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TRIANGULATION IN WEST VIRGINIA, OHIO, KENTUCKY, INDIANA, ILLINOIS, AND MISSOURI

BY

A. L. BALDWIN
Assistant Inspector of Geodetic Work
U. S. Coast and Geodetic Survey

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TRIANGULATION IN WEST VIRGINIA, OHIO, KENTUCKY, INDIANA, ILLINOIS, AND MISSOURI.

By A. L. BALDWIN, *Assistant Inspector of Geodetic Work, Coast and Geodetic Survey.*

GENERAL STATEMENT.

This publication brings together in convenient form for the use of engineers information in regard to the triangulation by the United States Coast and Geodetic Survey in six of the central States, namely, West Virginia, Ohio, Kentucky, Indiana, Illinois, and Missouri. The principal portion of these results is that part of the Transcontinental Triangulation, extending from the Atlantic to the Pacific, which lies within the limits of these six States. The field work was commenced in 1871 and finished in 1893, having been in progress during the whole interval, except during the years 1875, 1876, 1877, and 1888. A full account of the Transcontinental Triangulation has been published in so far as the features of special interest to the scientists are concerned.[1] Only the positions for the primary stations were there published, and but a few descriptions of stations. The positions of all stations, primary, secondary, and tertiary, are published herein on the North American (formerly called the United States Standard) Datum, together with all available descriptions.

The occasion for this publication at the present time is the completion in 1914 of a new scheme of primary triangulation in Indiana which connected for the first time the detached triangulation in Indiana and Kentucky north and south of Louisville. There is included a full report on this section of primary triangulation and also the results with the details omitted for that portion of the old secondary scheme which was required to connect the primary work with the base line near Louisville, measured in 1879 by Assistant G. A. Fairfield.

The positions and descriptions in this report were prepared for publication by Mr. C. H. Swick.

There are included in this publication 26 new stations of the Cincinnati city survey made in 1912 by a former officer of this survey, Mr. H. C. Mitchell. This work is fully described on pages 63 to 78 of the "Report on a Plan of Sewerage, City of Cincinnati." This report is a detailed one and the geographic positions contained therein are reprinted here without any discussion.

LOUISVILLE BASE LINE.

Prof. William Byrd Page selected the site for the Louisville base line, the northern end of which is about 4 miles southwest of Louisville, Ky. During July and August, 1879, Assistant G. A. Fairfield slightly modified the scheme and occupied both ends of the base line which was shortened to 5.09 miles. The first measurement of the base was begun on September 15, 1879, and completed in 10 consecutive working days. Six-meter contact slide rods Nos. 1 and 2 were used in making the measurement. A second measure was made early in October. A force of four officers and seven men was used on the second measurement.

The following table gives the result of the individual measures of the five sections into which the base was divided.

	Temperature first measure	Temperature second measure	First measure	Second measure	Difference
	°F.	*°F.*	*Meters.*	*Meters.*	*mm.*
North base to I	80.53	85.92	1559.9659	1559.9582	+ 7.7
I to II	74.03	89.83	1680.2916	1680.2995	− 7.9
II to III	78.00	94.60	1560.3807	1560.3992	−18.5
III to IV	82.98	91.91	1644.1502	1644.1704	−20.2
IV to South base	74.09	86.75	1743.4113	1743.4292	−17.9
Whole base	77.81	89.76	8188.1997	8188.2565	−56.8

[1] See The Transcontinental Triangulation, U. S. Coast and Geodetic Survey Special Publication No. 4.

There appears to be a tendency toward a greater length of measure for the higher temperature, which was undoubtedly due to a difference between the temperatures of the rods and of the thermometers.

The above results develop a probable error of ± 11.65 mm. for the mean of the two results for the measured length. To this probable error must be added the probable error of the apparatus for the temperature of measurement, ± 10.5 mm. The total probable error of the base is therefore $\sqrt{(11.65)^2+(10.5)^2}=\pm 15.7$ mm.

Since the thermometer during the measurement gives the temperature of the air rather than that of the rod, there is an uncertainty in the length which, assuming a half degree Fahrenheit as an average, would introduce an additional probable error of 26 mm.

The elevation of the surface of the ground at the northern end of the base was assumed to be 426.176 feet [1] above the mean sea level and from levels run over the base the corresponding elevation of the southern end of the base was found to be 452.075 feet above mean sea level. The base had never been connected with the precise levels and it was assumed that the height of the base as used might be in error by as much as 25 feet, which would introduce a fourth probable error of 10 mm.

The combination of these probable errors gives ± 32 mm. or 1 part in 256 000.

Length of base	=8188.228 meters.
Reduction to sea level (430 feet)	= −.171
Resulting length of base	=8188.057±.032
Logarithm of length of base	= 3.9131808±17 (in seventh place).

PROGRESS OF THE 1914 TRIANGULATION.

The actual work of reconnoissance for the Louisville connection was inaugurated on September 16, 1914, and three days later the signal building and marking of stations was begun. Signalman J. S. Bilby had charge of this portion of the work and, coming as it did at the close of a season in northern Alabama and Mississippi, the same party and outfit were used and the reconnoissance and building were easily completed on November 5, 1914. The three obstructed lines of the Transcontinental Triangulation, where the connection was made, were cleared by November 18.

Three stations established and occupied in the years 1884–1886 by Prof. J. I. Campbell were recovered and 5 new stations were selected, which, together with the 3 stations, Miller, Stout, and Tripp, make 11 stations in this scheme. The stations on the western side of the scheme are on high timbered knobs; on the eastern side they are on flat land, partly cultivated and partly timbered.

On October 22, 1914, Assistant E. H. Pagenhart, having moved his observing party from Huntsville, Ala., began the actual observing. Ten stations were occupied and, in spite of some delays, the observations were completed on November 19, 1914, in a period of but 28 days.

Signals.—The type of signal is that shown by illustrations and described in Appendix 4 of the Report of the United States Coast and Geodetic Survey for 1903. In that publication are also given detailed directions for its erection.

INSTRUMENTS USED ON TRIANGULATION.

Theodolite.—The type of instrument used for the horizontal measures is described in detail in Appendix 8 of the Report for 1894. In August, 1914, the red-metal circle with its graduation on coin silver was replaced by a new nickel-alloy circle. For the graduations on this new circle a strip of platinum was inserted in a groove in the plate and securely soldered and pinned in place. The same graduating engine which is briefly described in Appendix 8 of 1894 was used to make the graduations. The deviation of triangulation in azimuth, which is thought to be due to unequal temperature changes within the instrument itself, made this change

[1] In April, 1915, Assistant J. H. Peters connected North base with a bench mark of the U. S. Engineers and found the elevation assumed for it to be 21.8 feet too low (elevation of North Base, 136.579 meters or 448.093 feet). The base line was not recomputed as the change that would be necessary is less than one-third the probable error assigned for the base.

advisable. The coefficient of expansion of the nickel-alloy is 0.000004 per degree centigrade, in contrast to 0.000018 for the red metal which it replaced.

The vertical collimator used in centering the theodolite over the mark of a previously established station or in placing a mark under a new signal is fully described on pages 30 and 31 of Special Publication No. 19. In the succeeding pages of the same book the heliotropes and lamps are described and their use by the light keepers is explained in great detail.

PROGRAM OF OCCUPATION OF STATIONS.

In the following table the stations occupied during October and November, 1914, are arranged in the chronological order in which the observations were made. The second column indicates the days on which observations on the primary stations were taken and the third column gives the number of days at each station on which primary horizontal directions were observed.

Stations occupied.

[Assistant E. H. Pagenhart, chief of party and observer, season of 1914.]

Station	Days on which observations of primary horizontal directions were made	Total days	Station	Days on which observations of primary horizontal directions were made	Total days
Lutz	October 22	1	Summit	November 3	1
Six Mile	October 23	1	Finley	November 6, 7, 8	3
Popp	October 25, 26	2	Blocher	November 9	1
O. & M	October 27, 29	2	Stout	November 10, 11	2
Marysville	October 31, November 1	2	Miller	November 17	1

ABSTRACT OF HORIZONTAL DIRECTIONS AND ELEVATIONS OF TELESCOPE ABOVE THE STATION MARK.

All observed directions in the 1914 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 greatest elevation was at station Summit, 968 feet, and the corrections necessary to reduce the horizontal directions to sea level is less than one one-hundredth of a second in almost every case. The computation of these corrections was therefore omitted.

In the following table is also given the elevation of the telescope of the theodolite above the station mark at each of the 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.

Station occupied and elevation of instrument above station mark	Number of direction	Object observed	Observed direction	Final seconds after figure adjustment
			° ′ ″	″
Miller, 15.28 meters	3	Finley	0 00 00.00	00.60
	1	Stout	298 23 02.53	01.60
	2	Blocher	321 28 42.43	42.75
Stout, 23.47 meters	4	Blocher	00 00 00.00	59.75
	5	Finley	22 29 41.44	41.81
	6	Miller	63 28 39.74	39.59
Finley, 11.54 meters	7	Miller	00 00 00.00	59.71
	8	Stout	77 24 05.34	05.33
	9	Blocher	93 00 09.97	09.69
	10	Marysville	134 05 03.65	03.89
	11	Summit	165 39 23.13	23.48
Blocher, 23.42 meters	12	Marysville	00 00 00.00	59.85
	13	Summit	38 55 42.19	42.66
	14	Finley	65 16 55.58	55.78
	15	Miller	113 45 29.96	29.45
	16	Stout	207 11 09.89	09.87
Summit, 1.27 meters	17	Finley	00 00 00.00	59.94
	18	Blocher	80 59 34.02	33.57
	19	Marysville	125 46 23.05	23.63
	20	O. & M	174 30 37.10	36.71
	21	Popp	228 23 25.57	25.91
Marysville, 23.41 meters	22	O. & M	00 00 00.00	00.86
	23	Popp	28 44 41.56	41.83
	24	Summit	72 13 43.70	43.33
	25	Finley	94 53 00.97	00.33
	26	Blocher	168 31 11.08	10.98
Popp, 1.42 meters	27	Summit	00 00 00.00	59.97
	28	Marysville	33 53 56.62	56.75
	29	O. & M	57 09 10.24	09.77
	30	Lutz	91 23 39.61	40.56
	31	Six Mile	174 03 31.59	31.00
O. & M., 18.65 meters	32	Lutz	00 00 00.00	00.06
	33	Six Mile	47 34 58.34	57.14
	34	Popp	62 03 00.93	00.91
	35	Summit	131 01 01.93	02.43
	36	Marysville	190 03 06.61	07.27
Lutz, 15.59 meters	38	Six Mile	00 00 00.00	58.48
	39	Popp	21 18 58.97	58.25
	40	O. & M	105 01 27.20	26.88
Six Mile, 1.27 meters	41	Popp	00 00 00.00	00.65
	42	O. & M	48 37 34.20	35.81
	43	Lutz	76 01 09.33	10.60

CONDITION EQUATIONS.

No.

1. $0 = -1.84-(1)+(2)-(4)+(6)-(15)+(16).$
2. $0 = -1.26-(1)+(3)-(5)+(6)-(7)+(8).$
3. $0 = +0.42-(2)+(3)-(7)+(9)-(14)+(15).$
4. $0 = -1.41-(9)+(10)-(12)+(14)-(25)+(26).$
5. $0 = +0.03-(9)+(11)-(13)+(14)-(17)+(18).$
6. $0 = -1.92-(12)+(13)-(18)+(19)-(24)+(26).$
7. $0 = +2.04-(19)+(20)-(22)+(24)-(35)+(36).$
8. $0 = +0.72-(19)+(21)-(23)+(24)-(27)+(28).$
9. $0 = -0.81-(20)+(21)-(27)+(29)-(34)+(35).$
10. $0 = -1.74-(29)+(30)-(32)+(34)-(39)+(40).$
11. $0 = +0.12-(30)+(31)-(38)+(39)-(41)+(43).$
12. $0 = +0.40-(32)+(33)-(38)+(40)-(42)+(43).$
13. $0 = +10.02-(37)+(38)-(43)+(44)-(49)+(50).$
14. $0 = +2.66-(44)+(45)-(47)+(49)-(60)+(61).$
15. $0 = +2.77-(44)+(46)-(48)+(49)-(50a)+(51).$
16. $0 = +5.99-(47)+(48)-(51)+(52)-(59)+(61).$
17. $0 = -0.27-(52)+(55)-(58)+(59)-(73)+(75).$
18. $0 = -0.14-(53)+(55)-(73)+(78)-(79)+(80).$
19. $0 = -1.01-(56)+(58)-(75)+(78)-(79)+(81).$
20. $0 = -0.72-(52)+(54)-(57)+(59)-(65)+(66).$
21. $0 = -0.65-(54)+(55)-(63)+(65)-(73)+(76).$
22. $0 = +2.15-(62)+(64)-(67)+(68)-(71)+(72).$
23. $0 = +0.93-(63)+(64)-(67)+(69)-(74)+(76).$
24. $0 = +0.98-(68)+(69)-(70)+(71)-(74)+(77).$
25. $0 = -10.66-4.94(1)+7.59(2)-2.65(3)-4.03(4)+5.08(5)-1.05(6)+0.11(7)+7.54(8)-7.65(9).$
26. $0 = -1.49-0.66(9)+3.43(10)-2.77(11)-2.61(12)+6.86(13)-4.25(14)-5.28(24)+5.05(25)+0.23(26).$
27. $0 = +2.00-1.85(19)+3.38(20)-1.53(21)-3.17(22)+3.84(23)-0.67(24)-1.36(27)+4.90(28)-3.54(29).$
28. $0 = +4.04-1.12(32)+8.16(33)-7.04(34)-5.40(38)+5.64(39)-0.24(40)-1.33(41)+1.85(42)-0.52(43).$
29. $0 = +19.34-0.33(47)+5.20(48)-4.87(49)-1.68(50a)+1.71(51)-0.03(52)-4.61(59)+5.92(60)-1.31(61).$
30. $0 = -0.88-2.72(52)+3.30(53)-0.58(55)-2.08(73)+3.54(75)-1.46(78)-1.09(79)+4.42(80)-3.33(81).$
31. $0 = -2.31-2.81(52)+5.52(54)-2.71(55)-3.02(57)+2.76(58)+0.27(59)-0.30(73)+2.86(75)-2.56(76).$
32. $0 = +1.96-6.58(62)+7.66(63)-1.08(64)-2.92(67)+4.67(68)-1.75(69)-1.35(74)+10.84(76)-9.49(77).$
33. $0 = -0.73+(4)-(6)+(12)-(16)+(22)-(26).$
34. $0 = +4.97-(1)+(3)-(7)+(11)-(17)+(21)-(27)+(31)-(41)+(46)-(50a)+(55)-(73)+(74).$
35. $0 = -10.58-2.65(2)+2.65(3)-1.05(4)+1.05(6)-0.11(7)-0.55(9)+0.66(11)-2.61(12)+2.61(13)-0.13(15)+0.13(16)+0.33(17)-0.33(18)-1.53(20)$
$+1.53(21)-0.67(22)+0.44(24)+0.23(26)+1.36(27)-1.36(29)-0.27(30)+0.27(31)-1.12(32)+1.12(34)+1.26(35)-1.26(36)-0.43(37)+0.43(38)$
$+0.24(39)-0.24(40)+0.52(41)-0.52(43)+0.64(44)-0.64(46)-1.27(47)+1.27(48)+0.78(49)-0.78(50)+1.71(50a)-1.71(51)-2.71(54)+2.71(55)$
$-1.22(58)+1.49(59)-0.27(61)-0.73(63)+1.93(64)-1.20(65)+0.14(67)-0.14(69)+0.67(70)-0.67(71)+2.08(73)-1.35(74)-2.08(75)+1.35(77).$

ACCURACY AS INDICATED BY CORRECTIONS TO OBSERVED DIRECTIONS.

The corrections to observed directions resulting from the figure adjustments indicated by the preceding observation equations are as follows:

Table of corrections to observed directions

Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction	Number of direction	Correction to direction
	″		″		″		″
1	−0.93	22	+0.86	42	+1.16	62	+0.42
2	+0.32	23	+0.27	43	+1.27	63	−0.40
3	+0.60	24	−0.37	44	−0.51	64	−0.47
4	−0.25	25	−0.64	45	−0.83	65	+0.77
5	+0.40	26	−0.10	46	−2.19	66	−0.34
6	−0.15	27	−0.03	47	+1.89	67	+0.73
7	−0.29	28	+0.13	48	−0.57	68	−0.04
8	−0.01	29	−0.47	49	+1.42	69	−0.69
9	−0.28	30	+0.95	50	−2.74	70	+0.49
10	+0.24	31	−0.59	50a	+2.59	71	−0.01
11	+0.35	32	+0.06	51	−0.49	72	−0.50
12	−0.15	33	−1.20	52	−0.82	73	+0.06
13	+0.47	34	−0.02	53	−0.40	74	−0.48
14	+0.20	35	+0.50	54	−0.47	75	−0.20
15	−0.51	36	+0.66	55	−0.41	76	+0.08
16	−0.02	37	+2.26	56	+0.14	77	−0.31
17	−0.06	38	−1.52	57	−0.16	78	+0.24
18	−0.45	39	−0.72	58	+0.60	79	−0.23
19	+0.58	40	−0.32	59	+1.32	80	+0.34
20	−0.39	41	+0.65	60	−0.01	81	−0.12
21	+0.34			61	−1.88		

The maximum correction to an observed direction of the primary work is to direction 38 between stations Lutz and Popp and is 1.″52.

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 error of an observed direction computed for this work is 0.″64.

