, and to allow no other to be used but the precise number which you shall have selected for that purpose.

7. In meandering rivers you will take the bearings according to true meridian of the river and note the distance on any course when the river intersects the sectional lines, and the calculations of the contents of the fractions are to be made by the tables of difference of latitude and departure, and returned on your plats; but the quantity or contents of the whole section only are to be put down; in all the other sections, and each of them is to be accounted one mile square or 640 acres, unless your closing lines deviate very much from 80 chains, in which case you will be careful to put down their true length on your plats.

8. You must frequently while in the field attend to the correction of your chain: for this purpose you should be provided with some measure taken from the standard chain in the office of the Surveyor General.

9. All random lines, as well as the true, are to be noted in your field book at the time of running them, and are to be kept in the order in which the work is executed; also you must be careful to note the variation of the random lines from the corners or posts which they were intended to strike.

10. All courses of whatever lines must be taken with the sight of your compass set to the variation and estimated according to the true meridian for which purpose the variation of the needle at the place where your survey must be taken or previously known and your compass regulated to it before you commence running the lines.

11. No lines of whatever description are to be run, or marks of any kind made by any person but yourself, or who may be under the immediate inspection of yourself or some deputy surveyor duly authorized from this office.

12. Any considerable departure from these instructions will be considered as a forfeiture of the conditions of the contract or any claim for payment; and loose, inaccurate, or precipitate work will not be admitted, either as it respects surveys in the field or their returns in paper.

13. You will take care that your posts be well driven into the ground and that there be one or two sight trees marked between every quarter section corner; also at the section corners that there be marks for every section corner where they corner.

General Instructions for Deputies

1. You will provide a good compass of Rittenhouse's construction, having a nonius[a] division and movable sights, and a two pole chain of 50 links; the chain must be adjusted by the standard chain in the office of the Surveyor General, and it will be of importance that both it and the compass be frequently examined in the field in order to determine any errors and irregularities which may arise from the use of them.

2. Whenever you may be obstructed by insuperable obstacles, such as ponds, swamps, creeks, rivers, etc., you will take the necessary offsets, or by work of traverse or trigonometry, in order to ascertain the distance on any line which is not actually run.

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a Nonius. Merr. dict. definition: probably Latinized name of Nunes, name of a Portuguese mathematician (1492-1577). A device formerly used in graduating instruments, etc., subsequently improved into the vernier.

3. The courses of all navigable rivers, which may bound or pass through your district must be accurately surveyed and their width taken at those points where they may be intersected by township or sectional lines; also the distance of those points from the sectional corners and from the commencement of any course where you are meandering the river; you will likewise not fail to make special notice of all streams of water which fall in your way with their width and course from whence they appear to come or run.

4. All township or sectional lines which you may survey are to be marked in the manner hitherto practised in the surveys of the United States lands, viz.: all those trees which your line cuts must have two notches made on each side of the tree where the line cuts; but no spot or blaze is to be made on them, and all or most of the trees on each side of the line, and near it, must be marked with two spots or blazes diagonally or quartering towards the line.

5. The posts must be erected at the distance of every mile, and half mile from where the town or sectional line commenced (except a tree may be so situated as to supply the place of a post) which post must be at least three inches diameter and rise not less than three feet. All mile posts must have as many notches cut on two sides of them as there are miles distant from where the town or sectional line commenced, but the town corner posts, or trees shall be notched with six notches on each side, and the half mile sectional posts are to be without any marks; the places of the posts are to be perpetuated in the following manner, viz.: at each post the courses shall be taken and the distances measured to two or more adjacent trees in opposite directions, as nearly as may be, which trees, called bearing trees, shall be blazed on the side next the post and one notch made with an axe on the blaze, and there shall be cut with a marking iron on a bearing tree, or some other tree within and near each corner of a section, the number of the section, and over it the letter T with the number of the township, and above this the letter R with the number of the range, but for quarter-section corners, you are to put no numbers on the trees; they are to be distinguished by this mark, 1/4S.

6. You will be careful to note in your field book all the courses and distances you shall have run, the names and estimated diameters of all corners or bearing trees, and those trees which fall in your line called station or line trees notched as aforesaid, together with the courses and distances of the bearing trees from their respective corners, with the letters and numbers marked on them as aforesaid; also all rivers, creeks, springs and smaller streams of water, with their width, and the course they run in crossing the lines of survey, and whether navigable, rapid or mountainous; the kinds of timber and undergrowth with which the land may be covered, all swamps, ponds, stone quarries, coal beds, peat or turf grounds, uncommon natural or artificial productions, such as mounds, precipices, caves, etc., all rapids, cascades or falls of water; mineral, ores, fossils, etc.; the quality of the soil and the true situation of all mines, salt licks, salt springs and mill seats, which may come to your knowledge are particularly to be regarded and noticed in your note books.

7. In all measurements the level or horizontal length is to be taken, not that which arises from measuring over the surface of the ground when it happens to be uneven and hilly; for this purpose the chainmen

ascending or descending hills must alternately let down one end of the chain to the ground and raise the other to a level as nearly as may be, from the end of which a plumb should be let fall to ascertain the spot where to set the tally rod or stick; and where the land is very steep, it will be necessary to shorten the chain by doubling the links together, so as to obtain the true horizontal measure.

8. Though the line be measured by a chain of two perches, you are notwithstanding to keep your reckoning in chains of four perches (or) of one hundred links each, and all entries in your field books, and all your plans and calculations must be made according to the decimal measure of a chain.

9. Your courses and distances must be placed in the margin of your field books on the left, for which purpose it should be large, and your remarks made on the right in the manner following:

North

Chains	Links	Between sections 35 and 36. Town 4. Range 6.
20	30	A white oak 20 inch diameter.
37	40	A stream 30 links wide. S. E.
40	—	Set half mile post, from which a B oak 18 inch diameter bears S. 50 E. 40 links, and a sugar tree 15 inch diameter bears N. 10 W. 34 links.

East

Chains	Links	Between No. 25 and 36 Town 4 Range 6 on a random.
16	40	A brook 30 links wide, course S20W.
40	00	Set temporary quarter section post. This half mile over broken land. Timber oak, ash, etc.
64	30	A stream 25 links wide, course SE.
79	90	Intersected N. and S. line 20 links south of section corner. Over hilly land, soil rich and good for farming. Timber oak, hickory, poplar, ash, etc.

West

Chains	Links	Between section 25 and 36 Town 4, Range 6 on true line.
39	95	Moved temporary post to the average distance for ¼ section corner, from which a black jack 10 inch diameter bears S50E. 100 links, and a white birch 19 inch in diam. bears N25W. 20 links.
55	00	A white oak 11 inch in diameter.
79	90	Section corner.

In this manner you must enter all courses and distances in your field book; the date must follow the close of each days work, which field book, written with a fair hand, of each township separately, or a true and fair copy, together with the original you will return to the office of the surveyor general.

10. The plat of each township and fractional part of a township must be neatly and accurately protracted on durable paper, by a scale of 2 inches to a mile, or 40 chains to an inch, and must be in such measure and proportions in every line and part as actually was determined by measurement in the field. A compass having the true and magnetic meridian, and the scale by which the lines are laid down, are to be placed on the SE corner of the plat.

MANUAL OF SURVEYING INSTRUCTIONS OF 1855
GENERAL LAND OFFICE

INSTRUCTIONS TO THE SURVEYORS GENERAL OF PUBLIC LANDS OF THE UNITED STATES FOR THOSE SURVEYING DISTRICTS ESTABLISHED IN AND SINCE THE YEAR 1850

By direction of the Commissioner of the General Land Office, the accompanying instructions are prescribed for your official government, including a Manual of Instructions to regulate the field operations of your deputy surveyors. The latter is a revision of the Manual of Surveying Instructions prepared for Oregon in 1851, (the edition of which is now exhausted,) and presents, in some respects, more copious illustrations, both in the specimen field notes and in the diagrams, than could be furnished amidst the pressure of the exigency under which the former had to be prepared. It will be observed that the former edition, the township and section lines south of the baseline are made to start therefrom, and close on the first standard parallel south; whereas, under the present instructions, such lines are made to start from the first standard parallel south, and close to the north on the base; and thus there will be closing corners and starting corners both on the base and standard lines. Such modification is introduced for the sake of entire conformity of method in new fields of survey, and will not, of course, affect any past operations under the original instructions.

The starting corners on the base line and on the standards will, of course, be common to two townships or two sections lying on and north of such lines; and the closing corners on such lines, from the south, should

be carefully connected with the former by measurements to be noted in the field book.

Where stone can be had to perpetuate corner boundaries, such, for obvious reasons, should always be preferred for that purpose, and the dimensions of the stone, as herein prescribed (on page 9) are to be regarded as the minimum size; but in localities where it is found practicable to obtain a stone of increased dimensions, it is always desirable to do so, particularly for Township Corners, and especially for those on base, meridian, and standard lines; and to such purport the deputy surveyor is to be specially instructed.

Prior to entering upon duty, the deputy surveyor is to make himself thoroughly acquainted with the official requirements in regard to field operations in all the details herein set forth, and to be apprized of the weighty moral and legal responsibilities under which they act.

