DEPARTMENT OF COMMERCE AND LABOR

U.S. COAST AND GEODETIC SURVEY

O. H. TITTMANN

SUPERINTENDENT

GEODESY

THE TEXAS-CALIFORNIA ARC OF PRIMARY TRIANGULATION

BY

WILLIAM BOWIE

Inspector of Geodetic Work, and Chief of the Computing Division, Coast and Geodetic Survey

SPECIAL PUBLICATION No. 11

WASHINGTON
GOVERNMENT PRINTING OFFICE
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GENERAL STATEMENT.

In September, 1907, the Coast and Geodetic Survey began the reconnoissance (selection of stations) for an arc of primary triangulation to extend westward from the line Kyle-McClenny of the ninety-eighth meridian triangulation in central Texas to the line Cuyamaca-San Jacinto of the Pacific coast primary triangulation in the southern part of California. The reconnoissance was ended in February, 1908. The erection of signals was begun at the eastern end of the arc immediately after the completion of the reconnoissance, and the observing began in the fall of 1908. The observing was done in three seasons and was completed in February, 1911. The observing party also measured the bases to control the lengths in the triangulation, and it observed such astronomic azimuths as were needed along this arc for geodetic purposes.

The length of the primary triangulation of this arc, along the axis of the scheme, is 1207 miles (1942 kilometers), and the length of subsidiary schemes, secondary in character, is about 70 miles (113 kilometers). The latitudes of the two stations already established in Texas from which the arc started are 32° 49′ and 32° 27′. The latitudes of the two old stations in California to which the new work was joined are 32° 57′ and 33° 49′. In longitude the arc extends from 98° 12′ to 116° 41′. The range in latitude is 3° 58′. The area in the main scheme is 49 220 square statute miles.

There were 115 stations occupied for horizontal observations, 92 in the main scheme and 23 in the subsidiary schemes.

The Texas-California arc has been completed with greater rapidity and at a lower cost than any previous arc of primary triangulation in this country. It probably has not been excelled in rate of progress or low unit costs in any other country. This publication gives the details of the field and office work connected with the triangulation, together with the geographic positions and the descriptions of the stations.

The engineer intent only upon securing the necessary information to enable him to extend this triangulation or to base other surveys upon it will find the information he desires on pages 68 to 112, commencing with the explanation of the table of positions, lengths, and azimuths. The index printed on pages 135 to 141, used in connection with the sketches at the end of the publication, will enable him to find quickly the data for any given locality.

Several members of the Computing Division have taken part in the preparation of this report. The preparation of the descriptions and positions of stations was made by Mr. C. H. Swick. Mr. A. L. Baldwin had immediate direction of all the computations and adjustments connected with the arc, and he prepared the text and tables dealing with the adjustments. Mr. Walter F. Reynolds assisted Mr. Baldwin in directing the computations and adjustments.

RECONNOISSANCE.

The reconnoissance was done in one single season by a single party, which consisted of the writer, who was in charge; Signalman Jasper S. Bilby, who had previously had much experience in reconnoissance for primary triangulation; and a teamster. The equipment of the party consisted principally of five horses and mules, one freight wagon, one spring wagon, two riding saddles, two 9-foot center-pole tents, bedding for three men, a small amount of supplies and tools for making repairs, two draw telescopes, several binoculars and prismatic pocket compasses, a pocket tape line, a 4-inch transit with vertical circle, an odometer, and a small case of drawing instruments. Before going to the field copies of all Government and commercial maps were procured, as well as all available data relating to previous surveys in or near the area to be covered by the reconnoissance.

It was planned that the new triangulation should extend from a line of the ninety-eighth meridian primary triangulation, just to the westward of Weatherford, Tex.; follow the Texas & Pacific Railroad to El Paso, Tex.; cross the southern parts of New Mexico and Arizona as close as practicable to the international boundary; and then cross the State of California and connect with a line of the Pacific coast triangulation to the eastward of San Diego.

It was also planned that the new work should connect with existing triangulation by the United States Geological Survey, the California and Nevada boundary survey, the United States and Mexican boundary survey, and with monuments of the international boundary at El Paso, Tex., Nogales and Yuma, Ariz., and at other places where practicable.

Signalman Bilby arrived at Weatherford, Tex., on August 25, 1907, and began purchasing and preparing the outfit. On September 17 he began actual field work. The writer arrived on the field and took immediate charge of the party on September 24. The reconnoissance for the entire arc was completed on February 8, 1908, a total period of only 145 days.

The length through the axis of the main scheme, the area covered, and the number of stations selected are given on page 10.

The general instructions under which this reconnoissance was done were as follows:

INSTRUCTIONS FOR RECONNOISSANCE.

CHARACTER OF FIGURES.

(1) The chain of triangulation between base nets shall be made up of completed quadrilaterals and of central-point figures, with all stations occupied. It must not be allowed to degenerate even for a single figure to simple triangles. There must be two ways of computing the lengths through each figure. On the other hand, there must be no overlapping of figures and no excess of observed lines beyond those necessary to secure a double determination of every length, except that in a four-sided central-point figure one of the diagonals of the figure may be observed.

STRENGTH OF FIGURES.

(2) In the chain of triangulation between base nets the value of the quantity $R=\left(\frac{Nd-Nc}{Nd}\right)\Sigma[\delta^2_A+\delta_A\delta_B+\delta^2_B]$ for any one figure must not in the selected best chain (call it R_1) exceed 25, nor in the second best (call it R_2) exceed 80, in units of the sixth place of logarithms. These are extreme limits never to be exceeded. Keep the quantities R_1 and R_2 down to the limits 15 and 50 for the best and second best chains, respectively, whenever the estimated total cost does not exceed that for a chain barely within the extreme limits by more than 25 per cent. The values of R may be readily obtained by the use of the "Table for determining relative strength of figures in triangulation." (See p. 8.)

In the above formula the two terms $\frac{Nd-Nc}{Nd}$ and $\Sigma[\delta^2_A+\delta_A\delta_B+\delta^2_B]$ depend entirely upon the figures chosen and are independent of the accuracy with which the angles are measured. The product of these two terms is therefore a measure of the strength of the figures with respect to length, in so far as the strength depends upon the selection of stations and of lines to be observed over.

In the following table the values tabulated are $\Sigma[\delta^2_A+\delta_A\delta_B+\delta^2_B]$. The unit is one in the sixth place of logarithms. The two arguments of the table are the distance angles in degrees, the smaller distance angle being given at the top of the table. The distance angles are the angles in each triangle opposite the known side and the side required. δ_A and δ_B are the logarithmic differences corresponding to one second for the distance angles A and B of a triangle.

The square of the probable error of the logarithm of a side of a triangle is $\frac{4}{3}(d^2)\frac{Nd-Nc}{Nd}\Sigma[\delta^2_A+\delta_A\delta_B+\delta^2_B]$, in which d is the probable error of an observed direction. Nd is the number of directions observed in a figure and Nc is the number of conditions to be satisfied in the figure. The summation indicated by Σ is to be taken for the triangles used in computing the value of the side in question from the side supposed to be absolutely known.

The strength table is to be used in connection with the values of $\frac{Nd-Nc}{Nd}$[1] to decide during the progress of the reconnoissance which of the two or more possible figures is the strongest and to determine whether a sufficiently strong scheme has been obtained to make it inadvisable to spend more time in reconnoissance.

[1] Some values for this quantity are given on pp. 24 and 25 of General Instructions for the field work of the Coast and Geodetic Survey.

Table for determining relative strength of figures in triangulation.

°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
10	428	359																					
12	359	295	253																				
14	315	253	214	187																			
16	284	225	187	162	143																		
18	262	204	168	143	126	113																	
20	245	189	153	130	113	100	91																
22	232	177	142	119	103	91	81	74															
24	221	167	134	111	95	83	74	67	61														
26	213	160	126	104	89	77	68	61	56	51													
28	206	153	120	99	83	72	63	57	51	47	43												
30	199	148	115	94	79	68	59	53	48	43	40	33											
35	188	137	106	85	71	60	52	46	41	37	33	27	23										
40	179	129	99	79	65	54	47	41	36	32	29	23	19	16									
45	172	124	93	74	60	50	43	37	32	28	25	20	16	13	11								
50	167	119	89	70	57	47	39	34	29	26	23	18	14	11	9	8							
55	162	115	86	67	54	44	37	32	27	24	21	16	12	10	8	7	5						
60	159	112	83	64	51	42	35	30	25	22	19	14	11	9	7	5	4	4					
65	155	109	80	62	49	40	33	28	24	21	18	13	10	7	6	5	4	3	2				
70	152	106	78	60	48	38	32	27	23	19	17	12	9	7	5	4	3	2	2	1			
75	150	104	76	58	46	37	30	25	21	18	16	11	8	6	4	3	2	2	1	1	1		
80	147	102	74	57	45	36	29	24	20	17	15	10	7	5	4	3	2	1	1	1	0	0	
85	145	100	73	55	43	34	28	23	19	16	14	10	7	5	3	2	2	1	1	0	0	0	0
90	143	98	71	54	42	33	27	22	19	16	13	9	6	4	3	2	1	1	1	0	0	0	0
95	140	96	70	53	41	32	26	22	18	15	13	9	6	4	3	2	1	1	0	0	0	0	
100	138	95	68	51	40	31	25	21	17	14	12	8	6	4	3	2	1	1	0	0	0		
105	136	93	67	50	39	30	25	20	17	14	12	8	5	4	2	2	1	1	0	0			
110	134	91	65	49	38	30	24	19	16	13	11	7	5	3	2	2	1	1	1				
115	132	89	64	48	37	29	23	19	15	13	11	7	5	3	2	2	1	1					
120	129	88	62	46	36	28	22	18	15	12	10	7	5	3	2	2	1						
125	127	86	61	45	35	27	22	18	14	12	10	7	5	4	3	2							
130	125	84	59	44	34	26	21	17	14	12	10	7	5	4	3								
135	122	82	58	43	33	26	21	17	14	12	10	7	5	4									
140	119	80	56	42	32	25	20	17	14	12	10	8	6										
145	116	77	55	41	32	25	21	17	15	13	11	9											
150	112	75	54	40	32	26	21	18	16	15	13												
152	111	75	53	40	32	26	22	19	17	16													
154	110	74	53	41	33	27	23	21	19														
156	108	74	54	42	34	28	25	22															
158	107	74	54	43	35	30	27																
160	107	74	56	45	38	33																	
162	107	76	59	48	42																		
164	109	79	63	54																			
166	113	86	71																				
168	122	98																					
170	143																						

LENGTHS OF LINES.

(3) No line of the primary triangulation outside of the base nets should be less than 6 kilometers long. There is little if any advantage in so far as accuracy is concerned in making the lines much longer than this. Therefore endeavor, in laying out the triangulation scheme, to use the economic length of line; that is, endeavor to use in each region lines of such lengths as to make the total cost of reconnoissance, building, and triangulation a minimum per mile of progress, subject to the limitations stated in these instructions.

FREQUENCY OF BASES.

(4) If the character of the country is such that a base site can be found near any desired location ΣR_1 between base lines should be made about 130. This will be found to correspond to a chain of from 15 to 35 triangles, according to the strength of the figures secured. With strong figures but few base lines will be needed and a corresponding saving will be made on this part of the work. If topographic conditions make it difficult to secure a base site at the desired location, ΣR_1 may be allowed to approach but not exceed 200. There will be danger when this is done that an intervening base may be necessary; for if in any case the discrepancy between adjacent bases is found to exceed 1 part in 25 000 an intervening base must be measured.

BASE SITES AND BASE NETS.

(5) In selecting base sites keep in mind that a base can be measured with the required degree of accuracy on any site where the grade on any 50-meter tape length does not exceed 10 per cent, and that narrow valleys or ravines less than 50 meters wide in the direction of the base are not obstacles to measurement. The length of each base is to be not less than 4 kilometers. In each base net great care should be taken to secure as good geometrical conditions as possible. There should be no hesitancy in placing the base on rough ground, provided the roughness is not greater than that indicated above, if by doing so the geometrical conditions in the base net are improved. Each base net should not be longer than two ordinary figures of the main chain between bases. The base net may also be strengthened by observing over as many lines between stations of the net as can be made intervisible without excessive cost for building or cutting. Caution is necessary in thus strengthening a base net by observing extra lines to avoid naking the figure so complicated as to be excessively difficult and costly to adjust.

Kyle and McClenny[1] were the two stations of the ninety-eighth meridian triangulation which were used as the beginning of the new arc. It was found to be practicable to locate most of the stations within reasonable distances of a railroad, and thus the expense and time of transportation for the observing party on the triangulation were kept small in amount. The reader is referred to the illustrations at the back of this volume, which show the scheme of triangulation with the numerous connections made with existing triangulation stations and boundary monuments.

The first 330 miles at the eastern end of the arc runs through a partly wooded, rolling country, with an occasional isolated butte or hill (usually flat topped). In this section it was necessary to elevate the instrument at most of the stations. To the westward of the stations Ingle and Sist (see illustration No. 12 at the end of the volume) the country was mountainous and no structures were needed for elevating the instrument except at the Deming base. (Illustration No. 14.)

During the first part of the season the party remained together and the writer and Mr. Bilby went out from the camp together to nearly all of the selected stations. During the greater part of the season the party operated in two separate sections; the writer, with a saddle horse, teamster, and freight wagon, while Mr. Bilby used a spring wagon. After dividing, the party met only at Sierra Blanca, Tex.; El Paso, Tex.; Hermanas, N. Mex.; Tucson, Ariz.; and Yuma, Ariz. At each of these places the scheme was adopted from the stations located by the two observers.

No day or night signals of any kind were used during the entire season. The success of the reconnoissance is attested by the fact that no reconnoissance station was

[1] See illustration No. 14 in Appendix 4, Report for 1903.

abandoned during the subsequent triangulation. One station was moved about one-half mile on a flat-topped ridge in order to avoid elevating the instrument 16 feet, and the north end of the Deming base line was moved northward about 2 miles to improve the base net. In only a few cases was it necessary to elevate the instrument more than planned by the reconnoissance.

In the following table are given in condensed form the data regarding the progress and cost of the reconnoissance for the Texas-California arc. The cost includes all salaries, even that of the chief of party while at the office preparing for field work and after his return from the field while making out his final report on the reconnoissance. The cost also includes 25 per cent of the cost of five horses and mules and two wagons which were used about 20 months on this arc by the building and observing parties and only about five months by the reconnoissance party. In this table only the stations, the area, and the length of the main scheme are considered, although subsidiary stations located added to the total cost of the season.

Statistics of reconnoissance.

Date of beginning actual field operations	Sept. 17, 1907
Date of ending actual field operations	Feb. 8, 1908
Total length of season by months	4.7
Cost of work, including salaries	$4 855
Number of principal stations selected	92
Length of main scheme in miles	1 207
Area in main scheme, in square miles	49 220
Cost per station selected	$53
Cost per mile of progress	$4.02
Cost per square mile covered	$0.10
Progress in miles per month	260

On page 168 of Appendix 4, Report for 1911, there is given a table of statistics of reconnoissance done during three seasons on the ninety-eighth meridian. The mean cost per station varied from $19 to $39. The average cost per mile of progress varied from $3.90 to $6.90, and the mean cost per square mile covered varied from $0.40 to $0.90. The reconnoissance on the Texas-California arc cost more per station selected than the ninety-eighth meridian reconnoissance. Its cost per mile of progress is about the same as that for the season's reconnoissance on the ninety-eighth meridian in Texas in the winter of 1904–5. The cost per square mile of area covered is but slightly more than one-fourth of the lowest cost on the ninety-eighth meridian. The higher cost per station and the lower cost per square mile are due largely to the much longer lines used in the new triangulation. It is believed that the relative economy of two pieces of reconnoissance done under similar conditions (so far as ease of transportation and character of country are concerned) should be judged by the cost per mile of progress rather than the cost per station selected or square mile of area covered.

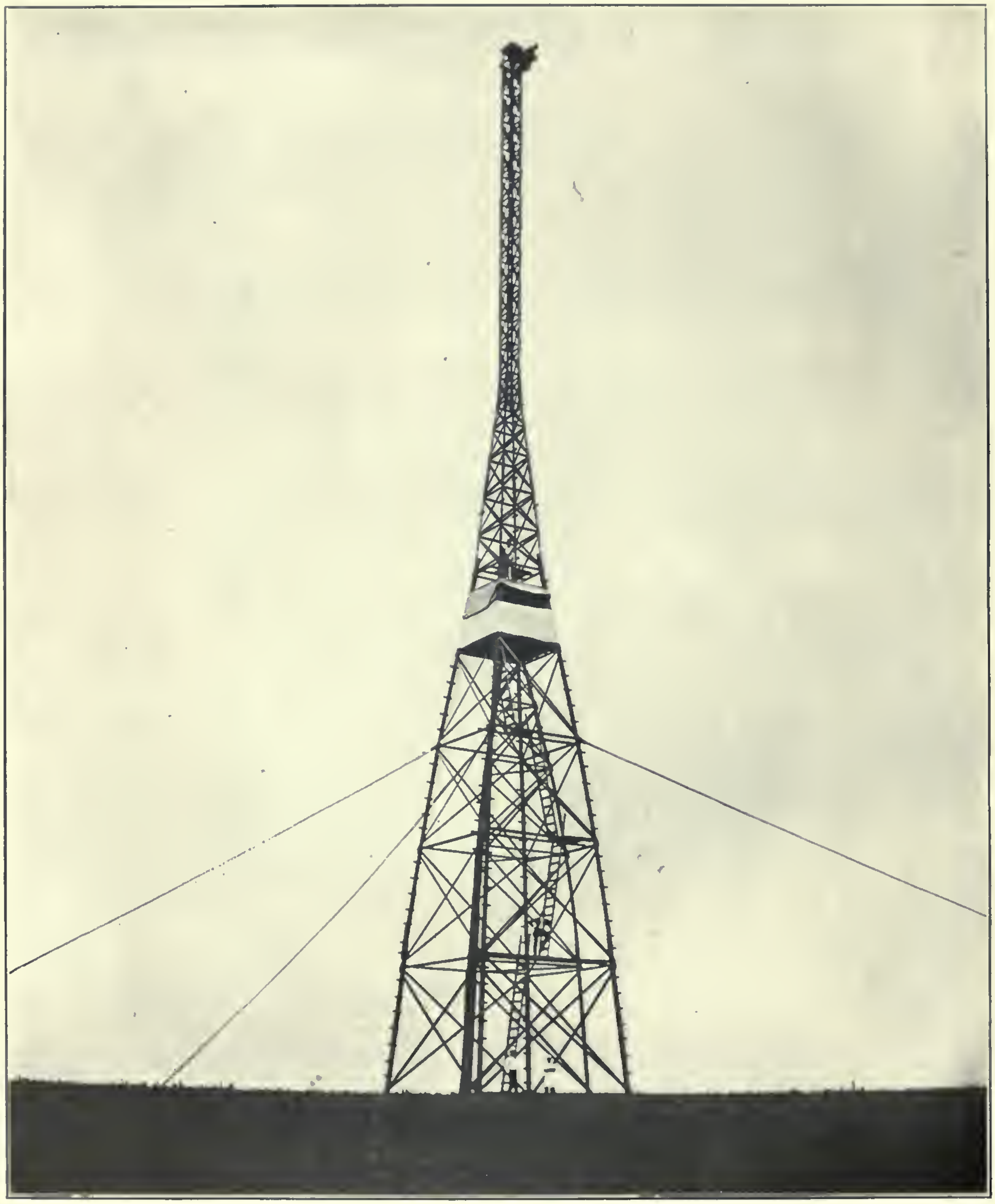
SIGNALS.

The signals used on the Texas-California triangulation were similar to those used on the greater portion of the ninety-eighth meridian triangulation, which are described in detail in Appendix 4 of the Report for 1903. Illustration No. 2 is taken from that report. When only one observing party is operating, as was the case on the Texas-California arc, the top platform shown on the signal in illustration No. 1 is omitted. The superstructure shown on the signal in illustration No. 2 is used to elevate the helio-

No. 1.

SIXTY-FOOT SIGNAL.

No. 2.



SIGNAL AT BURSON ON THE NINETY-EIGHTH MERIDIAN TRIANGULATION.

BOX HELIOTROPE USED ON PRIMARY TRIANGULATION.

trope and lamp at each end of an obstructed line. Signals at nearly all of the stations occupied during the first season were erected during the spring and fall of 1908 and before the beginning of the observing. Several signals were erected just before the close of the first observing season. The building party was under Signalman J. S. Bilby.

During the spring of 1908 36 signals of an aggregate height of 1015 feet (309 meters) were erected at a total cost of $3600. This includes the material for station and reference marks and the cost of putting them in place. This made the cost per vertical foot $3.55. The cost of building signals in 1902 on the ninety-eighth meridian triangulation was $3.20 per vertical foot, and it is believed the average cost for all the building on the ninety-eighth meridian done subsequently to 1902 was very close to that amount. The higher cost per vertical foot on the Texas-California triangulation is due to the higher cost of lumber on an average and to the lower average height of signal, only 28 feet. At 13 of the 36 stations under consideration, only stands about 3.3 feet high were erected. It is evident, therefore, that the signal building was done with the same high efficiency that obtained on the ninety-eighth meridian triangulation.

At the stations occupied during the second and third seasons the telescope of the theodolite was elevated only to the height of the observer's eye (except at the two stations at the ends of the Deming base). During each of these two seasons Signalman Bilby and one other man, each working along a side of the scheme, preceded the observing party and prepared the station for occupation. This consisted in putting in the station and reference marks and building the stand to support the theodolite. In most cases they transported the heliotroper from the nearest railroad station and posted him at his triangulation station.

PROGRESS OF OBSERVING.

SEASON OF 1908–9.

The first horizontal observations on the triangulation of the Texas-California arc were made on November 6, 1908, at station Kyle, at the eastern end of the arc, and during the first season the observing was extended westward to stations Ingle-Sist. The party was under the direction of the writer while occupying the first 19 stations of the scheme, that is, until early in January, 1909, when it was transferred to Assistant J. S. Hill. The chief of party in both cases was also the observer.

In addition to the chief, the observing party during the first season consisted of Signalman Bilby, a recorder, and a teamster. The camp equipage and means of transportation were practically the same as were used in the reconnoissance (see p. 6). With a light outfit quick moves could be made between stations, and the work about camp was reduced to a minimum. The members of the observing party lived in the tents and, wherever practicable, obtained board at farm and ranch houses. Where this was not convenient, a small emergency cooking outfit was used by the party in preparing meals.

The observing was done entirely on heliotropes and acetylene signal lamps. The usual form of heliotrope is shown in illustration No. 3. The lamp used on most of the Texas-California triangulation is shown in illustration No. 4. The smaller lamp, used on nearly all the ninety-eighth meridian triangulation and at a few stations of the new triangulation, is that shown in illustration No. 5.

Five light keepers were used by the triangulation party, and they were directed by letter and by code signals, sent in a modified Morse alphabet, using the lamps and heliotropes in signaling[1]. The light keepers lived in tents, prepared their own meals, and moved from station to station with teams hired for the individual trips. Each was supplied with a sketch of the triangulation and also with descriptions of the stations. They had no difficulty in moving from station to station, and only in rare instances did they have any trouble in getting the direction to the observer's station. With few exceptions, the same men were retained as light keepers throughout the season. It is essential to rapid progress to have a trained corps of light keepers who can operate without assistance from the observing party.

Between November 6 and December 30, inclusive, the writer occupied and completed all observations at 19 primary stations. In addition, primary azimuths were observed at 3 stations during that period. The observing at the remaining 32 stations of the first season was done by Mr. Hill, beginning with station Patterson. Mr. Hill also observed 4 primary azimuths and measured a primary base line at Stanton, Tex.[2] A table showing the days on which primary horizontal directions were observed at the several stations is given on page 15. The first season's observations ended with the stations Ingle and Sist (see illustration No. 12, at end of volume), and the last observing was done on April 8, 1909.

The country traversed during the first season was rolling, with occasional hills standing well above the general level of the country. The average length of the lines of the triangulation was about 15 miles (24 kilometers). The land was partially settled and the roads were fair. Very little difficulty was encountered in getting water for the party and stock.

SEASON OF 1909–10.

The second season's observing began on September 7, 1909, at the station Toyah, Texas (see illustration No. 13, at the end of the volume), and ended at the Deming base net, New Mexico, on January 7, 1910. Owing to the fact that the country to be worked over was arid, mountainous, and with few settlers, a somewhat different organization of party was used during this season.

The observing party consisted of the chief (who was the observer), a recorder, and a teamster. The camp equipage was reduced to a minimum. Seven heliotropers or light keepers were employed throughout the season. They were usually posted by the signalman and his assistant, who also prepared the stations for the observer and set the station marks. When a light keeper took a station he remained there until all observations on that station were completed. He was also at the station and assisted the observing party while the station was occupied for observations. The movements of the light keepers were, as usual, directed by signaling. When each of the light keepers was through with his work at a station he was moved to the nearest railroad station by a teamster, who was employed throughout the season for that purpose, and the light keeper traveled by train ahead of the observer and was posted as noted above. The teamster, whose work it was to move the rear light keepers to the railroad, usually communicated with the men on the mountain peaks by signaling with a heliotrope or lamp.

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[1] See pp. 826–828 of Appendix 4, Report for 1903.

[2] See "Primary Base Lines at Stanton, Texas, and Deming, New Mexico," App. 4, Report for 1910.

No. 4.

LARGE ACETYLENE SIGNAL LAMP.

No. 5.

SMALL ACETYLENE SIGNAL LAMP.

TWELVE-INCH THEODOLITE WITH ELECTRIC LIGHT FOR ILLUMINATING THE CROSS WIRES.

It was found to be necessary in most cases to haul water to the stations for the light keepers. As a rule, when he was posted, enough could be taken to a station to last until the observing party reached the station. Each of the several freight wagons was equipped to carry about 70 gallons of water in specially constructed cans. These cans were fastened to the outside of the wagon.

The camp equipage of the observing party and of the light keepers was taken to the station, or some point near it, by pack mules or horses. It was only occasionally that any hand packing was done.

At the end of the season the party measured the Deming base with invar tapes.[1]

SEASON OF 1910–11.

At the close of the second season's work there remained to be done about 600 linear miles of the arc. The stations at the eastern end of this section in New Mexico and Arizona are on high mountain peaks, and the three stations at the extreme western end of the section are also on high mountains. It was desired that all of this section be done in one observing season, and in order to do this the high mountain stations must be occupied during the summer months in order to avoid the snows of the early fall. The plan adopted and carried out was to complete the observations first at the stations forming the extreme western quadrilateral of the arc, then return to the vicinity of the Deming base net and work westward through the remainder of the scheme. The last one of the high peaks (Catalina) was occupied on November 1. The observations for this season began on July 6, 1910, and they ended on February 22, 1911. Neither the observing party nor the light keepers were seriously interfered with by snow during the season.

The organization and equipment of the party were the same as those of the preceding season and the management of the work was not changed in any material way.

METHODS OF OBSERVING EMPLOYED.

The observations for the primary horizontal angles were made in accordance with the General Instructions for Primary Triangulation, as given on pages 170–174 of Appendix 4, Report for 1911.

All the horizontal angle measures were made by the direction method, using the 12-inch (30-centimeter) theodolites made in the Instrument Division of the Survey, one of which is shown in illustration No. 6. These instruments are described in Appendix 8, Report for 1904. The telescope used has a clear aperture of 61 millimeters and its focal length is 74 centimeters. The circle is graduated to five-minute spaces and is read by the micrometer microscopes to single seconds.

The telescope of the theodolite has two parallel vertical wires, about 20 seconds apart, for making the pointings for horizontal angles. The results from a number of seasons' work indicate that this arrangement of the wires in the telescope is more satisfactory than either the single vertical wire or the oblique cross. The double wire is especially effective when the image of the light or heliotrope is large and unsteady.

In making the measurements of horizontal directions each direction in the main scheme was measured 16 times. A direct and reverse reading was considered one meas-

[1] See "Primary Base Lines at Stanton, Texas, and Deming, New Mexico," Appendix 4, Report for 1910.

urement, and 16 positions of the circle were used, corresponding approximately to the following readings upon the initial signal or station:

Number	°	′	″	Number	°	′	″
1	0	00	40	9	128	00	40
2	15	01	50	10	143	01	50
3	30	03	10	11	158	03	10
4	45	04	20	12	173	04	20
5	64	00	40	13	192	00	40
6	79	01	50	14	207	01	50
7	94	03	10	15	222	03	10
8	109	04	20	16	237	04	20

When a broken series was observed, the missing signals were observed later in connection with the chosen initial or with some other one, and only one, of the stations already observed in that series. With this system of observing no local adjustment was necessary. Little time was spent in waiting for the doubtful signal to show. If it was not showing within, say, one minute of when wanted, the observer passed to the next. A saving of time results from observing many or all of the signals in each series, provided there are no long waits for signals to show, but not otherwise.

In selecting the conditions under which to observe primary directions the observer proceeded upon the assumption that the maximum speed consistent with the requirement that the closing error of a single triangle in the primary scheme shall seldom exceed three seconds, and that the average closing error shall be but little greater than one second, was what was desired rather than a greater accuracy than that indicated with slower progress. This standard of accuracy used in connection with other portions of the general instructions defining the necessary strength of figures and frequency of bases will in general insure that the probable error of any base line, as computed from an adjacent base, is about 1 part in 88 000 and that the actual discrepancy between bases is always less than 1 part in 25 000.

The limit for rejection of observations upon directions in the main scheme was 5″ from the mean. No observation agreeing with the mean within this limit was rejected unless the rejection was made at the time of taking the observation and for some other reason than simply that the residual was large. A new observation was substituted for the rejected one before leaving the station, if possible, without much delay.

The number of observations at supplementary stations and on intersection stations, as well as the number of vertical angle observations, conformed to the requirements of the General Instructions. It is not necessary to specify them here.

The stations were all well marked and adequately described, as is indicated on pages 83 to 112 of this volume.

PROGRAM OF OCCUPATION OF STATIONS.

In the following three tables the primary stations occupied during the several seasons are arranged in the order of their occupation. The second column of each table indicates the days on which primary horizontal observations were made, and the third column the number of such days. The letters (az.) after the name of a station indicates that observations for primary astronomic azimuth were made at that station.

STATIONS OCCUPIED.

Assistant WILLIAM BOWIE, Chief of Party and Observer, until Dec. 31, 1908. Assistant J. S. Hill, Chief of Party and Observer, after Dec. 31, 1908. Season of 1908–9.

Station	Days on which observations of primary horizontal directions were made	Number of days
	1908	
Kyle	Nov. 6, 7	2
McClenny	Nov. 11, 13, 14	3
Rattlesnake	Nov. 16	1
Lacasa (az.)	Nov. 18, 19, 21, 23	4
Pierce	Nov. 24	1
Flat	Nov. 25, 26, 29	3
Hearn	Nov. 30, Dec. 2	2
Lamb	Dec. 4	1
Springgap (az.)	Dec. 7, 8	2
Hitson (U.S.G.S.)	Dec. 10	1
Clyde	Dec. 11	1
Kennard	Dec. 12	1
Clayton	Dec. 14, 15, 16, 17	4
Buzzard	Dec. 18	1
Morrison	Dec. 21	1
Sears (az.)	Dec. 22, 23, 24	3
Hale	Dec. 26	1
Boyd	Dec. 28, 29	2
Allen	Dec. 30	1
	1909	
Patterson	Jan. 1, 2, 4	3
Lloyd	Jan. 5	1
Bench	Jan. 6, 7, 8	3
Wolf	Jan. 9	1
Bynum (az.)	Jan. 13	1
Cuthbert	Jan. 15, 16, 17, 18	4
Top	Jan. 19, 20, 21	3
Signal	Jan. 23	1
Williams	Jan. 25	1
Evart	Jan. 26	1
Stanton (az.)	Jan. 27, 29, 30	3
Epley	Feb. 2, 3	2
Stanton north base	Feb. 5	1
Stanton south base	Feb. 6	1
Elkins [1]	Feb. 24	1
Dunn	Feb. 25	1
Morris	Feb. 26, 28	2
Scar	Feb. 27	1
Bates	Mar. 1	1
Odessa	Mar. 2	1
Smith (az.)	Mar. 3, 4, 5	3
Dublin	Mar. 6, 7, 8, 11	4
Douro	Mar. 13	1
Curtis	Mar. 15	1
Harris	Mar. 17	1
Aroya	Mar. 19, 20	2
Estes (az.)	Mar. 24, 25	2
Lee	Mar. 29, 30	2
Johnson	Mar. 31, Apr. 1	2
Hays	Apr. 2, 3	2
Sist	Apr. 6	1
Ingle	Apr. 7, 8	2

[1] The Stanton base was measured during the interval between the occupation of stations Stantou south base and Elkins.

STATIONS OCCUPIED—Continued.

Assistant J. S. Hill, Chief of Party and Observer. Season of 1909–10.

Station	Days on which observations of primary horizontal directions were made	Number of days
	1909	
Toyah	Sept. 7, 8	2
Round (az.)	Sept. 9, 10	2
Newman	Sept. 14, 15	2
Seay	Sept. 17, 18	2
Reynolds	Sept. 20	1
Krouse	Sept. 21, 22	2
Chispa	Sept. 27	1
Eagle (az.)	Sept. 30, Oct. 1, 2	3
Diablo	Oct. 5	1
Quitman	Oct. 11, 12	2
Black (az.)	Oct. 15, 16	2
Corduna	Oct. 20, 21	2
North Franklin	Nov. 5, 6, 9, 16	4
Jarilla (az.)	Nov. 20, 22	2
Kent	Nov. 24, 25	2
Cooks (az.)	Dec. 8, 9, 10, 12	4
Florida	Dec. 16, 19	2
Hermanas	Dec. 28, 29, 30	3
	1910	
Red	Jan. 4, 5	2
Deming north base	Jan. 6	1
Deming south base	Jan. 7	1

The Deming base was measured just after the completion of observations at the station Deming south base.

Assistant J. S. Hill, Chief of Party and Observer. Season of 1910–11.

Station	Days on which observations of primary horizontal directions were made	Number of days
	1910	
American (U. S. G. S.)	July 6, 7	2
Butte (az.)[1]	July 15	1
Cuyamaca	July 25, 26, 28, 29, Aug. 4	5
San Jacinto (az.)	Aug. 11, 12, 16, 17	4
Burro (az.)	Aug. 27, 29, 30, Sept. 1, 2	5
Line (U. S. G. S.)	Sept. 6, 7	2
Graham (U. S. G. S.) (az.)	Sept. 12, 13, 16, 17	4
Chiricahua (az.)	Sept. 24, 26, 27, 29, 30	5
Baldy (U. S. G. S.)	Oct. 16, 17	2
Catalina (az.)	Nov. 1	1
Superstition (U. S. G. S.) (az.)	Nov. 9, 10	2
Table	Nov. 21	1
Maricopa	Nov. 25	1
Whitetank (az.)	Dec. 5	1
Harquahalla (az.)	Dec. 14, 15, 20	3
Mohawk (az.)	Dec. 28, 29	2
	1911	
Kofa (az.)	Jan. 4, 5	2
Butte (az.)[2]	Feb. 2, 4	2
Chemehuevis	Feb. 11	1
Powell	Feb. 18, 19	2
Pine (az.)	Feb. 22	1

[1] Also occupied in January–February, 1911.

[2] Also occupied in July, 1910.

The season of 1908–9 is notable for the large number of stations at which primary observations were completed on a single day. This occurred at 27 of the 51 stations occupied during that season. It is also notable for the rapid rate at which stations were completed. During a period of 27 consecutive days between December 4 and December 30, twelve stations were completed by the writer. During a period of 25 consecutive days between February 24 and March 20, twelve stations were completed by Mr. Hill.

In the second and third seasons a number of subsidiary stations were occupied but they have not been considered in the rates of progress given in the table below. Nor have the azimuths observed been considered.

Each of the stations "American" and "Butte" was occupied twice during the third season. At the second occupation of "American" only secondary directions were observed. Each occupation has been considered as a separate station.

The following table gives the essential facts for each of the three seasons and for the whole arc:

	Number of observations of each primary direction	Total number of days of primary observations	Number of stations	Average number of days per station of primary observations	Maximum number of days per station of primary observations	Minimum number of days per station of primary observations	Average number of days at station between first and last primary horizontal observations	Average number of days between stations, from last observation at one station to first observation at next station	Average number of days per station	Rate of progress. Stations occupied per month
Season of 1908–9	16	91	51	1.8	4	1	2.0	0.8	2.7	11.1
Season of 1909–10	16	43	[1] 21	2.0	4	1	2.6	3.4	5.8	[2] 5.2
Season of 1910–11	16	49	[3] 22	2.2	5	1	3.1	7.8	10.5	2.9
Whole arc	16	183	94	1.9	5	1	2.4	2.9	5.3	5.7

[1] Eight supplementary stations were occupied during this season in addition to the 21 primary stations.
[2] The 17 days occupied in measuring the Stanton base are deducted from the total number of days in the season before computing the rate of progress.
[3] Fifteen supplementary stations were occupied during this season in addition to the 22 primary stations. The second occupation of stations "Butte" and "American" are each counted as a separate primary station, although only secondary directions were observed at the second occupation of "American."

The first season's work was in a country very similar to that found on the southern portion of the ninety-eighth meridian and not very different, so far as ease of transportation and weather conditions were concerned, from the northern portion of the ninety-eighth meridian. A comparison of the statistics for the first season with those of the ninety-eighth meridian triangulation executed after 1901, shown on page 180, Appendix 4, Report for 1911, shows that the average number of days per station on which primary observations were made was 1.8 for the season of 1908–9 and 2.6 for the ninety-eighth meridian. The average number of days at a station between the first and last primary observations was 2 against 3.2; while the progress in stations per month was 11.1 against 7.8. The weather conditions were somewhat better during the first season on the Texas-California arc than on the ninety-eighth meridian, but the principal causes for the increased rate of progress were a better signal lamp, a reduction of the correspondence and computing by the observing party, the very light camp equipage of the observing party and the fact that there were five light keepers in the party. With this number of light keepers the observer was enabled usually to make all the observations at a station on a single day.

The statistics in the preceding table for the second and third season show that the number of days per station on which primary observations were made is, in each case, only slightly greater than for the first season but the number of days at the station is, in each case, materially greater. The work was in a mountainous region where transportation of the light keepers was difficult and the weather (at the mountain stations) was not as favorable as during the first season. The time between the last observations at one station and the first at the next station was consumed by packing the outfit down one peak, up the peak at the next station, and in traveling by teams between stations. Considerable time was also used in traveling to and between the subsidiary stations and in observing at them. A comparison of the rate of progress in stations completed per month on this work and on the ninety-eighth meridian triangulation would give no idea of the relative economies of the two. A comparison may be made from the data given in the table on page 19, which shows the progress in linear miles per month and the cost per mile.

Mr. Hill, the chief of party and observer during the second and third seasons, deserves great credit for conducting so successfully the operations in an arid region where transportation was difficult and where water and provisions were not easily accessible. Mr. Hill in his reports on his work speaks highly of the assistance rendered by Mr. Bilby in helping to plan the operations of the parties, in preparing the stations for occupation, and in posting the light keepers.

CONNECTIONS MADE WITH STATIONS PREVIOUSLY ESTABLISHED.

The Texas-California primary triangulation connected with the triangulation of the United States Geological Survey near the eastern end of the arc on stations Hitson, Wasp, Abilene standpipe, and Cisco astronomic station; also in western Texas at stations Newman, Diablo, Quitman, Cerro Alto, and North Franklin; in New Mexico on stations Line and Corduna; in Arizona with stations Graham, Baldy, Benedict, Huachuca, Mule, Burro, Superstition, and Maricopa northwest base; and in California with stations American and Picacho.

Connections were made with the triangulation of the United States and Mexican Boundary Survey at El Paso, Nogales, and Yuma. Besides the monuments at each of those three places, international monuments Nos. 31, 32, 39, 40, and 91 were connected with the triangulation.

A connection with the triangulation of the California-Nevada boundary was made in the vicinity of Needles, Cal.

Connections made with precise leveling bench marks need not be mentioned here. They are referred to in the discussion of elevations on page 113.

STATEMENT OF COSTS.

The following table gives a statement of the unit costs of the three seasons' work separately and also the costs of the arc taken as a whole. The amounts stated include the salaries of the observer while on the field and during the limited times before and after each season while planning the work and making reports, etc.

Season and name of observer.	Number of months of observations.	Number of primary stations occupied.	Stations occupied per month.	Total field expenses.	Cost per station occupied.	Total points determined.	Cost per point determined.	Number of miles of progress.	Cost per mile of progress.	Area in main scheme in square miles.	Cost per square mile.
1908–9, W. Bowie and J. S. Hill	5.1	51	[1] 11.1	$13 275	$260	92	$144	330	$40	4 360	$3.04
1909–10, J. S. Hill	4.0	21	5.2	9 640	459	59	163	294	33	10 070	0.96
1910–11, J. S. Hill	7.6	[2] 22	2.9	15 469	703	111	139	583	27	34 790	0.44
Total arc	16.7	94	5.6	38 384	408	262	147	1 207	32	49 220	0.78
Ninety-eighth meridian triangulation after 1901	30.5	265	9.0	78 187	293	849	109	1 329	63	21 655	5.19

[1] Seventeen days during the season were occupied in measuring the Stanton base. This time was deducted from the total length of the season before preparing the statistics for this season.

[2] Each of stations "Butte" and "American" is counted as two stations, as each was occupied twice at different times during the season. See p. 17.

The tabulated costs do not include the expense of the reconnoissance. See p. 10.

For the first season the unit costs are somewhat lower than the costs for the southern portion of the ninety-eighth meridian. The topography on the eastern portion of the Texas-California arc is very similar to that along the ninety-eighth meridian in Texas. The cost per station occupied is about 10 per cent less than the southern ninety-eighth meridian triangulation. The cost per mile of progress is $40, against $62 on the ninety-eighth meridian south. The rate at which stations were occupied per month on the first season on the Texas-California arc was 11.1, against 10.5 on the southern ninety-eighth meridian. The cost per station occupied increased materially for the second and third seasons, and the number of stations occupied per month dropped to 5.2 and 2.9, respectively. At the same time the cost per mile of progress decreased from $40 to $33 and $27, respectively. The triangulation of the last two seasons was carried through a mountainous country where distances between stations were great and transportation difficult.

For purposes of comparison the statistics for the ninety-eighth meridian triangulation which was done after 1901 are shown in the last line of the preceding table.

The writer is justified in stating that the Texas-California arc of primary triangulation has been the most economically executed of the extensive arcs of primary triangulation in this country. He believes that no extensive arc in any other country equals this arc for low unit costs.

A statement of costs for the ninety-eighth meridian triangulation is given on pages 181–183 of Appendix 4, Report for 1911. It is stated there that the ninety-eighth meridian triangulation cost very much less than the triangulation of either the transcontinental or the oblique arc.

STATEMENT OF ADJUSTMENTS.

No local adjustments were made, these having become unnecessary since the adoption of the present method of supplying missing observations in broken series.[1]

The line Kyle-McClenny had been fixed in length, direction, and position by the adjustment of the ninety-eighth meridian triangulation,[2] and the line San Jacinto-Cuyamaca was similarly held by the adjustment of the primary triangulation of California.[3]

In addition to the line at each end of this scheme of triangulation there were known the lengths of the Stanton base and of the Deming base. At first a single adjustment was made of the entire chain of triangulation, but, for convenience, the single adjustment is considered in the three sections into which the base lines naturally divide it. The first section extends from the line Kyle-McClenny to the Stanton base; the second from the first section to the Deming base; and the third from the second section to the line San Jacinto-Cuyamaca.

ADJUSTMENT OF THE DISCREPANCIES IN LATITUDE, LONGITUDE, AND AZIMUTH.

After the completion of the adjustment of the primary chain from the fixed stations of the ninety-eighth meridian to stations of the California triangulation, the positions were computed through these adjusted triangles. The discrepancy in latitude which developed at the junction with the California triangulation was $1''.253$ (or 38.6 meters); in longitude, $0''.532$ (or 14 meters); and in azimuth $7''.49$. In other words, the closure of the loop of triangulation, forming nearly a rectangle with the Texas-California arc and the thirty-ninth parallel as the base and top, respectively, and the ninety-eighth meridian and the California triangulation as the sides, a total of 5300 kilometers, is 41 meters in position, or 1 part in 130 000.

This total discrepancy was thus distributed in only about one-third of the entire loop and in a portion fully as strong as the average of that part held fixed. The introduction of the whole loop into the adjustment, or of any considerable portion of it, other than the part used, was impracticable on account of the great amount of computation which would have been involved. Not only would such a step have greatly increased the work of making the loop adjustment which already included 190 conditions, but it would also have made necessary the recomputation of much other triangulation which was based on the previously adjusted portion of the loop. Besides, the geographic positions on the United States Standard Datum of the stations of the east and west sides of the loop have been published, and have been extensively used in public and private surveys. It will be seen on examining the corrections to the directions or angles, arising from the adjustment of these discrepancies in latitude, longitude, and azimuth, which are shown separately from those arising from the adjustment of the angle, side, and length equations, that a few large corrections fall on directions at the west end of the scheme. The maximum is $1''.56$ on the direction Cuyamaca to San Jacinto. The probable error of a direction which is the best test of the method adopted was $\pm 0''.33$ before distributing the latitude, longitude, and azimuth discrepancies, and it was increased to only $\pm 0''.41$ after this distribution. The maximum correction to a direction, $1''.03$, was increased to $1''.56$ by this distribution.

[1]See Appendix 4, Report for 1911, p. 171. [2] See Appendix 4, Report for 1903, p. 884. [3] See Appendix 9, Report for 1904, p. 541.

ABSTRACTS OF HORIZONTAL DIRECTIONS AND ELEVATION OF TELESCOPE ABOVE THE STATION MARK.

All observed directions in the triangulation have been given equal or unit weight. Those directions were reduced to center where either the instrument or the object observed was not coincident with the center of the station mark.

The horizontal directions are reduced to sea level. The correction expressed in seconds is given by

$$\frac{e^2 h \sin 2\alpha \cos^2\phi}{2\rho \sin 1''}$$

where $e^2=\frac{(a^2-{}^2b)}{a^2}$, h = height of station sighted, ρ = the radius of curvature in a plane normal to the meridian, ϕ = the latitude, and α = the azimuth counted from the south westward.

In the following table are also given the elevations of the telescope of the theodolite above the station mark at each of the primary stations. These elevations enable the reader to judge of the amount of building done and they permit the engineer or surveyor who uses the stations to form an estimate of the probable amount of building required to make any particular line clear.

Kyle-McClenny to Stanton base.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Rattlesnake, 1.59 meters	11	McClenny	0 00 00.02	59.48	59.58
	7	Hearn	181 02 50.14	50.98	50.64
	8	Pierce	238 27 56.43	56.55	56.46
	9	Lacasa	260 47 36.51	35.80	35.79
	10	Kyle	307 57 25.50	25.79	26.14
McClenny, 15.56 meters	6	Kyle	0 00 59.98	00.02	00.45
	4	Rattlesnake	267 48 56.02	56.16	55.83
	5	Lacasa	311 32 42.86	42.68	42.57
Kyle, 8.76 meters	1	McClenny	0 00 59.99	59.47	59.82
	2	Rattlesnake	35 46 24.75	25.35	25.19
	3	Lacasa	77 54 37.68	37.60	37.42
Hearn, 18.79 meters	27	Springgap	0 00 00.00	00.37	00.11
	28	Lamb	38 31 53.45	53.76	53.69
	29	Flat	92 02 46.88	47.02	47.05
	30	Pierce	118 23 34.07	34.10	34.24
	31	Rattlesnake	160 32 03.73	02.89	03.02
Flat, 18.66 meters	21	Lacasa	0 00 00.04	01.00	01.30
	22	Pierce	35 08 53.30	53.14	53.26
	23	Hearn	136 52 04.07	04.14	04.14
	24	Lamb	179 03 07.61	07.20	07.11
	25	Springgap	189 03 50.86	50.83	50.65
	26	Hitson (U. S. G. S.)	219 59 20.59	20.16	20.03
Pierce, 15.67 meters	20	Flat	0 00 59.93	00.09	59.97
	17	Lacasa	110 38 14.19	14.23	14.38
	18	Rattlesnake	227 37 29.44	29.30	29.40
	19	Hearn	308 03 57.22	57.16	57.03

Kyle-McClenny to Stanton base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Lacasa, 18.70 meters	16	Flat	0 00 00. 00	59. 08	58. 85
	12	Kyle	194 23 57. 07	56. 77	57. 02
	13	McClenny	248 02 04. 48	05. 51	05. 74
	14	Rattlesnake	285 05 57. 93	58. 19	58. 09
	15	Pierce	325 47 04. 87	04. 81	04. 67
Clyde, 1.32 meters	51	Kennard	0 00 59. 98	00. 32	00. 26
	48	Hitson (U. S. G. S.)	85 54 43. 12	43. 02	43. 13
	49	Springgap	159 24 58. 09	57. 84	57. 90
	50	Clayton	253 56 11. 03	11. 03	10. 93
Hitson (U. S. G. S.), 5.32 meters	44	Lamb	0 00 59. 97	59. 52	59. 59
	45	Springgap	56 57 59. 46	59. 11	59. 08
	46	Clyde	124 56 51. 45	51. 83	51. 72
	47	Kennard	160 32 02. 08	01. 80	01. 65
	43	Flat	329 20 28. 26	28. 97	29. 18
Springgap, 5.70 meters	36	Clayton	0 00 00. 00	00. 09	59. 87
	37	Clyde	47 25 20. 79	21. 48	21. 39
	38	Kennard	53 51 26. 04	25. 41	25. 30
	39	Hitson (U. S. G. S.)	85 56 14. 60	14. 79	14. 83
	40	Flat	147 23 17. 65	17. 74	17. 95
	41	Lamb	156 07 17. 38	17. 01	17. 12
	42	Hearn	183 08 46. 94	46. 87	46. 97
Lamb, 15.75 meters	32	Hearn	0 00 59. 96	59. 45	59. 52
	33	Springgap	114 26 37. 12	37. 23	37. 13
	34	Hitson (U. S. G. S.)	167 17 36. 59	36. 82	36. 75
	35	Flat	275 41 54. 60	54. 76	54. 86
Morrison, 1.28 meters	63	Kennard	0 00 00. 00	00. 42	00. 58
	64	Clayton	58 55 20. 04	19. 90	20. 02
	65	Buzzard	121 22 08. 62	08. 68	08. 66
	66	Hale	162 49 40. 55	40. 78	40. 62
	67	Sears	196 29 31. 20	30. 63	30. 51
Buzzard, 1.33 meters	68	Hale	0 00 00. 33	00. 20	00. 04
	69	Sears	48 44 29. 60	30. 09	29. 99
	70	Morrison	100 07 06. 41	06. 27	06. 30
	71	Kennard	137 38 36. 25	36. 35	36. 52
	72	Clayton	181 22 26. 92	26. 59	26. 68
Clayton, 5.43 meters	58	Buzzard	0 00 59. 95	00. 19	00. 01
	59	Morrison	36 17 52. 24	52. 48	52. 38
	60	Kennard	97 29 52. 59	51. 89	51. 95
	61	Clyde	115 56 07. 61	08. 31	08. 40
	62	Springgap	153 59 35. 78	35. 30	35. 42
Kennard, 9.95 meters	52	Hitson (U. S. G. S.)	0 00 59. 99	59. 98	00. 15
	53	Springgap	44 21 08. 47	08. 95	09. 09
	54	Clyde	58 30 07. 80	07. 71	07. 75
	55	Clayton	114 00 02. 65	02. 69	02. 67
	56	Buzzard	152 46 22. 98	23. 06	22. 87
	57	Morrison	173 52 46. 56	46. 06	45. 92
Hale, 1.40 meters	79	Allen	0 00 00. 03	00. 26	00. 16
	80	Sears	78 55 18. 66	18. 89	18. 91
	81	Morrison	113 43 14. 54	14. 35	14. 49
	82	Buzzard	152 08 37. 06	37. 16	37. 25
	78	Boyd	327 19 06. 36	06. 00	05. 86

Kyle-McClenny to Stanton base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Sears, 1.34 meters	73	Morrison	0 00 59.97	00.54	00.68
	74	Buzzard	53 30 03.75	03.29	03.40
	75	Hale	111 32 16.41	16.03	16.01
	76	Boyd	132 02 36.51	36.55	36.40
	77	Allen	170 14 17.61	17.86	17.77
Allen, 1.37 meters	85	Boyd	0 00 59.96	59.88	59.85
	86	Lloyd	53 14 10.77	10.89	10.78
	87	Patterson	89 52 35.41	35.62	35.52
	83	Sears	301 17 35.20	34.86	35.00
	84	Hale	343 40 15.35	15.44	15.53
Boyd, 1.43 meters	90	Allen	0 00 00.06	59.92	59.93
	91	Sears	83 05 54.32	54.53	54.65
	92	Hale	130 59 21.24	21.48	21.58
	88	Lloyd	262 30 08.86	08.55	08.43
	89	Patterson	304 46 03.97	03.98	03.85
Wolf, 1.38 meters	103	Patterson	0 00 00.02	00.28	00.38
	104	Lloyd	44 50 17.72	17.92	18.01
	105	Bench	60 05 31.38	30.57	30.57
	106	Bynum	156 58 46.36	46.52	46.45
	107	Cuthbert	194 24 03.68	03.88	03.75
Bench, 1.41 meters	112	Lloyd	0 00 00.05	59.88	59.98
	108	Bynum	210 50 34.58	34.20	34.11
	109	Cuthbert	232 14 30.60	30.48	30.38
	110	Wolf	255 39 17.36	18.18	18.17
	111	Patterson	301 48 13.39	13.24	13.34
Lloyd, 1.45 meters	102	Boyd	0 00 00.05	00.27	00.35
	98	Bench	183 37 45.77	45.90	45.80
	99	Wolf	244 01 52.05	52.04	51.92
	100	Patterson	286 21 08.81	08.48	08.49
	101	Allen	330 44 01.54	01.53	01.67
Patterson, 15.82 meters	97	Wolf	0 00 00.06	59.77	59.65
	93	Allen	168 10 49.72	49.46	49.60
	94	Boyd	203 04 18.69	18.77	18.83
	95	Lloyd	267 09 32.69	32.87	32.87
	96	Bench	286 14 23.74	24.04	23.94
Signal, 1.41 meters	128	Williams	0 00 00.09	59.89	59.86
	129	Evart	49 50 26.82	26.81	26.69
	130	Top	102 23 40.76	40.64	40.63
	131	Cuthbert	132 39 40.91	41.10	41.16
	132	Bynum	157 30 01.46	01.61	01.70
Top, 8.54 meters	123	Cuthbert	0 00 00.02	59.95	59.99
	124	Bynum	39 27 38.01	37.72	37.79
	125	Signal	110 19 21.84	21.90	21.93
	126	Williams	131 48 22.73	23.09	23.07
	127	Evart	168 12 41.82	41.76	41.63
Cuthbert, 5.33 meters	113	Wolf	0 00 00.00	00.06	00.12
	114	Bench	22 16 40.69	40.30	40.39
	115	Bynum	78 08 37.93	38.38	38.41
	116	Signal	127 42 46.21	45.96	45.91
	117	Top	167 07 24.93	25.04	24.94

Kyle-McClenny to Stanton base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Bynum, 1.38 meters	121	Wolf	0 00 00.06	59.72	59.80
	122	Bench	38 18 01.07	01.67	01.74
	118	Signal	189 58 20.97	20.83	20.78
	119	Top	244 00 17.34	17.60	17.49
	120	Cuthbert	295 33 54.56	54.19	54.18
Epley, 15.33 meters	143	Evart	00 00 00.03	00.03	59.96
	144	Williams	28 45 41.34	41.69	41.74
	145	Stanton	76 44 24.94	24.74	24.80
	146	Stanton S. base	115 13 50.06	50.20	50.31
	147	Stanton N. base	154 26 46.20	45.82	45.74
Stanton, 15.55 meters	151	Evart	0 00 00.06	00.02	00.04
	152	Williams	32 21 23.51	23.28	23.39
	148	Stanton S. base	209 13 59.78	59.79	59.77
	149	Stanton N. base	246 40 11.76	12.34	12.25
	150	Epley	286 41 38.72	38.40	38.36
Evart, 18.78 meters	134	Signal	0 00 59.93	00.05	00.11
	135	Williams	28 33 25.24	25.00	25.04
	136	Stanton	87 39 16.70	17.02	17.04
	137	Epley	117 36 32.62	32.40	32.23
	133	Top	290 26 32.27	32.30	32.28
Williams, 8.61 meters	138	Stanton	0 00 59.96	59.93	59.96
	139	Epley	26 21 33.46	33.47	33.34
	140	Evart	88 32 46.15	46.24	46.20
	141	Top	134 01 36.28	36.06	36.11
	142	Signal	190 08 54.83	54.98	55.05
Stanton S. base, 18.79 meters	4	Elkins	0 00 00.06	00.36	00.17
	5	Dunn	44 21 28.04	27.49	27.45
	6	Stanton N. base	85 51 41.32	41.41	41.44
	153	Epley	127 10 13.97	14.46	14.52
	154	Stanton	191 13 11.26	10.92	11.04
Stanton N. base, 18.68 meters	155	Epley	0 00 00.07	00.16	00.09
	156	Stanton	62 16 13.48	13.67	13.69
	1	Stanton S. base	99 28 32.29	32.03	32.03
	2	Elkins	143 40 42.85	42.71	42.65
	3	Dunn	204 05 47.53	47.66	47.78

Stanton base to Deming base.