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

The correction to each angle is the algebraic difference of the corrections to the separate directions. They are shown in the following table for every triangle of the primary scheme. In the table are shown the corrections to the angles resulting from the figure adjustment, 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

Station	Correction to angles from figure adjustment	Error of closure of triangle	Corrected spherical angles	Spherical excess	Station	Correction to angles from figure adjustment	Error of closure of triangle	Corrected spherical angles	Spherical excess
	″	″	° ′ ″	″		″	″	° ′ ″	″
Blocher	+0.49	+1.84	93 25 40.42	1.41	O. & M	+0.16	−2.04	59 02 04.84	0.39
Miller	+1.25		23 05 41.15		Summit	−0.97		48 44 13.08	
Stout	+0.10		63 28 39.84		Marysville	−1.23		72 13 42.47	
Finley	+0.28	+1.26	77 24 05.62	2.37	Popp	+0.16	−0.72	33 53 56.78	0.56
Miller	+1.53		61 36 59.00		Summit	−0.24		102 37 02.28	
Stout	−0.55		40 58 57.75		Marysville	−0.64		43 29 01.50	
Finley	+0.01	−0.42	93 00 09.98	1.50	Popp	−0.44	+0.81	57 09 09.80	0.52
Miller	+0.28		38 31 17.85		Summit	+0.73		53 52 49.20	
Blocher	−0.71		48 28 33.67		O. & M	+0.52		68 58 01.52	
Finley	−0.27	+0.16	15 36 04.36	0.54	Popp	−0.60	−0.51	23 15 13.02	0.35
Stout	+0.65		22 29 42.09		Marysville	−0.59		28 44 40.97	
Blocher	−0.22		141 54 14.09		O. & M	+0.68		128 00 06.36	
Summit	−0.39	−0.03	80 59 33.63	0.54	Lutz	+0.40	+1.74	83 42 28.63	0.27
Finley	+0.63		72 39 13.79		Popp	+1.42		34 14 30.79	
Blocher	−0.27		26 21 13.12		O. & M	−0.08		62 03 00.85	
Marysville	−0.27	+0.48	22 39 17.00	0.28	Six Mile	+0.96	+2.02	48 37 35.16	0.16
Summit	+0.64		125 46 23.69		Popp	−0.12		116 54 21.23	
Finley	+0.11		31 34 19.59		O. & M	+1.18		14 28 03.77	
Marysville	+0.27	+1.92	96 17 27.65	0.52	Six Mile	+0.62	−0.12	76 01 09.95	0.16
Summit	+1.03		44 46 50.06		Popp	−1.54		82 39 50.44	
Blocher	+0.62		38 55 42.81		Lutz	+0.80		21 18 59.77	
Marysville	+0.54	+1.41	73 38 10.65	0.78	Six Mile	−0.34	−0.40	27 23 34.79	0.27
Finley	+0.52		41 04 54.20		O. & M	−1.26		47 34 57.08	
Blocher	+0.35		65 16 55.93		Lutz	+1.20		105 01 28.40	

The maximum correction, 1.″54, to any angle is to the angle at Popp, between Lutz and Six Mile.

The average closing error of a triangle for the 16 triangles is 0.″99, which is exactly the same as that attained in the 186 triangles composing the one hundred and fourth meridian arc north of the thirty-ninth parallel, and is less than the average closure called for by the general instructions, viz., 1.″00.

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 triangles and n is the number of triangles in the season's work) was computed and found to be $\pm 0.''71$.

ACCORD IN AZIMUTH AND IN LENGTH.

A Laplace azimuth computed at station O. & M. was introduced into the triangulation as this azimuth was undoubtedly more accurate than the geodetic azimuth computed through the triangulation. The geodetic azimuth in the transcontinental triangulation at the northern end of the Louisville connection may be assumed to be without twist as the Laplace correction at the nearest station, Parkersburg, is only $-0.''53$. In solving the normal equations of the figure adjustment, the azimuth equation to bring into accord the Laplace azimuth was placed at or near the last of the group, so that after the conditions relating to triangle closures and ratios of lengths had been satisfied the discrepancy in azimuth became known. The azimuth computed to O. & M. station through the triangulation from the North American Datum azimuth of the line Miller-Stout was found to be too small by $2.''21$ when compared with the Laplace azimuth at O. & M.

Similarly the length of the Louisville base as computed from the line Miller-Stout was made to agree with the measured length of the base. This equation was assigned last place in the solution of the normal equations, so that after all the conditions relating to triangle closures and ratios of length had been satisfied the discrepancy in length became known. This discrepancy was 66 in the seventh place of logarithms or, expressed as a ratio, one part in 66 000, the measured length being longer than the computed.

THE NORTH AMERICAN DATUM.

Early in the year 1913 the Superintendent of the United States Coast and Geodetic Survey was notified by the director of the Comisión Geodésica Mexicana and by the chief astronomer of the Dominion of Canada Astronomical Observatory that the United States Standard Datum had been adopted as the datum for the triangulation of those organizations. They also reported that the Clarke spheroid of 1866, now used in the United States, would be used by them.

Owing to the international character of the datum now adopted by the three countries, the Superintendent of the United States Coast and Geodetic Survey has changed its designation from the "United States Standard Datum" to the "North American Datum."

EXPLANATION OF POSITIONS, LENGTHS, AND AZIMUTHS, AND OF THE NORTH AMERICAN DATUM.

The lengths, as already fully explained in connection with the adjustments, all depend upon the Kent Island, St. Albans, Holton, Olney, American Bottom, Versailles, Salina, Louisville, and Cincinnati 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) $\left[\frac{\text{mean elevation of the two ends of the line in meters}}{6\,370\,000}\right]$. The maximum value of this correction does not exceed $\frac{1}{4500}$ of the length of any line of the triangulation here published. The maximum error made in the use of the above approximate formula for the correction does not exceed $\frac{1}{2000000}$ of the length of any line 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 United States 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 the selected 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 expanded until they touched or overlapped.

The Transcontinental Triangulation, of which the office computation was completed in 1899, joined all of the detached portions mentioned and made of them one continuous triangulation. As soon as this was accomplished 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 was 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 was known from that time until 1913 as the United States Standard Datum, but is now known as the North American Datum (see p. 10), 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 was 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 United States 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 United States 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 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 later 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 (now the North American) 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 sums 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 standard, of that datum which had been in use for many years in the northeastern group of States and along the Atlantic coast as far south 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 datum for which the algebraic sum of the station errors of each class would be zero.[1]

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

	°	′	″
$\varphi =$	39	13	26.686
$\lambda =$	98	32	30.506
α to Waldo =	75	28	14.52

Points are then said to be upon the North American 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 geographic positions on pages 856 to 861 in Special Publication No. 4 are on the Transcontinental Datum. The corrections required to reduce these positions to the North American Datum vary at different parts of the thirty-ninth parallel, and in general fall between the limits $\Delta\varphi = +0.''8$ to $+2.''2$, $\Delta\lambda = +0.''5$ to $-0.''6$, and $\Delta\alpha = -3''$ to $+2''$. In order to reduce to the North American Datum the positions of those points of the thirty-ninth parallel which are included in this publication, the latitude of *Briery* was corrected by $+2.''085$, the longitude by $-0.''485$, and the azimuth of the line *Briery-Keeney* by $-1.''24$. Using this corrected position of *Briery* and the corrected azimuth of the line *Briery-Keeney*, the positions of all the points of the thirty-ninth parallel from this line to Kansas City were computed, using the adjusted triangles appearing on pages 74, 75, 93–96, 144–146, 166–169, 240–243, 393, 394, 411–416, 430–433, 446–449, 473–479, and 505–508 of Special Publication No. 4, no change being made in the angles and lengths.

The principal lists of geographic positions heretofore published on the adopted datum throughout the whole United States are contained in the following publications of the United States 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.

[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 United States Coast and Geodetic Survey.

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.
Special Publication No. 11, positions in Texas, New Mexico, Arizona, and California.
Special Publication No. 13, positions in California, Oregon, and Washington.
Special Publication No. 16, positions in Florida.
Special Publication No. 17, positions in Texas.
Special Publication No. 19, positions in Colorado, Utah, Nevada, Wyoming, Montana, South Dakota, and North Dakota.
Special Publication No. 24, positions in Alabama and Mississippi.
Triangulation in Greater New York.
Report on a Plan of Sewerage, Cincinnati.
Appendix EEE, pages 2905–3031, Annual Report of the Chief of Engineers, 1902, positions of points on and near the Great Lakes.
Publications of the Massachusetts Harbor and Land Commission.
Various bulletins of the United States Geological Survey.

EXPLANATION OF TABLE OF POSITIONS.

In the table of positions the latitude and longitude of each point are given on the North American Datum (see p. 10), also the length and azimuth of each line observed over, whether in one or both ways. With the latitude and longitude of each point are given the lengths and azimuths 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 hundreths 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 sketches at the end of this publication and the index on pages 63 to 67. 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 page on which its elevation above sea level is shown, and in the fifth column the number of the sketch on which it appears.

The following conversion tables are inserted for the convenience of those who may wish to change the distances or elevations given in this publication from meters to feet or from feet to meters:

Lengths—Feet to meters (from 1 to 1,000 units).

[Reduction factor: 1 foot = 0.3048006096 meter.]

Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.
0		**100**	30.48006	**200**	60.96012	**300**	91.44018	**400**	121.92024	**500**	152.40030	**600**	182.88037	**700**	213.36043	**800**	243.84049	**900**	274.32055
1	.30480	1	30.78486	1	61.26492	1	91.74498	1	122.22504	1	152.70511	1	183.18517	1	213.66523	1	244.14529	1	274.62535
2	.60960	2	31.08966	2	61.56972	2	92.04978	2	122.52985	2	153.00991	2	183.48997	2	213.97003	2	244.45009	2	274.93015
3	.91440	3	31.39446	3	61.87452	3	92.35458	3	122.83465	3	153.31471	3	183.79477	3	214.27483	3	244.75489	3	275.23495
4	1.21920	4	31.69926	4	62.17932	4	92.65939	4	123.13945	4	153.61951	4	184.09957	4	214.57963	4	245.06969	4	275.53975
5	1.52400	5	32.00406	5	62.48412	5	92.96419	5	123.44425	5	153.92431	5	184.40437	5	214.88443	5	245.36449	5	275.84455
6	1.82880	6	32.30886	6	62.78893	6	93.26899	6	123.74905	6	154.22911	6	184.70917	6	215.18923	6	245.66929	6	276.14935
7	2.13360	7	32.61367	7	63.09373	7	93.57379	7	124.05385	7	154.53391	7	185.01397	7	215.49403	7	245.97409	7	276.45415
8	2.43840	8	32.91847	8	63.39853	8	93.87859	8	124.35865	8	154.83871	8	185.31877	8	215.79883	8	246.27889	8	276.75895
9	2.74321	9	33.22327	9	63.70333	9	94.18339	9	124.66345	9	155.14351	9	185.62357	9	216.10363	9	246.58369	9	277.06375
10	3.04801	**110**	33.52807	**210**	64.00813	**310**	94.48819	**410**	124.96825	**510**	155.44831	**610**	185.92837	**710**	216.40843	**810**	246.88849	**910**	277.36855
1	3.35281	1	33.83287	1	64.31293	1	94.79299	1	125.27305	1	155.75311	1	186.23317	1	216.71323	1	247.19329	1	277.67336
2	3.65761	2	34.13767	2	64.61773	2	95.09779	2	125.57785	2	156.05791	2	186.53797	2	217.01803	2	247.49810	2	277.97816
3	3.96241	3	34.44247	3	64.92253	3	95.40259	3	125.88265	3	156.36271	3	186.84277	3	217.32283	3	247.80290	3	278.28296
4	4.26721	4	34.74727	4	65.22733	4	95.70739	4	126.18745	4	156.66751	4	187.14757	4	217.62764	4	248.10770	4	278.58776
5	4.57201	5	35.05207	5	65.53213	5	96.01219	5	126.49225	5	156.97231	5	187.45237	5	217.93244	5	248.41250	5	278.89256
6	4.87681	6	35.35687	6	65.83693	6	96.31699	6	126.79705	6	157.27711	6	187.75718	6	218.23724	6	248.71730	6	279.19736
7	5.18161	7	35.66167	7	66.14173	7	96.62179	7	127.10185	7	157.58192	7	188.06198	7	218.54204	7	249.02210	7	279.50216
8	5.48641	8	35.96647	8	66.44653	8	96.92659	8	127.40665	8	157.88672	8	188.36678	8	218.84684	8	249.32690	8	279.80696
9	5.79121	9	36.27127	9	66.75133	9	97.23139	9	127.71146	9	158.19152	9	188.67158	9	219.15164	9	249.63170	9	280.11176
20	6.09601	**120**	36.57607	**220**	67.05613	**320**	97.53620	**420**	128.01626	**520**	158.49632	**620**	188.97638	**720**	219.45644	**820**	249.93650	**920**	280.41656
1	6.40081	1	36.88087	1	67.36093	1	97.84100	1	128.32106	1	158.80112	1	189.28118	1	219.76124	1	250.24130	1	280.72136
2	6.70561	2	37.18567	2	67.66574	2	98.14580	2	128.62586	2	159.10592	2	189.58598	2	220.06604	2	250.54610	2	281.02616
3	7.01041	3	37.49047	3	67.97054	3	98.45060	3	128.93066	3	159.41072	3	189.89078	3	220.37084	3	250.85090	3	281.33096
4	7.31521	4	37.79528	4	68.27534	4	98.75540	4	129.23546	4	159.71552	4	190.19558	4	220.67564	4	251.15570	4	281.63576
5	7.62002	5	38.10008	5	68.58014	5	99.06020	5	129.54026	5	160.02032	5	190.50038	5	220.98044	5	251.46050	5	281.94056
6	7.92482	6	38.40488	6	68.88494	6	99.36500	6	129.84506	6	160.32512	6	190.80518	6	221.28524	6	251.76530	6	282.24536
7	8.22962	7	38.70968	7	69.18974	7	99.66980	7	130.14986	7	160.62992	7	191.10998	7	221.59004	7	252.07010	7	282.55017
8	8.53442	8	39.01448	8	69.49454	8	99.97460	8	130.45466	8	160.93472	8	191.41478	8	221.89484	8	252.37490	8	282.85497
9	8.83922	9	39.31928	9	69.79934	9	100.27940	9	130.75946	9	161.23952	9	191.71958	9	222.19964	9	252.67971	9	283.15977
30	9.14402	**130**	39.62408	**230**	70.10414	**330**	100.58420	**430**	131.06426	**530**	161.54432	**630**	192.02438	**730**	222.50445	**830**	252.98451	**930**	283.46457
1	9.44882	1	39.92888	1	70.40894	1	100.88900	1	131.36906	1	161.84912	1	192.32918	1	222.80925	1	253.28931	1	283.76937
2	9.75362	2	40.23368	2	70.71374	2	101.19380	2	131.67386	2	162.15392	2	192.63399	2	223.11405	2	253.59411	2	284.07417
3	10.05842	3	40.53848	3	71.01854	3	101.49860	3	131.97866	3	162.45872	3	192.93879	3	223.41885	3	253.89891	3	284.37897
4	10.36322	4	40.84328	4	71.32334	4	101.80340	4	132.28346	4	162.76353	4	193.24359	4	223.72365	4	254.20371	4	284.68377
5	10.66802	5	41.14808	5	71.62814	5	102.10820	5	132.58827	5	163.06833	5	193.54839	5	224.02845	5	254.50851	5	284.98857
6	10.97282	6	41.45288	6	71.93294	6	102.41300	6	132.89307	6	163.37313	6	193.85319	6	224.33325	6	254.81331	6	285.29337
7	11.27762	7	41.75768	7	72.23774	7	102.71781	7	133.19787	7	163.67793	7	194.15799	7	224.63805	7	255.11811	7	285.59817
8	11.58242	8	42.06248	8	72.54255	8	103.02261	8	133.50267	8	163.98273	8	194.46279	8	224.94285	8	255.42291	8	285.90297
9	11.88722	9	42.36728	9	72.84735	9	103.32741	9	133.80747	9	164.28753	9	194.76759	9	225.24765	9	255.72771	9	286.20777
40	12.19202	**140**	42.67209	**240**	73.15215	**340**	103.63221	**440**	134.11227	**540**	164.59233	**640**	195.07239	**740**	225.55245	**840**	256.03251	**940**	286.51257
1	12.49682	1	42.97689	1	73.45695	1	103.93701	1	134.41707	1	164.89713	1	195.37719	1	225.85725	1	256.33731	1	286.81737
2	12.80163	2	43.28169	2	73.76175	2	104.24181	2	134.72187	2	165.20193	2	195.68199	2	226.16205	2	256.64211	2	287.12217
3	13.10643	3	43.58649	3	74.06655	3	104.54661	3	135.02667	3	165.50673	3	195.98679	3	226.46685	3	256.94691	3	287.42697
4	13.41123	4	43.89129	4	74.37135	4	104.85141	4	135.33147	4	165.81153	4	196.29159	4	226.77165	4	257.25171	4	287.73178
5	13.71603	5	44.19609	5	74.67615	5	105.15621	5	135.63627	5	166.11633	5	196.59639	5	227.07645	5	257.55652	5	288.03658
6	14.02083	6	44.50089	6	74.98095	6	105.46101	6	135.94107	6	166.42113	6	196.90119	6	227.38125	6	257.86132	6	288.34138
7	14.32563	7	44.80569	7	75.28575	7	105.76581	7	136.24587	7	166.72593	7	197.20599	7	227.68606	7	258.16612	7	288.64618
8	14.63043	8	45.11049	8	75.59055	8	106.07061	8	136.55067	8	167.03073	8	197.51080	8	227.99086	8	258.47092	8	288.95098
9	14.93523	9	45.41529	9	75.89535	9	106.37541	9	136.85547	9	167.33553	9	197.81560	9	228.29566	9	258.77572	9	289.25578

