

DEPARTMENT OF THE INTERIOR

OFFICE OF UNITED STATES SURVEYOR-GENERAL

PHOENIX, ARIZONA.

-----oOo-----

CIRCULAR "SPECIAL INSTRUCTIONS"

in which numerous circulars and regulations have
been assembled and indexed for the convenient
reference

of

UNITED STATES SURVEYORS AND TRANSITMEN

OF THE

DISTRICT OF ARIZONA

-----oOo-----

JANUARY 20, 1915.

-----oOo-----

I N D E X .

Absence, leave of	35	Examination for oblit.	42
Accidents,	33	Examination of Bona	
Accounts,	21	Fides,	36
Accounts, oaths to,	26	Expenses, traveling,	29
Adjustments of instru-		Fees, porters',	26
ment,	2	Females,	35
Allowance for subsist-		Field Notes, preparing,	47
ence,	25	Field tablets,	48
Analysis of costs,		Freight charges,	28
monthly,	29	Holidays,	34
Approval of instrument,	3	Illness,	34
Asst. Supervisor of Sur-		Independent resurveys,	32
veys,	20	Instructions, Special,	
Assistants, selection,	10	departure from,	1
Assistants traveling		Instrumental adjustments,	3
alone,	25	Instrument, approval of,	2
Assistants, Per Diem	26	Intersections, Mng. claim,	52
Berths, sleeper,	27	Iron posts,	15-33
Bills of lading,	28	Iron post reports,	33
Blazing,	17	Ladies,	35
Bona Fides,	36	Land, descriptions,	18
Certification on honor,	27	Leave of absence,	35
Charges, freight,	28	Limit of error in solar,	7-15
Classifications,	31	Limit of error in surs.,	14
Collateral evidence,	44	L. S. T., determination,	15
Competition, necessity		Location Monuments,	52
for,	23	Manual, modifications of,	12
Corner markings, Appendix		Measurements,	12
Cor. Mkgs. . . changing,	44	Measurements, stadia,	14
Corner posts,	15-33	Meridian, determination,	15
Corners, witness,	16	Mineral Claims,	52
Definitions, topograph.,	49	Mineral monuments,	52
Dependent resurveys,	31	Modifications of Manual,	12
Depend. Resur. Principles	43	Night letters,	27
Disbanding,	36	Notes, field,	47
Drainage, description,	18	Notes, resurvey,	38
Duties of Associate,	9	Obliteration, examination	
Duties of Chief of Party	9	for,	42
Efficiency, personal,	33	Oaths to accounts,	26
Equipment reports,	32	Obliteration of mineral	
Evidences, collateral,	44	surveys,	54

Passenger checks,	28	Shipments, Government,	28
Patented claims,	52	Sickness,	34
Per diem,	25	Sleeping car fare,	27
Personal efficiency,	33	Solar adjustments,	2
Plats, advance,	9	Soil descriptions,	18
Plats, preliminary,	48	Solar, limit of error,	7-15
Porter's fees,	26	Stadia,	14
Posts, iron,	15-33	Stationery and Supplies,	21
Prehistoric ruins,	56	Subsistence allowance,	25
Preliminary plats,	48	Sundays,	33
Property lines,	44	Supply proposals,	22
Property reports,	32	Surface Classification,	31
Proposals for supplies,	22	Tablets, field,	48
Provisions left over,	24	Telegrams,	27
Fullman tariffs,	27	Telegraph franks,	27
Reports, iron post,	33	Timber classifications,	31
Reports, property,	32	Timber, description of,	18
Reports, weekly,	30	Time, observations for,	15
Requisition for stationery,	21	Topographical expressions,	49
Responsibility, personal,	57	Transitmen, per diem of,	26
Resurvey definitions,	31	Transportation of chainmen,	10
Resurvey returns,	47	Transportation on vouchers,	29
Resurveys, exterior,	37	Trees, blazing of,	17
Resurveys, township,	38	Undergrowth,	18
Retracements,	37	Undergrowth classification,	31
Returns, preparation of,	47	Vouchers, supply,	21
Ruins,	56	Vouchers, Traveling, etc.,	29
Sale of excess provisions,	24	Water, classification of,	31
Saturday half holidays,	34	Water courses,	49
Sections, subdivision of,	40	Weekly reports,	30
Segregations, mineral,	52	Weights of posts,	16
Selection of assistants,	10	Witness to post corners,	16
Settlers' applications,	36	Women,	35

In addition to the instructions found in the Manual of Surveying Instructions for the Survey of the Public Lands of the United States, edition of 1902, the following Circular "Special Instructions" are issued for the guidance of United States Surveyors and Transitmen in the execution of Public Land Surveys in the DISTRICT OF ARIZONA.

All United States Surveyors and Transitmen are required to have in their possession and be familiar with the following publications, issued by the General Land Office:-

Manual of Surveying Instructions, edition of 1902;
 Standard Field Tables;
 Ephemeris of the Sun and Polaris and Table of Azimuths of Polaris;
 Circular on the Restoration of Lost or Obliterated Corners and Subdivision of Sections, edition of June 1, 1909; and
 Circular No. 105, paragraphs 223 to 276, inclusive, and 290 to 305, inclusive.

The foregoing publications are furnished to all Surveyors and Transitmen in charge of parties, and may be secured for the use of head chainmen, when necessary, on requisition to the Surveyor-General therefor.

After the receipt of the Special and Assignment Instructions covering the survey of any GROUP, the Surveyor will repair to the field, when so directed by the Assistant Supervisor of Surveys.

If, for any sufficient cause, any of the instructions, regulations, or requirements relative to surveys can not be complied with, whenever practical a statement of the unusual condi-

tions encountered should be communicated immediately to the Surveyor-General. The reason for any deviation from the customary procedure should be stated in the field notes in its proper connection.

I N S T R U M E N T .

Before beginning the surveys assigned under any GROUP, the instrument should be tested on the observation station on the roof of the Federal building at Phoenix, Arizona, and must be approved by the Assistant Supervisor of Surveys, and it will further be the duty of the Surveyor to test his instrument on a true meridian determined by one of the approved methods of observation for true meridian hereinafter provided for. The Surveyor is required to know, from personally conducted observations, that his instrument is in proper adjustment when he commences work and at all other times when it is in use.

The following simple field adjustments of the Smith solar attachment are given by Mr. Arthur D. Kidder, Supervisor of Surveys:

THE LATITUDE VERNIER. Thoroughly level the transit and set the latitude arc at zero, clamp it, and place the striding level upon the telescope. Bring the bubble to the center by turning the tangent screw. Then reverse the level, and if the bubble settles in the same position as before, we may conclude that the axis is horizontal; but, if the bubble moves from its former position, turn the screw so as to move the bubble over half this distance, the other half to be ascribed to error in the level itself. If, when the level is reversed, the bubble occupies a simi-

lar position in the opposite direction, the adjustment is complete. The vernier will now indicate the index error, which may be corrected by shifting the vernier by means of the adjusting screws for that purpose, or allowed for as an index error.

THE DECLINATION ARC. Having set off the true latitude as determined by independent method, take an observation of the sun on the meridian, and bring its image accurately between the equatorial wires by means of the tangent screw of the declination arc. The difference between the observed and calculated declinations, corrected for refraction, will be the index error, which may be corrected by loosening the three small screws on top of the arc, and moving the arc to the correct reading, or allowed for as an index error.

The Vertical Planes of the Solar and Transit Telescopes should be made Parallel, but as this condition is sometimes disturbed, the following is the simple field adjustment, satisfactory for one latitude only: Having completed the adjustments above described, take a solar observation at about 9 a. m. and note the error east or west of the true meridian as indicated by the transit telescope directed south. Bring transit telescope to the meridian with the tangent screws. This will cause the sun's image to leave the equatorial wires diagonally. Then by means of the upper N. and lower S. capstan adjusting nuts move the lower S. corner of the plate east, if the error was east, or west, if it was west, until the sun is accurately between the wires, the upper N. corner of the plate being moved simultaneous-

ly with the lower S. corner, but in the opposite direction to avoid any strain on the plate. A solar observation at about 3 p. m. will verify the adjustment; but, if the morning and afternoon observations can not be made to agree, within reasonable limits, then a portion of the error must be ascribed to an uncertainty in the true latitude, uncorrected index errors in the latitude or declination arcs, or one of the fundamental adjustments.

FUNDAMENTAL ADJUSTMENTS OF THE SMITH SOLAR

ATTACHMENT.

1. COLLIMATION OF THE AUXILIARY TELESCOPE. The eyepiece and object glass of the auxiliary telescope are first carefully focused on a distant object or the sun; the error in collimation is then corrected by revolving the auxiliary telescope in its collar bearings and adjusting both pairs of screws of the diaphragm until the intersection of the cross wires remains on a distant fixed point while revolving the auxiliary telescope; to admit of additional light, the plane of the reflector is moved edgewise by freeing the tangent screw of the declination arc at the point where it is attached to its veriner.

2. THE EQUATORIAL WIRES. If the sun in traversing the field of view should appear to depart from the equatorial wires, the correction can be made by loosening the screws and rotating the diaphragm carrying the cross wires, until the equatorial wires are made parallel to the axis of the reflector which will be accomplished when the sun appears to follow the equatorial wires accurately. This adjustment must be made with the preceding.

3. THE ADJUSTMENT OF THE AXIS OF THE REFLECTOR at right angles to the optical axis of the auxiliary telescope. Accomplished only by the maker.

4. TO MAKE THE AXIS OF THE LATITUDE ARC HORIZONTAL. Accomplished by removing the auxiliary telescope, inserting the adjusting axis in place of the axis of the latitude arc, attaching the hanging level, and adjusting by means of the capstan nuts which adjust the solar attachment to the standard; in this adjustment the instrument is carefully leveled, the hanging level repeatedly reversed, and the axis adjusted so that the bubble will settle in a mean position about one-half division high at the end of the axis away from the center of the instrument to allow approximately for the weight of the solar telescope when it is replaced; the long telescope bubble is depended upon to thoroughly level the instrument and it is necessary to test this adjustment in connection with the following.

5. TO MAKE THE AXIS OF THE LATITUDE ARC NORMAL TO THE VERTICAL PLANE OF THE TRANSIT TELESCOPE. Accomplished by means of the capstan nuts which adjust the solar attachment to the standard, by direct parallel sighting of the transit and auxiliary telescopes, preferably to a distant object; this adjustment is properly approached together with the preceding. In case the plane of the latitude arc has received a severe strain, the axis of the latitude arc may have been disturbed from a position at right angles to the optical axis of the auxiliary telescope, in which event the test is made by adjustment as described in this paragraph, and then reversing both telescopes and testing for

parallelism; if failure in parallelism appears in the reversal, the axis of the latitude arc can not be at right angles to the optical axis of the auxiliary telescope.

6. THE ADJUSTMENT OF THE AXIS OF THE LATITUDE ARC AT RIGHT ANGLES TO THE OPTICAL AXIS OF THE AUXILIARY TELESCOPE. Accomplished only by the maker.

When approaching perfection, the 4th and 5th adjustments may be accomplished simultaneously as stated in the following paragraph.

A record of the required adjustments as derived from the analysis of the 4th and 5th tests can be made for each of the four pairs of capstan adjusting nuts by the use of a positive sign for required outward adjustment and a negative sign for required inward adjustment; and, having considered the proper adjustments, first, about a vertical axis, and second about a horizontal axis, two signs are derived for each pair of capstan adjusting nuts. With each of one set of diagonally opposite capstan adjusting nuts the signs will cancel, or compensate by reason of the signs being opposite in character, but with each of the other set of diagonally opposite capstan adjusting nuts the signs will be alike, or accumulative, one pair of capstan adjusting nuts showing two positive signs and the diagonally opposite pair of capstan adjusting nuts showing two negative signs, thus identifying the diagonally opposite pairs to adjust as well as the direction of adjustment. If the 4th and 5th adjustments are badly out, perfection may first be approached by releasing the upper S. pair of capstan adjusting nuts, leaving three pairs effect-

ive, thus a horizontal axis through the two lower pairs, movement about which may be controlled by the upper N. pair, may be considered, and a nearly vertical axis through the N. pairs, movement about which may be controlled by the lower S. pair; when the adjustments are nearly perfected the upper S. pair must again be made effective.

7. THE LATITUDE VERNIER. Adjusted, or tested for index error, as stated in the simple field adjustments.

The above adjustments and determinations are made without reference to the sun or a meridian, but are essential to a proper mechanical and optical performance of the solar attachment.

8. THE DECLINATION ARC. Adjusted, or tested for index error, at apparent noon, as stated in the simple field adjustments.

The final test of the solar attachment is now to be made by comparison of its indications with the true meridian as determined by independent approved methods. Remembering that the solar instrument properly handled is an instrument which will give remarkably close approximations to the true meridian, but that it can not be expected to be an instrument of absolute precision, the salient result to be desired is found in a series of indications, throughout the usual hours of solar work, holding within 1' 30" of the true meridian. Remembering also that any failure in the above adjustments may give compensating errors through part of the day and accumulative errors throughout the remainder of the day, the test must be carried throughout the usual hours both a. m. and p. m. It must also be

remembered that an instrument may give a constant indication throughout the entire day not agreeing with the true meridian, and it is therefore necessary to make the comparison with the true meridian as determined by other approved methods.