Unfaithfulness in the execution of public surveys will be detected by special examinations of the work to be made for that purpose, and, when detected, will immediately subject the delinquent deputy and his bondsmen to be sued by the district attorney of the United States, at the instance of the proper attorney general—the institution of which suit will act at once as a lien upon any property owned by him or them at that time; and such deliquency, moreover, is an offense punishable by the statute, with all pains and penalties of perjury, (see act of 1846, quoted on pages 19 and 20 hereof) and will of necessity debar the offending deputy from future employment in like capacity. Hence, in the execution of contracts for surveying public lands, there is every incentive to fidelity that can address itself either to the moral sense, or to the motives of private interest.

System of Rectangular Surveying

1-4 . . . . . .

5. Standard Parallels (usually called correction lines) are established at stated intervals to provide for or counteract the error that otherwise would result from the convergency of meridians, and also to arrest error arising from inaccuracies in measurements on meridian lines, which, however, must ever be studiously avoided. On the north of the principal base line it is proposed to have these standards run at distances of every four townships, or twenty-four miles, and on the south of the principal base, at distances of every five townships, or thirty miles.

Of Measurements, Chaining and Marking

1. Where uniformity in the variation of the needle is not found, the public surveys must be made with an instrument operating independently of the magnetic needle. Burt's improved solar compass, or other instrument of equal quality, must be used of necessity in such cases; and it is deemed best that such instrument should be used under all circumstances. Where the needle can be relied on, however, the ordinary compass may be used in subdividing and meandering.

2. The township lines, and the subdivision lines, will usually be measured by a two-pole chain of thirty-three feet in length, consisting of fifty links, and each link being seven inches and ninety-two hundredths of an inch long. On uniform and level ground, however, the four-pole

chain may be used. Your measurements will, however, always be represented according to the four-pole chain of one hundred links. The deputy surveyor must also have with him a measure of the standard chain, wherewith to compare and adjust the chain in use, from day to day, with punctuality and carefulness; and must return such standard chain to the Surveyor General's office for examination when his work is completed.

Of Tally Pins

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

Process of Chaining

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

Levelling the Chain and Plumbing the Pins

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

1. Ever keeping the chain stretched to its utmost degree of tension on even ground.
2. On uneven ground, keeping the chain not only stretched as aforesaid, but horizontally levelled. And when ascending and descending steep ground, hills, or mountains, the chain will have to be shortened to one-half its length, (and sometimes more) in order to accurately obtain the true horizontal measure.
3. The careful plumbing of the tally pins, so as to attain precisely the spot where they should be stuck. The more uneven the surface, the greater the caution needed to set the pins.

Marking Lines

6. All lines on which are to be established the legal corner boundaries are to be marked after this method, viz: those trees which may intercept

your line must have two chops or notches cut on each side of them without any other marks whatever. These are called "sight trees," "line trees," or "station trees."

A sufficient number of other trees standing nearest to your line, on either side of it, are to be blazed on two sides diagonally, or quartering towards the line, in order to render the line conspicuous, and readily to be traced, the blazes to be opposite each other, coinciding in direction with the line where the trees stand very near it, and to approach nearer each other the further the line passes from the blazed trees. Due care must ever be taken to have the lines so well marked as to be readily followed.

On Trial or Random Lines

The trees are not to be blazed, unless occasionally from indispensable necessity, and then it must 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 lines, must be pulled up when the surveyor returns to establish the true line.

Insuperable Objects of Line—Witness Points

7. Under circumstances where your course is obstructed by impassable obstacles, such as swamps, marshes, lakes, rivers, creek, etc., you will prolong the line across such obstacles by taking the necessary right angle offsets; or, if such be inconvenient, by a traverse or trigonometrical operation, until you regain the line on the opposite side. And in case a north and south, or a true east and west, line is regained in advance of any such obstacle, you will prolong and mark the line back to the obstacle so passed, and state all of the particulars in relation thereto in your field book. And at the intersection of lines with both margins of impassable obstacles, you will establish a Witness Point, (for the purpose of perpetuating the intersections therewith) by setting a post, and giving in your field book the course and distances therefrom to two trees on opposite sides of the line, each of which trees you will mark with a blaze and notch facing the post; but on the margins of navigable water courses, or navigable lakes, you will mark the trees with the proper number of the fractional section, township, and range.

The best marking tools adapted to the purpose must be provided for marking neatly and distinctly all the letters and figures required to be made at corners; and the deputy is to have always at hand the necessary implements for keeping the marking irons in order; for which purpose a rat-tail file and a small whetstone will be indispensable.

Establishing Corner Boundaries

To procure the faithful execution of this portion of a surveyor's duty is a matter of the utmost importance. After a true coursing, and most exact measurements, the corner boundary is the consummation of the work, for which all the previous pains and expenditures have been incurred. If, therefore, the corner boundary be not perpetuated in a permanent and workmanlike manner, the great aim of the surveying service will not have been attained. A boundary corner, in a timbered country, is to be a tree, if one be found at the precise spot; and if not, a post is to be planted thereat; and the position of the corner post is to be indicated by trees adjacent, the angular bearings and distances of which from the corner are facts to be ascertained and registered in your field book. (See article, "Bearing Trees".)

In a region where stone abounds the corner boundary will be a small monument of stones alongside of a single marked stone for a township corner, and a single stone for all other corners.

In a region where timber is not near, and stone not found, the corner will be a mound of earth, of prescribed size, varying to suit the case. The following are the different points for perpetuating corners, viz:

1. For township boundaries, at intervals of every six miles.
2. For section boundaries, at intervals of every mile, or 80 chains.
3. For quarter section boundaries, at intervals of every half mile, or 40 chains. Exceptions, however, occur in east and west lines, as explained hereafter.

(The half quarter section boundary is not marked in the field, but is regarded by law as a point intermediate between the half mile or quarter section corners. See act of 24th April, 1820, entitled "An act making further provision for the sale of the public lands," which act refers to the act of Congress passed on the 11th of February, 1805, entitled "An act concerning the mode of surveying the public lands of the United States," for the manner of ascertaining the corners and contents of half-quarter sections.)*

4. Meander posts are planted at all those points where the township or section lines intersect the banks of such rivers, bayous, lakes, or islands, as are by law directed to be meandered.

The course and distances on meandered navigable streams govern the calculations wherefrom are ascertained the true areas of the tracts of land (sections, quarter sections, etc.) known to the law as fractional, and bounding on such streams.

Manner of Establishing Corners by Means of Posts

Township, sectional, or mile corners, and quarter sectional or half mile corners, will be perpetuated by planting a post at the place of the corner, to be formed of the most durable wood of the forest at hand.

The posts must be set in the earth by digging a hole to admit them two feet deep, and must be very securely rammed with earth and also with stone, if any be found at hand. The portion of the post which protrudes above the earth must be squared off sufficiently smooth to admit of receiving marks thereon, to be made with appropriate marking irons, indicating what it stands for. Thus the sides of township corner posts should square at least four inches, (the post itself being five inches in diameter,) and must protrude two feet at least above the ground; the sides of section

* The subdivision of the half-quarter section into quarter-quarter sections is authorized by "An Act supplementary to the several laws for the sale of the public lands," approved April 5, 1832.

corner posts must square at least three inches, (the post itself being four inches in diameter,) and protrude two feet from the ground; and the quarter section corner posts and meander corner posts must be three inches wide, presenting flattened surfaces, and protruding two feet from the ground.

Where a township post is a corner common to four townships, it is to be set in the ground diagonally, thus:

N
W E
S

On each surface of the post is to be marked the number of the particular township, and its range, which it faces. Thus, if the post be a common boundary to four townships—say one and two, south of the baseline, of range one, west of the meridian; also to townships one and two, south of the baseline, of range two, west of the meridian, it is to be marked thus:

	(R1W)		(1W)
From N. to E.	(T1S)	from E. to S.	(2S)
	(S31)		(6)
	(2W)		(2W)
From N. to W.	(1S)	from W. to S.	(2S)
	(36)		(1)

These marks are not only to be distinctly but neatly cut into the wood, at least the eighth of an inch deep; and to make them yet more conspicuous to the eye of the anxious explorer, the deputy must apply to all of them a streak of red chalk.

Section or mile posts, being corners of sections, and where such are common to four sections, are to be set diagonally in the earth, (in the manner provided for township corner posts;) and on each side of the squared surfaces (made smooth, as aforesaid, to receive the marks) is to be marked the appropriate number of the particular one of the four sections, respectively, with such side faces; also on one side thereof are to be marked the numbers of its township and range; and to make such marks yet more conspicuous, in manner aforesaid, a streak of red chalk is to be applied.

In every township, subdivided into thirty-six sections, there are twenty-five interior section corners, each of which will be common to four sections.

A quarter section, or half mile post, is to have no other mark on it than ¼S, to indicate what it stands for.

Notching Corner Posts

Township corner posts, common to four townships are to be notched with six notches on each of the four angles of the squared part set to the cardinal points.

All mile posts on township lines must have as many notches on them, on two opposite angles thereof, as they are miles distant from the township corners, respectively. Each of the posts at the corners of sections in the interior of a township must indicate, by a number of notches on each of its

four corners directed to the cardinal points, the corresponding number of miles that it stands from the outlines of the township. The four sides of the post will indicate the number of the section they respectively face. Should a tree be found at the place of any corner, it will be marked and notched as aforesaid, and answer for the corner in lieu of a post, the kind of tree and its diameter being given in the field notes.