50	15.24003	**150**	45.72009	**250**	76.20015	**350**	106.68021	**450**	137.16027	**550**	167.64034	**650**	198.12040	**750**	228.60046	**850**	259.08052	**950**	289.56058
1	15.54483	1	46.02489	1	76.50495	1	106.98501	1	137.46507	1	167.94514	1	198.42520	1	228.90526	1	259.38532	1	289.86538
2	15.84963	2	46.32969	2	76.80975	2	107.28981	2	137.76988	2	168.24994	2	198.73000	2	229.21006	2	259.69012	2	290.17018
3	16.15443	3	46.63449	3	77.11455	3	107.59462	3	138.07468	3	168.55474	3	199.03480	3	229.51486	3	259.99492	3	290.47498
4	16.45923	4	46.93929	4	77.41935	4	107.89942	4	138.37948	4	168.85954	4	199.33960	4	229.81966	4	260.29972	4	290.77978
5	16.76403	5	47.24409	5	77.72416	5	108.20422	5	138.68428	5	169.16434	5	199.64440	5	230.12446	5	260.60452	5	291.08458
6	17.06883	6	47.54890	6	78.02896	6	108.50902	6	138.98908	6	169.46914	6	199.94920	6	230.42926	6	260.90932	6	291.38938
7	17.37363	7	47.85370	7	78.33376	7	108.81382	7	139.29388	7	169.77394	7	200.25400	7	230.73406	7	261.21412	7	291.69418
8	17.67844	8	48.15850	8	78.63856	8	109.11862	8	139.59868	8	170.07874	8	200.55880	8	231.03886	8	261.51892	8	291.99898
9	17.98324	9	48.46330	9	78.94336	9	109.42342	9	139.90348	9	170.38354	9	200.86360	9	231.34366	9	261.82372	9	292.30378
60	18.28804	**160**	48.76810	**260**	79.24816	**360**	109.72822	**460**	140.20828	**560**	170.68834	**660**	201.16840	**760**	231.64846	**860**	262.12852	**960**	292.60859
1	18.59284	1	49.07290	1	79.55296	1	110.03302	1	140.51308	1	170.99314	1	201.47320	1	231.95326	1	262.43332	1	292.91339
2	18.89764	2	49.37770	2	79.85776	2	110.33782	2	140.81788	2	171.29794	2	201.77800	2	232.25806	2	262.73813	2	293.21819
3	19.20244	3	49.68250	3	80.16256	3	110.64262	3	141.12268	3	171.60274	3	202.08280	3	232.56287	3	263.04293	3	293.52299
4	19.50724	4	49.98730	4	80.46736	4	110.94742	4	141.42748	4	171.90754	4	202.38760	4	232.86767	4	263.34773	4	293.82779
5	19.81204	5	50.29210	5	80.77216	5	111.25222	5	141.73228	5	172.21234	5	202.69241	5	233.17247	5	263.65253	5	294.13259
6	20.11684	6	50.59690	6	81.07696	6	111.55702	6	142.03708	6	172.51714	6	202.99721	6	233.47727	6	263.95733	6	294.43739
7	20.42164	7	50.90170	7	81.38176	7	111.86182	7	142.34188	7	172.82195	7	203.30201	7	233.78207	7	264.26213	7	294.74219
8	20.72644	8	51.20650	8	81.68656	8	112.16662	8	142.64669	8	173.12675	8	203.60681	8	234.08687	8	264.56693	8	295.04699
9	21.03124	9	51.51130	9	81.99136	9	112.47142	9	142.95149	9	173.43155	9	203.91161	9	234.39167	9	264.87173	9	295.35179
70	21.33604	**170**	51.81610	**270**	82.29616	**370**	112.77623	**470**	143.25629	**570**	173.73635	**670**	204.21641	**770**	234.69647	**870**	265.17653	**970**	295.65659
1	21.64084	1	52.12090	1	82.60097	1	113.08103	1	143.56109	1	174.04115	1	204.52121	1	235.00127	1	265.48133	1	295.96139
2	21.94564	2	52.42570	2	82.90577	2	113.38583	2	143.86589	2	174.34595	2	204.82601	2	235.30607	2	265.78613	2	296.26619
3	22.25044	3	52.73051	3	83.21057	3	113.69063	3	144.17069	3	174.65075	3	205.13081	3	235.61087	3	266.09093	3	296.57099
4	22.55525	4	53.03531	4	83.51537	4	113.99543	4	144.47549	4	174.95555	4	205.43561	4	235.91567	4	266.39573	4	296.87579
5	22.86005	5	53.34011	5	83.82017	5	114.30023	5	144.78029	5	175.26035	5	205.74041	5	236.22047	5	266.70053	5	297.18059
6	23.16485	6	53.64491	6	84.12497	6	114.60503	6	145.08509	6	175.56515	6	206.04521	6	236.52527	6	267.00533	6	297.48539
7	23.46965	7	53.94971	7	84.42977	7	114.90983	7	145.38989	7	175.86995	7	206.35001	7	236.83007	7	267.31013	7	297.79020
8	23.77445	8	54.25451	8	84.73457	8	115.21463	8	145.69469	8	176.17475	8	206.65481	8	237.13487	8	267.61494	8	298.09500
9	24.07925	9	54.55931	9	85.03937	9	115.51943	9	145.99949	9	176.47955	9	206.95961	9	237.43967	9	267.91974	9	298.39980
80	24.38405	**180**	54.86411	**280**	85.34417	**380**	115.82423	**480**	146.30429	**580**	176.78435	**680**	207.26441	**780**	237.74448	**880**	268.22454	**980**	298.70460
1	24.68885	1	55.16891	1	85.64897	1	116.12903	1	146.60909	1	177.08915	1	207.56922	1	238.04928	1	268.52934	1	299.00940
2	24.99365	2	55.47371	2	85.95377	2	116.43383	2	146.91389	2	177.39395	2	207.87402	2	238.35408	2	268.83414	2	299.31420
3	25.29845	3	55.77851	3	86.25857	3	116.73863	3	147.21869	3	177.69876	3	208.17882	3	238.65888	3	269.13894	3	299.61900
4	25.60325	4	56.08331	4	86.56337	4	117.04343	4	147.52350	4	178.00356	4	208.48362	4	238.96368	4	269.44374	4	299.92380
5	25.90805	5	56.38811	5	86.86817	5	117.34823	5	147.82830	5	178.30836	5	208.78842	5	239.26848	5	269.74854	5	300.22860
6	26.21285	6	56.69291	6	87.17297	6	117.65304	6	148.13310	6	178.61316	6	209.09322	6	239.57328	6	270.05334	6	300.53340
7	26.51765	7	56.99771	7	87.47777	7	117.95784	7	148.43790	7	178.91796	7	209.39802	7	239.87808	7	270.35814	7	300.83820
8	26.82245	8	57.30251	8	87.78258	8	118.26264	8	148.74270	8	179.22276	8	209.70282	8	240.18288	8	270.66294	8	301.14300
9	27.12725	9	57.60732	9	88.08738	9	118.56744	9	149.04750	9	179.52756	9	210.00762	9	240.48768	9	270.96774	9	301.44780
90	27.43205	**190**	57.91212	**290**	88.39218	**390**	118.87224	**490**	149.35230	**590**	179.83236	**690**	210.31242	**790**	240.79248	**890**	271.27254	**990**	301.75260
1	27.73686	1	58.21692	1	88.69698	1	119.17704	1	149.65710	1	180.13716	1	210.61722	1	241.09728	1	271.57734	1	302.05740
2	28.04166	2	58.52172	2	89.00178	2	119.48184	2	149.96190	2	180.44196	2	210.92202	2	241.40208	2	271.88214	2	302.36220
3	28.34646	3	58.82652	3	89.30658	3	119.78664	3	150.26670	3	180.74676	3	211.22682	3	241.70688	3	272.18694	3	302.66701
4	28.65126	4	59.13132	4	89.61138	4	120.09144	4	150.57150	4	181.05156	4	211.53162	4	242.01168	4	272.49174	4	302.97181
5	28.95606	5	59.43612	5	89.91618	5	120.39624	5	150.87630	5	181.35636	5	211.83642	5	242.31648	5	272.79655	5	303.27661
6	29.26086	6	59.74092	6	90.22098	6	120.70104	6	151.18110	6	181.66116	6	212.14122	6	242.62129	6	273.10135	6	303.58141
7	29.56566	7	60.04572	7	90.52578	7	121.00584	7	151.48590	7	181.96596	7	212.44602	7	242.92609	7	273.40615	7	303.88621
8	29.87046	8	60.35052	8	90.83058	8	121.31064	8	151.79070	8	182.27076	8	212.75083	8	243.23089	8	273.71095	8	304.19101
9	30.17526	9	60.65532	9	91.13538	9	121.61544	9	152.09550	9	182.57557	9	213.05563	9	243.53569	9	274.01575	9	304.49581

1 inch = .02540 meter.	4 inches = .10160 meter.	7 inches = .17780 meter.	10 inches = .25400 meter.
2 inches = .05080 meter.	5 inches = .12700 meter.	8 inches = .20320 meter.	11 inches = .27940 meter.
3 inches = .07620 meter.	6 inches = .15240 meter.	9 inches = .22860 meter.	12 inches = .30480 meter.

Lengths—Meters to feet (from 1 to 1,000 units).

[Reduction factor: 1 meter = 3.280833333 feet.]

Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.	Meters.	Feet.
0		**100**	328.08333	**200**	656.16667	**300**	984.25000	**400**	1,312.33333	**500**	1,640.41667	**600**	1,968.50000	**700**	2,296.58333	**800**	2,624.66667	**900**	2,952.75000
1	3.28083	1	331.36417	1	659.44750	1	987.53083	1	1,315.61417	1	1,643.69750	1	1,971.78083	1	2,299.86417	1	2,627.94750	1	2,956.03083
2	6.56167	2	334.64500	2	662.72833	2	990.81167	2	1,318.89500	2	1,646.97833	2	1,975.06167	2	2,303.14500	2	2,631.22833	2	2,959.31167
3	9.84250	3	337.92583	3	666.00917	3	994.09250	3	1,322.17583	3	1,650.25917	3	1,978.34250	3	2,306.42583	3	2,634.50917	3	2,962.59250
4	13.12333	4	341.20667	4	669.29000	4	997.37333	4	1,325.45667	4	1,653.54000	4	1,981.62333	4	2,309.70667	4	2,637.79000	4	2,965.87333
5	16.40417	5	344.48750	5	672.57083	5	1,000.65417	5	1,328.73750	5	1,656.82083	5	1,984.90417	5	2,312.98750	5	2,641.07083	5	2,969.15417
6	19.68500	6	347.76833	6	675.85167	6	1,003.93500	6	1,332.01833	6	1,660.10167	6	1,988.18500	6	2,316.26833	6	2,644.35167	6	2,972.43500
7	22.96583	7	351.04917	7	679.13250	7	1,007.21583	7	1,335.29917	7	1,663.38250	7	1,991.46583	7	2,319.54917	7	2,647.63250	7	2,975.71583
8	26.24667	8	354.33000	8	682.41333	8	1,010.49667	8	1,338.58000	8	1,666.66333	8	1,994.74667	8	2,322.83000	8	2,650.91333	8	2,978.99667
9	29.52750	9	357.61083	9	685.69417	9	1,013.77750	9	1,341.86083	9	1,669.94417	9	1,998.02750	9	2,326.11083	9	2,654.19417	9	2,982.27750
10	32.80833	**110**	360.89167	**210**	688.97500	**310**	1,017.05833	**410**	1,345.14167	**510**	1,673.22500	**610**	2,001.30833	**710**	2,329.39167	**810**	2,657.47500	**910**	2,985.55833
1	36.08917	1	364.17250	1	692.25583	1	1,020.33917	1	1,348.42250	1	1,676.50583	1	2,004.58917	1	2,332.67250	1	2,660.75583	1	2,988.83917
2	39.37000	2	367.45333	2	695.53667	2	1,023.62000	2	1,351.70333	2	1,679.78667	2	2,007.87000	2	2,335.95333	2	2,664.03667	2	2,992.12000
3	42.65083	3	370.73417	3	698.81750	3	1,026.90083	3	1,354.98417	3	1,683.06750	3	2,011.15083	3	2,339.23417	3	2,667.31750	3	2,995.40083
4	45.93167	4	374.01500	4	702.09833	4	1,030.18167	4	1,358.26500	4	1,686.34833	4	2,014.43167	4	2,342.51500	4	2,670.59833	4	2,998.68167
5	49.21250	5	377.29583	5	705.37917	5	1,033.46250	5	1,361.54583	5	1,689.62917	5	2,017.71250	5	2,345.79583	5	2,673.87917	5	3,001.96250
6	52.49333	6	380.57667	6	708.66000	6	1,036.74333	6	1,364.82667	6	1,692.91000	6	2,020.99333	6	2,349.07667	6	2,677.16000	6	3,005.24333
7	55.77417	7	383.85750	7	711.94083	7	1,040.02417	7	1,368.10750	7	1,696.19083	7	2,024.27417	7	2,352.35750	7	2,680.44083	7	3,008.52417
8	59.05500	8	387.13833	8	715.22167	8	1,043.30500	8	1,371.38833	8	1,699.47167	8	2,027.55500	8	2,355.63833	8	2,683.72167	8	3,011.80500
9	62.33583	9	390.41917	9	718.50250	9	1,046.58583	9	1,374.66917	9	1,702.75250	9	2,030.83583	9	2,358.91917	9	2,687.00250	9	3,015.08583
20	65.61667	**120**	393.70000	**220**	721.78333	**320**	1,049.86667	**420**	1,377.95000	**520**	1,706.03333	**620**	2,034.11667	**720**	2,362.20000	**820**	2,690.28333	**920**	3,018.36667
1	68.89750	1	396.98083	1	725.06417	1	1,053.14750	1	1,381.23083	1	1,709.31417	1	2,037.39750	1	2,365.48083	1	2,693.56417	1	3,021.64750
2	72.17833	2	400.26167	2	728.34500	2	1,056.42833	2	1,384.51167	2	1,712.59500	2	2,040.67833	2	2,368.76167	2	2,696.84500	2	3,024.92833
3	75.45917	3	403.54250	3	731.62583	3	1,059.70917	3	1,387.79250	3	1,715.87583	3	2,043.95917	3	2,372.04250	3	2,700.12583	3	3,028.20917
4	78.74000	4	406.82333	4	734.90667	4	1,062.99000	4	1,391.07333	4	1,719.15667	4	2,047.24000	4	2,375.32333	4	2,703.40667	4	3,031.49000
5	82.02083	5	410.10417	5	738.18750	5	1,066.27083	5	1,394.35417	5	1,722.43750	5	2,050.52083	5	2,378.60417	5	2,706.68750	5	3,034.77083
6	85.30167	6	413.38500	6	741.46833	6	1,069.55167	6	1,397.63500	6	1,725.71833	6	2,053.80167	6	2,381.88500	6	2,709.96833	6	3,038.05167
7	88.58250	7	416.66583	7	744.74917	7	1,072.83250	7	1,400.91583	7	1,728.99917	7	2,057.08250	7	2,385.16583	7	2,713.24917	7	3,041.33250
8	91.86333	8	419.94667	8	748.03000	8	1,076.11333	8	1,404.19667	8	1,732.28000	8	2,060.36333	8	2,388.44667	8	2,716.53000	8	3,044.61333
9	95.14417	9	423.22750	9	751.31083	9	1,079.39417	9	1,407.47750	9	1,735.56083	9	2,063.64417	9	2,391.72750	9	2,719.81083	9	3,047.89417
30	98.42500	**130**	426.50833	**230**	754.59167	**330**	1,082.67500	**430**	1,410.75833	**530**	1,738.84167	**630**	2,066.92500	**730**	2,395.00833	**830**	2,723.09167	**930**	3,051.17500
1	101.70583	1	429.78917	1	757.87250	1	1,085.95583	1	1,414.03917	1	1,742.12250	1	2,070.20583	1	2,398.28917	1	2,726.37250	1	3,054.45583
2	104.98667	2	433.07000	2	761.15333	2	1,089.23667	2	1,417.32000	2	1,745.40333	2	2,073.48667	2	2,401.57000	2	2,729.65333	2	3,057.73667
3	108.26750	3	436.35083	3	764.43417	3	1,092.51750	3	1,420.60083	3	1,748.68417	3	2,076.76750	3	2,404.85083	3	2,732.93417	3	3,061.01750
4	111.54833	4	439.63167	4	767.71500	4	1,095.79833	4	1,423.88167	4	1,751.96500	4	2,080.04833	4	2,408.13167	4	2,736.21500	4	3,064.29833
5	114.82917	5	442.91250	5	770.99583	5	1,099.07917	5	1,427.16250	5	1,755.24583	5	2,083.32917	5	2,411.41250	5	2,739.49583	5	3,067.57917
6	118.11000	6	446.19333	6	774.27667	6	1,102.36000	6	1,430.44333	6	1,758.52667	6	2,086.61000	6	2,414.69333	6	2,742.77667	6	3,070.86000
7	121.39083	7	449.47417	7	777.55750	7	1,105.64083	7	1,433.72417	7	1,761.80750	7	2,089.89083	7	2,417.97417	7	2,746.05750	7	3,074.14083
8	124.67167	8	452.75500	8	780.83833	8	1,108.92167	8	1,437.00500	8	1,765.08833	8	2,093.17167	8	2,421.25500	8	2,749.33833	8	3,077.42167
9	127.95250	9	456.03583	9	784.11917	9	1,112.20250	9	1,440.28583	9	1,768.36917	9	2,096.45250	9	2,424.53583	9	2,752.61917	9	3,080.70250
40	131.23333	**140**	459.31667	**240**	787.40000	**340**	1,115.48333	**440**	1,443.56667	**540**	1,771.65000	**640**	2,099.73333	**740**	2,427.81667	**840**	2,755.90000	**940**	3,083.98333
1	134.51417	1	462.59750	1	790.68083	1	1,118.76417	1	1,446.84750	1	1,774.93083	1	2,103.01417	1	2,431.09750	1	2,759.18083	1	3,087.26417
2	137.79500	2	465.87833	2	793.96167	2	1,122.04500	2	1,450.12833	2	1,778.21167	2	2,106.29500	2	2,434.37833	2	2,762.46167	2	3,090.54500
3	141.07583	3	469.15917	3	797.24250	3	1,125.32583	3	1,453.40917	3	1,781.49250	3	2,109.57583	3	2,437.65917	3	2,765.74250	3	3,093.82583
4	144.35667	4	472.44000	4	800.52333	4	1,128.60667	4	1,456.69000	4	1,784.77333	4	2,112.85667	4	2,440.94000	4	2,769.02333	4	3,097.10667
5	147.63750	5	475.72083	5	803.80417	5	1,131.88750	5	1,459.97083	5	1,788.05417	5	2,116.13750	5	2,444.22083	5	2,772.30417	5	3,100.38750
6	150.91833	6	479.00167	6	807.08500	6	1,135.16833	6	1,463.25167	6	1,791.33500	6	2,119.41833	6	2,447.50167	6	2,775.58500	6	3,103.66833
7	154.19917	7	482.28250	7	810.36583	7	1,138.44917	7	1,466.53250	7	1,794.61583	7	2,122.69917	7	2,450.78250	7	2,778.86583	7	3,106.94917
8	157.48000	8	485.56333	8	813.64667	8	1,141.73000	8	1,469.81333	8	1,797.89667	8	2,125.98000	8	2,454.06333	8	2,782.14667	8	3,110.23000
9	160.76083	9	488.84417	9	816.92750	9	1,145.01083	9	1,473.09417	9	1,801.17750	9	2,129.26083	9	2,457.34417	9	2,785.42750	9	3,113.51083