Elkins, 15.56 meters	16	Stanton S. base	0 00 00.05	59.93	59.90
	12	Scar	168 19 16.49	16.19	16.03
	13	Morris	207 18 39.13	39.49	39.52
	14	Dunn	254 46 44.14	44.41	44.45
	15	Stanton N. base	310 03 51.49	51.26	51.39
Dunn, 15.48 meters	7	Stanton N. base	0 00 00.04	00.21	00.35
	8	Stanton S. base	33 52 31.26	31.16	31.12
	9	Elkins	64 17 49.31	49.00	48.88
	10	Scar	114 14 18.84	19.41	19.32
	11	Morris	161 13 11.06	10.73	10.82

Stanton base to Deming base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Odessa, 10.07 meters	39	Bates	0 00 00.03	59.65	59.73
	40	Scar	50 35 16.08	15.96	15.89
	36	Douro	210 08 12.28	11.91	11.82
	37	Dublin	257 08 04.38	05.17	05.17
	38	Smith	305 32 36.88	36.96	37.03
Bates, 9.83 meters	27	Morris	0 00 00.00	59.97	00.04
	28	Scar	105 02 28.66	28.30	28.28
	29	Odessa	193 58 31.76	32.25	32.19
	30	Smith	273 49 12.61	12.49	12.51
Morris, 15.61 meters	17	Dunn	0 00 00.07	00.04	00.20
	18	Elkins	35 36 33.82	34.28	34.21
	19	Scar	75 16 13.42	13.29	13.23
	20	Bates	125 21 59.65	59.78	59.73
	21	Smith	188 25 28.91	28.46	28.51
Scar, 10.07 meters	22	Odessa	0 00 00.08	59.99	59.83
	23	Bates	40 28 39.56	40.18	40.20
	24	Morris	65 20 26.07	25.64	25.74
	25	Dunn	123 05 21.98	22.02	22.16
	26	Elkins	166 41 24.31	24.16	24.07
Curtis, 4.82 meters	60	Douro	0 00 00.07	59.95	59.90
	56	Estes	206 40 01.09	00.82	00.73
	57	Aroya	234 17 40.13	40.33	40.33
	58	Harris	259 52 00.05	00.05	00.10
	59	Dublin	313 50 38.80	38.99	39.06
Douro, 15.57 meters	47	Harris	0 00 00.07	00.09	00.12
	48	Dublin	55 16 04.14	04.25	04.30
	49	Smith	99 40 01.24	01.26	01.37
	50	Odessa	132 56 09.16	09.01	08.90
	46	Curtis	311 57 28.95	28.93	28.89
Dublin, 18.87 meters	41	Smith	0 00 00.07	00.57	00.69
	42	Odessa	36 04 29.46	29.41	29.29
	43	Douro	91 24 33.21	32.63	32.58
	44	Curtis	121 56 37.07	37.12	37.10
	45	Harris	168 20 43.57	43.66	43.71
Smith, 15.34 meters	31	Morris	0 00 00.06	00.37	00.49
	32	Bates	30 45 44.16	44.48	44.46
	33	Odessa	76 27 42.51	41.97	41.86
	34	Douro	127 47 09.34	10.16	10.12
	35	Dublin	171 58 43.14	42.23	42.29
Johnson, 15.34 meters	75	Sist	0 00 00.08	59.82	59.86
	76	Ingle	57 16 39.11	39.28	39.31
	71	Aroya	227 25 27.65	27.15	27.15
	72	Estes	257 14 33.05	33.41	33.36
	73	Lee	292 42 07.22	07.27	07.25
	74	Hays	332 51 40.51	40.68	40.69
Aroya, 15.89 meters	61	Harris	0 00 00.04	00.05	00.09
	62	Curtis	23 15 22.95	22.99	22.94
	63	Estes	82 20 02.95	02.69	02.67
	64	Lee	142 21 55.23	55.12	55.13
	65	Johnson	185 51 36.59	36.90	36.93

Stanton base to Deming base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Estes, 18.57 meters	68	Aroya	0 00 59.95	00.03	00.06
	69	Harris	55 40 40.97	40.89	40.95
	70	Curtis	93 17 42.36	42.43	42.34
	66	Lee	283 49 26.62	26.38	26.37
	67	Johnson	313 20 39.11	39.26	39.29
Harris, 10.05 meters	55	Aroya	0 00 00.08	00.00	00.03
	51	Dublin	149 12 26.14	26.00	26.05
	52	Douro	197 00 11.82	12.03	11.97
	53	Curtis	228 49 41.92	41.74	41.72
	54	Estes	318 00 42.24	42.43	42.42
Lee, 10.10 meters	77	Sist	0 00 00.05	59.78	59.80
	78	Hays	41 41 29.80	30.15	30.17
	79	Johnson	76 02 01.49	01.10	01.12
	80	Aroya	147 15 40.07	40.44	40.46
	81	Estes	191 03 15.49	15.42	15.37
Hays, 1.32 meters	83	Lee	0 00 59.96	59.78	59.76
	84	Sist	115 14 11.96	11.66	11.68
	85	Ingle	184 21 35.93	36.45	36.46
	82	Johnson	254 30 03.81	03.78	03.78
Round, 1.19 meters	97	Ingle	0 00 00.05	59.45	59.39
	98	Sist	45 11 39.15	39.62	39.55
	99	Toyah	104 09 46.42	46.40	46.44
	100	Newman	133 13 36.40	36.41	36.52
	101	Seay	169 47 21.11	21.24	21.21
Toyah, 1.24 meters	106	Sist	0 00 00.06	00.01	59.95
	102	Newman	190 58 25.11	25.25	25.36
	103	Seay	241 20 53.62	53.20	53.17
	104	Round	299 56 01.08	00.89	00.90
	105	Ingle	332 17 27.06	27.58	27.54
Ingle, 9.95 meters	86	Johnson	0 00 00.00	59.79	59.75
	87	Hays	25 26 35.01	34.60	34.55
	88	Sist	73 34 05.65	05.55	05.55
	89	Toyah	113 39 12.75	13.17	13.24
	90	Round	157 08 02.26	02.57	02.58
Sist, 9.88 meters	93	Ingle	0 00 59.96	59.68	59.70
	94	Johnson	49 09 16.09	16.19	16.18
	95	Hays	62 45 04.75	05.36	05.34
	96	Lee	85 49 23.81	23.79	23.73
	91	Toyah	247 47 37.54	37.15	37.22
	92	Round	308 45 34.68	34.68	34.69
Chispa, 1.40 meters	129	Diablo	0 00 59.88	59.42	59.35
	130	Krouse	55 14 38.28	38.67	38.59
	131	Reynolds	61 18 26.57	26.66	26.58
	132	Newman	93 47 40.98	40.84	40.89
	128	Eagle	314 10 17.12	17.23	17.42
Reynolds, 1.39 meters	120	Krouse	0 00 59.92	00.30	00.31
	121	Seay	125 22 51.90	52.18	52.12
	118	Newman	198 55 08.17	07.79	07.77
	119	Chispa	290 24 60.24	59.96	60.05

Stanton base to Deming base—Continued.

Station occupied and elevation of telescope above station mark.	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Seay, 1.26 meters	111	Krouse	0 00 00.10	59.89	59.92
	107	Round	168 25 11.05	11.08	10.98
	108	Toyah	224 12 32.09	32.32	32.26
	109	Newman	265 26 40.58	40.82	40.90
	110	Reynolds	345 49 32.92	32.63	32.69
Newman, 1.29 meters	117	Toyah	0 00 00.07	00.01	59.96
	112	Chispa	189 30 41.66	41.75	41.95
	113	Krouse	242 49 56.89	56.62	56.61
	114	Reynolds	245 31 39.43	40.10	40.08
	115	Seay	271 36 34.09	33.99	33.94
	116	Round	318 01 23.24	22.91	22.83
Diablo, 1.40 meters	133	Krouse	0 00 00.00	59.58	59.40
	134	Chispa	66 31 44.40	44.79	44.73
	135	Eagle	118 40 24.84	24.60	24.67
	136	Quitman	175 15 08.59	08.75	08.86
	137	Black	242 31 59.35	59.47	59.53
Eagle, 1.28 meters	140	Diablo	0 00 00.13	00.51	00.39
	141	Krouse	35 31 03.87	03.91	03.73
	142	Chispa	82 01 41.96	41.87	41.86
	138	Quitman	274 57 12.41	12.16	12.37
	139	Black	327 19 12.90	12.83	12.91
Krouse, 1.40 meters	122	Seay	0 00 00.07	00.32	00.21
	123	Reynolds	40 26 41.70	41.37	41.36
	124	Newman	56 40 05.61	05.54	05.51
	125	Chispa	144 47 53.92	53.78	53.84
	126	Eagle	177 12 59.56	59.32	59.47
	127	Diablo	203 01 33.97	34.51	34.46
Black, 1.35 meters	144	Eagle	0 00 59.97	59.92	59.87
	145	Quitman	40 05 23.37	23.80	23.87
	146	North Franklin	111 06 44.50	43.58	43.74
	147	Corduna	150 03 56.45	57.03	57.08
	143	Diablo	336 32 19.03	19.01	18.74
North Franklin, 1.33 meters.	170	Jarilla	0 00 00.11	00.23	00.21
	171	Corduna	48 23 33.31	33.22	33.09
	172	Black	72 40 39.11	38.99	38.68
	173	Quitman	98 09 46.22	46.66	46.49
	166	Hermanas	232 48 25.09	24.83	25.05
	167	Florida	249 49 27.14	27.19	27.35
	168	Cooks	268 22 25.68	25.44	25.61
	169	Kent	327 49 32.16	32.27	32.31
Kent, 1.41 meters	161	Jarilla	0 00 59.93	59.85	59.78
	162	Corduna	11 19 39.10	38.76	38.60
	163	North Franklin	72 00 28.72	28.67	28.64
	164	Florida	139 35 32.49	32.86	33.01
	165	Cooks	163 03 46.04	46.15	46.26
Corduna, 1.39 meters	153	Black	0 00 59.87	59.82	59.60
	154	Quitman	33 46 33.13	32.41	32.40
	155	North Franklin	116 45 52.97	53.56	53.63
	156	Kent	155 31 18.73	18.41	18.52
	157	Jarilla	161 27 32.29	32.79	32.84

Stanton base to Deming base—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Quitman, 1.33 meters	152	Eagle	0 00 59.83	00.07	00.05
	148	North Franklin	188 57 26.91	26.94	27.14
	149	Corduna	236 12 15.23	15.24	15.40
	150	Black	272 27 17.89	17.81	17.78
	151	Diablo	321 37 28.65	28.46	28.14
Deming N. base, 10.23 meters.	35	Red	0 00 59.91	00.07	00.10
	36	Cooks	72 06 14.96	14.58	14.64
	37	Florida	185 18 57.55	57.24	57.14
	34	Deming S. base	278 26 48.37	48.89	48.90
Deming S. base, 10.10 meters.	22	Red	0 00 59.93	00.03	59.92
	23	Cooks	26 05 14.10	14.46	14.45
	24	Deming N. base	45 11 39.20	38.63	38.63
	25	Florida	85 03 07.07	07.31	07.40
	26	Hermanas	216 31 59.79	59.67	59.71
Florida, 1.36 meters	27	Deming S. base	0 00 00.07	00.05	00.21
	28	Red	44 20 21.02	21.06	21.09
	29	Deming N. base	47 00 40.01	40.26	40.23
	30	Cooks	98 30 07.69	08.21	08.37
	31	Kent	178 13 59.89	59.61	59.50
	32	North Franklin	212 39 08.87	08.64	08.46
	33	Hermanas	331 37 22.35	22.07	22.02
Jarilla, 1.24 meters	160	Kent	0 00 59.90	00.21	00.27
	158	Corduna	197 15 51.63	51.56	51.48
	159	North Franklin	284 10 51.27	51.02	51.06
Cooks, 1.36 meters	10	Florida	0 00 59.93	59.55	59.59
	11	Deming N. base	15 17 49.95	50.22	50.23
	12	Deming S. base	22 32 01.12	01.07	01.02
	13	Hermanas	26 10 10.94	10.73	10.72
	14	Red	35 12 22.82	22.94	22.83
	15	Chiricahua	75 45 01.47	00.96	01.36
	16	Burro	107 27 05.27	05.75	06.05
	8	Kent	283 11 50.58	50.46	50.19
	9	North Franklin	312 41 45.74	46.15	45.86
Hermanas, 1.27 meters	5	Deming S. base	0 00 00.07	00.57	00.55
	6	Florida	20 08 31.38	31.42	31.23
	7	North Franklin	64 09 26.65	26.90	26.63
	1	Chiricahua	252 59 45.10	45.12	45.33
	2	Burro	311 38 26.07	25.85	26.10
	3	Red	345 40 00.04	59.91	59.97
	4	Cooks	353 11 24.75	24.28	24.25
Red, 1.37 meters	19	Florida	0 00 59.88	59.71	59.68
	20	Deming S. base	50 36 32.48	32.45	32.35
	21	Hermanas	72 48 32.01	32.28	07.51
	17	Cooks	269 22 07.49	07.57	32.41
	18	Deming N. base	357 21 21.82	21.69	21.72

Deming base net to San Jacinto-Cuyamaca.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″		
Burro, 1.25 meters	42	Line (U. S. G. S.)	0 00 59.86	59.85	59.97
	38	Cooks	156 13 49.41	49.30	49.04
	39	Hermanas	213 24 09.89	09.77	09.47
	40	Chiricahua	286 37 15.84	16.01	16.14
	41	Graham (U. S. G. S.)	336 44 50.82	50.89	51.18
Graham (U. S. G. S.), 2.99 meters	53	Line (U. S. G. S.)	0 00 00.06	00.23	00.07
	54	Burro	16 32 43.85	44.18	43.90
	55	Chiricahua	70 30 31.22	31.14	30.95
	56	Baldy (U. S. G. S.)	141 32 27.53	27.30	27.66
	57	Catalina	173 32 25.91	25.72	26.00
Baldy (U. S. G. S.), 1.49 meters	60	Catalina	0 00 00.03	00.83	00.83
	61	Graham (U. S. G. S.)	35 26 10.99	11.04	10.76
	62	Chiricahua	78 10 48.86	48.78	48.21
	58	Table	310 43 07.21	06.88	07.26
	59	Superstition (U. S. G. S.)	341 01 23.30	22.86	23.32
Catalina, 1.42 meters	67	Superstition (U. S. G. S.)	0 00 59.90	00.63	01.19
	63	Graham (U. S. G. S.)	99 13 02.28	02.69	02.36
	64	Chiricahua	141 28 57.19	56.72	56.14
	65	Baldy (U. S. G. S.)	211 47 12.26	11.75	11.78
	66	Table	313 36 16.99	16.85	17.16
Chiricahua, 1.44 meters	47	Burro	0 00 00.19	00.37	00.30
	48	Cooks	17 54 43.74	43.35	42.97
	49	Hermanas	48 08 40.42	40.52	39.97
	43	Baldy (U. S. G. S.)	217 50 48.94	48.93	49.36
	44	Catalina	249 22 16.47	16.81	17.20
	45	Graham (U. S. G. S.)	284 04 52.28	52.32	52.49
	46	Line (U. S. G. S.)	328 53 16.04	15.79	15.82
Line (U. S. G. S.), 1.38 meters	50	Burro	0 00 59.84	59.77	59.64
	51	Chiricahua	75 30 47.59	47.95	47.93
	52	Graham (U. S. G. S.)	140 12 15.36	15.07	15.22
Table, 1.32 meters	75	Superstition (U. S. G. S.)	0 00 00.12	00.14	00.22
	76	Catalina	62 20 23.88	24.02	23.42
	77	Baldy (U. S. G. S.)	91 14 51.70	51.84	51.34
	73	Maricopa	227 09 01.88	01.62	02.14
	74	Whitetank	293 21 36.46	36.41	36.92
Superstition (U. S. G. S.) 1.41 meters.	72	Whitetank	0 00 59.97	00.25	00.83
	68	Catalina	232 18 23.13	22.72	22.27
	69	Baldy (U. S. G. S.)	245 07 09.27	09.39	08.87
	70	Table	303 34 44.38	44.20	44.18
	71	Maricopa	312 10 21.82	22.00	22.43
Maricopa, 1.33 meters	86	Superstition, (U. S. G. S.)	0 00 00.12	00.04	59.50
	87	Table	38 33 27.93	28.14	27.58
	83	Mohawk	210 36 37.29	37.13	37.63
	84	Harquahalla	271 41 03.43	03.58	04.12
	85	Whitetank	298 30 13.72	13.58	13.66
Whitetank, 1.36 meters	82	Harquahalla	0 00 59.91	59.82	00.34
	78	Superstition (U. S. G. S.)	168 14 57.48	57.33	56.84
	79	Table	225 11 40.42	40.51	39.85
	80	Maricopa	238 55 56.63	56.63	56.63
	81	Mohawk	292 53 44.25	44.40	45.04

Deming base net to San Jacinto-Cuyamaca—Continued.

Station occupied and elevation of telescope above station mark	Number of direction	Object observed	Observed direction reduced to sea level	Seconds after figure adjustment	Final seconds after closure of loop
			° ′ ″	″	″
Harquahalla, 1.27 meters	88	Whitetank	0 00 59.94	00.05	59.50
	89	Maricopa	32 07 02.49	02.46	01.84
	90	Mohawk	81 38 15.04	14.76	14.90
	91	Kofa	123 45 45.07	45.42	45.87
	92	Powell	206 35 49.29	49.16	49.70
Powell, 1.33 meters	....	Chemehuevis	0 00 00.00		
	108	Harquahalla	225 32 44.73	44.77	44.24
	109	Kofa	265 01 09.27	09.48	09.43
	110	Butte	313 52 10.51	10.27	10.83
American (U. S. G. S.), 1.44 meters	...	Yuma No. 10	0 00 00.00		
	103	Cuyamaca	127 40 32.52	32.84	33.52
	104	San Jacinto	155 03 19.30	19.39	20.19
	105	Butte	178 48 21.19	21.05	21.09
	106	Kofa	262 03 60.57	60.44	59.92
	107	Mohawk	319 37 38.68	38.55	37.52
Butte, 1.36 meters	113	American (U. S. G. S.)	0 00 00.00	00.06	59.96
	114	Cuyamaca	95 40 29.62	29.12	29.86
	115	San Jacinto	138 35 29.64	29.62	30.19
	111	Powell	259 22 13.44	13.58	13.03
	112	Kofa	315 54 08.90	09.21	08.54
Kofa, 1.44 meters	101	Harquahalla	0 00 00.13	59.97	59.42
	102	Mohawk	100 54 38.65	38.70	38.20
	98	American (U. S. G. S.)	175 01 31.89	32.05	32.57
	99	Butte	227 40 22.01	22.01	22.52
	100	Powell	302 18 04.39	04.32	04.34
Mohawk, 1.40 meters	93	American (U. S. G. S.)	0 00 59.97	59.83	00.73
	94	Kofa	48 19 47.50	47.72	48.11
	95	Harquahalla	85 17 58.43	58.34	58.37
	96	Whitetank	116 33 55.31	55.36	54.81
	97	Maricopa	154 42 59.26	59.22	58.45
Cuyamaca, 1.50 meters	119	San Jacinto	0 00 00.00	00.00	01.56
	120	Butte	63 33 10.55	11.05	10.40
	121	American (U. S. G. S.)	96 45 27.21	26.65	25.80
San Jacinto, 2.95 meters	118	Cuyamaca	0 00 00.00	00.00	01.52
	116	Butte	286 27 41.45	41.71	40.84
	117	American (U. S. G. S.)	304 07 31.02	30.88	30.11

CONDITION EQUATIONS.

KYLE-McCLENNY TO STANTON BASE.

No.

1. $0.0=-1.98-(1)+(3)-(5)+(6)-(12)+(13)$
2. $0.0=-0.87-(2)+(3)-(9)+(10)-(12)+(14)$
3. $0.0=-0.19-(1)+(2)-(4)+(6)-(10)+(11)$
4. $0.0=+1.34-(8)+(9)-(14)+(15)-(17)+(18)$
5. $0.0=+1.51-(7)+(8)-(18)+(19)-(30)+(31)$
6. $0.0=+2.10-(15)+(16)+(17)-(20)-(21)+(22)$
7. $0.0=-0.34-(19)+(20)-(22)+(23)-(29)+(30)$
8. $0.0=+1.34-(23)+(24)-(28)+(29)+(32)-(35)$
9. $0.0=+0.49-(23)+(25)-(27)+(29)-(40)+(42)$
10. $0.0=-0.87-(27)+(28)-(32)+(33)-(41)+(42)$
11. $0.0=+1.57-(25)+(26)-(39)+(40)-(43)+(45)$
12. $0.0=+1.25-(24)+(26)-(34)+(35)-(43)+(44)$
13. $0.0=-0.08-(37)+(39)-(45)+(46)-(48)+(49)$
14. $0.0=-1.38-(38)+(39)-(45)+(47)-(52)+(53)$
15. $0.0=+1.18-(46)+(47)+(48)-(51)-(52)+(54)$
16. $0.0=+0.93-(36)+(38)-(53)+(55)-(60)+(62)$
17. $0.0=+0.33-(36)+(37)-(49)+(50)-(61)+(62)$
18. $0.0=+2.04-(55)+(57)-(59)+(60)-(63)+(64)$
19. $0.0=+1.34-(55)+(56)-(58)+(60)-(71)+(72)$
20. $0.0=-0.01-(58)+(59)-(64)+(65)-(70)+(72)$
21. $0.0=+2.29-(65)+(67)-(69)+(70)-(73)+(74)$
22. $0.0=-0.45-(65)+(66)-(68)+(70)-(81)+(82)$
23. $0.0=+2.17-(66)+(67)-(73)+(75)-(80)+(81)$
24. $0.0=-1.06-(75)+(77)-(79)+(80)-(83)+(84)$
25. $0.0=-0.82-(76)+(77)-(83)+(85)-(90)+(91)$
26. $0.0=-0.81-(78)+(79)-(84)+(85)-(90)+(92)$
27. $0.0=-0.47-(85)+(87)-(89)+(90)-(93)+(94)$
28. $0.0=-0.97-(88)+(89)-(94)+(95)-(100)+(102)$
29. $0.0=-0.85-(86)+(87)-(93)+(95)-(100)+(101)$
30. $0.0=+0.85-(95)+(97)-(99)+(100)-(103)+(104)$
31. $0.0=+2.63-(96)+(97)-(103)+(105)-(110)+(111)$
32. $0.0=+2.14-(98)+(99)-(104)+(105)-(110)+(112)$
33. $0.0=-1.50-(105)+(107)-(109)+(110)-(113)+(114)$
34. $0.0=-2.07-(108)+(109)-(114)+(115)-(120)+(122)$
35. $0.0=-3.11-(105)+(106)-(108)+(110)-(121)+(122)$
36. $0.0=+1.19-(115)+(117)-(119)+(120)-(123)+(124)$
37. $0.0=-1.02-(118)+(119)-(124)+(125)-(130)+(132)$
38. $0.0=-0.80-(116)+(117)-(123)+(125)-(130)+(131)$
39. $0.0=+0.14-(125)+(127)-(129)+(130)-(133)+(134)$
40. $0.0=+0.11-(128)+(129)-(134)+(135)-(140)+(142)$
41. $0.0=+1.00-(126)+(127)-(133)+(135)-(140)+(141)$
42. $0.0=-0.45-(135)+(137)-(139)+(140)-(143)+(144)$
43. $0.0=+0.42-(138)+(139)-(144)+(145)-(150)+(152)$
44. $0.0=+0.46-(136)+(137)-(143)+(145)-(150)+(151)$
45. $0.0=+0.98-(145)+(147)-(149)+(150)-(155)+(156)$
46. $0.0=+0.73-(145)+(146)-(148)+(150)-(153)+(154)$
47. $0.0=+0.31+(1)-(6)-(148)+(149)+(154)-(156)$
48. $0.0=+6.3+2.92(1)-5.25(2)+2.33(3)+2.28(4)-2.20(5)-0.08(6)-0.03(12)-2.79(13)+2.82(14)$
49. $0.0=+3.5+1.35(7)-6.48(8)+5.13(9)+2.45(14)-5.55(15)+3.10(16)+2.99(21)-2.55(22)-0.44(23)$ $+4.25(29)-6.58(30)+2.33(31)$
50. $0.0=-13.1+2.32(23)-14.25(24)+11.93(25)+2.64(27)-4.20(28)+1.56(29)+13.71(40)-17.84(41)$ $+4.13(42)$

No.

51. $0.0=-6.9+2.32(23)-4.75(24)+2.43(26)+2.64(27)-4.20(28)+1.56(29)+0.76(39)-4.89(41)+4.13(42)$
$+3.55(43)-4.92(44)+1.37(45)$

52. $0.0=+32.9+1.93(36)-20.60(37)+18.67(38)+8.36(53)-9.81(54)+1.45(55)+6.31(60)-9.00(61)$
$+2.69(62)$

53. $0.0=+16.8+1.93(36)-4.58(37)+2.65(39)+0.85(45)-3.79(46)+2.94(47)-2.74(54)+1.29(52)$
$+1.45(55)+6.31(60)-9.00(61)+2.69(62)$

54. $0.0=+4.3+1.22(55)-5.45(56)+4.23(57)+2.87(58)-4.03(59)+1.16(60)+2.42(70)-2.74(71)+0.32(72)$

55. $0.0=+3.2+0.56(65)-3.16(66)+2.60(67)+1.85(68)-3.53(69)+1.68(70)+2.40(80)-3.03(81)+0.63(82)$

56. $0.0=+3.0+4.35(75)-5.63(76)+1.28(77)+2.31(83)-9.50(84)+7.19(85)-1.83(90)-1.90(91)+3.73(92)$

57. $0.0=+0.7+1.57(85)-1.57(86)+3.02(93)-4.04(94)+1.02(95)+0.62(100)-3.76(101)+3.14(102)$

58. $0.0=+8.9+6.19(95)-6.09(96)-0.10(97)+2.12(103)-9.84(104)+7.72(105)-0.54(110)-1.31(111)$
$+1.85(112)$

59. $0.0=-9.5-0.25(105)-2.50(106)+2.75(107)+5.37(108)-10.23(109)+4.86(110)+5.14(113)-6.57(114)$
$+1.43(115)+1.01(120)-3.68(121)+2.67(122)$

60. $0.0=+2.0-0.59(118)-1.67(119)+2.26(120)+3.34(123)-2.56(124)-0.78(125)+3.61(130)-8.16(131)$
$+4.55(132)$

61. $0.0=+2.7+4.03(125)-5.35(126)+1.32(127)+0.78(133)-4.65(134)+3.87(135)-0.43(140)-1.41(141)$
$+1.84(142)$

62. $0.0=-6.0-1.26(135)+4.91(136)-3.65(137)-4.25(138)+5.36(139)-1.11(140)-3.84(143)+5.74(144)$
$-1.90(145)-0.63(150)+3.95(151)-3.32(152)$

63. $0.0=+5.8+3.12(1)+2.65(145)-5.23(146)+2.58(147)+2.28(148)-2.75(149)+0.47(150)-0.35(155)$
$-2.77(156)$

$\text{Length}=S_1 0.0=-1.6-0.45(1)+0.45(3)-2.20(4)+2.20(5)-1.35(7)+1.35(8)-0.34(9)+0.34(11)+1.55(12)$
$-1.55(13)-2.45(14)+2.45(15)-1.07(17)+1.07(18)-1.65(19)+1.65(20)-0.44(22)+0.44(23)$
$-2.43(24)+2.43(26)-1.56(28)+1.56(29)+2.33(30)-2.33(31)-0.21(32)-1.60(33)+1.60(34)$
$+0.21(35)-1.54(36)+1.54(38)+0.76(39)-0.76(41)+3.55(43)-3.55(44)+0.51(45)-0.51(47)$
$+2.15(52)-2.15(53)-1.22(55)+1.22(57)-2.87(58)+2.87(59)+1.39(60)-1.39(62)+1.27(63)$
$-1.27(64)-0.56(65)+0.56(67)-1.85(68)+1.85(69)+0.32(70)-0.32(72)+1.56(73)-1.56(74)$
$-2.68(76)+2.68(77)+0.83(78)-0.20(80)-0.63(82)+1.28(83)-1.28(85)-2.32(88)+2.32(89)$
$+1.90(91)-1.90(92)+3.02(93)-3.02(94)-0.61(96)+0.61(97)+0.48(98)+0.14(100)-0.62(102)$
$+1.21(103)-1.21(105)-2.75(106)+2.75(107)-2.12(108)+2.12(110)+1.31(111)-1.31(112)$
$+0.44(113)-0.48(115)+0.04(117)-1.53(118)+1.53(119)+2.67(121)-2.67(122)+2.56(123)$
$-2.56(124)-1.32(125)+1.32(127)-1.78(128)+1.78(129)+1.47(130)-1.47(132)+0.78(133)$
$-0.78(134)-0.03(135)+0.03(137)-4.25(138)+4.25(139)-0.43(140)+0.43(142)+3.84(143)$
$-3.84(144)-2.58(146)+2.58(147)-0.47(148)-0.12(150)+0.59(152)+1.02(153)-1.02(154)$
$-0.35(155)+0.35(1)$

STANTON BASE TO DEMING BASE.

No.

1. $0.0=-0.77-(1)+(3)-(5)+(6)-(7)+(8)$
2. $0.0=+1.45-(4)+(5)-(8)+(9)-(14)+(16)$
3. $0.0=+0.70-(2)+(3)-(7)+(9)-(14)+(15)$
4. $0.0=-0.37-(9)+(11)-(13)+(14)-(17)+(18)$
5. $0.0=-0.35-(12)+(13)-(18)+(19)-(24)+(26)$
6. $0.0=+0.54-(10)+(11)-(17)+(19)-(24)+(25)$
7. $0.0=+1.12-(19)+(20)-(23)+(24)-(27)+(28)$
8. $0.0=+0.47-(20)+(21)+(27)-(30)-(31)+(32)$
9. $0.0=-1.81-(22)+(23)-(28)+(29)-(39)+(40)$
10. $0.0=+1.93-(29)+(30)-(32)+(33)-(38)+(39)$
11. $0.0=+1.63-(33)+(35)-(37)+(38)-(41)+(42)$
12. $0.0=-0.37-(36)+(37)-(42)+(43)-(48)+(50)$
13. $0.0=+2.91-(34)+(35)-(41)+(43)-(48)+(49)$
14. $0.0=-1.11-(43)+(45)-(47)+(48)-(51)+(52)$
15. $0.0=+0.46-(46)+(47)-(52)+(53)-(58)+(60)$
16. $0.0=-0.20-(44)+(45)-(51)+(53)-(58)+(59)$

No.
17. 0.0=+0.07−(53)+(55)−(57)+(58)−(61)+(62)
18. 0.0=−0.79−(53)+(54)−(56)+(58)−(69)+(70)
19. 0.0=−0.16−(56)+(57)−(62)+(63)−(68)+(70)
20. 0.0=−1.36−(63)+(65)−(67)+(68)−(71)+(72)
21. 0.0=−0.40−(66)+(67)−(72)+(73)−(79)+(81)
22. 0.0=−1.73−(64)+(65)−(71)+(73)−(79)+(80)
23. 0.0=+0.76−(73)+(74)−(78)+(79)−(82)+(83)
24. 0.0=+0.54−(73)+(75)−(77)+(79)−(94)+(96)
25. 0.0=+0.13−(77)+(78)−(83)+(84)−(95)+(96)
26. 0.0=−0.92−(75)+(76)−(86)+(88)−(93)+(94)
27. 0.0=+0.75−(74)+(76)+(82)−(85)−(86)+(87)
28. 0.0=−0.06−(88)+(89)−(91)+(93)−(105)+(106)
29. 0.0=−1.17−(89)+(90)−(97)+(99)−(104)+(105)
30. 0.0=−0.03−(91)+(92)−(98)+(99)−(104)+(106)
31. 0.0=+0.03−(99)+(100)−(102)+(104)−(116)+(117)
32. 0.0=−0.10−(100)+(101)−(107)+(109)−(115)+(116)
33. 0.0=−0.58−(99)+(101)−(103)+(104)−(107)+(108)
34. 0.0=+1.96−(109)+(110)−(114)+(115)+(118)−(121)
35. 0.0=+0.60−(109;+(111)−(113)+(115)−(122)+(124)
36. 0.0=+0.60−(110)+(111)−(120)+(121)−(122)+(123)
37. 0.0=+0.95−(112)+(113)−(124)+(125)−(130)+(132)
38. 0.0=−0.46−(112)+(114)−(118)+(119)−(131)+(132)
39. 0.0=−2.34−(125)+(127)−(129)+(130)−(133)+(134)
40. 0.0=+1.68−(128)+(129)−(134)+(135)−(140)+(142)
41. 0.0=−0.05−(125)+(126)−(128)+(130)−(141)+(142)
42. 0.0=−0.78−(135)+(137)−(139)+(140)−(143)+(144)
43. 0.0=−0.98−(138)+(139)−(144)+(145)−(150)+(152)
44. 0.0=−0.30−(136)+(137)−(143)+(145)−(150)+(151)
45. 0.0=+0.61−(145)+(147)−(149)+(150)−(153)+(154)
46. 0.0=−1.82−(148)+(149)−(154)+(155)−(171)+(173)
47. 0.0=+0.90−(145)+(146)−(148)+(150)−(172)+(173)
48. 0.0=+0.48−(155)+(157)−(158)+(159)−(170)+(171)
49. 0.0=−0.60−(159)+(160)−(161)+(163)−(169)+(170)
50. 0.0=+0.82−(155)+(156)−(162)+(163)−(169)+(171)
51. 0.0=+1.32−(8)+(10)−(30)+(31)−(164)+(165)
52. 0.0=−1.03−(8)+(9)−(163)+(165)−(168)+(169)
53. 0.0=+1.83−(9)+(10)−(30)+(32)−(167)+(168)
54. 0.0=−0.47−(6)+(7)−(32)+(33)−(166)+(167)
55. 0.0=+0.4+2.72(1)−2.17(2)−0.55(3)+3.14(7)−6.73(8)+3.59(9)−0.57(14)−1.77(15)+2.34(16)
56. 0.0=+4.8+2.03(9)−1.77(10)−0.26(11)+2.94(17)−5.48(18)+2.54(19)−0.42(24)−2.21(25)+2.63(26)
57. 0.0=+8.2+1.76(19)−2.83(20)+1.07(21)+2.47(22)−7.01(23)+4.54(24)+3.54(31)−5.59(32)+2.05(33)
+1.50(38)−3.23(39)+1.73(40)
58. 0.0=+1.8+1.88(33)−1.68(34)−0.20(35)+2.89(41)−4.35(42)+1.46(43)+0.46(48)−3.21(49)+2.75(50)
59. 0.0=+3.6+3.57(43)−5.57(44)+2.00(45)+2.39(46)−1.89(47)−0.50(48)+0.39(51)−3.39(52)+3.00(53)
60. 0.0=+0.9+1.58(56)−4.40(57)+2.82(58)+4.62(61)−4.90(62)+0.28(63)+1.44(68)−4.17(69)+2.73(70)
61. 0.0=+2.0+1.21(63)−3.43(64)+2.22(65)+3.20(66)−3.72(67)+0.52(68)+0.97(71)−2.96(72)+1.99(73)
62. 0.0=+13.4+2.49(73)−6.60(74)+4.11(75)+2.36(77)−5.44(78)+3.08(79)+8.71(94)−13.65(95)
+4.94(96)
63. 0.0=−6.7+3.90(74)−4.11(75)+0.21(76)+4.43(86)−6.32(87)+1.89(88)+1.08(93)−8.71(94)+7.63(95)
64. 0.0=+7.5−0.86(91)−1.69(92)+2.55(93)+2.62(97)−2.09(98)−0.53(99)+3.32(104)−7.33(105)
+4.01(106)
65. 0.0=−0.4+2.84(99)−3.79(100)+0.95(101)+1.43(107)−3.83(108)+2.40(109)+0.06(115)−2.34(116)
+2.28(117)

No.

66. 0.0=+41.2+0.36(109)−8.70(110)+8.34(111)+44.73(113)+49.03(114)+4.30(115)+2.47(122)
−9.71(123)+7.24(124)

67. 0.0=−3.3+0.36(109)−8.70(110)+8.34(111)+1.42(112)−5.72(114)+4.30(115)+2.47(122)−1.93(123)
−0.54(125)+19.82(130)−23.13(131)+3.31(132)

68. 0.0=−3.9+3.32(125)−7.67(126)+4.35(127)+2.46(128)−2.05(129)−0.41(130)−1.15(133)−1.64(134)
+2.79(135)

69. 0.0=−3.3+0.18(138)−3.28(139)+3.10(140)+3.80(143)−4.85(144)+1.05(145)+1.82(150)−4.48(151)
+2.66(152)

70. 0.0=−3.8+0.24(148)−2.87(149)+2.63(150)+4.21(153)−3.15(154)−1.06(155)+4.67(171)−9.09(172)
+4.42(173)

71. 0.0=−19.1+2.13(155)−20.25(156)+18.12(157)+9.83(161)−10.51(162)+0.68(163)+3.35(169)
−5.22(170)+1.87(171)

72. 0.0=+1.2+0.49(8)−1.94(9)+1.45(10)+0.87(163)−5.72(164)+4.85(165)+5.83(167)−6.28(168)
+0.45(169)

73. 0.0=+3.3+4.14(4)−6.32(6)+2.18(7)+1.94(9)−6.22(10)+4.28(13)+6.88(166)−13.16(167)
+6.28(168)

Length=S_2 0.0=−6.3−1.20(2)+1.20(3)−0.15(4)+0.15(6)+1.01(7)−1.01(9)−1.96(10)+1.96(11)
−0.13(12)+0.13(14)+1.77(15)−1.77(16)+0.55(17)−2.31(19)+1.76(20)−2.47(22)+2.47(23)
+2.21(25)−2.21(26)−0.57(27)+0.57(28)−0.38(29)+0.38(30)+2.05(32)−1.85(33)−0.20(35)
−1.96(36)+1.96(37)+1.73(39)−1.73(40)+2.89(41)−2.89(42)−0.49(43)+0.49(45)−1.89(46)
+1.89(47)+0.46(48)−0.46(50)+1.91(51)−1.91(52)−2.34(54)+2.34(55)−1.58(56)+1.20(58)
+0.38(60)+0.28(61)−0.28(63)−2.22(64)+2.22(65)−0.52(66)+0.52(68)+2.73(69)−2.73(70)
+0.97(71)−0.97(73)−1.35(75)+1.35(76)−0.52(77)+0.52(79)+2.20(80)−2.20(81)+0.62(86)
−0.86(88)+0.24(90)−1.17(91)+1.17(92)+2.83(94)−2.83(96)+2.09(97)−2.09(98)−0.95(99)
+0.95(101)−1.74(102)+1.74(103)+1.21(104)−1.21(106)+1.43(107)−1.43(108)+0.17(109)
−0.17(111)−1.57(112)+1.57(113)+0.06(115)−0.06(117)+1.38(122)−1.38(124)−1.30(125)
+1.30(127)−2.05(128)+2.05(129)+2.64(130)−2.64(132)+0.91(133)−0.91(134)−0.88(136)
+0.88(137)−0.18(138)+0.47(140)−0.29(142)+1.05(143)−0.28(145)−0.77(147)−1.95(148)
+1.95(149)+2.66(151)−2.66(152)+3.15(153)−3.15(154)−2.13(155)+2.13(157)+0.11(158)
−0.64(159)+0.53(160)+0.68(161)−0.68(163)−4.85(164)+4.85(165)−0.45(167)+0.45(169)
+1.78(171)−1.78(173)+0.49(8)−5.56(10)+5.07(12)+1.27(23)−1.27(25)−1.96(27)+1.96(29)
+3.07(31)−3.07(32)+0.12(34)−0.12(37)

DEMING BASE NET TO SAN JACINTO-CUYAMACA.

No.

1. 0.0=+0.04−(1)+(2)−(39)+(40)−(47)+(49)
2. 0.0=−0.43−(2)+(4)−(13)+(16)−(38)+(39)
3. 0.0=−1.15−(3)+(5)−(20)+(21)+(22)−(26)
4. 0.0=−0.93−(3)+(6)−(19)+(21)+(28)−(33)
5. 0.0=−0.18−(3)+(4)−(13)+(14)−(17)+(21)
6. 0.0=−0.32−(12)+(14)−(17)+(20)−(22)+(23)
7. 0.0=+0.90−(11)+(14)−(17)+(18)−(35)+(36)
8. 0.0=−0.73−(10)+(14)−(17)+(19)−(28)+(30)
9. 0.0=−0.99−(10)+(11)−(29)+(30)−(36)+(37)
10. 0.0=−0.75−(10)+(12)−(23)+(25)−(27)+(30)
11. 0.0=+2.15−(11)+(12)−(23)+(24)−(34)+(36)
12. 0.0=−0.69−(15)+(16)−(38)+(40)−(47)+(48)
13. 0.0=−0.68−(40)+(42)−(46)+(47)−(50)+(51)
14. 0.0=+0.37−(40)+(41)−(45)+(47)−(54)+(55)
15. 0.0=+0.15−(41)+(42)−(50)+(52)−(53)+(54)
16. 0.0=+0.23−(43)+(45)−(55)+(56)−(61)+(62)
17. 0.0=+0.57−(43)+(44)−(60)+(62)−(64)+(65)
18. 0.0=+1.29−(44)+(45)−(55)+(57)−(63)+(64)
19. 0.0=−3.01−(59)+(60)−(65)+(67)−(68)+(69)

No.

20. $0.0=+0.29-(58)+(59)-(69)+(70)-(75)+(77)$

21. $0.0=-1.22-(66)+(67)-(68)+(70)-(75)+(76)$

22. $0.0=-0.77-(70)+(72)-(74)+(75)-(78)+(79)$

23. $0.0=-0.32-(71)+(72)-(78)+(80)-(85)+(86)$

24. $0.0=-0.93-(70)+(71)-(73)+(75)-(86)+(87)$

25. $0.0=+0.52-(80)+(82)-(84)+(85)-(88)+(89)$

26. $0.0=-0.11-(83)+(84)-(89)+(90)-(95)+(97)$

27. $0.0=-0.08-(80)+(81)-(83)+(85)-(96)+(97)$

28. $0.0=-0.53-(90)+(91)-(94)+(95)-(101)+(102)$

29. $0.0=+0.40-(91)+(92)-(100)+(101)-(108)+(109)$

30. $0.0=-0.47-(93)+(94)+(98)-(102)-(106)+(107)$

31. $0.0=+0.35-(99)+(100)-(109)+(110)-(111)+(112$

32. $0.0=+0.40-(98)+(99)-(105)+(106)-(112)+(113)$

33. $0.0=+0.70-(104)+(105)-(113)+(115)-(116)+(117)$

34. $0.0=+0.65-(103)+(104)-(117)+(118)-(119)+(121)$

35. $0.0=-0.73-(114)+(115)-(116)+(118)-(119)+(120)$

36. $0.0=-6.4+1.28(1)-3.66(2)+2.38(4)+0.32(13)-3.41(15)+3.09(16)+4.63(47)-6.52(48)+1.89(49)$

37. $0.0=+35.3-15.94(3)+33.58(4)-17.64(5)-33.13(12)+46.36(13)-13.23(14)+2.62(17)+2.54(20)$
$-5.16(21)+1.46(22)-4.30(23)+2.84(26)$

38. $0.0=+28.0+17.64(4)-23.38(5)+5.74(6)+5.07(10)-38.20(12)+33.13(13)-3.58(27)-0.32(30)$
$+3.90(33)$

39. $0.0=+2.6+7.70(10)-24.29(11)+16.59(12)+6.08(23)-8.60(24)+2.52(25)+1.96(27)-3.64(29)$
$+1.68(30)$

40. $0.0=+0.4+2.98(10)-9.36(12)+6.38(14)+4.12(22)-4.30(23)+0.18(25)+2.15(27)-3.67(28)+1.52(30)$

41. $0.0=-14.6+44.02(18)-45.59(19)+1.57(20)+2.09(22)-4.61(24)+2.52(25)+1.96(27)-45.14(28)$
$+43.18(29)$

42. $0.0=-0.5+0.63(40)-4.90(41)+4.27(42)+2.12(45)-5.61(46)+3.49(47)+6.34(53)-7.09(54)+0.75(55)$

43. $0.0=+0.2+3.43(43)-6.47(44)+3.04(45)-0.49(55)-3.37(56)+3{:}86(57)+2.52(60)-2.96(61)+0.44(62)$

44. $0.0=-0.6+1.81(58)-6.12(59)+4.31(60)+8.55(68)-9.26(69)+0.71(70)+1.10(75)-4.91(76)+3.81(77)$

45. $0.0=+4.5+12.54(70)-13.94(71)+1.40(72)+1.37(78)-9.98(79)+8.61(80)-0.37(85)-2.64(86)$
$+3.01(87)$

46. $0.0=+1.6+0.08(83)-4.16(84)+4.08(85)+3.04(88)-3.35(89)+0.31(90)+3.47(95)-6.15(96)+2.68(97)$

47. $0.0=+5.2+2.33(90)-2.59(91)+0.26(92)+1.87(93)-4.67(94)+2.80(95)+0.25(105)-1.59(106)$
$+1.34(107)+2.56(108)-4.40(109)+1.84(110)+1.39(111)-3.56(112)+2.17(113)$

48. $0.0=+1.8+1.70(103)-4.78(104)+3.08(105)+5.99(116)-6.61(117)+0.62(118)+1.05(119)-4.27(120)$
$+3.22(121)$

Length S_3. $0.0=+12.5+1.28(1)-1.28(2)-3.07(3)+3.07(6)-4.28(10)+4.60(13)-0.32(16)\dot{-}1.57(18)$
$+0.65(19)+1.57(20)-0.65(21)+0.18(22)-0.18(25)-2.15(27)+2.15(28)+1.58(30)-1.58(33)$
$+0.31(34)-0.31(35)-1.36(38)+1.36(39)+1.76(40)-1.76(41)+3.43(43)-3.43(44)-1.89(47)$
$+1.89(49)-1.53(54)+1.04(55)+0.49(57)+1.81(58)-2.25(60)+0.44(62)-2.32(63)+2.32(64)$
$+2.01(66)-2.01(67)-0.71(68)+2.11(70)-1.40(72)+0.93(73)-0.93(74)-3.81(76)+3.81(77)$
$-1.37(78)+1.37(79)+0.89(81)-0.89(82)+0.08(83)+0.29(85)-0.37(87)-0.31(88)+2.64(90)$
$-2.33(91)+1.87(93)-1.87(94)-2.68(96)+2.68(97)+1.61(98)-1.61(99)+0.41(101)-0.41(102)$
$+1.70(103)-1.70(105)-1.34(106)+1.34(107)-2.17(112)+2.17(113)+2.26(114)-2.26(115)$
$-0.62(116)+0.62(118)-3.22(120)+3.22(121)$

ACCURACY AS INDICATED BY CORRECTIONS TO OBSERVED DIRECTIONS.

In the following tables are given the corrections to the observed directions resulting from the figure adjustments, the additional corrections resulting from the introduction of latitude, longitude, and azimuth equations, and the combination of these two corrections. (See p. 20.)

TABLE OF CORRECTIONS TO OBSERVED DIRECTIONS.

Kyle-McClenny to Stanton base.

Number of direction	Corrections to directions—			Number of direction	Corrections to directions—		
	From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total		From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	″	″	″		″	″	″
1	−0.521	+0.346	−0.175	38	−0.628	−0.117	−0.745
2	+0.603	−0.167	+0.436	39	+0.193	+0.032	+0.225
3	−0.082	−0.180	−0.262	40	+0.087	+0.208	+0.295
4	+0.143	−0.328	−0.185	41	−0.372	+0.108	−0.264
5	−0.179	−0.108	−0.287	42	−0.069	+0.095	+0.026
6	+0.036	+0.436	+0.472	43	+0.713	+0.206	+0.919
7	+0.844	−0.342	+0.502	44	−0.453	+0.073	−0.380
8	+0.121	−0.093	+0.028	45	−0.351	−0.029	−0.380
9	−0.713	−0.010	−0.723	46	+0.377	−0.104	+0.273
10	+0.288	+0.347	+0.635	47	−0.285	−0.146	−0.431
11	−0.540	+0.097	−0.443	48	−0.100	+0.109	+0.009
12	−0.297	+0.245	−0.052	49	−0.247	+0.055	−0.192
13	+1.030	+0.227	+1.257	50	+0.004	−0.102	−0.098
14	+0.259	−0.100	+0.159	51	+0.343	−0.062	+0.281
15	−0.064	−0.139	−0.203	52	−0.015	+0.171	+0.156
16	−0.927	−0.232	−1.159	53	+0.479	+0.139	+0.618
17	+0.042	+0.150	+0.192	54	−0.090	+0.042	−0.048
18	−0.142	+0.106	−0.036	55	+0.043	−0.025	+0.018
19	−0.057	−0.139	−0.196	56	+0.080	−0.188	−0.108
20	+0.157	−0.118	+0.039	57	−0.497	−0.141	−0.638
21	+0.960	+0.299	+1.259	58	+0.239	−0.177	+0.062
22	−0.163	+0.124	−0.039	59	+0.239	−0.100	+0.139
23	+0.070	−0.004	+0.066	60	−0.705	+0.067	−0.638
24	−0.413	−0.093	−0.506	61	+0.703	+0.093	+0.796
25	−0.027	−0.193	−0.220	62	−0.475	+0.117	−0.358
26	−0.427	−0.135	−0.562	63	+0.416	+0.170	+0.586
27	+0.370	−0.260	+0.110	64	−0.139	+0.118	−0.021
28	+0.315	−0.072	+0.243	65	+0.064	−0.020	+0.044
29	+0.134	+0.039	+0.173	66	+0.231	−0.157	+0.074
30	+0.026	+0.150	+0.176	67	−0.572	−0.113	−0.685
31	−0.845	+0.145	−0.700	68	−0.130	−0.162	−0.292
32	−0.512	+0.075	−0.437	69	+0.490	−0.108	+0.382
33	+0.111	−0.099	+0.012	70	−0.136	+0.022	−0.114
34	+0.235	−0.075	+0.160	71	+0.104	+0.165	+0.269
35	+0.166	+0.100	+0.266	72	−0.329	+0.084	−0.245
36	+0.096	−0.231	−0.135	73	+0.566	+0.146	+0.712
37	+0.693	−0.098	+0.595	74	−0.464	+0.109	−0.355

Kyle-McClenny to Stanton base—Continued.

Number of direction.	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total	Number of direction	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	"	"	"		"	"	"
75	−0. 387	−0. 015	−0. 402	116	−0. 246	−0. 055	−0. 301
76	+0. 040	−0. 152	−0. 112	117	+0. 112	−0. 107	+0. 005
77	+0. 246	−0. 088	+0. 158	118	−0. 138	−0. 053	−0. 191
78	−0. 365	−0. 140	−0. 505	119	+0. 255	−0. 102	+0. 153
79	+0. 228	−0. 106	+0. 122	120	−0. 370	−0. 008	−0. 378
80	+0. 226	+0. 020	+0. 246	121	−0. 343	+0. 085	−0. 258
81	−0. 188	+0. 136	−0. 052	122	+0. 596	+0. 079	+0. 675
82	+0. 100	+0. 089	+0. 189	123	−0. 073	+0. 045	−0. 028
83	−0. 342	+0. 149	−0. 193	124	−0. 292	+0. 076	−0. 216
84	+0. 086	+0. 096	+0. 182	125	+0. 060	+0. 028	+0. 088
85	−0. 076	−0. 033	−0. 109	126	+0. 364	−0. 020	+0. 344
86	+0. 122	−0. 109	+0. 013	127	−0. 059	−0. 130	−0. 189
87	+0. 210	−0. 104	+0. 106	128	−0. 199	−0. 035	−0. 234
88	−0. 306	−0. 124	−0. 430	129	−0. 012	−0. 119	−0. 131
89	+0. 008	−0. 128	−0. 120	130	−0. 125	−0. 005	−0. 130
90	−0. 143	+0. 012	−0. 131	131	+0. 185	+0. 064	+0. 249
91	+0. 205	+0. 131	+0. 336	132	+0. 151	+0. 093	+0. 244
92	+0. 236	+0. 108	+0. 344	133	+0. 026	+0. 023	+0. 049
93	−0. 259	+0. 134	−0. 125	134	+0. 117	+0. 068	+0. 185
94	+0. 076	+0. 064	+0. 140	135	−0. 243	+0. 046	−0. 197
95	+0. 178	+0. 004	+0 182	136	+0. 322	+0. 024	+0. 346
96	+0. 295	−0. 090	+0. 205	137	−0. 222	−0. 162	−0. 384
97	−0. 290	−0. 112	−0. 402	138	−0. 032	+0. 040	+0. 008
98	+0. 128	−0. 097	+0. 031	139	+0. 009	−0. 124	−0. 115
99	−0. 012	−0. 116	−0. 128	140	+0. 090	−0. 036	+0. 054
100	−0. 331	+0. 008	−0. 323	141	−0. 219	+0. 051	−0. 168
101	−0. 007	+0. 133	+0. 126	142	+0. 152	+0. 069	+0. 221
102	+0. 222	+0. 072	+0. 294	143	+0. 002	−0. 069	−0. 067
103	+0. 262	+0. 095	+0. 357	144	+0. 351	+0. 052	+0. 403
104	+0. 200	+0. 087	+0. 287	145	−0. 198	+0. 064	−0. 134
105	−0. 813	+0. 004	−0. 809	146	+0. 228	+0. 023	+0. 251
106	+0. 157	−0. 066	+0. 091	147	−0. 384	−0. 072	−0. 456
107	+0. 194	−0. 121	+0. 073	148	+0. 009	−0. 017	−0. 008
108	−0. 381	−0. 085	−0. 466	149	+0. 579	−0. 083	+0. 496
109	−0. 121	−0. 102	−0. 223	150	−0. 320	−0. 036	−0. 356
110	+0. 820	−0. 010	+0. 810				
				151	−0. 036	+0. 018	−0. 018
111	−0. 150	+0. 103	−0. 047	152	−0. 232	+0. 116	−0. 116
112	−0. 168	+0. 092	−0. 076	153	+0. 492	+0. 062	+0. 554
113	+0. 062	+0. 056	+0. 118	154	−0. 335	+0. 122	−0. 213
114	−0. 386	+0. 088	−0. 298	155	+0. 086	−0. 070	+0. 016
115	+0. 458	+0. 019	+0. 477	156	+0. 191	+0. 019	+0. 210

Stanton base to Deming base.

Number of direction.	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total	Number of direction	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	"	"	"		"	"	"
1	−0.260	−0.002	−0.262	48	+0.117	+0.039	+0.156
2	−0.143	−0.065	−0.208	49	+0.022	+0.099	+0.121
3	+0.127	+0.119	+0.246	50	−0.146	−0.119	−0.265
4	+0.303	−0.189	+0.114	51	−0.144	+0.056	−0.088
5	−0.553	−0.027	−0.580	52	+0.206	−0.056	+0.150
6	+0.094	+0.034	+0.128	53	−0.177	−0.018	−0.195
7	+0.166	+0.146	+0.313	54	+0.193	−0.011	+0.182
8	−0.098	−0.036	−0.134	55	−0.079	+0.026	−0.053
9	−0.306	−0.122	−0.428	56	−0.270	−0.085	−0.355
10	+0.571	−0.088	+0.483	57	+0.198	+0.007	+0.205
11	−0.334	+0.098	−0.236	58	−0.003	+0.060	+0.057
12	−0.299	−0.158	−0.457	59	+0.194	+0.068	+0.262
13	+0.368	+0.025	+0.393	60	−0.118	−0.049	−0.167
14	+0.272	+0.041	+0.313	61	+0.010	+0.043	+0.053
15	−0.227	+0.126	−0.101	62	+0.043	−0.055	−0.012
16	−0.114	−0.035	−0.149	63	−0.258	−0.025	−0.283
17	−0.026	+0.159	+0.133	64	−0.108	+0.008	−0.100
18	+0.468	−0.077	+0.391	65	+0.313	+0.029	+0.342
19	−0.125	−0.069	−0.194	66	−0.236	−0.016	−0.252
20	+0.128	−0.054	+0.074	67	+0.156	+0.025	+0.181
21	−0.444	+0.042	−0.402	68	+0.083	+0.027	+0.110
22	−0.085	−0.165	−0.250	69	−0.078	+0.058	−0.020
23	+0.617	+0.024	+0.641	70	+0.075	−0.094	−0.019
24	−0.424	+0.097	−0.327	71	−0.499	+0.003	−0.496
25	+0.040	+0.140	+0.180	72	+0.363	−0.053	+0.310
26	−0.148	−0.095	−0.243	73	+0.048	−0.018	+0.030
27	−0.024	+0.065	+0.041	74	+0.175	+0.003	+0.178
28	−0.356	−0.024	−0.380	75	−0.258	+0.035	−0.223
29	+0.494	−0.060	+0.434	76	+0.171	+0.031	+0.202
30	−0.115	+0.019	−0.096	77	−0.274	+0.020	−0.254
31	+0.312	+0.119	+0.431	78	+0.352	+0.010	+0.362
32	+0.323	−0.024	+0.299	79	−0.388	+0.015	−0.373
33	−0.543	−0.111	−0.654	80	+0.374	+0.015	+0.389
34	+0.821	−0.045	+0.776	81	−0.065	−0.061	−0.126
35	−0.912	+0.061	−0.852	82	−0.032	−0.002	−0.034
36	−0.374	−0.082	−0.456	83	−0.180	−0.029	−0.209
37	+0.786	+0.009	+0.795	84	−0.305	+0.021	−0.284
38	+0.081	+0.069	+0.150	85	+0.517	+0.010	+0.527
39	−0.375	+0.078	−0.297	86	−0.212	−0.033	−0.245
40	−0.117	−0.074	−0.191	87	−0.409	−0.048	−0.457
41	+0.501	+0.120	+0.621	88	−0.105	+0.002	−0.103
42	−0.054	−0.113	−0.167	89	+0.416	+0.068	+0.484
43	−0.581	−0.046	−0.627	90	+0.310	+0.010	+0.320
44	+0.049	−0.014	+0.035	91	−0.392	+0.066	−0.326
45	+0.086	+0.053	+0.139	92	−0.007	+0.013	+0.006
46	−0.015	−0.045	−0.060	93	−0.286	+0.017	−0.269
47	+0.023	+0.026	+0.049	94	+0.098	−0.012	+0.086

Stanton base to Deming base—Continued.