Bearing Trees

The position of all corner posts, or corner trees, of whatever description, that may be established, is to be evidenced in the following manner, viz: from such post or tree the course must be taken and the distances measured to two or more adjacent trees in opposite directions, as nearly as may be, and these are called 'bearing trees'. Such are to be distinguished by a large smooth blaze, with a notch at its lower end, facing the corner, and in the blaze is to be marked the number of the range, township, and section; but at quarter section corners nothing but ¼S need to be marked. The letters B.T. (bearing tree) are also to be marked upon a smaller blaze directly under the large one, and as near the ground as practicable.

At all township corners, and at all section corners, on range or township lines, four bearing trees are to be marked in this manner, one in each of the adjoining sections.

At interior section corners four trees, one to stand within each of the four sections to which such corner is common, are to be marked in manner aforesaid, if such be found.

A tree supplying the place of a corner post is to be marked in the manner directed for posts; but if such tree should be a beech, or other smooth bark tree, the marks may be made on the bark, and the tree notched.

From quarter sections and meander corners two bearing trees are to be marked, one within each of the adjoining sections.

Where the requisite number of "bearing trees" is not to be found at convenient and suitable distances, such as are found are to be marked as herein directed; but in all such cases of deficiency in the number of bearing trees, (unless, indeed, the boundary itself be a tree) a quadrangular trench, with sides of five feet, and with the angles to the cardinal points, must be spaded up outside the corner, as a center, and the earth carefully thrown on the inside, so as to form a range of earth, which will become covered with grass, and present a small square elevation, which in aftertime will serve to mark, unmistakably, the spot of the corner.

Corner Stones

Where it is deemed best to use stones for boundaries, in lieu of posts, you may, at any corner, insert endwise into the ground, to the depth of 7 or 8 inches, a stone, the number of cubic inches in which shall not be less than the number contained in a stone 14 inches long, 12 inches wide, and 3 inches thick—equal to 504 cubic inches—the edges of which must be set north and south, on north and south lines, and east and west, on east and west lines; the dimensions of each stone to be given in the field notes at the time of establishing the corner. The kind of stone should also be noted.

which are common to two townships on the north side thereof, will have six notches on each of the west, north, and east sides or edges; and where such stones or posts are set for corners to two townships south of the base or standard, six notches will be cut on each of the west, south, and east sides or edges.

Stones, when used for quarter section corners, will have ¼ cut on them —on the west side on north and south lines, and on the north side on east and west lines.

Mounds

Whenever bearing trees are not found, mounds of earth, or stone, are to be raised around posts on which the corners are to be marked in the manner aforesaid. Whenever a mound of earth is adopted, the same will present a conical shape; but at its base, on the earth's surface, a quadrangular trench will be dug; by the "trench" (here meant) is to be understood a spade deep of earth thrown from the four sides of the line, outside the trench, so as to form a continuous elevation along its outer edge. In mounds of earth, common to four townships or to four sections, they will present the angles of the quadrangular trench (diagonally) towards the cardinal point. In mounds, common only to two townships or two sections, the sides of the quadrangular trench will face the cardinal points. The sides of the quadrangular trench at the base of a township mound are to be six feet, the height of the mound three feet.

At section, quarter section, and meander corners, the sides of the quadrangular trench at base of mounds are to be five feet, and the conical height two and a half feet.

Prior to piling up the earth to construct a mound, there is to be dug a spadeful or two of earth from the corner boundary point, and in the cavity so formed is to be deposited a marked stone, or a portion of charcoal, (the quantity whereof is to be noted in the field book;) or in lieu of charcoal or marked stone, a charred stake is to be driven twelve inches down into such center point; either of these will be a witness for the future, and whichever is adopted, the fact is to be noted in the field book.

When mounds are formed of earth, the spot from which the earth is taken is called the "pit", the center of which ought to be, wherever practicable, at a uniform distance and in a uniform direction from the center of the mound. There is to be a "pit" on each side of every mound, distant eighteen inches outside of the trench. The trench may be expected hereafter to be covered by tufts of grass, and thus to indicate the place of the mound, when the mound itself may have become obliterated by time or accident.

At meander corners the "pit" is to be directly on the line, eight links further from the water than the mound. Wherever necessity is found for

The earth is to be pressed down with the shovel during the process of piling it up. Mounds are to be covered with sod, grass side up, where sod is to be had; but, in forming a mound, sod is *never* to be wrought up with the earth, because sod decays, and in the process of decomposing it will cause the mound to become porous, and therefore liable to premature destruction.

Posts in Mounds

Posts in mounds must show above the top of the mound ten or twelve inches, and be notched and marked precisely as they would be for the same corner without the mound.

Mound Memorials

Besides the charcoal, marked stone or charred stake, one or the other of which must be lodged in the earth at the point of the corner, the deputy surveyor is recommended to plant midway between each pit and trench, seeds of some tree, (those of fruit trees adapted to the climate being always to be preferred), so that, in course of time, should such take root, a small clump of trees may possibly hereafter note the place of the corner. The facts of planting such seeds, and the kind thereof, are matters to be truthfully told in the field book.

Witness Mounds to Township or Section Corners

If a township or section corner, in a situation where bearing or witness trees are not found within a reasonable distance therefrom, shall fall within a ravine, or in any other situation where the nature of the ground, or the circumstances of its locality, shall be such as may prevent, or prove unfavorable to, the erection of a mound, you will perpetuate such corner by selecting in the immediate vicinity thereof a suitable plot of ground as a site for a bearing or witness mound, and erect thereon a mound of earth in the same manner and conditioned in every respect, with charcoal, stone, or charred stake deposited beneath, as before directed; and measure and state in your field book the distance and course from the position of the true corner of the bearing or witness mound so placed and erected.

Double Corners

Such corners are to be nowhere except on the base and standard lines, whereon are to appear both the corners which mark the intersections of the lines which close thereon, and those from which the surveys start on the north. On those lines, and at the time of running the same, the township, section, and quarter section corners are to be planted, and each of

these is a corner common to two (whether township or section corners,) on the north side of the line and must be so marked.

The corners which are established on the standard parallel, at the time of running it, are to be known as the "standard corners", and, in addition to all the ordinary marks (as herein prescribed), they will be marked with the letters S.C. Closing corners will be marked with the letters C.C. in addition to other marks.

The standard parallels are designed to be run in advance of the contiguous surveys on the south of them, but circumstances may exist which will impede or temporarily delay the due extension of the standard; and when, from uncontrollable causes, the contiguous townships must be surveyed in advance of the time of extending the standard, in any such event it will become the duty of the deputy who shall afterwards survey any such standard to plant thereon the double set of corners, to wit, the standard corners, to be marked S.C. and the closing ones which are to be marked C.C. and to make such measurement as may be necessary to connect the closing corners and complete the unfinished meridional lines of such contiguous and prior surveys, on the principles herein set forth, under the different heads of "exterior or township lines", and of the diagram.

You will recollect that the corners (whether township or section corners,) which are common to two (two townships or two sections), are not to be planted diagonally like those which are common to four, but with the flat sides facing the cardinal points, and on which the marks and notches are made as usual. This, it will be perceived, will serve yet more fully to distinguish the standard parallels from all other lines.

The Meandering of Navigable Streams

1. Standing with the face looking down stream, the bank on the left hand is termed "the left bank," and that on the right hand the "right bank". These terms are to be universally used to distinguish the two banks of a river or stream.

2. Both banks of navigable rivers are to be measured by taking the courses and distances of their sinuosities, and the same are to be entered in the field book.

At those points where either the township or section lines intersect the banks of a navigable stream, posts, or where necessary, mounds of earth or stone, are to be established at the time of running these lines. These are called "meander corners", and in meandering you are to commence at one of those corners on the township line, coursing the banks, and measuring the distance of each course from your commencing corner to the next "meander corner", upon the same or another boundary of the same township, carefully noting your intersection with all intermediate meander corners. By the same method you are to meander the opposite bank of the same river.

The crossing distance between the meander corners on same line is to be ascertained by triangulation, in order that the river may be protracted with entire accuracy. The particulars to be given in the field notes.

3. You are also to meander, in manner aforesaid, all lakes and deep ponds of the area of twenty-five acres and upwards; also, navigable bayous; shallow ponds, readily to be drained, or likely to dry up, are not to be meandered.

You will notice all streams of water falling into the river, lake, or bayou you are surveying, stating the width of the same at their mouth; also all springs, noting the size thereof and depth, and whether the water be pure or mineral; also the head and mouth of all bayous; and all islands, rapids and bars are to be noticed, with intersections to their upper and lower points to establish their exact situation. You will also note the elevation of the banks of rivers and streams, the heights of falls and cascades, and the length of rapids.

4. The precise relative position of islands, in a township made fractional by the river in which the same is situated, is to be determined trigonometrically-sighting to a flag or other fixed object on the island, from a special and carefully measured base line, connected with the surveyed lines, on or near the river bank; you are to form connection between the meander corners on the rivers to points corresponding thereto, in direct line, on the bank of the island, and there establish the proper meander corners, and calculate the distance across.

5. In meandering lakes, ponds, or bayous, you are to commence at a meander corner upon the township line, and proceed as above directed for the banks of navigable stream. But where a lake, pond, or bayou lies entirely within the township boundaries, you will commence at a meander corner established in subdividing, and from thence take the courses and distances of the entire margin of the same, noting the intersection with all the meander corners previously established thereon.