50	164.04167	**150**	492.12500	**250**	820.20833	**350**	1,148.29167	**450**	1,476.37500	**550**	1,804.45833	**650**	2,132.54167	**750**	2,460.62500	**850**	2,788.70833	**950**	3,116.79167
1	167.32250	1	495.40583	1	823.48917	1	1,151.57250	1	1,479.65583	1	1,807.73917	1	2,135.82250	1	2,463.90583	1	2,791.98917	1	3,120.07250
2	170.60333	2	498.68667	2	826.77000	2	1,154.85333	2	1,482.93667	2	1,811.02000	2	2,139.10333	2	2,467.18667	2	2,795.27000	2	3,123.35333
3	173.88417	3	501.96750	3	830.05083	3	1,158.13417	3	1,486.21750	3	1,814.30083	3	2,142.38417	3	2,470.46750	3	2,798.55083	3	3,126.63417
4	177.16500	4	505.24833	4	833.33167	4	1,161.41500	4	1,489.49833	4	1,817.58167	4	2,145.66500	4	2,473.74833	4	2.801.83167	4	3,129.91500
5	180.44583	5	508.52917	5	836.61250	5	1,164.69583	5	1,492.77917	5	1,820.86250	5	2,148.94583	5	2,477.02917	5	2,805.11250	5	3,133.19583
6	183.72667	6	511.81000	6	839.89333	6	1,167.97667	6	1,496.06000	6	1,824.14333	6	2,152.22667	6	2,480.31000	6	2,808.39333	6	3,136.47667
7	187.00750	7	515.09083	7	843.17417	7	1,171.25750	7	1,499.34083	7	1,827.42417	7	2,155.50750	7	2,483.59083	7	2,811.67417	7	3,139.75750
8	190.28833	8	518.37167	8	846.45500	8	1,174.53833	8	1,502.62167	8	1,830.70500	8	2,158.78833	8	2,486.87167	8	2,814.95500	8	3,143.03833
9	193.56917	9	521.65250	9	849.73583	9	1,177.81917	9	1,505.90250	9	1,833.98583	9	2,162.06917	9	2,490.15250	9	2,818.23583	9	3,146.31917
60	196.85000	**160**	524.93333	**260**	853.01667	**360**	1,181.10000	**460**	1,509.18333	**560**	1,837.26667	**660**	2,165.35000	**760**	2,493.43333	**860**	2,821.51667	**960**	3,149.60000
1	200.13083	1	528.21417	1	856.29750	1	1,184.38083	1	1,512.46417	1	1,840.54750	1	2,168.63083	1	2,496.71417	1	2,824.79750	1	3,152.88083
2	203.41167	2	531.49500	2	859.57833	2	1,187.66167	2	1,515.74500	2	1,843.82833	2	2,171.91167	2	2,499.99500	2	2,828.07833	2	3,156.16167
3	206.69250	3	534.77583	3	862.85917	3	1,190.94250	3	1,519.02583	3	1,847.10917	3	2,175.19250	3	2,503.27583	3	2,831.35917	3	3,159.44250
4	209.97333	4	538.05667	4	866.14000	4	1,194.22333	4	1,522.30667	4	1,850.39000	4	2,178.47333	4	2,506.55667	4	2,834.64000	4	3,162.72333
5	213.25417	5	541.33750	5	869.42083	5	1,197.50417	5	1,525.58750	5	1,853.67083	5	2,181.75417	5	2,509.83750	5	2,837.92083	5	3,166.00417
6	216.53500	6	544.61833	6	872.70167	6	1,200.78500	6	1,528.86833	6	1,856.95167	6	2,185.03500	6	2,513.11833	6	2,841.20167	6	3,169.28500
7	219.81583	7	547.89917	7	875.98250	7	1,204.06583	7	1,532.14917	7	1,860.23250	7	2,188.31583	7	2,516.39917	7	2,844.48250	7	3,172.56583
8	223.09667	8	551.18000	8	879.26333	8	1,207.34667	8	1,535.43000	8	1,863.51333	8	2,191.59667	8	2,519.68000	8	2,847.76333	8	3,175.84667
9	226.37750	9	554.46083	9	882.54417	9	1,210.62750	9	1,538.71083	9	1,866.79417	9	2,194.87750	9	2,522.96083	9	2,851.04417	9	3,179.12750
70	229.65833	**170**	557.74167	**270**	885.82500	**370**	1,213.90833	**470**	1,541.99167	**570**	1,870.07500	**670**	2,198.15833	**770**	2,526.24167	**870**	2,854.32500	**970**	3,182.40833
1	232.93917	1	561.02250	1	889.10583	1	1,217.18917	1	1,545.27250	1	1,873.35583	1	2,201.43917	1	2,529.52250	1	2,857.60583	1	3,185.68917
2	236.22000	2	564.30333	2	892.38667	2	1,220.47000	2	1,548.55333	2	1,876.63667	2	2,204.72000	2	2,532.80333	2	2,860.88667	2	3,188.97000
3	239.50083	3	567.58417	3	895.66750	3	1,223.75083	3	1,551.83417	3	1,879.91750	3	2,208.00083	3	2,536.08417	3	2,864.16750	3	3,192.25083
4	242.78167	4	570.86500	4	898.94833	4	1,227.03167	4	1,555.11500	4	1,883.19833	4	2,211.28167	4	2,539.36500	4	2,867.44833	4	3,195.53167
5	246.06250	5	574.14583	5	902.22917	5	1,230.31250	5	1,558.39583	5	1,886.47917	5	2,214.56250	5	2.542.64583	5	2,870.72917	5	3,198.81250
6	249.34333	6	577.42667	6	905.51000	6	1,233.59333	6	1,561.67667	6	1,889.76000	6	2,217.84333	6	2,545.92667	6	2,874.01000	6	3,202.09333
7	252.62417	7	580.70750	7	908.79083	7	1,236.87417	7	1,564.95750	7	1,893.04083	7	2,221.12417	7	2,549.20750	7	2,877.29083	7	3,205.37417
8	255.90500	8	583.98833	8	912.07167	8	1,240.15500	8	1,568.23833	8	1,896.32167	8	2,224.40500	8	2,552.48833	8	2,880.57167	8	3,208.65500
9	259.18583	9	587.26917	9	915.35250	9	1,243.43583	9	1,571.51917	9	1,899.60250	9	2,227.68583	9	2,555.76917	9	2,883.85250	9	3,211.93583
80	262.46667	**180**	590.55000	**280**	918.63333	**380**	1,246.71667	**480**	1,574.80000	**580**	1,902.88333	**680**	2,230.96667	**780**	2,559.05000	**880**	2,887.13333	**980**	3,215.21667
1	265.74750	1	593.83083	1	921.91417	1	1,249.99750	1	1,578.08083	1	1,906.16417	1	2,234.24750	1	2,562.33083	1	2,890.41417	1	3,218.49750
2	269.02833	2	597.11167	2	925.19500	2	1,253.27833	2	1,581.36167	2	1,909.44500	2	2,237.52833	2	2,565.61167	2	2,893.69500	2	3,221.77833
3	272.30917	3	600.39250	3	928.47583	3	1,256.55917	3	1,584.64250	3	1,912.72583	3	2,240.80917	3	2,568.89250	3	2,896.97583	3	3,225.05917
4	275.59000	4	603.67333	4	931.75667	4	1,259.84000	4	1,587.92333	4	1,916.00667	4	2,244.09000	4	2,572.17333	4	2,900.25667	4	3,228.34000
5	278.87083	5	606.95417	5	935.03750	5	1,263.12083	5	1,591.20417	5	1,919.28750	5	2,247.37083	5	2,575.45417	5	2.903.53750	5	3,231.62083
6	282.15167	6	610.23500	6	938.31833	6	1,266.40167	6	1,594.48500	6	1,922.56833	6	2,250.65167	6	2,578.73500	6	2,906.81833	6	3,234.90167
7	285.43250	7	613.51583	7	941.59917	7	1,269.68250	7	1,597.76583	7	1,925.84917	7	2,253.93250	7	2,582.01583	7	2,910.09917	7	3,238.18250
8	288.71333	8	616.79667	8	944.88000	8	1,272.96333	8	1,601.04667	8	1,929.13000	8	2,257 21333	8	2,585.29667	8	2,913.38000	8	3,241.46333
9	291.99417	9	620.07750	9	948.16083	9	1,276.24417	9	1,604.32750	9	1,932.41083	9	2,260.49417	9	2,588.57750	9	2,916.66083	9	3,244.74417
90	295.27500	**190**	623.35833	**290**	951.44167	**390**	1,279.52500	**490**	1,607.60833	**590**	1,935.69167	**690**	2,263.77500	**790**	2,591.85833	**890**	2,919.94167	**990**	3,248.02500
1	298.55583	1	626.63917	1	954.72250	1	1,282.80583	1	1,610.88917	1	1,938.97250	1	2,267.05583	1	2,595.13917	1	2,923.22250	1	3,251.30583
2	301.83667	2	629.92000	2	958.00333	2	1,286.08667	2	1,614.17000	2	1,942.25333	2	2,270.33667	2	2,598.42000	2	2,926.50333	2	3,254.58667
3	305.11750	3	633.20083	3	961.28417	3	1,289.36750	3	1,617.45083	3	1,945.53417	3	2,273.61750	3	2,601.70083	3	2,929.78417	3	3,257.86750
4	308.39833	4	636.48167	4	964.56500	4	1,292.64833	4	1,620.73167	4	1,948.81500	4	2,276.89833	4	2,604.98167	4	2,933.06500	4	3,261.14833
5	311.67917	5	639.76250	5	967.84583	5	1,295.92917	5	1,624.01250	5	1,952.09583	5	2,280.17917	5	2,608.26250	5	2,936.34583	5	3,264.42917
6	314.96000	6	643.04333	6	971.12667	6	1,299.21000	6	1,627.29333	6	1,955.37667	6	2,283.46000	6	2,611.54333	6	2,939.62667	6	3,267.71000
7	318.24083	7	646.32417	7	974.40750	7	1,302.49083	7	1,630.57417	7	1,958.65750	7	2,286.74083	7	2,614.82417	7	2,942.90750	7	3,270.99083
8	321.52167	8	649.60500	8	977.68833	8	1,305.77167	8	1,633.85500	8	1,961.93833	8	2,290.02167	8	2,618.10500	8	2,946.18833	8	3,274.27167
9	324.80250	9	652.88583	9	980.96917	9	1,309.05250	9	1,637.13583	9	1,965.21917	9	2,293.30250	9	2,621.38583	9	2,949.46917	9	3,277.55250

GEOGRAPHIC POSITIONS.

Thirty-ninth parallel.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Briery	38 08 39.590	1220.6	254 09 20.37	74 29 41.33	Paddy	49886.53	4.6979833
1880	80 20 40.462	985.2	268 07 20.39	88 45 31.91	Elliott Knob	90339.09	4.9558757
			299 06 41.94	119 24 56.03	Bald Knob	49638.59	4.6958194
Keeney	37 46 24.843	765.9	217 30 01.78	37.43 20.62	Briery	51948.66	4.7155743
1880	80 42 19.179	469.4	235 20 09.01	55 53 44.90	Paddy	96733.39	4.9855764
			257 04 32.52	77 35 58.98	Bald Knob	77037.38	4.8867015
Beech	38 06 44.564	1374.0	261 06 00.41	81 15 39.86	Briery	23131.38	4.3642015
1880	80 36 18.956	461.8	13 11 42.73	193 08 01.24	Keeney	38620.62	4.5868192
Summersville	38 16 55.359	1707.0	288 15 06.66	108 34 34.13	Briery	48391.04	4.6847649
1880	80 52 07.750	188.3	309 07 23.15	129 17 09.86	Beech	29793.83	4.4741263
Ivy	37 47 15.684	483.6	224 41 20.63	45 04 21.19	Summersville	77437.03	4.8889487
1881	81 29 28.382	694.5	244 53 36.06	65 26 17.50	Beech	85804.43	4.9335097
			271 03 22.37	91 32 15.67	Keeney	69251.00	4.8404260
Table Rock	38 11 18.534	571.5	260 44 04.63	81 11 46.73	Summersville	66134.76	4.8204298
1881	81 36 53.338	1298.0	346 14 43.14	166 19 17.01	Ivy	45791.33	4.6607832
Holmes	38 25 40.840	1259.3	284 08 02.35	104 34 59.93	Summersville	65333.92	4.8151387
1881	81 35 34.508	836.9	352 48 54.75	172 52 40.70	Ivy	71630.68	4.8550991
			4 07 36.98	184 06 48.11	Table Rock	26656.66	4.4258057
Piney	38 26 39.588	1220.7	272 24 33.51	92 41 54.45	Holmes	40652.19	4.6090839
1883	82 03 28.996	703.2	306 05 22.97	126 21 52.29	Table Rock	48053.50	4.6817250
			325 31 46.34	145 52 45.97	Ivy	88221.92	4.9455765
Pigeon	38 13 44.047	1358.1	181 48 06.28	1 48 25.52	Piney	23924.49	4.3788426
1883	82 04 00.015	0.4	276 19 40.94	96 36 27.09	Table Rock	39829.23	4.6002019
			313 55 13.01	134 16 28.69	Ivy	70373.36	4.8474083
Big Rocks	38 20 51.152	1577.2	43 20 40.14	223 15 23.74	Pigeon	18095.11	4.2575613
1891	81 55 29.367	713.2	132 45 01.79	312 40 03.91	Piney	15839.55	4.1997429
			252 46 37.51	72 58 59.51	Holmes	30343.10	4.4820599
			302 57 32.38	123 09 03.58	Table Rock	32369.13	4.5101310
Simms	38 27 11.408	351.7	277 16 39.70	97 25 54.34	Holmes	21814.81	4.3387514
1891	81 50 26.619	645.4	32 05 44.80	212 02 36.75	Big Rocks	13836.07	4.1410129
			87 06 25.74	266 58 19.25	Piney	18997.24	4.2786905
Coal	38 21 26.581	819.6	82 53 02.06	262 49 19.42	Big Rocks	8780.07	3.9434978
1893	81 49 30.578	742.4	115 27 06.28	295 18 25.49	Piney	22517.43	4.3525186
			172 43 01.00	352 42 26.19	Simms	10718.95	4.0301522
			248 48 06.07	68 56 45.31	Holmes	21751.59	4.3374909
Rogers	38 22 52.520	1619.4	62 15 04.87	242 12 03.20	Big Rocks	8030.73	3.9047549
1893	81 50 36.684	890.3	181 45 04.53	1 45 10.78	Simms	7986.28	3.9023445
			328 47 40.02	148 48 21.05	Coal	3097.87	3.4910626
Ryan	38 23 45.155	1392.3	32 42 34.01	212 41 23.83	Coal	5077.50	3.7056499
1892	81 47 37.571	911.7	64 56 22.16	244 51 29.26	Big Rocks	12647.18	4.1019936
			69 32 30.46	249 30 39.23	Rogers	4640.04	3.6665218
			147 12 02.90	327 10 17.84	Simms	7566.99	3.8789231
St. Albans east base	38 22 42.575	1312.8	94 09 22.60	274 07 34.29	Rogers	4245.42	3.6279206
1893	81 47 42.231	1024.9	183 21 16.68	3 21 19.57	Ryan	1932.87	3.2862037
St. Albans west base	38 23 21.472	662.1	259 05 17.53	79 06 54.59	Ryan	3862.22	3.5868366
1893	81 50 13.850	336.1	288 02 19.28	108 03 53.42	St. Albans east base	3870.403	3.5877562
			31 49 57.90	211 49 43.72	Rogers	1050.79	3.0215162
Davis	38 21 06.229	192.1	248 11 16.20	68 22 16.65	Piney	27774.43	4.4436451
1883	82 21 12.312	298.9	208 26 01.30	118 36 40.96	Pigeon	28552.31	4.4556412
Gebhardt	38 31 45.656	1407.8	298 57 14.47	119 04 31.38	Piney	19457.13	4.2890788
1883	82 15 11.048	267.6	333 54 43.16	154 01 39.78	Pigeon	37114.76	4.5695467
			23 59 24.92	203 55 40.32	Davis	21575.11	4.3339531
Wray	38 35 42.244	1302.6	291 52 47.43	112 00 33.64	Gebhardt	19520.81	4.2904979
1884	82 27 38.907	941.6	340 49 57.64	160 53 58.18	Davis	28590.74	4.4562253
Oakland	38 21 46.466	1432.7	212 18 47.31	32 25 46.67	Wray	30512.31	4.4844751
1884	82 38 52.881	1283.8	241 41 35.15	61 56 19.22	Gebhardt	39117.34	4.5923693
			272 40 01.16	92 50 59.31	Davis	25780.11	4.4112848
Fradd	38 35 46.927	1447.0	271 00 59.69	91 04 23.75	Wray	7917.68	3.8985980
1884	82 33 06.031	145.9	285 51 33.48	106 02 43.60	Gebhardt	27068.65	4.4324666
			18 00 13.70	197 56 37.88	Oakland	27244.57	4.4352799
Buena Vista	38 23 44.026	1357.5	224 47 25.11	44 56 55.06	Fradd	31451.43	4.4976404
1884	82 48 21.664	525.7	284 39 44.46	104 45 37.60	Oakland	14273.64	4.1545347
Gould	38 38 27.582	850.5	281 21 56.10	101 32 26.91	Fradd	24947.67	4.3970300
1885	82 49 56.728	1372.0	332 25 05.92	152 31 59.19	Oakland	34808.56	4.5416860
			355 09 35.66	175 10 34.86	Buena Vista	27341.14	4.4368167