The test of the solar apparatus is therefore dependent upon a series of comparisons with the true meridian both a. m. and p. m., and the differences may be styled "residual errors," which may be analyzed to determine their true character, but it must be emphasized that an analysis is of no consequence until the errors of the latitude and declination arcs are properly considered.

With the fundamental optical and mechanical adjustments of the solar attachment accomplished as perfectly as possible, the residual error of the mean of a series of a. m. and p. m. tests, under working conditions, as compared with the true meridian, represents the small residual lack of parallelism of the vertical planes through the two telescopes; this would better be treated as the resultant of residual errors in the 4th, 5th, and 6th adjustments as stated above, and corrected as instructed in the 3d paragraph of the simple field adjustments.

The amount of the necessary residual adjustment must depend upon the amount of the residual error; the adjustment must be made cautiously, with every small movement aiding to bring the sun's image squarely between the equatorial wires while the transit is fixed in the true meridian. After slight adjustment it is proper to make a new series of a. m. and p. m. tests, and a re-analysis of the residual error.

The adjustments (3) the proper adjustment of the reflector, and (6) the adjustment of the axis of the latitude arc at right angles to the optical axis of the auxiliary telescope, are complicated, but both possess considerable stability, and having been properly made by the instrument maker will seldom require attention except as incidental to other needed repairs at the hands of the maker.

It is emphasized in general that a more permanent and direct adjustment of the solar attachment, not subject to disturbance by change in latitude, will result from careful separate attention to each of the fundamental adjustments, followed by the elimination of the residual errors, based on an analysis of the a. m. and p. m. indications of the solar apparatus.

A D V A N C E D A T A .

As soon as practical, after the completion of the surveys in a township, the Surveyor will submit a rough diagram, giving all courses and distances and closings, in order that the surveys may be checked immediately. No attention need be paid to drafting or scaling--legibility alone being desired. When the preliminary plat is finally submitted, these data may be omitted.

DUTIES OF CHIEF OF PARTY AND HIS ASSOCIATE.

The Chief of Party will have entire charge of the management and conduct of the double party and the direction of the survey work of both divisions thereof. He will be held responsible for the General Land Office property assigned for the use of the party. He is further charged with the duty of employing or discharging assistants, the incurring of all expenses, and the ac-

counting therefor. Also, in all other respects, he is charged with the responsibility for the proper and economic conduct of the survey.

The Associate will have charge of his own surveying party on line and, in the temporary absence of the Chief of Party from camp, will be left in charge.

The work on line must be done by the Chief of Party and his Associate in their own proper persons. Before leaving the field, they will satisfy themselves that each and every section surveyed closes within the allowable limit of closing error.

S E L E C T I O N A N D P A Y O F A S S I S T A N T S .

Assistants will be engaged at the outfitting point or at the Surveyor-General's office, as the Assignment Instructions may specify. First and second chainmen may be transported from place to place within the state, and other assistants may be carried from one surveying field to another, if the distance from one outfitting point to another by railroad or stage does not exceed fifty miles. For a greater distance, special authority should be obtained from the Commissioner of the General Land Office through the Surveyor-General.

Assistants will be selected with great care and with particular reference to their capabilities for the class of work assigned them; yet it should be understood that they are not restricted to any special duty, but are required to perform any and all duties assigned to them.

In order to avoid frequent changes in the personnel of the party, assistants will be employed with the understanding

that they will be returned, at Government expense, to the place where they were hired if they remain in the service until the completion of the work. Assistants discharged from the service prior to the termination of field operations will be paid to the date of their dismissal only, but may be transported to the nearest town at Government expense.

The Chief of Party is directed to furnish to the Assistant Supervisor of Surveys, at the close of the work, a brief report and recommendation as to re-employment of all assistants who have been hired during the assignment.

As to the compensation of assistants, their pay should begin when the Assistant Supervisor of Surveys decides that service has commenced.

In the employment of assistants, such as flagmen, chainmen, and cornermen, the following rules must be followed:

The Assistant Supervisor of Surveys will keep a list of applicants for these places, and grade their qualifications and experience. Graduates of universities, colleges, and engineering schools should be given preference over undergraduates. The latter class, being obliged to serve only for the summer vacation, should not be encouraged. Graduates having had experience on public land surveys will, of course, be preferred to those who have had none. If a surveyor has employed chainmen and flagmen the previous year and has recommended them for re-employment, they should be preferred to new and untried men, but the list of such employees must receive the approval of the Assistant Supervisor of Surveys.

In case it is necessary to engage a man at once and there are none on the approved list, the Surveyor will be allowed to make his own selection, subject to the approval of the Assistant Supervisor of Surveys.

In cases where the Supervisor of Surveys or the General Land Office has been applied to for employment by prospective assistants, the merits of each applicant will be inquired into and, if it shows that the requirements are met, the Assistant Supervisor of Surveys will be notified and they will be given preference in the selection of assistants, unless the parties are already in the field.

Assistants should be selected:

1. From among young and vigorous men, capable of withstanding the hardships of camp life and the fatigue of long marches.
2. They should be intelligent and willing to help in a general way.
3. Dissipated men and those of questionable habits, such as gambling and drinking, should be avoided.
4. Boys under 18 should not be engaged, even if they appear robust and hardy.
5. Applicants who seek employment because it will improve their health should not be engaged.

M E A S U R E M E N T S .

The use of long steel tapes and clinometers for measurements on slopes is now approved, the fact of their use being duly stated in the field notes.

CORRECTIONS IN LINKS AND ELEVATIONS IN FEET

IN CONNECTION WITH SLOPE MEASUREMENTS.

Slope Angle	1 Chain		2 Chains		3 Chains		4 Chains		5 Chains	
	Corr.	Elev.	Corr.	Elev.	Corr.	Elev.	Corr.	Elev.	Corr.	Elev.
4°	0	5	0	9	1	14	1	18	1	23
5°	0	6	1	12	1	17	2	23	2	29
6°	1	7	1	14	2	21	2	28	3	34
7°	1	8	1	16	2	24	3	32	4	40
8°	1	9	2	18	3	28	4	37	5	46
9°	1	10	2	21	4	31	5	41	6	52
10°	2	11	3	23	5	34	6	46	8	57
11°	2	13	4	25	6	38	7	50	9	63
12°	2	14	4	27	7	41	9	55	11	69
13°	3	15	5	30	8	45	10	59	13	74
14°	3	16	6	32	9	48	12	64	15	80
15°	3	17	7	34	10	51	14	68	17	85
16°	4	18	8	36	12	55	15	73	19	91
17°	4	19	9	39	13	58	17	77	22	96
18°	5	20	10	41	15	61	20	82	24	102
19°	5	21	11	43	16	64	22	86	27	107
20°	6	23	12	45	18	68	24	90	30	113
21°	7	24	13	47	20	71	27	95	33	118
22°	7	25	15	49	22	74	29	99	36	124
23°	8	26	16	52	24	77	32	103	40	129
24°	9	27	17	54	26	81	35	107	43	134
25°	9	28	19	56	28	84	37	112	47	139
26°	10	29	20	58	30	87	40	116	51	145
27°	11	30	22	60	33	90	44	120	54	150
28°	12	31	23	62	35	93	47	124	59	155
29°	13	32	25	64	38	96	50	128	63	160
30°	13	33	27	66	40	99	54	132	67	165
31°	14	34	29	68	43	102	57	136	71	170
32°	15	35	30	70	46	105	61	140	76	175
33°	16	36	32	72	48	108	65	144	81	180
34°	17	37	34	74	51	111	68	148	85	185
35°	18	38	36	76	54	114	72	151	90	189
36°	19	39	38	78	57	116	76	155	95	194
37°	20	40	40	79	60	119	81	159	101	199
38°	21	41	42	81	64	122	85	163	106	203
39°	22	42	45	83	67	125	89	166	111	208
40°	23	42	47	85	70	127	94	170	117	212
41°	25	43	49	87	74	130	98	173	123	216
42°	26	44	51	88	77	132	103	177	128	221
43°	27	45	54	90	81	135	107	180	134	225
44°	28	46	56	92	84	138	112	183	140	229
45°	29	47	59	93	88	140	117	187	146	233

L I M I T O F E R R O R .

In every township, section, or tract surveyed, the error in latitude or departure must not exceed $1/640$ of the perimeter.

S T A D I A M E A S U R E M E N T S .

The General Land Office now approves a restricted use of the stadia method of measurements over surfaces that can not be accurately measured with the steel tape, the record of the test of the stadia wire interval to appear distinctly in the field notes as often as once a week, when used, and the essential part of the record of every stadia measurement to appear in the field notes.

The Surveyor will thoroughly familiarize himself with the formulas in this relation, set forth in the Standard Field Tables. In view of the brevity of the available official data in this connection, attention is drawn to the appended pamphlet published by Young and Sons, Instrument makers, which, however, it should be understood, bears no authority of official sanction and is introduced merely as a matter of information.

Stadia Measurements.

The demonstration to engineers in recent years of the value and attainable accuracy of stadia measurements has resulted in a constantly growing use of this method of measurement. The complication in the strict theory involved and the fact that some approximations are necessary have deterred many from using this method owing to lack of appreciation of the great simplicity of method of which it is capable and also that the errors due to approximation may be made utterly insignificant. The exact theory involved will be here given together with the development of such simple rules of procedure that untrained men may easily be instructed how to do the work even though they are utterly ignorant of the mathematical principles which are used.

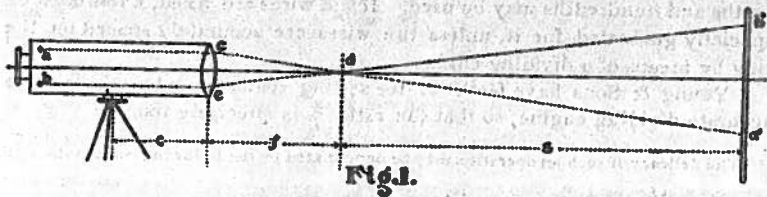


Fig. 1.

Horizontal Stadia Lines. In Fig. 1, let a and b represent the position of the upper and lower stadia wires. The object glass being focused so that an image of the rod is formed at the wires, and image of some part of the rod as a' will be formed at a and of b' at b . Of all the rays passing through the object glass to a , some will come parallel to the axis of the telescope. But all rays of light which pass out of a lens parallel to its axis must have passed through its principal focus (d) at a distance f from the lens. From the similar triangles dad and $db'a'$, $ce=ab=s$ and $a'b'=r$, and we have $f : s :: s : r$ from which $s = \frac{f^2}{r}$ and the total distance D from the center of the instrument to the rod is

$$D = \frac{f^2}{r} + f + c \quad (1)$$

c = the distance from the center of the instrument to the object glass—a slightly variable quantity dependent on the focusing; f = the distance from d to the line ce , the points c and e being the imaginary intersection of the parallel rays from a and b with the oblique rays through d .

Correction to the horizontal. The true horizontal distance is therefore (Eq. 2) equal to the distance as it would be taken for a horizontal sight, minus that distance times the square of the sine of the inclination plus a quantity which is practically the same as $(f + c)$. For a is generally small and generally nearly unity. If $(f + c)$ is really 1.3 feet but is taken as an even foot, it becomes all the more correct to consider $(f + c) \cos a$ as an even foot up to an angle of nearly 40° when it becomes exactly 1.0 foot.

It is generally more convenient to compute the correction to the horizontal distance which will be (neglecting any variation in the $f + c$ term).

$$\text{Corr. for hor. dist.} = R \sin^2 a \dots \dots \dots (4).$$

Table II gives values for $\sin^2 a$ for variable values of a up to 30° . To obtain the correction, multiply R by the coefficient given in the table. The correction must always be subtracted, whether the angle is positive or negative. These tables require a tedious multiplication for each observation which requires correction. This may be more easily computed by means of a stadia slide rule, described below.

When a is small, $\sin^2 a$ is nearly zero, and there is but little error in considering the true horizontal distance to be as though the line were really horizontal. For an error of 1%, the angles and distances are as follows:

Distance,	100 feet,	Vertical angle,	$5^\circ 44'$
"	500 "	"	$2^\circ 34'$
"	1,000 "	"	$1^\circ 46'$

A mere inspection of these figures will show that a large proportion of stadia observations in a generally level country, will not need any correction to the horizontal distance observed from the rod.