6. To meander a pond lying entirely within the boundaries of a section, you will run and measure two lines thereunto from the nearest section or quarter section corner on opposite sides of such pond, giving the course of such lines. At each of the points where such lines shall intersect the margin of such pond, you will establish a witness point, by fixing a post in the ground, and taking bearings to any adjacent trees, or, if necessary, raising a mound.

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 book.

7. In taking the connection of an island with the mainland, when there is no meander corner in line, opposite thereto, to sight from, you will measure a special base from the meander corner nearest to such island, and from such base you will triangulate to some fixed point on the shore of the island, ascertain the distance across, and then establish a special meander corner, wherefrom you will commence to meander the island.

8. The field notes of meanders will be set forth in the body of the field book according to the dates when the work is performed, as illustrated in the specimen notes annexed. They are to state and describe particularly the meander corner from which they commenced, each one with which they close, and are to exhibit the meanders of each fractional section separately; following, and comprising 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 you are meandering.

9. No blazes or marks of any description are to be made on the lines meandered between the established corners, but the utmost care must be

establishing boundary corners, etc.; and present, as far as possible, a full and complete topographical description of the country surveyed, as to every matter of useful information, or likely to gratify public curiosity.

There will be sundry separate and distinct field books of surveys as follows:

Field notes of the meridian and base lines, showing the establishment of the township, section or mile, and quarter section or half mile, boundary corners thereon; with the crossings of streams, ravines, hills, and mountains; character of soil, timber, mineral, etc.

Field notes of the "Standard Parallels, or Correction Lines," will show the establishment of the township, section, and quarter section corners, besides exhibiting the topography of the country on line, as required on base and meridian lines.

Field notes of the exterior lines of townships, showing the establishment of corners on lines, and the topography, as aforesaid.

Field notes of the subdivision of townships into sections and quarter sections.

The field notes must in all cases be taken precisely in the order in which the work is done on the ground, and the date of each day's work must follow immediately after the notes thereof. The variation of the needle must always occupy a separate line preceding the notes of measurements on line.

The exhibition of every mile of surveying, whether on township or subdivisional lines, must be complete in itself, and be separated by a black line drawn across the paper.

The description of the surface, soil, minerals, timber, undergrowth, etc., on each mile of line, is to follow the notes of survey of such line, and not be mixed up with them.

No abbreviations of words are allowable, except of such words as are constantly occurring, such as "sec" for "section," "in. dia." for "inches diameter," "chs." for "chains," "lks." for "links; "dist." for "distant," etc. Proper names must never be abbreviated, however often their recurrence.

The nature of the subject matter of the field book is to form its title page, showing the State or Territory where such survey lies, by whom surveyed, and the dates of commencement and completion of the work. The second page is to contain the names and duties of assistants. Whenever a new assistant is employed, or the duties of any one of them are changed, such facts, with the reasons therefore, are to be stated in an appropriate entry immediately preceding the notes taken under such changed arrangements. With the notes of the exterior lines of townships, the deputy

upon which are carefully to be laid down the measurements of each of the section lines on such boundaries whereon he is to close, the magnetic variation of each mile, and the particular description of each corner. P. in M. signifies post in mound. And on such diagram 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 on line at which the same occur, but also the direction and position of each between the lines, or within each section, so that every object of topography may be properly completed or connected in the showing.

These notes must be distinctly written out, in language precise and clear, and their figures, letters, words, and meaning are always to be unmistakable. No leaf is to be cut or mutilated, and none to be taken out whereby suspicion might be created that the missing leaf contained matter which the deputy believed it to be his interest to conceal.

Summary of Objects and Data Required to Be Noted

1. The precise length of every line run, noting all necessary offsets therefrom, and the reason and mode thereof.

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 kinds of materials (earth or stone) of which mounds are constructed—the fact of their being conditioned according to instructions—with the course and distance of the "pits", from the center of the mound, where necessity exists for deviating from the general rule.

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 first intersects and then leaves every settler's claim and improvement prairie, river, creek, or other "bottom"; or swamp, marsh, grove, and wind fall, with the course of the same at both points of intersection; also the distance at which you begin to ascend, arrive at the top, begin to descend, and reach 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.

6. Intersections by line of water objects. All rivers, creeks, and smaller streams of water which the line crosses; the distance on line at the point 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, or hilly.

8. The soil—whether first, second, or third 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 to inundation, stated to what depth.

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

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

13. Improvements. Towns and villages; Indian towns and wigwams; houses or cabins; fields, or other improvements; sugar tree groves, sugar camps, mill seats, forges, and factories.

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 therefore; also salt springs and licks. All reliable information you can obtain respecting these objects, whether they be on your immediate line or not, is to appear in the general description to be given at the end of the notes.

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

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

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

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

19. The variation of the needle must be noted at all points or places on the lines where there is found any material change of variation, and the position of such points must be perfectly identified in the notes.

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

Swamp Lands

By the act of Congress approved September 28, 1850, swamp and overflowed lands "unfit for cultivation," are granted to the State in which they are situated. In order clearly to define the quantity and locality of such lands, the field notes of surveys, in addition to the other objects of topography required to be noted, are to indicate the points at which you enter all lands which are evidently subject to such grant, and to show the distinctive character of the land so noted; whether it is a swamp or marsh, or otherwise subject to inundation to an extent that, without artificial means, would render it "unfit for cultivation". The depth of inundation is to be stated, as determined from indications on the trees where timber exists; and its frequency is to be set forth as accurately as may be, either from your own knowldge of the general character of the stream which overflows, or from reliable information to be obtained from others. The words "unfit for cultivation", are to be employed in addition to the usual phraseology in regard to entering or leaving such swamps, marshy, or overflowed lands.

It may be that sometimes the margin of bottom, swamp, or marsh, in which such uncultivable land exists, is not identical with the margin of the body of land "unfit for cultivation", and in such cases a separate entry must be made for each opposite the marginal distance at which they respectively occur.

But in cases where lands are overflowed by artificial means (say by dams for milling, logging, or for other purposes,) you are not officially to regard such overflow, but will continue your lines across the same without setting meander posts, stating particularly in the notes the depth of water, and how the overflow was caused.

Special Instruction Respecting the Noting of Settlers' Claims in Oregon, Washington, and New Mexico

The law requires that such claims should be laid down temporarily on the township plats; in order to do which, it is indispensably necessary to obtain, to some extent, connections to these claims with the lines of survey. Under the head of "intersection by line of land objects", the deputy is required to note the points in line whereat it may be intersected by such claims; but, in addition thereto, there must be obtained at least one angle of each claim, with its course and distance either from the point of intersection, or from an established corner boundary, so that its connection with the regular survey will be legally determined. If the settler's dwelling or barn is visible from line, the bearing thereof shall be carefully taken from two points noted on line, and set forth in the field notes.

Affidavits to Field Notes

At the close of the notes and the general description is to follow an affidavit, a form to which is given; and to enable the deputy surveyor to understand and appreciate the responsibility under which he is acting, his attention is invited to the provisions of the second section of the Act of Congress, approved August 8th 1846, entitled "An act to equalize the compensation of the surveyors general of the public lands of the United States, and for other purposes," and which is as follows:

"Sec. 2. That the surveyors general of the public lands of the United States, in addition to the oath now authorized by law to be administered to deputies on their appointment to office, shall require each of their deputies, on the return of his surveys, to take and subscribe an oath or affirmation that those surveys have been faithfully and correctly executed according to law and the instructions of the surveyor general; and on satisfactory evidence being presented to any court of competent juris-

diction, that such surveys, or any part thereof have not been thus executed, the deputy making such claim or affirmation shall be deemed guilty of perjury, and shall suffer all the pains and penalties attached to that offense; and the district attorney of the United States for the time being, in whose district any such false, erroneous, or fraudulent surveys shall have been executed shall, upon application of the proper surveyor general, immediately institute suit upon the bond of such deputy; and the institution of such suit shall act as a lien upon any property owned or held by such deputy, or his sureties, at the time such suit was instituted."

Following the "general description" of the township is to be "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.

Form of Official Oaths to Be Taken Prior to Entering Upon Duty

For a Deputy Surveyor

I, A.B., having been appointed a deputy surveyor of the lands of the United States in ....., do solemnly swear (or affirm) that I will well and faithfully, to the best of my skill and ability, execute the duties confided to me pursuant to a contract with C.D., surveyor general of the public lands in ....., bearing date of ..... day of ....., 185...., according to the laws of the United States and the instructions received from the said surveyor general.

(To be sworn and subscribed before a justice of the peace, or other officer authorized to administer oaths.)

For Chainman

I, E.F., do solemnly swear (or affirm) that I will faithfully execute the duties of chain carrier; that I will level the chain upon uneven ground, and plumb the tally pins, whether by sticking or dropping the same; that I will report the true distance to all notable objects, and the true length of all lines that I assist in measuring, to the best of my skill and ability.

(To be sworn and subscribed as above.)

For Flagman or Axeman

I, H.G., do solemnly swear (or affirm) that I will well and truly perform the duties of ..... according to instructions given me, and to the best of my skill and ability.

(To be sworn and subscribed as above.)