	Corrections to directions—				Corrections to directions—		
Number of direction.	From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total	Number of direction	From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	"	"	"		"	"	"
95	+0.608	−0.022	+0.586	135	−0.248	+0.078	−0.170
96	−0.022	−0.061	−0.083	136	+0.157	+0.112	+0.269
97	−0.597	−0.056	−0.653	137	+0.117	+0.059	+0.176
98	+0.468	−0.069	+0.399	138	−0.253	+0.214	−0.039
99	−0.018	+0.042	+0.024	139	−0.071	+0.086	+0.015
100	+0.012	+0.115	+0.127	140	+0.375	−0.117	+0.258
101	+0.135	−0.032	+0.103	141	+0.042	−0.181	−0.139
102	+0.143	+0.112	+0.255	142	−0.094	−0.002	−0.096
103	−0.418	−0.027	−0.445	143	−0.022	−0.264	−0.286
104	−0.184	+0.004	−0.180	144	−0.052	−0.042	−0.094
105	+0.513	−0.036	+0.477	145	+0.423	+0.080	+0.503
106	−0.054	−0.054	−0.108	146	−0.925	+0.167	−0.758
107	+0.034	−0.103	−0.069	147	+0.576	+0.059	+0.635
108	+0.227	−0.060	+0.167	148	+0.026	+0.203	+0.229
109	+0.238	+0.077	+0.315	149	+0.006	+0.167	+0.173
110	−0.290	+0.057	−0.233	150	−0.082	−0.028	−0.110
111	−0.209	+0.030	−0.179	151	−0.190	−0.319	−0.509
112	+0.090	+0.202	+0.292	152	+0.241	−0.021	+0.220
113	−0.270	−0.009	−0.279	153	−0.047	−0.222	−0.269
114	+0.669	−0.024	+0.645	154	−0.721	−0.006	−0.727
115	−0.101	−0.048	−0.149	155	+0.588	+0.072	+0.660
116	−0.328	−0.079	−0.407	156	−0.320	+0.104	−0.216
117	−0.061	−0.043	−0.104	157	+0.500	+0.051	+0.551
118	−0.384	−0.021	−0.405	158	−0.068	−0.089	−0.157
119	−0.277	+0.080	−0.197	159	−0.245	+0.032	−0.213
120	+0.382	+0.005	+0.387	160	+0.313	+0.056	+0.369
121	+0.279	−0.064	+0.215	161	−0.079	−0.076	−0.155
122	+0 246	−0.109	+0.137	162	−0.340	−0.168	−0.508
123	−0.332	−0.013	−0.345	163	−0.052	−0.029	−0.081
124	−0.077	−0.025	−0.102	164	+0.366	+0.159	+0.525
125	−0.139	+0.055	−0.084	165	+0.106	+0.115	+0.221
126	−0.236	+0.146	−0.090	166	−0.261	+0.222	−0.039
127	+0.539	−0.053	+0.486	167	+0.049	+0.167	+0.216
128	+0.111	+0.186	+0.297	168	−0.239	+0.178	−0.061
129	−0.462	−0.070	−0.532	169	+0.106	+0.049	+0.155
130	+0.394	−0.085	+0.309	170	+0.121	−0.022	+0.099
131	+0.091	−0.077	+0.014	171	−0.094	−0.122	−0.216
132	−0.134	+0.047	−0.087	172	−0.119	−0.307	−0.426
133	−0.415	−0.186	−0.601	173	+0.438	−0.164	+0.274
134	+0.390	−0.064	+0.326				

Deming base net to San Jacinto-Cuyamaca.

Number of direction	Corrections to directions—			Number of direction	Corrections to directions—		
	From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total		From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	″	″	″		″	″	″
1	+0.022	+0.205	+0.227	50	−0.068	−0.132	−0.200
2	−0.218	+0.244	+0.026	51	+0.361	−0.020	+0.341
3	−0.128	+0.061	−0.067	52	−0.293	+0.153	−0.140
4	−0.468	−0.032	−0.500	53	+0.172	−0.160	+0.012
5	+0.500	−0.022	+0.478	54	+0.334	−0.283	+0.051
6	+0.039	−0.185	−0.146	55	−0.078	−0.197	−0.275
7	+0.253	−0.271	−0.018	56	−0.235	+0.361	+0.126
8	−0.118	−0.279	−0.397	57	−0.194	+0.279	+0.085
9	+0.410	−0.295	+0.115	58	−0.331	+0.388	+0.057
10	−0.384	+0.043	−0.341	59	−0.436	+0.459	+0.023
11	+0.265	+0.012	+0.277	60	+0.798	+0.005	+0.803
12	−0.050	−0.054	−0.104	61	+0.048	−0.280	−0.232
13	−0.213	−0.011	−0.224	62	−0.080	−0.572	−0.652
14	+0.121	−0.111	+0.010	63	+0.405	−0.331	+0.074
15	−0.508	+0.393	−0.115	64	−0.471	−0.581	−1.052
16	+0.477	+0.303	+0.780	65	−0.516	+0.036	−0.480
17	+0.079	−0.054	+0.025	66	−0.145	+0.316	+0.171
18	−0.133	+0.037	−0.096	67	+0.727	+0.560	+1.287
19	−0.175	−0.027	−0.202	68	−0.408	−0.457	−0.865
20	−0.036	−0.094	−0.130	69	+0.125	−0.526	−0.401
21	+0.265	+0.138	+0.403	70	−0.179	−0.026	−0.205
22	+0.096	−0.109	−0.013	71	+0.179	+0.433	+0.612
23	+0.359	−0.012	+0.347	72	+0.283	+0.577	+0.860
24	−0.571	−0.002	−0.573	73	−0.261	+0.520	+0.259
25	+0.242	+0.082	+0.324	74	−0.047	+0.509	+0.462
26	−0.126	+0.041	−0.085	75	+0.024	+0.072	+0.096
27	−0.017	+0.163	+0.146	76	+0.142	−0.601	−0.459
28	+0.039	+0.039	+0.078	77	+0.143	−0.499	−0.356
29	+0.253	−0.030	+0.223	78	−0.152	−0.492	−0.644
30	+0.518	+0.165	+0.683	79	+0.086	−0.658	−0.572
31	−0.276	−0.113	−0.389	80	+0.003	−0.008	−0.005
32	−0.232	−0.182	−0.414	81	+0.151	+0.637	+0.788
33	−0.285	−0.041	−0.326	82	−0.088	+0.522	+0.434
34	+0.523	+0.007	+0.530	83	−0.156	+0.499	+0.343
35	+0.163	+0.031	+0.194	84	+0.157	+0.530	+0.687
36	−0.381	+0.063	−0.318	85	−0.138	+0.078	−0.060
37	−0.305	−0.101	−0.406	86	−0.076	−0.548	−0.624
38	−0.107	−0.260	−0.367	87	+0.212	−0.560	−0.348
39	−0.117	−0.298	−0.415	88	+0.102	−0.535	−0.433
40	+0.167	+0.140	+0.307	89	−0.032	−0.614	−0.646
41	+0.072	+0.290	+0.362	90	−0.284	+0.148	−0.136
42	−0.014	+0.128	+0.114	91	+0.345	+0.459	+0.804
43	−0.013	+0.429	+0.416	92	−0.131	+0.541	+0.410
44	+0.340	+0.388	+0.728	93	−0.143	+0.903	+0.760
45	+0.042	+0.163	+0.205	94	+0.221	+0.386	+0.607
46	−0.254	+0.026	−0.228	95	−0.088	+0.024	−0.064
47	+0.180	−0.074	+0.106	96	+0.048	−0.544	−0.496
48	−0.390	−0.383	−0.773	97	−0.038	−0.770	−0.808
49	+0.095	−0.550	−0.455	98	+0.165	+0.518	+0.683

Deming base net to San Jacinto-Cuyamaca—Continued.

Number of direction	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total	Number of direction	Corrections to directions— From figure adjustment	Due to the introduction of latitude, longitude, and azimuth equations	Total
	″	″	″		″	″	″
99	+0.004	+0.508	+0.512	111	+0.142	−0.550	−0.408
100	−0.064	+0.018	−0.046	112	+0.315	−0.670	−0.355
101	−0.157	−0.548	−0.705	113	+0.062	−0.095	−0.033
102	+0.053	−0.498	−0.445	114	−0.503	+0.747	+0.244
103	+0.315	+0.690	+1.005	115	−0.015	+0.566	+0.551
104	+0.087	+0.804	+0.891	116	+0.217	−0.831	−0.614
105	−0.141	+0.045	−0.096	117	−0.178	−0.733	−0.911
106	−0.128	−0.521	−0.649	118	−0.040	+1.564	+1.524
107	−0.134	−1.018	−1.152	119	+0.020	+1.542	+1.562
108	+0.039	−0.526	−0.487	120	+0.520	−0.672	−0.152
109	+0.208	−0.042	+0.166	121	−0.540	−0.869	−1.409
110	−0.247	+0.568	+0.321				

The maximum correction to an observed direction for each of the three seasons on the Texas-California arc is shown in the following table:

Maximum correction to an observed direction by seasons.

Season	Direction No.	Between stations	Correction
			″
Kyle-McClenny to Ingle-Sist, 1908–9	13	Lacasa and McClenny	1.03
Ingle-Sist to Deming base, 1909–10	146	Black and North Franklin	0.92
Deming base to San Jacinto-Cuyamaca, 1910–11	60	Baldy and San Jacinto	0.80

The first season's triangulation was in a rolling country, while the last two seasons were entirely in mountainous regions.

The maximum corrections to a direction for each of the three seasons' triangulation are also the maximum corrections for the three sections into which the arc is divided.

The maximum correction to a direction on the ninety-eighth meridian primary triangulation was $1''.96$, and the average maximum correction to a direction for the 17 sections into which that arc was divided was $0''.99$. The average maximum correction for the three sections of the Texas-California arc is $0''.92$.

The probable error of an observed direction is

$$d = 0.674\sqrt{\frac{\Sigma v^2}{c}}$$

in which Σv^2 is the sum of the squares of the corrections to directions, and c is the number of conditions.

The probable errors of an observed direction resulting from the figure adjustment for each of the three seasons are as follows:

	″
Kyle-McClenny to Ingle-Sist, 1908–9	±0.35
Ingle-Sist to Deming base, 1909–10	±0.30
Deming base net to San Jacinto-Cuyamaca, 1910–11	±0.27

The writer made the observations at about two-fifths of the stations of the first season, and Mr. Hill made the observations at all of the other stations of the arc. The methods employed, the instruments used, and the number of observations over each direction were the same throughout. The stations occupied during the last two seasons were in a mountainous region, and those in the first season were in a rolling country. The smaller probable errors in the last two seasons indicate that a mountainous country is more favorable for accurate triangulation.

The probable errors, resulting from the figure adjustment, of an observed direction for the three sections of the Texas-California arc are as follows:

	″
Kyle-McClenny to Stanton base	±0.37
Stanton base to Deming base	±0.32
Deming base net to San Jacinto-Cuyamaca	±0.28
Whole Texas-California arc	±0.33

Of the 17 sections of the ninety-eighth meridian triangulation there are 4 with a mean probable error of an observed direction less than $\pm 0''.28$, and 3 sections with a probable error greater than $\pm 0''.37$. The mean probable error for the entire ninety-eighth meridian is the same as for the Texas-California arc.

The average values of d for the four great arcs in the United States are as follows:

	″
Eastern oblique arc	±0.51
Transcontinental triangulation	±0.44
Ninety-eighth meridian	±0.33
Texas-California arc	±0.33

Each of these values was obtained by taking the mean of the values of d by sections.

ACCURACY AS INDICATED BY CORRECTIONS TO ANGLES AND CLOSURES OF TRIANGLES.

The correction to each angle is the algebraic sum of the corrections to two directions. In order to make it possible to study the corrections to the separate angles, they are shown in the following table for every triangle in the primary scheme. There are two columns of corrections to the angles, one for those resulting from the figure adjustment and the other for the total corrections, which include the correction due to the introduction of latitude, longitude, and azimuth equations. (See p. 36.) There are also shown the errors of closure of the triangles, the corrected spherical angles, and the spherical excess for each triangle. The plus sign prefixed to the error of closure of a triangle indicates that the sum of the angles is less than 180° plus the spherical excess. The spherical excess is a convenient indication of the size of the triangle, since it is proportional to the area.

TABLES OF TRIANGLES.

Kyle-McClenny to Stanton base.

Station	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Lacasa	+1. 33	+1. 31		53 38 08. 72	
Kyle	+0. 44	−0. 09	+1. 98	77 54 37. 60	4. 20
McClenny	+0. 21	+0. 76		48 27 17. 88	
Rattlesnake	+1. 00	+1. 36		47 09 50. 35	
Lacasa	+0. 56	+0. 21	+0. 87	90 42 01. 07	3. 65
Kyle	−0. 69	−0. 70		42 08 12. 23	
Rattlesnake	+0. 17	+0. 28		99 12 23. 79	
Lacasa	−0. 77	−1. 10	−0. 92	37 03 52. 35	2. 88
McClenny	−0. 32	−0. 10		43 43 46. 74	
Rattlesnake	−0. 83	−1. 08		52 02 33. 44	
Kyle	+1. 12	+0. 61	+0. 19	35 46 25. 37	3. 43
McClenny	−0. 10	+0. 66		92 11 04. 62	
Pierce	−0. 19	−0. 23		116 59 15. 02	
Lacasa	−0. 32	−0. 36	−1. 34	40 41 06. 58	0. 93
Rattlesnake	−0. 83	−0. 75		22 19 39. 33	
Flat	−1. 12	−1. 30		35 08 51. 96	
Lacasa	−0. 86	−0. 95	−2. 10	34 12 54. 18	0. 55
Pierce	−0. 12	+0. 15		110 38 14. 41	
Hearn	−0. 11	0. 00		26 20 47. 19	
Flat	+0. 23	+0. 11	+0. 34	101 43 10. 88	1. 01
Pierce	+0. 22	+0. 23		51 56 02. 94	
Hearn	−0. 87	−0. 88		42 08 28. 78	
Pierce	+0. 08	−0. 16	−1. 51	80 26 27. 62	2. 22
Rattlesnake	−0. 72	−0. 47		57 25 05. 82	
Lamb	−0. 68	−0. 70		84 18 04. 66	
Flat	−0. 48	−0. 57	−1. 34	42 11 02. 97	0. 99
Hearn	−0. 18	−0. 07		53 30 53. 36	
Springgap	−0. 46	−0. 56		8 43 59. 17	
Flat	+0. 39	+0. 29	−0. 02	10 00 43. 54	0. 44
Lamb	+0. 05	+0. 25		161 15 17. 73	
Springgap	−0. 16	−0. 27		35 45 29. 02	
Flat	−0. 10	−0. 28	−0. 49	52 11 46. 51	2. 47
Hearn	−0. 23	+0. 06		92 02 46. 94	
Springgap	+0. 30	+0. 29		27 01 29. 85	
Lamb	+0. 62	+0. 45	+0. 87	114 26 37. 61	1. 04
Hearn	−0. 05	+0. 13		38 31 53. 58	
Hitson (U. S. G. S.)	−1. 16	−1. 30		30 39 30. 41	
Flat	−0. 02	−0. 06	−1. 25	40 56 12. 92	1. 45
Lamb	−0. 07	+0. 11		108 24 18. 12	

Kyle-McClenny to Stanton base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Hitson (U. S. G. S.)	−1.06	−1.30		87 37 29.90	
Flat	−0.40	−0.34	−1.57	30 55 29.39	2.41
Springgap	−0.11	+0.07		61 27 03.12	
Hitson (U. S. G. S.)	+0.10	0.00		56 57 59.49	
Lamb	+0.12	+0.15	−0.34	52 50 59.62	1.40
Springgap	−0.56	−0.49		70 11 02.29	
Clyde	−0.15	−0.20		73 30 14.77	
Hitson (U. S. G. S.)	+0.73	+0.65	+0.08	67 58 52.64	0.85
Springgap	−0.50	−0.37		38 30 53.44	
Kennard	+0.49	+0.46		44 21 08.94	
Hitson (U. S. G. S.)	+0.07	−0.05	+1.38	103 34 02.57	1.04
Springgap	+0.82	+0.97		32 04 49.53	
Kennard	−0.08	−0.21		58 30 07.60	
Hitson (U. S. G. S.)	−0.66	−0.70	−1.18	35 35 09.93	0.40
Clyde	−0.44	−0.27		85 54 42.87	
Kennard	−0.57	−0.67		14 08 58.66	
Springgap	−1.32	−1.34	−2.48	6 26 03.91	0.21
Clyde	−0.59	−0.47		159 24 57.64	
Clayton	+1.41	+1.43		18 26 16.45	
Kennard	+0.13	+0.07	+1.88	55 29 54.92	0.70
Clyde	+0.34	+0.38		106 03 49.33	
Clayton	+0.23	+0.28		56 29 43.47	
Kennard	−0.44	−0.60	−0.93	69 38 53.58	2.48
Springgap	−0.72	−0.61		53 51 25.43	
Clayton	−1.18	−1.15		38 03 27.02	
Clyde	+0.25	+0.09	−0.33	94 31 13.03	1.57
Springgap	+0.60	+0.73		47 25 21.52	
Morrison	−0.56	−0.60		58 55 19.44	
Kennard	−0.54	−0.66	−2.04	59 52 43.25	2.26
Clayton	−0.94	−0.78		61 11 59.57	
Buzzard	+0.24	+0.38		37 31 30.22	
Morrison	−0.35	−0.54	−0.69	121 22 08.08	1.35
Kennard	−0.58	−0.53		21 06 23.05	
Buzzard	−0.19	−0.13		81 15 20.38	
Morrison	+0.20	+0.06	+0.01	62 26 48.64	1.39
Clayton	0.00	+0.08		36 17 52.37	
Buzzard	−0.43	−0.51		43 43 50.16	
Kennard	+0.03	−0.13	−1.34	38 46 20.20	2.30
Clayton	−0.94	−0.70		97 29 51.94	
Sears	−1.03	−1.06		53 30 02.72	
Morrison	−0.63	−0.73	−2.29	75 07 21.85	0.88
Buzzard	−0.63	−0.50		51 22 36.31	

Kyle-McClenny to Stanton base—Continued.

Stations	Corrections to angles— From figure adjustment	Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Hale	−0. 42	−0. 30		34 47 55. 58	
Sears	−0. 95	−1. 11	−2. 17	111 32 15. 33	0. 80
Morrison	−0. 80	−0. 76		33 39 49. 89	
Hale	−0. 13	−0. 06		73 13 18. 34	
Sears	+0. 08	−0. 05	+0. 57	58 02 12. 61	0. 90
Buzzard	+0. 62	+0. 68		48 44 29. 95	
Hale	+0. 29	+0. 24		38 25 22. 76	
Morrison	+0. 17	+0. 03	+0. 45	41 27 31. 96	0. 98
Buzzard	−0. 01	+0. 18		100 07 06. 26	
Boyd	+0. 03	+0. 01		47 53 26. 93	
Sears	+0. 43	+0. 29	+1. 05	20 30 20. 39	0. 37
Hale	+0. 59	+0. 75		111 36 13. 05	
Allen	+0. 43	+0. 38		42 22 40. 53	
Sears	+0. 63	+0. 56	+1. 06	58 42 01. 76	1. 04
Hale	0. 00	+0. 12		78 55 18. 75	
Allen	+0. 27	+0. 09		58 42 24. 85	
Sears	+0. 20	+0. 27	+0. 82	38 11 41. 37	0. 94
Boyd	+0. 35	+0. 46		83 05 54. 72	
Allen	−0. 16	−0. 29		16 19 44. 32	
Hale	+0. 59	+0. 63	+0. 81	32 40 54. 30	0. 27
Boyd	+0. 38	+0. 47		130 59 21. 65	
Patterson	+0. 33	+0. 26		34 53 29. 23	
Allen	+0. 29	+0. 22	+0. 47	89 52 35. 67	0. 98
Boyd	−0. 15	−0. 01		55 13 56. 08	
Lloyd	+0. 32	+0. 45		44 22 53. 18	
Patterson	+0. 44	+0. 31	+0. 85	98 58 43. 28	1. 19
Allen	+0. 09	+0. 09		36 38 24. 73	
Lloyd	+0. 55	+0. 62		73 38 51. 86	
Patterson	+0. 10	+0. 04	+0. 97	64 05 14. 04	1. 32
Boyd	+0. 32	+0. 31		42 15 55. 42	
Lloyd	+0. 23	+0. 17		29 15 58. 68	
Allen	+0. 20	+0. 12	+0. 59	53 14 10. 93	1. 11
Boyd	+0. 16	+0. 30		97 29 51. 50	
Bench	−0. 02	−0. 03		58 11 46. 63	
Patterson	+0. 12	+0. 02	−0. 36	19 04 51. 07	0. 39
Lloyd	−0. 46	−0. 35		102 43 22. 69	
Wolf	−0. 06	−0. 07		44 50 17. 63	
Patterson	−0. 41	−0. 58	−0. 85	92 50 26. 79	0. 98
Lloyd	−0. 32	−0. 20		42 19 16. 56	
Wolf	−1. 07	−1. 16		60 05 30. 20	
Patterson	−0. 59	−0. 61	−2. 63	73 45 35. 71	1. 08
Bench	−0. 97	−0. 86		46 08 55. 17	

Kyle-McClenny to Stanton base—Continued.

Stations	Corrections to angles—		Error of closure of triangle	Corrected spherical angles	Spherical excess
	From figure adjustment	Total, which includes that due to the introduction of latitude, longitude, and azimuth equations			
	″	″	″	° ′ ″	″
Wolf	−1. 01	−1. 10		15 15 12. 56	
Lloyd	−0. 14	−0. 16	−2. 14	60 24 06. 12	0. 49
Bench	−0. 99	−0. 88		104 20 41. 81	
Bynum	+0. 94	+0. 93		38 18 01. 94	
Wolf	+0. 97	+0. 90	+3. 11	96 53 15. 88	1. 88
Bench	+1. 20	+1. 28		44 48 44. 06	
Cuthbert	−0. 45	−0. 41		22 16 40. 28	
Wolf	+1. 01	+0. 88	+1. 50	134 18 33. 18	1. 25
Bench	+0. 94	+1. 03		23 24 47. 79	
Cuthbert	+0. 39	+0. 36		78 08 38. 29	
Wolf	+0. 04	−0. 02	+0. 46	37 25 17. 30	1. 21
Bynum	+0. 03	+0. 12		64 26 05. 62	
Cuthbert	+0. 84	+0. 78		55 51 58. 02	
Bench	+0. 26	+0. 24	+2. 07	21 23 56. 26	1. 84
Bynum	+0. 97	+1. 05		102 44 07. 56	
Top	−0. 22	−0. 19		39 27 37. 80	
Cuthbert	−0. 34	−0. 47	−1. 19	88 58 46. 53	1. 02
Bynum	−0. 63	−0. 53		51 33 36. 69	
Signal	+0. 31	+0. 38		30 16 00. 53	
Top	+0. 13	+0. 11	+0. 80	110 19 21. 93	1. 49
Cuthbert	+0. 36	+0. 31		39 24 39. 03	
Signal	+0. 28	+0. 37		55 06 21. 07	
Top	+0. 35	+0. 31	+1. 02	70 51 44. 14	1. 92
Bynum	+0. 39	+0. 34		54 01 56. 71	
Signal	−0. 03	0. 00		24 50 20. 55	
Cuthbert	−0. 71	−0. 78	−0. 97	49 34 07. 50	1. 45
Bynum	−0. 23	−0. 19		105 35 33. 40	
Williams	+0. 37	+0. 39		56 07 18. 94	
Top	+0. 30	+0. 26	+0. 75	21 29 01. 15	0. 86
Signal	+0. 08	+0. 10		102 23 40. 77	
Evart	+0. 09	+0. 14		69 33 27. 80	
Top	−0. 12	−0. 28	−0. 14	57 53 19. 70	1. 44
Signal	−0. 11	0. 00		52 33 13. 94	
Evart	−0. 27	−0. 25		98 06 52. 72	
Top	−0. 42	−0. 53	−1. 00	36 24 18. 56	1. 19
Williams	−0. 31	−0. 22		45 28 49. 91	
Evart	−0. 36	−0. 38		28 33 24. 93	
Signal	+0. 19	+0. 10	−0. 11	49 50 26. 83	0. 61
Williams	+0. 06	+0. 17		101 36 08. 85	
Stanton	−0. 20	−0. 10		32 21 23. 35	
Evart	+0. 57	+0. 54	+0. 49	59 05 52. 00	1. 59
Williams	+0. 12	+0. 05		88 32 46. 24	

Kyle-McClenny to Stanton base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	"	"	"	° ′ "	"
Epley	+0. 35	+0. 47		28 45 41. 78	
Evart	+0. 02	−0. 19	+0. 45	89 03 07. 19	1. 83
Williams	+0. 08	+0. 17		62 11 12. 86	
Epley	−0. 20	−0. 07		76 44 24. 84	
Evart	−0. 54	−0. 73	−0. 46	29 57 15. 19	1. 71
Stanton	+0. 28	+0. 34		73 18 21. 68	
Epley	−0. 55	−0. 54		47 58 43. 06	
Williams	+0. 04	−0. 12	−0. 42	26 21 33. 38	1. 47
Stanton	+0. 09	+0. 24		105 39 45. 03	
Stanton, S. base	−0. 83	−0. 77		64 02 56. 52	
Epley	+0. 43	+0. 39	−0. 73	38 29 25. 51	0. 62
Stanton	−0. 33	−0. 35		77 27 38. 59	
Stanton, N. base	+0. 11	+0. 19		62 16 13. 60	
Epley	−0. 19	−0. 32	−0. 98	77 42 20. 94	0. 65
Stanton	−0. 90	−0. 85		40 01 26. 11	
Stanton, N. base	−0. 35	−0. 28		99 28 31. 94	
Epley	−0. 61	−0. 71	−0. 56	39 12 55. 43	0. 45
Stanton, S. base	+0. 40	+0. 43		41 18 33. 08	
Stanton, N. base	−0. 45	−0. 47		37 12 18. 34	
Stanton	+0. 57	+0. 50	−0. 31	37 26 12. 48	0. 42
Stanton, S. base	−0. 43	−0. 34		105 21 29. 60	

Stanton base to Deming base.

Elkins	+0. 11	−0. 05		49 56 08. 51	
Stanton, N. base	+0. 12	+0. 06	+0. 02	44 12 10. 62	0. 40
Stanton, S. base	−0. 21	+0. 01		85 51 41. 27	
Dunn	−0. 26	−0. 45		33 52 30. 77	
Stanton, N. base	+0. 39	+0. 51	+0. 77	104 37 15. 75	0. 51
Stanton, S. base	+0. 64	+0. 71		41 30 13. 99	
Dunn	−0. 47	−0. 74		64 17 48. 53	
Stanton, N. base	+0. 27	+0. 45	−0. 70	60 25 05. 13	0. 60
Elkins	−0. 50	−0. 41		55 17 06. 94	
Dunn	−0. 21	−0. 29		30 25 17. 76	
Stanton, S. base	−0. 85	−0. 70	−1. 45	44 21 27. 28	0. 49
Elkins	−0. 39	−0. 46		105 13 15. 45	
Scar	−0. 19	−0. 42		43 36 01. 91	
Dunn	+0. 88	+0. 91	+1. 26	49 56 30. 44	0. 77
Elkins	+0. 57	+0. 77		86 27 28. 42	
Morris	+0. 49	+0. 26		35 36 34. 01	
Dunn	−0. 03	+0. 19	+0. 37	96 55 21. 94	0. 88
Elkins	−0. 09	−0. 08		47 28 04. 93	

Stanton base to Deming base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Morris	−0.10	−0.33		75 16 13.02	
Dunn	−0.91	−0.72	−0.54	46 58 51.50	0.94
Scar	+0.47	+0.51		57 44 56.42	
Morris	−0.59	−0.58		39 39 39.02	
Elkins	+0.66	+0.85	+0.35	38 59 23.49	0.83
Scar	+0.28	+0.08		101 20 58.32	
Bates	−0.33	−0.42		105 02 28.24	
Morris	+0.25	+0.27	−1.12	50 05 46.50	0.28
Scar	−1.04	−0.97		24 51 45.54	
Odessa	+0.26	+0.11		50 35 16.16	
Bates	+0.85	+0.81	+1.81	88 56 03.91	0.44
Scar	+0.70	+0.89		40 28 40.37	
Smith	+0.01	−0.13		30 45 43.97	
Morris	−0.57	−0.48	−0.47	63 03 28.78	0.28
Bates	+0.09	+0.14		86 10 47.53	
Smith	−0.86	−0.95		45 41 57.40	
Bates	−0.61	−0.53	−1.93	79 50 40.32	0.42
Odessa	−0.46	−0.45		54 27 22.70	
Dublin	−0.55	−0.79		36 04 28.60	
Smith	−0.37	−0.20	−1.63	95 30 60.43	0.89
Odessa	−0.71	−0.64		48 24 31.86	
Douro	−0.10	−0.03		44 23 57.07	
Dublin	−1.08	−1.25	−2.91	91 24 31.89	1.13
Smith	−1.73	−1.63		44 11 32.17	
Douro	−0.26	−0.42		77 40 04.60	
Dublin	−0.53	−0.46	+0.37	55 20 03.29	1.24
Odessa	+1.16	+1.25		46 59 53.35	
Douro	−0.17	−0.39		33 16 07.53	
Smith	+1.36	+1.43	+1.65	51 19 28.26	1.00
Odessa	+0.46	+0.61		95 24 25.21	
Curtis	−0.31	−0.43		46 09 20.84	
Dublin	+0.63	+0.66	+0.45	30 32 04.52	0.77
Douro	+0.13	+0.22		103 18 35.41	
Harris	+0.35	+0.24		47 47 45.92	
Dublin	+0.67	+0.77	+1.11	76 56 11.13	1.22
Douro	+0.09	+0.10		55 16 04.17	
Harris	−0.03	−0.11		79 37 15.67	
Dublin	+0.04	+0.10	+0.20	46 24 06.60	1.23
Curtis	+0.19	+0.21		53 58 38.96	
Harris	−0.38	−0.35		31 49 29.75	
Douro	+0.04	+0.11	−0.46	48 02 31.23	0.78
Curtis	−0.12	−0.22		100 07 59.80	

Stanton base to Deming base—Continued.

Stations	Corrections to angles—		Error of closure of triangle	Corrected spherical angles	Spherical excess
	From figure adjustment	Total, which includes that due to the introduction of latitude, longitude, and azimuth equations			
	″	″	″	° ′ ″	″
Estes	+0. 15	0. 00		37 37 01. 39	
Harris	+0. 37	+0. 38	+0. 79	89 11 00. 70	1. 46
Curtis	+0. 27	+0. 41		53 11 59. 37	
Aroya	+0. 03	−0. 06		23 15 22. 85	
Harris	+0. 10	+0. 14	−0. 07	131 10 18. 30	0. 92
Curtis	−0. 20	−0. 15		25 34 19. 77	
Aroya	−0. 27	−0. 34		82 20 02. 57	
Harris	−0. 27	−0. 23	−0. 70	41 59 17. 61	1. 07
Estes	−0. 16	−0. 13		55 40 40. 89	
Aroya	−0. 30	−0. 27		59 04 39. 73	
Curtis	+0. 47	+0. 56	+0. 16	27 37 39. 60	1. 61
Estes	−0. 01	−0. 13		93 17 42. 28	
Lee	−0. 44	−0. 51		43 47 34. 91	
Aroya	+0. 15	+0. 18	+0. 03	60 01 52. 46	1. 06
Estes	+0. 32	+0. 36		76 10 33. 69	
Johnson	+0. 86	+0. 81		29 49 06. 21	
Aroya	+0. 57	+0. 62	+1. 36	103 31 34. 26	1. 24
Estes	−0. 07	−0. 07		46 39 20. 77	
Johnson	+0. 55	+0. 53		65 16 40. 10	
Aroya	+0. 42	+0. 44	+1. 73	43 29 41. 80	1. 24
Lee	+0. 76	+0. 76		71 13 39. 34	
Johnson	−0. 31	−0. 28		35 27 33. 89	
Estes	+0. 39	+0. 43	+0. 40	29 31 12. 92	1. 06
Lee	+0. 32	+0. 25		115 01 14. 25	
Hays	−0. 15	−0. 17		105 29 55. 98	
Johnson	+0. 13	+0. 15	−0. 76	40 09 33. 44	0. 37
Lee	−0. 74	−0. 74		34 20 30. 95	
Sist	+0. 51	+0. 50		13 35 49. 16	
Johnson	−0. 43	−0. 40	+0. 35	27 08 19. 17	0. 43
Hays	+0. 27	+0. 25		139 15 52. 10	
Sist	−0. 12	−0. 17		36 40 07. 55	
Johnson	−0. 30	−0. 25	−0. 54	67 17 52. 61	1. 48
Lee	−0. 12	−0. 12		76 02 01. 32	
Sist	−0. 63	−0. 67		23 04 18. 39	
Hays	−0. 12	−0. 08	−0. 13	115 14 11. 92	0. 68
Lee	+0. 62	+0. 62		41 41 30. 37	
Ingle	−0. 20	−0. 21		25 26 34. 80	
Johnson	0. 00	+0. 02	−0. 75	84 24 58. 62	0. 74
Hays	−0. 55	−0. 56		70 08 27. 32	
Ingle	+0. 11	+0. 14		73 34 05. 79	
Johnson	+0. 43	+0. 43	+0. 92	57 16 39. 46	1. 73
Sist	+0. 38	+0. 35		49 09 16. 48	

Stanton base to Deming base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Ingle	+0. 31	+0. 36		48 07 31. 00	
Hays	+0. 82	+0. 81	+2. 02	69 07 24. 78	1. 42
Sist	+0. 89	+0. 85		62 45 05. 64	
Round	+1. 07	+1. 05		45 11 40. 15	
Ingle	+0. 41	+0. 42	+1. 20	83 33 57. 03	2. 19
Sist	−0. 28	−0. 27		51 14 25. 01	
Toyah	+0. 70	+0. 66		32 21 26. 64	
Round	+0. 58	+0. 68	+1. 17	104 09 47. 05	3. 03
Ingle	−0. 11	−0. 17		43 28 49. 34	
Toyah	+0. 13	+0. 07		60 03 59. 05	
Round	−0. 49	−0. 37	+0. 03	58 58 06. 90	3. 42
Sist	+0. 39	+0. 33		60 57 57. 47	
Toyah	−0. 57	−0. 59		27 42 32. 41	
Ingle	+0. 52	+0. 59	+0. 06	40 05 07. 69	2. 58
Sist	+0. 11	+0. 06		112 12 22. 48	
Seay	+0. 20	+0. 24		55 47 21. 28	
Round	+0. 15	+0. 08	+0. 58	65 37 34. 77	3. 77
Toyah	+0. 23	+0. 26		58 35 07. 72	
Newman	−0. 23	−0. 26		46 24 48. 89	
Seay	+0. 21	+0. 38	+0. 10	97 01 29. 91	3. 49
Round	+0. 12	−0. 02		36 33 44. 69	
Newman	+0. 04	+0. 04		88 23 26. 02	
Seay	+0. 01	+0. 15	−0. 51	41 14 08. 64	2. 47
Toyah	−0. 56	−0. 70		50 22 27. 81	
Newman	+0. 27	+0. 30		41 58 37. 13	
Round	+0. 03	+0. 10	−0. 03	29 03 50. 08	2. 75
Toyah	−0. 33	−0. 43		108 57 35. 54	
Reynolds	−0. 66	−0. 62		73 32 15. 65	
Seay	−0. 53	−0. 55	−1. 96	80 22 51. 79	1. 31
Newman	−0. 77	−0. 79		26 04 53. 87	
Krouse	−0. 58	−0. 48		40 26 41. 15	
Seay	+0. 08	+0. 05	−0. 60	14 10 27. 23	0. 19
Reynolds	−0. 10	−0. 17		125 22 51. 81	
Krouse	−0. 32	−0. 24		56 40 05. 30	
Seay	−0. 45	−0. 49	−0. 60	94 33 19. 03	1. 66
Newman	+0. 17	+0. 13		28 46 37. 33	
Krouse	+0. 26	+0. 24		16 13 24. 15	
Reynolds	+0. 76	+0. 79	+1. 96	161 04 52. 54	0. 16
Newman	+0. 94	+0. 93		2 41 43. 47	
Chispa	−0. 30	−0. 29		6 03 48. 00	
Krouse	+0. 19	+0. 26	+0. 55	104 21 12. 48	0. 74
Reynolds	+0. 66	+0. 58		69 34 60. 26	

Stanton base Deming base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	//	//	//	° ′ //	//
Chispa	−0. 53	−0. 40		38 33 02. 30	
Krouse	−0. 06	+0. 02	−0. 95	88 07 48. 33	5. 29
Newman	−0. 36	−0. 57		53 19 14. 66	
Chispa	−0. 23	−0. 10		32 29 14. 31	
Reynolds	+0. 11	+0. 21	+0. 46	91 29 52. 28	4. 71
Newman	+0. 58	+0. 35		56 00 58. 12	
Diablo	+0. 81	+0. 93		66 31 45. 33	
Krouse	+0. 68	+0. 57	+2. 34	58 13 40. 62	5. 19
Chispa	+0. 85	+0. 84		55 14 39. 24	
Eagle	−0. 34	−0. 40		35 31 03. 34	
Diablo	+0. 17	+0. 43	+0. 61	118 40 25. 27	3. 60
Krouse	+0. 78	+0. 58		25 48 34. 99	
Eagle	−0. 47	−0. 35		82 01 41. 47	
Diablo	−0. 64	−0. 50	−1. 68	52 08 39. 95	3. 35
Chispa	−0. 57	−0. 83		45 49 41. 93	
Eagle	−0. 13	+0. 05		46 30 38. 14	
Krouse	−0. 10	−0. 01	+0. 05	32 25 05. 63	4. 94
Chispa	+0. 28	+0. 01		101 04 21. 17	
Quitman	+0. 43	+0. 73		38 22 31. 91	
Diablo	+0. 40	+0. 44	+1. 46	56 34 44. 19	4. 11
Eagle	+0. 63	+0. 29		85 02 48. 01	
Black	−0. 03	+0. 19		23 27 41. 13	
Diablo	+0. 36	+0. 35	+0. 78	123 51 34. 85	3. 46
Eagle	+0. 45	+0. 24		32 40 47. 48	
Black	+0. 45	+0. 79		63 33 05. 13	
Diablo	−0. 04	−0. 09	+0. 30	67 16 50. 67	6. 16
Quitman	−0. 11	−0. 40		49 10 10. 36	
Black	+0. 48	+0. 60		40 05 24. 00	
Eagle	+0. 18	+0. 05	+0. 98	52 21 60. 54	6. 81
Quitman	+0. 32	+0. 33		87 32 42. 27	
Corduna	−0. 67	−0. 46		33 46 32. 80	
Black	+0. 15	+0. 13	−0. 61	109 58 33. 21	8. 39
Quitman	−0. 09	−0. 28		36 14 62. 38	
North Franklin	−0. 03	−0. 21		24 17 05. 59	
Corduna	+0. 64	+0. 93	+2. 11	116 45 54. 03	12. 96
Black	+1. 50	+1. 39		38 57 13. 34	
North Franklin	+0. 53	+0. 49		49 46 13. 40	
Corduna	+1. 31	+1. 39	+1. 82	82 59 21. 23	22. 89
Quitman	−0. 02	−0. 06		47 14 48. 26	
North Franklin	+0. 56	+0. 70		25 29 07. 81	
Black	−1. 35	−1. 26	−0. 90	71 01 19. 87	18. 32
Quitman	−0. 11	−0. 34		83 29 50. 64	

Stanton base to Deming base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	"	"	"	° ′ ″	"
Jarilla	−0. 18	−0. 06		86 54 59. 58	
Corduna	−0. 09	−0. 11	−0. 48	44 41 39. 21	11. 68
North Franklin	−0. 21	−0. 31		48 23 32. 89	
Kent	−0. 26	−0. 35		11 19 38. 82	
Jarilla	+0. 38	+0. 52	+0. 94	162 44 08. 79	1. 94
Corduna	+0. 82	+0. 77		5 56 14. 33	
Kent	+0. 03	+0. 07		72 00 28. 86	
Jarilla	+0. 56	+0. 58	+0. 60	75 49 09. 21	5. 97
North Franklin	+0. 01	−0. 05		32 10 27. 90	
Kent	+0. 29	+0. 42		60 40 50. 04	
Corduna	−0. 91	−0. 87	−0. 82	38 45 24. 89	15. 71
North Franklin	−0. 20	−0. 37		80 33 60. 78	
Florida	+0. 04	−0. 03		34 25 08. 95	
Kent	+0. 42	+0. 61	+0. 52	67 34 64. 38	18. 29
North Franklin	+0. 06	−0. 06		77 59 64. 96	
Cooks	+0. 53	+0. 51		29 29 55. 67	
Kent	+0. 16	+0. 30	+1. 03	91 03 17. 62	19. 99
North Franklin	+0. 34	+0. 22		59 27 06. 70	
Cooks	−0. 27	+0. 05		76 48 09. 40	
Kent	−0. 26	−0. 30	−1. 32	23 28 13. 25	13. 78
Florida	−0. 79	−1. 07		79 43 51. 13	
Cooks	−0. 79	−0. 46		47 18 13. 73	
North Franklin	−0. 29	−0. 28	−1. 83	18 32 58. 26	12. 08
Florida	−0. 75	−1. 09		114 08 60. 09	
Hermanas	+0. 72	+0. 48		70 57 62. 38	
Cooks	−0. 62	−0. 34	+0. 12	73 28 24. 86	27. 81
North Franklin	+0. 02	−0. 02		35 33 60. 57	
Hermanas	+0. 21	+0. 13		44 00 55. 40	
Florida	−0. 05	+0. 09	+0. 47	118 58 13. 57	11. 27
North Franklin	+0. 31	+0. 25		17 00 62. 30	
Red	+0. 10	−0. 03		53 15 10. 63	
Deming N. base	−0. 36	−0. 34	−0. 93	81 33 11. 20	0. 54
Deming S. base	−0. 67	−0. 56		45 11 38. 71	
Florida	+0. 06	−0. 07		44 20 20. 88	
Deming S. base	+0. 14	+0. 34	+0. 34	85 03 07. 48	1. 03
Red	+0. 14	+0. 07		50 36 32. 67	
Florida	+0. 27	+0. 08		47 00 40. 02	
Deming S. base	+0. 81	+0. 90	+1. 91	39 51 28. 77	0. 54
Deming N. base	+0. 83	+0. 93		93 07 51. 75	
Florida	+0. 22	+0. 15		2 40 19. 14	
Red	−0. 04	−0. 11	+0. 64	2 38 37. 95	0. 05
Deming N. base	+0. 46	+0. 60		174 41 02. 96	

Stanton base to Deming base—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Cooks	+0.65	+0.62		15 17 50.64	
Florida	+0.26	+0.46	+0.99	51 29 28.14	1.28
Deming N. base	+0.08	−0.09		113 12 42.50	
Cooks	+0.50	+0.35		35 12 23.24	
Florida	+0.48	+0.61	+0.73	54 09 47.28	2.68
Red	−0.25	−0.23		90 37 52.16	
Cooks	−0.15	−0.27		19 54 32.60	
Deming N. base	−0.54	−0.51	−0.90	72 06 14.54	1.35
Red	−0.21	−0.12		87 59 14.21	
Hermanas	−0.34	−0.43		7 31 24.28	
Red	+0.19	+0.38	+0.18	163 26 24.90	1.29
Cooks	+0.33	+0.23		9 02 12.11	
Cooks	+0.33	+0.24		22 31 61.43	
Florida	+0.54	+0.53	+0.75	98 30 08.15	2.53
Deming S. base	−0.12	−0.02		58 57 52.95	
Cooks	−0.32	−0.38		7 14 10.79	
Deming N. base	−0.90	−0.85	−2.15	153 39 25.74	0.71
Deming S. base	−0.93	−0.92		19 06 24.18	
Cooks	+0.17	+0.11		12 40 21.81	
Deming S. base	+0.26	+0.36	+0.32	26 05 14.53	1.18
Red	−0.11	−0.15		141 14 24.84	
Hermanas	+0.97	+0.98		6 48 36.30	
Cooks	−0.16	−0.12	+1.29	3 38 09.70	0.74
Deming S. base	+0.48	+0.43		169 33 14.74	
Hermanas	+0.63	+0.54		14 19 60.57	
Red	+0.30	+0.53	+1.15	22 11 60.06	0.85
Deming S. base	+0.22	+0.08		143 27 60.22	
Hermanas	+0.17	−0.08		34 28 31.26	
Red	+0.44	+0.61	+0.93	72 48 32.74	3.07
Florida	+0.32	+0.40		72 42 59.07	
Hermanas	+0.51	+0.35		26 57 06.98	
Cooks	+0.17	+0.12	+1.48	26 10 11.13	4.46
Florida	+0.80	+1.01		126 52 46.35	
Hermanas	−0.46	−0.62		20 08 30.69	
Deming S. base	−0.37	−0.41	−0.56	131 28 52.31	1.19
Florida	+0.27	+0.47		28 22 38.19	

Deming base net to San Jacinto–Cuyamaca.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Burro	−0. 01	−0. 05		57 10 20. 43	
Cooks	+0. 69	+1. 00	+0. 43	81 16 55. 33	13. 92
Hermanas	−0. 25	−0. 52		41 32 58. 16	
Chiricahua	−0. 57	−0. 88		17 54 42. 67	
Burro	+0. 27	+0. 67	+0. 69	130 23 27. 10	14. 47
Cooks	+0. 99	+0. 90		31 41 64. 70	
Chiricahua	−0. 08	−0. 56		48 08 39. 67	
Burro	+0. 28	+0. 72	−0. 04	73 12 66. 67	27. 11
Hermanas	−0. 24	−0. 20		58 38 40. 77	
Chiricahua	+0. 49	+0. 32		30 13 57. 00	
Cooks	−0. 30	+0. 11	−0. 30	49 34 50. 64	26. 56
Hermanas	−0. 49	−0. 73		100 11 38. 92	
Line (U. S. G. S.)	+0. 43	+0. 54		75 30 48. 29	
Burro	−0. 18	−0. 19	+0. 68	73 22 43. 83	16. 60
Chiricahua	+0. 43	+0. 33		31 06 44. 48	
Graham (U. S. G. S.)	+0. 16	+0. 04		16 32 43. 83	
Line (U. S. G. S.)	−0. 23	+0. 06	−0. 15	140 12 15. 58	8. 20
Burro	−0. 08	−0. 25		23 15 08. 79	
Graham (U. S. G. S.)	−0. 25	−0. 29		70 30 30. 87	
Line (U. S. G. S.)	−0. 65	−0. 48	−1. 20	64 41 27. 29	21. 49
Chiricahua	−0. 30	−0. 43		44 48 23. 33	
Graham (U. S. G. S.)	−0. 41	−0. 32		53 57 47. 05	
Burro	−0. 10	+0. 05	−0. 37	50 07 35. 03	29. 89
Chiricahua	+0. 14	−0. 10		75 54 67. 81	
Catalina	−0. 88	−1. 13		42 15 53. 78	
Graham (U. S. G. S.)	−0. 11	+0. 36	−1. 29	103 01 55. 05	24. 12
Chiricahua	−0. 30	−0. 52		34 42 35. 29	
Baldy (U. S. G. S.)	−0. 75	−1. 03		35 26 09. 93	
Catalina	−0. 92	−0. 56	−1. 63	112 34 09. 42	17. 69
Graham (U. S. G. S.)	+0. 04	−0. 04		31 59 58. 34	
Baldy (U. S. G. S.)	−0. 88	−1. 45		78 10 47. 38	
Catalina	−0. 04	+0. 57	−0. 57	70 18 15. 64	30. 86
Chiricahua	+0. 35	+0. 31		31 31 27. 84	
Baldy (U. S. G. S.)	−0. 13	−0. 42		42 44 37. 45	
Graham (U. S. G. S.)	−0. 15	+0. 40	−0. 23	71 01 56. 71	37. 29
Chiricahua	+0. 05	−0. 21		66 13 63. 13	
Table	0. 00	+0. 10		28 54 27. 92	
Catalina	+0. 37	+0. 65	+1. 50	101 48 65. 38	26. 87
Baldy (U. S. G. S.)	+1. 13	+0. 75		49 16 53. 57	
Superstition (U. S. G. S.)	+0. 53	+0. 46		12 48 46. 60	
Catalina	+1. 24	+1. 77	+3. 01	148 12 49. 41	13. 52
Baldy (U. S. G. S.)	+1. 24	+0. 78		18 58 37. 51	

Deming base net to San Jacinto-Cuyamaca—Continued.

Stations	Corrections to angles—		Error of closure of triangle	Corrected spherical angles	Spherical excess
	From figure adjustment	Total, which includes that due to the introduction of latitude, longitude, and azimuth equations			
	″	″	″	° ′ ″	″
Superstition (U. S. G. S.)	+0. 23	+0. 66		71 16 21. 91	
Catilina	+0. 87	+1. 11	+1. 22	46 23 44. 02	29. 14
Table	+0. 12	−0. 55		62 20 23. 21	
Superstition (U. S. G. S.)	−0. 30	+0. 20		58 27 35. 31	
Baldy (U. S. G. S.)	−0. 11	−0. 03	−0. 29	30 18 16. 06	42. 49
Table	+0. 12	−0. 46		91 14 51. 12	
Whitetank	+0. 24	+0. 07		56 56 43. 01	
Superstition (U. S. G. S.)	+0. 46	+1. 06	+0. 77	56 25 16. 65	22. 96
Table	+0. 07	−0. 36		66 38 23. 30	
Maricopa	+0. 06	−0. 56		61 29 45. 84	
Whitetank	+0. 16	+0. 64	+0. 32	70 40 59. 79	24. 02
Superstition (U. S. G. S.)	+0. 10	+0. 24		47 49 38. 39	
Maricopa	+0. 35	−0. 29		100 03 13. 92	
Whitetank	−0. 08	+0. 27	+0. 48	13 44 16. 78	5. 48
Table	+0. 12	+0. 50		66 12 34. 78	
Maricopa	+0. 29	+0. 27		38 33 28. 08	
Superstition (U.S.G.S.)	+0. 36	+0. 82	+0. 93	8 35 38. 26	4. 42
Table	+0. 28	−0. 16		132 50 58. 08	
Mohawk	−0. 09	−0. 31		38 08 63. 64	
Whitetank	+0. 15	+0. 79	+0. 08	53 57 48. 41	28. 08
Maricopa	+0. 02	−0. 40		87 53 36. 03	
Harquahalla	−0. 14	−0. 21		32 06 62. 34	
Whitetank	−0. 09	+0. 44	−0. 52	121 03 63. 72	15. 60
Maricopa	−0. 29	−0. 75		26 49 09. 54	
Harquahalla	−0. 39	+0. 30		81 38 15. 40	
Whitetank	−0. 21	−0. 35	−0. 49	67 06 15. 31	27. 15
Mohawk	+0. 11	−0. 44		31 15 56. 44	
Harquahalla	−0. 25	+0. 51		49 31 13. 06	
Maricopa	+0. 31	+0. 35	+0. 11	61 04 26. 49	39. 63
Mohawk	+0. 05	−0. 75		69 24 60. 08	
Kofa	+0. 21	+0. 26		100 54 38. 78	
Harquahalla	+0. 63	+0. 94	+0. 53	42 07 30. 97	20. 01
Mohawk	−0. 31	−0. 67		36 58 10. 26	
American (U. S. G. S.)	0. 00	−0. 51		57 33 37. 60	
Kofa	+0. 11	+1. 13	+0. 47	74 06 54. 37	19. 35
Mohawk	+0. 36	−0. 15		48 19 47. 38	
Powell	+0. 17	+0. 65		39 28 25. 19	
Harquahalla	−0. 48	−0. 39	−0. 40	82 49 63. 83	24. 10
Kofa	−0. 09	−0. 66		57 41 55. 08	

Deming base net to San Jacinto-Cuyamaca—Continued.

Stations	Corrections to angles— From figure adjustment	Corrections to angles— Total, which includes that due to the introduction of latitude, longitude, and azimuth equations	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	″	° ′ ″	″
Butte	+0. 17	+0. 05		56 31 55. 51	
Powell	−0. 45	+0. 16	−0. 35	48 50 61. 40	38. 73
Kofa	−0. 07	−0. 56		74 37 41. 82	
Butte	−0. 25	+0. 32		44 05 51. 42	
Kofa	−0. 16	−0. 17	−0. 40	52 38 49. 95	20. 20
American (U. S. G. S.)	+0. 01	−0. 55		83 15 38. 83	
Cuyamaca	−1. 06	−1. 26		33 12 15. 40	
Butte	−0. 56	+0. 28	−2. 08	95 40 29. 90	32. 87
American (U. S. G. S.)	−0. 46	−1. 10		51 07 47. 57	
San Jacinto	−0. 40	−0. 30		17 39 49. 27	
Butte	−0. 08	+0. 59	−0. 70	138 35 30. 23	20. 40
American (U. S. G. S.)	−0. 23	−0. 99		23 44 60. 90	
San Jacinto	−0. 26	+2. 14		73 32 20. 69	
Butte	+0. 49	+0. 31	+0. 73	42 54 60. 33	29. 85
Cuyamaca	+0. 50	−1. 72		63 33 08. 83	
San Jacinto	+0. 14	+2. 43		55 52 31. 41	
American (U. S. G. S.)	−0. 23	−0. 11	−0. 65	27 22 46. 67	42. 32
Cuyamaca	−0. 56	−2. 97		96 45 24. 24	

The maximum correction (−1″.73) to any angle (in the second column) is to the angle at Smith between the stations Douro and Dublin.

The statistics as to closures of triangles and the mean error of an angle for the seasons and sections of the Texas-California arc are given in the two following tables. The mean error of an angle $a=\sqrt{\frac{\Sigma\Delta^2}{3n}}$, in which $\Sigma\Delta^2$ is the sum of the squares of the closing errors of the triangle and n is the number of triangles in the season's work or in the section.

Season	Number of triangles — Total	Number of triangles — With plus closures	Number of triangles — With minus closures	Average closure	Maximum closure	Mean error of an angle
				″	″	″
Kyle-McClenny to Sist-Ingle, 1908–9	99	50	49	0. 95	+3. 11	±0. 70
Sist-Ingle to Deming base net, 1909–10	53	35	28	0. 89	+2. 34	±0. 61
Deming base net to San Jacinto-Cuyamaca, 1910–11	31	14	17	0. 74	+3. 01	±0. 56

Section	Number of triangles			Average closure	Maximum closure	Mean error of an angle
	Total	With plus closures	With minus closures			
				″	″	″
Kyle-McClenny to Stanton base	62	28	34	1.02	+3.11	±0.71
Stanton base to Deming base	72	44	28	0.87	−2.91	±0.64
Deming base net to San Jacinto-Cuyamaca	49	27	22	0.77	+3.01	±0.57
Sums and means for the three sections (by sections)	183	99	84	0.89	+3.11	±0.64

The last two seasons have smaller average closing errors of a triangle and smaller mean errors of an angle than the first season's triangulation, and confirm the evidence furnished by the probable error of an observed direction (see p. 42) that a mountainous region is more favorable to accuracy in triangulation.

The average closing error of a triangle for the 183 triangles of the Texas-California arc is 0″.90. This average closing error indicates that the methods employed on the field and the number of observations made on each direction give greater accuracy than that called for by the instructions. There are only two triangles with closing errors greater than 3″.00. It does not appear advisable to cut down the number of observations at least in the near future or on long arcs. A decrease in the number of positions of the circle from 16 to 12 would materially increase the average closing error of the triangles and would also increase the number of triangles for which the closing errors are greater than 3″. For all geographic purposes an average accuracy greater than that now obtained is not necessary, while with frequent Laplace[1] or twist stations to insure true geodetic azimuths, the accuracy attained is believed to be sufficient for all geodetic purposes.

To obtain greater accuracy would undoubtedly require a greater expenditure of time, and the cost of the triangulation would be greatly increased. It is believed that it is more important to accomplish the maximum amount of work of a reasonable accuracy rather than a smaller amount at a greater accuracy. That portion of the general instruction for primary triangulation bearing on this subject states that "In selecting the conditions under which to observe primary directions, proceed upon the assumption that the maximum speed consistent with the requirement that the closing error of a single triangle in the primary scheme shall seldom exceed three seconds, and that the average closing error shall be but little greater than one second, is what is desired rather than a greater accuracy than that indicated with slower progress."