Difference of elevation. Eq. 3 gives the difference of elevation in two terms. This may be reduced to one term by writing

$$OH = (R + f + c) \frac{1}{2} \sin^2 a \dots \dots \dots (5).$$

For usual angles of elevation or depression (10° or less) the error is absolutely insignificant and it is always independent of the distance. For the very unusual angle of 30° and with $(f + c) = 1.3$, the error = 0.087, which is less than the usual unit (0.1) for differences of elevation. The difference of elevation may therefore be computed by multiplying $(R + f + c)$, the distance as it would be figured for a horizontal line, by $\frac{1}{2} \sin^2 a$. This may be found (a) by direct application of trigonometrical tables, or (b) from Table I, which gives the value of $\frac{1}{2} \sin^2 a$ for values of a varying by $2'$, or (c) by the use of the stadia slide rule.

Stadia slide rules. Of the three methods indicated above, the first is so laborious that it discourages the use of the stadia, although on occasion it is the only method available. Method (b) is a great improvement on method (a), although it requires considerable time to compute numerically the difference of elevation and horizontal correction—if any. But the slide rule is a great time saver. Two men can readily "reduce" in an evening a day's work of several hundred "shots" and thus one great objection to the use of the stadia has been eliminated. There are several of these on the market, but the Webb Stadia Slide Rule, price \$5, is perhaps the best and most convenient of those which are really accurate. Full directions for use accompany this rule.

APPROVED METHODS OF OBSERVATION TO DETERMINE THE TRUE MERIDIAN.

1. Polaris at elongation.
2. Polaris by the hour-angle method, with record of independent time observation.
3. A series of three altitude observations of the sun for azimuth, taking the resulting mean.
4. A series of three equal-altitude observations of the sun for meridian, taking the resulting mean.
5. The solar attachment, properly adjusted to hold the true meridian at all approved hours of solar work within 1' 30" of the true meridian, as determined by other approved methods outlined above.

APPROVED METHODS OF OBSERVATION FROM WHICH TO DETERMINE CORRECT LOCAL MEAN TIME FOR USE WITHIN 24 HOURS IN HOUR-ANGLE OBSERVATIONS OF POLARIS.

1. Altitude observation of the sun.
2. Meridian observation of the sun.
3. Comparison with the standard telegraphic clock.

The essential elements of all azimuth and time determinations must appear in the field notes, but the field notes do not need to be unnecessarily elaborated to show the detailed process of reduction.

A P P R O V E D C O R N E R M O N U M E N T S .

Three-foot iron posts, one, two, and three inches in diameter, fitted with brass caps, are now used wherever practicable in monumenting surveys. A sufficient number for use in the execution of the surveys of any Group will be delivered at

the nearest practicable railroad station. The surveyor must always advise the Assistant Supervisor as to when additional posts will be required and in ample time to arrange for their shipment and delivery, so that no delay may be encountered in the field operations. The most advantageous point for delivery should always be designated and also the point to which the bill-of-lading is to be sent.

A diagram showing sample markings for the brass caps on these posts is attached to these Circular "Special Instructions."

The three-inch iron posts weigh 30 pounds each; are to be used for all standard section and township corners; closing township corners; corners referring to one, two, or four townships; all section corners on township boundaries; and mile corners on boundary surveys; and must be set 24 inches in the ground.

The two-inch iron posts weigh 13 pounds each; are to be used for all section corners in subdivisional surveys, including closing section corners on standard lines or township boundaries; and must be set 24 inches in the ground.

The one-inch iron posts weigh 5 pounds each; are to be used for all quarter section corners, meander corners, and corners of private claims surveyed under any assignment; and must be set 26 inches in the ground.

All witness corners are required to be of the same size as would be used for the true corner.

Iron post corners are required to be witnessed by bear-

ing trees, except only in the absence of sound trees of suitable size within a distance of three chains, in which case the notes will state, "No trees available," or "No other trees available," as the case may require.

When the point for a corner falls upon a rock in place, the exact corner point will be marked with a cross and the post set on a surveyed line in the most available ground within ten chains, the distance from the corner being given in the field notes and the brass cap marked for a witness corner. If the ground be such as to prevent the setting of the iron post firmly on a surveyed line within ten chains of the point, the post may be set anywhere practicable, off line, but within five chains of the point.

When impracticable, for any reason, to use iron posts, the best native stone, if of proper quality, may be used as prescribed in the Manual, the necessity for using other than an iron-post corner being stated in the field notes.

When impracticable to use iron posts or suitable native stone, wooden posts, witnessed by bearing trees, may be used as prescribed in the Manual, and the proper explanation inserted in the field notes.

The usual accessories prescribed in the Manual are required at all corners.

BLAZING OF TREES.

The provisions of the Manual in regard to the blazing of tree trunks must be strictly complied with, excepting only the blazing of trees having branches growing to the ground, the expense of blazing such trees being prohibitive.

CUTTING OF UNDERGROWTH ON LINES OF SURVEY.

Undergrowth must be sufficiently removed to permit the proper projection of all lines. Within distances of five chains of all corners, within two chains of lines of travel, and over the tops of ridges, the undergrowth must be sufficiently removed to enable settlers and other interested people to identify the true lines of survey readily.

INFORMATION RELATIVE TO LAND, SOIL, TIMBER, ETC.

The General Land Office now requires Surveyors to go into the matter of kind of soil, timber, etc., at the end of the field notes of each mile more fully than heretofore required under the Manual of 1902.

It is not intended to set aside any considerable space in the notes for this purpose; hence, entries should be as concise as possible, yet specific, for each portion of the line surveyed, while features common to large portions of the township should, to avoid repetition, appear in the "General Description" at the end of the notes. No additional entries are contemplated in the line-notes proper, other than to record more fully what the Manual already prescribes, when needed for the fuller purpose above stated.

Topographic features should be considered, as affecting the use of the lands, and as exposing to or sheltering from storms or unfavorable winds. The position of the lands relative to adjacent areas, as being higher or lower, and the "exposure" (to the south, east, etc.,) as being favorable or otherwise,

should be noted. When lands are rolling or hilly, the character of the uplands, slopes, and valleys should be observed, for, quite often, the uplands and slopes are denuded of good soil and the valleys are of small value. Steep slopes are often subject to soil denudation. The systems of natural drainage in the several portions of the township should also be stated.

In addition to noting streams or other sources of water, with the character of the latter, the presence in the soil of water available for plant use should be observed, and also what can be readily done for lands needing irrigation or drainage.

The agricultural value of lands depends to no small extent upon the relations existing between soils and subsoils. The usual excavations at corners will aid in this determination to some extent, and the exposures on steep banks and in various ravines and drains should also be examined for this purpose.

The ordinary record, such as "Soil, sandy loam, 3d rate," should be supplemented wherever possible with a more definite description. In regions where surveys are contemplated, soils, ordinarily speaking, are, in general, composed of humus or decomposed organic matter, clay, and sand of various kinds, or of a friable mixture of all these, called loam, in widely varying proportions. With the soils may be stones, gravel, broken or partly disintegrated rocks and shales, etc. As the relative amounts of the constituents determine in a large degree the proper use of the land, whatever brief terms with the usual significations are employed, although not expected to be ^{nti}qu_λatatively exact, should be sufficiently descriptive in this respect.

Texture, depending on the relative amounts of grains of various sizes, is of importance as affecting the aeration of soils and plant use of moisture. Color is often indicative of constituents. Soils are also properly described as stiff, friable, strong, weak, rich, poor, dry, wet, cold, warm, sharp, fine, or soft, etc. If calcareous, that fact should be stated.

If farming is done, DRY or OTHERWISE, along or near any line, the vegetable or cereal crop should be noted as to kind, condition, yield, etc. In other cases, conclusions should be drawn from facts and conditions observed, as to the agricultural uses of the land, but care should be taken that this is done only within the surveyor's knowledge of the subject.

A description at the end of the notes of a line surveyed, prepared in harmony with the above, may, for instance, be as follows:

"S. 30 chs., high, gently rolling prairie, E. slope; soil; rich dark clay loam, 4 to 8 ins. deep, medium texture, moist, on clay subsoil; good growth bunch grass; N. 50 chs., broken and hilly; ridges with light poor sandy loam, washed on slopes, stony; valleys, good broken clay loam with some gravel, drains to NE.; subsoil, clay and decomposing shales. No timber."

In the "General Description," the geological formations, whence come the bases of the soil and subsoil, should be noted, if known, and what apparent action of the kind is now in progress.

ASSISTANT SUPERVISOR OF SURVEYS.

The duties of the Assistant Supervisor of Surveys are to supervise the proper organization of field parties, their instrumental and camping equipment and subsistence. In general,

he is to exercise his judgment and experience in promoting efficiency in the field work, economy in expenditures, and, as far as possible, uniformity in proper field methods in the execution of surveys and in the preparation of the returns thereof.

The Surveyor will, therefore, address to the Assistant Supervisor of Surveys all communications in regard to the organization of his party, additional equipment, authorizations for special expenditures, leaves of absence, etc.

All questions relating to Special Instructions, methods of survey, accounts, preparation of returns, etc., should be addressed to the Surveyor-General.

STATIONERY AND SUPPLIES.

The Surveyor-General will furnish, upon requisition by the Surveyor, all necessary blanks, paper, envelopes, typewriter ribbons, and other articles of stationery as they may be needed.

ACCOUNTS.

In the matter of accounts, the Surveyor will be mainly guided by Circular No. 105 of the General Land Office, heretofore referred to, and by Assignment Instructions issued by the Assistant Supervisor of Surveys. The following modifications of Circular No. 105 and miscellaneous instructions are taken from current circulars.

SUPPLY VOUCHERS.

The Surveyor-General is not authorized to pay a claim against the United States until a certified voucher is pre-

sented to him and found to be in proper form. He is then under no obligation to make such payment unless he is satisfied that the charge is a proper one and that the evidence submitted in support of the claim is in accordance with the statutes and regulations.

Supply vouchers must show the date of purchase, the amount, the unit price, and the total charge in connection with each item. Such expressions as "case," "sack," "box," "can," etc., are indefinite and must be amplified so the accounting officers may determine the exact quantity of the commodity secured in pounds, ounces, quarts, pints, cubical contents, or number (the latter being acceptable only for such items as eggs, lemons, etc.)

The Surveyor should fill the blanks in the certificate on the face and the corresponding blanks on the back of the voucher, showing the method of or reason for the absence of advertising in connection with the purchases described, before he transmits the claim for payment.

PROPOSALS FOR SUPPLIES.

Purchases of supplies and such small articles of equipment as Assignment Instructions authorize Surveyors to make should be made under competitive proposals. If it is impossible to secure proposals from two or more dealers, a proposal should be secured from the one dealer, that there may be some definite understanding as to prices, and in order that it may be possible to secure competition through other supply points, should local prices be deemed excessive. If a dealer is un-

willing to make sales from month to month under the same proposal, new proposals should be secured and his competitors given an opportunity to secure the business. Voucher prices are always checked with the proposals under which the purchases are made and in the absence of written evidence of a change, only proposal prices will be allowed. Such evidence may be in the form of a letter from the dealer to the Surveyor stating the reason for the change in price and the specific amount of the change. If this is satisfactory, the Surveyor will transmit the same to the Surveyor-General with a statement that inquiry by him or his teamster, as agent, verified the general advance in market price of the article in question, in consequence of which the increase of price is accepted. If the change in price appears unreasonable or unjustified, new proposals should invariably be secured.

The Surveyor should understand that the required explanation is not merely for the satisfaction of the disbursing officer, who is more or less familiar with conditions throughout the state, but will be attached to the voucher in order that the accounting officers of the General Land Office may be assured that the competitive requirements, stipulated by the statutes as necessary in all Government purchases, have not been set aside, as would otherwise appear from a mere comparison of the original proposal and the voucher submitted. The Surveyor-General has no authority in the matter whatever and, unless the explanation indicates that a conscientious, even though informal, attempt has been made at securing competi-

tion, the advance can not be paid.

When soliciting bids on supplies, the Surveyor should insert in the blank proposals furnished to dealers the names of such small items as he may be likely to purchase which are not already listed in the printed form; e. g., muslin, ax handles, lantern globes, crisco, cottolene, etc. While vouchers are occasionally approved which cover items not specifically mentioned in the proposal, they are not satisfactory and, if the number of items so interjected appears unjustifiable, the voucher will be suspended and returned.

If, for any reason, a Surveyor can not accept the proposal giving the lowest average price, he must set forth his reasons for accepting a higher one. This may be done over his signature on the proposal, or he may put it in a letter and attach same to the voucher carrying the proposal.

After the first bill of goods is secured, the teamster, after proper instructions, is usually able to attend to the purchasing of supplies. If, however, unusual circumstances or a change of supply point makes it appear necessary for the Surveyor to leave camp, with a resulting idleness of his party for a day or more, he will, in anticipation of such delay, advise the Assistant Supervisor of Surveys, who will either arrange for the necessary supplies or issue the necessary instructions in the matter.

PROVISIONS LEFT OVER ON COMPLETION OF ASSIGNMENT.