Exteriors or Township Lines

The principal meridian, the base line, and the standard parallels having been first run, measured, and marked, and the corner boundaries thereon established, according to instructions, the process of running, measuring, and marking the exterior lines of townships will be as follows:

Townships Situated North of the Base Line, and West of the Principal Meridian.

Commence at No. 1 (see figures on the diagram), being the southwest corner of T1N, R1W, as established on the base line; thence north, on

a true meridian line, four hundred and eighty chains, establishing the section and quarter section corners thereon, as per instructions, to No. 2, whereat establish the corner of Tps. 1 and 2 N, Rs. 1 and 2 W.; thence east, on a random or trial line, setting temporary section and quarter section stakes, to No. 3, where measure and note the distance at which the line intersects the eastern boundary, north or south of the true or established corner. Run and measure westward, on the true line, (taking care to note all the land and water crossings, etc., as per instructions,) to No. 4, which is identical with No. 2, establishing the section and quarter section permanent corners on said line. Should it happen, however, that such random line falls short, or overruns in length, or intersects the eastern boundary of the township at more than three chains and fifty links distance from the true corner thereon, as compared with the corresponding boundary on the south, (either of which would indicate an important error in surveying,) the lines must be retraced, even if found necessary to remeasure the meridional boundaries of the township, (especially the western boundary,) so as to discover and correct the error, in doing which, the true corners must be established and marked, and the false ones destroyed and obliterated, to prevent confusion in the future; and all the facts must be distinctly set forth in the notes. Thence proceed in a similar manner from No. 4 to No. 5, No. 5 to No. 6, No. 6 to No. 7, and so on to No. 10, the southwest corner of T4N, R1W. Thence north, still on a true meridian line, establishing the mile and half mile corners, until reaching the Standard Parellel or correction line; throwing the excess over, or deficiency under, four hundred and eighty chains, on the last half mile, according to law, and at the intersection establishing the "closing corner", the distance of which from the standard corner must be measured and noted as required by instructions. But should it ever so happen that some impassable barrier will have prevented or delayed the extension of the standard parallel along and above the field of present survey, then the deputy will plant, in place, the corner of the township, subject to correction thereafter should such parallel be extended.

North of the Base Line, and East of the Principal Meridian.

Commence at No. 1, being the southeast corner of T1N, R1E, and proceed as with townships situated "north and west", except that the random or trial lines will be run and measured west, and the true lines east throwing the excess over or deficiency under four hundred and eighty chains on the west end of the line, as required by law; wherefore the surveyor will commence his measurement with the length of the deficient or excessive half section boundary on the west of the township, and thus the remaining measurements will be even miles and half miles.

Method of Subdividing

1. The first mile, both of the south and east boundaries of each township you are required to subdivide, is to be carefully traced and measured before you enter upon the subdivision thereof. This will enable you to observe any change that may have taken place in the magnetic variation, as it existed at the time of running the township lines, and will also enable you to compare your chaining with that upon the township lines.

4. From the section corner last named, run a random line, without blazing due east, for corner of sections 25 and 36, in east boundary, and at forty chains from the starting point set a post for temporary quarter section corner. If you intersect exactly at the corner, you will blaze your random line back, and establish it as the true line; but if your random line intersects the said east boundary, either north or south of said corner, you will measure the distance of such intersection, from which you will calculate a course that will run a true line back to the corner from which your random started. You will establish the permanent quarter section corner at a point equidistant from the two terminations of the true line.

5. From the corners of sections, 25, 26, 35, 36, run due north between sections 25 and 26, setting the quarter section post, as before, at forty chains, and at eighty chains establishing the corner of sections 23, 24, 25, 26. Then run a random due east for the corner of sections 24 and 25 in east boundary; setting temporary quarter section post at forty chains; correcting back, and establishing permanent quarter section corner at the equidistant point on the true line, in the manner directed on the line between sections 25 and 36.

6. In this manner you will proceed with the survey of each successive section in the first tier, until you arrive at the north boundary of the township, which you will reach in running up a random line between sections 1 and 2. If this random line should not intersect at the corner established for sections 1, 2, 35, and 36, upon the township line, you will note the distance that you fall east or west of the same, from which distance you can calculate a course that will run a true line south to the corner from which your random started. Where the closing corner is on the base or standard line, a deviation from the general rule is explained under the head of "diagram B".

7. The first tier of sections being thus laid out and surveyed, you will return to the south boundary of the township, and from the corner of sections 34 and 35 commence and survey the second tier of sections in the same manner that you pursued in the survey of the first, closing at the section corners on the first tier.

8. In like manner proceed with the survey of each successive tier of sections until you arrive at the fifth tier; and from each section corner which you establish upon this tier, you are to run random lines to the corresponding corners established upon the range line forming the western boundary of the township; setting, as you proceed, each temporary quarter section post at forty chains from the interior section corner, so as to throw the excess or deficiency of measurement on the extreme tier deficiency in the measurements will be thrown, according to law, on the extreme tier of quarter sections.

Every north and south section line, except those terminating in the north boundary of the township, is to be eighty chains in length. The east and west section lines, except those terminating on the west boundary of the township, are to be within one hundred links of eighty chains in length; and the north and south boundaries of any one section, except in the extreme western tier, are to be within one hundred links of equal length. The meanders within each fractional section, or between any two meander posts, or of a pond or island in the interior of a section, must close within one chain and fifty links.

. . . . . .

The subdivision of fractional sections into forty acre lots(as near as may be) are to be so laid down on the official township plat in red lines, so as to admit of giving to each a specific designation, if possible, according to its relative position in the fractional section, as per examples afforded . . . as well as by a number, in all cases where the lot cannot properly be designated as a quarter section. Those fractional subdivision lots which are not susceptible of being described according to relative local position, are to be numbered in regular series; No. 1 being (wherever practicable, and as a general rule) either the northeastern or the most easterly fractional lot, and proceeding from east to west and from west to east, alternately, to the end of the series; but such general rule is departed from under circumstances given as examples in fractional sections 4, 7, 19, and 30, where No. 1 is the interior lot of the northern and western tiers of the quarter sections to which there is a corresponding No. 2 given to the exterior lot, and the series of numbers is in continuation of the latter. The lots in the extreme northern and western tiers of quarter sections, containing either more or less than the regular quantity, are always to be numbered as per example. Interior lots in such extreme tiers are to be twenty chains wide, and the excess or deficiency of measurement is always to be thrown on the exterior lots; elsewhere, the assumed subdivisional corner will always be a point equidistant from the established corners.

The official township plat to be returned to the General Land Office is to show on its face, on the right hand margin, the meanders of navigable streams, islands, and lakes. Such details are wanted in the adjustment of the surveying accounts, but may be omitted in the copy of the township plat to be furnished to the district land office by the surveyor general. A suitable length for binding is to be preserved on the left hand side of each plat. Each plat is to be certified, with the table annexed, according

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

Printed blank forms for such notes will be 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 face of the township plat, to be furnished to the register of the district land office. There is shown a series of meander corners on diagram B, viz: from No. 1 to No. 22, on the river and islands; 23 to 28 being on Island lake; 29 and 30 on Clear Lake; and 31 and 32 on lake in section 26.

There is also a distinct series of numbers, 1 to 7, to designate corners D. Reed's private survey, and to fractional sections, made such thereby; and the same series is continued from 8 to 14 inclusive, to designate corners to S. William's private survey and to fractional sections made such thereby. These are numberings on the plat merely for the purpose of ready reference to the descriptions of such corners to be furnished to the registers.

The letters on "diagram B", at the "corners" on the township boundaries; are referred to in the descriptive notes to be furnished to the district land office, but are not required to be inserted on the official plat to be returned to the General Land Office.

Variations and Methods of Ascertaining

The following chapter, on the subject of the variation of the magnetic needle, is extracted from the revised editions of the work on surveying by Charles Davies, L.L.D., a graduate of the Military Academy at West Point. The work itself will be a valuable acquisition to the deputy surveyor; and his attention is particularly invited to the following chapter, which sets forth the modes by which the variation may be ascertained.

Variation of the Needle

(Author's note: This material may be found in any modern book on surveying.)

. . . . . .

Methods of Ascertaining the Variation

(Author's note: This material, likewise, may be found in any modern book on surveying.)

. . . . . .

be placed about one foot in front of the theodolite, a lamp or candle placed on the shelf at its lower edge; and let the board be slipped up or down, until the pole-star can be seen through the hole. The light reflected from the paper will show the cross hairs in the telescope of the theodolite.

Then, let the vertical spider's line be brought exactly upon the pole-star, and, if it is an eastern elongation that is to be observed, and the star has not yet reached the most easterly point, it will move from the line towards the east, and the reverse when the elongation is west.

At the time the star attains its greatest elongation, it will appear to coincide with the vertical spider's line for some time, and then leave it, in the direction contrary to its former motion.

As the star moves towards the point of greatest elongation, the telescope must be continually directed to it, by means of the tangent screw of the vernier plate; and when the star has attained its greatest elongation. great care should be taken that the instrument be not afterwards moved.

Now, if it be convenient to leave the instrument in its place until daylight, let a staff, with an candle or small lamp upon its upper extremity, be arranged at thirty or forty yards from the theodolite, and in the same vertical plane with the axis of the telescope. This is easily effected by revolving the vertical limb about its horizontal axis without moving the vernier plate, and aligning the staff to coincide with the vertical hair. Then mark the point directly under the theodolite; the line passing through this point and the staff, makes an angle with the true meridian equal to the azimuth of the pole-star.