Although the party on the Texas-California arc of primary triangulation was not striving for extreme accuracy at the expense of progress, yet the average accuracy of the results as shown by the triangle closures (see also the comparison of probable errors of an observed direction, p. 63) is greater than that for the other great arcs of the United States, the transcontinental triangulation, the eastern oblique arc, and the ninety-eighth meridian.

[1] See the Supplemental Investigation in 1909 of the Figure of the Earth and Isostasy, p. 17.

The comparisons of the average closing errors are given below:

Arc	Average closing error
	"
Transcontinental triangulation	1.06
Eastern oblique arc	1.19
Ninety-eighth meridian	0.92
Texas-California arc	0.90

No attempt has been made here to set forth the agreement of the separate measures of each direction as a criterion of accuracy, since it is well known that it is of little value for that purpose. A close agreement of the separate measures of a given direction is of little consequence, since such measures are usually subject to constant errors of considerable size, which become evident as soon as the closure of the triangles are studied or an attempt is made to adjust a figure.

ACCORD OF BASES.

There are five bases which serve to fix the length in the triangulation discussed here.

The Bowie and the Stephenville bases were adjusted in the ninety-eighth meridian triangulation, which fixed the length of the line Kyle-McClenny. The Los Angeles base, in the California triangulation, fixed the length of the line San Jacinto-Cuyamaca. The Stanton and Deming bases furnish three valuable tests of the accuracy of the triangulation, dividing it, as they do, into three parts.

In solving the normal equations in each section of the figure adjustment the length equation was, as usual, assigned to the last place, so that after all the conditions relating to triangle closures and ratios of length had been satisfied the discrepancy in length became known. In the following table the discrepancies developed between bases are given in terms of the seventh place of logarithms and are also expressed as ratios. A plus sign before the discrepancy expressed in terms of logarithms means that the first base mentioned is longer as measured than as computed through the intervening triangulation from the second base mentioned.

Bases	Discrepancy in seventh place of logarithms	Discrepancy expressed as a ratio
Bowie-Stephenville (ninety-eighth meridian)	−77	1/56000
Kyle-McClenny to Stanton	−11	1/395000
Stanton to Deming	−59	1/74000
Deming to San Jacinto-Cuyamaca	+72	1/60000

ACCORD OF AZIMUTHS.

Laplace azimuths were computed at two stations of this triangulation, viz, at Stanton and Jarilla. While it was reasonably certain that the Laplace azimuth at both of these stations was more accurate than the geodetic azimuth computed through the triangulation, it was also known that the United States Standard azimuth at the ninety-eighth meridian required a considerable correction to reduce to Laplace or true geodetic azimuth. The nearest station at the eastern end is Bowie NW. base, where the correction to the United States Standard value is $-6''.85$.[1] After the preliminary adjustment had been made, so that all the conditions relating to triangle closures and ratios of length had been satisfied the correction to this United States Standard value at Stanton was $-4''.62$, at Jarilla $-2''.24$, and projecting this azimuth into the fixed triangulation of southern California the correction necessary at the San Diego Laplace station would be $-1''.28$.

The loop closure in azimuth was $7''.49$, the value from the east being the smaller. The same reasons which made it advisable to distribute the entire discrepancy in latitude and longitude in this small section of 1 200 miles made it also imperative to distribute the seven and a half seconds of azimuth accumulated in a loop of 3 300 miles in this small section. After this had been done the corrections to reduce the United States Standard azimuths to Laplace azimuths were reduced from $-4''.62$, at Stanton, to $-0''.95$ and from $-2''.24$, at Jarilla, to $+0''.48$. It is evident, therefore, that although this seven and a half seconds of azimuth was distributed through the whole arc between the ninety-eighth meridian and the California triangulation only the portion west of Jarilla was much affected. At two additional Laplace stations of the United States and Mexico Boundary Survey at Nogales and Yuma azimuths were computed which were considered nearly as good as the geodetic azimuth computed through the triangulation. The corrections to the final United States Standard values at these two stations are $+1''.4$ at Nogales and $-3''.5$ at Yuma. The United States Standard azimuth, therefore, agrees very closely with the Laplace or geodetic azimuth throughout the entire length of this scheme.

STUDY OF ERRORS.

While the primary triangulation done by the Coast and Geodetic Survey is sufficiently accurate for geographic and geodetic purposes, at the same time it is well to search for the causes of the larger errors and to try to eliminate them, if possible without an increase in the time and cost of the triangulation. Or, if the causes of the largest errors can be found and removed, it might be possible to obtain the present accuracy with fewer observations over each direction in the scheme of triangulation. It is known to all observers of experience that large errors are likely to occur in observations made on a heliotrope before the late afternoon, when the wind makes the support of the instrument vibrate badly and when a line passes close to a steep slope or a factory or heated stack. There must be other more obscure sources of error. In the text below there are given data with reference to the accuracy of observations made over lines of different degrees of clearness and also the relative accuracy of observations made during the day on heliotropes and at night on lamps and the relative

[1] See supplementary investigation in 1909 of the Figure of the Earth and Isostasy, p. 20.

accuracy of observations made during one observing period and during more than one observing period.

Beginning with the season of 1904 each observer on the northern portion of the ninety-eighth meridian triangulation and on the Texas-California arc kept a record, called the error book, in which he made notes of the weather conditions, the character of the line observed over, and the appearance of the object observed upon. For each period of observations of primary horizontal angles there were entered in the record the date, with the hour; the direction of the wind; the strength of the wind; the station observed; the intensity, size, and degree of steadiness of the image of the heliotrope or lamp; the character of the image, whether symmetrical or asymmetrical; and the character of the line, whether high, low, grazing, or clear only at night as a result of elevation by refraction. In a column of remarks notes were made regarding the condition of the atmosphere, whether clear, hazy, or smoky. It has been impossible for the author, in the limited time at his disposal for such work, to make an analysis of all the accumulated data.[1]

HIGH, LOW, GRAZING, AND REFRACTION LINES.

As considered in the Error Book,[2] a high line is one with its greater portion elevated well above the ground and obstructions. This usually occurs when the line crosses a depression or valley. A low line passes over a very flat country or just over ridges, trees, houses, or other obstructions. Grazing was the term employed to describe a line which was barely clear during the day. A refraction line was one which was clear only at night as a result of great refraction. A refraction line is, strictly speaking, a grazing line.

The section between El Paso, Tex., and the eastern end of the arc has lines which have various degrees of elevation. That portion of the arc to the westward of El Paso is in mountainous regions and all except a very few lines are classed as high. There are two directions over the Deming base, which is a refraction line, for which the corrections are 0''.57 and 0''.52. The average size of the corrections on 122 directions to the west of El Paso is 0''.21.

The following table gives certain data regarding the character of the lines to the east of El Paso, the percentage of lines which are high, low, and grazing and refraction and the average correction for the several classes of lines:

	Number	Percentage of all	Average correction to a direction
All lines	324	100	0''.26
High lines	250	77	0.25
Low lines	51	16	0.27
Grazing and refraction lines	23	7	0.27

The mean correction for the high lines is about 8 per cent smaller than for the low lines and the grazing and refraction lines.

[1] See also pp. 224 to 231 of Appendix 4, Report for 1911, Triangulation along the ninety-eighth meridian, Nebraska to Canada and connection with the Great Lakes.

[2] See Appendix 4, Report for 1911, p. 224.

The following table gives the number of large corrections for the triangulation east of El Paso, appearing on all the directions and on each of the three classes of lines:

	Corrections greater than 0″.34		Corrections greater than 0″.49	
	Number	Percentage of all	Number	Percentage of all
On all lines	90	100	43	100
On high lines	68	75	29	68
On low lines	15	17	10	23
On grazing and refraction lines	7	8	4	9

This table indicates that the corrections greater than 0″.34 are not more frequent proportionately on one character of line than on another, and that the corrections greater than 0″.49 occur less frequently proportionately on the high lines and they occur more frequently on the low, grazing and refraction lines. Only 16 per cent of the directions considered are classed as low and yet 23 per cent of the corrections greater than 0″.49 appear on such lines. Grazing and refraction directions appear to give slightly better results than the low directions. It is sufficient, owing to the small number of grazing and refraction directions under consideration, to assume that they are about equal in reliability to the low lines. It is significant, however, that the average correction to a direction in the mountainous section of the arc is only 0″.20 (leaving out the two directions on the Deming base) and of the 120 directions in that region (west of El Paso) only 22 have corrections greater than 0″.34 and only 9 greater than 0″.49. These make 18 and 7 per cent, respectively, of the directions considered. To the east of El Paso the percentages of the total corrections greater than 0″.34 and 0″.49 are, respectively, 28 and 13.

From the above considerations it appears that more accurate work can be done in a mountainous region than where the country is comparatively flat or rolling, and that in the latter kind of country the corrections on the lines classed as high are not materially smaller than on the low, grazing and refraction lines.

This matter of the character of the line and the sizes of the corrections was discussed in Appendix 4, Report for 1911. On page 227 of that publication it was stated that:

The evidence given above for high and low lines is so conflicting that no safe conclusions can be drawn from it.

The data for the grazing and refraction lines are also conflicting, doubtless due to the small number of directions involved.

It can not be said that the data for the Texas-California arc are conflicting and contradictory, but one should be very cautious in assuming that the relations between errors and the character of lines which obtained on one arc or group of stations will occur on any other arc of triangulation.

CORRECTIONS TO DIRECTIONS OBSERVED IN A SINGLE PERIOD AND IN TWO OR MORE PERIODS.

Beginning with the season of 1902 on the ninety-eighth meridian triangulation the observer began making all observations at a station in the shortest time practicable. At each of many stations of that arc all observations for primary horizontal directions were made in a single day. All of the observations for each of a number of directions were made in only one observing period. The observer on the Texas-California arc of primary triangulation followed the same plan.

On pages 228 to 230 of Appendix 4, Report for 1911, it is shown that the directions observed during only one observing period required on an average larger corrections than those directions which were observed in two or more observing periods. This increase was about 30 per cent.

In the Texas-California triangulation each of 132 directions was observed in only one period and the average correction to a direction from the figure adjustment is $0''.25$. Each of 320 directions were observed in two or more periods and the average correction is $0''.24$. The two average corrections are so nearly equal that so far as the results on this arc are concerned the one-period directions have the same accuracy as those directions observed in more than one period. Of the 53 corrections to directions of $0''.50$ or greater, 17 corrections, 32 per cent of all, were on directions which were observed in one period. As 29 per cent of the directions were observed in one period each, it appears that the one-period directions have a slightly greater proportion of the larger corrections.

As the accuracy obtained is well within that represented by an average closing error of a triangle of $1''$, it is not deemed advisable to have the observations on each direction extended over many periods if this would add to the cost of the triangulation and reduce the rate of progress. As most of the directions which were observed in more than one period were observed in only two periods, it appears from the evidence furnished that it would probably be necessary to greatly increase the number of observing periods to obtain a decided increase in accuracy.

ACCURACY OF DAY AND NIGHT OBSERVATIONS.

Much the greater portion of the observing was done at night. On this arc there were 24 primary directions on which all the observations were made during the day, and there were 159 directions on which all the observations were made at night. For each group of directions the average correction to a direction was $0''.25$. This would indicate that the day and night observations have equal accuracy. Owing to the limited number of directions observed in daylight only, the above evidence should not be considered as conclusive.

AN EXAMPLE OF GREAT LATERAL REFRACTION.

The line Clayton-Kennard, about 32 kilometers in length, passed very close to a steep slope of a flat top hill about 4 kilometers from Clayton. At Clayton 16 measures of the direction of this line were made during each of 5 observing periods. While the light at Kennard was very satisfactory during each period and the range of the separate measures was satisfactory and small, yet the means of the values for the direction for the several periods had an extreme range of $7''.7$. During most of the observations the wind was blowing from the hill across the line between the stations Clayton and Kennard, and the results gave excessive closing errors to the triangles involving this line. The observations made when the wind was blowing across the line toward the hill gave values for the direction which closed the triangles in a satisfactory manner. The latter observations were retained and the others were rejected. The figure adjustment gave a correction of $0''.70$ to the direction Clayton to Kennard, which shows that the selection was justified. The distance from the hill to Kennard was about 28 kilometers, and the line passing close to the slope would affect the direction from that station only a small amount. The correction to the direction Kennard-Clayton resulting from the figure adjustment was only 0″.04. No reoccupation of the station Clayton was necessary, for the trouble was discovered before the completion of the station, and an analysis of the observations at this and other stations showed that the difficulty was on the line to Kennard.

ACCURACY OF THE PRIMARY TRIANGULATION IN THE UNITED STATES.

In the following table, 62 sections of triangulation in the United States, for which the required tabular values can be conveniently obtained, have been arranged in the order of accuracy, the most accurate being placed first. The most severe and therefore the best test of accuracy is believed by the writer to be the quantity *d*, expressing the probable error of the observed direction as derived from the corrections to directions resulting from the figure adjustment; accordingly the various sections of triangulation have been placed in the order of the values of *d*. In the few cases in which *d* is the same to the nearest hundredth of the second for several sections the next column, *a*, has been used to decide their relative rank. The method of computing *d* and *a* has already been explained fully on pages 41 and 56.

Sections of triangulation in order of accuracy.

No.	Section.	Probable error of an observed direction $=d$	Mean error of an angle $=a$	Average closing error of a triangle.	Maximum correction to a direction.	Maximum closing error of a triangle.	Discrepancy between bases [1]
		″	″	″	″	″	
1	Nevada-California series	±0.23	±0.42	0.57	0.60	1.57	+83
2	Stephenville base net to Lampasas base	±0.23	±0.45	0.56	0.60	2.09	−47
3	Yolo base net	±0.24	±0.51	0.68	0.64	2.60	
4	Point Isabel base net	±0.25	±0.40	0.50	0.60	1.61	
5	Elliff-Nolan to Laguna Madre base	±0.25	±0.62	0.85	0.62	2.23	+73
6	Dauphin Island base net	±0.26	±0.51	0.83	0.49	1.25	
7	New England section	±0.26	±0.53	0.75	1.17	2.02	+[2]44
8	Meades Ranch-Waldo to Shelton base net	±0.27	±0.35	0.50	0.62	1.42	+75
9	DEMING BASE NET TO SAN JACINTO-CUYAMACA	±0.28	±0.57	0.77	0.80	3.01	+72
10	Shelton base net to Page base	±0.29	±0.44	0.60	0.87	1.77	−16
11	Olney base net	±0.29	±0.54	0.78	0.70	1.78	
12	Bowie base net to Stephenville base	±0.29	±0.63	0.90	0.70	2.50	−77
13	Eastern oblique art to Augusta	±0.30	±0.60	0.78	0.74	2.73	+85
14	Rocky Mountain series	±0.32	±0.57	0.84	0.80	2.31	
15	STANTON BASE TO DEMING BASE	±0.32	±0.64	0.87	0.72	2.91	−59
16	Salt Lake base net	±0.32	±0.66	0.81	0.84	3.18	
17	Shelton base net	±0.33	±0.45	0.80	0.88	2.07	
18	Stephen base net to Canada	±0.33	±0.61	0.84	0.78	2.38	−64
19	El Reno base to Bowie base	±0.33	±0.97	1.19	1.40	4.43	
20	Fire Island base net	±0.34	±0.49	0.70	1.43	1.43	−6
21	Illinois series	±0.34	±0.57	0.79	0.99	1.72	
22	Holton base net	±0.34	±0.58	0.79	0.84	2.28	−71
23	Indiana series	±0.34	±0.60	0.80	1.31	3.20	+2

[1] The discrepancy between bases in the last column of the table is expressed in terms of the seventh decimal place of logarithms. It is the discrepancy remaining after the angle and side equations have been satisfied. A plus sign before the discrepancy means that the first base mentioned is longer as measured than as computed through the intervening triangulation from the second base mentioned.

[2] There were 3 bases connected by this section, Epping, Massachusetts, and Fire Island. The 3 discrepancies were +44, +3, and +41.

Sections of triangulation in order of accuracy—Continued.

No.	Section.	Probable error of an observed direction $=d$	Mean error of an angle $=a$	Average closing error of a triangle.	Maximum correction to a direction.	Maximum closing error of a triangle.	Discrepancy between bases [1]
24	Atlanta base net to Dauphin Island base net, IV	±0.34	±0.63	0.85	0.93	2.19	
25	Fergus Falls to Stephen base	±0.34	±0.63	0.85	0.90	3.07	+ 24
26	Transcontinental triangulation to Anthony base	±0.35	±0.54	0.79	1.39	1.98	+ 41
27	Missouri-Kansas series	±0.35	±0.60	0.88	1.12	2.37	+169
28	Atlanta base net to Dauphin Island base net, V	±0.35	±0.68	0.97	1.12	2.87	+ 2
29	Anthony base net to El Reno base net	±0.36	±0.69	1.05	0.84	2.17	+ 7
30	Brown Valley base net to Royalton base	±0.36	±0.70	0.96	0.98	3.84	+ 98
31	Atlanta base net to Dauphin Island base net, III	±0.36	±0.77	1.10	0.84	2.69	+ 2
32	Royalton base net to Duluth	±0.36	±0.86	1.16	1.22	4.41	+ 80
33	KYLE-McCLENNY TO STANTON BASE	±0.37	±0.71	1.02	0.82	3.11	− 11
34	Versailles base net	±0.40	±0.64	0.90	0.95	2.71	
35	El Paso base net	±0.40	±0.68	0.94	0.93	2.60	
36	Seguin base net to Alice base	±0.41	±0.78	1.04	1.09	3.25	−144
37	Kent Island base net to Atlanta base net, I	±0.41	±0.88	1.14	1.48	3.60	
38	Yolo base net to Los Angeles base net	±0.41	±0.91	1.16	1.34	5.52	− 41
39	Kent Island base net	±0.41	±0.91	1.33	0.75	2.97	
40	Page base net to Brown Valley base	±0.42	±0.77	1.03	1.44	3.81	+ 65
41	Salina base net	±0.44	±0.75	1.13	1.11	2.37	
42	Los Angeles base net	±0.44	±0.91	1.39	1.22	3.09	
43	Lampasas base net to Seguin base	±0.45	±0.82	1.13	1.96	3.31	− 7
44	Ohio series	±0.45	±0.85	1.14	1.32	5.08	−24
45	Allegheny series	±0.45	±0.98	1.37	1.37	4.03	+11
46	Epping base net	±0.47	±0.63	0.90	1.25	2.63	
47	Fire Island base net to Kent Island base net	±0.47	±0.86	1.29	2.02	3.35	+46
48	St. Albans base net	±0.47	±1.04	1.38	1.53	4.94	
49	Kansas-Colorado series	±0.50	±0.75	1.00	1.43	3.92	−92
50	Los Angeles base net to Soledad-Cuyamaca	±0.50	±0.82	1.16	1.15	2.53	
51	Epping base net to Canadian boundary	±0.51	±0.74	1.15	1.12	2.09	
52	Dauphin Island westward, I	±0.53	±0.78	1.12	1.31	2.80	
53	Kent Island base net to Atlanta base net, III	±0.62	±0.78	1.66	1.72	4.03	
54	Atlanta base net	±0.65	±1.00	1.19	1.31	4.35	
55	Missouri series	±0.66	±0.81	1.09	1.89	4.64	+86
56	Atlanta base net to Dauphin Island base net, II	±0.67	±0.78	1.03	1.84	2.88	+ 2
57	Coast Range series	±0.67	±1.37	1.80	2.73	6.49	
58	Eastern Shore series	±0.72	±1.22	1.75	1.85	5.24	
59	Kent Island base net to Atlanta base net, II	±0.72	±1.31	1.80	2.05	4.64	+24
60	Dauphin Island base net to New Orleans	±0.78	±1.20	1.50	2.65	5.40	
61	Atlanta base net to Dauphin Island base net, I	±0.79	±0.97	1.35	2.19	3.44	+ 2
62	American Bottom base net	±0.82	±1.59	2.22	1.80	6.36	

Of the 62 sections of triangulation tabulated, the three sections of the Texas-California arc rank as numbers 9, 15, and 33. The mean value of d, 0".33, for the whole arc falls between sections 16 and 20 of the above list. The average accuracy of the Texas-California arc of primary triangulation is equal to that of the Ninety-eighth meridian triangulation. It is also equal to that of the better half of all the primary triangulation previously done by the Coast and Geodetic Survey in the United States.

EXPLANATION OF POSITIONS, LENGTHS, AND AZIMUTHS, AND OF THE UNITED STATES STANDARD DATUM.

The lengths, as already fully explained in connection with the adjustments, all depend upon the Bowie, Stephenville, Stanton, Deming, and Los Angeles bases. The lengths as given are all reduced to sea level. If the actual length of a line simply reduced to the horizontal is desired, it may be obtained with all the accuracy ordinarily needed by adding to the sea-level length as given a correction = (length of line as given) $\left[\frac{\text{mean elevation of the two ends of the line in meters}}{6370000}\right]$. The maximum value of this correction does not exceed $\frac{1}{2000}$ for the length of any portion of the triangulation here published. The maximum error made in the use of the above approximate formula for the correction does not exceed $\frac{1}{1000000}$ for the length of any portion of this triangulation.

The positions—that is, the latitudes, longitudes, and azimuths—need special explanation.

All of the positions and azimuths have been computed upon the Clarke spheroid of 1866, as expressed in meters, which has been in use in the Coast and Geodetic Survey for many years.

After a spheroid has been adopted and all the angles and lengths in a triangulation have been fully fixed, it is still necessary, before the computation of latitudes, longitudes, and azimuths can be made, to adopt a standard latitude and longitude for a specified station and a standard azimuth of a line from that station. For convenience, the adopted standard position (latitude and longitude) of a given station, together with the adopted standard azimuth of a line from that station, is called the geodetic datum.

The primary triangulation in the United States was commenced at various points and existed at first as a number of detached portions in each of which the geodetic datum was necessarily dependent only upon the astronomic stations connected with that particular portion. As examples of such detached portions of triangulation there may be mentioned the early triangulation in New England and along the Atlantic coast, a detached portion of the transcontinental triangulation centering on St. Louis and another portion of the same triangulation in the Rocky Mountain region, and three separate portions of triangulation in California in the latitude of San Francisco, in the vicinity of Santa Barbara Channel, and in the vicinity of San Diego. With the lapse of time these separate pieces have expanded until they have touched or overlapped.

The transcontinental triangulation, of which the office computation was completed in 1899, joins all of the detached portions mentioned and makes them one continuous triangulation. As soon as this took place the logical necessity existed of discarding the old geodetic data used in these various pieces and substituting one for the whole country, or at least for as much of the country as is covered by continuous triangulation. To do this is a very heavy piece of work and involved much preliminary study to determine the best datum to be adopted. On March 13, 1901, the superintendent adopted what is now known as the United States Standard Datum, and it was decided to reduce the positions to that datum as rapidly as possible. The datum adopted was that formerly in use in New England, and therefore its adoption did not affect the positions which had been used for geographic purposes in New England and along the

Atlantic coast to North Carolina, nor those in the States of New York, Pennsylvania, New Jersey, and Delaware. The adopted datum does not agree, however, with that used in The Transcontinental Triangulation and in The Eastern Oblique Arc of the United States, publications which deal primarily with the purely scientific problem of the determination of the figure of the earth and which were prepared for publication before the adoption of the new datum.

As the adoption of such a standard datum is a matter of considerable importance, it is in order here to explain the desirability of this step more fully.

The main objects to be attained by the geodetic operations of the Coast and Geodetic Survey are, first, the control of the charts published by the Survey; second, the furnishing of geographic positions (latitudes and longitudes), of accurately determined elevations, and of distances and azimuths, to officers connected with the Coast and Geodetic Survey and to other organizations; third, the determination of the figure of the earth. For the first and second objects it is not necessary that the reference spheroid should be accurately that which most closely fits the geoid within the area covered, nor that the adopted geodetic datum should be absolutely the best that can be derived from the astronomic observations at hand. It is simply desirable that the reference spheroid and the geodetic datum adopted shall be, if possible, such a close approximation to the truth that any correction which may hereafter be derived from the observations which are now or may become available shall not greatly exceed the probable errors of such corrections. It is, however, very desirable that one spheroid and one geodetic datum be used for the whole country. In fact, this is absolutely necessary if a geodetic survey is to perform fully the function of accurately coordinating all surveys within the area which it covers. This is the most important function of a geodetic survey. To perform this function it is also highly desirable that when a certain spheroid and geodetic datum have been adopted for a country they be rigidly adhered to, without change, for all time, unless shown to be largely in error.

In striving to attain the third object, the determination of the figure of the earth, the conditions are decidedly different. This problem concerns itself primarily with astronomic observations of latitude, longitude, and azimuth, and with the geodetic positions of the points at which the astronomic observations were made, but is not concerned with the geodetic positions of other points fixed by the triangulations. The geodetic positions (latitudes and longitudes) of comparatively few points are therefore concerned in this problem. However, in marked contrast to the statements made in preceding paragraphs, it is desirable in dealing with this problem that, with each new important accession of data, a new spheroid fitting the geoid with the greatest possible accuracy, and new values of the geodetic latitudes, longitudes, and azimuths of the highest degree of accuracy, should be derived.

The United States Standard Datum was adopted with reference to positions furnished for geographic purposes, but has no reference to the problem of the determination of the figure of the earth. It is adopted with reference to the engineer's problem of furnishing standard positions and does not affect the scientist's problem of the determination of the figure of the earth.

The principles which guided in the selection of the datum to be adopted were: First, that the adopted datum should not differ widely from the ideal datum for which the sum of the station errors in latitude, longitude, and azimuth should each be zero; second, it was desirable that the adopted datum should produce minimum changes in the publications of the Survey, including its charts; and, third, it was desirable, other things being equal, to adopt that datum which allowed the maximum number of positions already in the office registers to remain unchanged, and therefore necessitated a minimum amount of new computation. These considerations led to the adoption as the United States standard of the datum which had been in use for many years in the northeastern group of States and along the Atlantic coast as far as North Carolina.

An examination of the station errors available in 1903, on the United States Standard Datum, at 246 latitude stations, 76 longitude stations, and 152 azimuth stations, scattered widely over the United States from Maine to Louisiana and to California, indicated that this datum approaches closely the ideal with which the algebraic sum of the station errors of each class would be zero.[1]

The adopted United States Standard Datum, upon which the positions and azimuths given in this publication depend, may be defined in terms of the position of the station Meades Ranch as follows:

	°	′	″
ϕ =	39	13	26.686
λ =	98	32	30.506
α to Waldo =	75	28	14.52

Points are then said to be upon the United States Standard Datum when they are connected with the station Meades Ranch by a continuous triangulation, through which the corresponding latitudes, longitudes, and azimuths have been computed on the Clarke spheroid of 1866, as expressed in meters, starting from the above data.

The principal lists of geographic positions heretofore published on the United States Standard Datum throughout the whole United States are contained in the following publications of the Coast and Geodetic Survey and of other organizations:

Appendix 8 of the Report for 1885, positions in Massachusetts and Rhode Island; Appendix 8 of the Report for 1888, positions in Connecticut; Appendix 8 of the Report for 1893, positions in Pennsylvania, Delaware, and Maryland; Appendix 10 of the Report for 1894, positions in Massachusetts; Appendix 6 of the Report for 1901, positions in Kansas and Nebraska; Appendix 3 of the Report for 1902, positions in Kansas, Missouri, Nebraska, and Colorado; Appendix 4 of the Report for 1903, positions in Kansas, Oklahoma, and Texas; Appendix 9 of the Report for 1904, positions in California; Appendix 5 of the Report for 1905, positions in Texas; Appendix 3 of the Report for 1907, positions in California; Appendix 5 of the Report for 1910, positions in California; Appendix 4 of the Report for 1911, positions in Nebraska, Minnesota, North Dakota, and South Dakota; Appendix 5 of the Report for 1911, positions in Texas; Appendix 6 of the Report for 1911, positions in Florida; in Appendix EEE, pages 2905–3031, Annual Report of the Chief of Engineers, 1902, positions of points on or near the Great Lakes; in the publications of the Massachusetts Harbor and Land Commission; and in various bulletins of the United States Geological Survey.

[1] This is further borne out in the reduction of 765 astronomic stations in connection with the "Supplementary investigation in 1909 of the figure of the earth and isostasy," by J. F. Hayford, published by the Coast and Geodetic Survey.

TABLES OF POSITIONS.

In the tables of positions the latitude and longitude of each point are given on the United States Standard Datum (see p. 65), also the length and azimuth of each line observed over, whether in one or both ways. Along with the latitude and longitude of each point the lengths and azimuths are given of lines from that point to other points of the triangulation. No lengths or azimuths are repeated, and for a given line the length and azimuth will generally be found opposite the position of the last mentioned of the two stations involved.

For the convenience of the draftsman a column of "seconds in meters" is given, in which is placed the length (in meters) of each small arc of a meridian or parallel corresponding to the seconds of the given latitude or longitude. To facilitate further the use of the tables, a column is given of the logarithms of the lengths. It must be remembered that it is the logarithm which is derived first from the computation, the lengths given in this table being then derived from the corresponding logarithms.

The rule followed in recent publications of this Office has been to give latitudes and longitudes to thousandths of seconds for all points the positions of which are fixed by fully adjusted triangulation. Points, the positions of which are given to hundredths of seconds only, are marked by footnotes as being without check (observed from only two stations) or checked by verticals only.

In the columns giving azimuths, distances, and logarithms of distances, the accuracy is indicated to a certain extent by the number of decimal places given, it being understood that in each case two doubtful figures are given. In some cases there is very little doubt of the correctness of the second figure from the right, while in a few cases some doubt may be cast on the third figure from the right.

These tables may be conveniently consulted by using as finders the 9 sketches at the end of this appendix, and the index on pages 135 to 141. In the third column of the index will be found for each point a reference to the page on which its description is given, in the fourth column the number of the sketch on which it appears, and in the fifth column the page on which its elevation above sea level will be found.

For the convenience of those who wish to convert the distances given in this table or the elevations given later on from meters into feet the following conversion table is here inserted:

Meters	Feet	Feet	Meters
1	3.280833	1	0.3048006
2	6.561667	2	0.6096012
3	9.842500	3	0.9144018
4	13.123333	4	1.2192024
5	16.404167	5	1.5240030
6	19.685000	6	1.8288037
7	22.965833	7	2.1336043
8	26.246667	8	2.4384049
9	29.527500	9	2.7432055
10	32.808333	10	3.0480061

Kyle-McClenny to Stanton base.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Kyle	32 49 18.014	554.9					
1902	98 19 12.209	317.6					
McClenny	32 27 09.026	278.0	163 48 20.05	343 44 13.50	Kyle	42637.12	4.6297878
1902	98 11 35.060	915.8					
Lacasa	32 39 05.105	157.3	241 26 47.45	61 38 51.10	Kyle	39628.07	4.5980030
1908	98 41 30.374	791.6	295 04 56.17	115 21 02.17	McClenny	51773.87	4.7141106
Rattlesnake	32 21 43.991	1355.1	152 14 36.69	332 08 48.52	Lacasa	36255.88	4.5593785
1908	98 30 42.487	1110.7	199 24 27.04	19 30 38.87	Kyle	54036.81	4.7326897
			251 27 00.48	71 37 15.43	McClenny	31611.86	4.4998500
Pierce	32 30 55.837	1719.9	192 48 44.27	12 49 55.10	Lacasa	15456.77	4.1891187
1908	98 43 41.896	1093.5	309 47 59.29	129 54 57.36	Rattlesnake	26523.49	4.4236307
Hearn	32 15 21.163	651.9	210 08 43.64	30 14 26.91	Pierce	33309.47	4.5225677
1908	98 54 22.792	596.6	252 17 12.42	72 29 51.54	Rattlesnake	38981.82	4.5908621
Flat	32 29 48.746	1501.5	226 56 30.01	47 02 49.28	Lacasa	25126.38	4.4001299
1908	98 53 14.818	386.9	262 05 21.97	82 10 29.85	Pierce	15097.35	4.1789007
			3 48 32.85	183 47 56.45	Hearn	26782.94	4.4278582
Lamb	32 21 40.262	1240.2	225 54 16.57	45 59 35.82	Flat	21640.69	4.3352712
1908	99 03 10.155	265.5	310 12 21.23	130 17 03.09	Hearn	18074.46	4.2570653
Springgap	32 15 55.018	1694.7	235 47 22.30	56 00 19.36	Flat	45803.66	4.6609002
1908	99 17 25.765	674.3	244 31 21.47	64 38 58.84	Lamb	24779.82	4.3940981
			271 32 51.32	91 45 09.51	Hearn	36213.13	4.5588661
Hitson (U. S. G. S.)	32 28 36.120	1112.6	266 42 01.63	86 55 48.74	Flat	40268.79	4.6049686
1908	99 18 54.769	1430.1	297 21 32.04	117 29 58.45	Lamb	27807.55	4.4441627
			354 19 31.53	174 20 19.18	Springgap	23559.19	4.3721604
Clyde	32 24 44.979	1385.5	242 13 46.02	62 18 24.17	Hitson (U. S. G. S.)	15300.46	4.1847046
1908	99 27 33.236	868.5	315 44 00.79	135 49 25.74	Springgap	22778.37	4.3575227
Kennard	32 29 55.403	1706.6	277 47 29.32	97 53 34.10	Hitson (U. S. G. S.)	17898.75	4.2528228
1908	99 30 13.903	363.0	322 08 38.26	142 15 29.65	Springgap	32760.38	4.5153489
			336 17 36.92	156 19 03.15	Clyde	10442.31	4.0187964
Clayton	32 15 19.475	599.9	211 41 49.89	31 47 31.84	Kennard	31727.34	4.5014337
1908	99 40 52.481	1373.7	230 08 06.34	50 15 13.82	Clyde	27209.26	4.4347167
			268 11 33.36	88 24 04.22	Springgap	36835.95	4.5662719
Morrison	32 30 24.426	752.4	271 29 07.14	91 40 15.10	Kennard	32462.31	4.5113794
1908	99 50 56.988	1487.6	330 24 26.58	150 29 50.32	Clayton	32042.18	4.5057221
Buzzard	32 21 40.866	1258.8	212 47 41.64	32 51 15.22	Morrison	19191.46	4.2831079
1908	99 57 35.203	920.4	250 19 11.86	70 33 52.05	Kennard	45505.06	4.6580597
			294 03 02.02	114 11 57.95	Clayton	28742.08	4.4585182
Sears	32 33 30.799	948.7	287 52 31.35	107 58 37.07	Morrison	18651.96	4.2707245
1908	100 02 17.040	444.6	341 22 34.07	161 25 05.33	Buzzard	23073.70	4.3631173
Hale	32 25 56.192	1730.9	219 20 50.14	39 24 46.68	Sears	18116.73	4.2580799
1908	100 09 37.327	975.1	254 08 45.72	74 18 47.18	Morrison	30400.89	4.4828863
			292 34 08.48	112 40 35.38	Buzzard	20445.85	4.3106052
Boyd	32 27 20.721	638.3	239 48 22.81	59 55 07.07	Sears	22704.97	4.3561209
1908	100 14 49.278	1287.0	287 41 49.74	107 44 37.09	Hale	8554.46	3.9321927
Allen	32 35 30.547	940.9	277 57 49.31	98 06 48.44	Sears	26377.89	4.4212401
1908	100 18 58.391	1522.8	320 20 29.84	140 25 31.39	Hale	22966.89	4.3611023
			336 40 14.16	156 42 28.09	Boyd	16429.46	4.2156232
Patterson	32 30 24.944	768.4	246 25 23.70	66 32 49.83	Allen	23593.99	4.3728015
1909	100 32 47.594	1242.3	281 18 52.93	101 28 32.01	Boyd	28721.64	4.4582093
Lloyd	32 19 52.443	1615.4	165 25 50.98	345 24 06.97	Patterson	20131.50	4.3038761
1909	100 29 33.593	878.6	209 48 44.16	29 54 25.10	Allen	33319.82	4.5227027
			239 04 42.84	59 12 36.60	Boyd	26923.03	4.4301240
Bench	32 17 57.094	1758.7	184 28 21.05	4 28 58.04	Patterson	23106.44	4.3637330
1909	100 33 56.622	1481.5	242 40 07.68	62 42 28.29	Lloyd	7743.66	3.8889465
Wolf	32 28 17.209	530.1	258 08 06.64	78 14 33.75	Patterson	19222.99	4.2838209
1909	100 44 48.283	1260.8	302 58 24.27	123 06 34.42	Lloyd	28515.92	4.4550874
			318 13 36.84	138 19 25.88	Bench	25592.79	4.4081177

Kyle-McClenny to Stanton base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Bynum	32 19 15.921	490.4	234 58 43.73	55 06 52.72	Wolf	29102.69	4.4639331
1909	101 00 00.967	25.3	273 16 45.67	93 30 41.82	Bench	40995.08	4.6127318
Cuthbert	32 28 54.582	1681.3	272 22 58.89	92 32 10.02	Wolf	26825.66	4.4285504
1909	101 01 54.669	1427.4	294 39 39.17	114 54 38.09	Bench	48308.89	4.6840270
			350 31 37.18	170 32 38.11	Bynum	18070.39	4.2569675
Top	32 26 42.133	1297.8	259 22 53.73	79 30 23.71	Cuthbert	22270.38	4.3477276
1909	101 15 52.993	1384.3	298 50 31.53	118 59 01.42	Bynum	28428.40	4.4537524
Signal	32 11 44.424	1368.4	189 40 39.15	9 42 15.67	Top	28051.97	4.4479633
1909	101 18 53.522	1401.9	219 56 39.68	40 05 44.68	Cuthbert	41434.60	4.6173631
			244 47 00.22	64 57 04.71	Bynum	32744.38	4.5151368
Williams	32 11 25.135	774.2	211 05 28.04	31 11 16.82	Top	33000.87	4.5185254
1909	101 26 45.402	1189.3	267 12 46.98	87 16 58.38	Signal	12374.47	4.0925267
Evart	32 21 47.230	1454.8	247 28 04.98	67 35 35.37	Top	23767.95	4.3759916
1909	101 29 53.451	1397.5	317 01 32.78	137 07 25.21	Signal	25357.40	4.4041048
			345 34 57.71	165 36 38.13	Williams	19783.76	4.2963089
Stanton	32 07 33.087	1019.2	224 32 00.82	44 40 49.71	Evart	36954.44	4.5676666
1909	101 46 24.746	648.5	256 53 24.17	77 03 51.89	Williams	31718.73	4.5013158
Epley	32 16 32.417	998.5	254 26 08.50	74 38 04.90	Evart	36366.43	4.5607007
1909	101 52 13.415	351.1	283 11 50.28	103 25 25.27	Williams	41110.86	4.6139565
			331 10 33.34	151 13 39.14	Stanton	18956.95	4.2777685
Stanton south base	32 05 33.745	1039.4	189 38 48.66	9 39 58.85	Epley	20579.88	4.3134428
1909	101 54 25.195	660.6	253 41 45.18	73 46 00.55	Stanton	13121.55	4.1179852
Stanton north base	32 11 38.191	1176.4	228 49 22.99	48 52 54.28	Epley	13773.14	4.1390330
1909	101 58 49.549	1297.9	291 05 36.59	111 12 13.03	Stanton	20925.43	4.3206744
			328 17 54.93	148 20 15.58	Stanton south base	13191.34	4.1202889

Stanton base to Deming base.

Elkins	32 02 33.267	1024.7	192 28 50.14	12 30 05.55	Stanton N. base	17191.38	4.2353106
1909	102 01 11.387	298.7	242 24 58.65	62 28 34.31	Stanton S. base	12017.19	4.0798030
Dunn	32 09 08.284	255.2	252 50 06.06	72 55 10.68	Stanton N. base	15683.06	4.1954308
1909	102 08 21.624	566.7	286 42 36.83	106 50 01.59	Stanton S. base	22900.07	4.3598368
			317 07 54.59	137 11 43.20	Elkins	16592.25	4.2199052
Scar	31 56 14.562	448.5	187 03 25.30	7 04 25.03	Dunn	24013.83	4.3804614
1909	102 10 14.207	373.2	230 39 27.21	50 44 14.78	Elkins	18415.13	4.2651748
Morris	32 02 27.622	850.8	233 57 32.24	54 03 16.53	Dunn	20999.04	4.3221995
1909	102 19 09.578	251.3	269 34 06.25	89 43 38.27	Elkins	28288.74	4.4516136
			309 13 45.26	129 18 28.88	Scar	18153.75	4.2589663
Bates	31 58 11.043	340.1	179 19 33.64	359 19 31.76	Morris	7903.41	3.8978143
1909	102 19 06.034	158.4	284 22 01.88	104 26 43.34	Scar	14420.19	4.1589711
Odessa	31 51 48.208	1484.7	193 17 09.73	13 18 05.80	Bates	12116.16	4.0833651
1909	102 20 52.079	1369.0	243 52 25.89	63 58 02.97	Scar	18661.32	4.2709423
Smith	31 58 35.288	1086.8	242 18 24.75	62 23 00.54	Morris	15421.37	4.1881230
1909	102 27 49.901	1310.2	273 04 08.72	93 08 46.12	Bates	13775.06	4.1390936
			318 46 06.12	138 49 47.04	Odessa	16664.27	4.2217862
Dublin	31 51 53.672	1653.1	234 11 20.89	54 17 06.55	Smith	21165.78	4.3256343
1909	102 38 43.651	1147.5	270 15 49.49	90 25 15.18	Odessa	28169.22	4.4497748
Douro	31 42 28.536	878.9	145 39 51.13	325 35 52.79	Dublin	21087.58	4.3240268
1909	102 31 11.175	294.3	190 03 48.20	10 05 34.38	Smith	30242.73	4.4806210
			223 19 55.73	43 25 21.83	Odessa	23715.93	4.3750401
Curtis	31 36 31.953	984.1	176 08 35.62	356 07 57.31	Dublin	28453.19	4.4541311
1909	102 37 30.846	813.1	222 17 56.46	42 21 15.73	Douro	14854.87	4.1718688
Harris	31 42 33.556	1033.5	222 26 47.51	42 32 03.92	Dublin	23395.33	4.3691291
1909	102 48 44.309	1166.7	270 14 33.43	90 23 46.96	Douro	27730.84	4.4429630
			302 04 03.18	122 09 56.66	Curtis	20948.37	4.3211502

Stanton base to Deming base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Estes	31 29 50.428	1553.1	211 10 20.79	31 15 03.89	Harris	27481.20	4.4390356
1909	102 57 44.531	1175.1	248 47 22.18	68 57 57.29	Curtis	34316.77	4.5355064
Aroya	31 38 58.380	1798.0	253 07 04.43	73 14 21.50	Harris	22900.88	4.3598521
1909	103 02 36.554	963.1	276 22 27.28	96 35 36.89	Curtis	39936.46	4.6013696
			335 27 07.00	155 29 39.90	Estes	18550.07	4.2683455
Lee	31 27 29.871	920.0	215 24 00.01	35 28 59.46	Aroya	26027.95	4.4154399
1909	103 12 08.798	232.3	259 11 34.92	79 19 06.21	Estes	23220.54	4.3658723
Johnson	31 36 08.861	272.9	258 49 51.55	78 58 41.26	Aroya	27129.94	4.4334488
1909	103 19 26.730	704.7	288 38 57.76	108 50 19.13	Estes	36270.55	4.5595541
			324 06 31.65	144 10 20.67	Lee	19722.40	4.2949598
Hays	31 29 55.018	1694.4	184 15 48.06	4 16 05.10	Johnson	11545.85	4.0624260
1909	103 19 59.290	1564.7	289 45 44.04	109 49 49.72	Lee	13199.24	4.1205489
Sist	31 21 20.272	624.3	211 18 54.30	31 24 24.26	Johnson	32049.22	4.5058175
1909	103 29 58.617	1549.2	224 54 43.46	44 59 55.96	Hays	22402.37	4.3502940
			247 59 01.85	68 08 19.35	Lee	30466.85	4.4838275
Ingle	31 35 49.018	1509.7	268 32 41.46	88 41 03.73	Johnson	25276.83	4.4027226
1909	103 35 25.284	666.6	293 59 16.26	114 07 20.74	Hays	26747.56	4.4272841
			342 06 47.25	162 09 37.82	Sist	28111.10	4.4488779
Round	31 28 54.637	1682.7	245 31 26.35	65 40 44.28	Ingle	30895.49	4.4898951
1909	103 53 11.902	314.1	290 43 06.50	110 55 12.81	Sist	39371.41	4.5951809
Toyah	31 07 45.601	1404.4	169 43 32.87	349 41 13.40	Round	39722.47	4.5990362
1909	103 48 43.488	1152.2	202 04 59.51	22 11 54.94	Ingle	55972.88	4.7479777
			229 47 31.92	49 57 15.35	Sist	38929.82	4.5902824
Seay	31 16 15.406	474.5	235 07 44.76	55 18 48.17	Round	40992.67	4.6127062
1909	104 14 26.077	689.8	290 55 06.04	111 08 25.15	Toyah	43752.45	4.6410024
Newman	31 00 07.100	218.7	152 14 21.61	332 09 14.68	Seay	33712.56	4.5277917
1909	104 04 32.501	862.3	198 39 10.50	18 45 03.48	Round	56168.99	4.7494966
			240 37 47.63	60 45 57.34	Toyah	28851.06	4.4601618
Reynolds	31 11 09.916	305.4	232 28 06.27	52 32 06.47	Seay	15455.28	4.1890769
1909	104 22 09.379	248.3	306 00 21.92	126 09 27.74	Newman	34659.41	4.5398212
Krouse	31 12 05.529	170.3	246 36 44.23	66 42 33.72	Seay	19424.56	4.2883512
1909	104 25 40.020	1059.4	287 03 25.38	107 05 14.46	Reynolds	5833.92	3.7659608
			303 16 49.53	123 27 44.28	Newman	40222.69	4.6044711
Chispa	30 48 09.928	305.8	211 15 55.19	31 24 37.87	Krouse	51762.02	4.7140112
1909	104 42 34.783	924.7	217 19 43.19	37 30 14.20	Reynolds	53507.60	4.7284155
			249 48 57.49	70 08 29.62	Newman	64507.87	4.8096126
Diablo	31 11 52.719	1623.6	269 23 11.33	89 38 18.49	Krouse	46362.95	4.6661710
1909	104 54 51.217	1355.9	335 54 56.66	156 01 15.96	Chispa	47974.65	4.6810118
Eagle	30 55 16.688	514.0	207 58 19.02	28 03 36.61	Diablo	34745.67	4.5409007
1909	105 05 06.790	180.3	243 29 22.36	63 49 43.50	Krouse	70019.03	4.8452161
			290 00 00.49	110 11 34.04	Chispa	38248.36	4.5826128
Quitman (Tex.)	31 08 58.819	1811.4	264 20 15.89	84 38 20.80	Diablo	55759.42	4.7463183
1909	105 29 47.102	1247.6	302 42 47.80	122 55 31.01	Eagle	46713.62	4.6694436
Black (Tex.)	31 34 21.899	674.5	331 47 53.41	151 55 11.47	Diablo	47122.15	4.6732251
1909	105 08 52.357	1380.7	355 15 34.54	175 17 31.54	Eagle	72472.15	4.8601711
			35 20 58.54	215 10 05.53	Quitman	57445.57	4.7592565
Corduna (N. Mex.)	32 01 31.467	969.2	325 07 53.74	145 19 31.76	Black	61100.94	4.7860479
1909	105 30 57.015	1496.1	358 54 26.54	178 55 03.15	Quitman	97115.49	4.9872885
North Franklin (Tex.)	31 54 10.436	321.4	261 22 44.70	81 53 47.77	Corduna	93403.60	4.9703636
1909	106 29 36.241	952.3	285 39 50.29	106 22 18.42	Black	132655.47	5.1227252
			311 08 58.10	131 40 14.90	Quitman	126256.31	5.1012531
Jarilla (N. Mex.)	32 23 59.912	1845.5	306 16 21.58	126 35 27.00	Corduna	69939.03	4.8447196
1909	106 06 45.737	1195.2	33 11 21.16	212 59 11.81	North Franklin	65786.97	4.8181398
Kent (N. Mex.)	32 30 27.408	844.2	288 48 34.47	109 00 30.37	Jarilla	36832.12	4.5662267
1909	106 28 59.825	1561.6	300 08 13.29	120 39 12.67	Corduna	105678.54	5.0239868
			0 49 03.33	180 48 43.92	North Franklin	67061.65	4.8264742
Florida	32 07 01.834	56.5	247 47 27.42	68 24 07.71	Kent	116054.43	5.0646617
1910	107 37 36.040	944.8	282 12 36.37	102 48 38.96	North Franklin	109681.36	5.0401328

Stanton base to Deming base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Cooks	32 32 09.548	294.1	271 12 05.57	91 52 20.95	Kent	117293.32	5.0692733
1910	107 43 52.419	1367.9	300 42 01.24	121 21 37.22	North Franklin	136176.74	5.1341029
			348 00 14.97	168 03 36.29	Florida	47473.18	4.6764483
Hermanas	31 48 11.577	356.6	194 03 30.85	14 10 26.11	Cooks	83783.96	4.9231609
1910	107 56 52.331	1376.6	221 00 37.83	41 10 49.94	Florida	46194.16	4.6645871
			265 01 33.23	85 47 36.65	North Franklin	138100.92	5.1401966
Red	32 13 00.806	24.8	203 07 28.04	23 12 38.22	Cooks	38488.12	4.5853266
1910	107 53 31.665	829.2	293 45 20.20	113 53 49.01	Florida	27370.93	4.4372896
			6 33 52.94	186 32 06.57	Hermanas	46171.00	4.6643693
Deming S. base	32 03 00.447	13.8	20 55 37.59	200 52 07.15	Hermanas	29305.43	4.4669480
1910	107 50 14.406	377.9	164 23 37.80	344 21 52.88	Red	19201.18	4.2833279
			190 28 52.33	10 32 16.41	Cooks	54795.58	4.7387455
			249 26 45.28	69 33 28.14	Florida	21232.28	4.3269967
Deming N. base	32 10 19.489	600.3	29 37 52.33	209 35 16.51	Deming S. base	15554.33	4.1918512
1910	107 45 21.268	557.2	111 11 03.53	291 06 42.25	Red	13772.59	4.1390156
			183 17 18.07	3 18 05.62	Cooks	40420.07	4.6065971
			296 30 00.57	116 34 08.15	Florida	13627.82	4.1344265

Deming base net to San Jacinto-Cuyamaca.

Burro (N. Mex.)	32 35 26.637	820.5	275 04 42.75	95 27 21.44	Cooks	66131.35	4.8204074
1910	108 25 56.758	1480.4	332 15 03.18	152 30 32.69	Hermanas	98555.73	4.9936819
Chiricahua (Ariz.)	31 52 23.561	725.7	225 00 55.31	45 28 09.85	Burro	112997.05	5.0530671
1910	109 17 01.339	35.2	242 55 37.98	63 45 16.74	Cooks	163786.26	5.2142775
			273 09 34.98	93 51 51.92	Hermanas	126688.24	5.1027363
Line (U. S. G. S.) (N. Mex.)	32 51 06.601	203.3	298 32 35.67	118 50 53.68	Burro	60302.65	4.7803364
1910	108 59 48.023	1248.7	14 03 23.96	193 54 10.83	Chiricahua	111831.10	5.0485626
Grabam (U. S. G. S.) (Ariz.)	32 42 06.048	186.3	258 16 27.07	78 44 51.24	Line (U. S. G. S.)	83598.08	4.9221964
1910	109 52 15.894	414.0	274 49 10.89	95 35 44.88	Burro	135541.82	5.1320733
			328 46 57.94	149 05 47.50	Chiricahua	107242.47	5.0303668
Catalina (Ariz.)	32 26 34.063	1049.2	251 19 15.13	71 48 52.98	Graham (U. S. G. S.)	90795.23	4.9580630
1910	110 47 18.163	474.5	293 35 08.91	114 23 12.20	Chiricahua	155355.42	5.1913264
Baldy (U. S. G. S.)	31 41 46.065	1418.8	183 51 31.04	3 53 24.55	Catalina	82983.28	4.9189906
1910	110 50 51.939	1367.8	219 17 40.97	39 48 54.64	Graham (U. S. G. S.)	144613.52	5.1602089
			262 02 18.43	82 51 44.36	Cbiricahua	149434.20	5.1744499
Table	32 45 12.148	374.2	284 59 17.55	105 42 29.93	Catalina	130114.89	5.1143270
1910	112 07 29.903	778.4	313 53 45.47	134 34 37.47	Baldy (U. S. G. S.)	168041.44	5.2254164
Superstition (U. S. G. S.)	33 24 39.852	1227.8	331 46 16.25	152 06 13.95	Catalina	121686.19	5.0852413
1910	111 24 01.480	38.2	344 35 02.85	164 52 53.53	Baldy (U. S. G. S.)	197130.31	5.2947534
			43 02 38.16	222 38 54.34	Table	99482.70	4.9977476
Whitetank	33 34 02.053	63.3	278 49 35.35	99 27 54.81	Superstition (U. S. G. S.)	108964.87	5.0372865
1910	112 33 28.731	741.1	335 46 18.37	156 00 31.04	Table	98886.45	4.9951368
Maricopa	32 45 08.501	261.9	169 36 26.69	349 30 35.15	Whitetank	91894.49	4.9632895
1910	112 22 46.044	1198.7	231 06 12.53	51 38 16.42	Superstition (U. S. G. S.)	117015.47	5.0682433
			269 39 40.61	89 47 56.26	Table	23849.12	4.3774724
Mohawk	32 35 22.608	696.4	222 52 42.87	43 28 23.56	Whitetank	148667.90	5.1722172
1910	113 38 50.720	1322.8	261 01 46.51	81 42 50.66	Maricopa	120296.61	5.0802534
Harquahalla	33 48 42.659	1314.3	290 08 24.27	110 34 38.87	Whitetank	77983.75	4.8920041
1910	113 20 47.388	1218.8	322 15 26.61	142 47 17.15	Maricopa	148061.08	5.1704409
			11 46 39.67	191 36 46.44	Mohawk	138425.05	5.1412147
Kofa (Ariz.)	33 21 33.578	1034.5	233 29 44.96	53 54 10.64	Harquahalla	84775.84	4.9282721
1911	114 04 56.894	1470.9	334 24 23.74	154 38 36.18	Mohawk	94554.48	4.9756821
American (U. S. G. S.)	32 51 27.747	854.7	228 09 20.91	48 31 18.11	Kofa	83689.21	4.9226695
1910 (Cal.)	114 45 08.310	216.1	285 42 58.51	106 18 48.80	Mohawk	107759.86	5.0324570
			93 45 54.51	272 45 28.81	Cuyamaca	173731.19	5.2398778
			121 08 41.18	300 05 09.17	San Jacinto	208419.81	5.3189390

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Butte (Cal.)	33 33 41.442	1276.8	280 28 23.29	101 10 08.06	Kofa	119435.99	5.0771352
1910	115 20 39.657	1023.0	324 34 14.70	144 53 42.08	American (U.S.G.S.)	95599.98	4.9804578
			60 14 44.60	239 33 13.40	Cuyamaca	135921.67	5.1332887
			103 09 44.93	282 25 19.90	San Jacinto	126896.34	5.1034491
Powell (Ariz.)	34 32 56.405	1738.0	316 15 52.27	136 44 14.47	Harquahalla	112719.36	5.0519985
1910	114 11 17.196	438.4	355 44 17.46	175 47 49.88	Kofa	132317.41	5.1216170
			44 35 18.86	223 56 27.78	Butte	152946.31	5.1845390
Pine (Ariz.)	34 46 08.486	261.5	336 07 43.38	156 24 51.48	Harquahalla	115977.6	5.0643745
1910	113 51 12.165	309.3	51 35 41.95	231 24 16.66	Powell	39207.4	4.5933675
Chemehuevis (Cal.)	34 33 08.328	256.6	249 29 49.94	69 54 01.38	Pine	69287.3	4.8406537
1910	114 33 44.271	1128.8	270 30 24.22	90 43 08.20	I owell	34347.3	4.5358925
			305 53 27.19	126 34 26.35	Harquahalla	138954.0	5.1428711
Cuyamaca (Cal.)	32 56 48.643	1498.4					
1898	116 36 22.527	585.2					
San Jacinto (Cal.)	33 48 53.459	1647.0	355 57 40.60	176 00 04.57	Cuyamaca	96505.82	4.9845535
1898	116 40 44.187	1136.3					

Kyle-McClenny to Stanton base.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points.							
Carbon schoolhouse belfry [1]	32 16 02.337	72.0	80 42 19.1	260 39 41.4	Hearn	7834.3	3.893999
	98 49 27.423	717.7	250 14 17.6	70 24 18.9	Rattlesnake	31251.9	~.494876
1908							
Eastland courthouse [1]	32 24 04.520	139.2	27 12 23.7	207 09 34.4	Hearn	18122.2	4.258212
1908	98 49 06.253	163.4	148 32 21.1	328 30 07.7	Flat	12433.0	4.094577
Eastland schoolhouse belfry [1]	32 24 02.012	62.0	26 36 30.5	206 33 46.4	Hearn	17940.3	4.253830
	98 49 15.814	413.2	149 42 40.9	329 40 32.7	Flat	12371.1	4.092410
1908							
Cisco astronomic station (U. S. G. S)	32 23 24.857	765.7	63 49 29.4	243 47 15.3	Lamb	7298.9	3.863258
	98 58 59.617	1558.2	217 16 10.4	37 19 15.4	Flat	14864.4	4.172147
1908			334 03 37.3	154 06 05.4	Hearn	16565.2	4.219197
Cisco standpipe	32 23 24.785	763.5	63 53 28.5	243 51 14.0	Lamb	7311.1	3.863984
1908	98 58 59.054	1543.5	64 30 20.6	244 20 28.8	Springgap	32090.4	4.506375
			217 13 09.9	37 16 14.5	Flat	14857.2	4.171938
			334 06 10.2	154 08 37.9	Hearn	16556.8	4.218977
Cisco Metbodist Church spire [1]	32 23 09.191	283.1	333 32 08.8	153 34 35.4	Hearn	16101.0	4.206854
	98 58 56.913	1487.5	67 32 25.3	247 30 09.7	Lamb	7164.5	3.855187
1908							
Church 7 miles south of Cisco	32 18 27.415	844.5	311 46 14.5	131 48 25.5	Hearn	8609.1	3.934956
	98 58 28.089	734.9	81 07 24.5	260 57 16.8	Springgap	30137.1	4.479101
1908			128 51 48.8	308 49 17.9	Lamb	9471.2	3.976405
Baird courthouse dome	32 23 40.294	1241.2	219 07 25.0	39 09 57.3	Hitson (U. S. G. S.)	11749.5	4.070018
1908	99 23 38.695	1011.3	325 44 03.5	145 47 22.9	Springgap	17335.8	4.238944
			108 01 32.4	287 59 26.7	Clyde	6445.0	3.809223
Baird tall churcb spire [1]	32 23 39.303	1210.7	220 17 06.2	40 19 45.4	Hitson (U. S. G. S.)	11989.3	4.078793
1908	99 23 51.651	1350.0	324 45 36.0	144 49 02.4	Springgap	17503.7	4.243131
Clyde church spire [1]	32 24 21.939	675.8	256 07 13.0	76 08 11.9	Clyde	2960.4	3.471347
1908	99 29 23.220	606.8	309 42 47.6	129 49 11.3	Springgap	24410.5	4.387576
Abilene standpipe (U. S. G. S.)	32 26 44.754	1378.6	65 08 09.1	245 01 16.0	Buzzard	22214.4	4.346634
	99 44 44.305	1157.3	124 50 -3.5	304 47 03.4	Morrison	11852.8	4.073822
1908			255 26 53.0	75 34 40.4	Kennard	23475.5	4.370614
			343 57 35.8	163 59 39.9	Clayton	21961.5	4.341662
Abilene courthouse dome	32 26 44.715	1377.4	347 14 28.0	167 16 05.7	Clayton	21640.4	4.335265
1908	99 43 55.065	1438.5	66 28 14.3	246 20 54.8	Buzzard	23387.2	4.368978
			254 37 11.6	74 44 32.6	Kennard	22233.1	4.347001

[1] Checked by vertical angles only.