Care should be exercised not to have on hand an excess of supplies toward the end of the assignment. Such supplies

left over as are not perishable should be turned in at the close of the field work with the surveying outfit. If possible, perishable groceries should be returned to the dealer and credit for same secured on the voucher for the month. If this is impossible, one or more notices should be posted in a public place and the perishable supplies sold at public sale for cash and the money at once turned over to the Surveyor-General, for deposit to the credit of the appropriation involved, with a description of the supplies sold and the name and address of the purchaser.

ASSISTANTS TRAVELING AWAY FROM PRINCIPAL.

When an assistant is traveling on duty away from the Surveyor, or when, for any reason, he spends money from his private funds for which reimbursement is to be claimed, he must make such claim on a voucher for services and traveling and other expenses, in his own name, duly sworn to and supported by all required subvouchers. This does not apply to an employee detailed to go to a nearby town or railroad station for supplies, mail, etc., and in this connection expends money advanced him by his principal. Such expenditures may be stated in the principal's name as though made by him direct. Subvouchers, in such cases, should be taken in the name of the principal, showing payment by the detailed employee as deputy.

SUBSISTENCE ALLOWANCE.

(Cir. 312) The Chief of Party, classified or temporary, is entitled to reimbursement for actual cost of subsist-

ence when engaged in such field duties as outfitting, disbanding, traveling to and from the field, and when absent from camp on authorized official business, to the extent of \$3.00 for any one day.

For Associate Surveyors or Transitsmen, classified or temporary, the corresponding daily allowance is limited to \$2.50.

For the subsistence of assistants, \$2.00 a day is the maximum allowance for each man. Assistants are not entitled to reimbursement for pullman fares, except to the extent that their subsistence for the day falls below \$2.00.

PORTERS' FEES.

Porters' fees, classed under "Subsistence," paragraph 247, Circular No. 105, are now classified as "Miscellaneous," page 55 of Circular No. 105. Paragraph 250 will not be construed to apply to such fees. (Cir. No. 155.)

OATHS TO EXPENSE ACCOUNTS.

As provided by section 8 of the Act of August 24, 1912, affidavits may be executed before a postmaster, an assistant postmaster, a collector of United States customs, a collector of United States internal revenue, the chief clerk, of any executive department or bureau, or the clerk designated by him for that purpose; the superintendent, acting superintendent, custodian, or principal clerk of any national park or other Government reservation, the superintendent, acting superintendent, or principal clerk of any Indian superintendency or Indian agency; the chief of a field party, or a notary

public who is in the service of the United States. The officers named above are not permitted by law to make any charge for such service and no jurat fee will be allowed therefor.

Affidavits executed before any other officer who has been authorized to administer oaths for general purposes and whose signature is attested by an official seal will be accepted, but no jurat fee will be allowed.

CERTIFICATION TO EXPENSE VOUCHERS ON HONOR.

Attention is called to the provisions of paragraph 257 of Circular 105, relative to certification to accounts on honor. It should be noted that the certificate should be dated and the place in which the Surveyor is located at the time distinctly shown. The other requirements of the paragraph just referred to should be carefully fulfilled.

TELEGRAMS.

The sending of "night letters" by telegram is not approved, as the Government rate for "night messages" is less than the rate for "night letters." The use of the "night message" is, therefore, the approved method and should always be used if possible. The Surveyor-General and Assistant Supervisor have identification cards from the Western Union and the Postal Union Telegraph Companies. Messages that are strictly official business and are so marked, may be sent to these officers "collect."

PULLMAN TARIFFS.

Pullman tariffs effective February 1, 1911, quote up-

per berths at eighty per cent. of the rates for lower berths. It will, therefore, be necessary for all persons traveling for or on account of the General Land Office who secure pullman accommodations on transportation requests to show on both the request and the coupon whether upper or lower berth is secured; and, hereafter, each voucher for services and traveling and other expenses in which appear charges for berths must be accompanied by the passenger's checks covering such charges.

BILLS OF LADING.

Hereafter every General Land Office employee who uses a Government bill of lading for a shipment of freight, or who forwards a bill of lading to a private dealer to be used by him for a shipment of Government freight, must note on the reverse side thereof the correct title of the appropriation properly chargeable with the cost of transportation, and make the same notation on the face of the memorandum bill of lading.

The amount of the freight charges for the shipment must also be stated on the face of the memorandum bill of lading by the consignor immediately following the appropriation. If, in any case, the actual cost of transportation can not be ascertained from the freight agent, an estimate of the approximate cost should be obtained from him and that amount noted after the appropriation. In every instance the memorandum bill of lading should be forwarded to the Surveyor-General.

Where a bill of lading is forwarded to a private deal-

er to be used by him for a shipment of Government freight, such dealer should, at the same time, be requested to state the cost of the transportation on the memorandum bill of lading, immediately following the appropriation, before mailing it to the Surveyor-General for proper notation and subsequent transmission to the Commissioner of the General Land Office.

MONTHLY CLOSING OF ALL ACCOUNTS.

Vouchers should be submitted to the Surveyor-General for payment as soon as the purchases or services thereunder are completed. Where purchases are to be made of the same dealer from time to time, vouchers may be submitted at the close of the month for all purchases made during the month. All accounts must be settled and vouchers submitted for payment at the close of each month, at which time the Surveyor will submit, on Form 4-491, a statement of the month's expenses. Voucher numbers will be inserted on these monthly expense reports by the Surveyor-General.

ITEMIZED STATEMENTS ON EXPENSE VOUCHERS.

That the Surveyor may have a guide in the preparation of his voucher for services and traveling and other expenses, there follows a copy of a General Land Office circular, approved July 3, 1914, which will be of material assistance. An effort should be made to have the statements on the voucher as brief as possible without omitting any of the essentials. Careful study of the circular will make the work of the Surveyor as well as of the accounting officers much simpler.

DEPARTMENT OF THE INTERIOR.

GENERAL LAND OFFICE.

ITEMIZED STATEMENT OF EXPENSES IN TRAVELING-EXPENSE VOUCHERS.

In this sample no attempt is made to connect any of the charges with prior ones; each item must be considered as standing alone. Nor does this sample authorize any of the expenses represented. When an employee has incurred an authorized expense, this sample may be referred to for stating the charge in his voucher in the approved form. This warning is necessary because the sample covers items that would be proper for an employee with actual subsistence, but that would not be proper for an employee who receives a per diem in lieu of subsistence. In the date column, instead of the actual date of payment, item numbers are given in consecutive order, for ready reference; this must not be done on vouchers.

Date.	Sub-voucher No.	Itemized statement of expenses.	Amount.
1914.			
June 1		D. & R. G. Ry. fare, Denver to Glenwood Springs, Colo.....	\$10.00
2		Pullman Co., lower berth Denver to Glenwood Springs.....	2.00
3		Fee to porter on sleeper.....	.25
4		Fee to porter on sleeper, Denver to Glenwood Springs.....	.25
5		Alaska S. S. Co., fare Seattle, Wash., to Valdez, Alaska.....	45.00
6		Fee to cabin boy.....	.25
7		Myrtle Point Stage Line, fare Myrtle Point to Roseburg, Oreg.....	7.00
8	1	Myrtle Point Stage Line, stage fare.....	2.00
9		Seat in parlor car, Alamosa to Durango, Colo.....	.75
10		Fee to porter on parlor car.....	.10
11		Transfer self and baggage, hotel to depot, Alamosa.....	.25
12		Transfer baggage, depot to home, Denver (3 pieces).....	.75
13		Street car fares in Denver (3).....	.15
14		Checking baggage at depot, Denver (2 pieces).....	.20
15		Breakfast on dining car, Denver to Glenwood Springs.....	.85
16	2	James West, Durango, Colo., B. & L. team and driver, June 2S-3B.....	1.50
17	3	George Wills, Durango, Colo., livery hire, June 2-3.....	10.00
18		John Ross, Durango, Colo., dinner for team and driver.....	.75
19		George Wills, Durango, Colo., hire 2 horses and buggy without driver, 9 a. m. to 11 a. m., June 4.....	1.00
20	4	George Wills, Durango, Colo., auto hire June 2-3.....	30.00
21	5	Harry Ross, Tanana, Alaska, hire launch June 4.....	10.00
22		Howard Phillips, New Castle, Colo., ferrriage of self, 2 horses, buggy, and driver across Grand River.....	1.00
23	6	Howard Phillips, New Castle, Colo., ferrriage June 5.....	1.50
24		Toll over Rifle and Meeker turnpike, Rifle to Meeker and return.....	.75

Item
No.

34. Whenever tickets are purchased for other than self, the names and titles of extra travelers must be shown.
35. Same as item 34, as applied to subsistence.

Approved.

CLAY TALLMAN,
Commissioner.

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D. C., July 3, 1914.

○

W E E K L Y R E P O R T S .

The Surveyor will transmit to the Surveyor-General, at the end of each week and for each fractional week at the beginning or end of the month, a report, showing the nature of his employment from day to day, the additions to, deductions from, or changes of assignment of men already in the entire party over which he is placed. These reports must show the exact time of the commencement and termination of the pay status of employees. These weekly reports constitute the basis of settlement for time employed. From the data contained therein the Surveyor-General prepares a monthly report for filing with the Supervisor of Surveys and the Commissioner of the General Land Office. The instructions printed on the report blanks should be carefully followed. These reports should be submitted promptly. They will be retained by the Surveyor-General no longer than one day, after which they will be forwarded to the Commissioner of the General Land Office through the Assistant Supervisor of Surveys and the Supervisor of Surveys. Incomplete or erroneous reports will go forward in the same manner and supplemental reports called for. Each Surveyor or Transitman will report his own work, showing the lines run or other work accomplished each day. When writing returns, he will report the number of miles of survey for which he has written notes during the day, showing only the township and range in connection with subdivisational work and the particular boundaries in connection with notes of exteriors. When on annual leave, weekly reports must be submitted as when on field or office work.

On the reverse side of the weekly report forms will be found diagrams for weekly progress reports. In explanation of A, B, and C classes, the following is given:

1. Surface:
 - A Level or rolling land.
 - B Rolling mountainous land.
 - C Rough mountainous land.
2. Timber:
 - A No timber.
 - B Scattering timber.
 - C Heavy timber.
3. Undergrowth:
 - A Little or no undergrowth.
 - B Considerable short undergrowth.
 - C Considerable undergrowth exceeding 4 ft. in height.
4. Transportation:
 - A Wagon haul less than 25 miles to supplies.
 - B Wagon haul more than 25 miles to supplies, or pack train transportation less than 25 miles.
 - C Pack train transportation more than 25 miles to supplies.
5. Water:
 - A Abundant.
 - B Scarce.
 - C No water within one day's haul.
6. General Complications of Survey:
 - A Original surveys.
 - B Boundaries requiring re-establishment, and resurvey of subdivisional lines.
 - C Retracement-restoration surveys, or metes and bounds surveys of private claims within townships being resurveyed.

The expressions "Dependent" and "Independent" as applied to resurveys in the weekly reports, may be defined as follows:

A DEPENDENT resurvey of a boundary, for instance, is one where certain of the old corners are found and the obliterated corners are restored by proportional measurements. Sim-

ilarly, a DEPENDENT resurvey of a township is dependent on such of the old corners as may be found and on proportional measurements for the remainder.

An INDEPENDENT resurvey of a boundary is one where the old corners are totally ignored, the line being subject to rectification. In an INDEPENDENT resurvey of the subdivisions of a township, the disposals are designated as tracts and are surveyed out by metes and bounds. The remainder of the old corners are then ignored and new subdivisional lines closed on the tracts.

Weekly reports must show the actual results of each day's work, and any attempt at equalizing one day with another will be regarded as falsification of accounts, THE SERIOUSNESS OF WHICH THE SURVEYOR WILL READILY UNDERSTAND.

PROPERTY REPORTS.

A list of all Government property turned over to the Surveyor will be furnished him by the Assistant Supervisor of Surveys on a form prepared for that purpose. The Surveyor will record thereon, in pencil, all articles of equipment furnished to or purchased by him during the assignment. All the data required on the form should be carefully supplied. Upon completion of the assignment, the Surveyor will ink in the pencil figures and report to the Assistant Supervisor of Surveys, on the above-mentioned form, in detail, regarding all items of equipment. Equipment worn out or lost will be accounted for in the proper columns. Equipment returned should be thoroughly cleaned and properly tagged.

IRON POST REPORTS .

Upon returning from the field, the Surveyor will submit to the Surveyor-General a report of the number of each size of iron posts used in each township and also the total number used, received, and returned.

PERSONAL EFFICIENCY .

A number of accidents to instruments have been reported which, upon investigation, show conclusively, that they are either directly due or are traceable to carelessness on the part of the Surveyor. It is realized that a certain amount of injury or wear is unavoidable, but many of the cases reported are due to thoughtlessness, or to a non-observance of the elementary rules for the care of instruments.

A record of efficiency of each surveyor and transitman is being kept as a basis for future action relative to the good of the service, as well as for their own individual welfare. The condition, at the close of a field season, of the Government instruments and tools furnished a Surveyor must be considered as a reflection, to some degree, upon the methods and efficiency of the individual using them, and a clear record in this respect carries with it its own argument of the ability and worth of the surveyor. (S-S 7-8-12.)