From the table of azimuths, take the azimuth corresponding to the year and nearest latitude. If the observed elongation was east, the true meridian lies on the west of the line which has been found, and makes with it an angle equal to the azimuth. If the elongation was west, the true meridian lies on the east of the line; and, in either case, laying off the azimuth angle with the theodolite, gives the true meridian.

To Find the True Meridian With the Compass

Drive two posts firmly into the ground, in a line nearly east and west; the upper most ends, after the posts are driven, being about three feet above the surface, and the posts about three feet apart; then lay a plank, or a piece of timber three or four inches in width, and smooth on the upper side, upon the posts, and let it be pinned or nailed, to hold it firmly.

Prepare a piece of board four or five inches square, and smooth on the upper side. Let one of the compass sights be placed at right angles to the upper surface of the board, and let a nail be driven through the board, so that it can be tacked to the timber resting on the posts.

At about twelve feet from the stakes, and in the direction of the pole-star, let a plumb be suspended from the top of an inclined stake or pole. The top of the pole should be of such a height that the pole-star will appear about six inches below it; and the plumb should be swung in a vessel of water to prevent it from vibrating.

This being done, about twenty minutes before the time of elongation, place the board, to which the compass sight is fastened, on the horizontal plank, and slide it east or west, until the aperture of the compass sight, the plumb-line, and the star, are brought into the same range. Then if the star departs from the plumb-line, move the compass-sight east or west along the timber, as the case may be, until the star shall attain its greatest elongation, when it will continue behind the plumb-line for several minutes, and will then recede from it in the direction contrary to its motion before it became stationary. Let the compass-sight be now fastened to the horizontal plank. During this observation it will be necessary to have the plumb-line lighted; this can be done by an assistant holding the candle near it.

Let now a staff, with a candle or lamp upon it, be placed at a distance of thirty or forty yards from the plumb-line, and in the same direction with it and the compass-sight. The line so determined makes, with the true meridian, an angle equal to the azimuth of the pole-star; and from this line the variation of the needle is readily determined, even without tracing the true meridian on the ground.

Place the compass upon this line, turn the sights in the direction of it, and note the angle shown by the needle. Now if the elongation, at the time of observation was west, and the north end of the needle is on the west side of the line, the azimuth, plus the angle shown by the needle, is the true meridian. But should the north end of the needle be found on the east side of the line, the elongation being west, the difference between the azimuth and the angle would show the variation, and the reverse when the elongation is east. (Author's note: There follow some examples and a brief discussion of variation. Of these remarks one is important.) The variation of the needle should always be noted on every survey made with the compass, and then if the land be surveyed at a future time, the old lines can always be re-run.

A very near approximation to a true meridian, and consequently to the variation, may be had, by remembering that the pole-star very nearly reaches the true meridian, when it is in the same vertical plane with the star Alioth in the tail of the Great Bear, which lies nearest the four stars forming the quadrilateral.

The vertical position can be ascertained by means of a plumb-line. To see the spider's lines in the field of the telescope at the same time with the star, a faint light should be placed near the object glass. When the plumb-line, the star Alioth, and the north star, fall on the vertical spider's line, the horizontal limb is firmly clamped, and the telescope brought down to the horizon; a light, seen through a small aperture in a board, and held at some distance by an assistant, is then moved according to signals, until it is covered by the intersection of the spider's lines. A picket driven into the ground, under the light, serves to mark the meridian line for reference by day, when the angle formed by it and the magnetic meridian may be measured.

FIELD NOTES OF THE SURVEY OF THE EXTERIOR BOUNDARIES OF TOWNSHIP 25 NORTH OF RANGE 2 WEST OF THE WILLAMETTE MERIDIAN, IN THE TERRITORY OF OREGON, BY ROBERT ACRES, DEPUTY SURVEYOR, UNDER HIS CONTRACT NO.

1, BEARING DATE OF THE 2D OF JANUARY, 1854

South Boundary, T25N, R2W, Willamette Meridian.

Chains	
	Begin at the post, the established corner to townships 24 and 25 north, in ranges 2 and 3 west. The witness trees all standing, and agree with the descriptions furnished me by the office, viz:
	A black oak, 20 in. dia. N37E 27 links.
	A burr oak, 24 in. dia., N43W 35 links.
	A maple, 18 in. dia. S27W 39 links.
	A white oak, 15 in. dia. S47E 41 links.
	East on a random line on the south boundaries of sections 31, 32, 33, 34, 35, and 36.
	Variation by Burt's improved solar compass, 18° 41′ E.
	I set temporary half mile and mile posts at every 40 and 80 chains, and at 5 miles 74 chains, 53 links, to a point 2 chains and 20 links north of the corner to townships 24 and 25 north, ranges 1 and 2 W.
	(Therefore the correction will be 5 chains, 47 links west, and 37 links south per mile)
	I find the corner standing and the witness trees to agree with the description furnished me by the surveyor general's office, viz:
	(Description of Trees)
	From the corner to townships 24 and 25 N, ranges 1 and 2 W, I run (at a variation of 18° 25′ East)
	west on a true line along the south boundary of section 36.
40 00	Set a post for quarter section corner from which bears, etc.
62 50	A brook, 6 links wide runs north.
80 00	Set a post for corner to sections 35 and 36, 1 and 2, from which bears, etc.
	Land level, good soil, fit for cultivation.
	Timber, etc.

AN EXAMPLE OF TRIANGULATION

North between sections 19 and 24,

Variation 18° 50′ East

32 50	A hickory, 20 in. dia. on the left bank of Chickeeles river; mark it for corner to fractional sections 19 and 24, from which bears, etc.
	I now cause a flag to be set on the right bank of the river, and in the line between sections 19 and 24, and from the corner run a base East 5.90 chains to a point 9.00 chains East of the corner on the river bank, from which the flag bears N25° 15′W, which gives by calculation as the mean result of the two observations for the distance across the river on the line between sections 19 and

General Description

The description gives the quality of the land, kinds of timber, minerals, settlements, etc.

List of Names

A list of the names of the individuals employed to assist in running, measuring, or marking the lines and corners described in the foregoing field notes of Township No. 25 North of the base line of Range No. 2 west of the Willamette meridian, showing the respective capacities in which they acted:

Peter Long, Chainman.
John Short, Chainman.
George Sharp, Axeman.
Adam Dull, Axeman.
Henry Flagg, Compassman.

We hereby certify that we assisted Robert Acres, deputy surveyor, in surveying the exterior boundaries and subdividing township number twenty-five north of the base line of range number two west of the Willamette meridian, and that said township has been in all respects, to the best of our knowledge and belief, well and faithfully surveyed, and the boundary monuments planted according to the instructions furnished by the surveyor general.

Peter Long, Chainman.
John Short, Chainman.
George Sharp, Axeman.
Adam Dull, Axeman.
Henry Flagg, Compassman.

Subscribed and sworn to by the above named persons, before me, a Justice of the Peace for the country of , in the State (or Territory) of , this day of , 185 .

Henry Doolittle,
Justice of the Peace.

I, Robert Acres, deputy surveyor, do solemnly swear that, in pursuance of a contract with surveyor of the public lands of the United States in the State (or Territory) of , bearing date the day of 185 , and in strict conformity to the laws of the United States and the instructions furnished by the said Surveyor General, I have faithfully surveyed the exterior boundaries (or subdivision and meanders, as the case may be) of Township number twenty-five north of the baseline of range number two west of the Willamette meridian, in the aforesaid, and do solemnly swear that the foregoing are the true and original field notes of such survey.

Robert Acres,
Deputy Surveyor.

Subscribed by said Robert Acres, deputy surveyor, and sworn to before me, a Justice of the Peace for county, in the State (or Territory) of , this day of , 185 .

Henry Doolittle,
Justice of the Peace.

Specifications in Manual of 1881

The next change in instructions came with the Manual of 1881, which specified "the form and language to be used by the deputy surveyors in describing the establishment of corners in their field notes, and their work in the field must strictly conform with the same." Specific form and language were given for the following kinds of corners: standard township, closing township, standard section, section closing, common to four townships and common to four sections, quarter-section, and meander.

The following is the form and language required for a standard township corner. That for the other corners is similar:

STANDARD TOWNSHIP CORNERS

Stone with Pits and Mound. Sec. 1. Set a —— stone —x—x— ins. — ins. in the ground, for Standard Cor. to (e. g.) Twps. 5 N., R's 2 & 3 W., marked with S.C. with six notches on the N., E., & W. edges; dug pits 24x18x12 ins. crosswise on each line, N., E., & W. of stone six feet dist. and raised a mound of earth, 2½ feet high, 5 ft. base along side.

Stone with Mound of Stone. Sec. 2. Set a —— stone —x—x— ins. — ins. in the ground, for Standard Cor. to (e. g.) Twps. 5 N., R's 2 & 3 W., marked S.C., with 6 notches on N. E., & W. edges, and raised a mound of stone alongside. Pits impracticable.

Stone with Bearing Trees. Sec. 3. Set a —— stone —x—x— ins. — ins. in the ground, for Standard Cor. to (e. g.) Twps. 5 N., R's 2 & 3 W., marked S.C. with six notches on N. E., & W. edges from which

A —, — ins. diam. bears N. —° W. — lks., dist. marked T. 5 N. R. 2 W. S. 31, B.T.