Kyle-McClenny to Stanton base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Abilene low standpipe	32 26 44.282	1364.0	65 09 52.8	245 02 59.7	Buzzard	22203.9	4.346430
1908	99 44 44.488	1162.1	124 54 38.1	304 51 18.1	Morrison	11857.2	4.073983
			255 25 00.2	75 32 47.6	Kennard	23483.7	4.370766
			343 56 15.1	163 58 19.2	Clayton	21948.9	4.341413
Abilene asylum stack [1]	32 25 05.568	171.5	348 24 23.3	168 25 38.9	Clayton	18428.4	4.265488
1908	99 43 13.968	365.0	74 24 56.7	254 17 15.3	Buzzard	23376.5	4.368780
Church north of Tye, belfry [1]	32 45 01.930	59.5	19 16 18.9	199 11 08.4	Buzzard	45707.9	4.659991
1908	99 47 58.199	1515.2	43 55 36.1	223 43 56.3	Hale	48922.6	4.689510
Tye Baptist church spire	32 27 20.563	633.4	40 12 27.8	220 09 26.5	Buzzard	13696.0	4.136595
1908	99 51 57.030	1489.5	84 43 05.9	264 33 37.1	Hale	27818.1	4.444327
			195 28 05.3	15 28 37.5	Morrison	5876.6	3.769123
Tye Methodist church spire	32 27 32.537	1002.2	38 13 15.1	218 10 20.3	Buzzard	13783.7	4.139365
1908	99 52 09.030	235.8	83 53 32.9	263 44 10.6	Hale	27542.8	4.440008
			199 33 10.2	19 33 48.9	Morrison	5619.0	3.749656
Church 6 miles west of Morrison, belfry [1]	32 32 34.407	1059.8	293 59 30.5	114 02 35.6	Morrison	9837.1	3.992867
1908	99 56 41.283	1077.2	101 14 27.3	281 11 26.7	Sears	9830.6	3.950883
Merkel church, square spire	32 28 05.107	157.3	73 57 51.3	253 53 08.1	Hale	14341.0	4.156579
1908	100 00 49.745	1299.1	167 12 39.3	347 11 52.4	Sears	10287.9	4.012328
			336 44 32.7	156 46 16.9	Buzzard	12881.2	4.109955
Merkel electric light plant, tall stack	32 28 07.151	220.3	74 34 35.9	254 29 36.3	Hale	15128.2	4.179788
1908	100 00 19.106	498.9	162 50 59.7	342 49 56.3	Sears	10433.9	4.018446
			340 11 32.4	160 13 00.3	Buzzard	12646.0	4.101952
Merkel tall water tank	32 28 11.494	354.1	73 41 04.6	253 36 12.8	Hale	14799.9	4.170259
1908	100 00 33.632	878.2	86 03 37.1	265 55 57.7	Boyd	22400.7	4.350261
			164 39 45.2	344 38 49.6	Sears	10199.3	4.008571
Trent schoolhouse belfry [1]	32 29 28.467	876.9	30 29 21.2	210 28 02.1	Hale	7587.1	3.880077
1908	100 07 09.976	260.4	71 52 12.7	251 48 06.1	Boyd	12622.7	4.101153
Trent Christian Church spire [1]	32 29 20.591	634.3	31 15 49.7	211 14 31.2	Hale	7364.9	3.867165
1908	100 07 11.021	287.7	72 53 10.2	252 49 04.1	Boyd	12523.2	4.097717
Eskota water tank [1]	32 31 44.809	1380.3	319 17 11.2	139 20 21.1	Hale	14161.7	4.151115
1908	100 15 30.913	806.7	352 23 09.7	172 23 32.1	Boyd	8207.1	3.914189
Sweetwater schoolhouse cupola [1]	32 28 30.141	928.4	211 33 23.3	31 36 07.4	Allen	15201.0	4.181872
1908	100 24 03.440	89.8	278 21 49.7	98 26 47.2	Boyd	14629.2	4.165220
Wasp, U. S. G. S.	32 34 04.728	145.6	257 36 01.4	77 40 10.3	Allen	12345.1	4.091493
1908	100 26 40.726	1062.3	9 46 18.2	189 44 45.4	Lloyd	26638.5	4.425509
			54 45 34.5	234 42 17.2	Patterson	11725.2	4.069121
Roscoe cotton gin stack	32 26 52.740	1624.6	9 44 21.9	189 43 24.0	Bench	16740.3	4.223762
1909	100 32 08.381	218.9	171 06 01.1	351 05 40.0	Patterson	6616.3	3.820612
			342 38 04.4	162 39 27.3	Lloyd	13563.8	4.132380
Roscoe schoolhouse cupola	32 26 17.989	554.1	8 34 54.6	188 34 07.0	Bench	15603.4	4.193218
1909	100 32 27.628	721.7	176 04 50.1	356 04 39.4	Patterson	7624.8	3.882230
			339 01 40.8	159 03 14.0	Lloyd	12717.3	4.104395
Loraine schoolhouse cupola [1]	32 24 10.75	331.1	157 02 32	337 01 26	Wolf	8245.3	3.916204
1909	100 42 45.12	1179.1	309 45 01	129 49 44	Bench	17984.6	4.254901
Colorado, west standpipe	32 22 58.018	1787.1	65 50 44.6	245 45 33.0	Bynum	16690.6	4.222471
1909	100 50 18.739	489.8	221 15 43.1	41 18 40.3	Wolf	13084.6	4.116760
			289 46 18.4	109 55 03.8	Bench	27304.9	4.436240
Westbrook Methodist Church spire [1]	32 21 30.01	924.4	173 18 44	353 18 11	Cuthbert	13788.0	4.139500
1909	101 00 53.17	1390.2	341 42 22	161 42 50	Bynum	4350.2	3.638507
Morgans Peak	32 21 13.967	430.2	116 00 21.6	295 53 15.7	Top	23103.0	4.363669
1909	101 02 38.088	995.9	184 34 06.1	4 34 29.4	Cuthbert	14233.6	4.153314
			311 29 39.9	131 31 04.0	Bynum	5486.8	3.739323

[1] Checked by vertical angles only.

Kyle-McClenny to Stanton base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Muchakooago Peak	32 43 26.624	820.1	307 41 41.9	127 53 37.6	Cuthbert	43833.0	4.641801
1909	101 24 03.026	78.8	319 47 15.0	140 00 10.3	Bynum	58423.8	4.766590
			337 31 14.0	157 35 37.9	Top	33477.7	4.524755
Stanton courthouse cupola	32 07 52.322	1611.6	154 56 41.6	334 54 09.0	Epley	17687.0	4.247654
1909	101 47 27.197	712.8	258 31 05.5	78 42 06.6	Williams	33192.1	4.521035
			289 53 31.7	109 54 04.8	Stanton	1740.9	3.240767
Stanton longitude station	32 07 33.014	1016.9	180	00	Stanton	2.26	0.35411
	101 46 24.746	648.6					

Stanton base to Deming base.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Midland courthouse cupola	31 59 52.623	1620.8	53 06 25.3	233 03 25.1	Scar	11181.5	4.048500
1909	102 04 33.755	886.1	160 46 05.3	340 44 04.3	Dunn	18128.5	4.258361
			227 00 35.8	47 02.23.1	Elkins	7258.5	3.860849
Odessa courthouse cupola [1]	31 50 49.70	1530.8	147 38 59	327 35 56	Smith	16979.9	4.229935
1909	102 22 03.84	101.0	226 18 25	46 19 03	Odessa	2609.1	3.416498
Castle Gap Mountain [2]	31 18 52.41	1614.0	136 57 01.0	316 46 56.6	Curtis	44716	4.650464
1909	102 18 12.83	339.3	154 50 26.7	334 43 39.8	Douro	48208	4.683122
Judkins schoolhouse cupola [2]	31 42 54.60	1681.7	274 26 57	94 30 22	Douro	10282.7	4.012108
1909	102 37 40.51	1066.6	358 45 44	178 45 49	Curtis	11788.0	4.071440
Windmill 2 miles south of Dublin	31 50 10.792	332.4	321 25 03.4	141 28 50.4	Douro	18205.1	4.260193
1909	102 38 22.347	587.6	356 55 08.0	176 55 35.1	Curtis	25256.3	4.402369
			49 20 00.8	229 14 33.2	Harris	21590.8	4.334269
			169 58 37.9	349 58 26.7	Dublin	3217.9	3.507567
Barstow courthouse cupola	31 27 41.627	1282.0	40 32 59.8	220 29 41.8	Sist	15450.8	4.188952
1909	103 23 38.575	1018.4	128 53 22.5	308 47 13.0	Ingle	23936.1	4.379054
			203 01 16.8	23 03 28.5	Johnson	16976.2	4.229840
			234 37 06.3	54 39 00.9	Hays	7097.9	3.851130
Pecos courthouse cupola [1]	31 25 17.12	527.3	4 01 41	184 01 30	Sist	7621.3	3.882031
1909	103 29 38.36	1013.2	154 28 48	334 25 47	Ingle	21228.6	4.326922
Davis Mountain, or Black Mountain, center of highest round peak	30 43 23.375	719.8	200 56 39.3	21 08 47.6	Ingle	103798.9	5.016193
1909	103 58 52.664	1401.2	213 07 58.8	33 22 52.9	Sist	83852.7	4.923517
			215 33 24.0	35 53 29.6	Hays	105897.8	5.024887
Davis [1]	30 54 33.87	1043.0	194 48 03	14 53 32	Round	65657.3	4.817283
1909	104 03 47.34	1257.1	224 27 05	44 34 51	Toyah	34194.2	4.533952
Flat Top [1]	31 10 27.24	838.9	122 31 28	302 25 58	Seay	19968.1	4.300339
1909	104 03 49.64	1314.5	281 39 06	101 46 55	Toyah	24512.3	4.389384
Gomez Peak	31 01 34.619	1066.1	8 15 01.0	188 14 53.4	Newman	2723.4	3.435115
1909	104 04 17.770	471.3	122 02 11.8	301 52 58.2	Reynolds	33471.3	4.524672
			149 19 57.0	329 14 42.5	Seay	31550.2	4.499002
Newman U. S. G. S.	31 00 00.488	15.0	126 43 14	306 34 14	Reynolds	34540.5	4.538329
1909	104 04 43.739	1160.4	235 39 58	55 40 04	Newman	361.0	2.557543
High or Sawtooth Mountain	30 41 06.134	188.9	161 36 27.9	341 30 18.0	Krouse	60361.8	4.780762
1909	104 13 40.616	1081.1	166 22 13.4	346 17 51.9	Reynolds	57167.1	4.757146
			202 28 34.4	22 33 15.4	Newman	38035.5	4.580189
East	31 09 45.974	1415.9	80 59 03.5	260 57 28.0	West	4951.7	3.694751
1911	104 21 35.283	934.4	123 34 13.2	303 32 06.5	Krouse	7776.0	3.890758
			160 44 59.5	340 44 41.9	Reynolds	2738.3	3.437479
Mid	31 07 10.428	321.2	10 02 20.4	190 02 03.8	Boracho	4886.0	3.688953
1911	104 22 52.586	1393.4	144 41 18.4	324 40 23.0	West	4918.5	3.691834
			203 08 25.8	23 09 05.8	East	5209.7	3.716809
Cone [1]	31 20 28.05	863.9	355 28 28	175 28 55	Reynolds	17242.7	4.236604
1909	104 23 00.76	20.1	15 14 24	195 13 01	Krouse	16039.5	4.205190
Pinnacle [2]	31 44 24.72	761.5	359 18 20	179 18 35	Reynolds	61441	4.788459
	104 22 37.50	987.0	4 37 32	184 35 57	Krouse	59918	4.777557

[1] No check on this position.

[2] Checked hy vertical angles only.

Stanton base to Deming base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Boracho	31 04 34.202	1053.4	167 16 47.1	347 16 08.2	West	9046.7	3.956489
1911	104 23 24.716	655.2	196 47 45.9	16 48 42.4	East	10029.8	4.001292
Boracho longitude station	31 04 33.989	1046.8	180	0	Boracho	6.565	0.817235
1911	104 23 24.716	655.2					
West	31 09 20.742	638.8	162 35 41.5	342 35 10.4	Krouse	5318.6	3.725795
1911	104 24 39.925	1057.4	229 50 48.1	49 52 06.0	Reynolds	5215.3	3.717276
Krouse U. S. G. S. cairn	31 12 05.480	168.8	248 42 18	68 42 18	Krouse	4.16	0.6191
1909	104 25 40.166	1063.3					
Cone Peak [1]	31 53 31.46	969.0	284 50 55	105 31 05	Ingle	124935.3	5.096685
1909	104 51 46.19	1213.9	294 20 15	115 03 08	Sist	142359.1	5.153385
Diablo U. S. G. S. cairn	31 11 52.744	1624.4	76 33 45	256 33 45	Diablo	3.28	0.5159
1909	104 54 51.097	1352.7					
Allamore	31 04 39.476	1215.6	24 28 51.0	204 26 17.9	Eagle	19040.4	4.279677
1909	105 00 09.624	255.1	99 45 06.6	279 29 48.1	Quitman	47772.0	4.679173
Quitman U. S. G. S. cairn	31 08 58.875	1813.2	30 57 41	210 57 41	Quitman	2.0	0.3010
1909	105 29 47.063	1246.6					
Corduna U. S. G. S. cairn	32 01 31.717	976.9	350 47 45	170 47 45	Corduna	7.8	0.8921
1909	105 30 57.063	1497.3					
Cerro Alto	31 56 43.141	1328.8	84 42 16.3	264 25 41.0	North Franklin	49669.0	4.696085
1909	105 58 14.045	368.8	258 12 15.9	78 26 43.1	Corduna	43884.6	4.642312
			332 50 14.0	153 05 07.1	Quitman	99042.1	4.995820
Cerro Alto U. S. G. S. cairn	31 56 43.353	1335.3	338 49 58	158 49 58	Cerro Alto	7.0	0.8451
1910	105 58 14.141	371.4					
Mesa	31 45 35.296	1087.1	137 21 06.9	317 16 13.4	North Franklin	21585.5	4.334162
1909	106 20 19.693	518.3	239 21 13.6	59 32 53.2	Cerro Alto	40469.4	4.607127
			309 58 22.7	130 24 45.2	Quitman	104819.0	5.020440
Silo [1]	31 44 59.87	1844.0	122 26 25	302 24 27	Boundary monument No. 2	7010.6	3.845758
1909	106 28 28.42	748.0	265 06 56	85 11 14	Mesa	12908.5	4.110877
El Paso:							
Courthouse	31 45 30.164	929.1	99 55 33.2	279 55 25.6	Federal Building (flagstaff)	386.0	2.586643
1893	106 29 02.349	62.0	119 01 03.6	298 59 22.7	A	5766.0	3.760878
			119 22 06.8	299 20 26.3	Boundary monument No. 2	5764.7	3.760778
			128 20 40.8	308 19 46.7	C	3451.3	3.537979
			269 18 12.3	89 22 47.4	Mesa	13755.7	4.138482
Federal Building, center	31 45 32.308	995.1	120 40 10.5	300 38 37.6	Boundary monument No. 2, Ecc.	5396.0	3.732073
1910	106 29 16.706	439.7	269 35 17.0	89 39 59.6	Mesa	14132.9	4.150230
Federal Building, flagstaff	31 45 32.324	995.6	120 40 44.4	300 39 11.6	Boundary monument No, 2, Ecc.	5393.7	3.731887
1893	106 29 16.798	442.1	269 35 23.1	89 40 05.8	Mesa	14135.3	4.150304
Mills	31 45 32.489	1000.6	200 41 50	20 41 52	Weather	294.3	2.46877
1911	106 29 19.424	511.2	274 27 29	94 27 31	Federal building (center)	71.7	1.85582
			279 03 12	99 03 21	Courthouse	455.0	2.65805
Weather	31 45 41.427	1275.9	315 07 39	135 07 46	El Paso courthouse	489.5	2.68975
1911	106 29 15.472	407.2	6 35 46	186 35 46	Federal building (center)	282.7	2.45139
City Hall	31 45 32.228	992.6	90 26 07	270 26 01	Federal building (center)	326.3	2.51356
1911	106 29 04.309	113.4	91 09 38	271 09 30	Mills	397.9	2.59973
			133 57 57	313 57 51	Weather	408.1	2.61081
West	31 45 36.435	1122.2	231 11 51	51 11 53	East	121.5	2.08454
1911	106 29 29.968	788.7	248 02 53	68 03 00	Weather	411.3	2.61415
			293 39 20	113 39 25	Mills	302.9	2.48133
East	31 45 38.907	1198.3	254 51 21	74 51 26	Weather	297.1	2.47292
1911	106 29 26.370	694.0	317 14 27	137 14 30	Mills	269.2	2.43013

[1] No check on this position.

Stanton base to Deming base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.							
El Paso—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Presbyterian church 1911	31 45 49.285 106 29 24.845	1517.9 653.8	314 27 24	134 27 28	Weather	345.6	2.53852
			337 43 32	157 43 36	Federal building (center)	565.1	2.75209
			344 35 02	164 35 04	Mills	536.6	2.72967
Longitude station 1911	31 45 36.361 106 29 29.968	1119.9 788.7	180 00	0 00	West	2.28	0.3579
Latitude and longitude station (lost) 1892	31 45 35.80 106 29 27.46	1102.6 722.7					
Wheeler's latitude and longitude station (called Fort Bliss) (lost) 1878	31 45 34.77 106 29 18.11	1070.9 476.6					
A 1893	31 47 00.935 106 32 13.995	28.8 368.2	90 25 13.8	270 23 48.8	Boundary monument No. 3	4244.7	3.627845
			211 19 49.0	31 19 49.4	Boundary monument No. 2	35.3	1.548205
			300 19 43.9	120 21 17.2	Federal building (flagstaff)	5402.7	3.732611
B 1893	31 47 13.949 106 32 44.525	429.6 1171.4	294 16 42.1	114 16 58.6	Boundary monument No. 2	901.3	2.954882
			296 31 02.0	116 31 18.1	A	897.7	2.953119
			83 51 50.2	263 50 41.3	Boundary monument No. 3	3461.2	3.539221
C 1893	31 46 39.670 106 30 45.224	1221.8 1189.9	311 42 30.9	131 43 17.4	Federal building (flagstaff)	3117.2	3.493761
			105 40 15.9	285 39 29.2	A	2425.8	3.384847
			133 49 34.2	313 49 09.6	North base	1706.9	3.232212
North base 1893	31 47 18.044 106 31 32.031	555.8 842.7	64 29 17.6	244 28 55.5	A	1223.4	3.087552
			65 24 56.0	245 24 34.3	Boundary monument No. 2	1193.9	3.076977
			86 13 17.0	266 12 38.8	B	1911.4	3.281350
South base 1893	31 47 00.200 106 31 31.206	6.2 821.0	91 09 21.2	271 08 58.7	A	1126.0	3.051545
			92 44 04.7	272 43 42.6	Boundary monument No. 2	1108.7	3.044803
			102 23 13.0	282 22 34.5	B	1974.9	3.295551
			177 44 15.9	357 44 15.5	North base	550.0	2.740390
Astronomic station No. 1 1893	31 47 01.917 106 31 32.351	59.0 851.2	180 58 11.5	0 58 11.7	North base	496.8	2.696166
			330 20 23.8	150 20 24.4	South base	60.9	1.784410
Juarez water tower[1] (Mex.) 1910	31 44 18.930 106 29 15.84	583.0 416.9	137 04 50	317 03 17	Boundary monument No. 2	6856.3	3.836091
			260 29 53	80 34 35	Mesa	14305.9	4.155516
Juarez Cathedral (Mex.) 1893	31 44 18.458 106 29 11.962	568.5 314.8	136 15 48.4	316 14 12.6	A	6927.6	3.840581
			136 32 43.7	316 31 08.3	Boundary monument No. 2	6936.7	3.841155
			150 34 10.3	330 33 21.2	C	4994.0	3.698450
			176 47 50.7	356 47 48.2	Federal building (flagstaff)	2278.6	3.357662
Boundary monument No. 1 (U. S. & Mex.) 1893	31 47 01.917 106 31 46.242	59.0 1216.6	216 58 05.2	36 58 12.7	North base	621.7	2.793578
			269 59 56.6	90 00 03.8	Astronomic station No. 1	365.5	2.562862
			277 36 53.1	97 37 01.0	South base	399.1	2.601106
Juarez bell tower (Mex.) 1893	31 44 19.430 106 29 11.020	598.4 290.0	135 56 39.4	315 55 03.1	A	6923.2	3.840306
			150 09 08.6	330 08 19.0	C	4980.3	3.697253
			176 07 30.7	356 07 27.6	Federal building (flagstaff)	2250.2	3.352230
Boundary monument No. 2 (U. S. & Mex.) 1893	31 47 01.915 106 32 13.297	59.0 349.8	90 00 47.2	269 59 21.9	Boundary monument No. 3	4262.9	3.629709
			197 21 43.9	17 23 06.8	North Franklin	13829.4	4.140804
			278 02 03.3	98 08 19.0	Mesa	18966.0	4.277975
			300 41 39.2	120 43 12.2	Federal building (center)	5404.5	3.732758
			300 42 13.2	120 43 46.1	Federal building (flagstaff)	5402.2	3.732571

[1] No check on this position.

Stanton base to Deming base—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Boundary monument No. 2, eccentric (U. S. & Mex.) 1909	31 47 01.642 106 32 13.111	50.6 345.0	197 19 56.8 278 00 40.0	17 21 19.6 98 06 55.6	North Franklin Mesa	13836.0 18959.9	4.141011 4.277837
Boundary monument No. 3 (U. S. & Mex.) 1893	31 47 01.918 106 34 55.324	59.1 1455.6	212 25 09.1 270 06 09.4	32 27 57.4 90 07 34.8	North Franklin Boundary monument No. 2 Ecc.	15639.2 4267.8	4.194215 3.630209
Alamagordo Peak [1] 1910	33 22 20.59 105 48 36.29	634.3 938.1	33 28 02 63 12 53	213 06 04 242 10 10	Kent Cooks	114720.5 202163.2	5.059641 5.305702
Orogrande Smelter [2] 1910	32 23 09.96 106 05 18.83	306.8 492.2	110 03 30 124 07 15	289 50 48 304 06 28	Kent Jarilla	39487.4 2743.4	4.596458 3.438292
Jarilla longitude station 1911	32 23 59.900 106 06 45.641	1845.1 1192.8	98 38½	278 38½	Jarilla	2.53	0.40312
North Franklin U. S. C. S. cairn 1909	31 54 10.530 106 29 36.252	324.3 952.5	354 04 49	174 04 49	North Franklin	2.9	0.4624
Noonday Peak [2] 1910	32 47 31.82 107 47 24.56	980.2 639.1	348 58 24 3 05 59	169 00 18 183 04 28	Cooks Deming south base	28942.6 82405.7	4.461537 4.915957
Deming city waterworks 1910	32 16 10.606 107 46 01.390	326.7 36.4	18 19 27.3 63 39 14.1 186 29 59.9 321 53 53.5 354 26 54.4	198 13 42.1 243 35 13.9 6 31 09.1 141 58 22.8 174 27 15.8	Hermanas Red Cooks Florida Deming north base	54463.2 13157.9 29729.9 21469.3 10866.0	4.736103 4.119188 4.473193 4.331817 4.036070
Black Mountain, cairn [1] 1910	32 19 59.00 107 53 01.40	1817.3 36.6	325 57 23 352 03 02	146 01 28 172 04 31	Deming north base Deming south base	21533.8 31676.9	4.333121 4.500742
Members Peak 1910	32 42 15.442 107 56 19.273	475.7 502.0	313 43 54.9 343 42 44.7 352 28 56.5	133 50 37.5 163 48 37.6 172 32 11.8	Cooks Deming north base Deming south base	26971.4 61469.4 73164.4	4.430903 4.788659 4.864300
Cone, summit [2] 1910	32 12 02.71 108 06 32.80	83.5 859.1	275 21 30 303 00 08	95 32 47 123 08 48	Deming north base Deming south base	33459.7 30605.7	4.524522 4.485803
Bear, highest point 1910	32 50 08.865 108 21 29.602	273.1 769.9	299 18 52.7 322 16 33.1 330 30 50.9	119 39 11.6 142 35 58.3 150 47 36.8	Cooks Deming north base Deming south base	67551.0 92848.3 99949.1	4.829632 4.967774 4.999779

Deming base net to San Jacinto-Cuyamaca.

Near 1910	31 47 23.753 108 11 03.844	731.6 101.1	235 19 06.8 266 10 31.9	55 36 49.4 86 18 00.5	Florida Hermanas	64007.4 22448.6	4.806230 4.351190
Boundary monument No. 39 (U. S. & Mex.) 1910	31 47 01.260 108 11 11.468	38.8 301.7	196 08 46.7 234 54 47.6 264 27 49.0	16 08 50.7 55 12 34.1 84 35 21.6	Near Florida Hermanas	721.2 64568.1 22705.1	2.858076 4.810018 4.356123
[2] Boundary monument No. 31 (U. S. & Mex.) 1910	31 47 01.169 107 55 45.394	36.0 1194.3	140 55 39.0 217 38 46.6	320 55 03.7 37 48 23.1	Hermanas Florida	2793.5 46755.9	3.446143 4.669836
Boundary monument No. 32 (U. S. & Mex.) 1910	31 47 01.200 107 57 18.025	37.0 474.2	90 03 56.8 91 53 29.7 197 19 04.5	269 56 37.8 271 46 14.7 17 19 18.0	Boundary monument No. 39 Near Hermanas	21927.9 21757.7 2270.5	4.340998 4.337214 3.356127
Boundary monument No. 40 (U. S. & Mex.) 1910	31 47 01.265 108 12 29.563	39.0 777.8	252 55 14.3 269 59 54.8	72 55 59.4 90 00 35.9	Near Boundary monument No. 39	2359.2 2054.7	3.372758 3.312747
Burro U. S. G. S. 1910	32 35 26.607 108 25 56.643	819.6 1477.2	107 01 04	287 01 04	Burro	3.145	0.4976
Huachuca 1910	31 29 26.044 110 22 55.582	802.1 1466.9	117 24 08.59 247 32 53.57	297 09 30.37 68 07 30.41	Baldy Chiricahua	49726.0 112459.4	4.6965837 5.0509958
Huachuca U. S. G. S. cairn 1910	31 29 26.037 110 22 55.561	801.9 1466.4	109 35 00	289 35 00	Huachuca	0.6	9.7782

[1] Checked by vertical angles only. [2] No check on this position.

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Mule (U. S. G. S.)	31 26 37.246	1147.1	97 28 34.28	277 15 19.06	Huachuca	40550.4	4.6079953
1910	109 57 32.216	850.7	233 11 12.68	53 32 28.55	Chiricahua	79809.6	4.9020553
Boundary monument No. 91 (U. S. & Mex.)	31 20 02.447	75.4	109 50 55.60	289 34 59.91	Huachuca	51451.2	4.7113959
1910	109 52 21.943	580.1	146 02 01.91	325 59 20.31	Mule (U. S. G. S.)	14664.4	4.1662641
Nogales No. 7	31 21 37.630	1158.9	211 16 57.23	31 24 26.55	Baldy	43578.2	4.6392697
1893	111 05 11.191	295.8	257 39 34.76	78 01 36.81	Huachuca	68504.0	4.8357162
Boundary monument No. 128 (U. S. & Mex.)	31 20 00.894	27.5	165 51 05.70	345 50 50.92	Nogales No. 7	3072.5	3.4874898
	111 04 42.775	1130.9	208 32 47.11	28 40 01.40	Baldy	45786.6	4.6607385
1910			255 05 36.40	75 27 23.12	Huachuca	68475.8	4.8355369
Benedict (U. S. G. S.)	31 23 46.696	1438.2	64 56 31.22	244 51 38.83	Boundary monument No. 128	16394.6	4.2147000
1910	110 55 20.999	554.7					
			75 44 36.81	255 39 29.51	Nogales No. 7	16093.9	4.2066625
			192 01 53.57	12 04 14.34	Baldy	33992.3	4.5313800
Boundary monument No. 120 (U. S. & Mex.)	31 19 58.282	1794.9	89 18 22.83	269 18 01.71	Boundary monument No. 121	1073.8	3.0309209
	110 55 38.554	1019.2					
1910			101 28 08.72	281 23 10.82	Nogales No. 7	15442.7	4.1887237
			183 46 18.69	3 46 27.82	Benedict (U.S.G.S.)	7049.9	3.8481845
			190 36 48.04	10 39 17.85	Baldy	40981.6	4.6125891
Boundary monument No. 121 (U. S. & Mex.)	31 19 57.858	1781.9	90 26 19.29	270 21 57.41	Boundary monument No. 128	13314.1	4.1243121
	110 56 19.168	506.8					
1910			102 21 49.50	282 17 12.73	Nogales No. 7	14394.8	4,1582057
			192 18 02.58	12 18 32.85	Benedict (U.S.G.S.)	7213.4	3.8581406
Mexican customhouse flagstaff (Nogales)	31 19 52.319	1611.3	103 28 11.7	283 23 44.5	Nogales No. 7	13961.5	4.144933
	110 56 37.461	990.4	195 38 02.6	15 38 42.4	Benedict (U.S.G.S.)	7495.8	3.874819
1893			250 34 07.1	70 34 16.6	Boundary monument No. 121	512.8	2.709978
Nogales No. 5	31 20 08.584	264.4	106 12 40.4	286 09 34.4	Nogales No. 7	9838.4	3.992926
1893	110 59 13.737	363.2	276 54 06.4	96 55 27.7	Mexican customhouse flagstaff	4161.7	3.619273
Nogales No. 8	31 19 35.732	1100.5	163 40 26.7	343 40 05.1	Nogales No. 7	3912.0	3.592397
1893	111 04 29.583	782.1	263 04 06.7	83 06 50.9	Nogales No. 5	8411.2	3.924860
Nogales No. 6	31 18 32.070	987.7	103 32 58.8	283 30 18.6	Nogales No. 8	8382.0	3.923349
1893	110 59 21.372	565.1	121 44 21.9	301 31 19.9	Nogales No. 7	10871.3	4.036280
			183 53 04.0	3 53 07.9	Nogales No. 5	2979.3	3.474107
Nogales No. 3	31 19 53.054	1633.9	67 20 41.6	247 18 44.2	Nogales No. 6	6470.8	3.810957
1893	110 55 35.552	939.9	89 12 42.5	269 12 10.3	Mexican customhouse flagstaff	1636.9	3.214015
			94 45 20.5	274 43 27.0	Nogales No. 5	5787.9	3.762521
Nogales No. 4	31 18 56.882	1751.8	82 56 45.4	262 54 44.4	Nogales No. 6	6207.8	3.792939
1893	110 55 28.392	750.7	110 21 11.3	290 19 14.1	Nogales No. 5	6353.9	3.803043
			173 45 21.2	353 45 17.5	Nogales No. 3	1740.3	3.240624
Nogales No. 1	31 19 48.789	1502.6	253 37 28.1	73 37 35.4	Mexican customhouse flagstaff	385.6	2.586157
1893	110 56 51.455	1360.4					
			266 14 57.8	86 15 37.3	Nogales No. 3	2011.0	3.303411
			306 02 43.6	126 03 26.8	Nogales No. 4	2716.4	3.433991
Nogales No. 2	31 19 23.610	727.1	188 21 23.0	8 21 25.2	Nogales No. 1	783.8	2.894199
1893	110 56 55.764	1474.4	246 50 32.2	66 51 14.0	Nogales No. 3	2306.4	3.362941
			289 36 20.3	109 37 05.7	Nogales No. 4	2452.4	3.389598
Nogales:							
Azimuth station	31 19 57.391	1767.5	276 36 59.9	96 37 22.5	Nogales No. 3	1158.6	3.063934
1893	110 56 19.084	504.5	324 16 20.5	144 16 46.9	Nogales No. 4	2295.5	3.360868
			72 10 37.2	252 10 27.7	Mexican customhouse flagstaff	510.3	2.707841
			72 48 07.2	252 47 50.4	Nogales No. 1	895.9	2.952242
Astronomic station	31 20 01.764	54.3	327 13 50.8	147 13 52.5	Nogales azimuth station	160.2	2.204561
1893	110 56 22.363	591.2					
			53 55 00.9	233 54 53.1	Mexican customhouse flagstaff	493.9	2.693623
			62 32 51.5	242 32 36.4	Nogales No. 1	866.7	2.937877
Montezuma hotel, flagpole	31 20 03.228	99.4	323 21 22.0	143 21 24.6	Nogales azimuth station	224.0	2.350304
	110 56 24.142	638.2					
			313 47 33.1	133 47 34.0	Nogales astronomic station	65.1	1.813833
			58 22 35.0	238 22 20.8	Nogales No. 1	848.0	2.928405

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.							
Nogales—continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Levy's store, flagpole	131 19 59.260	1825.0	285 34 36.9	105 34 41.0	Nogales azimuth station	214.3	2.331104
	10 56 26.894	711.0					
			63 35 28.1	243 35 15.4	Nogales No. 1	725.0	2.860335
			237 13 32.1	57 13 34.5	Nogales astronomic station	142.5	2.153680
South hase 1893	31 19 24.472	753.7	85 47 16.5	265 47 09.4	Nogales No. 2	361.6	2.558192
	110 56 42.125	1113.8	161 46 13.0	341 46 08.2	Nogales No. 1	788.5	2.896791
North base 1893	31 19 47.846	1473.6	6 48 00.6	186 47 58.9	Nogales south base	725.0	2.860314
	110 56 38.878	1027.8	30 53 01.8	210 52 52.9	Nogales No. 2	869.7	2.939386
			94 59 34.6	274 59 28.1	Nogales No. 1	333.8	2.523433
Courthouse, dome [1]	31 20 10.949	337.2	14 47 24.2	194 47 22.1	Boundary monument No. 121	417.0	2.620127
	110 56 15.141	400.3					
			192 08 55.2	12 09 23.4	Benedict (U.S.G.S.)	6796.8	3.832307
Catbolic cburch [1]	31 20 15.258	469.9	194 37 58.9	14 38 32.4	Benedict (U S.G.S.)	6730.3	3.828033
	110 56 25.356	670.3	343 01 23.8	163 01 27.0	Boundary monument No. 121	560.3	2.748409
Public school [1]	31 20 13.486	415.3	194 47 50.1	14 48 24.3	Benedict (U.S.G.S.)	6791.8	3.831984
	110 56 26.657	704.6	337 38 25.2	157 38 29.2	Boundary monument No. 121	520.4	2.716374
Rincon Peak [2] 1910	32 07 10.55	324.8	33 18 17.7	213 07 59.2	Baldy (U. S. G. S.)	56126.6	4.749169
	110 31 21.68	568.3	115 25 57.2	294 34 23.2	Table	166267.4	5.220807
Four Peaks, second from north	33 40 51.311	1580.8	36 05 05.5	215 38 52.1	Table	126936.3	5.103586
	111 19 37.996	978.7	43 53 50.8	223 19 15.6	Maricopa	142223.4	5.152971
			84 02 26.7	263 21 33.2	Whitctank	114897.6	5.060311
Desert Peak	32 43 07.741	238.4	93 25 25.4	273 01 54.0	Table	68062.0	4.832905
	111 23 59.976	1561.9	92 35 06.4	272 03 19.6	Maricopa	91883.0	4.963235
			179 58 15.5	359 58 14.7	Superstition (U. S. G. S.)	76772.4	4.885205
Comobabi Peak	31 46 15.841	487.9	155 31 56.4	335 14 58.9	Table	119086.9	5.078482
	111 35 43.794	1152.4	185 41 54.8	5 48 13.0	Superstition (U. S. G. S.)	182785.6	5.261942
			276 29 27.7	96 53 03.6	Baldy (U. S. G. S.)	71346.4	4.853372
Maricopa astronomic station, eccentric 1910	33 03 34.351	1058.2	11 37 50.8	191 35 25.0	Table	34663.1	4.539867
	112 03 01.456	37.8	42 11 32.5	222 00 48.9	Maricopa	45914.7	4.661952
Maricopa northwest base, (U.S.G.S.) 1910	33 03 00.494	15.2	13 58 24.9	193 55 34.1	Table	33910.9	4.530339
	112 02 15.343	398.1	44 10 38.7	223 59 30.1	Maricopa	45972.9	4.662502
			131 05 10.8	311 04 45.7	Maricopa astronomic station, eccentric.	1587.2	3.200624
Maricopa east pier	33 03 33.527	1032.8	138 07 19.6	318 07 19.3	Maricopa astronomic station, eccentric.	21.673	1.335919
	112 03 00.898	23.3					
Maricopa west pier	33 03 33.826	1042.0	141 54 59.6	321 54 59.3	Maricopa astronomic station, eccentric.	20.544	1.312685
	112 03 00.968	25.1					
Mare	33 16 24.506	755.0	141 40 41.4	321 31 31.0	Whitetank	41572.4	4.618805
	112 16 49.289	1275.6	259 12 20.3	79 41 21.5	Superstition (U. S. G. S.)	83325.7	4.920779
			345 49 42.5	165 54 47.2	Table	59479.0	4.774364
			9 07 48.1	189 04 33.8	Maricopa	58529.1	4.767372
Sierra Del Ajo [1] 1910	32 01 38.24	1177.9	199 53 28.0	20 03 27.0	Maricopa	85549.2	4.932216
	112 41 24.13	633.2	213 17 15.4	33 35 25.2	Table	96485.9	4.984464
Flat Top (center)	32 38 07.643	235.4	189 22 39.4	9 28 40.8	Whitetank	104751.9	5.020162
	112 44 30.457	793.9	249 01 06.5	69 12 51.1	Maricopa	36368.0	4.560720
			257 05 41.5	77 25 40.9	Table	59302.6	4.773074
Watson Peak [1] 1910	34 09 13.66	420.9	18 46 49.8	198 38 52.1	Whitctank	68690.4	4.836896
	112 19 11.35	290.7	68 29 47.7	247 55 21.8	Harquahalla	102170.6	5.009326
Gila Peak	33 10 03.124	96.2	214 22 13.8	34 33 01.0	Whitetank	53764.7	4.730497
	112 53 05.521	143.0	302 40 28.2	123 05 16.5	Table	84600.9	4.927375
			314 07 05.3	134 23 35.2	Maricopa	65976.6	4.819390

[1] Checked by vertical angles only. [2] No check on this position.

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Needles	33 24 12.500	385.1	86 20 48.3	265 55 06.6	Kofa	72589.4	4.860873
	113 18 14.916	385.4	175 03 06.5	355 01 42.1	Harquahalla	45464.1	4.657669
			255 07 03.6	75 31 45.6	Whitetank	71687.4	4.855443
Peak "N" [1]	34 19 44.93	1384.5	101 19 01.8	280 32 24.1	Powell	128629.9	5.109342
	112 48 50.20	1283.2	117 22 51.2	296 47 29.0	Pine	107160.8	5.030036
Peak "I" [1]	34 56 53.15	1637.8	61 38 58.4	241 08 39.1	Powell	92475.6	4.966027
	113 18 05.24	133.1	68 40 24.7	248 21 29.0	Pine	54240.3	4.734322
High sharp peak, 25 miles northeast of Needles [1]	35 05 25.61	789.2	308 34 34	128 51 18	Pine	57010.1	4.755952
	114 20 24.83	628.9	346 54 39	166 59 52	Powell	61656.1	4.789976
Gila 1911	32 44 14.775	455.1	111 25 40.7	291 13 49.6	American (U. S. G. S.)	36669.4	4.5643034
	114 23 15.506	403.7	202 22 18.4	22 32 17.5	Kofa	74626.7	4.8728945
Castle Dome 1910	33 05 05.357	165.0	30 46 39.4	210 38 40.8	Gila	44808.9	4.6513646
	114 08 34.856	904.0	41 19 34.8	221 05 00.8	Yuma No. 10	63546.6	4.8030924
			66 18 41.8	245 58 48.1	American (U. S. G. S.)	62280.1	4.7943493
			115 37 33.2	294 57 57.2	Butte	123723.0	5.0924503
			190 29 10.6	10 31 10.0	Kofa	30962.8	4.4908403
Yuma No. 10 1911	32 39 13.344	411.0	146 10 36.2	326 05 20.6	American (U.S.G.S.)	27245.7	4.4352987
	114 35 25.039	652.5	211 05 43.4	31 22 19.4	Kofa	91518.2	4.9615077
			243 54 15.3	64 00 49.4	Gila	21150.5	4.3253207
Yuma No. 9 1893	32 39 16.475	507.5	193 49 28.1	13 50 00.5	Azimuth station	6536.7	3.815357
	114 38 04.871	127.0	271 18 51.8	91 20 18.0	Yuma No. 10	4166.4	3.619764
Yuma:							
Azimuth station 1911	32 42 42.524	1309.9	142 10 15.3	322 05 53.4	American (U.S.G.S.)	20494.4	4.311636
	114 37 04.898	127.6	262 26 31.1	82 33 59.5	Gila	21783.6	4.338130
			338 00 24.0	158 01 17.8	Yuma No. 10	6949.0	3.841923
West base 1893	32 41 58.216	1793.3	224 24 42.7	44 25 10.4	Azimuth station	1910.9	3.281232
	114 37 56.244	1465.0	2 35 01.1	182 34 56.3	Yuma No. 9	4987.4	3.697871
East base 1893	32 41 48.834	1504.3	27 10 54.3	207 10 04.2	Yuma No. 9	5275.6	3.722274
	114 36 32.395	843.8	97 32 39.0	277 31 53.7	West base	2203.1	3.343041
			152 53 45.1	332 53 27.5	Azimuth station	1858.0	3.269044
			339 52 21.8	159 52 58.0	Yuma No. 10	5101.1	3.707664
Courthouse dome 1910	32 43 26.206	807.2	140 36 21.5	320 32 07.6	American (U.S.G.S.)	19204.6	4.283405
	114 37 19.560	509.3	266 02 32.2	86 10 08.5	Gila	22028.7	4.342988
			339 02 04.3	159 03 05.9	Yuma No. 10	8341.0	3.921220
			344 09 30.0	164 09 38.0	Azimuth station	1398.7	3.145737
Indian school water tank	32 43 52.469	1616.3	344 45 33.1	164 46 21.6	Yuma No. 10	8911.4	3.949946
	114 36 54.929	1430.3	6 52 15.5	186 52 10.1	Azimuth station	2170.2	3.336499
			137 34 02.9	317 29 35.6	American (U.S.G.S.)	19013.2	4.279055
B	32 43 31.332	965.2	341 48 12.9	161 48 34.5	East base	3323.6	3.521605
	114 37 12.239	318.7	352 45 12.5	172 45 16.5	Azimuth station	1515.6	3.180586
Boundary post	32 43 32.528	1002.0	349 58 41.2	169 58 52.9	East base	3243.7	3.511046
	114 36 54.066	1407.9	10 22 44.7	190 22 38.8	Azimuth station	1566.0	3.194782
			85 32 59.0	265 32 49.1	B	474.7	2.676382
Latitude station	32 43 37.671	1160.4	311 01 29.5	131 01 34.1	B	297.5	2.473476
	114 37 20.858	543.1	346 15 04.5	166 15 13.1	Azimuth station	1748.9	3.242759
			92 56 23.1	272 52 21.8	Pilot Knob	11635.7	4.065794
Indian school	32 43 56.481	1739.9	1 41 58.4	181 41 57.0	Azimuth station	2279.2	3.357785.
	114 37 02.303	60.0	18 28 05.5	198 28 00.1	B	816.8	2.912100
			90 05 04.9	270 00 53.5	Pilot Knob	12103.6	4.082913
Penitentiary	32 43 37.808	1164.6	9 46 06.0	189 45 59.9	Azimuth station	1728.0	3.237556
	114 36 53.641	1396.8	67 36 45.7	247 36 35.6	B	523.8	2.719139
Pilot Knob 1893	32 43 56.823	1750.4	280 43 50.6	100 48 00.5	Azimuth station	12253.0	4.088243
	114 44 47.147	1227.6	300 46 06.3	120 51 09.8	Yuma No. 10	17048.7	4.231691
			309 27 44.7	129 31 22.0	Yuma No. 9	13578.9	4.132866
Picacho, U. S. G. S. cairn	32 58 16.864	519.5	315 02 20.4	135 11 19.5	Gila	36612.8	4.563633
	114 39 49.171	1276.9	348 55 32.8	168 58 55.9	Yuma No. 10	35890.0	4.554973
			351 32 41.9	171 34 11.1	Azimuth station	29097.7	4.463858

[1] Checked by vertical angles only.

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Boundary monument No.	32 29 04.019	123.8	186 25 37.9	6 26 42.0	Pilot Knob	27676.2	4.442107
204 (U. S. & Mex.)	114 46 46.131	1204.5	210 58 06.5	31 03 19.6	Azimuth station	29418.2	4.468616
1893			223 22 35.6	43 28 42.2	Yuma No. 10	25844.6	4.412369
Boundary monument No.	32 43 04.857	149.6	273 41 03.0	93 44 42.9	Azimuth station	10618.4	4.026060
207 (U. S. & Mex.)	114 43 51.769	1348.3	281 31 57.4	101 35 54.9	East base	11680.7	4.067469
1910			298 20 28.6	118 25 02.2	Yuma No. 10	15004.2	4.176213
Boundary monument No.	32 42 56.346	1735.7	271 42 32.0	91 47 21.3	Azimuth station	13949.3	4.144552
208 (U. S. & Mex.)	114 46 00.267	7.0	277 57 40.3	98 02 47.2	East base	14936.0	4.174235
1910			292 29 44.5	112 35 27.5	Yuma No. 10	17917.9	4.253287
Boundary monument No.	32 43 06.919	213.1	274 21 42.9	94 25 06.0	Azimuth station	9817.1	3.991981
206 (U. S. & Mex.)	114 43 20.749	540.3	282 42 47.3	102 46 28.0	East base.	10904.2	4.037595
1910			300 06 11.3	120 10 28.2	Yuma No. 10	14330.1	4.156250
Yuma No. 11	32 41 26.382	812.7	238 59 37.8	59 02 17.9	Pilot Knob	9002.1	3.954343
1893	114 49 43.478	1132.6	263 10 24.0	83 17 13.8	Azimuth station	19897.4	4.298797
			280 19 06.1	100 26 49.5	Yuma No. 10	22739.3	4.356777
			348 33 08.3	168 34 43.8	Boundary monument No. 204	23330.7	4.367928
Hill (Cal.)	34 54 11.922	367.4	281 01 45.62	101 29 47.35	Pine	76272.4	4.8823676
1893	114 40 16.167	410.4	311 28 43.60	131 45 14.23	Powell	59180.7	4.7721798
			345 36 20.99	165 40 04.25	Chemehuevis	40193.5	4.6041553
Knoll	34 50 10.107	311.4	151 47 05.5	331 45 35.4	Hill	8457.4	3.927237
1893	114 37 38.673	982.7	275 46 47.3	96 13 17.7	Pine	71220.8	4.852607
			349 15 07.0	169 17 20.4	Chemehuevis	32045.8	4.505771
Bluff	34 54 59.391	1830.2	356 07 16.8	176 07 30.4	Knoll	8934.8	3.951086
1893	114 38 02.459	62.4	66 41 49.9	246 40 33.4	Hill	3696.1	3.567747
C. & G. S. B. M. N 6,	34 51 46.962	1447.0	204 29 42.2	24 30 43.1	Bluff	6516.7	3.814027
eccentric	114 39 48.900	1242.1	277 46 39.7	98 14 25.1	Pine	74859.0	4.874244
			312 02 39.2	132 03 53.6	Knoll	4455.7	3.648917
Bar	34 50 06.669	205.5	92 53 26.0	272 52 38.7	Knoll	2105.7	3.323404
1893	114 36 15.904	404.1	141 05 59.1	321 03 41.7	Hill	9713.7	3.987384
			163 18 32.2	343 17 31.3	Bluff	9417.5	3.973937
			201 21 29.5	21 21 40.1	Needles east base	1292.5	3.111426
Needles east base	34 50 45.731	1409.2	66 54 29.5	246 53 31.6	Knoll	2798.0	3.446851
1893	114 35 57.376	1457.9	134 03 04.6	314 00 36.6	Hill	9141.6	3.961024
			157 53 39.5	337 52 28.0	Bluff	8437.4	3.926209
Needles west base	34 51 00.619	19.1	30 46 35.2	210 46 14.3	Knoll	1811.6	3.258070
1893	114 37 02.190	55.6	140 07 51.0	320 06 00.0	Hill	7682.5	3.885501
			168 15 15.4	348 14 40.9	Bluff	7515.3	3.875948
			285 33 50.6	105 34 27.6	Needles east base	1709.3	3.232825
			324 43 20.7	144 43 47.1	Bar	2036.4	3.308857
Needles schoolhouse tower	34 50 08.246	254.1	60 34 53.2	240 34 51.2	Bar	98.95	1.995424
1893	114 36 12.512	317.9	91 30 26.2	271 29 36.9	Knoll	2190.0	3.340447
			141 58 35.2	321 58 06.8	Needles west base	2048.8	3.311504
			198 24 45.7	18 24 54.3	Needles east base	1217.4	3.085447
Needles longitude station	34 50 16.036	494.1	340 16 24.6	160 16 26.5	Needles schoolhouse	255.0	2.406539
1889	114 36 15.899	404.0	0 01 27.1	180 01 27.1	Bar	288.6	2.460355
Needles public school, east dome	34 50 08.256	254.4	91 29 58.1	271 29 08.9	Knoll	2190.3	3.340497
1911	114 36 12.502	317.7	118 58 18.2	298 56 14.6	C. & G. S. B. M. N 6, eccentric	6282.9	3.798161
			140 31 23.9	320 29 04.6	Hill	9730.4	3.988132
Base	34 50 08.212	253.0	53 31 34.2	233 31 32.8	Bar	80.0	1.903090
1893	114 36 13.372	339.8	165 05 12.6	345 05 11.2	Needles longitude station	249.5	2.397047
Peak "E"	35 16 24.571	757.2	305 00 52.6	125 30 44.3	Pine	96933.8	4.986475
	114 43 14.105	356.5	328 39 14.2	148 57 31.3	Powell	93955.2	4.972921
			349 42 21.3	169 47 47.4	Chemehuevis	81301.8	4.910100
Peak "D"	35 36 08.271	254.9	307 03 16.2	127 49 06.4	Pine	152067.7	5.182037
	115 10 44.544	1121.3	321 59 38.3	142 33 48.4	Powell	147722.6	5.169447
			334 02 47.7	154 24 03.7	Chemehuevis	129356.4	5.111778

Deming base net to San Jacinto-Cuyamaca—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Peak "C"	35 15 31.833	981.0	291 48 04.9	112 38 15.4	Pine	143686.9	5.157417
	115 18 38.560	974.9	307 11 01.7	127 49 34.3	Powell	129336.2	5.111720
			318 40 27.3	139 06 09.1	Chemehuevis	104028.2	5.017151
Peak "B"	34 57 19.395	597.7	277 11 18.5	98 08 53.8	Pine	154921.6	5.190112
	115 31 56.763	1440.2	289 43 51.1	110 29 49.9	Powell	131086.8	5.117559
			296 26 33.4	116 59 44.2	Chemehuevis	99447.1	4.997592
Peak "A"	34 47 39.051	1203.3	270 25 13.0	91 28 22.4	Pine	168913.0	5.227663
	115 41 54.782	1392.8	280 41 05.5	101 32 38.8	Powell	141081.8	5.149471
			284 07 26.3	104 46 13.3	Chemehuevis	107539.8	5.031569
Sharp Peak [1]	33 37 02.72	84.0	329 29 27.0	149 46 52.0	American (U.S.G.S.)	97650.4	4 989674
1910	115 16 54.88	1414.8	43 04 56.1	223 02 51.7	Butte	8488.2	3.928814

[1] Checked by vertical angles only.

DESCRIPTIONS OF STATIONS.

This list may be conveniently consulted by reference to the illustrations at the end of this publication or to the index. All azimuths given in these descriptions are reckoned continuously from true south around by west to 360°, south being 0°, west 90°, north 180°, and east 270°. Where magnetic azimuths are given they are indicated as such.

In general the surface and underground marks are not in contact, so that a disturbance of the surface mark will not necessarily affect the underground mark. The underground mark should be resorted to only in cases where there is evidence that the surface mark has been disturbed.

The dates and initials given in each description immediately after the county refer to the date of establishment of the station, the man by whom it was established, and the date when the station was last visited.

Any person who finds that one of the stations herein described has been disturbed, or that the description no longer fits the facts, is requested to send such information to the Superintendent, Coast and Geodetic Survey, Washington, D. C.

MARKING OF STATIONS.

The standard triangulation disk station mark referred to in the following notes and descriptions consists of a disk and shank, as shown in illustration No. 8, made of brass and cast in one piece. The disk is 90 mm. in diameter, with a small hole at the center surrounded by a 20 mm. equilateral triangle, and has the following inscribed legend: "U. S. Coast and Geodetic Survey triangulation station. For information write to Superintendent, Washington, D. C. $250 fine or imprisonment for disturbing this mark." The shank is 25 mm. in diameter and 80 mm. long, with a slit at the lower end into which a wedge is inserted so that when it is driven into a drill hole in the rock it will bulge at the bottom and hold the mark securely in place.

Another type of station mark shown in illustration No. 8 and referred to in the following notes and descriptions is made in the form of a cap to fit a 3-inch pipe instead of with the shank, but in other respects is exactly similar to the disk station mark described above.

The old type of station mark referred to in the following notes and descriptions is somewhat similar to the disk station mark described above, except that the disk has a raised rim and that the legend which is on the depressed part within the rim consists only of the following raised letters: "U. S. C. & G. S."

GENERAL NOTES IN REGARD TO STATION MARKS.

NOTE 1.—The underground mark is the point of a 40-penny nail projecting one-fourth of an inch above the concrete that fills an iron pipe 1½ inches in diameter and 12 inches long, which in turn is embedded in a cylinder of concrete 12 inches in diameter and 12 inches long. The surface mark is similar to the underground mark, except that the cylinder of concrete and the iron pipe are each 24 inches long and the cylinder is 20 inches in diameter. The top of the underground mark is 30 inches below the surface of the ground, and 6 inches of sand or earth separates it from the surface mark.

NOTE 2.—The underground mark is a 40-penny wire nail cemented into a drill hole in the solid rock, the point of the nail projecting one-fourth of an inch. The surface mark is similar to the surface mark described in note 1, except that the length of the cylinder of concrete and of the iron pipe depends upon the depth of the soil above solid rock. Six inches of sand or earth separates the surface mark from the underground mark.

NOTE 3.—The underground mark is an old type station mark, described above, cemented into a drill hole in the solid rock. The surface mark is the same as the surface mark described in note 2. Six inches of sand or earth separates the surface and underground marks.