SUNDAYS .

The very nature of the life incident to and a part of public land surveying precludes the possibility of proper observance in camp of the accepted order of living in settled communities. However, it is desired that the accepted customs

and regular standards should be observed in camp whenever practicable, and there should be one day in each week, Sunday if possible, set aside for rest for men and animals. This is essential to good results. In the event of storms, resulting in serious delays, the fair weather must be taken advantage of, regardless of the days of the week upon which it happens. The Chief of Party should exercise his own good judgment in the matter of determining the days for work and the day for rest, bearing in mind that the valuation set upon him for efficiency is largely determined from the interpretation of his ability and judgment, as reflected in his weekly reports of progress and utilization of time. (S-S 6-21-11.)

H O L I D A Y S .

The only holidays that may be observed by the U. S. Surveyors, Transitmen, and the U. S. Surveyor-General's Office are the following: January 1st, February 22d, May 30th, July 4th, Labor Day (first Monday in September), Thanksgiving Day (last Thursday in November), and December 25th. Under no conditions will purely state holidays be observed.

Under Departmental order of July 2, 1914, the field surveying service is not permitted to take Saturday half holidays during the summer months, except such Surveyors as are engaged in writing field notes at the Surveyor-General's Office.

S I C K N E S S .

Surveyors suffering from a temporary illness of two or three days' duration while in camp may employ their crews in setting corners or other duties, except actual running of lines,

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE.

Railroad Building, Denver, Colo.

April 28, 1914.

Mr. A. J. Horton, Jr.,

Asst. Supervisor of Surveys,

Phoenix, Arizona.

Dear Sir:

Some inquiry has been made recently as to the position of the office in the matter of surveyors employing their wives as party books in work.

On account of the heavy work everyone is called upon to do in surveying camps and for other obvious reasons only men books will be selected.

Very respectfully,

Samuel Johnson
SPECIAL AGENT IN CHARGE

R.H.

and should so report. Under such circumstances, no formal application for sick leave need be made, but, if the illness appears so serious as to warrant the belief that it will last a week or more, he should wire the circumstances to the Assistant Supervisor of Surveys, recommending the appointment of a temporary Transitman, if any member of the party is competent to fill the position. (S-S 3-28-13.)

Assistants are entitled to pay only when on duty. The question of whether an assistant is on duty or not is strictly a matter for the Chief of Party to decide. If the illness is of sufficient length or severity to incapacitate the assistant entirely, the facts will be duly stated in the weekly report, and no salary will be paid for the time lost. If an assistant is merely in camp for a day or two, due to accident or a temporary indisposition, through no delinquency of his own, and is assigned to any of the numerous duties around camp, he need not be reported off duty on account of illness and no deduction in pay will be made. (S-S 1-5-15.)

LEAVES OF ABSENCE.

Surveyors and Transitsmen in the Classified Service are entitled to annual leave for the current calendar year.

Temporary Transitsmen are entitled to leave after two months of service.

Applications for leave of absence should be transmitted to the Assistant Supervisor of Surveys.

WOMEN.

Wives of U. S. Surveyors and Transitsmen are not per-

mitted to be in camp, and, inasmuch as regulations wisely issued by Mr. Johnson, Supervisor of Surveys, require that only male cooks shall be employed, the Chief of Party may safely conclude that the presence of any woman in, or immediately adjacent to his camp is permitting something entirely contrary to the policy of the General Land Office.

D I S B A N D I N G .

Prior to the completion of his assignment, the Surveyor will communicate with the Assistant Supervisor of Surveys relative to instructions for additional work or for disbanding. Under no circumstances will the Surveyor, in view of what he might consider unusual conditions, disband without authority.

E X A M I N A T I O N O F B O N A F I D E S .

Under General Land Office Circular No. 293 of January 15, 1914, the matter of examining the bona fides of applicants for survey is placed under the immediate direction of the Assistant Supervisor of Surveys. When such an examination is desired, Surveyors will be directed to make the same. This will be done by a letter from the Assistant Supervisor of Surveys, formal Assignment Instructions being unnecessary. The Surveyor will also avail himself of any opportunity that may be presented during the progress of the work to gather reliable information as to settlements in the townships adjoining his assignment and will make an informal report and recommendation thereon without awaiting formal instructions therefor.

A full report is also desired covering any township passed through in going to or from an assignment where the condition of settlement is such as would warrant a survey thereof. It is the desire of the General Land Office to extend the public land surveys where they are most needed and the more information on file in this connection, the more satisfactory will be the groupings.

R E T R A C E M E N T S A N D R E S U R V E Y S .

Under the heading in this circular styled "Weekly Reports," definitions of dependent and independent resurveys will be found.

In any case where a misclosure is found in connecting new with accepted surveys, the presumption is in favor of the correctness of the accepted work, instead of the new lines that are being run, provided no evidence to the contrary exists. A single trial or random line run can not be held to discredit the connected system of work previously accepted. It, therefore, becomes the Surveyor's duty first to retrace and examine those of his own lines liable to contain the error which caused such misclosure. If he finds all of his own work to be accurate, he will rerun the section boundaries adjoining the work in progress, in order to locate the error, and reset corners if found dilapidated or insufficiently witnessed. He is not required to rerun lines beyond the adjoining sections when he finds a discrepancy in the subdivisional work upon which his work is being closed. If, in subdividing a township whose boundaries are entirely or partly obliterated,

a Surveyor can not identify or locate some of the corners, it then becomes his duty to re-establish the line in accordance with the rules laid down in the Manual, and, when applicable, the pamphlet of instructions for the "Restoration of Lost or Obliterated Corners and Subdivision of Sections," issued by the General Land Office.

Notes of resurveys and retracements will be full notes in every particular, and they may be incorporated with the field notes of the subdivisions to which they are directly related and, in such cases, will be covered by the oath accompanying said subdivisional field notes, or they may be incorporated in a book by themselves. In the latter event, the title page thereof will clearly state, as usual, the surveys made, when and by whom made, and under what authority. Following the index will be a statement by the Surveyor explanatory of the lines so resurveyed or retraced and setting forth the absolute necessity therefor.

In all cases of retracements and resurveys, the surveyor will append a table of latitudes and departures showing that the exterior lines of his work close within limits. Following the notes, the usual final oaths will be inserted. They will cover only the lines resurveyed or retraced, when such notes are in a book by themselves.

T O W N S H I P R E S U R V E Y S .

In order that the Surveyor may be properly informed as to the policy of the General Land Office in the matter of township resurveys, the following is quoted from the Annual

Instructions of 1914:

"The appropriation also provides for the examination of surveys heretofore made and reported to be defective or fraudulent and in the application of funds for the purpose of determining the defective or fraudulent character of surveys, it will be your duty to require applicants to furnish such information as may be available from any reliable source upon which the allegation of defects, obliteration or fraud in the surveys is based, in order that this office may determine as to the application of the provisions of the Act of March 3, 1909, (35 Stats., 845) as amended by the joint resolution of June 25, 1910, (36 Stats., 884) authorizing the Secretary of the Interior to cause to be made such resurveys of public lands as after full investigation he may deem essential to properly mark the boundaries of the public lands remaining undisposed of. Under departmental ruling of May 22, 1909, as to the application of the said Act of March 3, 1909, it was held that where the lands in a given township had been disposed of by the Government by final entry, approved State selections, school lands, and patent, in excess of 50 per centum of the total area thereof, such township was not eligible for examination and resurvey under said act. In the application of the terms of this act, it is not intended that there shall be undertaken any work involving the mere re-establishment of lost or obliterated or misplaced corners in a limited area of a township, such work being within the province of the local surveyors and the authority of your of-

office will be limited to the giving of advice in accordance with the circular for the restoration of lost or obliterated corners; as employees of the Government are prohibited from participating in the re-establishment of lost corners or in the subdivision of sections for private parties, even if the expense is borne by the county or municipal authorities or by individuals. To permit any further procedure would bring the Government into controversy with parties who felt aggrieved at the conclusions reached and would make the Government a party to various suits involving lands in private ownership in which it was not a real party in interest by virtue of ownership in the lands affected, and would ultimately extend to such calls for assistance from owners of private lands in settling their disputes as could not be met without detriment to the real purpose for which the appropriations under control of this office are made.

"The Government's real interest in the resurvey of the public lands is well stated in the said act of March 3, 1909, "to properly mark the boundaries of the public lands remaining undisposed of." Its duty being thus defined, this office has consistently refrained from attempting to do more in the location of corners of privately-owned lands in townships being resurveyed than to place such corners where the surrounding evidences of surveys unquestionably point to one conclusion as to the proper place for the re-establishment of a lost corner; otherwise, if conflicts arise out of the disputed location of such corners, to survey out the claims

by notes and bounds, showing the resulting conflicts and leaving the adjudication of the question to the local courts having jurisdiction over the lands involved.

"Advice as to the proper procedure may be given in accordance with the conditions, but such conclusions as this or your office may draw can only be advisory and if the parties can not agree without resort to the courts, their remedy properly lies in that direction, the courts alone being clothed with the power necessary to assemble testimony concerning the locations of alleged old corners, to consider the methods adopted in the restoration of such as are missing, and to enforce their decrees; and persons deeming themselves injured by the resurvey may present complaint in such courts, where methods and results of the restoring surveyor may be carefully considered and a decision reached that shall be binding on all parties in interest.

"The duty of this office in making resurveys may therefore again be stated to be the proper marking of the boundaries of the public lands remaining undisposed of, and this only after full investigation as to the necessity therefor by reason of obliteration of the evidences of the original survey. The application for resurvey should be made by a majority of the settlers in the township affected and should set forth in detail the facts showing the necessity therefor, including a statement as to the extent of the obliteration of evidences of the original survey, the efforts made to identify the lands by reference to such evidences as

are extant and such other relevant matters as may be necessary to place all the facts before this office. Upon receipt of such application, you will, if practicable, procure from the local office of the district in which the land is situated, a report as to the extent of disposals and if such disposals are not in excess of fifty per centum of the total area of the township, you will transmit the papers to this office with a recommendation as to the action to be taken.

"If the necessity for resurvey is apparent and the township is shown to be eligible therefor, you will be authorized to provide for a field examination thereof as a basis for the ultimate authority for resurvey under the provisions of the Act of March 3, 1909, which provides for the resurvey under the rectangular system now provided by law, and further, provides that no such resurvey or retracement shall be so executed as to impair the bona fide rights or claims of any claimant, entryman, or owner of lands affected by such resurvey or retracement.

"The final examination, when authorized, should be made so as to cover a fair proportion of the lines in the townships affected and attention should be given by the examiner to the manner in which, in the absence of evidences of original survey, the claimants of the lands have located their holdings and his report should contain such information as will permit the resurvey when made to be so executed as not to impair the bona fide rights of any claimant. It has been found that it is seldom, if ever, necessary for the examiner to pass over as many as half of the corner points before it is

possible to determine whether or not the extent of obliteration is sufficient to warrant the resurvey. The amount of retracement and extent of examination to be made, however, must be largely left to the judgment of the examiner, guided by the conditions as they are developed in the field, and while it is desired that he should carry his work to the full extent necessary to enable him to make a satisfactory examination and report, it is believed that the existence or non-existence of original corners which are possible of development without the refinement of field procedure usually present in general survey work can ordinarily be ascertained in two or three days' work in each township.

"Upon your receipt of the examiner's report, the same will be transmitted to this office with recommendation and you will be promptly advised as to the conclusions reached. If resurvey is to be made, authority therefor being vested in the Secretary of the Interior, his approval of the proposed resurvey is necessary before field work may be commenced."

DEPENDENT RESURVEYS.

The general principals governing dependent resurveys are as follows: (G. L. O. Letter "E" TCH 7-22-11.)

"1. The necessity to retrace and re-establish the township lines bounding the territory to be resurveyed and separating these townships from those not to be resurveyed, thus protecting the property rights in the latter townships.

"2. That with the boundaries fixed in their original

positions a proper basis is created for a complete restoration of the original subdivisional lines in the townships to be surveyed.

"3. That, in general, the principles governing the procedure in the fixation of the lines of private claims, by a "metes and bounds survey" are identical with the principles governing the procedure to be followed in the restoration of lost or obliterated corners and the subdivision of sections, and as many private rights exist in the township to be resurveyed, which must be protected, the interests of the settlers, as well as the interests of the Government, are jointly conserved in the retracement and restoration of the original subdivisional lines, considering carefully all evidence of authentic original corners and the evidence of the position of the original section lines as defined by existing property lines such as fence, roads, and other evidence agreed upon by the claimants.

"4. That as this township lies in a regular block--no reason exists for complicating the resurvey with sectional guide meridians, sectional correction lines, or other lines differing in position from the original lines from which to initiate regular surveys, and that it is much better not to complicate the resurvey by double sets of corners on the boundaries or double sets of corners and lines within the area now settled.