A —, — ins. diam. bears N. —°W. — lks., dist. marked T. 5 N. R 3 W. S. 36, B.T.

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

Post in Mound. Sec. 4. Set a post, 4½ ft. long, 4 ins. square, with marked stone (charred stake or quart of charcoal), 12 ins. in the ground, for Standard Cor. to (e. g.) Twp. 5 N., R's 2 & 3 W.,
marked S.C. T. 5 N. on N.
R. 2 W. S. 31, on E. and
R. 3 W. S. 36 on W. faces, with 6 notches on N. E., & W.
faces, dug pits, 24x18x12 ins. crosswise on each line, N., E., & W. of post, 6 ft. dist. and raised mound of earth 2½ ft. high, 5 ft. base, around post.

Post with Bearing Trees. Sec. 5. Set a post, 4½ ft. long, 4 ins. square, 24 ins. in the ground, for Standard Cor. to (e. g.) Twps. 5 N., R's 2 & 3 W. marked
S.C. T. 5 N. on N.
R. 2 W. S. 31, on E. and
R. 3 W. S. 36 on W. faces, with 6 notches on N., E. & W. faces; from which
A —, — ins., diam., bears N —°E, — lks.dist. marked T. 5 N. R 2 W. S. 31, B. T.
A —, —ins. diam., bears N. —°W. — lks. dist. marked T. 5 N. R. 3 W. S. 36, B. T.
A —, — ins., diam., bears S —°W — lks. dist. marked T. 4 N. R. 3 W. S. 1, B. T.

Mound with Post or Stone. Sec. 6. Deposited a marked stone (charred stake or quart of charcoal) 12 ins. in the ground, for Standard Cor. to (e. g.) Twps. 5 N., R's 2 & 3 W., dug pits 24x18x12 ins. crosswise on each line, N., E. & W. of cor., 6 ft. dist. and raised a mound of earth 2½ ft. high, 5 ft. base, over it. In E. pit drove a stake 2 ins. square, 2 ft. long, 12 ins. in the ground, marked
S.C. T 5 N. on N.
R. 2 W. S. 31, on E. and
R. 3 W. S. 36 on W. faces, with 6 notches on N., E. & W. faces.

Tree Corner without Bearing Trees. Sec. 7. A —, —ins. diam., which I marked (e. g.) S. C. T. 5 N. on N.
R. 2 W. S. 31, on E. and
R. 3 W. S. 36 on W. faces, with 6 notches on N., E. & W. faces, dug pits 24x18x12 ins. crosswise on each line, N., E. & W. of tree 6 ft. dist., and raised a mound of earth around tree, for Standard Cor. to Twps. 5 N., R's 2 & 3 W.

Tree Corner with Bearing Trees. Sec. 8. A —, — ins. diam., which I marked (e. g.) T. 5 N. S. C. on N.
R. 2 W. S. 31, on E. and
R. 3 W. S. 36 on W faces, with 6 notches on N., E. & W. faces, for Standard Cor. to Twps. 5 N., R's 2 & 3 W.; from which
A —, — ins. diam., bears N. — °E. — lks. dist. marked T. 5 N. R. 2 W. S. 31, B. T.
A —, — ins. diam., bears N —°W. — lks. dist. marked T. 5 N. R. 3 W. S. 36, B. T.
A —, — ins. diam., bears S —°W. — lks, dist. marked T. 4 N. R. 3 W. S. 1, B. T.

All quarter-section corners on standard lines were "established in all respects like other quarter-section corners, with the addition of the letters S. C., and if bearing trees are established for such corners, each tree must be marked S. C. ¼S. B. T."

Witness corners were required to "bear the same marks that would be placed upon the corner for which it is a witness, with the addition of the letters W.C., and be established in all respects like such corner." If bearing trees were established for a witness corner, each tree was marked W.C. in addition to the usual marks.

Meander corners were required on both banks of the navigable streams at the intersection of all section lines.

Marking Corners

General rules for establishing and marking corners set up under a heading called "Miscellaneous" in the 1881 Manual were:

Rock in Place. Sec. 1. When a rock in place is established for a Corner, its dimensions above ground must be given, and a cross (X) marked at exact corner point.

Mounds of Earth. Sec. 2. Where mounds of earth are raised "alongside" of corners, on N. and S. lines, they must be placed on the W. and on E. and W. lines on the N. side of corner. In case the character of the land is such that this cannot be done, the deputy will state in his notes instead of "alongside," S (or E).

Mounds of Stone. Sec. 3. In case where pits are practicable, the deputy prefers raising a mound of stone, or stone covered with earth, as more likely to perpetuate the corner, he will use the form given for mound of stone, omitting the words "pits impracticable," and adding "covered with earth," when so established.

Bearing Trees. Sec. 4. Where the requisite number of trees can be found within 300 links of the corner point, three (3) bearing trees should be established for every Standard or Closing Cor., four (4) for every Cor. common to 4 Townships or Sections, and two (2) for every Quarter-Sec. Cor. or Meander Cor. In case the requisite number cannot be found within limits, the deputy must state in his field notes after describing those established, "no other trees within limits," and "dug pits in Secs. — & —," or "raised mound of stone alongside."

Stones. Sec. 5. Stones 18 ins. and less long must be set two-thirds, and over 18 ins. long, three-fourths of their length in the ground. No stones containing less than 504 cubic inches must be used for corners.

Objects to be Noted. Sec. 6. Particular attention is called to the "Summary of objects and data required to be noted," on pages — and — of these instructions, and it is expected that the deputy will thoroughly comply with the same in his work and field notes.

direction from the section corners on the auxiliary base thus established.

Boundaries. Sec. 9. When no part of the east or west boundaries can be run, both the north and south boundaries will be established as true lines.

Convergency. Sec. 10. Allowance for the convergency of Meridians must be made whenever necessary.

Red Chalk. Sec. 11. All letters and figures cut in posts or trees must be marked over with red chalk to make them still more plain and durable.

Mode of Setting Corners. Sec. 12. Township corners common to four townships, and section corners common to four sections, are to be set diagonally in the earth, with the angles in the direction of the lines. All other corners are to be set square, with the sides facing the direction of the lines.

Size of Posts. Sec. 13. The sizes of wooden posts, mounds, and pits noted in foregoing descriptions of corners are to be regarded as MINIMUM, and whenever practicable to increase their dimensions it is desirable to do so.

Corner Materials. Sec. 14. In establishing corners, stones should be used wherever practicable; then posts; and lastly, mounds, with stake in pit.

Examine Instructions. Sec. 15. It is expected that the deputy surveyors will carefully read and familiarize themselves with these instructions, and all others contained in this volume, and will instruct their assistants as to their duties before commencing work. Extra copies will be furnished the deputies for the use of their assistants.

Specifications in Manual of 1890

The manual of 1890 made no changes in the form and language to be used in describing corners. Under the "Miscellaneous" items some additions were made to Section 4 of the 1881 Manual:

Bearing Trees. Sec. 4. Where the requisite number of trees can be found within 300 links of the corner point, three (3) bearing trees should be established for every Standard or Closing Cor., four (4) for every Cor. common to (four) townships or sections, and two (2) for every Quarter-Sec. Cor. or Meander Cor. When a bearing tree is located on the side of a Base Line or Standard parallel *opposite* the township to which the corner *survey*, and the distance should be measured *from* the center of the tree to the center of the corner. The height of the top of all blazes and markings on trees must be limited to *two and a half feet above the ground.*

Specifications in Manual of 1894

The Manual of 1894 made slight changes in the form and description for corners. They need not be repeated here. Certain clarifying and descriptive data were added for each corner. For example, on the Standard Township Corner there were:

When more than one-half of all the standard township and section corners on any six 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. and W. faces;"

When under the conditions above specified the corner described in paragraph 1 is established, a stake may be driven in the east pit and marked instead of the stone, and described as exemplified in the last clause of paragraph 6, page 24.

Considerable descriptive matter was added to that on the closing Township Corner. This included, "Connecting Lines; Relative Positions of Closing Corners, Pits, Mounds, and Bearing Trees; Positions and Dimensions of Pits of Closing Corners on Irregular Boundaries; Township or Section Interfering Closing Corners; Positions and Dimensions of Pits and Mounds of Interfering Closing Corners."

The following additional corners were added: "Corners common to two Townships only, Corners referring to one Township only, Section Corners common to two Sections only, Section Corners referring to one Section only, Quarter-Section Corners common to two quarters of one Section, Special and Auxiliary Meander Corners, Corners on Reservation or other

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.

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

3. 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.

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

The point for a corner falling on a railroad, street, or wagon road, will be perpetuated by a marked stone (charred stake or quart of charcoal), deposited 24 inches in the ground, (The deposit will not be practicable in the case of railroads; but the witness corners will be established on the lines limiting the right of way) 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 road or streets, as the case may be.

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 ¼s." as the case may be.

If bearing trees are available as accessories to *witness points*, each tree will be marked W.P.B.T.

Much was added to the "Miscellaneous" section relating to corners in the 1894 Manual. Some of these additions were:

1. Corners on rock in place, or on boulders.

When a corner falls on a rock *in place*, or on a *boulder*, a cross (X), will be made at the exact corner point, and witnessed by the proper number

be carefully stated. The use of the indefinite description "alongside" will be discontinued.