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Howland 1885	38 37 47.115	1452.8	264 43 17.96	84 49 09.90	Gould	13690.61	4.1364228
	82 59 20.415	493.7	328 23 44.36	148 30 34.56	Buena Vista	30504.44	4.4843631
Scioto 1885	38 45 47.719	1471.3	292 56 07.10	113 14 50.55	Fradd	47235.01	4.6742640
	83 03 03.622	87.4	305 26 57.47	125 35 09.49	Gould	23361.24	4.3684959
			339 58 48.81	160 01 08.36	Howland	15770.77	4.1978529
Cave 1885	38 32 39.734	1225.2	217 43 46.95	37 46 56.11	Howland	11988.06	4.0787487
	83 04 23.698	573.9	305 13 32.71	125 23 31.19	Buena Vista	28578.74	4.4560430
Round Top 1885	38 36 35.371	1090.7	219 07 22.42	39 13 21.31	Scioto	21969.63	4.3418228
	83 12 37.795	914.5	263 23 19.14	85 31 36.82	Howland	19416.44	4.2881697
			301 14 09.83	121 19 17.93	Cave	13994.19	4.1459478
Twin Creek 1886	38 42 08.710	268.3	251 18 44.51	71 27 23.87	Scioto	21155.86	4.3254307
	83 16 53.681	1297.1	328 55 54.36	148 58 34.20	Round Top	11997.12	4.0790769
Peach Mount 1886	38 53 43.525	1342.1	298 24 44.26	118 36 26.39	Scioto	30738.91	4.4876884
	83 21 43.441	1046.9	341 54 01.03	161 57 02.59	Twin Creek	22537.43	4.3529044
Cherry Ridge 1886	38 39 38.337	1182.1	201 55 26.06	21 59 58.74	Peach Mount	28101.29	4.4487263
	83 28 58.825	1422.3	255 07 09.25	75 14 42.46	Twin Creek	18130.39	4.2584071
			283 17 23.46	103 27 35.99	Round Top	24389.25	4.3871984
Cave Hill 1886	38 50 58.103	1791.6	255 56 14.99	76 05 08.08	Peach Mount	21102.41	4.3243321
	83 35 52.857	1274.6	334 27 55.00	154 32 14.18	Cherry Ridge	23223.12	4.3659205
Ash Ridge 1887	38 55 13.430	414.1	274 30 47.22	94 45 38.23	Peach Mount	34294.16	4.5352201
	83 45 22.093	532.2	299 48 01.26	119 53 58.59	Cave Hill	15818.55	4.1991666
			320 27 37.25	140 37 53.24	Cherry Ridge	37343.77	4.5722181
Minerva 1887	38 42 31.158	960.8	210 54 46.17	31 00 52.57	Ash Ridge	27411.80	4.4379375
	83 55 06.653	160.7	240 35 41.44	60 47 44.08	Cave Hill	31937.60	4.5043022
			277 52 07.49	98 08 27.44	Cherry Ridge	38267.15	4.5828261
Tate 1887	38 56 26.711	823.7	273 49 44.66	94 03 58.90	Ash Ridge	32822.68	4.5161741
	84 08 01.532	36.9	323 58 19.89	144 06 25.69	Minerva	31831.46	4.5028566
Flaugher 1887	38 43 50.435	1555.1	200 34 17.59	20 38 05.53	Tate	24914.15	4.3964461
	84 14 05.027	121.4	242 58 36.79	63 16 36.98	Ash Ridge	46593.01	4.6683208
			274 58 50.51	95 10 42.58	Minerva	27609.43	4.4410575
Stevens 1887	38 55 25.319	780.8	266 35 02.83	86 49 20.25	Tate	32919.04	4.5174471
	84 30 45.975	1107.4	311 30 01.83	131 40 29.40	Flaugher	32281.71	4.5089565
Dry Ridge 1889	38 40 41.112	1267.7	191 40 59.99	11 43 26.66	Stevens	27844.26	4.4447357
	84 34 40.043	967.9	258 49 26.75	79 02 19.01	Flaugher	30407.69	4.4829835
Tanner 1889	39 00 03.064	94.5	278 17 24.29	98 36 57.12	Tate	45385.76	4.6569196
	84 39 06.362	153.1	305 21 57.76	125 27 12.41	Stevens	14781.63	4.1697223
			349 48 49.21	169 51 36.23	Dry Ridge	36401.30	4.5611169
Stow 1890	38 51 07.065	217.9	241 01 19.70	61 14 21.67	Tanner	34233.46	4.5344508
	84 59 50.905	1227.5	297 45 15.25	118 01 01.25	Dry Ridge	41268.57	4.6156194
Reizin 1889	39 02 53.857	1660.8	276 56 47.50	97 15 14.26	Tanner	42609.07	4.6295020
	85 08 24.085	579.1	330 24 08.94	150 29 31.55	Stow	25054.71	4.3988894
Culbertson 1890	38 49 56.092	1729.7	190 51 41.94	10 53 42.22	Reizin	24422.58	4.3877916
	85 11 35.465	855.4	262 35 57.60	82 43 19.48	Stow	17132.16	4.2338121
			287 32 49.66	107 55 56.50	Dry Ridge	56164.60	4.7494627
Correct 1890	39 00 56.697	1748.4	253 42 58.06	73 48 22.83	Reizin	12919.76	4.1112545
	85 16 59.801	1438.8	338 59 16.56	159 02 40.34	Culbertson	21817.72	4.3388093
Glasgow 1890	39 06 18.567	572.6	294 51 37.97	114 57 34.44	Reizin	14987.66	4.1757338
	85 17 49.592	1191.6	353 07 06.37	173 07 37.75	Correct	9997.56	3.9998939
Green 1890	39 06 09.779	301.6	269 03 45.17	89 11 32.25	Glasgow	17796.00	4.2503224
	85 30 10.134	243.5	296 51 53.32	117 00 11.33	Correct	21314.30	4.3286711
Holton north base 1890	39 04 48.842	1506.3	102 29 14.67	282 24 17.96	Green	11580.75	4.0637308
	85 22 19.580	470.6	246 52 50.83	66 55 41.08	Glasgow	7053.71	3.8484174
			312 55 24.70	132 58 46.15	Correct	10506.18	4.0214449
Holton south base 1890	39 01 50.926	1570.6	124 19 56.39	304 14 49.52	Green	14168.78	4.1513323
	85 22 03.204	77.1	175 53 47.07	355 53 36.75	Holton north base	5500.570	3.7404077
			216 25 54.54	36 28 34.38	Glasgow	10261.14	4.0111958
			282 52 41.90	102 55 52.93	Correct	7487.66	3.8743460
Mud Lick 1890	38 50 52.126	1607.3	204 10 08.48	24 13 47.06	Correct	20439.04	4.3104605
	85 22 47.639	1148.8	276 01 31.05	96 08 32.60	Culbertson	16303.03	4.2122682
Stout 1890	38 51 12.501	385.5	193 17 18.47	13 20 09.56	Green	28433.30	4.4538273
	85 34 42.121	1015.8	234 45 33.44	54 56 41.04	Correct	31292.23	4.4954365
			272 01 34.23	92 09 02.42	Mud Lick	17240.48	4.2365493
Tripp 1890	38 59 58.155	1793.3	226 45 04.30	46 50 23.99	Green	16739.45	4.2237412
	85 38 37.560	903.8	340 41 43.98	160 44 11.01	Stout	17172.92	4.2348441
Miller 1889	38 50 36.473	1124.7	242 52 48.97	63 07 35.62	Tripp	38155.71	4.5815595
	86 02 08.848	213.3	268 15 14.43	88 32 27.36	Stout	39725.89	4.5990736

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Weed Patch	39 10 00.634	19.6	276 21 07.30	96 48 09.77	Green	62149.90	4.7934405
1889	86 13 00.771	18.5	290 21 27.79	110 43 08.55	Tripp	52955.87	4.7239141
			336 20 23.14	156 27 13.46	Miller	39176.81	4.5930291
Fountain	38 56 36.824	1135.5	187 31 54.46	7 33 20.48	Weed Patch	25003.76	4.3980053
1887	86 15 17.290	416.4	300 15 02.24	120 23 17.28	Miller	22011.75	4.3426545
Rariden	38 45 27.798	857.1	227 19 34.73	47 29 18.50	Fountain	30482.80	4.4840548
1887	86 30 47.909	1156.8	256 55 39.08	77 13 36.28	Miller	42560.43	4.6290060
Leonard	39 06 28.225	870.4	258 49 32.83	79 04 14.18	Weed Patch	34169.73	4.5336416
1887	86 36 17.122	411.5	300 55 43.03	121 08 56.31	Fountain	35369.24	4.5486257
			348 26 25.03	168 29 51.91	Rariden	39667.94	4.5984396
Beard	38 58 03.862	119.1	182 17 42.01	2 17 58.35	Leonard	15565.63	4.1921666
1887	86 36 43.065	1036.9	236 59 44.67	57 14 41.06	Weed Patch	40714.99	4.6097543
			274 50 32.87	95 04 01.26	Fountain	31075.66	4.4924204
			339 48 06.76	159 51 49.61	Rariden	24836.93	4.3950978
Calvary	39 04 42.133	1299.3	259 43 22.62	79 51 19.21	Leonard	18455.40	4.2661235
1886	86 48 52.913	1271.9	304 54 35.17	125 02 14.71	Beard	21426.23	4.3309457
Osborn	38 51 23.456	723.3	192 16 16.78	12 18 36.95	Calvary	25206.38	4.4015105
1886	86 52 35.794	863.1	241 38 27.97	61 48 26.41	Beard	26064.40	4.4160477
			289 02 58.99	109 16 38.67	Rariden	33408.89	4.5238621
Sisson	38 58 11.846	365.3	253 25 33.12	73 43 21.71	Calvary	42561.74	4.6290193
1885	87 17 10.030	241.4	289 23 36.74	109 39 02.77	Osborn	37684.97	4.5761682
Wright	39 07 13.640	420.6	277 57 37.40	98 12 01.11	Calvary	33238.72	4.5216442
1886	87 11 42.410	1018.7	25 16 32.45	205 13 06.07	Sisson	18471.95	4.2665127
Summit	38 45 42.538	1311.7	197 37 21.29	17 40 32.63	Sisson	24247.15	4.3846606
1884	87 22 14.956	361.1	256 05 05.47	76 23 40.53	Osborn	44196.05	4.6453835
Merom College	39 03 02.714	83.7	256 16 54.24	76 30 53.16	Wright	32903.23	4.5172386
1885	87 33 53.017	1274.8	290 18 06.40	110 28 37.74	Sisson	25744.85	4.4106903
			332 16 01.76	152 23 20.18	Summit	36217.90	4.5589233
Honey Creek	38 55 28.776	887.3	221 57 30.82	42 03 00.35	Merom College	18837.48	4.2750229
1884	87 42 36.781	886.0	301 25 20.68	121 38 07.00	Summit	34569.36	4.5386913
Belle Air	39 10 36.159	1115.1	297 52 55.69	118 04 26.90	Merom College	29806.31	4.4743082
1879	87 52 08.658	207.8	333 46 40.11	153 52 40.41	Honey Creek	31177.79	4.4938454
Hunt City	39 03 58.583	1806.7	225 55 14.02	46 00 47.10	Belle Air	17638.84	4.2464700
1879	88 00 56.552	1359.6	300 36 51.41	120 48 23.45	Honey Creek	30783.08	4.4883121
Claremont	38 45 28.551	880.4	176 57 28.28	356 56 40.75	Hunt City	34278.07	4.5350164
1879	87 59 40.884	987.1	233 03 48.88	53 14 31.16	Honey Creek	30863.94	4.4894513
			269 20 56.50	89 44 22.59	Summit	54228.69	4.7342291
Oblong	38 59 54.394	1677.2	21 17 59.43	201 13 28.90	Claremont	28649.61	4.4571187
1879	87 52 29.872	718.8	121 45 19.86	301 40 00.78	Hunt City	14325.65	4.1561143
			181 28 25.92	1 28 39.29	Belle Air	19797.00	4.2965993
Buffalo Mound	38 54 08.186	252.5	190 58 49.98	11 00 22.42	Hunt City	18546.39	4.2682595
1879	88 03 23.494	566.2	235 47 38.99	55 54 20.88	Oblong	19018.54	4.2791772
			341 27 15.54	161 29 35.12	Claremont	16899.25	4.2278675
Newton	38 55 28.587	881.5	219 11 40.01	39 17 15.89	Hunt City	20305.89	4.3076221
1883	88 09 50.322	1212.2	321 29 04.59	141 35 26.81	Claremont	23630.13	4.3734661
Denver	38 46 17.966	554.0	193 49 15.17	13 51 03.94	Newton	17486.49	4.2427027
1879	88 12 43.732	1055.7	222 55 55.36	43 01 46.69	Buffalo Mound	19819.76	4.2970984
			274 32 27.76	94 40 37.92	Claremont	18961.62	4.2778753
Onion Hill	38 48 57.527	1773.8	226 48 44.68	46 53 10.58	Buffalo Mound	14006.85	4.1463405
1879	88 10 27.315	659.0	292 23 07.61	112 29 52.54	Claremont	16880.30	4.2273802
			33 47 56.33	213 46 30.85	Denver	5920.07	3.7723270
Olney west base	38 51 38.566	1189.2	44 00 29.44	223 56 21.63	Denver	13737.21	4.1378986
1879	88 06 08.380	202.1	51 31 54.71	231 29 12.33	Onion Hill	7978.74	3.9019341
			220 43 40.98	40 45 24.48	Buffalo Mound	6089.47	3.7845792
			320 38 03.05	140 42 05.91	Claremont	14751.15	4.1688260
Olney check base	38 48 20.534	633.2	95 20 38.86	275 15 19.44	Onion Hill	12350.09	4.0916702
1879	88 01 57.634	1390.8	135 17 53.51	315 15 16.28	Olney west base	8594.68	3.9342297
			169 04 36.90	349 03 43.05	Buffalo Mound	10918.37	4.0381580
			328 05 22.46	148 06 48.13	Claremont	6246.53	3.7956385
Olney east base	38 51 44.093	1359.6	340 36 09.94	166 37 21.54	Claremont	11903.63	4.0756794
1879	88 01 35.112	846.6	4 56 52.82	184 56 38.70	Olney check base	6300.43	3.7993701
			68 14 14.26	248 08 40.51	Onion Hill	13825.11	4.1406685
			88 32 33.31	268 29 41.85	Olney west base	6590.780	3.8189368
			149 33 25.14	329 32 17.11	Buffalo Mound	5154.37	3.7121755
Olney middle base	38 51 41.348	1274.9	88 31 10.50	268 29 44.85	Olney west base	3292.30	3.5174993
1879	88 03 51.876	1250.7	188 35 20.54	8 35 38.36	Buffalo Mound	4579.34	3.6608027
			268 31 04.50	88 32 30.31	Olney east base	3298.48	3.5183139