NOTE 4.—The underground mark is similar to the underground mark described in note 1, except that the iron pipe is embedded in an irregular mass of concrete instead of in a cylinder of concrete. The surface mark is a cap station mark, described on page 83, screwed to the top of a 3-inch iron pipe 30 inches long, which is embedded in a cylinder of concrete 20 inches in diameter and 30 inches long. The top of the underground mark is 3 feet below the surface of the ground, and 6 inches of sand or earth separates it from the surface mark.

NOTE 5.—The underground mark is a disk station mark, described on page 83, set in a cylinder of concrete 10 inches in diamater and 8 inches long. The surface mark is the same as the surface mark described in note 4. The top of the underground mark is 3 feet below the surface of the ground, and 6 inches of sand or earth separates it from the surface mark.

NOTE 6.—The underground mark is a disk station mark, described on page 83, cemented into a drill hole in a rock. The surface mark is a cap station mark, described on page 83, screwed to the top of a 3-inch iron pipe 2½ feet long set in the ground with earth and rock well tamped around it. The top of the underground mark is 3 feet below the surface of the ground, and 6 inches of sand or earth separates it from the surface mark.

NOTE 7.—The station is marked by a disc station mark, described on page 83, cemented into a drill hole in solid outcropping rock.

NOTE 8.—The underground mark is an old type station mark, described on page 84, set in cement 2 feet below the surface of the ground. The surface mark is a cap station mark, described on page 83, screwed to the top of a 3-inch iron pipe 2 feet long, which is anchored by means of an iron rod through a horizontal hole near the bottom of the pipe.

GENERAL NOTES IN REGARD TO REFERENCE MARKS.

NOTE 9.—The mark is the point of a 40-penny nail projecting one-fourth inch above the concrete that fills an iron pipe 1½ inches in diameter and 24 inches long, which in turn is embedded in a cylinder of concrete 12 inches in diameter and 24 inches long.

NOTE 10.—The mark is similar to that described in note 9 except that the lower end of the pipe is cemented into a drill hole in the solid rock, and the lengths of the pipe and of the cylinder of concrete depend upon the depth of soil above the solid rock.

NOTE 11.—The mark is a three-fourths inch iron rod 18 inches long, set in a cylinder of concrete 12 inches in diameter and 20 inches long.

KYLE-McCLENNY TO STANTON BASE.

PRINCIPAL POINTS.

Kyle (Palo Pinto County, Tex., O. W. F., 1902; 1908).—On the highest part of Kyle Mountain, which rises above the south bank of the Brazos River, 4 miles north by west of the town of Palo Pinto and 1⅓ miles west of the Palo Pinto-Jacksboro road at a point 3 miles south of the ford where the road crosses the river. The top of the mountain is a table-land, about 2 acres in extent, belonging to Mrs. T. A. McClure, and the station is in the middle of this area longitudinally and about one-fourth of the distance from the northeast end. The underground mark at the station is the point of a spike projecting one-fourth of an inch from a 6-inch bed of concrete. Above the underground mark is 4 inches of sand, and resting on the sand is the surface mark, which consists of a 60-penny wire nail cemented in the top of a piece of terra-cotta pipe 14 inches long. The reference mark, a five-eighths inch drill hole surrounded by a 5-inch equilateral triangle cut in one of the highest and most prominent of the large rocks near the station, is 52.472 meters from the station in azimuth 38° 07′ 22″.

McClenny (Erath County, Tex., O. W. F., 1902; 1908).—At the center and highest point of a long wooded ridge extending east-northeast and west-southwest on land belonging to D. Cantrell, 6 miles by road north of the town of Morgan Mills, 100 meters east of the Morgan Mills-Caraway-Roberts Settlements road, between Paluxy Creek to the south and Buck Creek to the north and three-fourths of a mile west by south from the "B. D." spring. The underground mark at the station is the point of a 60-penny wire nail projecting one-fourth of an inch above the concrete that fills a 4-inch terra-cotta pipe 2 feet long, which in turn is embedded in a cylinder of concrete 1 foot in diameter and 2 feet long. The surface mark is similar to the underground mark except that the cylinder of concrete is 18 inches in diameter, and the top of the terra-cotta pipe is embedded 1 inch below the top of the concrete. A 6-inch layer of sand separates the underground and surface marks. Three square-blazed oak trees are at the following distances and directions from the station: 13.17 meters, N. 38° E.; 6.20 meters, S. 65° E.; and 5.13 meters, N. 88° W. The reference mark is exactly similar to the underground mark at the station except that it is flush with the surface of the ground and is 53.915 meters from the station in azimuth 198° 47′ 28″. Three oak trees are at the following distances and directions from the reference mark: 3.10 meters, N. 34° E.; 6.25 meters, S. 56° E.; and 6.70 meters, S. 83° W.

Lacasa (Stephens County, Tex., W. B., 1908).—Thirteen miles due north of Ranger, a town on the Texas & Pacific Railway, 3 miles north of Lacasa post office and 1 mile west of the Ranger-Caddo road on top of the highest peak of a very prominent ridge. The peak is somewhat rounded and is partly covered with low trees. The station is on the property of Robert Milholland and 6.80 meters south of the fence between his property and that of Matt Stevenson. It is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 29.56 meters from the station in azimuth 97° 10′. The center of Milholland's house is about 200 meters from the station in azimuth 348° 38′.

Rattlesnake (Eastland County, Tex., W. B., 1908).—On Rattlesnake Mountain, 15 miles south of Strawn, a town on the Texas & Pacific Railway, 2 miles southwest of Tanner post office, 300 meters west of the Granbury and Eastland City road, in the W. T. Marshall pasture, and on the southern and higher one of two peaks known as Little Rattlesnake and Big Rattlesnake Mountains. The top of the peak is bare. The station is marked according to note 1, page 84. The reference mark, a 20-penny wire nail cemented into a ledge of rock, is 22.25 meters from the station, in azimuth 186° 15′ 57″.

Pierce (Stephens County, Tex., W. B., 1908).—About 5 miles by road, or 3½ miles direct, northwest of Ranger, a town on the Texas & Pacific Railway, about 375 meters west of the center of the Ranger-Wayland public road, and about one-fifth mile north of the boundary between Stephens and Eastland Counties, on the property of David Z. Pierce. The station is in a wood lot, 16.94 meters north of an east-and-west fence which separates the wood lot from a cultivated field, and 25 paces northeast of a tenant house. It is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is in the east-and-west fence mentioned above, and 16.94 meters from the station, in azimuth 347° 06′. Other distances and azimuths are as follows: South gable of Pierce's house, 221.60 meters, 244° 49′; chimney on Pierce's house, 225 meters, 241° 50′.

Hearn (Eastland County, Tex., W. B., 1908).—Ten miles south and 4 miles east of Cisco, a town on the Texas & Pacific Railway, 1 mile south and 4⅓ miles west of Carbon, a town on the Texas Central Railroad, at the highest point of the Carbon-Romney public road, and about 1 mile east of where this road joins the Cisco-Long Branch public road. The station is 4.74 meters south of the south side of the road, on land covered with low trees and belonging to J. M. Hearn, about 100 meters west of the northeast corner of his property, and about five-eighths of a mile northeast of his house. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is in the fence line on the south side of the road, and 27.17 meters from the station, in azimuth 99° 17′ 05″.

Flat (Eastland County, Tex., W. B., 1908).—About 8½ miles by road northwest of Eastland, 12½ miles by road northeast of Cisco, towns on the Texas & Pacific Railway, and one-half mile west of the Cisco-Gunsight public road, on the highest point and near the north end of a short wooded ridge called on the United States Geological Survey map "Flat Top Mountain," a name not recognized locally. The station is 43.40 meters west of a north-and-south fence running along the eastern edge of the top of the peak, on land belonging to P. Thorp, of Gunsight. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is in the east-and-west fence mentioned above, and 47.53 meters from the station, in azimuth 297° 59′ 06″. Other distances and azimuths are as follows: Chimney of a white house, about three-fourths of a mile, 231° 22′ 36″; chimney of N. J. Ramsower's house, about three-fourths of a mile, 298° 31′ 36″.

Lamb (Eastland County, Tex., W. B., 1908).—Two miles south and 5 miles west of Cisco, 2 miles south, and 2 miles east of Dathan, towns on the Texas & Pacific Railway, and 1 mile south of the old Base Line public road, on one of the highest points of an extensive plateau. It is on the property of J. J. Livingston and in a grove of low oak trees just to the east of a north-and-south road. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 0.40 meter east of the fence line on the east side of the road, and 21.09 meters from the station, in azimuth 105° 24′ 11″. Other distances and azimuths are as follows: South gable of J. F. Lamb's house, about 120 meters, 158° 11′ 41″; east chimney of Livingston's house, 78.10 meters, 356° 27′ 51″.

Springgap (Callahan County, Tex., W. B., 1908).—Twelve miles by road southwest of Putnam, 12 miles by road southeast of Baird, towns on the Texas & Pacific Railway, and one-half mile south of the Baird-Brownwood public road, near the northwest corner of the Springgap Mountains. It is on a peak having a flat top partly covered with brush, and is 475 paces S. 80° E. from the extreme northwest corner of the top of the mountain, on property belonging to Richard Cordwell, of Admiral. The station is marked according to note 2, page 84. Reference mark No. 1, a cross with a drill hole at its center and marked with the letters U. S. C. & G. S. cut into a ledge of rock at the edge of a bluff, is 44.022 meters from the station, in azimuth 204° 35′. Reference mark No. 2, a pipe set in concrete, is 12.705 meters from the station, in azimuth 214° 45′. From the station the south gable of the Admiral Church is distant about 2 miles, in azimuth 172° 35′, and the south gable of J. H. Brown's house is distant about one-half mile, in azimuth 198° 50′.

Hitson (*U. S. G. S.*) (Callahan County, Tex., W. B., 1908).—This station is identical with the United States Geological Survey station of the same name. It is on the higher and more southern one of the two highest peaks of the Hitson Mountains, on the property of R. D. Williams, of Putnam, about 12 miles by road northwest of Putnam and 9 miles by road northeast of Baird, towns on the Texas & Pacific Railway. It is 30 paces west of the east break of the top of the peak, 35 paces east of the west break, and 100 paces south of the north break. The station is marked according to note 2, page 84. The reference mark, a cross with a drill hole at its center cut into the solid outcropping rock, is 19.160 meters from the station in azimuth 235° 55′.

Clyde (Callahan County, Tex., W. B., 1908).—Four and one-half miles by road northwest of Baird, 2½ miles by road northeast of Clyde, towns on the Texas & Pacific Railway, and 600 meters south of the upper or north Baird-Clyde public road, on the highest point of the more southern one of two prominent hills which are about one-half mile apart. The hill is rather sharp and covered with oak bushes, and the land is owned by Joseph Weldy, of Clyde. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 3.517 meters from the station in azimuth 314° 13′. The northeast corner of a house is about 50 paces from the station in azimuth 142° 13′.

Kennard (Callahan County, Tex., W. B., 1908).—Eleven miles by road northwest of Baird, about 16 miles by road northeast of Abilene, and 7½ miles north of Clyde, towns on the Texas & Pacific Railway, in a cultivated field belonging to John Kennard, whose address is Clyde, and near the northwest corner of a long north-and-south ridge which has a nearly flat top with a few scattered trees growing on it. A peach orchard is just south of the station. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is in an east-and-west fence and 234.13 meters from the station in azimuth 172° 25′ 11″. Other distances and azimuths are as follows: North gable of Kennard's house, 144.92 meters, 345° 39′; northwest corner of Kennard's barn, about 150 meters, 311° 51′.

Clayton (Taylor County, Tex., W. B., 1908).—This station is very close to the United States Geological Survey station "Lidel," which was recovered only approximately. It is about 13 miles by road southeast of Abilene, a town on the Texas & Pacific Railway, about 3 miles south-southwest of the post office and village of Potosi, and about one-half mile east of the East Abilene-Coleman public road at a point where it crosses the mountain. It is on a clear peak, the highest peak of a very prominent ridge, and in the pasture of George Clayton. The station is marked according to note 3, page 84, except that only 4 inches of earth separates the surface and underground marks. The reference mark, which is similar to that described in note 9, page 85, except that the pipe projects about 5 inches above the ground, is 14.280 meters from the station in azimuth 151° 19′.

Morrison (Taylor County, Tex., W. B., 1908).—About 9 miles by road from Abilene and 2 miles east and 4 miles north of Tye, towns on the Texas & Pacific Railway. It is in the Morrison pasture on the highest point of the highest hill in the vicinity, which has a flat top, almost level, with its edges cut by ravines. The station is near the extreme western edge of the top of the hill 300 meters south-southwest from a water tank and near the head of a deep ravine running southwest. It is marked according to note 2, page 84. The reference mark, described in note 10, page 85, is 14.620 meters from the station in azimuth 159° 44′.

Buzzard (Taylor County, Tex., W. B., 1908).—Six miles south and 3 miles east of Merkel, a town on the Texas & Pacific Railway, on Buzzard Peak, which is the northeast spur or corner of an extensive flat-topped ridge, and about 1 mile east-southeast of East Peak, shown on the United States Geological Survey map. The station is where the Buzzard Peak spur joins the main ridge on land belonging to either Fred Dubo or J. T. Humphreys, whose address is Merkel. The peak or spur is flat-topped and covered with scrub brush. The station is marked according to note 3, page 84. The reference mark, which is similar to that described in note 9, page 85, except that the pipe projects about 5 inches above the ground, is 14.800 meters from the station in azimuth 293° 59′. Other distances and azimuths are as follows: North corner of Buzzard Peak, about 400 meters, 193° 51′; east corner of Buzzard Peak, about 400 meters, 286° 30′.

Sears (Jones County, Tex., W. B., 1908).—Nine miles by road, or 6 miles direct, N. 13½° W. from Merkel, a town on the Texas & Pacific Railway, and 1 mile east of the Merkel-Noinda public road, on a prominent flat-topped hill in the pasture of John Sears, of Whitewright, Grayson County. The station is 3 miles south of the village of Noodle, which is on the main public road. It is in clear pasture land on the highest part of the more western one of the two most southern spurs of the hill, 115 meters west of a north-and-south ravine, about 60 paces northeast of the head of a ravine running southwest and about 300 meters northeast of the end of the spur. The station is marked according to note 3, page 84. The reference mark, described in note 9, page 85, is 12.94 meters from the station in azimuth 262° 47′. The east gable of a house in the southwest corner of the pasture, near the Merkel-Neinda road, is about three-fourths of a mile from the station in azimuth 73° 46′.

Hale (Nolan County, Tex., W. B., 1908).—Nine miles in a direct line S. 73½° W. from Merkel, and 4½ miles direct S. 33° W. from Trent, towns on the Texas & Pacific Railway. It is 1 mile west of the house of T. C. Hale and three-fourths of a mile southeast of the house of F. C. Hale, on the highest point of the mountain in this vicinity, and about 600 meters south of the extreme north edge of the top of the hill. The station is marked according to note 3, page 84. The reference mark described in note 9, page 85, is 14.120 meters from the station in azimuth 280° 35′.

Boyd (Nolan County, Tex., W. B., 1908).—About 5½ miles in a direct line south from Eskota, a town on the Texas & Pacific Railway, and on a somewhat rounded knoll near the north edge of a very prominent ridge. The station is on solid rock, about 10 meters south-southeast of the highest point of this part of the ridge, and is in the Boyd pasture. In erecting the stand, holes 6 inches square and 6 inches deep were drilled in the solid rock to receive the lower ends of the legs, and when the stand decays these holes will serve as reference marks. The station is marked with an old-type station mark, described on page 84, cemented into a drill hole in the solid rock. The reference mark, a cross cut in a large solid rock with a 1-inch drill hole at the center, is 18.110 meters from the station in azimuth 217° 44′. A small tree is 22.20 meters from the station in azimuth 277° 06′.

Allen (Fisher County, Tex., W. B., 1908).—Six miles direct, or 7½ miles by road, northwest from Eskota, 10 miles direct, or 14 miles by road, northeast from Sweetwater, towns on the Texas & Pacific Railway and 200 meters west of the Eskota-Roby public road. It is on prairie land on the highest part of a prominent round-topped knoll. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 14.825 meters from the station in azimuth 0° 11′. The chimney of N. H. Allen's house is about 300 meters from the station in azimuth 236° 41′, and a cotton-gin stack is distant about 2 miles in azimuth 91° 21′.

Patterson (Nolan County, Tex., J. S. H., 1909).—Four miles due north of Roscoe, a town on the Texas & Pacific Railway, on an extensive table-land on the farm of A. A. Patterson, who lives three-fourths of a mile north of the station. It is 9.83 meters north of the north edge of the main east-and-west road, 700 meters east of the southwest corner of Patterson's property and between two of his tenant houses. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 5.80 meters south of the fence on the south side of the road and 23.684 meters from the station in azimuth 359° 05′. Other distances and azimuths are as follows: East gable of tenant house, about 300 meters, 80° 17′; Patterson's windmill, about 1 mile, 208° 31′; southeast corner of other tenant house, 67.80 meters, 241° 47′.

Lloyd (Nolan County, Tex., J. S. H., 1909).—Nine miles by road, or 8¼ miles direct, S. 21° E. from Roscoe, a town on the Texas & Pacific Railway and three-fourths of a mile east of the Roscoe-Decker public road. It is near the north end of a high flat-top ridge in a pasture owned by Charles Lloyd, whose house is about one-half mile west of the station. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 13.375 meters from the station in azimuth 356° 05′. Other distances and azimuths are as follows: Helen's windmill, about one-half mile, 71° 22′; J. W. Watt's windmill, about one-fourth of a mile, 99° 42′.

Bench (Nolan County, Tex., J. S. H., 1909).—Ten miles south by west from Roscoe and 12 miles southeast from Loraine, towns on the Texas & Pacific Railway, and on the highest point of the western end of a prominent flat-top peak known as Bench Mountain, which is the second point from the northwestern end of the ridge. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 17.092 meters from the station in azimuth 243° 04′. Other distances and azimuths are as follows: P. R. Key's house, about 2 miles, 84° 40′; M. A. Dougherty's house chimney, about 1½ miles, 140° 20′.

Wolf (Mitchell County, Tex., J. S. H., 1909).—Five miles north of Loraine, a town on the Texas & Pacific Railway, and one-half mile west of the Loraine-Snyder public road, on the property of Walter Tubbs and on the western one of two very prominent peaks known as the Lone Wolf Mountains. The station is marked according to note 3, page 84. The reference mark, described in note 10, page 85, is 13.350 meters from the station in azimuth 185° 59′. Other distances and azimuths are as follows: Windmill about 1 mile, 271° 59′; windmill about 1½ miles, 123° 13′; well stand, about 200 meters, 233° 34′.

Bynum (Mitchell County, Tex., J. S. H., 1909).—Three miles south of Westbrook, a town on the Texas & Pacific Railway, on a round-top hill in a pasture belonging to G. D. Bynum, of Colorado, Tex., and about 170 meters west of his tenant house. There are a few scattered mesquite trees on the hill. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 14.612 meters from the station in azimuth 356° 44′. The south gable of Boswell's house is distant about 230 meters in azimuth 270° 10′.

Cuthbert (Mitchell County, Tex., J. S. H., 1909).—In the town of Cuthbert, 15 miles by road northwest of Colorado, a town on the Texas & Pacific Railway, on a lot owned by D. T. Bozeman, postmaster of the town, and 1 meter south of the south side of the main east-and-west road through the town. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 14.330 meters from the station in azimuth 270° 58′. Other distances and azimuths are as follows: Schoolhouse, about 250 meters, 312° 47′; flagstaff on Bozeman's store, about 90 meters, 48° 57′; center of church, about 150 meters, 109° 51′.

Top (Howard County, Tex., J. S. H., 1909).—Ten miles north and 3 miles east of Coahoma, a town on the Texas & Pacific Railway, on the north end and highest point of Flat Top Mountain and in a large pasture. There is an east-and-west wagon road about one-fourth of a mile south of the station. The station is marked according to note 1, page 84. The reference mark, described in note 9, page 85, is 16.936 meters from the station in azimuth 15° 08′. The southeast point of the mountain is about 400 meters distant in azimuth 5° 24′.

Signal (Howard County, Tex., J. S. H., 1909).—Eight miles south of Coahoma, a town on the Texas & Pacific Railway, on the northern end of Signal Mountain, which is the first peak south of Signal Peak, a peak conspicuous for its conical shape. The distance between the two peaks is about 600 meters. The station is marked according to note 2, page 84, the nail in the underground mark being 15 inches below the surface. The reference mark, a 2-inch hole 3 inches deep drilled in a ledge of rock on the northwest edge of the mountain, is 29.90 meters from the station in azimuth 138° 38′.

Williams (Howard County, Tex., J. S. H., 1909).—Four miles direct, or 6 miles by road, south of Big Springs, a large town on the Texas & Pacific Railway, on the property of Jim Williams of Big Springs, and on the highest part of a north and south ridge. It is 11 meters east of the road running along the ridge and 5 meters north of a fence line. The station is marked according to note 3, page 84, the underground mark being 17 inches below the surface. The reference mark, described in note 10, page 85, is in the fence line mentioned above and is 23.770 meters from the station in azimuth 63° 20′.

Evart (Howard County, Tex., J. S. H., 1909).—Seven and one-half miles due north of Big Springs, a town on the Texas & Pacific Railway and one-third of a mile east of the Big Spring-Caboka public road, on land owned by G. C. Black, which was formerly known as the old Evart place. The reconnoissance description states that the point selected was on the east side of a pasture near a north and south fence, 80 meters south of the farmhouse and 100 meters southeast of a windmill and tank. The station is probably either at or near the point selected by the reconnoissance party. It is marked according to note 4, page 84. The reference mark, described in note 9, page 85, is 60.441 meters from the station in azimuth 184° 19′.

Stanton (Martin County, Tex., J. S. H., 1909).—About 1 mile S. 54° E. from the city water tower at Stanton, a town on the Texas & Pacific Railway, on the highest point of a narrow ridge running north and south and about one-half mile south of the railroad. The station is marked according to note 4, page 84. The reference mark, described in note 9, page 85, is 20.260 meters from the station in azimuth 64° 06′. The Stanton courthouse cupola is about 1 mile distant in azimuth 109° 54′.

Epley (Martin County, Tex., J. S. H., 1909).—Eleven miles direct, or 12½ miles by road, N. 25° W. from Stanton, a town on the Texas & Pacific Railway, one-fourth of a mile west of the Stanton-Lamera public road, on the highest elevation in the vicinity and on land owned by a Mr. Norton, of New York. The station is marked according to note 4, page 84. The reference mark, described in note 9, page 85, is 20.678 meters from the station in azimuth 89° 47′. Other distances and azimuths are as follows: Chimney of A. L. Graham's house, about 1¼ miles, 1°00′; chimney of Walker's house, about one-half mile, 84° 29′.

Stanton south base (Martin County, Tex., J. S. H., 1909).—Seven and one-eighth miles direct, or 7½ miles by road, west-southwest from Stanton, a town on the Texas & Pacific Railway, and two-thirds of a mile north of the railroad on level clear prairie land. The underground and surface marks at this station are described in notes 3 and 4, respectively, page 84. The reference mark, described in note 9, page 85, is 29.590 meters from the station in azimuth 148° 14′.

Stanton north base (Martin County, Tex., J. S. H., 1909).—Eleven miles direct, or 14 miles by road, N. 69° W. from Stanton, a town on the Texas & Pacific Railway, and about 2 miles west of the Stanton-Gaines County public road, on the highest part of a small bare knoll in the pasture of J. E. Henson. The station is marked according to note 4, page 84, except that the cylinder of concrete for the surface mark is 24 inches in diameter instead of 20. The reference mark, described in note 9, page 85, is 23.550 meters from the station in azimuth 327° 20′.

STANTON BASE TO DEMING BASE.

PRINCIPAL POINTS.

Elkins (Midland County, Tex., J. S. H., 1909).—Four and one-half miles direct, or 6 miles by road, northeast of Midland, a town on the Texas & Pacific Railway, on the property of Frank Elkins, of Midland, 1¼ miles north of the railroad and on the highest point of the south end of a north-and-south ridge. The station is marked according to note 4, page 84. The reference mark, described in note 9, page 85, is 24.662 meters from the station in azimuth 162° 09′. Other distances and azimuths are as follows: Smith's windmill, 1¼ miles, 358° 14′; chimney on house, one-half mile, 16° 57′.

Dunn (Martin County, Tex., J. S. H., 1909).—Fourteen miles by road, or 11 miles direct, N. 27° W. from Midland, a town on the Texas & Pacific Railway, and 1⅜ miles west of the Midland-Seminole public road. It is on the south side of a large pasture owned by Ole Dunn and about 10 meters north of an east-and-west fence, which is the south line fence of Mr. Dunn's property. The underground and surface marks at this station are described in notes 3 and 4, respectively, page 84. The reference mark, described in note 9, page 85, is in the above-mentioned fence line and 23.593 meters from the station in azimuth 271° 45′.

Scar (Midland County, Tex., J. S. H., 1909).—Seven miles west of Midland, 3 miles east of Warfield, towns on the Texas & Pacific Railway, and one-half mile south of the railroad, on a round knoll in a cultivated field, the property of the Scarborough Cattle Co. of Midland. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 38.161 meters from the station in azimuth 271° 37′. A windmill is 8.53 meters from the station in azimuth 331° 56′.

Morris (Ector County, Tex., J. S. H., 1909).—Seventeen miles by road, or 14 miles direct, N. 72° W. from Midland, a town on the Texas & Pacific Railway, in the C. Morris pasture, known as the "C" pasture, and on the highest knoll in the vicinity. It is one-half mile east of R. A. Anderson's east line fence. The station is marked according to note 4, page 84, except that the underground mark has an old-type station mark in place of the iron pipe and nail. The reference mark, described in note 9, page 85, is 29.615 meters from the station in azimuth 352° 52′. Two windmills in the Morris pasture are at the following distances and azimuths from the station: About 1½ miles, 276° 59′; about 2 miles, 337° 58′.

Bates (Ector County, Tex., J. S. H., 1909).—Nine and one-half miles direct, or 10 miles by road, N. 20° E. from Odessa, a town on the Texas & Pacific Railway, near a large round depression in the top of a ridge, and on the "Old Bates Ranch," now owned by H. S. Ratliff. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 18.945 meters from the station in azimuth 350° 56′. Other distances and azimuths are as follows: Center of depression, 550 meters, 287°; center of the old Bates ranch house, about 1½ miles, 64° 40′.

Odessa (Ector County, Tex., J. S. H., 1909).—Two miles east of Odessa, a town on the Texas & Pacific Railway, and 1 mile north of a railroad crossing, on the highest point of a low bare knoll in the pasture of C. P. Turner and one-half mile north of his house. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 19.145 meters from the station in azimuth 247° 00′.

Smith (Ector County, Tex., J. S. H., 1909).—Ten and one-half miles direct, or 14 miles by road, N. 35° W. from Odessa, a town on the Texas & Pacific Railway, three-fourths mile west of the main county road, on the ranch owned by R. W. Smith and 1 mile southwest of his residence. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 20.684 meters from the station in azimuth 88° 12′. Smith's windmill is about three-fourths mile from the station in azimuth 204° 19′.

Dublin (Ector County, Tex., J. S. H., 1909).—Sixteen and one-half miles direct, or 20 miles by road, N. 85° W. from Odessa, a town on the Texas & Pacific Railway, and 5 miles S. 75° W. from the ranch house of J. W. Buchanan. It is on the west side of a pasture owned by the Dublin brothers, 20 meters south of the wagon road leading through their pasture from Buchanan's ranch, and about 30 meters southeast of the gate where the road enters the pasture to the westward. The underground and surface marks at this station are described in notes 3 and 5, respectively, page 84. The reference mark, described in note 11, page 85, is 17.780 meters from the station in azimuth 347° 30′. A windmill is about 2½ miles distant in azimuth 349° 58′.

Douro (Ector County, Tex., J. S. H., 1909).—Four miles direct, across pasture, S. 2° W. from Douro, a station on the Texas & Pacific Railway, on a round top knoll near the south edge of a large plateau and on the property of Mr. Henderson, about one-third of a mile south by east from his ranch house. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 20.541 meters from the station in azimuth 259° 41′. A windmill at Henderson's west ranch house is about 500 meters from the station in azimuth 166° 41′.

Curtis (Crane County, Tex., J. S. H., 1909).—Eight miles direct, or 10 miles by road, directly south of Judkins, about 7 miles direct south by east from Metz, towns on the Texas & Pacific Railway, and very near the southern end of a prominent narrow ridge which extends 4 miles southeast from the J. A. Graham ranch house. The station is on the "04" pasture, owned by Mrs. A. G. Curtis, of Midland. The underground and surface marks at this station are described in notes 2 and 5, respectively, page 84. The reference mark, described in note 11, page 85, is 13.757 meters from the station in azimuth 266° 08′. The eastern one of two windmills is about 1 mile distant in azimuth 336° 27′.

Harris (Winkler County, Tex., J. S. H., 1909).—Nine miles direct, or 10½ miles by road, N. 83° W. from Metz, a station on the Texas & Pacific Railway, 3 miles N. 55° W. from the Judge Murphy cattle pens, where there are four windmills, and on land owned by M. W. Harris, who lives 1 mile north by east of the station. The station is 150 meters west from the southeast corner of the four-section claim of Mr. Harris and just north of a line of old fence posts to which no wire is attached. The underground and surface marks at the station are described in notes 1 and 5, respectively, page 84. The reference mark, described in note 11, page 85, is 16.065 meters from the station in azimuth 232° 39′. Other distances and azimuths are as follows: Harris ranch windmill, about 2 miles, 110° 17′; windmill, about 1 mile, 201° 15′.

Estes (Ward County, Tex., J. S. H., 1909).—Seven and one-fourth miles direct, or 9 miles by road, S. 30° W. from Monahans, a town on the Texas & Pacific Railway, 5½ miles direct S. 10° E. from the section house at Aroya switch on the same railroad, on land owned by E. W. Estes and 400 meters northeast of his house. The windmill and cottonwood trees at Mr. Estes's house may be seen from Monahans, the trees being very prominent and the only ones in the vicinity. The underground and surface marks at the station are described in notes 2 and 5, respectively, page 84. The reference mark, described in note 11, page 85, is 21.729 meters from the station in azimuth 276° 03′. Estes' windmill is about one-fourth of a mile from the station in azimuth 31° 01′.

Aroya (Winkler County, Tex., J. S. H., 1909).—Nine miles direct, or 11½ miles by road, N. 68° W. from Monahans, a town on the Texas & Pacific Railway, 6 miles direct N. 35° W. from the section house at Aroya switch on the same railroad, and on the highest point of a flat-top knoll in the McElroy pasture. The underground and surface marks at the station are described by notes 2 and 5 respectively, page 84. The reference mark, described in note 11, page 85, is 15.714 meters from the station in azimuth 76° 27′. The center of a water tank is about 1¼ miles distant in azimuth 172° 38′.

Lee (Ward County, Tex., J. S. H., 1909).—Seven miles direct, or 7½ miles by road, S. 43° W. from Pyote, a small town on the Texas & Pacific Railway, on the highest point of a prominent ridge and on the property of Capt. J. M. Lee, who lives about 2 miles west of the station. The ridge on which the station is located is the more distant one of the two ridges southwest of Pyote. The station is marked according to note 6, page 84. The reference mark, a 1½-inch hole drilled in the top of a natural white limestone rock, is 16.643 meters from the station in azimuth 228° 12′. Other distances and azimuths are as follows: Railway pumping station, about 3 miles, 155° 09′; windmill, about 1 mile, 260° 20′.

Johnson (Ward County, Tex., J. S. H., 1909).—Eleven miles direct, or 13 miles by road, N. 22½° E. from Barstow, a town on the Texas & Pacific Railway, in the "W" pasture one-fourth mile west by north of the road leading through this pasture from Barstow. It is 4 miles north by east of the gate where the road enters the "W" pasture, on the highest point of a ridge on a spur projecting to the southwest from the main ridge and near its southwest end. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 19.024 meters from the station in azimuth 167° 55′. The center of a tank at a group of three windmills is about 1½ miles distant in azimuth 213° 48′.

Hays (Ward County, Tex., J. S. H., 1909).—Four and one-half miles direct N. 55° E. from Barstow, a town on the Texas & Pacific Railway, on the northwest corner and highest point of the first very prominent hill northeast of Barstow. It is 1¾ miles N. 28° W. from the Roger's rock quarry and in the pasture of N. L. Hays, whose ranch house is S. 55° E. from the station and 1 mile distant. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 19.365 meters from the station in azimuth 55° 54′.

Sist (Reeves County, Tex., J. S. H., 1909).—Four and three-fourths miles direct, or 5 miles by road, S. 3° W. from the courthouse in Pecos, a town on the Texas & Pacific Railway, and 500 meters west of the Pecos-Fort Stockton road, on the 4-section claim of T. J. Disk, who lives about 200 meters southeast of the station. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is in the northwest corner of a lot, and 35.900 meters from the station in azimuth 10° 58′. Sist's windmill is about 75 meters from the station in azimuth 328° 05′.

Ingle (Reeves County, Tex., J. S. H., 1909).—Twelve and one-half miles direct, or 13 miles by road, N. 26° W. of Pecos, a town on the Texas & Pacific Railway, and 375 meters west of the "Hill" public road which is parallel to and west of the Pecos Valley Southern Railway. It is on a prominent round-top hill, 4 miles north of where the road crosses a deep draw in which are a windmill and ranch house owned by a Mr. Engle. The station is marked according to note 5, page 84. The reference mark, described in note 11, page 85, is 21.278 meters from the station in azimuth 22° 31′. A windmill is about 1 mile from the station in azimuth 32° 10′.

Round (Reeves County, Tex., J. S. H., 1909).—Twelve miles direct, or 14 miles by road, N. 25½° W. from Toyah, a town on the Texas & Pacific Railway, and on a very prominent hill, visible from Toyah, known as Round Mountain, which is in a pasture owned by Dug Coalson and 1½ miles northeast of his house. To reach the station from Toyah, go north and west on the "Dug Coalson" road to his house and from there to the top of the mountain. The station is marked according to note 6, page 84. The reference mark, described in note 11, page 85, is 16.236 meters from the station in azimuth 196° 55′.

Toyah (Reeves County, Tex., J. S. H., 1909).—Fourteen and three-fourths miles by road, or 13 miles direct, S. 7° W. from Toyah, a town on the Texas & Pacific Railway, and three-fourths mile east of the Toyah-Toyah Valley road. It is on the highest and most southwesterly hill in the vicinity and 8 feet south of a conical pile of rocks on this hill. The station is marked according to note 6, page 84. The reference mark, described in note 11, page 85, is 15.15 meters from the station in azimuth 350° 46′.

Seay (El Paso County, Tex., J. S. H., 1909).—Thirteen miles direct, or about 17 miles by road, N. 54° W. from the section house at San Martine, a station on the Texas & Pacific Railway, on the highest peak of a high group of hills, and in the west pasture of J. P. Seay, who lives 7 miles north of San Martine at the "Seven Heart" ranch house. The peak has a dome-shaped top about 120 meters across. The station is marked according to note 6, page 84. The reference mark, a cross cut in the top of a flat rock flush with the surface of the ground, is 10.67 meters from the station in azimuth 254° 28′. Two windmills about 3 miles from the station are in azimuth 30° 01′.

Newman (Jeff Davis County, Tex., J. S. H., 1909).—This station is near the United States Geological Survey station of the same name. It is 11 miles direct S. 3° E. from the section house at San Martine, a station on the Texas & Pacific Railway, about 2 miles south of the northwest end of the Davis Mountains, and about 2 miles north by east of J. W. McElroy's place. The station is marked according to note 6, page 84. The reference mark is a 20-penny nail driven flush in the top of a hard rock at the edge of a bluff and is 26.125 meters from the station in azimuth 223° 17′. Other distances and azimuths are as follows: High peak, about three-fourths of a mile, 263° 35′; Newman, U. S. G. S., about 300 meters 55° 40′; Gomez Peak, about 1½ miles, 188° 15′. A blazed pine tree is 2.04 meters east of the station.

Reynolds (El Paso County, Tex., J. S. H., 1909; 1911).—Seven and one-half miles N. 7½° E. of Boracho, 11 miles direct N. 50° W. from Kent, small towns on the Texas & Pacific Railway, and on the highest point of the highest peak near the center of a very prominent high ridge which is about 7 miles north of the railroad and parallel to it. It is in the pasture of the Reynolds Cattle & Land Co. The station is marked according to note 6, page 84. The reference mark, a cross cut in the top of a flat rock flush with the ground, is 14.28 meters from the station in azimuth 19° 50′.

Krouse (El Paso County, Tex., J. S. H., 1909; 1911).—This station is near the United States Geological Survey station of the same name. It is 8½ miles N. 15° W. from Boracho, a station on the Texas & Pacific Railway, and on the highest peak near the western end of a very prominent ridge which is about 7 miles north of the railroad and parallel to it. The station is about 1 mile east of the Krouse zinc mines and is marked according to note 6, page 84. The reference mark, a cross cut in the top of a rock flush with the ground, is 6.49 meters from the station in azimuth 95° 18′. The cairn at the Geological Survey station Krouse is 4.16 meters distant in azimuth 68° 42′.

Chispa (Jeff Davis County, Tex., J. S. H., 1909).—This station is near the United States Geological Survey station of the same name. It is on the highest peak of the mountains about 4 miles north by west from Chispa, a town on the Southern Pacific, and 2 miles northeast of the railroad at its nearest point. The station is identical with one of the United States Geological Survey reference marks, a bronze bench-mark disk, which marks the station. The reference mark is identical with another of the United States Geological Survey reference marks, a cross cut in the top of a large flat rock, and is 5.51 meters from the station in azimuth 336° 51′. The United States Geological Survey station Chispa, marked by a cairn, is about 3 meters from the station in azimuth 312° 18′.

Diablo (El Paso County, Tex., J. S. H., 1909).—This station is near the United States Geological Survey station of the same name. It is 9½ miles direct, or 13 miles by road, north by east from Allamore, a station on the Texas & Pacific Railway, and on the more eastern one of two peaks near the southern extremity of the Diablo Mountains, about 2¼ miles direct, north by east from the old Marvin-Judson silver mine. The station is marked according to note 7, page 84. The reference mark is identical with the United States Geological Survey reference mark, a cross cut in a ledge of rock at the end of the peak, and is 7.83 meters from the station in azimuth 234° 12′. The United States Geological Survey station Diablo, marked by a cairn, is 3.28 meters from the station in azimuth 256° 34′.

Eagle (El Paso County, Tex., J. S. H., 1909).—On the highest peak of the Eagle Mountains, locally known as Eagle Peak, 25 miles southeast of Sierra Blanca, a town at the junction of the Southern Pacific and the Texas & Pacific Railways, and 8⅓ miles direct, or 13 miles by road and trail from Dalberg, a station on the Southern Pacific. It is 2 miles northwest of the "Francisco" sheep ranch, and on the same peak as the United States Geological Survey station Eagle, the marking of which could not be found. The station is marked according to note 7, page 84. The reference mark, a cross cut in a rock over the edge of the hill, is 5.77 meters from the station in azimuth 177° 01′.

Quitman (El Paso County, Tex., J. S. H., 1909).—The station is near the United States Geological Survey station of the same name. It is 8½ miles direct, or 10 miles by road, S. 80° W. from Sierra Blanca, a town at the junction of the Southern Pacific and the Texas & Pacific Railways, on the highest peak of the Quitman Mountains near the northern end of the Quitman Range, and in the pasture of the Love brothers. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a large rock, is 3.83 meters from the station in azimuth 357° 32′. The United States Geological Survey station Quitman, marked by a cairn, is 2 meters from the station in azimuth 210° 58′.

Black (El Paso County, Tex., J. S. H., 1909).—Thirty miles direct and 35 miles by road, N. 23° E. from Sierra Blanca, a town at the junction of the Southern Pacific and the Texas & Pacific Railways, and on the highest and most southern point of the southeast end of a small range of isolated mountains known locally as the Black Mountains, but given as the Sierra Prieta Mountains on the United States Geological Survey map of this region. The station is about 400 meters south of the United States Geological Survey triangulation station "Salt," which is marked by a large rock on a very rough peak of about the same height as the one described above. The station is marked according to note 7, page 84. The reference mark, a galvanized nail driven into a crevice in a rock 6 inches below its top and on the opposite side of the rock from the station, is 3.39 meters from the station in azimuth 82° 54′.

Corduna (Otero County, N. Mex., J. S. H., 1909).—This station is near the United States Geological Survey station of the same name. It is about 1½ miles north of the Texas-New Mexico boundary, 70 miles by road, or 60 miles direct, north of Sierra Blanca, a town at the junction of the Southern Pacific and the Texas Pacific Railways, and about 3 miles northeast of San Antonio peak, on the highest peak in the vicinity, known locally as Wind Mountain. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a rock, is 4.63 meters from the station in azimuth 157° 43′. The United States Geological Survey station, Corduna, marked by a cairn, is 7.8 meters from the station in azimuth 170° 48′.

North Franklin (El Paso County, Tex., J. S. H., 1909).—This station is near the United States Geological Survey station of the same name. It is 10 miles direct, or 16 miles by road and trail, north of El Paso, and on the highest peak of the Franklin Mountains, which is smooth in appearance, rather pointed, and red in color. The station is marked by a United States Geological Survey bench-mark disk, cemented into a drill hole in the solid rock. The disk has inscribed on it the elevation above sea level, 7,141 feet. The reference mark is the highest point of the upper one of two outcropping rocks on the north side of the ridge, 0.48 meter from the south point and 0.47 meter from the west point of the rock. The top of this rock is about 3 feet above the top of the lower rock, which has a precipitous face about 4 feet high on the north side. The reference mark is 14.61 meters from the station in azimuth 303° 38′. The United States Geological Survey station North Franklin, marked by a cairn, is 2.9 meters from the station in azimuth 174° 05′.

Jarilla (Otero County, N. Mex., J. S. H., 1909).—On the extreme south peak of the Jarilla Mountain, about 2½ miles in a direct line N. 26° W. from the railroad station at Orogrande, a town on the El Paso & Southwestern Railroad, 1 mile southwest of the Brice post office, and about one-half mile west of the railroad and wagon road which lead from Orogrande to the Brice post office and mines in that vicinity. The station is marked according to note 7, page 84. The reference mark, which is the center of an iron pipe embedded in concrete, is 7.14 meters from the station in azimuth 269° 42′. A conical pile of rocks with a stone at the top bearing inscription "I. P. Jarilla U. S. M. M." is 9.72 meters from the station in azimuth 275° 42′.

Kent (Donna Ana County, N. Mex., J. S. H., 1909).—Twenty-five miles by road northeast of Lascruces, a town on the Santa Fe Central Railway, 9 miles northeast of the mountain town of Organ and 2 miles north of Kent post office, on the most northern and highest one of three peaks close together on Black Mountain. Black Mountain is a spur running east from the San Andreas Range just north of the San Augustine Pass and has a mine on its west side 100 meters from the top. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a flat rock which is 2 feet lower than the station, is 6.86 meters from the station in azimuth 160° 15′.

Florida (Grant County, N. Mex., J. S. H., 1910).—Fifteen miles in a direct line southeast of Deming, a town on the Southern Pacific, on the Florida Mountains about 500 meters south of the highest rock peaks at the north end of the mountains. It is on a flat-top knob in the saddle of the mountains, about midway between the high rock peak to the north and the round-top peak to the south. The station is best reached by pack from McDougal's goat ranch, which is southeast of the station. It is marked according to note 7, page 84. The reference mark, a cross cut in the rock, is 4.59 meters from the station in azimuth 346° 41′.

Cooks (Grant County, N. Mex., J. S. H., 1910).—On Cooks Peak, 20 miles in a direct line north of Deming, a town on the Southern Pacific, and about 3 miles a little west of south from Cooks post office. It is best reached from Grover Bros. ranch, which is on the east side of the peak. The station is marked according to note 7, page 84. The reference mark, a cross cut in the rock, is 11.62 meters from the station in azimuth 202° 13′.

Hermanas (Luna County, N. Mex., J. S. H., 1909).—On the highest one of four hills 3 miles S. 5° E. from Hermanas, a station and junction point on the El Paso & Southwestern Railroad. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a large high bowlder, is 11.68 meters from the station in azimuth 349° 10′.

Red (Grant County, N. Mex., J. S. H., 1910).—Eight and one-half miles in a direct line S. 65° W. from Deming, a town on the Southern Pacific, and about 20 paces a little north of east of the highest point of Red Mountain, a very conspicuous low mountain. The station is marked according to note 7, page 84. The reference mark, a cross cut in the east side of a small rock, is 5.27 meters from the station in azimuth 70° 52′.

Deming south base (Grant County, N. Mex., J. S. H., 1910).—About 15 miles S. 15° W. from Deming, a town on the Southern Pacific, 1½ miles S. 83° E. from the Midland switch on the Deming branch of the El Paso & Southwestern Railroad, 1¾ miles N. 75° E. from the ranch house and windmills of R. W. Yeargins, and on F. W. Schweiyer's ranch. The marking at this station is exactly similar to that at Deming north base. (See following description.) The reference mark is 16.58 meters from the station in azimuth 10° 53′. Schweiyer's house is about 300 meters from the station in azimuth 79° 54′.

Deming north base (Grant County, N. Mex., J. S. H., 1910).—About 6 miles south of Deming, a town on the Southern Pacific, and 2 miles due south of J. M. Kennedy's house, on a broad flat sandy ridge which is 5 or 6 feet above the general level. The station can best be located by bearings to triangulation stations near it. The underground mark at the station is an old-type station mark described on page 84, set in a cylinder of concrete 12 inches in diameter and 6 inches long, and the surface mark is a cap station mark, described on page 83, on a 3-inch iron pipe set in a cylinder of concrete 20 inches in diameter and 24 inches long, the top of the concrete and the pipe being flush with the surface of the ground. The reference mark is a 20-penny nail cemented into the top of a 3-inch iron pipe which is embedded in a concrete cylinder 18 inches in diameter and 30 inches long. The top of the concrete is flush with the surface of the ground and the point of the nail projects one-fourth inch above the concrete. It is 19.90 meters from the station in azimuth 32° 17′.

DEMING BASE NET TO SAN JACINTO-CUYAMACA.

PRINCIPAL POINTS.

Burro (Grant County, N. Mex., J. S. H., 1910).—This station is near a United States Geological Survey station. It is on the northeast and highest point of Big Burro Mountain, 16 miles in a direct line south from Silver, a town on the Atchison, Topeka & Santa Fe Railway, and 23 miles in a direct line northeast of Lordsburg, a town on the Southern Pacific. It is about 4 miles south of the Silver-Duncan wagon road and about 3 miles in a southerly direction from the Richardson ranch. The station is marked according to note 7, page 84. The reference mark is the stem of a United States Geological Survey brass station mark cemented in a drill hole in the rock, the top or disk part having been broken off, and is 3.145 meters from the station in azimuth 287° 01′. Other distances and azimuths are as follows: One-half inch drill hole in a depression in the top of a rock, 4.800 meters, 208° 28′. A large blazed tree on slope, 40.3 meters, 217° 17′.

Chiricahua (Cochise County, Ariz., J. S. H., 1910).—On the most northern one of several high peaks on the crest of the Chiricahua Mountains, about 17 miles west of Rodeo, N. Mex., a town on the El Paso & Southwestern Railroad, and about 8 miles west-southwest of Postal and 6 miles south-southwest of Paradise, both of which are mining towns. The station is about 10 meters northwest of the highest point of the west end of the peak and several feet lower. The peak on which the station is located is not the highest peak of the ridge. The station is marked according to note 7, page 84. The reference mark, a one-half inch drill hole 2 inches deep in the top of a rock on the highest point of the west end of the peak, is 9.496 meters from the station in azimuth 329° 09′. Two blazed trees, the first one having 3 nails in the blaze and the second one 4 nails, are at the following distances and azimuths from the station: 12.18 meters, 304° 21′, and 13.61 meters, 202° 10′.

Line (*U. S. G. S.*) (Grant County, N. Mex., J. S. H., 1910).—This station is identical with the United States Geological Survey station of the same name. It is on the highest point of Laura Mountain, also called Vanderbilt Mountain, about 15 miles northeast from Duncan, Ariz., a town on the Arizona & New Mexico Railway, 2 miles from Steeple Rock post office or Carlisle mine, and about one-half mile from the Laura mining camp. The station is marked by a United States Geological Survey triangulation station mark cemented into the solid rock. The reference mark, a cross cut in the highest point of a rock ledge, is 5.020 meters from the station in azimuth 234° 01′.

Graham (*U. S. G. S.*) (Graham County, Ariz., J. S. H., 1910).—This station is identical with a United States Geological Survey station the name of which is unknown. It is about 16 miles southwest from Safford, a town on the Globe Branch of the Southern Pacific, on the highest point of Graham Mountain, about 10 meters northeast of the southwest point of the mountain. The station is marked with a United States Geological Survey triangulation station mark cemented into the rock. The reference mark, a one-half inch drill hole one-half inch deep in the top of a large rock, is 13.43 meters from the station in azimuth 248° 21′. Two blazed pine trees, 9 inches in diameter, with a 40-penny nail in the center of the blaze on each tree, are at the following distances and azimuths from the station: 13.10 meters, 9° 45′, and 11.95 meters 125° 25′.

Catalina (Pima County, Ariz., J. S. H., 1910).—On the north spur of what is locally known as Lemon Mountain, the highest peak of the Catalina Mountains, about 22 miles in a direct line northeast of Tucson, a town on the Southern Pacific. The best approach is from the north from the town of Oracle, via the "3C" ranch and Camp Apache mine, but the station may also be reached from the south or Tucson side by a trail leading up the Salino Canyon. Timber on the peak obstructs the view except where it has been cleared. The station is marked according to note 7, page 84. The reference mark, a United States Geological Survey bench-mark disk cemented into the rock, is 3.215 meters from the station in azimuth 206° 04′. A nail in a blazed tree is 8.29 meters from the station in azimuth 51° 22′.

Baldy (*U. S. G. S.*) (Santa Cruz County, Ariz., J. S. H., 1910).—This station is identical with the United States Geological Survey station of the same name. It is on Old Baldy or Santa Rita peak, a high prominent peak near the south end of the Santa Rita Range, 11 miles northwest of Crittenden and 12 miles northwest of Patagonia, towns on the Southern Pacific. It is best reached from Young's ranch via the old mill road. The station is marked with a United States Geological Survey triangulation station mark cemented into the solid rock. The reference mark, which is identical with the United States Geological Survey reference mark, is a cross cut in the top of a rock and 18.22 meters from the station in azimuth 220° 53′.

Table (Pinal County, Ariz., J. S. H., 1910).—On the highest point of the northeast knob of Table Top Mountain, about 22 miles direct, or 34 miles by road, southwest from Casa Grande, a town on the Southern Pacific, 12 miles by road west by north from Cucklebur Indian village and 7 miles northwest of the Casa Grande-Vekol wagon road. To reach the station from Cucklebur follow the Vekol road about 5 miles or until the foothills to the north are passed and Table Mountain opens to view up a broad level wash, then turn toward the mountain. The station is marked according to note 7, page 84 The reference mark, a cross cut in a large flat rock nearly flush with the surface of the ground, is 3.80 meters from the station in azimuth 265° 46′.

Superstition (*U. S. G. S.*) (Pinal County, Ariz., J. S. H., 1910).—This station is identical with the United States Geological survey station called Superstition Point. It is on the highest peak of the Superstition Mountains, 25 miles north of Florence and 25 miles east of Mesa, towns on a branch of the Southern Pacific, and about 3 miles northwest of the Criswell ranch (old Bark's ranch). The peak is rugged, but with care pack animals can be taken within 50 meters of the top. The best approach is from Mesa via the Criswell ranch. The station is marked with a United States Geological Survey disk station mark cemented into a drill hole in the solid rock. The reference mark, a cross cut in the top of a large rock, is 2.265 meters from the station in azimuth 110° 33′.

Whitetank (Maricopa County, Ariz., J. S. H., 1910).—On the more southern one of two knobs of about the same elevation on the lower, larger, and more southern one of the two highest peaks of the Whitetank Mountains, about 22 miles due west of Peoria, a town on the Santa Fe, Prescott & Phoenix Railway. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a large firm rock, is 5.425 meters from the station in azimuth 203° 21′.

Maricopa (Maricopa County, Ariz., J. S. H., 1910).—On the highest and most western peak of a short spur of mountains extending to the eastward on the Maricopa divide, 23 miles direct, or 28 miles by road, southeast of Gila Bend, a town on the Southern Pacific, and about 24 miles direct, or 28 miles by road, northwest of the Vekol mining camp. The peak is one-half mile north of the Vekol-Gila Bend road and is the most prominent one to be seen in approaching the mountains from the eastward. The station is marked according to note 7, page 84. The reference mark, a cross cut in a depression in a large bowlder, is 6.475 meters from the station in azimuth 252° 30′.

Mohawk (Yuma County, Ariz., J. S. H., 1910).—On the highest and most southern peak of the Mohawk Mountains, 11 miles S. 1° W. (true) from Stovall, from which place the peak may be seen, and 16 miles by road from Mohawk, small towns or stations on the Southern Pacific. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a bowlder near the edge of a bluff, is 13.31 meters from the station in azimuth 186° 28′.

Harquahalla (Maricopa County, Ariz., J. S. H., 1910).—On the highest peak of the Harquahalla Mountains, about 11 miles direct, or 16 miles by road and trail, east of Wenden, a town on a branch of the Santa Fe, Prescott & Phoenix Railway, and about 7 miles south of the nearest point of the railroad. The station is marked according to note 7, page 84. The reference mark is a cross cut in the top and near the north edge of a large bowlder and has the following description near it: "R. P. C. & G. S. 1910." It is 8.21 meters from the station in azimuth 88° 32′.

Kofa (Yuma County, Ariz., J. S. H., 1910).—On the highest and most westerly mountain at the west end of the Squaw Tank Mountains, 45 miles direct, or 54 miles by road, north by west from Mohawk, a station on the Southern Pacific, 9 miles northwest of the North Star mine or Polaris post office and about 5 miles direct in a westerly direction from the Squaw Tanks. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a fairly solid rock, is 11.22 meters from the station in azimuth 227° 39′.

American (*U. S G. S.*) (Imperial County, Cal., J. S. H., 1910).—This station is identical with the United States Geological Survey station of the same name. It is on the highest point of the most easterly peak of the first range of mountains on the California side of the Colorado River, about 12 miles in a direct line northwest of Yuma, and 3 miles a little south of east from the "American Girl" gold mine. The station is marked with a United States Geological Survey bronze disk station mark cemented into the rock. The first reference mark, a cross cut in a flat rock which is in the saddle south of the station, is 1½ feet lower than the station and 3.61 meters distant in azimuth 357° 06′. The second reference mark, a cross cut in the pinnacle of a large bowlder, is about 6 feet lower than the station and 7.23 meters distant in azimuth 237° 23′.

Butte (Riverside County, Cal., J. S. H., 1910).—On the highest and most easterly knob of Black Butte Mountain, about 24 miles direct, or 32 miles by road and trail, N. 23° E. from Imperial Junction, a station on the Southern Pacific, and about 12 miles to the northward of the Chocolate Range of mountains. Black Butte Mountain can be seen from Imperial Junction through a gap in the Chocolate Mountains. The station is marked with a disk station mark described on page 83, cemented into a drill hole in a large flat rock which is in a level spot about 5 meters east and 1 meter below the highest point of the ridge. The first reference mark, a cross cut in the top of the lowest and most eastern rock of a large ledge of rocks running west of the station, is 5.445 meters from the station in azimuth 21° 59′. The second reference mark, a cross cut in the east sloping face of an outcrop of rock, is 1 foot lower than the station and 4.555 meters distant in azimuth 259° 35′.

Powell (Mohave County, Ariz., J. S. H., 1910).—On a peak locally known as Powell Peak, the higher and more eastern one of two peaks on the Arizona branch of the Chemehuevis Mountains, about 15 miles S. 20° E. from Franconia, a station on the Atchison, Topeka & Santa Fe Railway and about 30 miles S. 51° E. from the town of Needles. The station is marked according to note 7, page 84. The reference mark, a cross cut in the west face of a rock, is 2 feet lower than the station and 5.62 meters from it in azimuth 21° 11′.

Pine (Mohave County, Ariz., J. S. H., 1910).—On the more southern one of two knobs of the highest peak, locally known as Pine Peak, near the southern end of the Hualapai Mountains, about 18 miles direct, or 23 miles by road and trail, S. 67° E. from Yucca, a town on the Atchison, Topeka & Santa Fe Railway. The station is marked by a disk station mark, described on page 83, cemented into a drill hole in a large rock about 1½ feet above the surface of the ground. The reference mark, a large cross cut in the south side of a very large rock which is near the highest point of the peak, is in azimuth 161° 13′ from the station.

Chemehuevis (San Bernardino County, Cal., J. S. H., 1910).—On the highest and most southwesterly peak of the Chemehuevis Mountains, 22 miles south by east of Needles, a town on the Atchison, Topeka & Santa Fe Railway, and about 3 miles east of the Parker-Needles road. The station is marked according to note 7, page 84. The reference mark, a cross cut in the solid rock, is 5 feet lower than the station and 6.42 meters distant in azimuth 7° 24′.