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

3. Mounds of Stone covered with Earth.

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

4. 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.

. . . . . .

5. Stones for corners: Same as 1890 Manual.
6. Objects to be noted: Same as 1890 Manual.
7. Lines discontinued at legal corners: Same as 1890 Manual.
8. Marks to be cut.

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

9. 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*

In the 1902 Manual further refinements and improvements were made in the descriptions and requirements. Some of these were:

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.

. . . . . .

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.

. . . . . .

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.

Specifications in Manual of 1902

No changes were made in corner descriptions in the 1902 Manual. Two tables were added, giving in compact form the pertinent data for all corners. These tables follow:

Specifications in Manual of 1930

The latest (1930) Manual of the General Land Office is a complete revision in form and a substantial revision in material as compared with the preceding manual (1902). Copies of this new manual are readily available

those terminating on the north boundary of the township, must be eighty chains in length. The east and west section lines, except those terminating on the west boundary of the township, are to be within one hundred links of eighty chains in length; and the north and south boundaries of any section, except in the extreme western tier, are to be within one hundred links of equal length. The meanders within each fractional section, or between any two meander posts, or of a pond or island in the interior of a section, must also close within one chain and fifty links."

Limits, 1881

These requirements were revised slightly in the Manual of 1881, where they were set forth under "Prescribed Limits for Closings and Lengths of Lines in Certain Cases," as follows:

1. Every north and south section line, except those terminating in the north boundary of the township, must be eighty chains in length.

2. The east and west section lines, except those terminating in the north boundary of the township, are to be within eighty links of the actual distance established on the south boundary line of the township for the width of said tier of sections, and must close within eighty links north or south of the section corner.

3. The north boundary and south boundary of any one section, except in the extreme western tier, are to be within eighty links of equal length.

4. The meanders within each fractional section, or between any two meander posts, or of an island in the interior of a section must close within one chain and fifty links.

5. In running random township corners, if such random lines fall short or overrun in length, or intersect the eastern or western boundary, as the case may be, of the township, at more than three chains north or south of the true corner, the lines must be retraced, even if found necessary to remeasure the meridional boundaries of the township. One set of chainmen, only, is required in subdividing.

of an arc from a true meridian or latitude line."—Author.)

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

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

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

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

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

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

6. The north boundary and the south boundary of any one section, except in the extreme western range of sections, shall be within fifty links of equal length.

Limits given in the Manual of 1902 showed further progress:

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 rerun, 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 eighty chains in length, without allowance of 50 links per mile for difference of measure, or any other allowance beyond a small reasonable discrepancy according to the nature of the surface, to be determined upon examination.

176. The random meridional 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.

Under the contract system, each surveyor general made a contract with each of his deputies for surveying a certain district. The general scheme in effect in 1882 is described by Donaldson as follows:[7]

The surveyors general . . . enter into contracts with professional surveyors, whom they commission as their deputies, and who are thoroughly acquainted with the system and the official requirements in regard to field operations. Surveying contracts describe the particular field work to be executed, time within which is to be completed, consideration stipulated at so much per lineal mile of surveying, including all expenses of the surveyor, his party and instruments, together with the proper returns of survey to the office of the surveyor general, to be accompanied by an affidavit of the surveyor to the effect that the work was performed by him, in his own proper person, in accordance with his contract and the manual of surveying instructions, and in strict conformity to the laws governing the surveys.

The party of the deputy surveyor generally consists of two chainmen, flagman, axeman, and two moundsmen, whose duties are to assist him in running, measuring and marking the lines, and constructing and setting corner boundaries. They are sworn to perform their respective duties with fidelity before they enter on the same, and on completing their work they make affidavits to the effect that the deputy surveyor was assisted by them in the survey which they describe, and that it has been executed in all respects well and faithfully.

To guard the government from any loss that might be occasioned by erroneous or fraudulent surveys on the part of the surveyor, he is required to give bond, with appropriate securities, in double the amount of his contract, and when his unfaithfulness is detected the delinquent deputy and his bondsmen are punishable by law, and the surveyor debarred from future employment in like capacity.

Summary

This whole discussion of the evolution of section corners is summed up nicely by Arthur D. Kidder, Associate Supervisor of Surveys, General Land Office, in a letter to the author. He says: "The acid test of a section *corner-monument* is that of lasting quality or durability. Altogether too much weight was given to the value of mounds of earth, and to charcoal memorials. These were both good if left undisturbed, but comparatively few mounds of earth escaped destruction by buffalo or cattle, or erosion by rainfall; the pawing down or washing of the soil resulted in filling the pits, and the plowing of the soil scattered the charcoal deposits. The fact is that the pits in a firm sod were a very lasting marker, but these passed out by the thousands with the arrival of the settler's plow and the laying out of roads on section lines. Even the best of durable monuments oftentimes were given very little regard where roads were laid on section lines.

"Section corners are and should be well constructed of durable material; what happens afterwards depends upon the judgment and good intentions of engineers, road supervisors, landowners, and others. . . It has fallen to me probably more than to any other individual to take part in or to supervise the retracement. on a very broad scale, of extensive areas of the early public land surveys, both in the eastern public land states and in the west. I can state most emphatically that the marking of bearing trees and line trees, where available, and the placing of stone corner-monuments and marked-stone deposits, in the very early surveys, have proven to be the most lasting and the most valuable markers for the identification of the surveys; to a very much less extent, but nevertheless very valuable, pits were good markers where the site conditions were in the firm sod."

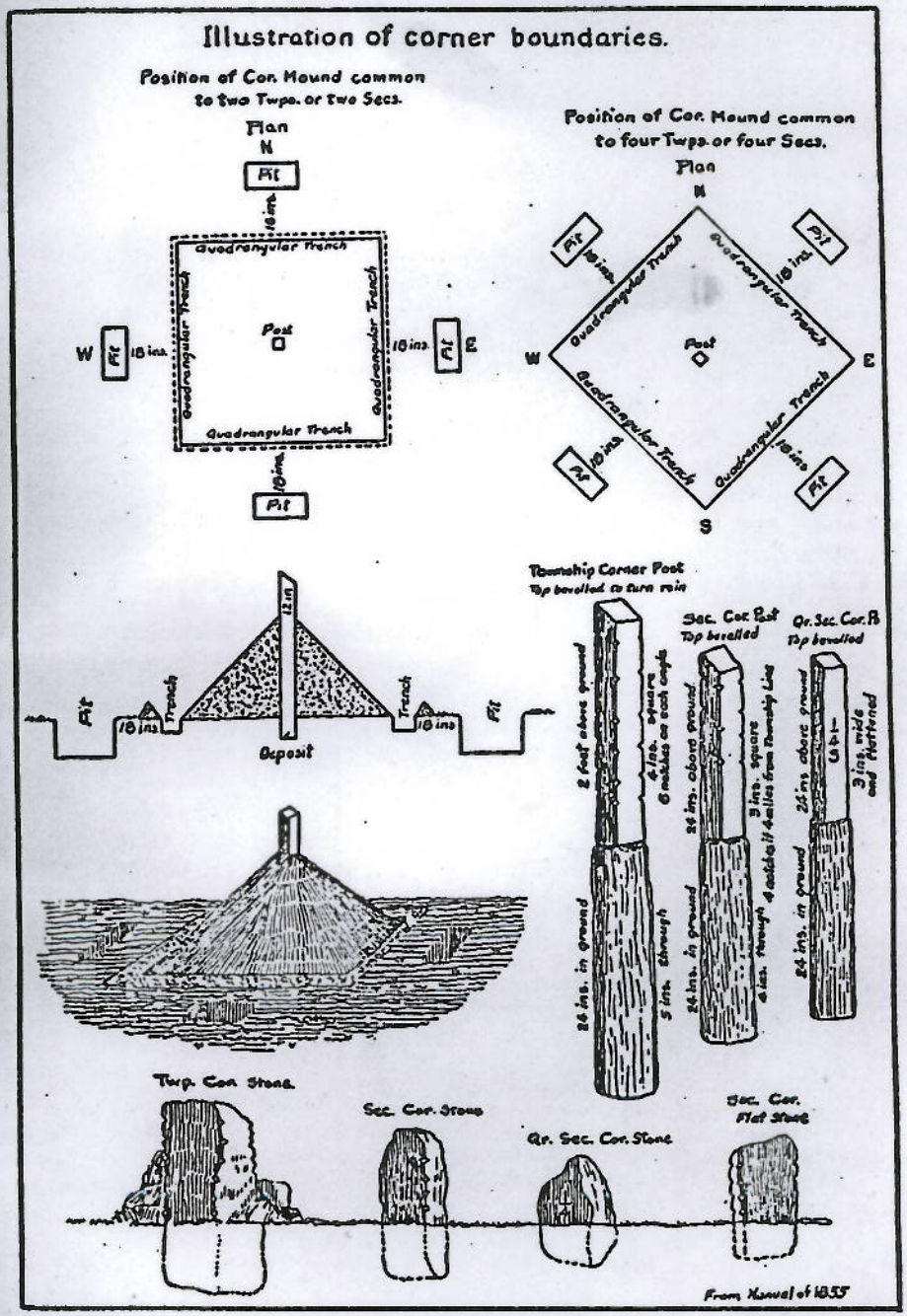

Figure 11. Corner boundaries used in land surveys. (from Manual of 1855)