"5. That where the lines of private claims are at variance with the re-established section lines, through no

delinquency of bona fide claimants and whose right would be impaired by adjusting the lines of their claims to the re-established section lines, special authority is provided for a "notes and bounds survey" of such claims as do not conflict with the rights of other claimants properly located in accordance with the original survey.

"Your first duty in the field is to acquaint yourself with the existing evidence of authentic corners of the original survey of the Standard Line and township boundaries included in the assignment, together with the recognized point for corners of the original survey of these lines, as defined by recognized property line, considering carefully such evidence as property, fence, corners of private survey, in conformity with the law, roads, and other evidence agreed upon by claimants. The evidence so admitted as authentic must be consistent in a large measure with the general existing evidence of the original survey and the present recognized property lines.

"Concluding upon the best existing evidence of the points marking the original position of the corners defining the township boundaries, the same will be reconstructed regularly. The remaining "lost or obliterated" corners of the township boundaries will be re-established between reconstructed corners at distances proportional to the distances shown on the original plats, in which restoration the proper procedure is fully covered by the pamphlet.

"In the event that the foregoing procedure is found

to impair the present bona fide rights of any actual claimant, through no delinquency of his own and whose rights would be impaired by adjusting the lines of their claims to the re-established section lines, you are directed, in so far as such claims do not conflict with the rights of other claimants properly located in accordance with the original survey, to fix, mark, and survey by "metes and bounds" such claims, the fact being stated fully in your field notes."

CHANGING CORNER MARKINGS.

Owing to the difficulty of changing the markings on brass caps, the Surveyor should make every effort to detect any errors in the surrounding accepted surveys that might necessitate a subsequent change of markings. This must not be construed as authority for making indiscriminate retracements, but no surveyor will subject himself to criticism in reasonably assuring himself that an old and questionable survey upon which his work depends, is within limits. It is a matter upon which no definite advance instructions can be given, and the Surveyor can only be cautioned to consider the results carefully, as they are revealed by his township random lines, and anticipate, if possible, the conditions likely to be encountered when subsequently closing his subdivisional lines.

In some cases, the necessity for changing markings may be obviated by deferring the actual marking, or perhaps a portion thereof, until the remaining lines that affect the corner have been run.

FIELD NOTES.

On the completion of an assignment or assignments for the survey of public lands in this District, the Surveyor will be directed by the Assistant Supervisor of Surveys to proceed to the Surveyor-General's Office and prepare his field notes and sketch plats, observing the hours of labor and the regulations of said office.

The Surveyor should understand that field notes must be written up in the regular order as indicated in the specimen field notes in the Manual, irrespective of the order in which the lines are surveyed. This applies equally to any township surveyed by a double party.

In following the prescribed order, it is usually found necessary to divide the work of each Surveyor into two or more parts, each of which should be signed individually in the final combination. If the work is unusually involved, the lines run and corners set by each surveyor may be indicated by appropriate symbols on the index diagram, in which event the joint signature of the two surveyors at the end of the book of notes will be accepted.

In preparing his returns, the Surveyor will designate in the notes and on the plats the location of each and every settlement near the lines of his survey, and also any Indian settlements, whether permanent in character or not, together with names of such settlers and their improvements, if any. If no settlers are found, the notes must expressly so state. The Surveyor is not authorized to report names of his

own selection for natural objects. He will give those in use, if they can be obtained by reasonable diligence, or will let the object go unnamed.

Field notes, to be filed in the office of the Surveyor-General, should be typewritten with black non-copying ribbon. Both sides of the paper will be used and the notes will be single-spaced. Legal cap field note paper will be furnished for this purpose, together with necessary blank forms of oaths for surveyors and assistants. These returns of surveys will be filed with the Surveyor-General when completed and must conform, in every particular, to the requirements of the Manual of 1902 and its authorized modifications.

F I E L D T A B L E T S .

All Surveyors are cautioned to maintain complete field tablets of all surveys executed, and to compute all doubtful closings in the field as the work progresses in order that the entire record of survey may always be kept complete, thus avoiding the necessity to return to the field except under the most unusual conditions.

All field tablets must be filed with the Surveyor-General upon completion of the finished field notes.

P R E L I M I N A R Y P L A T S .

The field notes must be accompanied by preliminary plats showing complete connected topography of the country over which the lines of survey pass. No high order of drafting is required, yet the plats must be prepared with care and

must accurately delineate all of the topographic features over which the lines may pass, as well as the topography contiguous to or intersected by them, presenting thereby a connected representation of the country actually surveyed.

TOPOGRAPHICAL EXPRESSIONS.

Considerable difficulty has been experienced in securing a uniform interpretation of Surveyors' notes on account of the lack of agreement as to the meaning and use of many of the current topographical expressions, a condition that is particularly noticeable where two Surveyors have operated in one township. The following definitions and diagram have been prepared, after due consideration of western usage; and, although a trifle arbitrary, it is hoped that a more uniform phraseology will result. As Webster defines a canyon, for example, as a "deep gorge, ravine, or gulch," the need of definite distinctions will be appreciated.

WATER COURSES:

Arroyo and Asequia. Unnecessary importations from the Spanish.

Canyon. (Spanish "cañon" and "cañada" not recommended.)

The canyon, ravine, gulch, and gully are distinctly the product of fluvial erosion, and are characterized by steep sides, well-defined and deep. The choice of the proper terms largely depends on the magnitude, and the following arbitrary limits and distinctions are suggested, the expression "gully" having been eliminated

as unnecessary.

Gulch. Relatively deep, with steep sides, well defined. Should generally be confined to water courses not over five chains in width.

Ravine. Applied more particularly to water courses of "V" cross-section. As an upper limit, a mean width of less than 5 chains, or about 10 chains at top of rim is suggested.

Canyon. May be defined as a large gulch or ravine, the former usually classed as a box canyon. That is, "canyon" will be used where the limits of the gulch and ravine are exceeded. Walls usually of rock.

Creek. See "river."

Drain. The act of draining is a gradual drawing off, and a drain is a water course that accomplishes this, and therefore indicates that there is some sort of a depression, such as, for example, a swamp, to be drained.

Draw. Carries water only during an actual freshet. Usually shallow, wide, and short, forming a comparatively level area between adjacent slopes from which the water is immediately drawn during the freshet.

Gorge. A narrow passage with steep walls, forming a comparatively short portion of a general water course.

LEGEND

- | | | |
|------------|-------------------|-----------------|
| 1 Mountain | 9 Bench | 17 Swale |
| 2 Peak | 10 Mesa | 18 Draw |
| 3 Spur | 11 Bluff or Cliff | 19 Drain |
| 4 Saddle | 12 Box Canyon | 20 Creek |
| 5 Hill | 13 Canyon | 21 Marsh |
| 6 Knoll | 14 Gulch | 22 Rolling land |
| 7 Butte | 15 Ravine | |
| 8 Ridge | 16 Wash | |



- Gulch. See "canyon."
- Gully. See "canyon."
- River. "River," "stream," and "creek" always imply running water.
- Swale. A slight depression without any definite banks or boundaries, varying from a dry condition to that of a swamp, according to climatic conditions.
- Wash. Dry and shallow, often ill-defined and of irregular width.

LAND FEATURES:

- Bench. A flat or comparatively level area or stretch interrupting a general ascent. This term is preferable to "ledge" on account of the mineral associations of the latter.
- Butte. Usually isolated, turret-shaped, and more precipitous than a knoll or a hill. Distinctively a rock formation.
- Divide. This very general term should be restricted to water sheds between streams well known in the locality. In general, the "ridge" will lead off from the "divide" and the "spur" from the "ridge," each being the water-shed of less important tributaries. A characteristic of the "ridge" is length, and the designation of a branch "ridge" of a mile or more in length as a "spur" is erroneous. The term "spur" carries

with it the idea of "projecting out," and should be confined to the projections from a ridge that drains directly into the smaller water-courses. The term should not be applied to an independent topographical feature.

Hill. The hill has not the regular shape of a knoll nor the size of a mountain and is less precipitous than a butte.

Knoll. Characterized by a somewhat round or oval base, and rather regular outline.

Mountain. Not usually applied to a feature less than 500 feet in height above the surrounding country.

Peak. A high, conspicuous point of a ridge or mountain. Should not be confused with "butte."

Saddle. A conspicuously low portion of a ridge. Should not be applied to the unimportant depressions along the backbone of a ridge; nor applied to a pass, which is a very marked notch, altogether too precipitous to be suggestive of an actual saddle.

Slough. A short arm of a stream, or an adjoining area flooded therefrom at high water, but, at other times, muddy or dry.

LOCATION OF MINERAL MONUMENTS AND PATENTED MINING CLAIMS.

On the diagrams furnished to the Surveyor in connection with any GROUP, are depicted all patented mineral claims

and United States Location or Mineral Monuments shown by the records of the Surveyor-General's office to be in the vicinity of the surveys to be executed. Necessarily the determination of the locations of mining claims and mineral or location monuments on unsurveyed ground is, in many instances, attended with a great degree of uncertainty. Therefore, the diagrams furnished are not to be considered plats depicting exact locations except where claims are directly or indirectly tied to accepted public land surveys.

The Surveyor is required to locate in the field, by direct measurement or triangulation, the exact position of all United States Location or Mineral Monuments that may be found within a reasonable distance of or embraced within his lines of survey. Wherever practicable, these monuments should be connected with the nearest regular corner of the public land surveys. The correct location of all such monuments is imperative, and a mere statement that a monument can not be found will be deemed insufficient reason for failure to comply with this requirement until the utmost diligence has been employed to locate the point in question. Copies of the original field notes of the establishments of monuments presumed to be near the lines of public surveys to be established under any GROUP will be furnished the Surveyor before he goes to the field.

Field notes of public land surveys must state in every instance the points at which patented mineral ground is entered or left, giving course and distance to the nearest

corner on the boundary of the claim so intersected. Closing corners will not be set, nor is it necessary to state intersections with any lines common to two patented mineral claims.

When a patented mineral claim is found to be located within a section and is not intersected by any line of the public land surveys, no line will be surveyed to it if the United States Location or Mineral Monument to which it is tied is embraced within the lines to be surveyed in the GROUP. If the United States Location or Mineral Monument with which the patented mineral claim is connected is without the public lands included within the GROUP and its position is not ascertainable for the purpose of proper segregation, the Surveyor will then connect, by the shortest possible line, a corner of the patented mineral claim with a regular corner of the public surveys or with some well-defined point on a line of the same.

If there are found any patented claims within the GROUP other than those depicted on the diagrams furnished, they must be properly segregated. If the data furnished the Surveyor are insufficient for the proper identification of any corners of patented mineral claims to be segregated, he should notify the Surveyor-General and the field notes of the claim in question will be furnished immediately in order that the proper intersections may be determined.

Where all evidence of the location of a patented mineral claim, as it was purported to have existed on the ground at the time of the survey thereof, is lost, the Surveyor will

specifically so state in his field notes. This office will thereafter segregate the area of such claim by theoretical computations based on the tie from said claim to the United States Location or Mineral Monument, whose position has been previously determined by the Surveyor with reference to a corner of the public land survey.

It must not be understood from the foregoing that the Surveyor is to extend his lines over lands clearly non-agricultural merely for the purpose of segregating patented mineral claims.

EXTENSION OF SURVEYS OVER NON-AGRICULTURAL LANDS.

While, in most instances, it will be desirable and necessary to extend the survey of standard lines over mountainous or inarable regions in order to establish proper bases for succeeding lines and to insure correct connections, it is not deemed imperative to extend township exterior lines over lands that are clearly non-agricultural in character and, therefore, unsurveyable under existing law and instructions, for the sole purpose of making proper closures. It is the policy of the General Land Office to cause the survey of exterior lines to be executed at the same time as the subdivisional surveys, as the same may be called for by the actual or prospective occupation of the land. In order to reach agricultural land, it is not absolutely necessary that the survey of the exterior lines of a township be completed, and circumstances may arise where it will be found necessary to run section lines as township exteriors in order to avoid non-

agricultural and unsurveyable land or insurmountable objects. In so far as the closing of surveys is concerned, section lines are considered as important as township lines. In the execution of subdivisinal and township exterior surveys, the work must be confined to lands adapted to agriculture and grazing, as, under existing law, preference is to be given to occupied lands or lands adapted to agriculture.

If, in the case of railroad lands and state selections, it is desired to survey the entire area embraced in a township, irrespective of the agricultural value of the same, that fact will be definitely stated in the Special Instructions.

DIAGRAMS AND FIELD NOTES FURNISHED.

Diagrams of accepted lines of survey from which the surveys of a GROUP are to be initiated or upon which they are to be closed and sufficient field notes of these lines for the Surveyor's guidance in the field will be furnished when the assignment of a GROUP has been made. These diagrams will indicate in a general way the new work as well as the adjacent accepted surveys.

SPECIAL REPORTS.