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Island Creek 1883	39 06 10.729	330.9	278 17 19.28	98 29 24.10	Hunt City	27930.46	4.4460780
	88 20 06.201	149.0	323 08 21.38	143 14 49.08	Newton	24731.82	4.3932561
			343 48 11.52	163 52 49.59	Denver	38293.58	4.5831260
Lucas 1883	38 56 14.702	453.3	204 28 32.28	24 32 11.56	Island Creek	20199.38	4.3053380
	88 25 54.482	1312.2	273 25 11.15	93 35 17.01	Newton	23267.07	4.3667417
			313 54 45.95	134 03 02.02	Denver	26498.20	4.4232163
Parkersburg 1879	38 34 51.518	1558.5	143 16 15.64	323 09 26.49	Denver	26429.43	4.4220878
	88 01 49.004	1186.1	188 56 58.53	8 58 18.58	Claremont	19885.80	4.2985430
Holtzhausen 1883	38 48 01.888	58.2	236 10 38.15	56 20 30.38	Lucas	27359.86	4.4371139
	88 41 38.218	922.2	274 13 35.10	94 31 41.61	Denver	41985.58	4.6231002
Mound 1883	39 04 05.433	167.6	264 03 07.41	84 19 43.59	Island Creek	38171.25	4.5817363
	88 46 26.231	630.6	295 59 09.29	116 12 04.51	Lucas	33002.76	4.5185503
			346 50 00.12	166 53 01.12	Holtzhausen	30511.56	4.4844644
Sturgess 1883	38 56 57.121	1761.3	244 52 53.50	65 05 13.95	Mound	31234.14	4.4946295
	89 06 02.602	62.7	294 55 50.59	115 11 09.67	Holtzhausen	38967.96	4.5907077
Hartlin 1882	38 42 28.166	868.5	150 52 17.47	330 45 48.49	Sturgess	30690.69	4.4870066
	88 55 42.219	1020.1	198 28 16.31	18 34 05.35	Mound	42187.73	4.6251861
			243 08 08.07	63 16 56.40	Holtzhausen	22830.40	4.3585135
Bording 1882	38 36 45.305	1397.0	209 03 46.13	29 12 46.66	Sturgess	42781.24	4.6312533
	89 20 25.603	619.4	253 26 50.20	73 42 16.87	Hartlin	37391.21	4.5727695
Hoile 1882	38 53 43.065	1327.9	257 21 12.28	77 32 53.39	Sturgess	27540.83	4.4399770
	89 24 38.546	928.9	296 15 44.84	116 33 52.87	Hartlin	46782.30	4.6700816
			348 57 53.77	169 00 32.11	Bording	31972.12	4.5047714
Geoffrey 1881	38 32 58.184	1794.1	184 53 41.94	4 55 07.27	Hoile	38527.75	4.5857737
	89 26 54.964	1330.9	233 21 01.30	53 25 04.11	Bording	11741.59	4.0697269
Parkinson 1881	38 43 26.882	828.9	233 57 06.20	54 08 26.67	Hoile	32361.61	4.5100301
	89 42 44.281	1069.6	290 49 17.46	111 03 13.88	Bording	34051.14	4.5397175
			310 05 34.73	130 15 27.47	Geoffrey	30049.72	4.4778404
Berger 1881	38 36 40.158	1238.2	197 43 06.34	17 44 49.99	Parkinson	13167.04	4.1194880
	89 45 30.167	729.9	284 07 53.67	104 19 29.12	Geoffrey	27847.72	4.4447896
Turkey Hill 1880	38 28 32.971	1016.6	211 12 30.96	31 19 42.49	Parkinson	32247.81	4.5085002
	89 54 15.988	387.6	220 14 30.21	40 19 57.85	Berger	19693.19	4.2943160
			258 14 07.23	78 31 09.08	Geoffrey	40590.48	4.6084242
Clarks Mound 1871	38 34 45.727	1410.0	262 30 05.12	82 41 45.31	Berger	27391.01	4.4376081
	90 04 12.598	304.9	308 26 41.12	128 32 52.74	Turkey Hill	18464.86	4.2663459
Sugar Loaf Mound 1871	38 42 05.290	163.1	264 18 50.57	84 29 55.54	Parkinson	25811.64	4.4118157
	90 00 27.536	665.4	294 43 17.11	114 52 37.65	Berger	23902.10	4.3784360
			21 53 56.89	201 51 36.35	Clarks Mound	14606.10	4.1645343
Insane Asylum 1871	38 36 13.965	430.6	245 16 07.65	65 26 17.54	Sugar Loaf Mound	25977.70	4.4146007
	90 16 43.980	1064.2	278 26 40.35	98 34 29.04	Clarks Mound	18386.76	4.2645053
American Bottom upper base 1872	38 39 50.135	1545.9	26 44 34.01	206 42 32.07	Clarks Mound	10509.11	4.0215661
	90 00 57.230	1383.6	73 51 09.13	253 41 18.04	Insane Asylum	23849.45	4.3774783
American Bottom lower base 1872	38 36 15.956	492.0	89 53 39.06	269 45 06.56	Insane Asylum	19875.51	4.2983183
	90 03 02.580	62.4	199 10 35.71	19 12 12.56	Sugar Loaf Mound	11405.57	4.0571172
			204 38 51.94	24 40 10.20	American Bottom upper base	7266.884	3.8613482
Dreyer 1871	38 30 06.300	194.3	148 16 50.19	328 13 49.66	Insane Asylum	13331.10	4.1248661
	90 11 54.318	1316.2	232 20 42.66	52 25 30.34	Clarks Mound	14116.49	4.1497267
			276 18 36.07	96 29 34.73	Turkey Hill	25810.27	4.4117925
Minoma 1872	38 41 57.617	1776.6	269 20 27.41	89 30 38.32	Sugar Loaf Mound	23612.03	4.3731333
	90 16 44.019	1078.3	279 39 30.15	99 49 22.25	American Bottom upper base	23234.24	4.3661285
			297 51 08.07	117 59 41.50	American Bottom lower base	22496.94	4.3521235
			306 08 49.05	126 16 38.62	Clarks Mound	22542.10	4.3529944
			359 54 59.09	179 54 59.49	Insane Asylum	10596.59	4.0251661
Kleinschmidt 1871	38 30 19.817	611.0	200 09 29.05	20 11 12.31	Insane Asylum	11633.63	4.0657152
	90 19 29.663	718.7	249 39 27.09	69 48 58.50	Clarks Mound	23674.40	4.3742789
			272 07 26.56	92 12 10.04	Dreyer	11041.21	4.0430167
Morgan 1871	38 40 20.741	639.5	253 48 14.31	73 52 40.95	Minoma	10733.62	4.0307463
	90 23 51.171	1237.1	306 20 03.83	126 24 30.57	Insane Asylum	12831.60	4.1082807
			341 07 08.00	161 09 51.11	Kleinschmidt	19580.45	4.2918227
Patterson 1873	38 27 52.652	1623.5	207 08 32.46	27 13 37.56	Morgan	25931.53	4.4138282
	90 32 00.538	13.0	235 04 15.02	55 13 46.02	Insane Asylum	27051.02	4.4321837
			255 56 03.96	76 03 51.24	Kleinschmidt	18756.10	4.2731426
Kessler 1871	38 36 33.996	1048.2	244 45 36.95	64 52 00.82	Morgan	16429.20	4.2156164
	90 34 05.910	143.0	271 18 47.47	91 29 37.60	Insane Asylum	25218.26	4.4017151
			349 17 34.09	169 18 52.20	Patterson	16359.66	4.2137744

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Tavern Rock	38 36 19.119	589.5	256 20 23.17	76 33 41.34	Morgan	31800.88	4.5024391
1873	90 45 09.458	228.8	268 18 20.98	88 25 15.00	Kessler	16061.73	4.2057922
			309 11 26.08	129 19 37.57	Patterson	24677.67	4.3923042
Lynch	38 24 27.713	854.5	175 39 26.66	355 38 43.80	Tavern Rock	21999.09	4.3424046
1873	90 44 00.615	14.9	250 02 46.29	70 10 13.92	Patterson	18572.29	4.2688656
Halleck	38 28 07.655	236.0	224 28 28.47	44 34 51.91	Tavern Rock	21256.58	4.3274933
1873	90 55 24.924	604.2	292 10 02.03	112 17 07.44	Lynch	17928.42	4.2535419
Dieckhaus	38 35 16.610	512.2	263 21 40.00	83 28 50.82	Tavern Rock	16822.91	4.2259012
1873	90 56 40.055	969.4	317 19 37.21	137 27 29.95	Lynch	27184.75	4.4343253
			352 09 33.47	172 10 20.29	Halleck	13351.18	4.1255197
Peters	38 27 46.555	1435.5	216 36 22.64	36 40 48.06	Dieckhaus	17295.30	4.2379280
1874	91 03 46.186	1119.7	239 36 16.57	59 47 52.27	Tavern Rock	31326.74	4.4959152
			266 53 31.25	86 58 43.07	Halleck	12169.68	4.0852791
			281 56 02.87	102 08 19.86	Lynch	29400.71	4.4683578
Enoch Knob	38 34 43.772	1349.7	266 28 14.84	86 35 25.18	Dieckhaus	16732.05	4.2235491
1874	91 08 10.082	244.0	303 19 02.12	123 26 58.71	Halleck	22197.60	4.3463060
			333 33 10.36	153 35 54.71	Peters	14365.50	4.1573208
Berger	38 35 58.120	1792.1	272 19 07.44	92 32 05.89	Dieckhaus	30227.62	4.4804039
1874	91 17 27.984	677.1	279 35 16.09	99 41 04.06	Enoch Knob	13695.62	4.1365818
			307 13 01.11	127 21 33.04	Peters	25019.10	4.3982716
Jacobs	38 26 18.167	560.2	173 58 53.23	353 58 04.71	Berger	17981.88	4.2548351
1874	91 16 10.071	244.2	216 40 49.16	36 45 48.01	Enoch Knob	19449.89	4.2889171
			261 20 38.03	81 28 20.61	Peters	18242.79	4.2610912
Winter	38 27 41.358	1275.2	219 06 40.55	39 12 01.33	Berger	19753.39	4.2956416
1874	91 26 02.931	71.1	280 03 56.18	100 10 04.84	Jacobs	14603.17	4.1644471
Gasconade	38 35 33.323	1027.6	267 06 02.00	87 12 38.72	Berger	15408.81	4.1877693
1874	91 28 03.935	95.2	314 38 38.45	134 46 02.98	Jacobs	24333.65	4.3862072
			348 36 07.35	168 37 22.72	Winter	14845.02	4.1715807
Turnpike Bluff	38 35 29.074	896.5	269 11 11.27	89 15 19.59	Gasconade	9635.82	3.9838889
1878	91 34 42.054	1017.7	318 52 08.22	138 57 31.55	Winter	19134.05	4.2818069
Geyer	38 26 57.017	1758.1	185 50 50.81	5 51 32.42	Turnpike Bluff	15871.74	4.2006245
1878	91 35 48.869	1185.1	215 14 17.89	35 19 07.45	Gasconade	19501.34	4.2900644
			264 27 08.96	84 33 13.36	Winter	14272.82	4.1545098
Bradford	38 33 57.210	1764.0	260 42 25.26	80 49 54.30	Turnpike Bluff	17658.68	4.2469583
1879	91 46 42.138	1020.2	263 39 16.24	83 50 53.55	Gasconade	27228.27	4.4350200
			291 00 00.10	111 12 51.75	Winter	32181.81	4.5076104
			309 14 44.86	129 21 31.60	Geyer	20454.89	4.3107972
Pilot Knob	38 20 11.236	346.4	183 59 26.15	4 00 11.79	Bradford	25530.25	4.4070550
1879	91 47 55.525	1348.6	214 08 12.12	34 16 25.69	Turnpike Bluff	34219.73	4.5342766
			234 34 52.43	54 42 23.72	Geyer	21622.07	4.3348973
McDaniel	38 27 35.671	1099.9	218 58 52.00	39 02 56.98	Bradford	15141.35	4.1801645
1879	91 53 15.568	377.4	330 25 52.49	150 29 11.28	Pilot Knob	15751.26	4.1973153
Kennedy	38 20 59.524	1835.4	236 00 58.94	56 08 43.98	McDaniel	21889.40	4.3402338
1879	92 05 44.190	1073.3	273 11 29.08	93 22 32.05	Pilot Knob	25994.53	4.4148819
Cedar	38 36 03.897	120.2	276 52 11.77	97 05 53.44	Bradford	32126.51	4.5068636
1879	92 08 39.616	958.7	304 55 04.80	125 04 40.42	McDaniel	27322.72	4.4365240
			351 18 52.18	171 20 41.33	Kennedy	28208.01	4.4503725
Belshe	38 22 30.363	936.2	222 07 27.26	42 17 11.45	Cedar	33864.30	4.5297421
1879	92 24 18.292	444.0	275 48 57.70	96 00 29.15	Kennedy	27192.71	4.4344525
Moreau	38 31 36.904	1137.9	251 16 00.52	71 26 28.74	Cedar	25749.52	4.4107692
1879	92 25 27.361	662.8	304 18 17.38	124 30 32.94	Kennedy	34779.83	4.5413275
			354 19 06.48	174 19 49.43	Belshe	16935.12	4.2287882
Medlock	38 38 13.256	408.7	283 18 26.24	103 25 39.29	Cedar	17252.96	4.2368636
1879	92 20 13.462	325.6	11 33 12.94	191 30 40.51	Belshe	29672.56	4.4723551
			31 53 43.27	211 50 27.51	Moreau	14390.59	4.1580786
Christian	38 37 38.403	1184.1	266 34 30.96	86 42 23.57	Medlock	18341.50	4.2634349
1879	92 32 50.462	1220.7	316 03 51.45	136 08 27.75	Moreau	15469.03	4.1894630
			336 03 00.28	156 08 19.12	Belshe	30626.10	4.4860917
High Point	38 29 29.396	906.4	191 42 58.64	11 44 19.23	Christian	15390.80	4.1875152
1880	92 34 59.741	1447.8	254 07 20.90	74 13 17.29	Moreau	14414.65	4.1588042
			309 39 12.60	129 45 51.33	Belshe	20223.41	4.3058543
Hunter	38 25 45.210	1394.0	221 48 21.41	41 56 48.40	Christian	29534.37	4.4703277
1880	92 46 24.373	591.2	247 19 54.51	67 27 00.33	High Point	17980.88	4.2548110
			280 27 42.16	100 41 25.89	Belshe	32732.98	4.5149856
Cole	38 38 06.770	208.8	273 07 57.44	93 14 42.66	Christian	15724.12	4.1965664
1880	92 43 39.538	956.3	321 41 12.08	141 46 36.10	High Point	20319.26	4.3079078
			9 55 07.28	189 53 24.58	Hunter	23211.58	4.3657048

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Versailles north base 1880	38 29 34.790 92 48 23.327	1072.7 565.3	203 29 41.99 236 29 07.89 270 25 11.24 290 21 02.32 337 49 23.03	23 32 38.92 56 38 49.38 90 33 31.40 110 36 00.58 157 50 37.02	Cole Christian High Point Belshe Hunter	17217.07 27064.93 19475.24 37411.46 7643.852	4.2359593 4.4324069 4.2894828 4.5730046 3.8833123
Hubbard 1880	38 40 28.145 92 51 46.805	867.8 1131.4	280 41 08.94 290 15 42.80 309 43 04.80 346 14 42.79	100 52 58.67 110 20 47.18 129 53 32.85 166 16 49.69	Christian Cole High Point Versailles north base	27972.26 12562.69 31729.06 20739.29	4.4467275 4.0990827 4.5014572 4.3167939
Hughes 1880	38 25 56.501 92 55 52.086	1742.2 1263.3	192 26 23 24 218 10 23.32 236 59 20.72 238 13 06.61 271 23 57.04	12 28 56.11 38 17 59.70 57 13 41.37 58 17 45.74 91 29 49.91	Hubbard Cole Christian Versailles north base Hunter	27525.23 28667.82 39854.17 12793.58 13774.33	4.4397310 4.4573946 4.6004737 4.1069919 4.1390705
Schnackenberg 1882	38 29 51.828 93 11 27.625	1598.1 669.4	235 25 37.06 287 39 35.04	55 37 53.53 107 49 16.98	Hubbard Hughes	34666.37 23813.29	4.5399083 4.3768194
Heard 1880	38 42 56.400 93 12 26.321	1739.0 635.9	278 34 10.24 322 29 12.53 356 38 06.90	98 47 05.16 142 39 32.47 176 38 43.52	Hubbard Hughes Schnackenberg	30301.50 39601.01 24233.87	4.4814642 4.5977013 4.3844228
Kendrick 1882	38 39 38.948 93 25 59.385	1200.9 1435.8	252 42 52.63 310 33 08.03	72 51 20.86 130 42 11.66	Heard Schnackenberg	20572.36 27803.00	4.3132840 4.4440917
High Point Tebo 1882	38 34 34.278 93 34 20.189	1057.0 488.7	232 09 58.69 284 33 43.35	52 15 11.26 104 47 58.48	Kendrick Schnackenberg	15331.10 34364.78	4.1855733 4.5361135
Knob Noster 1882	38 46 35.456 93 33 07.090	1093.3 171.1	282 35 45.69 321 08 43.31 4 32 58.41	102 48 42.25 141 13 10.84 184 32 12.73	Heard Kendrick High Point Tebo	30715.57 16483.73 22307.84	4.4873586 4.2170555 4.3484575
Normal 1883	38 45 32.997 93 44 16.442	1017.4 397.0	263 08 42.12 324 35 08.84	83 15 41.25 144 41 21.38	Knob Noster High Point Tebo	16273.83 24906.91	4.2114898 4.3963198
Caldwell 1882	38 34 05.336 93 45 22.440	164.5 543.3	184 17 51.90 217 28 47.79 266 45 23.66	4 18 33.13 37 36 27.28 86 52 16.57	Normal Knob Noster High Point Tebo	21264.12 29171.98 16056.41	4.3276475 4.4649659 4.2056485
Baker 1883	38 45 37.030 94 04 13.090	1141.8 316.0	270 08 33.28 307 51 53.81	90 21 02.45 128 03 40.19	Normal Caldwell	28892.94 34671.82	4.4607917 4.5399766
Hutton Mound 1883	38 32 51.375 94 10 50.114	1584.1 1213.6	202 05 37.22 266 20 22.62	22 09 45.21 86 36 14.82	Baker Caldwell	25486.34 37059.07	4.4063074 4.5688945
Chapel Hill 1883	38 54 47.232 94 03 28.583	1456.4 688.6	301 29 31.35 3 37 26.88	121 41 33.85 183 36 58.97	Normal Baker	32623.27 17000.05	4.5135275 4.2304502
Thornton 1883	38 50 05.360 94 14 47.115	165.3 1136.4	241 57 17.53 298 20 55.73 349 47 41.95	62 04 23.38 118 27 32.99 169 50 10.10	Chapel Hill Baker Hutton Mound	18522.78 17394.24 32393.71	4.2677062 4.2404055 4.5104607
Fulton 1883	38 38 43.589 94 18 34.346	1344.0 830.6	194 36 38.04 238 26 03.29 313 59 26.65	14 39 00.24 58 35 01.82 134 04 16.25	Thornton Baker Hutton Mound	21727.32 24405.63 15625.53	4.3370063 4.3874900 4.1938346
Bowler 1884	38 53 16.076 94 23 39.564	495.7 953.6	204 23 32.05 294 33 59.38 344 39 22.96	84 36 12.51 114 39 33.46 164 42 34.07	Chapel Hill Thornton Fulton	29316.26 14120.50 27894.67	4.4671085 4.1498502 4.4455213
Berry 1884	38 49 13.996 94 33 33.688	431.6 812.7	242 25 32.30 311 44 47.07	62 31 45.02 131 54 10.38	Bowler Fulton	16154.20 29150.23	4.2082854 4.4646420
Marty 1884	38 59 22.786 94 40 15.041	702.6 362.0	295 09 51.59 332 42 35.51	115 20 17.24 152 46 47.57	Bowler Berry	26508.27 21117.51	4.4233814 4.3246428
Haskin 1885	38 44 23.610 94 41 06.663	728.0 160.9	182 33 56.07 230 38 40.88 287 40 09.79	2 34 28.46 50 43 24.59 107 54 15.18	Marty Berry Fulton	27755.18 14132.49 34322.37	4.4433441 4.1502186 4.5355773
Supplementary points.							
Cold Knob [1] 1880	38 03 58.98 80 28 03.92	1818.5 95.6	32 48 112 59 231 16	212 39 292 54 51 21	Keeney Beech Briery	38635 13099 13841	4.58698 4.11725 4.14118
Grassy Knob [1] 1880	38 03 55.81 80 29 48.48	1720.7 1181.7	29 34 71 53 236 43	209 26 250 16 56 49	Keeney Ivy Briery	37231 92709 15963	4.57090 4.96712 4.20312
Jobs Knob [1] 1880	38 04 46.649 80 32 32.756	1438.3 798.3	69 03 45.04 123 25 42.54 247 27 16.28	248 28 45.27 303 23 22.98 67 34 35.91	Ivy Beech Briery	89483.3 6002.8 18780.0	4.9517419 3.8197268 4.2736967
Big Clear Creek Mountain [1] 1880	37 57 52.07 80 36 05.27	1605.4 128.6	23 22 228 24	203 18 48 33	Keeney Briery	23074 30115	4.36313 4.47879
Big Sewall Mountain [1] 1880	37 54 30.54 80 56 05.52	941.6 134.8	74 52 306 28	254 31 126 37	Ivy Keeney	50769 25148	4.70560 4.40051

