

DEPARTMENT OF THE INTERIOR,

OFFICE OF UNITED STATES SURVEYOR-GENERAL

PHOENIX, ARIZONA.

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CIRCULAR "SPECIAL INSTRUCTIONS".

to

UNITED STATES SURVEYORS AND TRANSITMEN

for the

DISTRICT OF ARIZONA.

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OCTOBER 25, 1912.

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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 and Obliterated Corners and Subdivision of Sections, edition of June 1, 1909; and Circular No. 105, paragraphs 223 to 276, and 290 to 305, inclusive.

The foregoing publications are furnished to all Surveyors or Transitmen in charge of parties and may be secured for the use of principal assistants 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 Surveyor-General.

If, for any sufficient cause, any of the instructions or requirements relative to surveys cannot be complied with, that cause should be stated in the field notes in its proper connection.

#### INSTRUMENT.

Before beginning the surveys assigned under any GROUP, all instruments must be approved by the Supervisor of Surveys, and it will

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be the duty of the Surveyor to test his instrument on the 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 similar 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 simultaneously 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 vernier.
  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 telescopes, 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 telescopes.
  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.

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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 effective, thus a horizontal axis through the two lower pairs, movement about which may be controlled by the upper H. pair, may be considered, and a nearly vertical axis through the two H. 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 cannot 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.

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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 3rd paragraph of the single field adjustment.

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 again 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 are 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.

Advance Data. As soon as practical, after the completion of a township, the surveyor will submit a rough diagram, giving all courses and distances and closings, in order that the survey may be immediately checked. 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.

Selection and pay of assistants. Assistants should be ordinarily engaged at the outfitting point, but if exigencies arise, they may be hired at the Surveyor General's office; in the latter case, special authority should be secured. First and second assistants 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 does not exceed fifty miles, and for a greater distance special authority should be obtained from the Commissioner of the General Land Office.

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As to the compensation of assistants, their pay should begin when the Supervisor or Surveyor-General decides that service has commenced.

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

The Surveyor General 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 rodmen the previous year whom he recommends, they should be preferred to new and untried men, but the list of assistants should be submitted to this office, and if practicable, to the Supervisor, for inspection and approval.

In case it is necessary to engage men at once, and there are none recommended by a surveyor nor on the waiting list, endorsed by the Supervisor, the surveyor will be allowed to make his own selection.

In cases where the Supervisor of General Land Office has been applied to for employment by prospective assistants, the merits of each applicant will be inquired into, and if found that the requirements are met, this office will be notified and they will be given preference in the selection as 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;

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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.

#### MODIFICATIONS OF THE MANUAL OF 1902.

##### MEASUREMENTS:

In addition to the method of measurement prescribed by the Manual, the General Land Office now approves the use of long steel tapes, in measurements on slopes, with the use of clinometers in the determination of slope angles and proper reduction to true horizontal distances, for entry in the official field notes. The fact of the use of the long steel tape and clinometer method must be stated in the field notes. The general Land Office further approves a restricted use of the stadia method of measurements over surfaces that cannot 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.

##### 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.



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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.

APPROVED CONNER MONUMENTS:

Three-foot iron posts, one, two and three inches in diameter, fitted with brass caps, are now used wherever practicable in monumenting all 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 this office as to when additional posts will be required, in ample time to arrange for their shipment and delivery, so that no delay may be encountered in the field operations. As a check on this office, the most advantageous point for delivery should be designated and a statement or estimate made of any surplus of iron posts on hand.

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

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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 25 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 bearing 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 brace set 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

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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.

#### BLASING OF TREES:

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

In order that this office may compile "Descriptive Sheets" in accordance with the recent requirements of the General Land Office, U. S. Surveyors and Transition are required to go more fully into the matter of kind of soil, timber, etc., at the end of the field notes of each mile 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 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 exposures on steep banks and in ravines and drains should also be examined for this purpose.

The ordinary record, 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; and 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 a proper use of the land, whatever brief terms with the usual significations are employed, although not expected to be quantitatively 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 popularly 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, **WAY** 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 lands, 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 found as follows:

"N. 30 chs., high, gently rolling prairie, E. slope; soil, rich dark clay loam,  $\frac{1}{2}$  to 8 in. 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 brown clay loam with some gravel, drains to N. E., 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.