In connection with the surveys provided for in any GROUP, it is hereby directed that the Surveyor locate, with reference to said public land surveys, all ruins, prehistoric or otherwise, and such natural curiosities situate upon the public domain as he may deem worthy of reservation. He will submit a special report thereon to the Surveyor-General immediately after determining the location of said objects, giving

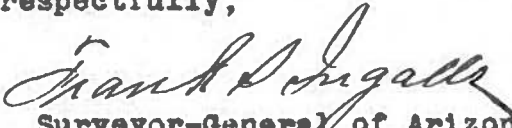
a complete description thereof, in order that reservation can be made, if found advisable. (Cir. 10-8-08.)

PERSONAL ATTENTION OF SURVEYOR REQUIRED.

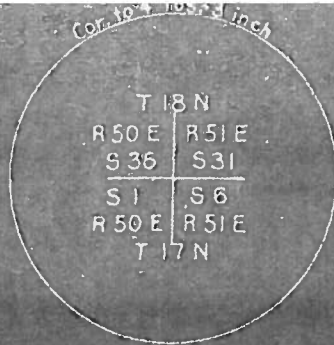
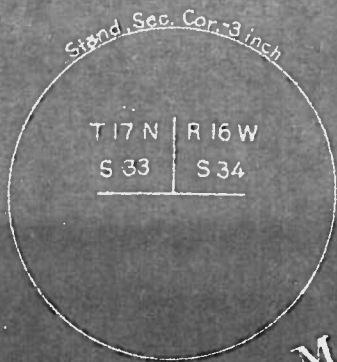
The Surveyor must distinctly understand that he is personally responsible for the alinement of his surveys and, under no conditions, can the instrument work be intrusted to subordinates. A violation of this rule will carry with it the due penalties of falsification.

Before making oath as to the correctness of returns of surveys and filing the same with the Surveyor-General, the Surveyor will make a critical personal examination of his notes and plats to see that they are correct and in accordance with the notes taken in the field. Special attention should be paid to the descriptions of all corners, and to the calculations for declination, azimuth, and time of Polaris observations.

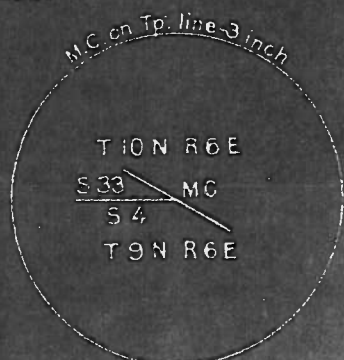
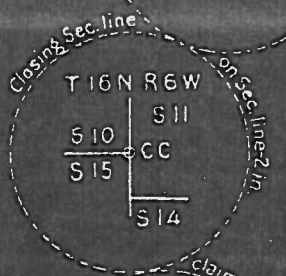
Very respectfully,


Surveyor-General of Arizona.

A-CRC.



SAMPLE MARKINGS FOR BRASS CAPS



DESCRIPTION OF CAP MARKINGS.

N ^o	COR.	W.C.	N ^o	COR.	W.C.
1	T15N IN N HALF; R10E, S36 IN NW & R1E, S31 IN NE QUADRANT	WG S OF CENTRE, T17N R10E, S36, R1E, S31, IN N- HALF	21	GG E OF CENTRE, T16N R6W IN N & S11, S14 IN E HALF; S10 IN NW & S15 IN SW QUAD.	WGG E OF CENTRE, ETC.
2	T17N R16W IN N HALF; S33 IN NW & S34 IN NE QUADRANT	WG S OF CENTRE; T17N R16W S33, S34 IN N HALF	22	GG S OF CENTRE; T17N R5W, S6, S5 IN N HALF; S8 IN SE & S7 IN SW QUAD.	WGG N OF CENTRE, ETC.
3	DO	WG S OF CENTRE, T17N R16W IN N HALF, S33 IN NW & S34 IN NE QUAD.	23	GG S OF CENTRE, T22S R4W, S34, S35 IN N HALF, S2 IN SE & S3 IN SW QUADRANT	WGG N OF CENTRE, ETC.
4	1/4 S35 IN N HALF	WG 1/4 IN W HALF, & S35 IN NE QUADRANT	24	GG E OF CENTRE; T14S IN N & S7, S18, R8W IN E HALF; S12 IN NW & S13 R9W IN SW QUAD.	WGG E OF CENTRE, ETC.
5	T18N, IN N, R5E IN E, T17N IN S & R50E IN W HALF, S36 IN NW, S31 IN NE, S6 IN SE & S1 IN SW QUADRANT	WG S OF CENTRE, ETC.	25	GG S OF CENTRE, T22N, S33, S34 IN N, T21N, IN S & R8 W IN W HALF; S3 IN SE & S4 IN SW QUAD.	WGG N OF CENTRE, ETC.
6	T14N IN N, & S1, R8W, T6, RTW T13N IN S HALF; R8W, S36 IN NW & R7W, S31 IN NE QUADRANT	WG S OF CENTRE, ETC.	26	GG S OF CENTRE; T14S R8W, T150 IN N HALF; S15 IN SE & S16 IN SW QUAD.	WGG N OF CENTRE, ETC.
7	R5E IN E & R2E T19N, S36, S1, T18N, IN W HALF, T19N, S31 IN NE & S6, T18N IN SE QUADRANT	WG W OF CENTRE, ETC.	27	GG E OF CENTRE; NPIR IN NW & T9S R3E IN SE HALF; S9 IN SE & S8 IN SW SECTOR	WGG E OF CENTRE, ETC.
8	T13N, R4W, S31 IN NE QUAD. S1, S6, T12N IN S & S36, R5W IN W HALF	WG W OF CENTRE, ETC.	28	GG W OF CENTRE, NPIR IN NW & T9S R5E IN SE HALF; S15 IN NE & S22 IN SE SECTOR	WGG W OF CENTRE, ETC.
9	T22N IN N HALF; R60W, S12 IN NW, R59W, S7 IN NE S18 IN SE & S13 IN SW QUAD.	WG S OF CENTRE, ETC.	29	T8N R9W IN N HALF; 4TR38 IN NW, 3TR37 IN NE, 2TK 4L IN SE & 1TR40 IN SW QUAD.	WG S OF CENTRE, ETC.
10	T6N IN N, T5N IN S, & R20E IN W HALF; S33 IN NW, S34 IN NE, S3 IN SE & S4 IN SW QUADRANT	WG N OF CENTRE, ETC.	30	T12S R8W IN N & S12 IN S HALF, 3TR47 IN NE QUADRANT	WG S OF CENTRE, ETC.
11	T22N IN N, S3, S4, T21N IN S & R8W IN W HALF; S33 IN NW & S34 IN NE QUAD.	WG S OF CENTRE, ETC.	31	T12S IN N & S7, R9W IN W HALF, 3TR38 IN NE & S12, R8W IN SE QUADRANT	WG W OF CENTRE, ETC.
12	T14S IN N & S7, S18, R8W IN E HALF, S12 IN NW & S13, R9W IN SW QUADRANT	WG E OF CENTRE, ETC.	32	T11S, S35 IN N, T12S IN S & R8W IN W HALF; 2TR40 IN SE & S2 IN SW QUAD.	WG N OF CENTRE, ETC.
13	T21S R12W IN N HALF; S2 IN NW, S1 IN NE, S12 IN SE & S11 IN SW QUADRANT	WG N OF CENTRE, ETC.	33	1/4 S12 IN W & S7 IN E HALF	WG 1/4 IN N HALF S7 IN SE & S12 IN SW QUAD.
14	T14S R3E IN N & S16, S21, IN W HALF; S15 IN NE & S22 IN SE QUAD.	WG W OF CENTRE, ETC.	34	1/4 S22 IN N & S27 IN S HALF	WG 1/4 IN E HALF; S22 IN NW & S27 IN SW QUAD.
15	T14S R3E, S3, S2 IN N HALF, S11 IN SE & S10 IN SW QUAD.	WG N OF CENTRE, ETC.	35	NPIR 3M IN NW & PL IN SE HALF	WG 3M, W OF CENTRE; NPIR IN NW & PL IN SE HALF
16	T21N R10W IN N, S16, S21 IN E & S20 IN S HALF; S17 IN NW QUADRANT.	WG E OF CENTRE, ETC.	36	SW COR. W OF CENTRE, NPIR IN NE SECTOR; PL IN SW HALF.	WG SW COR. E OF CENTRE, NPIR IN NE SECTOR PL IN SW HALF
17	GG S OF CENTRE, T14N, R6W, S36, R1W, S31 IN N & T13N IN S HALF; S6, R7W IN SE & S1, R8W IN SW QUADRANT.	WGG N OF CENTRE, ETC.	37	5M, NPIR IN NW & S23, T10N R15E IN SE HALF	WG 5M, W OF CENTRE, NPIR IN NW & S23 T10N R15 E IN SE HALF
18	GG W OF CENTRE, R17W IN E & T8N, S36, S1, T1N, R18W IN W HALF, T8N, S31 IN NE & T11, S6 IN SE QUADRANT.	WGG W OF CENTRE, ETC.	38	NW COR. NPIR IN SE SECTOR, T10N R20E, S13 IN NW HALF.	WG NW COR. E OF CENTRE, NPIR IN SE SECTOR; T10N R20E, S13 IN NW HALF.
19	GG EAST OF CENTRE, NPIR IN NW & T10N IN SE HALF S7, R3E IN SE & S12, R4E IN IN SW SECTOR	WGG E OF CENTRE, ETC.	39	MG W OF CENTRE, T21N R6E IN N HALF; S33 IN NE SECTOR.	WGMG W OF CENTRE, ETC.
20	GG W OF CENTRE, NPIR IN NW & R8E IN SE HALF T10N, S32 IN NE & T9N, S5 IN SE SECTOR	WGG W OF CENTRE, ETC.	40	MG E OF CENTRE, T10N IN N, T9N IN S & R6E IN W & S33 IN NW & S4 IN SW SECTOR	WGMG E OF CENTRE, ETC.
			41	MG E OF CENTRE; T20N IN N HALF, S7, R4E IN SE & S12, R3E IN SW SECTOR	WGMG E OF CENTRE, ETC.
			42	MG E OF CENTRE; T60S R60W IN N HALF; S14 IN SE & S15 IN SW SECTOR.	WGMG E OF CENTRE, ETC.

STANDARD

COR. W.C.
St. Tp. Cor. 3 in.



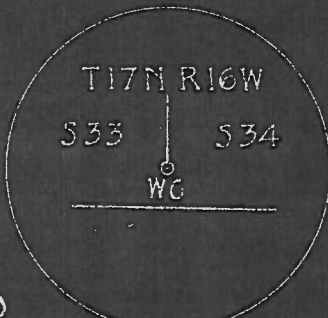
1

St. Sec. Cor. 3 in.



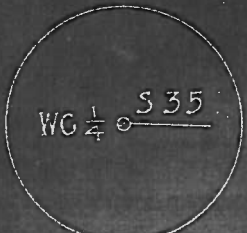
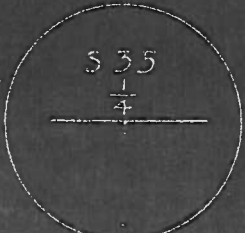
2

St. Sec. Cor. 3 in.



3

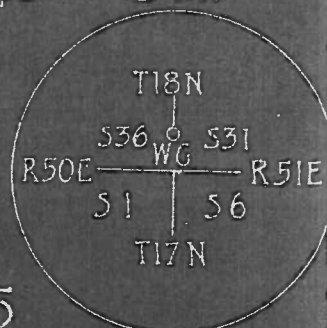
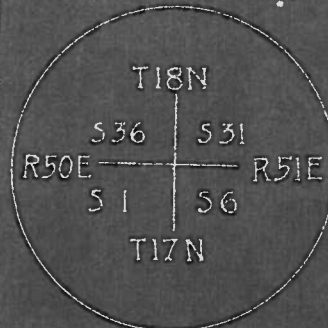
St. 1/4 Cor. 1 in.



4

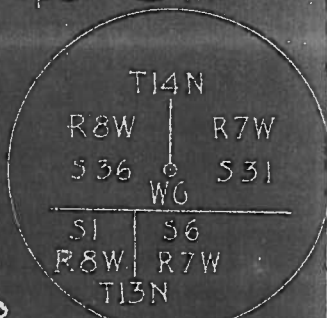
TOWNSHIP

COR. W.C.
Cor. to 4 Tps. 3 in.



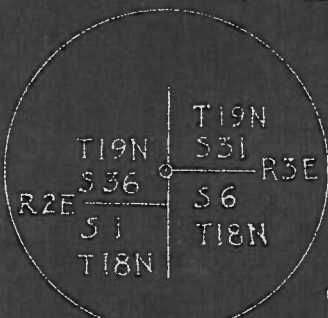
5

Cor. to 2 Tps. 3 in.