[1] Checked by vertical angles only.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Townsend Mountain [1] 1880	37 56 30.01 81 17 43.19	925.2 1054.6	45 18 224 35 289 35	225 11 44 51 109 57	Ivy Summersville Keeney	24273 53164 55173	4.38513 4.72562 4.74173
Paint Creek, east tree 1880	37 56 51.054 81 18 30.116	1574.0 735.3	42 15 51.64 134 56 18.68 225 56 10.11 253 16 19.98 289 48 24.16	222 09 07.57 314 44 58.43 46 12 26.80 73 42 19.37 110 10 36.56	Ivy Table Rock Summersville Beech Keeney	23948.9 37928.1 53522.1 64386.3 56470.5	4.3792862 4.5789611 4.7285329 4.8087936 4.7518220
Coal River Mountain, long flat [1] 1880	37 53 15.47 81 25 47.96	477.0 1172.0	25 56 154 08 281 00	205 54 334 02 101 27	Ivy Table Rock Keeney	12332 37127 65040	4.09105 4.56969 4.81318
Coal River Mountain [1] 1881	37 53 39.84 81 25 12.70	1228.3 310.3	27 51 152 26	207 48 332 19	Ivy Table Rock	13393 36843.	4.12687 4.56635
Creed 1881	38 24 16.751 81 33 35.629	516.5 864.5	11 20 20.9 131 58 00.3	191 18 18.3 311 56 46.4	Table Rock Holmes	24471.2 3878.1	4.388656 3.588624
Elk 1881	38 22 20.653 81 36 56.713	636.8 1376.7	197 54 06.4 233 43 17.1	17 54 57.5 53 45 22.0	Holmes Creed	6486.9 6052.3	3.812034 3.781921
Martin 1881	38 21 25.278 81 36 18.273	779.4 443.7	187 40 20.8 216 43 58.0 151 20 38.0	7 40 48.0 36 45 39.0 331 20 14.1	Holmes Creed Elk	7951.2 6598.3 1945.8	3.900434 3.819435 3.289101
Ferguson 1881	38 20 37.875 81 38 15.080	1167.8 366.2	210 58 26.4 242 43 36.5	30 59 15.0 62 44 49.0	Elk Martin	3696.4 3190.8	3.567774 3.503893
Fort Scammon 1881	38 21 06.240 81 39 17.095	192.4 415.1	236 02 20.4 262 17 05.7 300 08 29.0	56 03 47.5 82 18 56.7 120 09 07.5	Elk Martin Ferguson	4108.6 4381.4 1741.5	3.613691 3.641615 3.240913
Charleston astronomic [2] 1881	38 21 02.287 81 37 59.193	70.5 1437.3	27 08 14.0 93 41 36.6	207 08 04.1 273 40 48.2	Ferguson Fort Scammon	845.8 1895.5	2.927268 3.277726
Charleston Catholic Church 1881	38 20 49.640 81 38 00.098	1530.6 2.4	45 05 02.9 105 18 58.0 208 44 03.0	225 04 53.6 285 18 10.2 28 44 42.3	Ferguson Fort Scammon Elk	513.8 1938.5 3200.5	2.710774 3.287458 3.505221
Second Presbyterian Church [2] 1881	38 20 55.812 81 38 07.420	1720.9 180.2	18 35 21.2 100 45 59.3	198 35 16.5 280 45 16.1	Ferguson Fort Scammon	583.5 1722.1	2.766040 3.236066
Colored Baptist Church 1881	38 20 59.437 81 37 51.663	1832.6 1254.5	40 32 32.6 95 46 52.0 208 02 29.4	220 32 18.1 275 45 59.0 28 03 03.5	Ferguson Fort Scammon Elk	874.8 2085.0 2837.4	2.941928 3.319111 3.452921
South Methodist Church 1881	38 21 00.949 81 37 53.631	29.3 1302.3	36 12 34.2 94 36 34.7 209 20 37.1	216 12 20.9 274 35 42.9 29 21 12.4	Ferguson Fort Scammon Elk	881.7 2013.2 2819.5	2.945328 3.308182 3.450166
Old Capitol, top of belfry 1881	38 21 02.213 81 37 57.289	68.2 1391.1	29 55 52.7 93 40 23.8 211 17 49.0	209 55 41.7 273 39 34.3 31 18 26.6	Ferguson Fort Scammon Elk	865.9 1941.8 2830.7	2.937463 3.288208 3.451886
Courthouse spire [2] 1881	38 21 03.198 81 38 21.075	98.6 511.7	93 56 56.8 220 36 33.6	273 56 22.1 40 37 26.0	Fort Scammon Elk	1363.5 3146.2	3.134650 3.497789
North Methodist Church spire 1881	38 21 11.442 81 38 06.680	352.8 162.2	11 08 58.9 84 38 47.4 218 30 46.1	191 08 53.7 264 38 03.7 38 31 29.5	Ferguson Fort Scammon Elk	1054.9 1717.3 2727.5	3.023211 3.234842 3.435772
First Baptist Church spire 1881	38 21 12.298 81 37 55.766	379.2 1354.1	23 50 27.1 84 36 13.7 214 13 09.4	203 50 15.1 264 35 23.2 34 13 46.0	Ferguson Fort Scammon Elk	1160.4 1983.6 2549.1	3.064596 3.297451 3.406379
Ironton, Kelly's house, cupola [2] 1885	38 31 59.67 82 40 10.36	1839.9 250.9	235 39 56 354 19 06	55 44 20 174 19 54	Fradd Oakland	12435.5 19000.8	4.094663 4.278771
Springville 1885	38 43 22.218 83 00 05.688	685.1 137.4	55 27 42.82 136 15 04.19 301 37 53.59	235 19 52.92 316 13 12.83 121 44 14.17	Round Top Scioto Gould	22090.8 6212.5 17297.1	4.3442118 3.7932694 4.2379744
Portsmouth North meridian 1885	38 44 38.845 82 58 41.303	1197.8 997.4	40 47 18.42 108 33 31.80	220 46 25.62 288 30 47.59	Springville Scioto	3120.4 6680.7	3.4942173 3.8248232
Scioto County courthouse [2] 1885	38 44 06.18 83 00 01.74	190.6 42.0	4 01 28.2 125 30 04.2	184 01 25.7 305 28 10.4	Springville Scioto	1358.8 5394.0	3.133157 3.731911
Sixth Street Methodist Church spire [2] 1885	38 44 05.65 82 59 46.89	174.2 1132.5	18 43 41.2 123 32 36.3	198 43 29.4 303 30 33.2	Springville Scioto	1414.0 5698.7	3.150443 3.755778
German Catholic Church west gable of tower [2] 1885	38 44 03.56 83 00 09.82	109.8 237.2	355 31 16.0 127 26 26.9	175 31 18.6 307 24 38.1	Springville Scioto	1278.7 5285.0	3.106771 3.723041

[1] Checked by vertical angles only.

[2] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.							
Portsmouth—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
First Presbyterian Church, corner Third and Court Streets [1] 1885	38 43 56.21 83 00 03.98	1733.2 96.1	2 15 37.6 128 25 00.9	182 15 36.5 308 23 08.5	Springville Scioto	1048.9 5535.7	3.020714 3.743176
Davis Steel Works, chimney [1] 1885	38 43 57.46 83 00 30.14	1771.7 728.0	331 28 34 132 32 34	151 28 49 312 30 58	Springville Scioto	1237.0 5029.6	3.09237 3.70153
Davis Distillery, chimney [1] 1885	38 45 05.17 83 01 37.59	159.4 907.7	325 01 52 112 16 59	145 02 49 302 16 05	Springville Scioto	3873.8 2456.8	3.58814 3.39037
South meridian [1] 1885	38 44 33.4 82 58 41.3	1030.8 997.4	179 59 57	359 59 57	North meridian	167 [2]	2.2227
West Union courthouse 1886	38 47 42.978 83 32 46.122	1325.3 1113.0	143 11 41.0 235 06 58.9 339 48 25.5	323 09 43.9 55 13 54.5 159 50 47.7	Cave Hill Peach Mount Cherry Ridge	7516.3 19468.0 15920.9	3.8760066 4.2893215 4.2019667
West Union Children's Home 1886	38 47 42.631 83 32 08.862	1314.6 213.9	138 08 39.20 233 31 26.24 342 53 47.20	318 06 18.78 53 37 58.53 162 55 46.09	Cave Hill Peach Mount Cherry Ridge	8095.1 18743.8 15623.1	3.9082209 4.2728575 4.1937670
Unity Church spire [1] 1886	38 53 30.09 83 31 18.12	927.8 436.7	268 14 12.7 54 44 20.7	88 20 13.5 234 41 28.3	Peach Mount Cave Hill	13855.7 8113.7	4.141629 3.909220
Eckmansville Church spire [1] 1886	38 51 50.03 83 38 34.63	1542.7 835.0	261 44 27.6 328 18 35.2	81 55 02.3 148 24 35.7	Peach Mount Cherry Ridge	24624.0 26501.5	4.391358 4.423271
Georgetown courthouse, dome 1887	38 51 56.326 83 54 14.766	1736.9 356.0	244 37 03.53 4 06 52.91 62 33 20.02	64 42 37.97 184 06 20.41 242 20 54.23	Ash Ridge Minerva Flaugher	14203.4 17472.4 32396.0	4.1523932 4.2423524 4.5104910
Felicity town hall 1887	38 50 25.130 84 05 48.208	774.9 1162.7	44 37 02.79 163 56 08.62 313 17 07.88	224 31 51.58 343 54 44.92 133 23 49.66	Flaugher Tate Minerva	17085.5 11603.6 21294.4	4.2326288 4.0645943 4.3282657
Alexandria Courthouse 1889	38 57 34.911 84 23 12.143	1076.6 292.4	69 57 21.50 101 19 59.44 130 57 22.29 275 23 55.92	249 52 36.25 281 09 59.18 310 51 37.41 95 33 28.36	Stevens Tanner Lookout House Tate	11637.4 23418.2 17442.4 22028.5	4.0658553 4.3695530 4.2416051 4.3429844
Lookout House 1889	39 03 45.313 84 32 20.038	1397.3 481.8	351 38 21.50 54 59 42.62	171 39 20.69 234 55 26.74	Stevens Tanner	15583.6 11936.8	4.1926681 4.0768871
Cold Spring larger spire 1889	39 01 35.269 84 26 51.356	1087.6 1235.4	26 21 31.86 80 55 47.45 116 55 46.45	206 19 04.29 260 48 04.76 296 52 19.40	Stevens Tanner Lookout House	12729.6 17910.6 8863.4	4.1048134 4.2531091 3.9475999
Observatory, Cincinnati 1889	39 08 20.787 84 25 21.540	641.0 517.3	351 06 33.55 9 48 08.19 49 50 50.64	171 07 55.08 189 47 11.57 229.46 26.70	Alexandria Courthouse Cold Spring larger spire Lookout House	21158.7 12690.1 13164.0	4.3044618 4.1034657 4.1193886
Price Hill 1889	39 06 19.806 84 33 23.702	610.8 569.5	312 53 44.23 342 11 18.02 349 20 16.16 35 22 29.12	132.57 51.50 162 11 58.16 169 21 55.46 215 18 53.23	Cold Spring larger spire Lookout House Stevens Tanner	12882.6 5003.9 20536.1 14242.9	4.1100029 3.6993050 4.3125182 4.1535973
Mount Lookout transit pier 1881	39 08 21.872 84 25 21.929	674.5 526.6	344 23 05	164 23 05	Observatory	34.75	1.540955
Mount Adams Convent 1889	39 06 27.655 84 29 56.350	852.8 1353.9	34 36 43.81 48 09 49.14 87 14 12.11	214 35 13.22 228 04 02.60 267 12 01.32	Lookout House Tanner Price Hill	6081.8 17763.9 4988.0	3.7840351 4.2495390 3.6979269
Williamstown Courthouse [1] 1887	38 38 12.52 84 33 39.37	386.0 952.2	162 15 06.0 249 44 24.1	342 14 28.1 69 56 38.1	Dry Ridge Flaugher	4811.0 30236.2	3.682239 4.480527
Cold Spring Church spire [3] 1912	39 01 35.272 84 26 51.345	1087.7 1235.0	26 21 34.66 116 55 37.91	206 19 07.08 296 52 10.85	Stevens Lookout House	12729.75 8863.61	4.1048198 3.9476194
Fort Thomas [3] 1912	39 04 03.300 84 26 49.103	101.8 1180.4	0 40 37.65 86 02 24.33	180 40 36.24 265 58 55.77	Cold Spring Church spire Lookout House	4565.11 7975.60	3.6594515 3.9017633
Cincinnati							
Brothers' Protectory [3] 1912	39 05 14.757 84 36 31.014	455.1 767.0	21 08 29.44 294 28 16.17	201 06 52.15 114 30 54.93	Tanner Lookout House	10304.42 6653.21	4.0130234 3.8230311
Warsaw School [3] 1912	39 06 46.734 84 35 10.057	1441.2 241.7	34 44 52.83 292 40 16.09 323 50 33.70	214 44 01.20 112 45 31.97 143 52 20.85	Brothers' Protectory Fort Thomas Lookout House	3451.67 13051.70 6927.95	3.5380287 4.1156670 3.8406046
Eden Park water tower spire [3] 1912	39 07 02.207 84 29 24.852	68.1 597.0	34 45 13.42 72 08 31.93 86 44 14.71 325 49 54.20	214 43 22.95 252 04 02.54 266 40 36.89 145 51 32.41	Lookout House Brothers' Protectory Warsaw School Fort Thomas	7388.80 10783.48 8307.07 6666.91	3.8685741 4.0327588 3.9194476 3.8239245