### ACCOUNTS:

In the matter of accounts you will be mainly guided by circular

No. 108, heretofore referred to, and by Assignment Instructions issued to you by the Supervisor of Surveys. The following miscellaneous instructions are taken from current circulars:

CAMP SUBSISTENCE:

The graded per diem allowances granted U. S. Surveyors and transitmen in the classified service have been carefully computed and made a part of the several grades with a view to allowing such surveyors and transitmen an amount in addition to their salaries sufficient to cover the actual average cost of subsistence when engaged in field duties, both when necessarily absent from camp for short periods during the field season, and when in camp.

A computation of the actual cost of subsistence per man when in camp, including the cook's wages, transportation of supplies, etc., shows that \$1.00 per day or \$0.33 1-3 per meal is in excess of such cost, but for the purpose of simplifying and expediting the settlement of accounts; surveyors and transitmen receiving a per diem in lieu of subsistence are authorized, when in camp using Government supplies, to charge themselves on their monthly Voucher for Services and Traveling and Other Expenses at the rate of \$0.33 1-3 per meal or \$1.00 per day. When absent from camp on authorized official business, and at all times when not using government supplies, no charge for subsistence above the specified per diem of the grade in question will be allowed. The specific days or parts of days for which camp subsistence is deducted must in each case be shown on the voucher in form as follows:

Expenditures, as shown by foregoing itemized statement	\$36.50
Services, from Nov. 1 to Nov. 30, inclusive at \$150.00	150.00
Per diem in lieu of subsistence from Nov. 1 to Nov. 30	20.00
(except _____), 30 days at \$2.00 per day	600.00
Total	766.50
Less Camp subsistence 13-26D, 29D-30D, 27 days.	220.00
Amount due	546.50

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If a surveyor is subsisted in camp at such irregular intervals that it is impracticable to list the periods in one line, an itemized statement may be given on the inside of the voucher and the deduction made as: "Less camp subsistence per statement."

As soon as practicable after the close of a month, each disbursing officer will report by groups or parties the cost of subsistence, including cook's salary and transportation, and subsistence outside of camp, if any, and supplies purchased during that month, together with names of men, exclusive of the cook, subsisted therefrom, and, if at the end of the calendar year it is found that the average cost of subsistence in any camp exceeds the cost hereinabove named, each party therein subsisted who receives a per diem allowance in lieu of subsistence will be charged with the additional amount, on his last full month voucher for Services and Traveling and Other Expenses in connection with that year's service in the field.

In case the average cost of subsistence per capita in any one camp is less than the rate charged against an employee receiving a per diem, the difference for the season will be credited to said employee in his last voucher for services, traveling and other expenses in connection with that year's services in the field. It will, of course, be understood that the average cost of subsistence in camp should be much less than \$1.00 per day per man, and any apparent extravagance on the part of any surveyor will require satisfactory explanation.

Transitmen not in the classified service will be allowed actual subsistence when engaged in field duties and will be entitled to reimbursement for actual cost of subsistence not in excess of \$3.00 for any one day in the case of the chief of party, and not in excess of \$2.50 per day in the case of associate transitman, when outfitting or

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or disbanding or when otherwise absent from camp on authorized official business. (G.L.O. Circular of May 13, 1912).

PORTER'S FEES:

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

OATHS TO EXPENSE ACCOUNTS:

Your attention is called to the following act of Congress, approved August 24, 1912 -- Sundry Civil Appropriation Act:

219 "Sec. 2. After June thirtieth, nineteen hundred and twelve, postmasters, assistant postmasters, collectors of customs, collectors of internal revenue, chief clerks of the various executive departments and bureaus, or clerks designated by them for the purpose, the superintendent, the acting superintendent, custodian, and principal clerks of the various national parks and other Government reservations, superintendent, acting superintendents, and principal clerks of the different Indian superintendencies or Indian agencies, and chiefs of field parties, are required, empowered, and authorized, when requested, to administer oaths, required by law or otherwise, to accounts for travel or other expenses against the United States, with like force and effect as officers having a seal; for such services when so rendered, or when rendered on demand after said date by notaries public, who at the time are also salaried officers or employees of the United States, no charge shall be made; and on and after July first, nineteen hundred and twelve, no fee or money paid for the services herein described shall be paid or reimbursed by the United States."