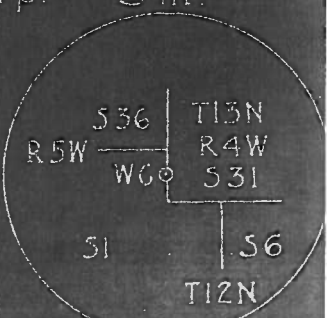
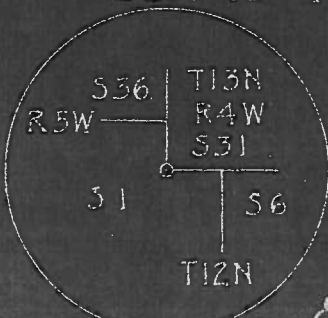
6

Cor. to 2 Tps. 3 in.



7

Cor. to 1 Tps. 3 in.



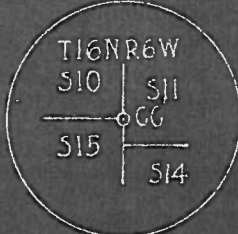
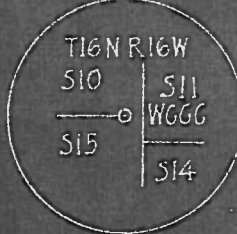
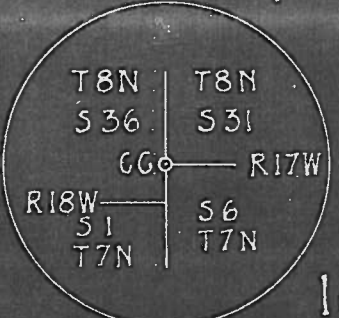
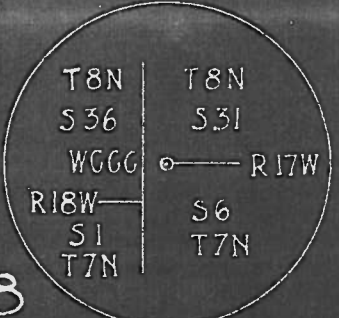
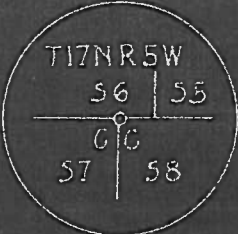

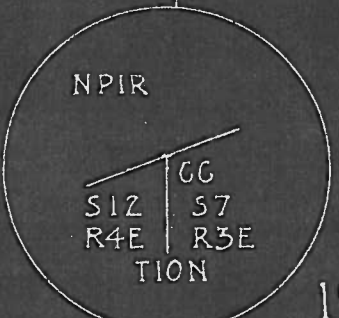

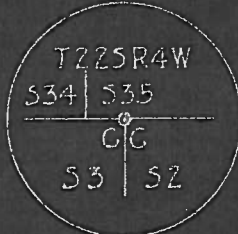

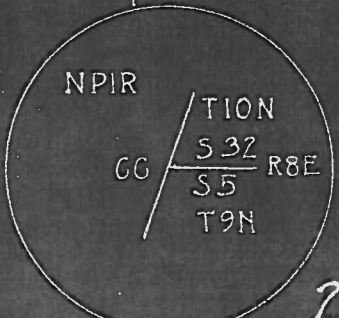
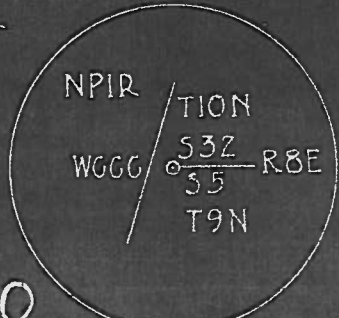
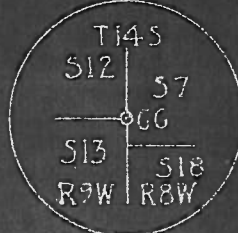
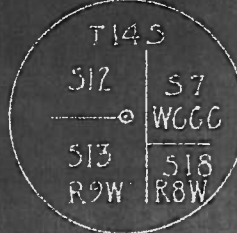


8

SECTION

EXTERIOR		INTERIOR	
COR.	W.C.	COR.	W.C.
Cor. to 4 Secs. on Rq. line - 3 in.		Cor. to 4 Secs. 2 in.	
<p style="text-align: center;">T22N R60W R59W S12 S7 S13 S18</p>	<p style="text-align: center;">T22N R60W R59W S12 S7 WG S13 S18</p>	<p style="text-align: center;">T21SR12W S2 S1 S11 S12</p>	<p style="text-align: center;">T21SR12W S2 S1 WG S11 S12</p>
Cor. to 4 Secs. on Tp. line - 3 in.		Cor. to 2 Secs. - 2 in.	
<p style="text-align: center;">T6N R20E S33 S34 S4 S3 T5N</p>	<p style="text-align: center;">T6N R20E S33 S34 WG S4 S3 T5N</p>	<p style="text-align: center;">T14SR3E S16 S15 S21 S22</p>	<p style="text-align: center;">T14SR3E S16 S15 WG S21 S22</p>
Cor. to 2 Secs. on Tp. line - 3 in.		Cor. to 2 Secs. 2 in.	
<p style="text-align: center;">T22N R6W S33 S34 S4 S3 TZIN</p>	<p style="text-align: center;">T22N R6W S33 S34 WG S4 S3 TZIN</p>	<p style="text-align: center;">T14SR3E S3 S2 S10 S11</p>	<p style="text-align: center;">T14SR3E S3 S2 WG S10 S11</p>
Cor. to 2 Secs. on Rq. line - 3 in.		Cor. to 1 Sec. only - 2 in.	
<p style="text-align: center;">T14S S12 S18 S13 R9W R8W</p>	<p style="text-align: center;">T14S S12 S18 WG S13 R9W R8W</p>	<p style="text-align: center;">T9NR10W S17 S16 S20 S21</p>	<p style="text-align: center;">T9NR10W S17 S16 WG S20 S21</p>

CLOSING

COR.	W.C.	COR.	W.C.
Township C.C. 3 in.	Township C.C. 3 in.	Interior Sec. C.C. 2 in.	Interior Sec. C.C. 2 in.
			
17	17	21	21
Township C.C. 3 in.	Township C.C. 3 in.	Interior Sec. C.C. 2 in.	Interior Sec. C.C. 2 in.
			
18	18	22	22
Tp. C.C. on Reservation 3"	Tp. C.C. on Reservation 3"	Sec. C.C. on St. 2 in.	Sec. C.C. on St. 2 in.
			
19	19	23	23
Tp. C.C. on Reservation 3"	Tp. C.C. on Reservation 3"	Sec. C.C. on Rq line 2 in.	Sec. C.C. on Rq line 2 in.
			
20	20	24	24

CLOSING

TRACT

COR.

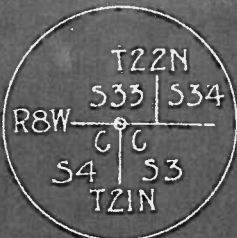
W.C.

COR.

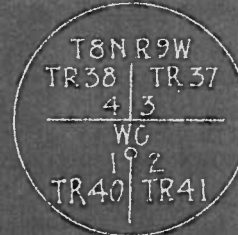
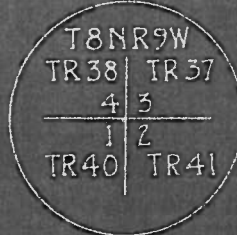
W.C.

Sec. C.C. on Tp. line - 2 in.

Cor. of 4 Tracts - 1 in.



25



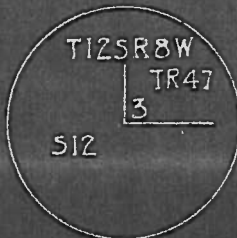
29

Sec. C.C. on Claim line - 1 in.

Cor. of 1 Tract only - 1 in.



26



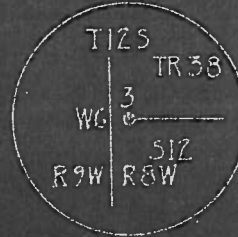
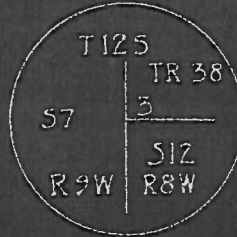
30

Sec. C.C. on Reservation - 2 in.

Cor. of 1 Tract only on Rq. line - 1 in.



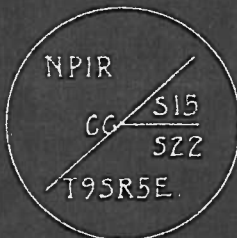
27



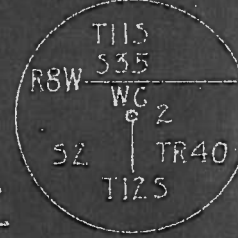
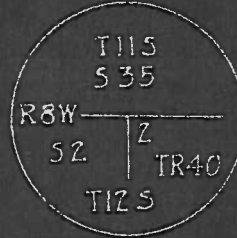
31

Sec. C.C. on Reservation - 2 in.

Cor. of 1 Tract only, on Tp. line - 1 in.



28

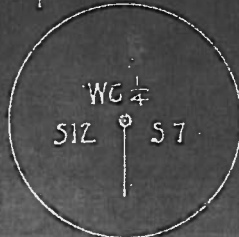
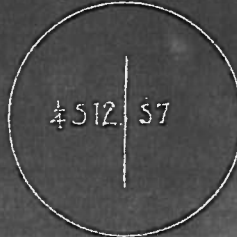


32

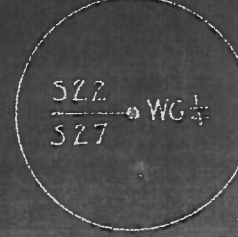
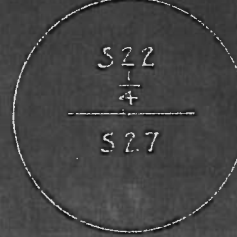
1/4 CORNERS

1/4 Cor. on Rq. line - 1 in.

Interior 1/4 Cor. 1 in.



33



34

RESERVATION

MEANDER

COR.

W.C.

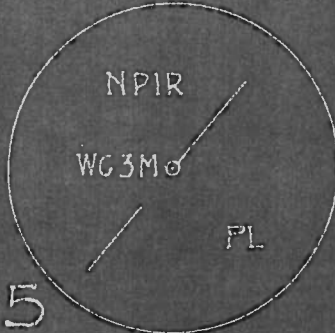
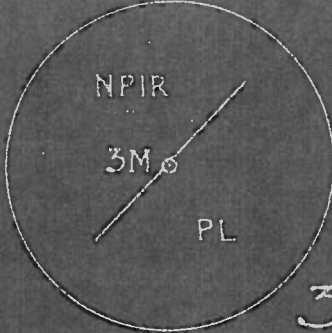
COR.

W.C.

Mile Mon. on unsurveyed land - 3'

St. M.C.

1 in.



35

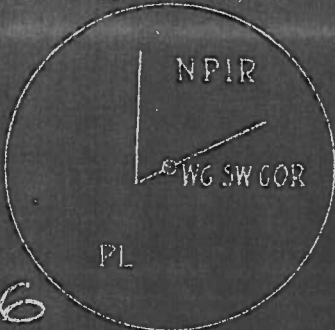
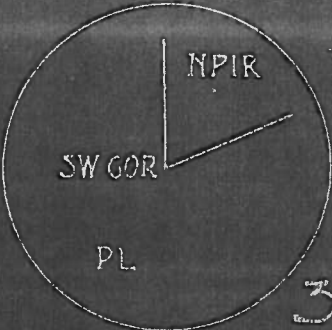


39

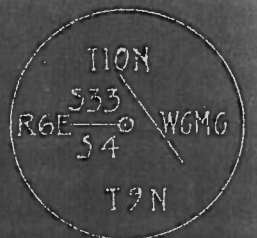
Corner on unsurveyed land - 3'

M.C. on Tp. line -

1 in.



36

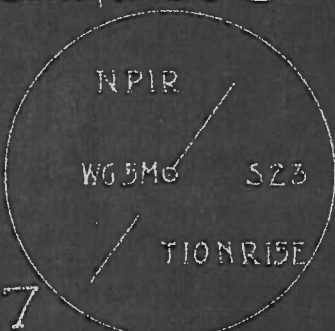
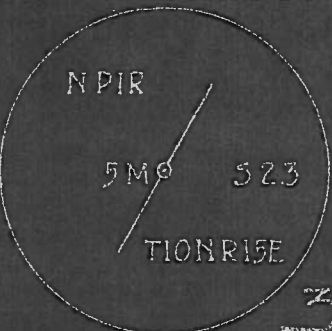


40

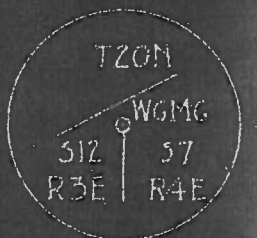
Mile Mon. on surveyed land - 3'

M.C. on Rq. line -

1 in.



37



41

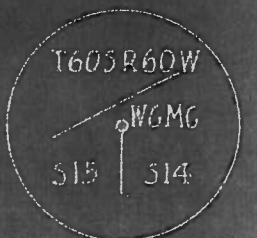
Corner on surveyed land - 3'

Interior M.C.

1 in.



38



42