Cuyamaca (San Diego County, Cal., A. T. M., 1898; 1910).—About 10 feet south of the highest point of the backbone of the large ledge that forms the highest part of the southern and highest peak of Cuyamaca Mountain, about 60 miles northeast of San Diego and about 4 miles from Cuyamaca Lake. A light wagon can be driven to within one-third of a mile of the station. The station was originally marked by a copper bolt cemented in a 1 by 4 inch drill hole, but the copper bolt has since been removed and the center of the drill hole is now the station. The reference marks, each consisting of a cross cut in the rock with a copper bolt set at the intersection, are at the following distances and directions from the station: 2.340 meters, north; 2.145 meters, northeast; and 1.900 meters, south. The rock containing the north reference mark has been broken, but the original position of the mark may be obtained approximately by placing the broken segments together. In 1910 a cross was cut in the face of a large rock almost directly under this old mark, the center of this new mark being 2.448 meters from the station.

San Jacinto (Riverside County, Cal., A. T. M., 1898; 1910).—On the highest and most northern peak of San Jacinto Mountain, 33 miles by road and trail from San Jacinto, a town on the Southern California Railway, and 10 miles by road and trail from the summer resort in Strawberry Valley called Idylwild. The trail from Idylwild to the peak is steep and rather dangerous in places. The station is marked by a 1¼-inch drill hole 3 inches deep in the top of a large bowlder 13 feet southwest from the top of the highest bowlder on the peak. The reference marks, 4 drill holes, each 1¼ inches in diameter and 3 inches deep in rocks on the top of the peak, are at the following distances and azimuths from the station: 17.19 meters, 21° 19′ 14″; 8.75 meters, 162° 26′ 04″; 3.44 meters, 252° 55′ 09″; 10.42 meters, 332° 59′ 09″.

KYLE-McCLENNY TO STANTON BASE.

SUPPLEMENTARY POINTS.

Cisco astronomic station (*U. S. G. S.*) (Eastland County, Tex., W. B., 1908).—Just west of the standpipe in Cisco. The station is marked by a cross and the letters "U. S. G. S." in the top of a stone.

Abilene standpipe (*U. S. G. S.*) (Taylor County, Tex., W. B., 1908).—The older and taller of the two standpipes at Abilene and on the west side of the town.

Wasp, U. S. G. S. (Fisher County, Tex., W. B., 1908).—This station is practically identical with the United States Geological Survey station of the same name, the stone mark of which was found lying on top of the ground. It is 7 miles direct, or 7½ miles by road, N. 17° W. from Sweetwater, a town on the Texas & Pacific Railway, 1 mile west of the Sweetwater-White Flat public road and 150 meters east of the Sweetwater-Clatonville public road, on the highest point of the highest and most prominent peak in the vicinity. The peak has an easy slope on the west side and a steep bluff on the east side. It is in a pasture owned by Joe Nunn. The station was re-marked according to note 2, page 84.

Stanton longitude station (Martin County, Tex., E. S., 1911).—Directly south of station Stanton (see p. 91) and 2.26 meters distant. The station is marked by a standard disk station mark in the top of a concrete pier 18 by 34 inches and 31 inches high. The station mark used is similar to the one described on page 83, except that it has the words "Astronomical station" stamped on the disk in addition to the regular inscription.

STANTON BASE TO DEMING BASE.

SUPPLEMENTARY POINTS.

East (El Paso County, Tex., C. V. H., 1911).—On a small mesa-topped hill at the middle and highest part of a long ridge extending east and west about 6 miles north of Boracho, a town on the Texas & Pacific Railway. The top of the hill is about 30 meters north and south by 50 meters east and west, and the highest part is at the northwest edge, about 20 meters N. 70° W. from the station. The station is marked by a cross, the western one of two crosses, cut in the top of a flat rock, which is about 2 feet in diameter and flush with the surface of the ground. A small conspicuous yellow knoll on an adjoining ridge bears N. 5° E. from the station and Boracho bears S. 3° 30′ W.

Boracho (El Paso County, Tex., C. V. H., 1911).—Due north of Boracho longitude station (see following description) and 6.565 meters distant. The station is marked by a cross on the top of a stone post, 6 by 8 by 20 inches, which projects 1 inch above the ground. A stone post, 6 inches square on top, with a square hole at the center one-half inch deep, surrounded by the letters "U. S. B. M.", is on the south side of the track, directly opposite the section house and 152.34 meters from the station in azimuth 235° 05′. The south end of the roof of the Boracho store and post office is 122.74

meters from the station in azimuth 262° 27′, and the west end of the roof of the section house is in azimuth 224° 45′. The southeast corner of a large adobe corral is about 40 meters N. 40° E. from the station.

Boracho longitude station (El Paso County, Tex., C. V. H., 1911).—About 100 meters south of the Texas & Pacific Railway track and 200 meters southwest of the new section house at Boracho. A concrete pier was built at the station, 14 by 26 inches in cross section, with a notch in the top to give room for the reversing apparatus of the transit. The station is marked by a standard disk station mark set in the notch of the concrete pier. The station mark used is similar to the one described on page 83, except that it has the words "Astronomical station" stamped on the disk in addition to the regular inscription.

West (El Paso County, Tex., C. V. H., 1911).—About 200 meters from the western end of the first high ridge north of Boracho, a town on the Texas & Pacific Railway. As seen from station Boracho (see p. 103), the station is directly in line with a large bush showing against the sky line about 300 meters east of station Krouse (see p. 96). The station is marked by a cross one-half inch deep cut in the top of a rock 3 feet in diameter, the top of which is flush with the surface of the ground.

Allamore (El Paso County, Tex., J. S. H., 1909).—Near a water tank on the north side of the Texas & Pacific Railway track about 2 miles west of the Allamore section house. The station is marked according to note 8, page 85, except that no underground mark was used. The center of the water tank is 8.79 meters from the station in azimuth 338° 11′. The north rail of the track is 12.49 meters south of the station and the railway fence line is 1.56 meters north.

Cerro Alto (El Paso County, Tex., J. S. H., 1909).—On the same peak as the United States Geological Survey station of the same name, at the highest point of the Cerro Alto Mountains, about 40 miles a little north of east of El Paso, and just north of the road leading from Corduna Mountain, near the foot of Mud Peak, to El Paso. The station is marked according to note 7, page 84. The reference mark, a cross cut in the top of a large rock, is 4.17 meters from the station in azimuth 339° 39′. The United States Geological Survey station marked by a cairn, is 7.0 meters from the station in azimuth 158° 50′.

Mesa (El Paso County, Tex., J. S. H., 1909).—About 10 miles in a direct line S. 89° E. from the post office in El Paso, 4 miles N. 20° E. from Ysleta, a town on the Southern Pacific, and on a long narrow point extending south on the south side of the mesa. This point is the most southern point of the mesa in the vicinity and quite prominent on account of its steep high bluffs on the east, south, and west sides. The station is marked according to note 7, page 84. The reference mark, a cross cut in a rock near the edge of the bluff, is 15.53 meters from the station in azimuth 327° 32′.

El Paso Courthouse (El Paso County, Tex., J. S. H., 1911).—Center of the dome of the courthouse at El Paso.

El Paso Federal Building, center (El Paso County, Tex., J. S. H., 1909; 1911).—Cen- of the tower of the Federal Building at El Paso.

Mills, El Paso (El Paso County, Tex., C. V. H., 1911).—The tall iron flagstaff on top of the new Mills Building, in the downtown section of El Paso and opposite the post office and Plaza. The station is near the northeast edge of the house over the elevator shaft and at the top of the flight of steps leading to the top of this house.

Weather, El Paso (El Paso County, Tex., C. V. H., 1911).—The iron pole at the center of the small house over the elevator shaft on top of the new El Paso & Southwestern Railroad Co.'s building at El Paso. The pole is used by the United States Weather Bureau and bears their aerometer at the top.

Presbyterian Church, El Paso (El Paso County, Tex., C. V. H., 1911).—The wooden finial surmounting the square bell tower over the southeast or main entrance of the brick Presbyterian Church at the corner of Stanton and Boulevard Streets, El Paso.

El Paso longitude station (El Paso County, Tex., C. V. H., 1911).—It was found in 1911 that the old longitude station of 1892 had been destroyed and so a new station was established. It is in the western corner of Cleveland Park and about 30 meters west of the new concrete band stand. The station is marked by a concrete pier 18 by 34 inches in cross section with its foundation 3 feet in the ground.

El Paso astronomic station No. 1 (El Paso County, Tex., 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on a sand plain on the east side of the Rio Grande between the river and the Atchison, Topeka & Santa Fe Railway. The station is marked by a lead plug in the top of a bowlder weighing about 250 pounds buried with its top about 3 inches below the surface of the sand. A notch was made on the near rail of the railroad directly in the line with boundary monuments No. 1 and No. 2, and this notch is 38.68 meters from the station.

Juarez Cathedral (Mexico, J. S. H., 1909).—The cross on the top of the cathedral at Juarez.

Boundary monument No. 1 (*U. S. & Mex.*) (New Mexico-Mexico, 1893).—On the west bank of the Rio Grande and 172.6 meters from the center of the channel. It is a cut stone monument 12 feet high, 5 feet square at the base, and 2½ feet square at the top, with a jacket of concrete 4 feet high around the base.

Boundary monument No. 2, eccentric (*U. S. & Mex.*) (New Mexico-Mexico, J. S. H., 1909).—About 3 miles west of El Paso on the west side of the Rio Grande and about 1 mile from a large smelter. The station is marked according to note 7, page 84. Boundary monument No. 2, an obelisk of concrete 4 feet square at the base and 12 feet high, is 9.75 meters from the station in azimuth 149° 55′. The above-mentioned smelter is in azimuth 294° 12′ from the station.

Boundary monument No. 3 (*U. S. & Mex.*) (New Mexico-Mexico, J. S. H., 1909).—About 5 miles west of El Paso. This monument is similar to boundary monument No. 2, described above.

Jarilla longitude station (Otero County, N. Mex., E. S., 1911).—Two and one-half meters east and 0.38 meter south of station Jarilla (see p. 97). The station is marked by a standard disk station mark in the top of a concrete pier 14 by 26 inches and 35 inches high above the solid rock on which it rests. The station mark used is similar to the one described on page 83 except that it has the words "Astronomical station" stamped on the disk in addition to the regular inscription.

Deming city waterworks (Luna County, N. Mex., J. S. H., 1909).—High red water tank which supplies Deming with water and which is known as the Deming city waterworks. A United States Geological Survey bench mark is near the base of the tower and it is used to control the vertical angle elevations of the triangulation in this vicinity.

DEMING BASE NET TO SAN JACINTO-CUYAMACA.

SUPPLEMENTARY POINTS.

Near (Luna County, N. Mex., J. S. H., 1910).—Five miles in a direct line S. 33° W. from Victoria, a station on the El Paso & Southwestern Railroad, on a high rocky peak, the more eastern one of two peaks in that vicinity and about 1 mile west-northwest of the International Mines. The station is marked according to note 7, page 84. The reference mark, a cross cut in the rock, is 4.11 meters from the station in azimuth 116° 30′.

Boundary monument No. 39 (U. S. & Mex.) (New Mexico-Mexico, J. S. H., 1909).—An iron monument on a sharp ridge sloping south of the Sierra Rica Mountains. It is best reached from Victoria, a town on the El Paso & Southwestern Railroad, via the International Mines. The reference mark, a small cross cut in the top of a rock, is 2.80 meters from the monument in azimuth 221° 29′.

Boundary monument No. 31 (U. S. & Mex.) (New Mexico-Mexico, J. S. H., 1909).—About 4 miles southeast of Hermanas, a town on the El Paso & Southwestern Railroad, and on the first ridge of the Carrizalillo Mountains in a commanding position overlooking the valley to the eastward. The monument is of iron.

Boundary monument No. 32 (U. S. & Mex.) (New Mexico-Mexico, J. S. H., 1909).—A stone monument 4 miles south of Hermanas, a town on the El Paso & Southwestern Railroad, and on the highest point of the boundary line where it crosses the Carrizalillo Mountains.

Boundary monument No. 40 (U. S. & Mex.) (New Mexico-Mexico, J. S. H., 1910).—About 2½ miles in a direct line west of the International Mines. It is known as the "upper corner" or "jog," since the boundary line makes a right-angled turn at this point. The monument was occupied eccentrically and the eccentric point marked according to note 7, page 84. The monument is 43.570 meters from the point occupied in azimuth 2° 16′.

Huachuca (Cochise County, Ariz., J. S. H., 1910).—This station is near a United States Geological Survey station, the name of which is unknown. It is on the highest peak of the mountain, at the north end of the Huachuca range, about 11 miles south of Huachuca, a town on the Southern Pacific, 4 miles south of Fort Huachuca and about 2½ miles south of a prominent round-top peak, called Nigger Head peak. The station is marked according to note 7, page 84. The reference mark, a one-half inch drill hole one-half inch deep at the edge of a bluff, is 5.78 meters from the station, in azimuth 94° 33′. The United States Geological Survey station, marked by a cairn, is 0.6 meter distant, in azimuth 289° 35′.

Mule (U.S.G.S.) (Cochise County, Ariz., J. S. H., 1910).—This station is in approximately the same location as the United States Geological Survey station. It is on the southeast and lower one of the two highest peaks of the Mule Mountains, 7½ miles N. 5° W. from Naco, 4 miles northwest of Don Luis, and 2½ miles west of Bisbee, towns on the El Paso & Southwestern Railroad. The station is marked by a standard disk station mark, described on page 83, cemented in the top of a 1-inch iron pipe, 18 inches long, which was driven down flush with the surface of the ground. The reference mark, a cross cut in a ledge of rock with a one-half inch drill hole one-fourth of an inch deep at its center, is 5.79 meters from the station, in azimuth 210° 36′.

Boundary monument No. 91 (*U. S. & Mex.*) (Arizona-Mexico, J. S. H., 1910).—On the center one of three small hills, 4½ miles directly east of Naco, a town on the El Paso & Southwestern Railroad, one-half mile south of the Naco-Douglas road and three-fourths mile south of the railroad. The monument is of iron and rests on a concrete base. It was occupied eccentrically, the eccentric point, marked by a small cross cut in the solid rock, being 3 meters from the monument, in azimuth 104° 46′.

Nogales No. 7 (Santa Cruz County, Ariz., J. S. H., 1910).—This is one of the United States and Mexico boundary survey stations. It is on the more northern one of two prominent round-top hills, about 9 miles west by north of Nogales, and about 2 miles north-northwest of the angle in the international boundary line marked by monument No. 127. The station is marked by a five-eighths inch iron rod. Two similar iron rods, one of them 1.605 meters north of the station and the other 1.600 meters south of the station, are the reference marks. · A one-half inch drill hole one-half inch deep in the top of a rock is 4.97 meters from the station in azimuth 256° 55′.

Boundary monument No. 128 (*U. S. & Mex.*) (Arizona–Mexico, J. S. H., 1910).—About 8 miles west of Nogales on the north slope of a ridge, the highest point of the boundary line in this vicinity, and 394 meters west of the angle in the line which is marked by monument No. 127. The eccentric point used is marked by a one-half inch iron rod driven in the ground with about 3 inches of its top projecting. It is 1.218 meters from the monument in azimuth 111° 03′.

Benedict (*U. S. G. S.*) (Santa Cruz County, Ariz., J. S. H., 1910).—This station is identical with the United States Geological Survey station of the same name. It is on the highest round hill between the Santa Cruz River and Nogales Creek, about 5 miles south of Calabasas and 4 miles north of Nogales. The station is marked with a standard disk station mark, described on page 83, cemented into the solid rock. The reference mark, a cross cut in the top of a rock, is 14.37 meters from the station in azimuth 230° 36′.

Boundary monument No. 120 (*U. S. & Mex.*) (Arizona–Mexico, J. S. H., 1910).—On the north slope of a sharp bald ridge three-fourths of a mile east of Nogales. The monument marks the highest point of the boundary in the vicinity of Nogales and overlooks a wide extent of country. The eccentric point used at this station is marked with a standard disk station mark, described on page 83, cemented in the top of a 1-inch pipe 18 inches long, flush with the surface of the ground. It is 1.250 meters from the monument in azimuth 89° 46′.

Boundary monument No. 121 (*U. S. & Mex.*) (Arizona–Mexico, J. S. H., 1910).—An iron monument on the north slope of a sharp ridge about 200 meters southeast of the principal street of Nogales. The eccentric point used at this station is marked with a standard disk station mark, described on page 83, cemented in the top of a 1-inch pipe 15 inches long, flush with the surface of the ground. It is 2.777 meters from the monument in azimuth 96° 25′.

Nogales No. 5 (Santa Cruz County, Tex., 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the ridge between Ephraims Canyon and Mariposa Canyon and about 300 meters north of the international boundary line. The station is marked by a one-fourth inch drill hole at the center of a 4 by 4 inch pine stake. Four reference marks, each consisting of a nail at the center of a 2 by 2 inch pine stub, are at the following distances from the station: 1.008 meters north; 1.171 meters east; 1.102 meters south; and 1.041 meters west.

Nogales No. 8 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the highest peak south of the angle in the international boundary line, marked by monument No. 127. The station is marked by a five-eighths inch iron rod driven in the ground. Two reference marks, each consisting of a nail driven in a tree, are at the following distances from the station: 3.757 meters southeast and 6.570 meters southwest. A nail in a stump northwest of the station is 1.254 meters distant.

Nogales No. 6 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the northwest end of a high ridge southwest of Nogales and near the head of the canyon leading southwest from the Mexican cemetery. The Mexican cemetery is in the canyon running west from the Mexican customhouse in Nogales. A higher parallel ridge is about a mile southwest of the ridge on which the station is located. The station is marked by a five-eighths inch iron rod driven in the ground. Four reference marks similar to the station mark are at the following distances: 1.140 meters north, 1.113 meters east, 1.128 meters south, and 1.225 meters west.

Nogales No. 3 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the round-topped reddish hill about 1 mile east of Nogales. The international boundary line crosses this hill on the north slope. The station is marked by a five-eighths inch iron rod driven in the ground. Four reference marks similar to the station mark are at the following distances: 1.140 meters north, 1.080 meters east, 0.966 meter south, and 1.110 meters west.

Nogales No. 4 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on one of the highest peaks of the group of hills southwest of Nogales. The station is marked by a five-eighths inch iron rod driven in the ground. Four reference marks similar to the station mark are at the following distances: 0.972 meter north, 0.976 meter east, 1.017 meters south, 1.070 meters west.

Nogales No. 1 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the first hills west of the Sonora Railroad south of Nogales. The station is marked by a 2 by 4 inch pine stake. Four reference marks, consisting of five-eighths inch iron rods driven in the ground, are at the following distances from the station: 1.082 meters north, 1.182 meters east, 1.182 meters south, and 1.220 meters west.

Nogales No. 2 (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the first hills west of the Sonora Railroad south of Nogales, on a small peak a few feet lower and about 100 meters east of a more prominent peak. The station is marked by a five-eights inch iron rod driven in the ground. Four reference marks similar to the station mark are at the following distances: 1.088 meters north, 0.971 meter east, 0.923 meter south; and 0.926 meter west.

Nogales azimuth station (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the top of the first ridge east of Nogales and almost in line with International Street produced. The station is marked by a one-fourth inch drill hole in the top of a 2 by 4 inch pine tree stake. Four reference marks, each consisting of a nail in the top of a 1 by 1 inch pine stub, are at the following distances from the station: 0.831 meter north, 0.989 meter east, 1.025 meters south; and 0.844 meter west.

Nogales astronomic station (Santa Cruz County, Ariz., 1893).—This is one of the United States and Mexico Boundary Commission stations. It is in the grounds at the rear of the Montezuma hotel at Nogales. The station is marked by a nail in the top of a rectangular stake. Due north of the station is an old brick longitude pier 17 by 25 inches in cross section. An old brick latitude pier 17 inches square and 3 feet high above the ground is 2.22 meters north and 1.28 meters west of the station. The longitude pier is 1.27 meters due east of the latitude pier.

Nogales south base (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the point of a small ridge 9.58 meters east of the center of the tract of the Sonora Railroad at a point about midway between two trestles. The station is marked by a hole in the top of a 2 by 4 inch pine stub. Three reference marks similar to the station mark are at the following distances: 0.765 meter north, 0.845 meter east, and 0.784 meter west.

Nogales north base (State of Sonora, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is in the switch yard of the Sonora Railroad south of the Mexican customhouse at Nogales and on the prolongation of the last tangent of the main track before it enters the switch yard. The station is marked by a hole in the top of a 2 by 4 inch pine stub. Three reference marks similar to the station mark are at the following distances: 0.975 meter north, 1.077 meters south, and 0.899 meter west.

Maricopa northwest base (*U. S. G. S.*) (Pinal County, Ariz., J. S. H., 1910).—About one-half mile southeast of Maricopa, a town on the Southern Pacific, 26 feet north of the center of the railroad track, opposite mile post 897. The station is marked by an iron bench mark post set flush with the ground and surrounded with a collar of concrete. The bottom of the post rests on a rock.

Maricopa astronomic station, eccentric (Maricopa County, Ariz., J. S. H., 1910).—For the general location of this station see the following description of *Maricopa east pier*. The station is marked by a nail in the top of a stake. The following distances and azimuths were measured: *Maricopa east pier* 21.673 meters, 318° 07′; *Maricopa west pier* 20.544 meters, 321° 55′; U.S.G.S.B.M. Maricopa 394.98 meters, 325° 12′.

Maricopa east pier (Maricopa County, Ariz., J. S. H., 1910).—This is an old longitude pier. It is west by south of the depot of the Santa Fe, Prescott & Phoenix Railway at Maricopa and on the opposite side of the track. The station is marked by a standard disc station mark, described on page 83, cemented in the top of a brick pier which is 3 bricks east and west by 2 bricks north and south, 30 inches in the ground and 30 inches above. The following distances were measured: Center of the Santa Fe, Prescott & Phoenix Railway track, 20.64 meters east; fifth telegraph pole of the same track, 10.64 meters; danger post at a public road crossing on the same railway, 26.39 meters; center of Southern Pacific track, 175.61 meters south.

Maricopa west pier (Maricopa County, Ariz., J. S. H., 1910).—This is an old latitude pier. It is 1.85 meters directly west of Maricopa east pier (see preceding description).

The station is marked by a standard disc station mark, described on page 83, cemented in the top of a brick pier, 2 bricks square, 30 inches in the ground and 36 inches above.

Gila (Yuma County, Ariz., J. S. H., 1911).—On the most northern peak at the northwest end of the Gila Mountains, 2 miles west of Dome, a station on the Southern Pacific and 1½ miles south of the railroad where it makes a bend across the north point of the mountains. There are other and higher peaks south of the one on which the station is located. The station is marked according to note 7, page 84. The reference mark, a cross cut in a sloping rock face, is 3.00 meters from the station in azimuth 286° 51′.

Yuma No. 10 (Yuma County, Ariz., J. S. H., 1911).—This station was established by the United States and Mexico Boundary Commission. It is on the highest point of the southern one of two black hills on the mesa about 6 miles south by east from Yuma. The station mark is the point of a 40-penny nail in the center of a 1½-inch iron pipe 22 inches long which is filled with concrete and embedded in a column of concrete 10 by 12 by 20 inches, the pipe projecting 2 inches above the top of the column. The reference marks are a United States Geological Survey bronze bench mark tablet on an iron post 0.66 meter from the station in azimuth 236° 01′, and a five-eighths-inch iron pin 3.04 meters east of the station.

Yuma azimuth station (Yuma County, Ariz., J. S. H., 1911).—This station was established by the United States and Mexico Boundary Commission, and it is identical with the United States Geological Survey station. It is on the southern peak of a hill called Sierra Prieta, just south of Yuma. The station is marked by a standard disk station mark, described on page 83, cemented in the top of a brick pier which is built on solid rock and is 1 foot high. The reference mark, a United States Geological Survey bronze bench-mark tablet on the top of an iron post, is 1.10 meters from the station in azimuth 150° 03′. Three iron bolts are at the following distances from the station: 1.50 meters north, 1.83 meters east, and 1.70 meters southwest.

Yuma west base (Yuma County, Ariz., 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the mesa south of Yuma and near the western limit of the Blaisdell farm. The station is marked by a hole in the top of a 2 by 4 inch pine stub. Four reference marks, each consisting of a tack in the top of a pine stub, are at the following distances from the station: 2.078 meters north, 1.951 meters east, 1.766 meters south, and 2.223 meters west.

Yuma east base (Yuma County, Ariz., J. S. H., 1911).—This station was established by the United States and Mexico Boundary Commission. It is on the most western peak of a small hill which is composed of black rock and drifting sand and is about 2 miles southeast of Yuma. The Southern Pacific Railroad curves around the south and west sides of this hill. The station is marked by a five-eighths-inch iron pipe projecting about 2 inches above the surface of the ground, near the center of a mound of rock which was piled around the station for the observer to walk upon. Two iron rods similar to the one marking the station and located at the edge of the mound are at the following distances and azimuths from the station: 1.34 meters, 180° 56′; and 0.68 meter 1° 16′; a 1-inch hollow iron pipe with top battered is 1.13 meters from the station in azimuth 274° 07′.

Yuma latitude station (Yuma County, Ariz., C. H. S., 1892).—In the east end of the old adobe building which forms part of the north side of the corral on the Government reservation known as the Yuma Quartermaster's Depot Reservation. This depot has been abandoned for several years. The station is marked by a brick pier 17 inches square and 3 feet high. A brick longitude pier is 1.7 meters southeast of the station.

Pilot Knob (San Diego County, Cal., 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the rocky hill called Pilot Knob, about 1 mile north of the international boundary line and near the Colorado River. The station is marked by a pine stub. Three reference marks consisting of similar pine stubs are at the following distances from the station: 1.695 meters north-northwest; 2.088 meters east-northeast; and 1.350 meters west-southwest.

Boundary monument No. 204 (U. S. & Mex.) (Arizona-Mexico, 1894).—This is an old monument repaired in 1894 by the United States and Mexico Boundary Commission. It is at the western limit of the Yuma Desert mesa and overlooks the Colorado River bottom. The monument is of cast iron plates and has a concrete foundation.

Boundary monument No. 207 (U. S. & Mex.) (California-Mexico, J. S. H., 1910).—A masonry monument at the foot of Pilot Knob Mountain, overlooking the Colorado River Valley, and 810 meters west of monument No. 206. (See below.)

Boundary monument No. 208 (U. S. & Mex.) (California-Mexico, J. S. H., 1910).—An iron monument near a line of heavy sand hills on the same mesa as monument No. 207 (see preceding description) and about 2 miles farther west.

Boundary monument No. 206 (U. S. & Mex.) (California-Mexico, J. S. H., 1910).—An iron monument 229 meters west of the center of the channel of the Colorado River at a point about 6 miles below the mouth of the Gila River.

Yuma No. 11 (State of Lower California, Mexico, 1893).—This is one of the United States and Mexico Boundary Commission stations. It is on the highest peak of the southeast extension of the sand ridge southwest of Pilot Knob. (See above.) This peak is about 1 mile almost due east of another sand peak of about the same height. The station is marked by a 2 by 4 inch pine stub. Three reference marks consisting of similar pine stubs are at the following distances from the station: 2.472 meters north; 2.560 meters south; and 2.197 meters west.

Hill (San Bernardino County, Cal., W. B. F., 1893; 1910).—This station is identical with the United States Geological Survey station of the same name. It is about 6 miles northwest of Needles, a town on the Atchison, Topeka & Santa Fe Railway, 2 miles west of the Colorado River, and about 2 miles northwest of the Dinsmore ranch on the highest sand hill in the vicinity, the highest one between the Dinsmore ranch and the first great wash. The underground mark at the station is a bottle buried with mouth up, 2½ feet below the surface of the ground, and the surface mark is a disk station mark described on page 83, cemented in a drill hole in the top of a large irregular rock approximately 18 by 18 by 20 inches in size.

Knoll (San Bernardino County, Cal., W. B. F., 1893; 1911).—This station is identical with the United States Geological Survey station of the same name. It is on the most prominent knoll on the desert about 1½ miles due west of the schoolhouse at Needles. The knoll is sharp, with very little room on top, and is covered with rocks. The station is marked as follows: A bottle is buried in a vertical position with the neck up, 2½ feet below the surface, and 6 inches above this bottle are three others with their mouths toward the center. The surface mark is a standard disk station mark, described on page 83, cemented in a drill hole in an irregular rock about 15 by 15 by 18 inches in size.

Bluff (San Bernardino County, Cal., W. B. F., 1893; 1911).—About 6 miles north of the town of Needles on a prominent high bluff that projects out from the mesa toward the Colorado River. The bluff is the highest one in the vicinity and about 150 meters west of the river. The station is marked as follows: A bottle is buried in a vertical position with the neck up, 2½ feet below the surface, and 6 inches above this bottle are three others in a horizontal position with their mouths toward the center. The surface mark is a nail in the top of a redwood stake 4 inches square and 2 feet long. The signal was left standing with piles of rock around the center pole and each of the legs.

C. & G. S. B. M. N_6, *eccentric* (San Bernardino County, Cal., J. S. H., 1911).—Near the west switch of the Atchison, Topeka & Santa Fe Railway at Hartoum. The station is marked by a cross on the square head of an iron pipe 18 inches long. The bench mark is opposite a rail rack, 12.32 meters south of the center of the track and 5.015 meters from the station in azimuth 343° 26′. The bench mark consists of a standard 3-inch red metal cap screwed to the top of an iron pipe about 3 feet long set in the ground with about 4 inches exposed. The bottom of the pipe is split in three parts, which are spread to a diameter of about 10 inches, and a steel plate 1 foot square is riveted to these flanges.

Needles longitude station (San Bernardino County, Cal.; C. H. S., 1889).—On the Catholic Church lot at Needles, 38.1 feet northwest of the northwest corner of the church and 300 meters from the main track of the Atchison, Topeka & Santa Fe Railway. The station is marked by a pier constructed of adobe bricks and cement. A latitude pier of similar construction is 27.8 feet south and 3.2 feet east of the station. A cemetery is directly west of the station. Connection was made with the triangulation by means of an eccentric station located on a knoll about 30 feet high 100 feet west of the station.

Bar (San Bernardino County, Cal., W. B. F., 1893; 1908).—Eighty meters west of the schoolhouse on the hill south of Needles and near the edge of a bluff. The station was marked by a 1½-inch iron bar set in cement. The station was reported as probably lost in 1909.

Needles east base (San Bernardino County, Cal., W. B. F., 1893; 1909).—This station has been destroyed.

Needles west base (San Bernardino County, Cal., W. B. F., 1893; 1909).—On the mesa 1½ miles northwest of Needles and one-half mile north of the railroad track, at the corner of Q and Vine Streets, in a real estate subdivision of Needles. The station is marked as follows: A bottle is buried with mouth up, 2½ feet below the ground, and 6 inches above this bottle are three others with their mouths toward the center. The surface mark is a copper bolt in the top of a sandstone monument 12 by 12 by 36 inches in size projecting 1 foot above the surface.

COMPUTATION, ADJUSTMENT, AND ACCURACY OF THE ELEVATIONS.

The zenith distances directly observed at each station were first computed. These zenith distances were corrected for height of the object observed and of instrument so as to refer them all to the ground at each station or to the station marks.

The difference of elevation of each pair of stations in the main scheme was then computed from the observations over the line joining them by the formula

$$h_2-h_1=s \tan \tfrac{1}{2}(\zeta_2-\zeta_1)\left[1+\frac{h_2+h_1}{2\rho}+\frac{s^2}{12\rho^2}\right]$$

in which h_2 and h_1 are elevations of the stations, ζ_2 and ζ_1 are the measured zenith distances as corrected for height of instrument and of object observed, s is the horizontal distance between the stations, and ρ is the radius of curvature.

As there are always two or more lines to each new station, many rigid conditions exist between the observed difference of elevation, even if the connections with the precise leveling were ignored, and the least square adjustment furnishes the readiest accurate means of deriving the required elevations.

The elevations of the primary scheme from the stations of the ninety-eighth meridian triangulation westward to the primary triangulation in California were adjusted in three sets of equations.

The first adjustment involved all stations of the primary scheme from the ninety-eighth meridian to the Stanton base.

The second adjustment fixed the elevations of all primary stations from the Stanton base to the Deming base.

The third adjustment fixed the elevations of all the stations of the primary scheme between the stations of the second adjustment and the stations of the California primary triangulation.

In the first adjustment the elevations of Lamb, Patterson, Stanton, Stanton south base, and Stanton north base were held fixed at 534.80, 726.68, 825.59, 821.20, and 853.04 meters, respectively. These elevations were determined by the line of precise levels run in 1910, each station being a bench mark except Stanton north base, which was determined by precise levels run by the base-line party. The elevations of stations Kyle and McClenny were also held fixed, they having been determined by a previous adjustment.[1] These two elevations are 412.4 and 401.6 meters, respectively.

The elevations of the 26 remaining stations connected by the observations are unknowns to be determined by least squares from the 71 observed differences of elevation indicated below.

In the following tabulation there are shown the observed differences of elevation treated in the first adjustment, together with their adjusted values. The weight p assigned to each observed difference of elevation is inversely proportional to the square of the length s of the line between stations in meters and was conveniently computed by the formula $\log p=9-2 \log s$. The observed difference of elevation is given the sign of the elevation of the second station named minus the elevation of the first. The quantity contained in the last column but one is the correction to be added to an observed difference of elevation to obtain the adjusted difference of elevation.

[1] See Appendix 4, Report for 1903, p. 924.

Kyle-McClenny to Stanton base.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv^2
			Meters	*Meters*	*Meters*	
Kyle	McClenny	0.55	− 11.29	− 10.81	+0.48	0.127
Kyle	Rattlesnake	0.34	+ 77.75	+ 80.75	+3.00	3.060
McClenny	Rattlesnake	1.00	+ 92.27	+ 91.56	−0.71	0.504
Lacasa	Rattlesnake	0.76	+ 5.57	+ 5.70	+0.13	0.013
Lacasa	Pierce	4.19	+ 2.22	+ 2.04	−0.18	0.136
Lacasa	Flat	1.58	+ 8.94	+ 9.37	+0.43	0.292
Rattlesnake	Pierce	1.42	− 3.95	− 3.66	+0.29	0.119
Pierce	Hearn	0.90	+ 8.75	+ 10.25	+1.50	2.025
Pierce	Flat	4.38	+ 7.73	+ 7.33	−0.40	0.701
Hearn	Springgap	0.76	+162.98	+164.53	+1.55	1.826
Hearn	Lamb	3.06	+ 35.00	+ 35.06	+0.06	0.011
Flat	Lamb	2.13	+ 38.36	+ 37.98	−0.38	0.308
Flat	Springgap	0.48	+167.19	+167.45	+0.26	0.032
Flat	Hitson (U. S. G. S.)	0.62	+ 76.06	+ 75.50	−0.56	0.194
Lamb	Springgap	1.63	+129.82	+129.47	−0.35	0.200
Lamb	Hitson (U. S. G. S.)	1.29	+ 37.60	+ 37.52	−0.08	0.008
Springgap	Clayton	0.74	+ 45.25	+ 45.68	+0.43	0.137
Springgap	Clyde	1.93	− 31.54	− 30.44	+1.10	2.335
Springgap	Kennard	0.93	− 43.23	− 44.99	−1.76	2.881
Springgap	Hitson (U. S. G. S.)	1.80	− 91.89	− 91.95	−0.06	0.006
Hitson (U. S. G. S.)	Clyde	4.28	+ 61.20	+ 61.51	+0.31	0.411
Hitson (U. S. G. S.)	Kennard	3.12	+ 47.58	+ 46.96	−0.62	1.199
Clyde	Kennard	9.18	− 14.98	− 14.55	+0.43	1.697
Clayton	Clyde	1.35	− 76.46	− 76.12	+0.34	0.156
Clayton	Buzzard	1.21	+ 23.30	+ 24.30	+1.00	1.210
Clayton	Morrison	0.98	−148.26	−148.78	−0.52	0.265
Clayton	Kennard	0.99	− 89.82	− 90.67	−0.85	0.715
Kennard	Buzzard	0.48	+113.57	+114.97	+1.40	0.941
Kennard	Morrison	0.95	− 56.94	− 58.11	−1.17	1.300
Buzzard	Morrison	2.72	−173.09	−173.08	+0.01	0.000
Buzzard	Hale	2.39	+ 38.64	+ 39.09	+0.45	0.484
Buzzard	Sears	1.88	−156.74	−156.30	+0.44	0.364
Morrison	Sears	2.88	+ 17.25	+ 16.78	−0.47	0.636
Morrison	Hale	1.08	+212.39	+212.17	−0.22	0.052
Hale	Boyd	13.68	− 2.99	− 2.90	+0.09	0.111
Sears	Hale	0.30	+195.93	+195.39	−0.54	0.088
Sears	Boyd	1.94	+193.32	+192.49	−0.83	1.336
Sears	Allen	1.44	+ 94.70	+ 95.56	+0.86	1.065
Hale	Allen	1.90	− 99.52	− 99.83	−0.31	0.183
Boyd	Allen	3.71	− 96.82	− 96.93	−0.11	0.045
Boyd	Lloyd	1.38	+ 20.71	+ 22.17	+1.46	2.942
Boyd	Patterson	1.21	− 42.11	− 43.76	−1.65	3.294
Allen	Patterson	1.80	+ 52.92	+ 53.17	+0.25	0.112
Allen	Lloyd	0.90	+119.35	+119.10	−0.25	0.056
Patterson	Lloyd	2.47	+ 66.90	+ 65.93	−0.97	2.324
Patterson	Bench	1.88	+ 67.44	+ 66.74	−0.70	0.921
Patterson	Wolf	2.70	+ 24.86	+ 24.92	+0.06	0.010
Lloyd	Bench	16.67	+ 0.85	+ 0.81	−0.04	0.027
Lloyd	Wolf	1.23	− 40.98	− 41.01	−0.03	0.001
Bench	Wolf	1.53	− 40.76	− 41.82	−1.06	1.719
Bench	Bynum	0.60	− 94.51	− 95.44	−0.93	0.519
Bench	Cuthbert	0.43	−107.18	−106.45	+0.73	0.229
Wolf	Bynum	1.18	− 53.45	− 53.62	−0.17	0.034
Wolf	Cuthbert	1.39	− 63.68	− 64.63	−0.95	1.254
Bynum	Cuthbert	3.06	− 11.02	− 11.01	+0.01	0.000
Bynum	Signal	0.93	+136.97	+136.37	−0.60	0.335
Bynum	Top	1.24	+ 71.92	+ 71.71	−0.21	0.055
Cuthbert	Signal	0.58	+147.99	+147.38	−0.61	0.216
Cuthbert	Top	2.02	+ 83.01	+ 82.72	−0.29	0.170
Signal	Top	1.27	− 65.28	− 64.66	+0.62	0.488
Signal	Williams	6.53	+ 31.38	+ 30.91	−0.47	1.442

Kyle-McClenny to Stanton base—Continued.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv_2
			Meters	*Meters*	*Meters*	
Signal	Evart	1.56	− 18.15	− 17.25	+0.90	1.264
Top	Williams	0.92	+ 95.16	+ 95.57	+0.41	0.155
Top	Evart	1.77	+ 47.66	+ 47.41	−0.25	0.111
Williams	Evart	2.55	− 47.68	− 48.16	−0.48	0.588
Williams	Stanton	0.99	− 38.88	− 39.67	−0.79	0.618
Williams	Epley	0.59	+ 5.06	+ 3.89	−1.17	0.808
Evart	Stanton	0.73	+ 8.22	+ 8.49	+0.27	0.053
Evart	Epley	0.76	+ 52.71	+ 52.05	−0.66	0.331
Stanton	Stanton S. base	5.78	− 4.54	− 4.39	+0.15	0.130
Stanton	Stanton N. base	2.29	+ 28.33	+ 27.45	−0.88	1.773
Stanton	Epley	2.78	+ 44.14	+ 43.56	−0.58	0.935
Epley	Stanton S. base	2.36	− 47.49	− 47.95	−0.46	0.499
Epley	Stanton N. base	5.27	− 15.80	− 16.11	−0.31	0.506
Stanton N. base	Stanton S. base	5.74	− 32.40	− 31.84	+0.56	1.800

The probable error of an observation of weight unity derived from the preceding adjustment is ±0.70 meter. In other words, the reciprocal observations over a line 31.7 kilometers (19⅔ miles) long, this being the length of the line corresponding to unit weight, determined the difference of elevation of two points with such a degree of accuracy that it is an even chance whether the error is greater or less than 0.70 meter. The probable errors for lines of other lengths were assumed to be proportional to their lengths.

The probable errors of the elevations of the five stations fixed by precise leveling are about ±0.05 meter. The probable error approaches this value for stations adjacent to those fixed by precise leveling and is greatest for the most remote stations. Of the elevations least accurately determined, station Buzzard, one of these, has a probable error estimated at not to exceed ±0.5 meter.

The elevations of the stations of the main scheme from the Stanton base at the east to the Deming base at the west, including four secondary stations, were obtained from the second adjustment as shown in the tabulation below. The elevations of Scar, Odessa, Hays, and Allamore were held fixed at 880.79, 898.70, 853.20, and 1 387.33 meters, respectively, these being the elevations as fixed by precise leveling. Four other elevations were held fixed, having been determined by the spirit leveling of the United States Geological Survey and the United States and Mexico Boundary Commission, as follows: Boundary monument No. 2 (U. S. & Mex.), Deming City Water Works, Boundary monument No. 32 (U. S. & Mex.), and Boundary monmuent No. 40 (U. S. & Mex.), and their elevations are 1 307.64, 1 324.91, 1 494.99, and 1 501.39 meters, respectively. The nonreciprocal observations connecting one of these, Boundary monument No. 32 (U. S. & Mex.), were used in this adjustment with a weight 0.3 of that assigned to corresponding lines of the main scheme and over which reciprocal observations were obtained.

In addition to the eight elevations held fixed there were the elevations of Stanton south base and Stanton north base which were common to the first adjustment and the difference of elevation between the two ends of the Deming base which was held as determined by the precise leveling, namely, 20.54 meters.

The elevations of the two ends of the Deming base and the 38 remaining stations connected by the observations are unknowns, to be determined by least squares from the 106 observed differences of elevation indicated on pages 116 and 117.

Stanton base to Deming base.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv^2
			Meters	*Meters*	*Meters*	
Stanton N. base	Elkins	3.38	+ 6.33	+ 5.83	− 0.50	0.845
Stanton N. base	Dunn	4.06	+ 34.08	+ 33.86	− 0.22	0.195
Stanton S. base	Elkins	6.92	+ 37.75	+ 37.67	− 0.08	0.042
Dunn	Elkins	3.63	− 28.56	− 28.03	− 0.53	1.020
Dunn	Sear	1.73	− 4.63	− 6.11	− 1.48	3.789
Dunn	Morris	2.27	+ 19.51	+ 19.39	− 0.12	0.033
Elkins	Sear	2.95	+ 21.98	+ 21.92	− 0.06	0.012
Elkins	Morris	1.25	+ 47.54	+ 47.42	− 0.12	0.018
Morris	Sear	3.03	− 24.32	− 25.50	− 1.18	4.218
Morris	Bates	16.00	+ 7.46	+ 7.76	+ 0.30	1.440
Morris	Smith	4.21	+ 15.07	+ 14.67	− 0.40	0.674
Sear	Bates	4.81	+ 34.28	+ 33.26	− 1.02	5.002
Bates	Odessa	6.81	− 15.33	− 15.35	− 0.03	0.006
Bates	Smith	5.27	+ 6.89	+ 6.91	+ 0.02	0.002
Smith	Odessa	3.60	− 21.94	− 22.26	− 0.32	0.368
Smith	Dublin	2.23	+ 58.61	+ 58.41	− 0.20	0.089
Odessa	Dublin	1.26	+ 79.86	+ 80.67	+ 0.81	0.827
Dublin	Douro	2.25	− 43.13	− 43.97	− 0.84	1.588
Dublin	Harris	1.83	− 100.15	− 98.81	+ 1.34	3.286
Douro	Curtis	4.53	− 64.95	− 65.15	− 0.20	0.181
Douro	Harris	1.30	− 54.07	− 54.84	− 0.77	0.771
Harris	Curtis	2.28	− 10.53	− 10.31	+ 0.22	0.110
Harris	Estes	1.32	− 83.03	− 83.16	− 0.13	0.022
Harris	Aroya	1.90	− 46.74	− 46.12	+ 0.62	0.730
Curtis	Estes	0.85	− 72.39	− 72.85	− 0.46	1.799
Aroya	Estes	2.90	− 37.65	− 37.04	+ 0.61	1.079
Aroya	Lee	1.48	− 6.86	− 7.36	− 0.50	0.370
Aroya	Johnson	1.36	+ 35.30	+ 35.39	+ 0.09	0.011
Estes	Lee	1.85	+ 29.00	+ 29.68	+ 0.68	0.855
Estes	Johnson	0.76	+ 72.55	+ 72.43	− 0.12	0.011
Hays	Lee	5.74	− 25.96	− 26.12	− 0.16	0.147
Johnson	Hays	7.50	− 16.78	− 16.63	+ 0.15	0.169
Johnson	Sist	0.97	− 70.35	− 72.09	− 1.74	2.937
Johnson	Ingle	1.57	− 35.12	− 34.71	+ 0.41	0.264
Lee	Sist	1.08	− 28.99	− 29.34	− 0.35	0.132
Hays	Sist	1.99	− 56.27	− 55.46	− 0.81	1.306
Hays	Ingle	1.40	− 19.37	− 18.08	+ 1.29	2.330
Ingle	Toyah	0.32	+ 190.11	+ 194.42	+ 4.31	5.944
Ingle	Round	1.05	+ 154.72	+ 155.75	+ 1.03	1.122
Sist	Toyah	0.66	+ 232.44	+ 231.80	− 0.64	0.271
Round	Toyah	0.63	+ 37.98	+ 38.67	+ 0.69	0.300
Round	Newman	0.32	+ 955.32	+ 956.94	+ 1.62	0.839
Round	Seay	0.60	+ 235.42	+ 235.74	+ 0.32	0.060
Toyah	Newman	1.20	+ 917.65	+ 918.28	+ 0.63	0.476
Toyah	Seay	0.52	+ 195.86	+ 197.07	+ 1.21	0.761
Seay	Newman	0.88	+ 721.95	+ 721.21	− 0.74	0.482
Seay	Reynolds	4.19	+ 416.11	+ 416.10	− 0.01	0.000
Seay	Krouse	2.65	+ 497.10	+ 497.66	+ 0.56	0.831
Newman	Chispa	0.24	− 363.69	− 362.82	+ 0.87	0.182
Newman	Krouse	0.62	− 224.02	− 223.55	− 0.47	0.137
Newman	Reynolds	0.83	− 304.74	− 305.11	− 0.37	0.114
Reynolds	Chispa	0.35	− 60.98	− 57.71	− 3.27	3.742
Reynolds	Krouse	29.38	+ 81.61	+ 81.56	− 0.05	0.073
Krouse	Chispa	0.37	− 138.49	− 139.27	− 0.78	0.224
Krouse	Eagle	0.20	+ 563.04	+ 560.53	− 2.51	1.260
Krouse	Diablo	0.47	+ 260.39	+ 262.69	+ 2.30	2.486
Diablo	Chispa	0.43	− 401.32	− 401.96	− 0.64	0.176
Diablo	Eagle	0.83	− 297.82	− 297.84	− 0.02	0.000
Diablo	Black	0.45	− 294.69	− 291.91	− 2.78	3.488
Chispa	Eagle	0.68	+ 698.64	+ 699.80	+ 1.16	0.916

Stanton base to Deming base—Continued.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv^2
			Meters	*Meters*	*Meters*	
Eagle	Allamore	2.76	− 897.48	− 897.47	+ 0.01	0.000
Black	Quitman	0.30	+ 342.29	+ 343.30	+ 1.01	0.306
Black	North Franklin	0.06	+ 490.37	+ 493.48	+ 1.89	0.214
Black	Corduna	0.27	+ 523.83	+ 523.38	− 0.45	0.054
Quitman	Allamore	0.44	− 652.16	− 651.02	+ 1.14	0.572
Quitman	Diablo	0.32	− 50.19	− 51.39	− 1.20	0.461
Quitman	North Franklin	0.06	+ 141.57	+ 148.96	+ 7.39	3.277
Quitman	Cerro Alto	0.10	+ 34.77	+ 30.31	− 4.46	1.989
Quitman	Corduna	0.11	+ 181.99	+ 180.08	− 1.91	0.401
Corduna	Cerro Alto	0.52	− 150.68	− 149.77	+ 0.91	0.430
Corduna	North Franklin	0.11	− 31.93	− 31.12	− 0.81	0.072
Corduna	Kent	0.09	− 90.31	− 85.75	+ 4.56	1.871
Corduna	Jarilla	0.20	− 739.00	− 740.29	− 1.29	0.333
Cerro Alto	Mesa	0.61	− 854.44	− 855.16	− 0.72	0.316
Cerro Alto	North Franklin	0.41	+ 122.03	+ 118.65	− 3.38	4.684
Mesa	North Franklin	2.15	+ 972.58	+ 973.81	+ 1.23	3.253
Mesa	Boundary monument No. 2 (U. S. & Mex.)	2.78	+ 95.00	+ 94.14	− 0.86	2.057
North Franklin	Boundary monument No. 2 (U. S. & Mex.)	5.22	− 879.99	− 879.67	+ 0.32	0.532
North Franklin	Kent	0.22	− 56.13	− 53.63	+ 2.50	1.375
North Franklin	Jarilla	0.23	− 711.37	− 709.17	+ 2.20	1.113
Jarilla	Kent	0.74	+ 654.21	+ 654.54	+ 0.33	0.080
Kent	Florida	0.07	+ 1.60	+ 12.36	+ 10.76	8.103
Cooks	Florida	0.44	− 416.71	− 417.82	− 1.11	0.542
Cooks	Deming N. base	0.61	−1261.89	−1261.88	+ 0.01	0.001
Cooks	Deming city water works	1.13	−1238.49	−1237.95	+ 0.54	0.330
Cooks	Red	0.67	− 911.26	− 911.45	− 0.19	0.024
Florida	Hermanas	0.47	− 530.04	− 534.06	− 4.02	7.557
Florida	Deming S. base	2.22	− 866.13	− 864.60	+ 1.53	5.197
Florida	Deming N. base	5.38	− 844.26	− 844.06	+ 0.20	0.215
Florida	Deming city water works	2.17	− 819.80	− 820.13	+ 0.33	0.236
Deming N. base	Deming city water works	8.47	+ 23.59	+ 23.93	+ 0.34	0.982
Red	Deming city water works	5.78	− 326.43	− 326.50	+ 0.07	0.029
Red	Deming N. base	5.27	− 350.10	− 350.43	− 0.33	0.574
Red	Florida	1.33	+ 492.37	+ 493.63	+ 1.26	2.112
Red	Deming S. base	2.71	− 370.77	− 370.97	− 0.20	0.108
Red	Hermanas	0.47	− 42.20	− 40.43	+ 1.77	1.472
Hermanas	Cooks	0.14	+ 954.72	+ 951.88	− 2.84	1.129
Deming S. base	Hermanas	1.16	+ 331.00	+ 330.54	− 0.46	0.245
Hermanas	Boundary monument No. 39 (U. S. & Mex.)	1.94	− 77.03	− 78.86	− 1.83	6.497
Hermanas	Near	1.99	+ 38.52	+ 38.38	− 0.14	0.040
Near	Boundary monument No. 39 (U. S. & Mex.)	1923.0	− 117.23	− 117.24	− 0.01	0.192
Near	Boundary monument No. 40 (U. S. & Mex.)	179.5	− 148.08	− 147.97	+ 0.11	2.172
Near [1]	Boundary monument No. 32 (U. S. & Mex.)	0.70	− 154.88	− 154.37	+ 0.50	0.175
Boundary monument No. 39 (U. S. & Mex.)	Boundary monument No. 40 (U. S. & Mex.)	236.6	− 30.63	− 30.73	− 0.10	2.366
Boundary monument No. 39 (U. S. & Mex.)	Boundary monument No. 32 (U. S. & Mex.)	0.62	− 37.64	− 37.13	+ 0.51	0.161
Hermanas	Boundary monument No. 32 (U. S. & Mex.)	58.19	− 116.04	− 115.99	+ 0.05	0.116

[1] Nonreciprocal observations. Weight is reduced by multiplying by 0.3.

The probable error of an observation of weight unity derived from this second adjustment is ±0.92 meter. Unit weight corresponds, as in the first adjustment, to reciprocal observations over a line 31.7 kilometers (19⅔ miles) long.

The probable error of the stations fixed by precise leveling is about ±0.05 meter. Station Corduna was assumed to be the one least accurately determined and its probable error was therefore computed as a limiting value and was found to be ±0.87 meter from the vertical angles alone. When combined with the probable error of the elevations fixed by the precise leveling, it was the same.

In other words, for the least accurately determined station in the main scheme between the Stanton and the Deming bases there is an even chance that the elevation is correct within 0.9 meter (or 3 feet), and for most stations in the main scheme the accuracy is greater than this.

The results of the third adjustment, in which the stations concerned are those from the line Cooks-Hermanas of the second adjustment to the line San Jacinto-Cuyamaca, are shown below in the form used for the first adjustment.

Deming base net to San Jacinto—Cuyamaca.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv^2
			Meters	*Meters*	*Meters*	
Burro	Cooks	0.23	+ 100.46	+ 99.86	− 0.60	0.08
Burro	Hermanas	0.10	− 856.50	− 852.02	+ 4.48	2.00
Chiricahua	Burro	0.08	− 490.53	− 492.41	− 1.88	0.28
Chiricahua	Hermanas	0.06	−1351.17	−1344.43	+ 6.74	2.72
Line (U. S. G. S.)	Burro	0.28	+ 384.65	+ 386.30	+ 1.65	0.76
Line (U. S. G. S.)	Chiricahua	0.08	+ 881.78	+ 878.71	− 3.07	0.75
Graham (U. S. G. S.)	Line (U. S. G. S.)	0.14	−1192.42	−1190.88	+ 1.54	0.33
Graham (U. S. G. S.)	Chiricahua	0.09	− 308.79	− 312.17	− 3.38	1.03
Mule (U. S. G. S.)	Chiricahua	0.16	+ 702.18	+ 709.81	+ 7.63	9.31
Mule (U. S. G. S.)	Boundary monument, No. 91 (U. S. & Mex.)	4.65	− 765.18	− 765.50	− 0.60	1.67
Huachuca	Mule (U. S. G. S.)	0.61	− 317.30	− 317.66	− 0.36	0.08
Huachuca	Boundary monument No. 91 (U. S. & Mex.)	0.38	−1082.66	−1083.26	− 0.36	0.05
Catalina	Graham (U. S. G. S.)	0.12	+ 468.65	+ 468.95	+ 0.30	0.00
Catalina	Chiricahua	0.04	+ 160.51	+ 155.78	− 4.73	0.89
Baldy (U. S. G. S.)	Catalina	0.14	− 76.39	− 79.85	− 3.46	1.67
Baldy (U. S. G. S.)	Chiricahua	0.04	+ 81.69	+ 75.93	− 5.76	1.33
Baldy (U. S. G. S.)	Huachuca	0.40	− 314.67	− 316.12	− 1.45	0.84
Nogales No. 7	Huachuca	0.21	+ 967.19	+ 967.56	+ 0.37	0.03
Nogales No. 7 [1]	Boundary monument No. 128 (U. S. & Mex.)	31.78	+ 70.20	+ 70.29	+ 0.09	3.18
Baldy (U. S. G. S.) [1]	Boundary monument No. 128 (U. S. & Mex.)	0.14	−1213.84	−1213.32	+ 0.52	0.04
Benedict (U. S. G. S.)	Nogales No. 7	3.86	+ 204.07	+ 204.15	+ 0.08	0.04
Benedict (U. S. G. S.)	Baldy (U. S. G. S.)	0.86	+1489.35	+1487.80	− 1.55	2.06
Boundary monument No. 121 (U. S. & Mex.) [1]	Boundary monument No. 128 (U. S. & Mex.)	1.69	+ 442.99	+ 442.07	− 0.92	1.44
Boundary monument No. 121 (U. S. & Mex.)	Nogales No. 7	4.82	+ 371.24	+ 371.78	+ 0.54	1.40

[1] Nonreciprocal observations. Weight reduced by multiplying by 0.3.

Deming base net to San Jacinto—Cuyamaca—Continued.