It will be seen from the above that on and after July 1, 1912, no fee paid to an officer for administering an oath to a voucher for traveling and other expenses shall be paid or reimbursed by the United States. (Circular No. 152.)

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,



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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.

Where a bill of lading is forwarded to a private dealer 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.  
(Circular No. 133.)

### PULLMAN TARIFFS:

Pullman tariffs effective February 1, 1911, quote upper berths at eighty per cent of the rates for lower berths. It will therefore be necessary, hereafter, 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. (Circular of February 6, 1911.)

### TELEGRAMS:

It is observed that some of the local officers and field officials are sending, by telegram, night letters, thinking, of course, that the use of the wires for messages at this rate is cheaper than night telegrams, and I wish to advise you that it is not the case, the Government rate for night telegrams being much less than that for night letters. Please discontinue the practice of sending the latter.  
(Circular of December 8, 1910.)

In this connection you are informed that this office has now identification cards from the Western Union and Postal Telegraph Co., so that messages that are strictly official business and are so marked may be sent "collect".

TRANSPORTATION VOUCHERS:

"Vouchers for Services and Traveling and other Expenses" or other vouchers which include charges for transportation shall show, in addition to the facts already required, the number of miles traveled and the initials of all roads involved in connection with each trip made. Cash fares, fares secured on transportation requests and mileage should be listed on the "Vouchers for Services and Traveling and other Expenses" in accordance with the following sample:

				\$4.80
Mar.	1	Pullman Co., lower berth, Washington to Chicago,		5.00
"	2	Pullman Co., lower berth, Chicago to Denver.		3.25
"	3	UPRR, Denver to Cheyenne	{ 107 }	3.10
"	6	UPRR, Cheyenne to Sidney, Nebr.,	{ 78 }	1.85
"	8	CRAGOR, Sidney to Bridgeport and return	{ 103 }	3.10
"	10	UPRR, Sidney to Cheyenne,	{ 107 }	3.25
"	11	UPRR, Cheyenne to Denver,		7.00
"	15	Pullman Co., upper berth, Denver to Missoula,		
TRANSPORTATION REQUESTS.				
Mar.	1	52325 PARR, CRAGOR, Wash. to Denver, Col.	{ 1837 }	\$39.35
"	15	52326 CRAGOR, NPKY, Denver to Portland,	{ 1711 }	41.05
MILEAGE.				
Mar.	20	5554 NPKY, SPOKRY, Portland to Spokane	{ 379 }	1300-1579
"	24	5554 NPKY, Spokane to Ellensburg,	{ 172 }	1580-1922

It is required that the analysis shall show the class of fare furnished. When, therefore, second or third class, or excursion tickets are furnished, that fact should be briefly indicated. The fact that the above sample is single spaced does not alter the existing regulation prohibiting writing between the lines on vouchers. (Circular of March 25, 1911.)

REPORTS:

WEEKLY REPORTS: (Form 4-429).

The weekly reports called for in your assignment instructions must be submitted promptly. They will be retained in this office not longer than one day, after which they will be forwarded to the Commissioner of the General Land Office through the Supervisor of Surveys. Incomplete or erroneous reports will also go forward in the same manner, after which the Surveyor will be called on for a supplemental report. Reports covering fractional weeks at the beginning and end of a month will, also, be promptly forwarded.

PROGRESS REPORTS:

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 surveys:

- A. Original surveys.
- B. Boundaries requiring reestablishment, and resurvey of subdivisional lines.
- C. Retracement-restoration surveys, or notes and bounds survey of private claims within townships being resurveyed.

The expressions "Dependent" and "Independent" resurveys used

in these reports may be defined, as follows:

A dependent resurvey of a boundary, for instance, is one where certain of the old corners were found and the obliterated ones restored by proportional measurements. Similarly 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 cor-

ners 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 and progress 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 REPORT:

Upon the completion of the assignment and return of outfit the surveyor will submit a full and complete detailed report of all equipment under his charge. Any lost articles or those recommended for condemnation, as well as equipment purchased in the field, must have special mention.

#### IRON POST REPORTS:

Upon return from the field the surveyor will submit a report of the number of each size of iron posts used in each township and also the total number received, used and returned.

#### PERSONAL EFFICIENCY:

"A number of accidents to instruments have been reported to this office, 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 in this office 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, of 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." (Letter from Supervisor of Surveys, dated July 8, 1912).

"In the matter of surveying parties' observing Sundays when in the field by remaining in camp, regardless of the number of week days lost on account of stormy weather or other causes, I desire to submit an opinion, based upon not only my own personal experience and observation, but upon the customs of all surveying parties of any description, when engaged in survey work, the success of which depends to a large extent upon weather conditions, and the proper utilization of time favorable to progress in the field.

"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. 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. (June 21, 1911)

RETRACEMENTS AND RESURVEYS:

Under heading of "Progress 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 cannot 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 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 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

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will be covered by the preliminary and final oaths 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 an affidavit by the surveyor explanatory of the lines so resurveyed or retraced and setting forth the absolute necessity therefor. Following this affidavit will be the usual preliminary oaths of assistants covering the resurveys or retracements. Then will follow the field notes proper.

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.

#### 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 securing 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 carefully consider the results 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 obviat-

ed by deferring the actual marking, or perhaps a portion thereof, until the remaining lines that affect the corner have been run.

FIELD NOTES AND PRELIMINARY PLATS:

On the completion of an assignment or assignments for the survey of public lands in this District, the Surveyor or Transitman will be directed by the Supervising Surveyor, or Surveyor-General, to proceed to the proper place and prepare his field notes and sketch plats of the surveys provided for in his instructions.

In writing his field notes, the surveyor will designate in the notes and on the plat 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. He is not authorized to report names of his own selection for natural objects. He must give those in use, if they can be obtained by reasonable diligence, or let the object go unnamed.

All Surveyors and Transitmen executing surveys are cautioned to maintain complete field notes thereof in every particular 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.

The limits of closing errors are set forth on pages 55 et seq. of the Manual. In irregular and fractional sections, a closing error greater than 1-640 of the perimeter will be considered excessive.

Small books will be furnished by the Surveyor-General for use in taking notes in the field.

Field notes to be filed in this office must be either written by

Nov. 26-1912



hand or typewritten with black non-copying ribbon. In either case both sides of the paper will be used and, if the notes are typewritten, they 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 in this office when completed and must conform to the requirements of the Manual of 1902, and its authorized modifications, in every particular.

The preliminary plate accompanying the field notes must show complete connected topography of the country over which the lines of survey pass. No high order of draftsmanship is required, yet the plate must be prepared with care and must accurately delineate all of the topographic features over which the lines may pass, as well as topography contiguous to or intersected by them, presenting thereby a connected representation of the country actually surveyed. Both surveys and returns should be correct in the first instance.

TOPOGRAPHICAL EXPRESSIONS:

This office has experienced considerable difficulty 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 Acequia:** Unnecessary importations from the Spanish.

**Canyon:** (Spanish Canon and Canada 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 term 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 accomplished this, and therefore entails some sort of depression, (such as, e.g., 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

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water is immediately drawn during the freshet.

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

Gulch }  
Gully } See "Canyon".

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, 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 a 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: 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 approximate 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 plates depicting exact locations except where claims are directly or indirectly tied to accepted public land surveys.

The Surveyor or Transitman 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 establishment of monuments presumed to be near the lines of the public surveys to be established under any Group will be furnished the Surveyor before going 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

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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 this office, 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 Monuments, 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.

#### M I S C E L L A N E O U S.

##### 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 deemed not to be imperative to extend township exterior lines over lands that are clearly non-agricultural in character and unsurveyable, under existing law and in-

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

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 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 this office immediately after determining the location of said objects, giving a complete description thereof, in order that reservation can be made, if found advisable.

Personal Attention of Surveyor Required:

The Surveyor or Transitman 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 survey and transmitting the same to this office, the Surveyor or Transitman 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,

*Frank S. Ingalls*  
Surveyor-General of Arizona.

A-ARC



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