Station 1	Station 2	Weight p	Observed difference of elevations h_2-h_1	Adjusted difference of elevations h_2-h_1	Adjusted minus observed v	pv^2
			Meters	*Meters*	*Meters*	
Boundary monument No. 121 (U. S. & Mex.)	Benedict (U. S. G. S.)	19.22	+ 167.68	+ 167.63	− 0.05	0.00
Superstition (U. S. G. S.)	Catalina	0.07	+1253.08	+1258.13	+ 5.05	1.78
Superstition (U. S. G. S.)	Baldy (U. S. G. S.)	0.03	+1334.36	+1337.98	+ 3.62	0.39
Table	Superstition (U. S. G. S.)	0.10	+ 207.68	+ 208.49	+ 0.81	0.07
Table	Catalina	0.06	+1469.01	+1466.62	− 2.39	0.34
Table	Maricopa astronomic Sta.	0.83	− 974.42	− 974.74	− 0.32	0.08
Table	Maricopa northwest base	0.87	− 972.79	− 973.18	− 0.39	0.13
Whitetank	Superstition (U. S. G. S.)	0.08	+ 330.05	+ 322.58	− 7.47	4.46
Whitetank	Table	0.10	+ 112.16	+ 114.09	+ 1.93	0.37
Maricopa	Whitetank	0.12	− 26.02	− 26.06	− 0.04	0.00
Maricopa	Maricopa astronomic Sta.	0.47	− 887.28	− 886.71	+ 0.51	0.12
Maricopa	Maricopa northwest base	0.47	− 884.00	− 885.15	− 1.15	0.62
Maricopa	Table	1.76	+ 88.52	+ 88.03	− 0.49	0.42
Maricopa	Superstition (U. S. G. S.)	0.07	+ 282.59	+ 296.52	+13.93	13.58
Harquahalla	Whitetank	0.16	− 507.28	− 509.64	− 2.36	0.89
Harquahalla	Maricopa	0.05	− 488.40	− 483.70	+ 4.70	1.10
Mohawk	Harquahalla	0.05	+ 889.30	+ 886.02	− 3.28	0.54
Mohawk	Maricopa	0.07	+ 407.99	+ 402.32	− 5.67	2.25
Kofa	Mohawk	0.11	− 627.64	− 628.98	− 1.34	0.20
Powell	Harquahalla	0.08	+ 173.44	+ 173.16	− 0.28	0.01
Powell	Kofa	0.06	− 88.67	− 83.88	+ 4.79	1.38
Pine	Harquahalla	0.07	− 423.82	− 425.86	− 2.04	0.29
Pine	Powell	0.65	− 600.04	− 599.02	+ 1.02	0.68
Hill	Pine	0.17	+1912.26	+1909.04	− 3.24	1.78
Hill	Powell	0.29	+1308.08	+1310.02	+ 1.94	1.09
Hill	Knoll	13.98	− 38.26	− 38.38	− 0.12	0.14
Pine	U. S. C. & G. S. B. M. N_6	0.18	−1926.31	−1929.08	− 2.77	1.38
Knoll	U. S. C. & G. S. B. M. N_6	50.38	+ 18.24	+ 18.24	0.00	0.00
Knoll	Pine	0.20	+1948.30	+1947.32	− 0.98	0.19
Chemehuevis	Hill	0.62	− 882.12	− 882.41	− 0.29	0.05
Chemehuevis	Harquahalla	0.05	+ 597.44	+ 600.77	+ 3.33	0.55
Chemehuevis	Pine	0.21	+1022.96	+1026.63	+ 3.67	2.83
Chemehuevis	Powell	0.85	+ 428.50	+ 427.61	− 0.89	0.67
American (U.S.G.S.)	Kofa	0.14	+ 821.67	+ 822.65	+ 0.98	0.13
American (U.S.G.S.)	Mohawk	0.09	+ 198.23	+ 193.67	− 4.56	1.87
American (U.S.G.S.)	Yuma azimuth Sta.	2.38	− 557.97	− 558.08	− 0.11	0.02
Yuma No. 10	American (U. S. G. S.)	1.35	+ 549.72	+ 549.64	− 0.08	0.01
Yuma No. 10	Yuma azimuth Sta.	20.71	− 8.44	− 8.44	0.00	0.00
Yuma No. 10	Kofa	0.12	+1376.54	+1372.29	− 4.25	2.17
Gila	Yuma No. 10	2.24	− 393.56	− 393.16	+ 0.40	0.36
Gila	Yuma azimuth Sta.	2.11	− 401.57	− 401.60	− 0.03	0.00
Maricopa astronomic Sta.	Maricopa northwest base (U. S. G. S.)	396.95	+ 2.76	+ 2.76	0.00	0.00
Gila	American (U. S. G. S.)	0.74	+ 157.63	+ 156.48	− 1.15	0.98
Butte	Powell	0.04	+ 189.58	+ 186.90	− 2.68	0.29
Butte	Kofa	0.07	+ 101.12	+ 103.02	+ 1.90	0.25
Butte	American (U. S. G. S.)	0.11	− 724.52	− 719.63	+ 4.89	2.63
Butte	Cuyamaca	0.05	+ 610.78	+ 614.28	+ 3.50	0.61
American (U.S.G.S.)	Cuyamaca	0.03	+1340.23	+1333.91	− 6.32	1.20
San Jacinto	Cuyamaca	0.11	−1315.92	−1318.30	− 2.38	0.62

In this third and last adjustment the elevations of twelve stations were taken as fixed. The stations Cooks and Hermanas had been fixed by the second adjustment, their elevations being 2 562.86 and 1 610.98 meters, respectively. The stations San Jacinto and Cuyamaca had been fixed by the adjustment of the California triangulation, their published[1] elevations being 3 301.2 and 1 982.9 meters, respectively. Stations Maricopa astronomic Sta., Maricopa northwest base (U. S. G. S.), Yuma azimuth station, Yuma No. 10, Yuma east base, C. & G. S. Bench mark N_6, Boundary monuments Nos. 91 and 128 (U. S. & Mex.) were held fixed from the results of spirit leveling, their elevations being 358.27, 359.83, 90.91, 99.35, 79.73, 225.46, 1 480.1, and 1 666.12 meters, respectively. The leveling which fixed these elevations was done by the United States Geological Survey, by the United States and Mexico Boundary Commission, and by this Survey.

The elevations of the remaining 26 stations connected by the observations are the unknowns determined by least squares from the 72 observed differences of elevation in the above table.

The probable error of an observation of weight unity derived from this adjustment is ± 0.91 meter. Unit weight corresponds as in the other adjustments to reciprocal observations over a line 31.7 kilometers (19⅔ miles) long.

Station Graham (U. S. G. S.) may be assumed to be the one least accurately determined, and the probable error computed for its elevation is ± 0.43 meter from the vertical angle measures alone. This probable error, combined with the probable error of the stations fixed by the spirit leveling, may be stated to be ± 0.5 meter.

ELEVATIONS.

The datum for all the elevations is mean sea level.

The stations are in three classes: First, those fixed directly by the spirit leveling and of which the elevations are subject to a probable error of ± 0.05 meter; second, the stations in the main scheme fixed by reciprocal measures of vertical angles and which are subject to probable errors varying from ± 0.1 to ± 0.9 meter; and, third, the intersection stations whose elevations are subject to probable errors which may be as great as ± 3 meters in some cases. These elevations are fixed by measurements of vertical angles which are not reciprocal, the intersection stations not being occupied.

The accuracy with which each elevation in the main scheme is determined depends mainly upon the remoteness of that station from the nearest one of which the elevation is fixed by spirit leveling, as indicated in class 1 of the following table. Station Corduna is probably least accurately determined of all the stations in the main scheme.

For a table to be used in converting feet to meters, or vice versa, see page 68.

[1] See Appendix No. 9, Report for 1904, p. 744.

TABLE OF ELEVATIONS

Kyle-McClenny to Stanton base

Station	Point to which elevation refers	Elevation
Class 1		*Meters*
Lamb	Station mark	534.80
Patterson	Station mark	726.68
Stanton	Station mark	825.59
Stanton south base	Station mark	821.20
Stanton north base	Station mark	853.04
Class 2		
Kyle	Station mark	412.4
McClenny	Station mark	401.6
Rattlesnake	Station mark	493.2
Lacasa	Station mark	487.4
Pierce	Station mark	489.5
Flat	Station mark	496.8
Hearn	Station mark	499.7
Springgap	Station mark	664.3
Hitson (U. S. G. S.)	Station mark	572.3
Clyde	Station mark	633.8
Kennard	Station mark	619.3
Clayton	Station mark	710.0
Morrison	Station mark	561.2
Buzzard	Station mark	734.3
Sears	Station mark	578.0
Hale	Station mark	773.3
Boyd	Station mark	770.4
Allen	Station mark	673.5
Lloyd	Station mark	792.6
Bench	Station mark	793.4
Wolf	Station mark	751.6
Bynum	Station mark	698.0
Cuthbert	Station mark	687.0
Top	Station mark	769.7
Signal	Station mark	834.4
Williams	Station mark	865.3
Evart	Station mark	817.1
Epley	Station mark	869.2
Class 3		
Carbon schoolhouse	Top of roof	503.2
Eastland courthouse	Top of dome	467.0
Eastland schoolhouse	Top of roof	457.7
Cisco astronomic station (U. S. G. S.)	Station mark	511.5
Cisco standpipe	Top	531.2
Cisco Methodist church	Top of cone	519.3
Church 7 miles south of Cisco	Top of roof	517.2
Baird courthouse	Top of dome	538.8
Baird tall church	Top of spire	544.7
Clyde church	Bottom of cone	619.0
Abilene standpipe (U. S. G. S.)	Top	562.6
Abilene courthouse	Top of dome	550.6
Abilene low standpipe	Top	556.7
Abilene asylum stack	Top	562.0
Church north of Tye	Top of roof	545.8
Tye Baptist church	Top of spire	564.7
Tye Methodist church	Top of spire	559.8
Church 6 miles west of Morrison	Top	557.9
Merkel church	Top of spire	589.2
Merkel electric light plant	Top of stack	590.0
Merkel tall water tank	Top	584.9
Trent schoolhouse belfry	Top	595.2
Trent Christian church	Bottom of cone	591.8
Eskota water tank	Top	599.4
Sweetwater schoolhouse	Top of roof	677.0
Wasp U. S. G. S.	Station mark	719.1
Roscoe cotton gin	Top of stack	748.8
Roscoe schoolhouse	Top of cupola	746.4
Loraine schoolhouse	Top of dome	736.4
Colorado west standpipe	Top	693.2
Westbrook Methodist church	Top of spire	675.1
Morgans Peak	Top	700.9
Muchakooago Peak	Top	872.4
Stanton courthouse	Top of cupola	839.7

Stanton base to Deming base.

Station	Point to which elevation refers	Elevation
Class 1		*Meters*
Scar	Station mark	880.79
Odessa	Station mark	898.70
Hays	Station mark	853.20
Allamore	Station mark	1387.33
Boundary monument No. 2 (U. S. & Mex.)	Top of masonry base	1307.64
Deming city water works	Geological Survey B. M.	1324.91
Boundary monument No. 32 (U. S. & Mex.)	Top of monument	1494.99
Boundary monument No. 40 (U. S. & Mex.)	Top of monument	1501.39
Class 2		
Dunn	Station mark	886.9
Elkins	Station mark	858.9
Morris	Station mark	906.3
Bates	Station mark	914.1
Smith	Station mark	921.0
Douro	Station mark	935.4
Dublin	Station mark	979.4
Curtis	Station mark	870.3
Harris	Station mark	880.6
Aroya	Station mark	834.4
Estes	Station mark	797.4
Lee	Station mark	827.1
Johnson	Station mark	869.8
Sist	Station mark	797.7
Ingle	Station mark	835.1
Round	Station mark	990.9
Toyah	Station mark	1029.5
Newman	Station mark	1947.8
Seay	Station mark	1226.6
Reynolds	Station mark	1642.7
Krouse	Station mark	1724.3
Chispa	Station mark	1585.0
Diablo	Station mark	1987.0
Eagle	Station mark	2284.8
Quitman	Station mark	2038.3
Black	Station mark	1695.0
Corduna	Station mark	2218.4
Cerro Alto	Station mark	2068.7
North Franklin	Station mark	2187.3
Mesa	Station mark	1213.5
Jarilla	Station mark	1478.1
Kent	Station mark	2132.7
Florida	Station mark	2145.0
Cooks	Station mark	2562.9
Hermanas	Station mark	1611.0
Near	Station mark	1649.4
Boundary monument No. 39 (U. S. & Mex.)	Top of monument	1534.2
Red	Station mark	1651.4
Deming north base	Station mark	1301.0
Deming south base	Station mark	1280.4
Class 3		
Newman U. S. G. S.	Top of cairn	1950.7
Midland courthouse	Top of cupola	868.1
Odessa courthouse [1]	Top of cupola	899.2
Castle Gap Mountain	Top	961.5
Judkins schoolhouse	Top of cupola	894.8
Windmill 2 miles south of Dublin	Center of wheel	987.0
Barstow courthouse	Top of cupola	804.0
Pecos courthouse [1]	Top of cupola	811.7
Davis Mountain, or Black Mountain	Top	2357
High or Sawtooth Mountain	Top	2342.6
Alamagordo Peak	Top	3603.5
Black Mountain	Top of peak	1638.7
Bear	Top	2449.5
Flat Top	Top	1222.4
Davis	Top	1996.7
Gomez Peak	Top	1927.2
Cone	Top	1510.4
Pinnacle	Top	1273.1
Boundary monument No. 3 (U. S. & Mex.)	Top of masonry base	1257.7
El Paso courthouse	Top of tower	1164.9

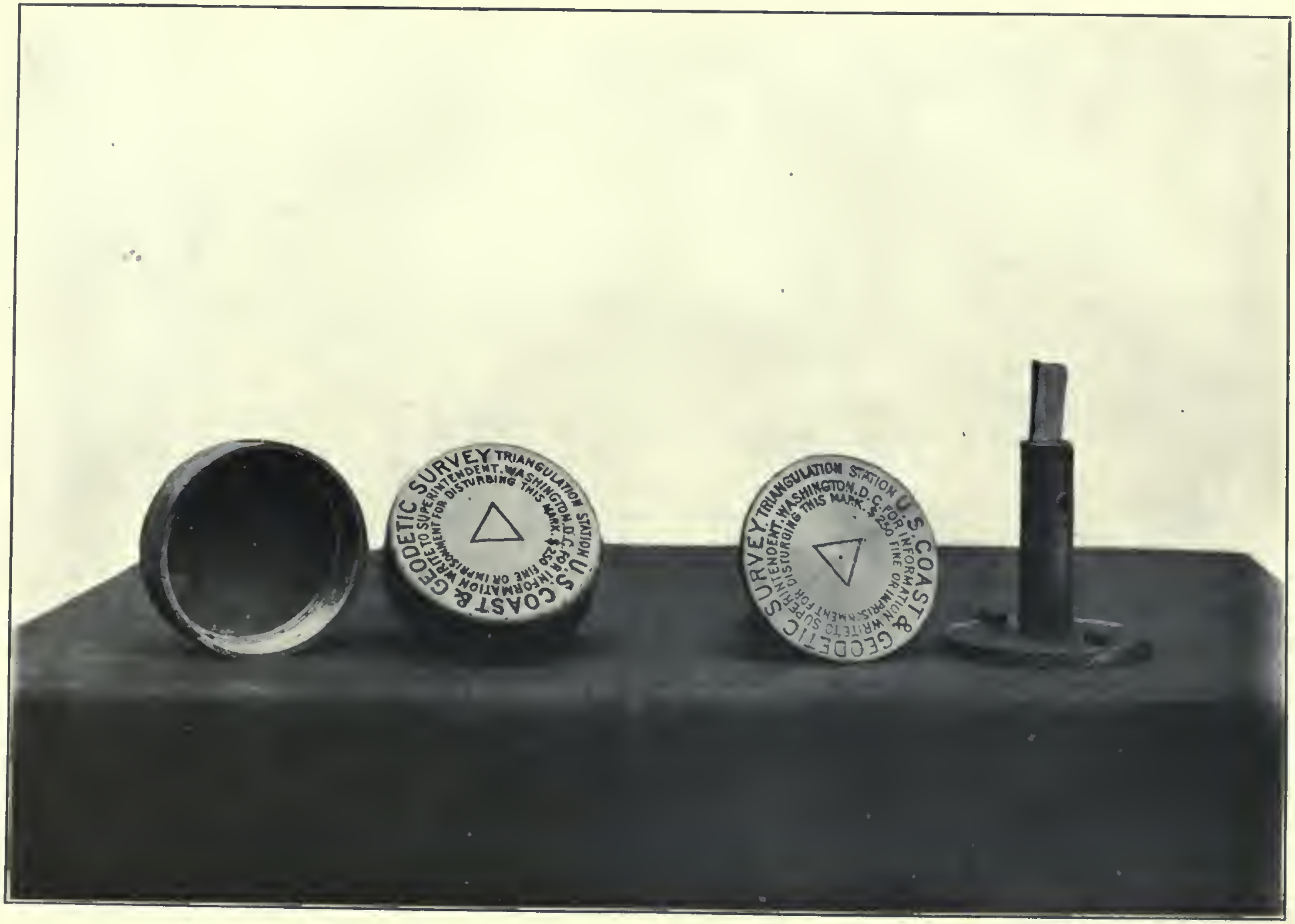
[1] No check on this elevation.

Deming base net to San Jacinto-Cuyamaca.

Station	Point to which elevation refers	Elevation
Class 1		*Meters*
Boundary monument No. 91 (U. S. & Mex.)	Top of masonry base	1480. 10
Boundary monument No. 128 (U. S. & Mex.)	Top of masonry base	1666. 12
Maricopa astronomic station	Station mark	358. 27
Maricopa northwest base (U. S. G. S.)	Station mark	359. 83
Yuma azimuth station	Station mark	90. 91
Yuma No. 10	Station mark	99. 35
Yuma east base	Station mark	79. 73
C. & G. S. B. M. N6	Station mark	225. 46
Class 2		
Burro	Station mark	2463. 0
Line (U. S. G. S.)	Station mark	2076. 7
Chiricahua	Station mark	2955. 4
Graham (U. S. G. S.)	Station mark	3267. 6
Mule (U. S. G. S.)	Station mark	2245. 6
Huachuca	Station mark	2563. 4
Catalina	Station mark	2799. 6
Baldy (U. S. G. S.)	Station mark	2879. 5
Boundary monument No. 121 (U. S. & Mex.)	Top of masonry base	1224. 0
Benedict (U. S. G. S.)	Station mark	1391. 7
Nogales No. 7	Station mark	1595. 8
Superstition (U. S. G. S.)	Station mark	1541. 5
Table	Station mark	1333. 0
Maricopa	Station mark	1245. 0
Whitetank	Station mark	1218. 9
Mohawk	Station mark	842. 7
Harquahalla	Station mark	1728. 7
Kofa	Station mark	1471. 6
Gila	Station mark	492. 5
American (U. S. G. S.)	Station mark	649. 0
Pine	Station mark	2154. 5
Powell	Station mark	1555. 5
Hill	Station mark	245. 5
Knoll	Station mark	207. 2
Chemehuevis	Station mark	1127. 9
Butte	Station mark	1368. 6
Bluff	Station mark	167. 8
Class 3		
Peak "E"	Top	1716. 4
Peak "D"	Top	2151. 5
Peak "C"	Top	2314. 7
High sharp peak, north of Needles	Top	1588. 6
Boundary monument No. 31 (U. S. & Mex.)	Top of masonry base	1437. 6
Boundary monument No. 120 (U. S. & Mex.)	Top of masonry base	1278. 3
Mexican customhouse	Top of dome	1199. 9
Nogales courthouse	Base of pedestal	1203. 7
Nogales Catholic church	Top of dome	1194. 1
Nogales public school	Top of dome	1201. 3
Four Peaks, second from north	Top	2344. 3
Desert Peak	Top	1380. 6
Comobabi Peak	Top	2397. 0
Mare	Top	1373. 9
Sierra Del Ajo	Top	1476
Flat Top (center)	Top	868. 8
Watson Peak	Top	2195. 9
Gila Peak	Top	975
Needles	Top	1002. 4
Peak "N"	Top	1991. 5
Peak "I"	Top	2281. 9
Yuma courthouse	Bottom of pole	80. 0
Indian school water tank	Top of roof	83. 9
Pilot Knob	Top	273. 2
Picacho U. S. G. S. cairn	Top of cairn	592. 3
Boundary monument No. 207 (U. S. & Mex.)	Top of masonry base	50. 0
Boundary monument No. 206 (U. S. & Mex.)	Top of masonry base	37. 6
Castle Dome	Top	1156. 1
Needles public school	Top of east dome	184. 0

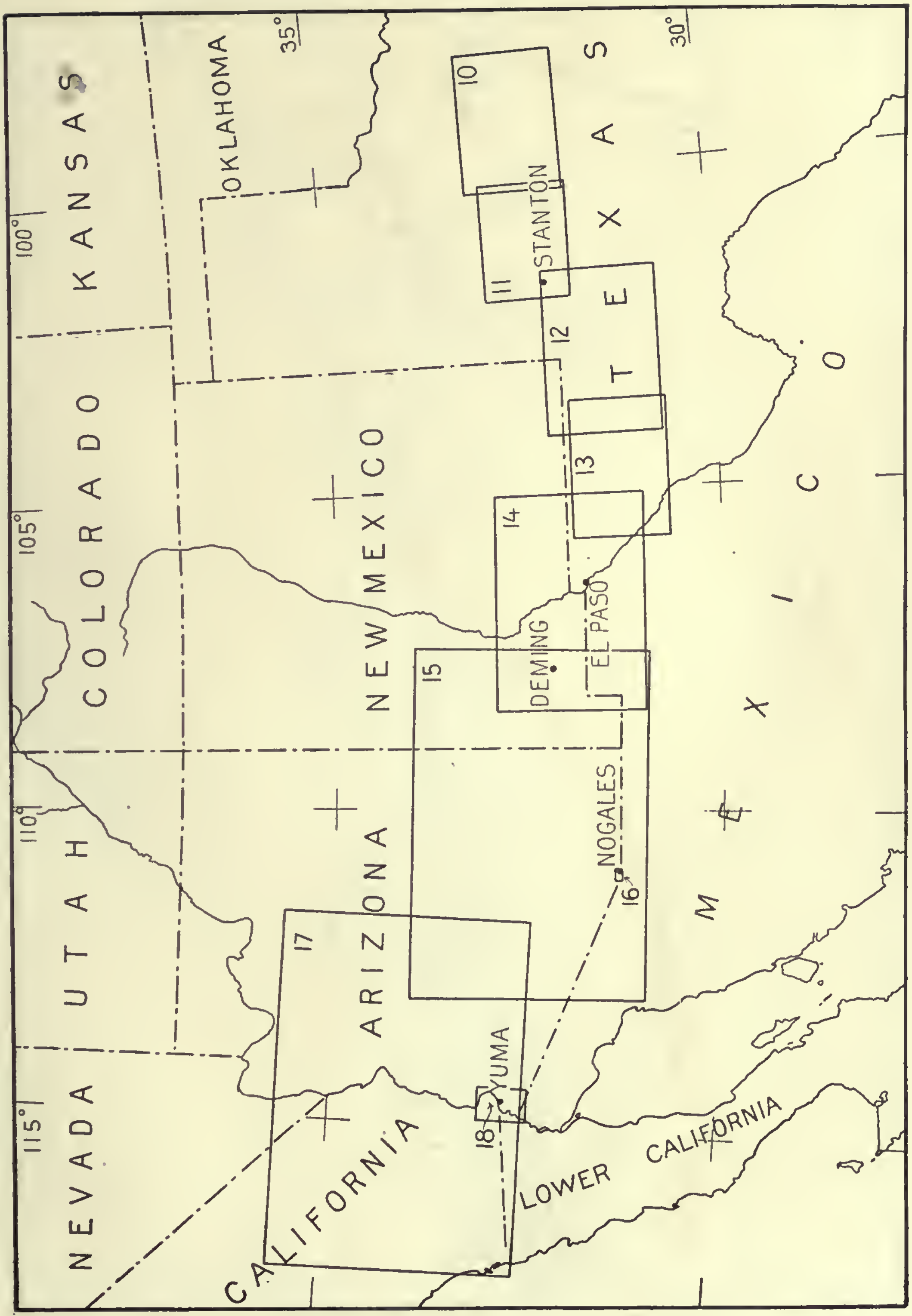
VERTICAL CIRCLE USED IN TRIGONOMETRIC LEVELING AND FOR MAKING TIME OBSERVATIONS.

No. 8.



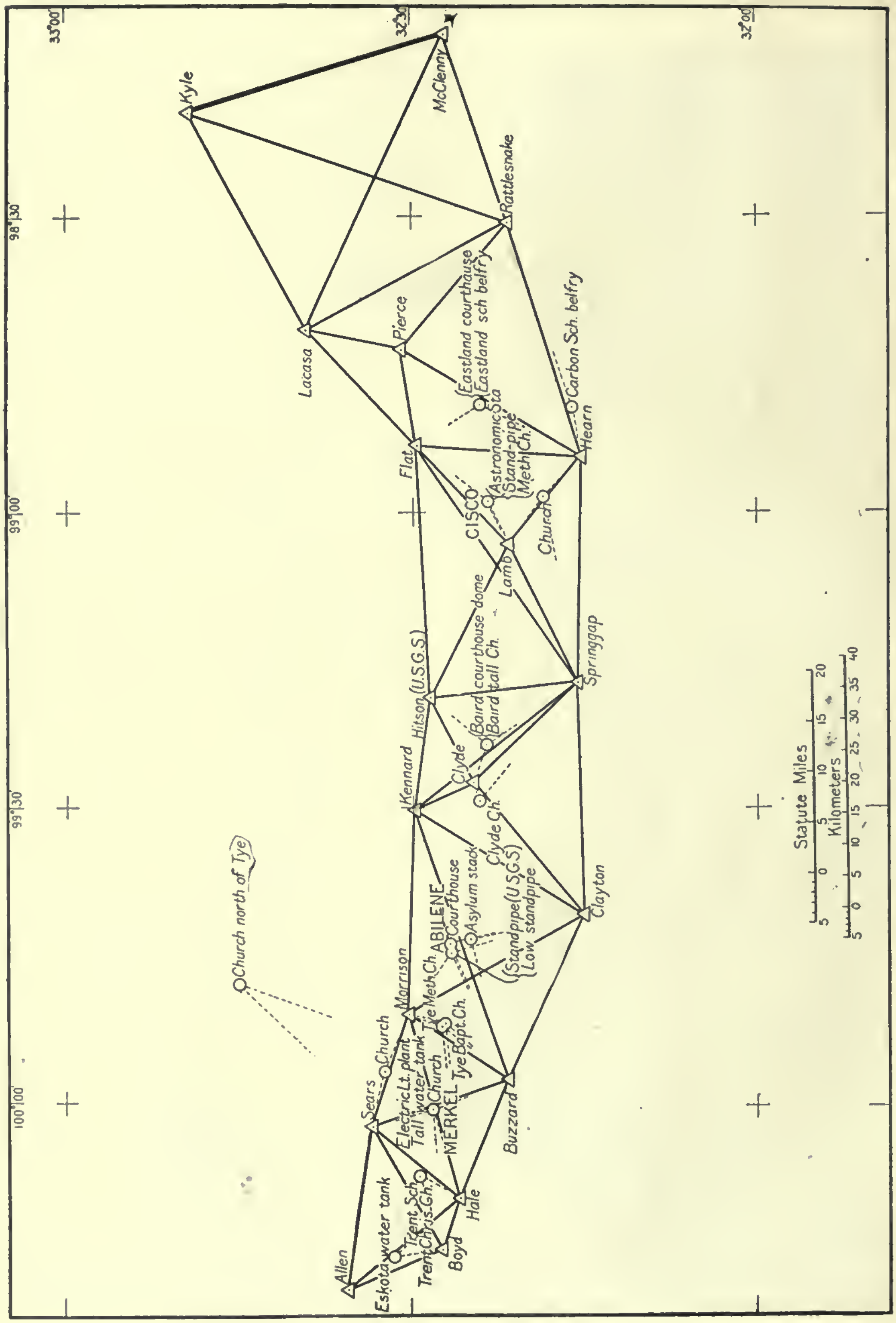
STANDARD TRIANGULATION STATION MARKS.

No. 9.



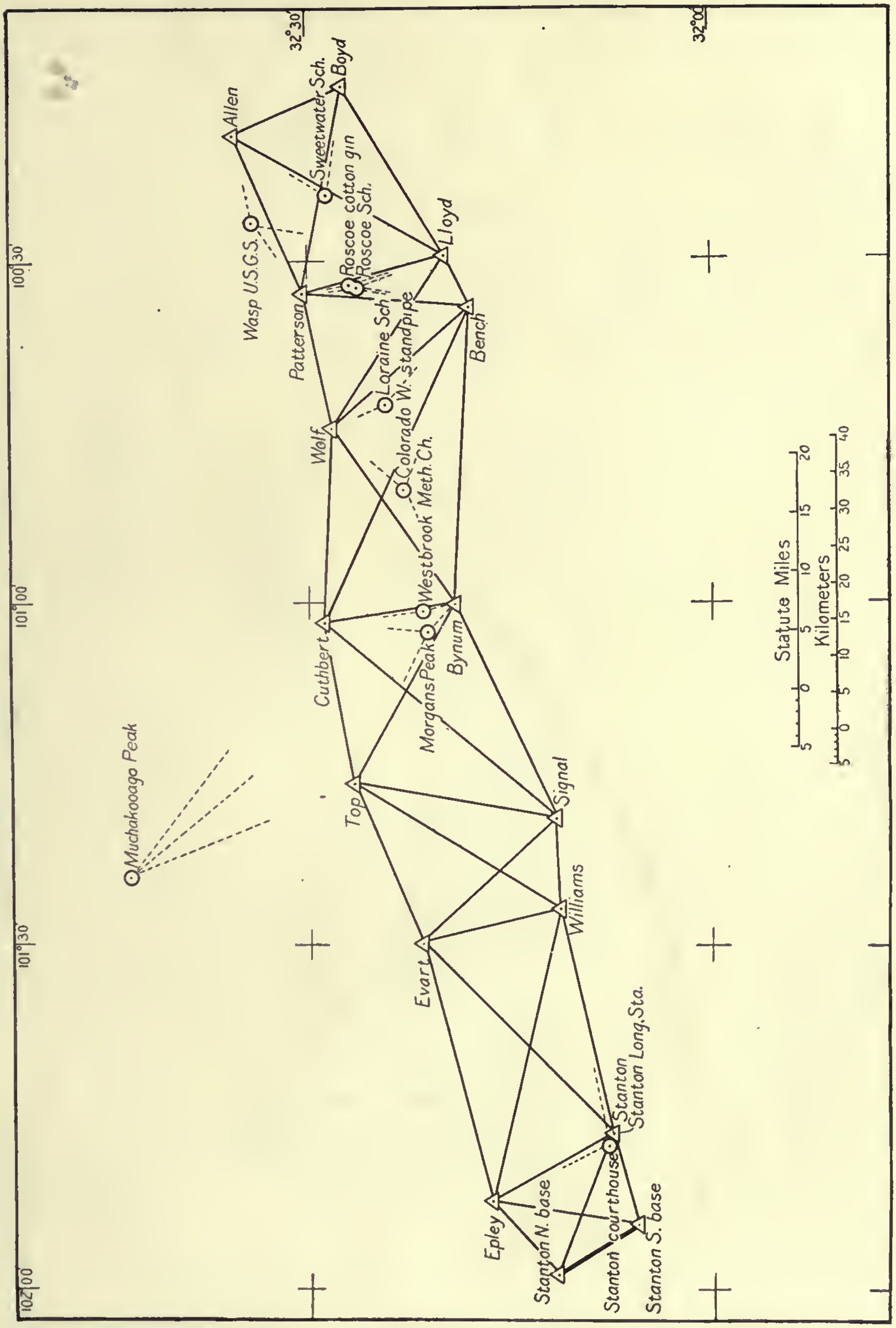
INDEX MAP.

No. 10.



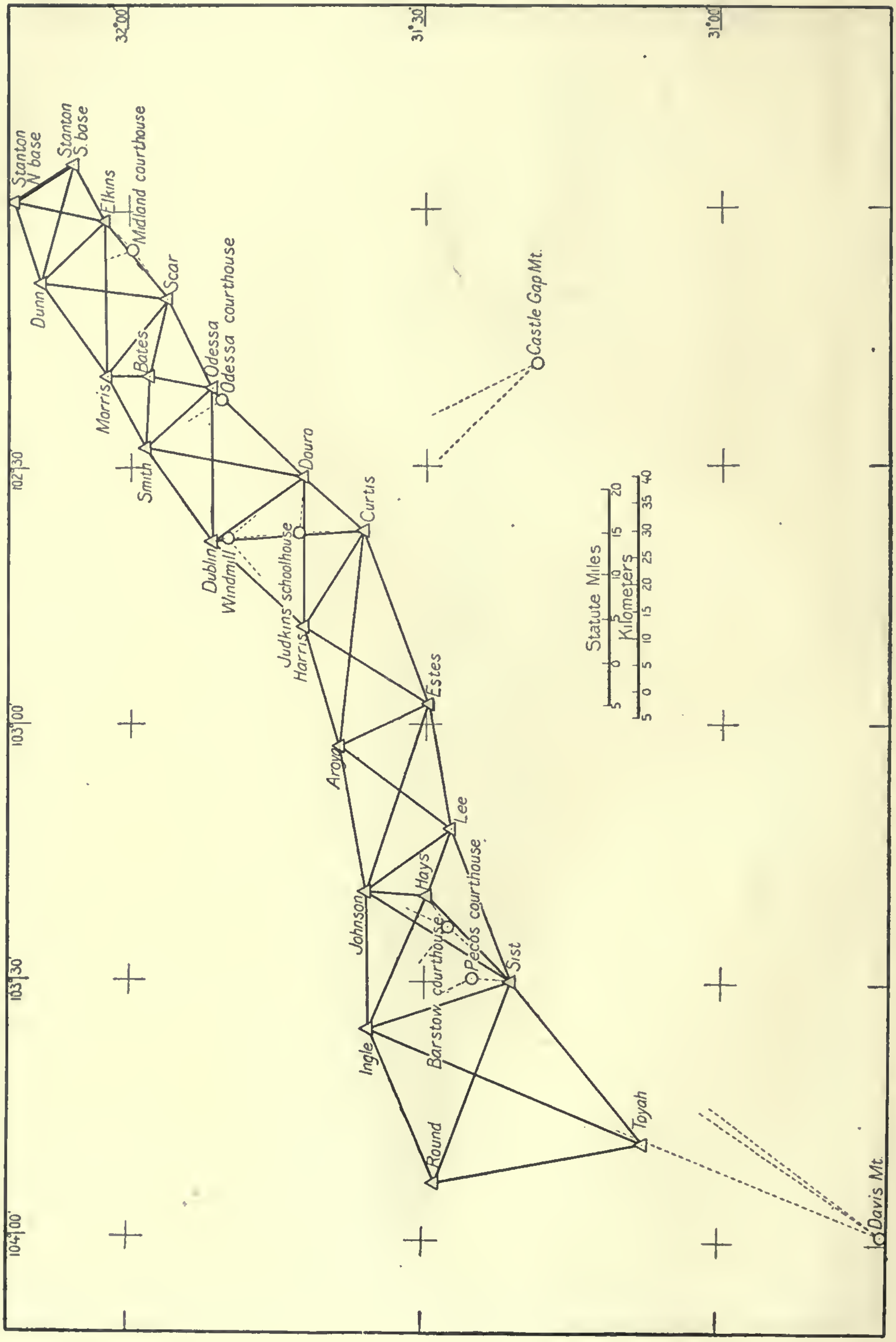
TRIANGULATION, KYLE-McCLENNY TO ALLEN-BOYD.

No. 11.



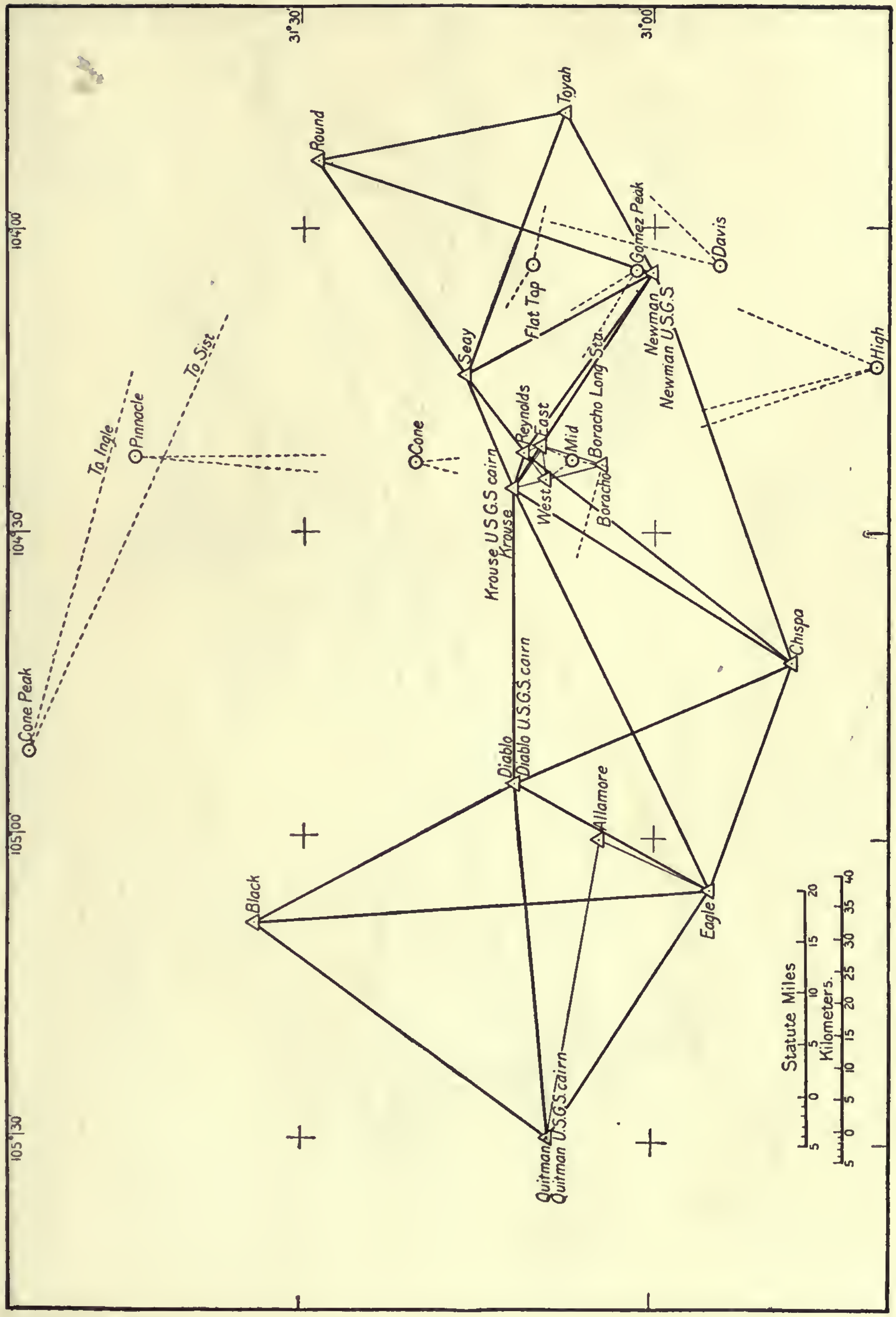
TRIANGULATION, ALLEN-BOYD TO STANTON BASE.

No. 12.



TRIANGULATION, STANTON BASE TO ROUND-TOYAH.

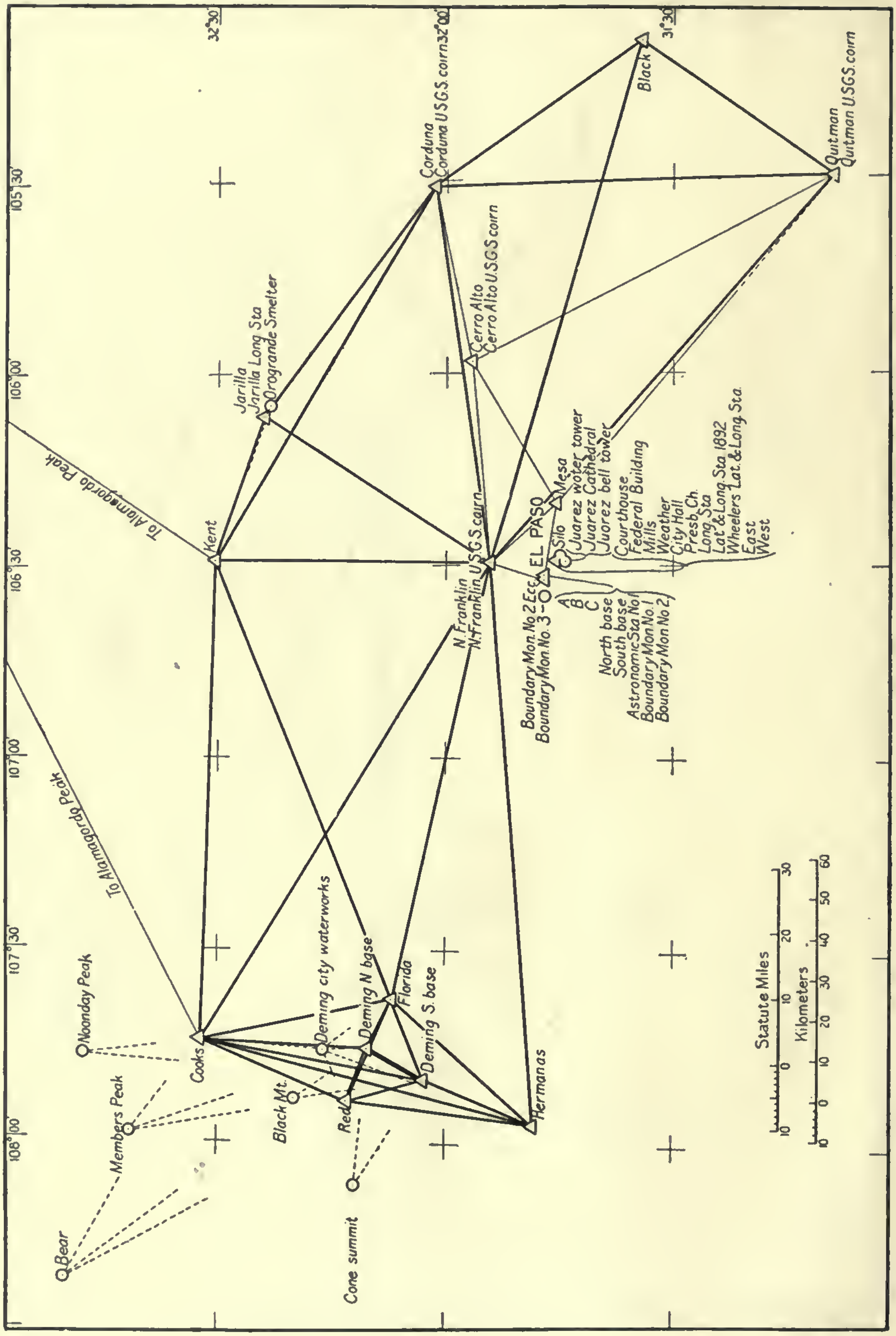
No. 13.



TRIANGULATION, ROUND-TOYAH TO BLACK-QUITMAN.

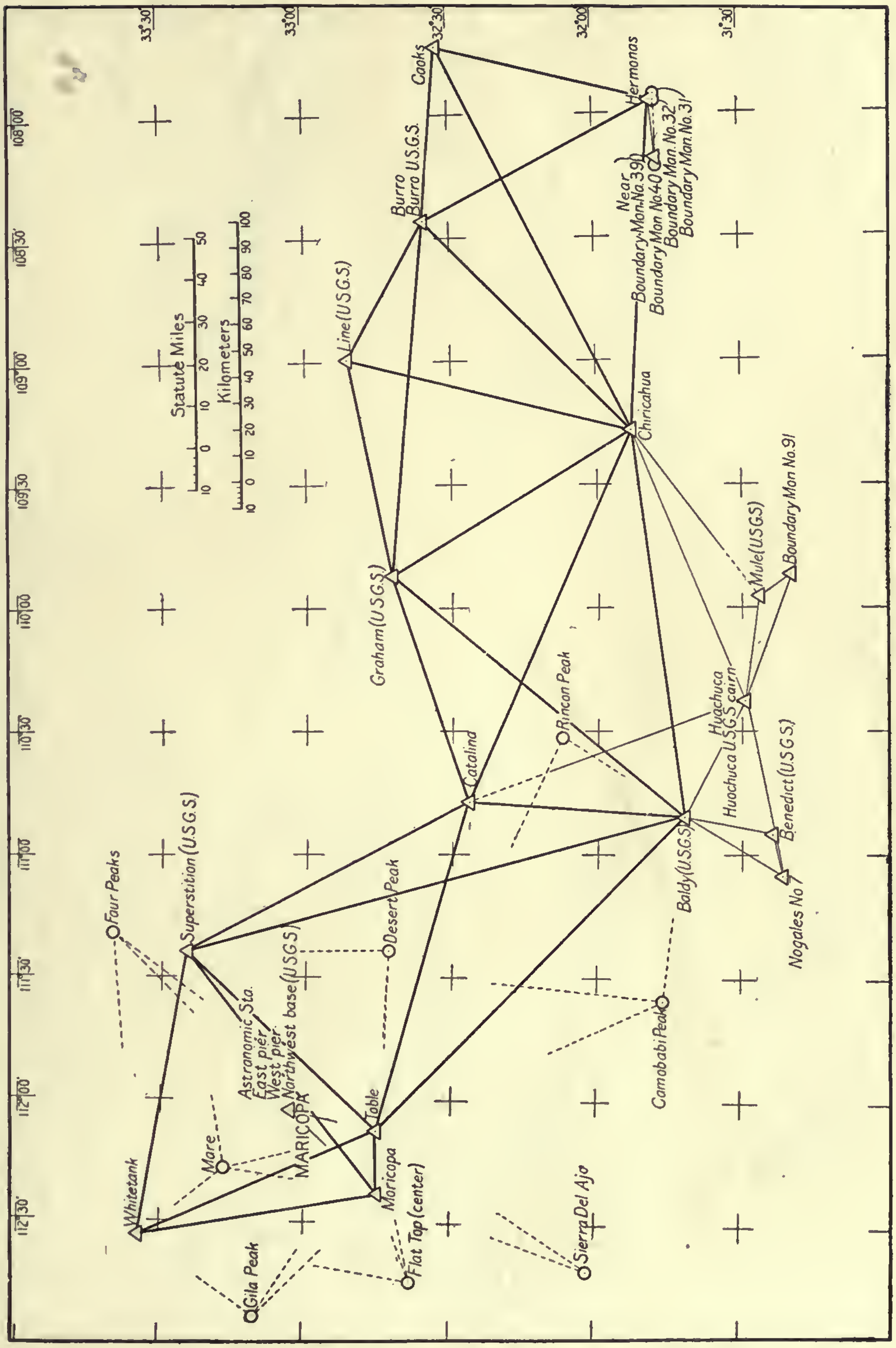
49571°—12——9

No. 14.



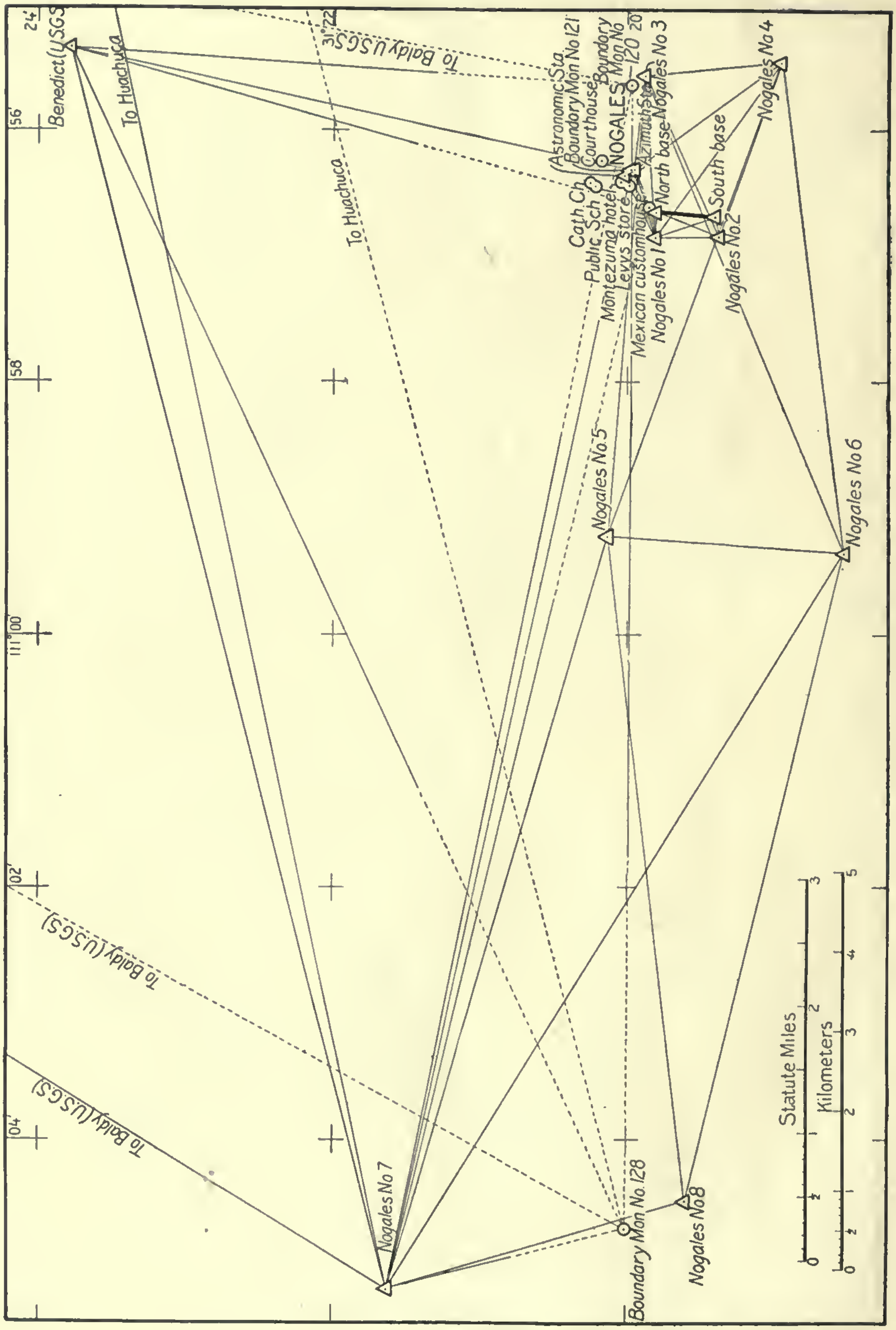
TRIANGULATION, BLACK-QUITMAN TO DEMING BASE.

No. 15.



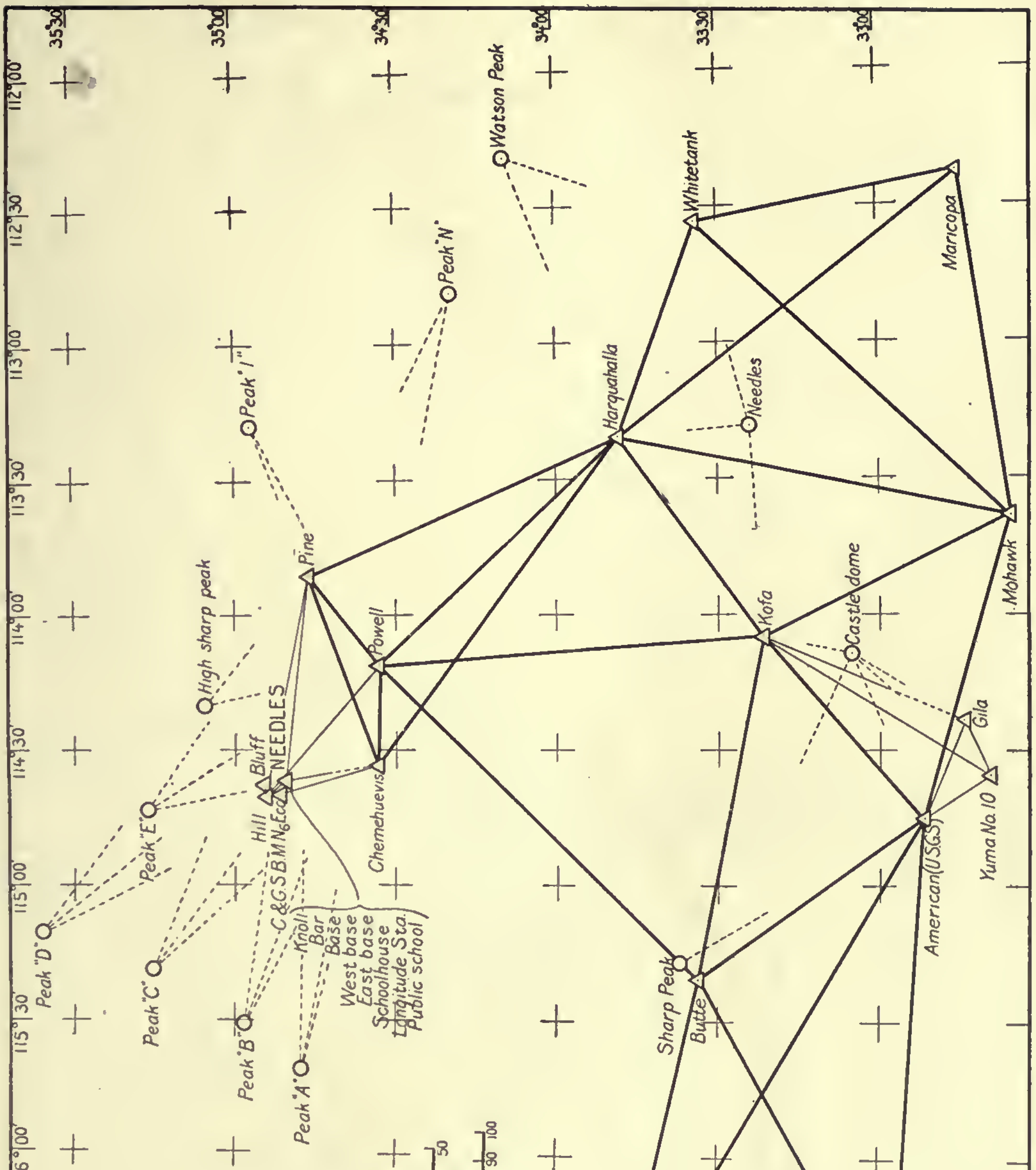
TRIANGULATION, DEMING BASE NET TO WHITETANK-MARICOPA.

No. 16.



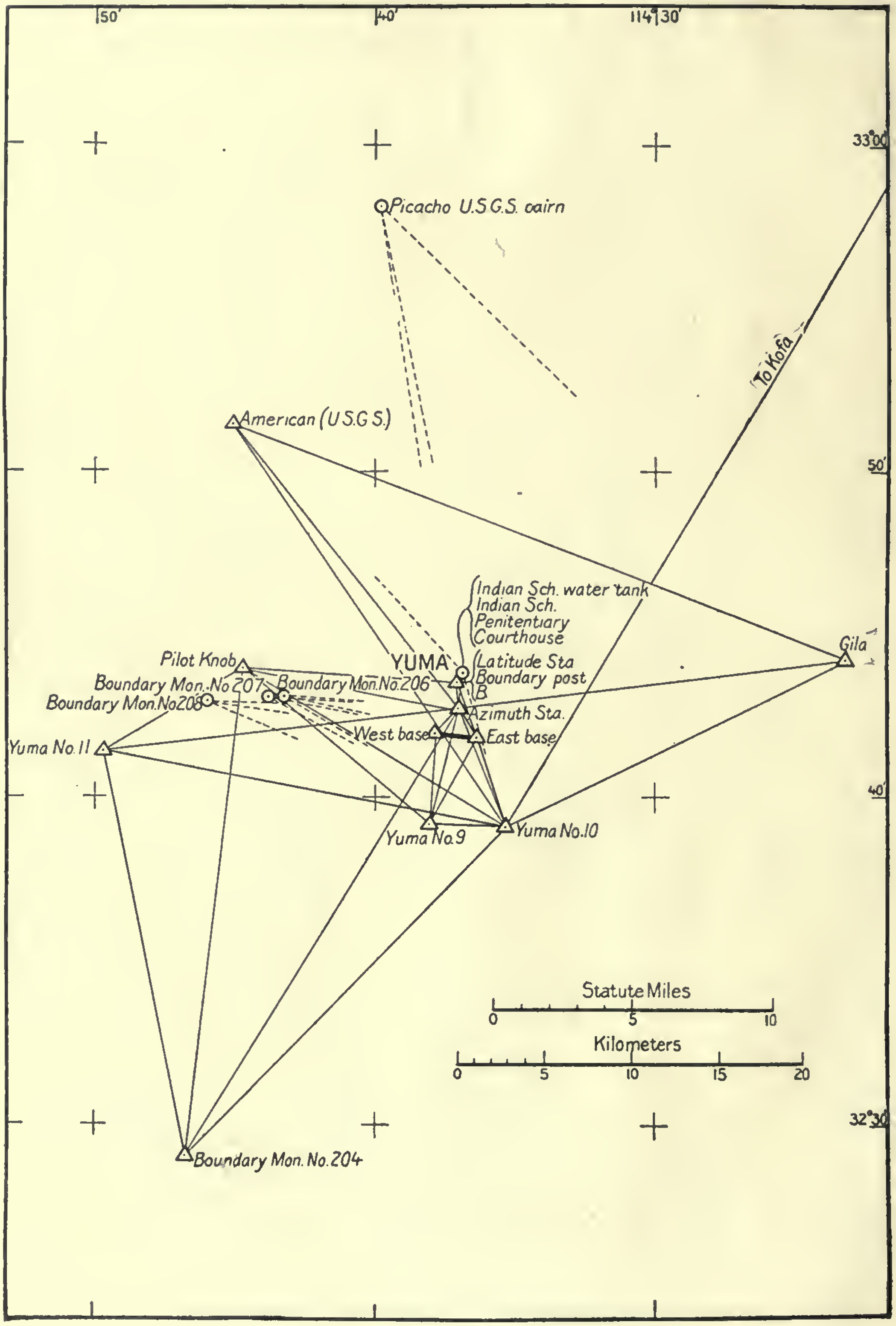
TRIANGULATION, NOGALES AND VICINITY.

No. 17.



TRIANGULATION, WHITETANK-MARICOPA TO SAN JACINTO-CUYAMACA.

No. 18.



TRIANGULATION, YUMA AND VICINITY.

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Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

Index to positions, descriptions, sketches, and elevations—Continued.

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