[1] No check on this position. [2] Approximate. [3] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.							
Cincinnati—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Hughes High School[1] 1912	39 07 43.101	1329.1	11 41 29.78	191 40 49.98	Lookout House	7488.13	3.8743735
	84 31 16.928	406.6	58 52 35.29	238 49 16.60	Brothers' Protectory	8843.26	3.9466125
			72 46 37.77	252 44 10.66	Warsaw School	5863.89	3.7681858
			295 05 20.11	115 06 30.83	Eden Park water tower	2972.98	3.4731922
			316 27 36.06	136 30 24.98	Fort Thomas	9346.86	3.9706656
Westwood School[1] 1912	39 08 51.848	1599.0	7 21 29.68	187 21 06.98	Brothers' Protectory	6750.14	3.8293129
	84 35 55.943	1343.3	287 31 53.11	107 34 49.22	Hughes High School	7028.36	3.8468538
			344 03 11.59	164 03 40.53	Warsaw School	4012.57	3.6034227
Stross[1] 1912	39 09 18.729	577.6	76 20 05.88	256 18 36.32	Westwood School	3505.64	3.5447678
	84 33 34.088	818.4	311 49 28.95	131 50 55.53	Hughes High School	4421.12	3.6455327
Clifton School[1] 1912	39 09 00.729	22.5	4 37 16.78	184 37 11.69	Hughes High School	2401.69	3.3805173
	84 31 08.872	213.0	99 03 26.29	279 01 54.60	Stross	3530.79	3.5478716
College Hill Methodist Home[1] 1912	39 11 13.312	410.5	17 22 09.49	197 21 40.41	Stross	3702.23	3.5684640
	84 32 48.058	1153.4	22 32 24.36	202 30 54.69	Warsaw School	8899.76	3.9493781
			45 58 21.29	225 56 22.62	Westwood School	6274.98	3.7976123
			329 46 32.31	149 47 34.96	Clifton School	4731.36	3.6749859
			341 20 27.03	161 21 24.57	Hughes High School	6841.74	3.8351664
Observatory[1] 1912	39 08 20.648	636.7	14 13 44.48	194 12 51.71	Fort Thomas	8186.89	3.9131189
	84 25 25.398	609.9	67 12 40.51	247 10 09.41	Eden Park water tower	6239.66	3.7951611
			82 13 19.62	262 09 37.76	Hughes High School	8522.12	3.9305476
			98 33 09.05	278 29 32.23	Clifton School	8340.44	3.9211889
Norwood[1] 1912	39 10 02.597	80.1	34 17 19.66	214 15 40.01	Eden Park water tower	6731.82	3.8281328
	84 26 46.989	1128.1	56 27 15.43	236 24 25.01	Hughes High School	7779.65	3.8909600
			73 08 38.19	253 05 52.83	Clifton School	6570.79	3.8176178
			328 03 48.31	148 04 39.82	Observatory	3704.33	3.5687094
Longview[1] 1912	39 11 23.951	738.6	28 11 51.50	208 10 15.52	Hughes High School	7726.65	3.8879915
	84 28 44.931	1078.3	86 48 10.84	266 45 37.22	College Hill Methodist Home	5844.16	3.7667217
			311 32 13.83	131 33 28.34	Norwood	3782.64	3.5777947
Mount Washington School[1] 1912	39 05 28.615	882.4	35 57 51.76	215 55 35.03	Cold Springs Church spire	8888.23	3.9488153
	84 23 14.343	344.7	63 00 45.69	242 58 30.31	Fort Thomas	5793.86	3.7629682
			107 59 40.21	287 55 46.52	Eden Park water tower	9358.78	3.9712193
			149 19 21.93	329 17 59.22	Observatory	6169.03	3.7902167
			165 19 36.07	345 18 32.39	Kennedy	9558.34	3.9803827
			177 06 46.67	357 06 36.72	Madisonville School	7505.38	3.8753727
Madisonville School[1] 1912	39 09 31.690	977.2	51 39 32.82	231 38 20.02	Observatory	3530.79	3.5478717
	84 23 30.088	722.4	101 40 02.39	281 37 58.15	Norwood water tower	4822.27	3.6832517
			130 35 23.49	310 34 29.73	Kennedy	2690.67	3.4298611
Kennedy[1] 1912	39 10 28.451	877.4	10 25 25.84	190 25 06.77	Observatory	4007.27	3.6028485
	84 24 55.209	1325.2	73 50 37.40	253 49 26.90	Norwood water tower	2789.33	3.4455005
Norwood water tower[1] 1912	39 10 03.267	100.7	11 42 50.28	191 42 50.17	Norwood	21.13	1.3249365
	84 26 46.810	1123.7	56 20 41.93	236 17 51.39	Hughes High School	7794.67	3.8917980
			131 16 46.19	311 15 31.56	Longview	3772.17	3.5765907
			328 17 17.28	148 18 08.68	Observatory	3719.65	3.5705017
St. Joe - 1912	39 05 50.314	1551.5	2 49 10.38	182 48 56.57	Tanner	10721.20	4.0302432
	84 38 44.446	1068.1	215 51 15.74	35 53 02.08	Westwood School	6908.18	3.8393635
			251 19 07.42	71 21 22.66	Warsaw School	5437.18	3.7353740
			288 59 07.42	109 00 30.99	Brothers' Protectory	3368.49	3.5274350
			292 36 44.93	112 40 47.26	Lookout House	10011.54	4.0005007
Reading[1] 1912	39 12 48.360	1491.3	4 28 15.31	184 28 04.84	Norwood water tower	5106.65	3.7081359
	84 26 30.228	725.3	51 09 57.70	231 08 32.56	Longview	4150.03	3.6180515
			72 07 01.89	252 03 03.09	College Hill Methodist Home	9528.27	3.9790142
Madisonville water tower[1] 1912	39 09 18.598	573.5	47 21 08.3	227 20 17.4	Observatory	2637.37	3.4211716
	84 24 04.625	111.0	150 35 31.7	330 34 59.7	Kennedy	2472.87	3.3932014
			244 02 09.3	64 02 31.1	Madisonville School	922.30	2.9648715
			350 19 49.5	170 20 21.1	Mount Washington School	7194.22	3.8569836
St. Francis de Sales Church spire[1] 1912	39 07 47.125	1453.2	40 28 47.9	220 28 16.8	Eden Park water tower	1820.94	3.2602948
	84 28 35.646	856.2	88 10 46.9	268 09 05.1	Hughes High School	3875.94	3.5883765
			178 05 28.8	358 05 22.9	Longview	6690.17	3.8254370
			211 58 39.9	31 59 48.4	Norwood	4925.52	3.6924516
			257 14 06.5	77 16 06.5	Observatory	4684.85	3.6706957

[1] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.							
Cincinnati—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
St. Clemon's Church spire [1] 1912	39 09 57.065	1759.7	23 50 29.0	203 49 41.0	Hughes High School	4516.33	3.6547859
	84 30 00.927	22.2	43 12 17.7	223 11 34.8	Clifton School	2383.15	3.3771513
			120 23 20.9	300 21 35.3	College Hill Methodist Home	4650.01	3.6674537
			214 14 27.3	34 15 15.3	Longview	3241.38	3.5107303
			267 53 05.5	87 55 07.9	Norwood	4659.00	3.6682928
Westwood Methodist Church spire [1] 1912	39 09 02.071	82.4	228 30 46.3	48 32 46.2	College Hill Methodist Home	6083.44	3.7841492
	84 35 57.938	1391.2	270 28 08.2	90 31 10.7	Clifton School	6941.44	3.8414498
			289 57 21.6	110 00 18.9	Hughes High School	7181.01	3.8561855
			344 39 15.8	164 39 46.0	Warsaw School	4346.89	3.6381789
			351 49 51.9	171 49 53.1	Westwood School	337.18	2.5278676
St. Lawrence Church spire [1] 1912	39 06 40.437	1247.0	49 35 20.2	229 33 58.8	Brothers' Protectory	4074.80	3.6101060
	84 34 22.820	548.3	99 42 52.0	279 42 22.2	Warsaw School	1151.36	3.0612128
			151 06 41.0	331 05 42.3	Westwood School	4628.75	3.6654635
			193 28 46.9	13 29 17.7	Stross	5019.73	3.7006803
			227 06 00.9	47 08 03.3	Clifton School	6357.55	3.8032896
			246 35 02.8	66 37 00.1	Hughes High School	4865.84	3.6871579
			331 20 13.0	151 21 30.4	Lookout House	6154.09	3.7891636
Whittier's School flagstaff [1] 1912	39 06 30.941	954.1	57 06 23.8	237 04 48.6	Brothers' Protectory	4324.37	3.6359228
	84 34 00.831	20.0	106 19 42.1	286 18 58.4	Warsaw School	1733.06	3.2388135
			147 32 26.5	327 31 13.9	Westwood School	5150.41	3.7118422
			187 04 26.9	7 04 43.8	Stross	5213.94	3.7171660
			334 37 03.5	154 38 07.0	Lookout House	5652.95	3.7522751
St. Mary Seminary flagstaff [1] 1912	39 06 39.899	1230.4	57 22 46.0	237 20 58.4	Brothers' Protectory	4868.56	3.6874006
	84 33 41.297	992.2	95 39 10.1	275 38 14.1	Warsaw School	2142.90	3.3310024
			182 01 25.4	2 01 30.0	Stross	4901.01	3.6902856
			240 39 08.3	60 40 39.5	Hughes High School	3978.27	3.5996944
			340 03 22.1	160 04 13.3	Lookout House	5727.13	3.7579371
Cedar Grove Academy cupola [1] 1912	39 06 46.953	1447.9	43 06 56.9	223 05 47.0	Brothers' Protectory	3894.19	3.5904175
	84 34 41.171	989.2	89 26 44.5	269 26 26.3	Warsaw School	694.03	2.8413754
			250 32 38.6	70 34 47.5	Hughes High School	5202.98	3.7162520
			328 47 29.6	148 48 58.5	Lookout House	6548.33	3.8161303
Wolf Hill 1885	38 47 56.220	1733.6	292 38 50.5	112 43 06.4	Summit	10689.5	4.028958
	87 29 03.558	85.9	166 01 08.4	345 58 06.5	Merom College	28809.8	4.459540
Vincennes courthouse center cupola 1885	38 40 35.216	1085.9	195 15 51.8	15 17 28.0	Wolf Hill	14096.8	4.149121
	87 31 37.354	902.9	235 03 21.8	55 09 13.6	Summit	16565.0	4.219191
Vincennes latitude and longitude 1881	38 40 35.70	1100.8					
	87 31 35.05	847.3					
St. Marie Catholic Church white spire 1879	38 55 56.50	1742.2	39 15 29.0	219 14 17.8	Buffalo Mound	4313.1	3.634786
	88 01 30.23	728.0	40 08 49.1	220 05 54.4	Olney west base	10401.6	4.017102
Dundas Baptist Church tower 1879	38 50 05.93	182.9	151 06 14.8	331 05 33.8	Olney west base	3262.9	3.513610
	88 05 02.98	72.0	238 51 23.9	58 53 34.3	Olney east base	5855.8	3.767585
Olney Courthouse dome 1879	38 43 50.42	1554.8	112 30 13.4	292 25 28.2	Denver	11906.6	4.075790
	88 05 08.07	194.9	249 01 02.0	69 04 26.8	Claremont	8461.1	3.927425
Olney Evangelical Church spire 1879	38 43 42.54	1311.6	112 53 47.7	292 48 53.0	Denver	12339.2	4.091286
	88 04 52.87	1277.1	246 31 07.0	66 34 22.2	Claremont	8213.1	3.914507
Olney schoolhouse tower 1879	38 43 41.77	1288.1	113 51 31.2	293 46 48.4	Denver	11925.8	4.076489
	88 05 11.93	288.3	187 42 14.0	7 43 22.0	Buffalo Mound	19492.5	4.289867
Flora schoolhouse spire [2] 1879	38 40 17.44	537.8	127 23 01.9	307 14 55.2	Holtzhausen	23624.5	4.373362
	88 28 40.31	974.7	244 13 32.9	64 23 31.3	Denver	25643.5	4.408977
Flora tall spire [2] 1879	38 40 12.91	398.1	128 58 13.4	308 50 29.2	Holtzhausen	23025.6	4.362211
	88 29 16.36	395.6	244 46 02.7	64 56 23.6	Denver	26490.1	4.423084
Effingham Catholic Church spire [2] 1883	39 07 29.49	909.4	277 42 02.1	97 49 49.8	Island Creek	17976.1	4.254695
	88 32 27.57	662.2	72 43 59.3	252 35 10.4	Mound	21113.2	4.324555
Farina Baptist Church [2] 1883	38 50 10.55	325.3	179 56 09.8	359 56 09.1	Mound	25745.1	4.410694
	88 46 25.04	604.0	299 48 14.5	119 51 14.3	Holtzhausen	7976.2	3.901796
Hill 1883	39 03 13.389	412.9	358 27 13.3	178 27 21.5	Sturgess	11607.2	4.064728
	89 06 15.609	375.3					
Henderson 1883	39 03 25.943	800.0	274 24 42.4	94 26 53.3	Hill	5011.9	3.700005
	89 09 43.428	1044.2	336 04 45.7	156 07 04.7	Sturgess	13114.8	4.117761
North base 1883	39 04 35.082	1081.8	310 09 54.8	130 11 13.0	Hill	3904.9	3.591611
	89 08 19.711	473.8	43 21 23.1	223 20 30.4	Henderson	2932.0	3.467159

[1] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

[2] No check on the position.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
South base, stone A, on third principal meridian (U. S. L. S.) 1883	39 03 26.875 89 08 19.037	828.7 457.7	89 11 44.6 179 33 31.0 277 57 57.4	269 10 51.5 359 33 30.6 97 59 15.2	Henderson North base Hill	2029.3 2103.4 2996.8	3.307347 3.322922 3.476656
Carlyle Catholic Church spire 1884	38 36 44.202 89 22 20.778	1363.0 502.7	43 37 24.3 112 52 40.9 173 58 03.6 269 17 27.7	223 34 33.3 292 39 56.4 353 56 37.4 89 18 39.6	Geoffrey Parkinson Hoile Bording	9623.7 32079.3 31592.9 2786.8	3.983342 4.506225 4.499590 3.445101
Breese Catholic Church spire 1881-2	38 36 31.990 89 31 44.353	986.4 1073.1	90 47 37.6 128 46 55.5 197 53 02.7 268 30 32.4 313 14 20.8	270 39 02.3 308 40 03.2 17 57 29.3 88 37 36.0 133 17 21.3	Berger Parkinson Hoile Bording Geoffrey	19982.2 20450.3 33415.1 16427.3 9619.2	4.3006430 4.3106989 4.5239432 4.2155673 3.9831409
Hanover Catholic Church spire 1880-1	38 33 13.106 89 32 15.994	404.1 387.3	74 59 56.7 108 26 30.6 141 17 38.0 273 21 35.1	254 46 14.6 288 18 15.3 321 11 05.6 93 24 55.1	Turkey Hill Berger Parkinson Geoffrey	33125.5 20254.9 24271.1 7787.2	4.5201626 4.3065306 4.3850892 3.8913825
Damiansville Church spire 1880-1	38 30 35.809 89 37 24.416	1104.2 591.5	81 18 16.3 133 43 52.2 253 52 56.8	261 07 46.6 313 38 49.4 73 59 28.9	Turkey Hill Berger Geoffrey	24805.6 16264.5 15866.0	4.3945501 4.2112398 4.2004681
Venedy Church tall brown tower, white spire 1880	38 23 48.126 89 38 48.686	1483.9 1181.3	111 24 42.5 157 48 25.0 225 30 29.4	291 15 06.0 337 44 15.1 45 37 53.4	Turkey Hill Berger Geoffrey	24144.2 25716.2 24228.0	4.382813 4.410206 4.384317
Trenton Lutheran Church spire[1] 1881	38 36 29.24 89 42 40.76	901.6 986.2	285 47 12 94 42 40	105 57 02 274 40 54	Geoffrey Berger	23800.6 4112.5	4.376588 3.614109
Lebanon Methodist Church spire 1880-1	38 36 14.731 89 48 50.167	454.2 1213.9	213 32 45.6 260 46 46.3 29 01 25.7 83 04 16.6	33 36 34.2 80 48 51.1 208 58 02.7 262 54 41.2	Parkinson Berger Turkey Hill Clarks Mound	15994.3 4902.3 16278.6 22492.0	4.2039665 3.6903966 4.2116166 4.3520273
Lebanon College chapel spire 1880-1	38 36 23.145 89 48 57.311	713.7 1386.7	214 34 55.7 264 00 24.0 28 03 22.0 82 21 23.3	34 38 48.8 84 02 33.2 208 00 03.4 262 11 52.3	Parkinson Berger Turkey Hill Clarks Mound	15876.3 5039.3 16423.9 22353.4	4.2007480 3.7023712 4.2154766 4.3493435
Shiloh Church spire 1880-1	38 33 34.120 89 53 52.932	1052.1 1281.6	148 50 13.1 221 26 31.1 244 42 59.4 3 26 40.3	328 46 06.7 41 33 28.6 64 48 12.9 183 26 25.9	Sugar Loaf Mound Parkinson Berger Turkey Hill	18426.7 24404.5 13452.9 9302.6	4.2654474 4.3874692 4.1288165 3.9686022
Belleville Catholic Church spire[1] 1871	38 30 38.04 89 59 16.75	1172.9 405.8	297 51 24.4 86 00 49.9	117 54 31.6 266 52 58.3	Turkey Hill Dreyer	8245.9 18382.0	3.916238 4.264392
Collinsville Baptist Church spire[1] 1871	38 40 11.45 89 59 26.88	353.0 649.8	34 33 30.6 157 20 24.2	214 30 32.3 337 19 46.3	Clarks Mound Sugar Loaf Mound	12191.9 3804.2	4.086070 3.580267
Centerville Church spire 1871	38 27 35.514 90 05 36.401	1095.0 882.7	116 56 36.1 188 41 38.3 263 48 39.5	296 52 41.0 8 42 30.5 83 55 42.8	Dreyer Clarks Mound Turkey Hill	10272.5 13419.8 16589.9	4.011676 4.127747 4.219844
Forder[1] 1873	38 30 39.614 90 17 31.425	1221.5 761.4	77 58 53.6 186 21 15.4	257 57 40.0 6 21 45.0	Kleinschmidt Insane Asylum	2929.1 10373.4	3.466734 4.015921
St. Louis:							
Standpipe 1871	38 40 13.571 90 12 30.214	418.5 730.4	29 02 39.06 39 44 20.30 90 49 42.59 117 34 33.28 258 46 48.68 272 24 35.44 298 02 21.40 309 58 50.82 357 20 25.95	208 58 17.42 219 41 41.85 270 42 37.08 297 31 54.27 78 54 20.38 92 31 48.41 118 08 15.82 130 04 01.43 177 20 48.33	Kleinschmidt Insane Asylum Morgan Minoma Sugar Loaf Mound American Bottom upper base American Bottom lower base Clarks Mound Dreyer	20934.45 9605.04 16463.22 6935.61 17803.20 16769.02 15561.49 15719.13 18745.25	4.3208615 3.9824991 4.2165148 3.8410844 4.2504982 4.2245078 4.1920511 4.1964284 4.2728911
Courthouse 1871	38 37 32.394 90 11 21.026	998.8 508.6	41 36 44.7 72 49 47.8 161 24 01.6 254 13 17.5 281 00 56.9 296 19 54.0	221 31 40.2 252 46 26.2 341 23 18.4 74 19 47.0 101 06 08.1 116 24 21.3	Kleinschmidt Insane Asylum Standpipe American Bottom upper base American Bottom lower base Clarks Mound	17828.6 8179.1 5244.0 15672.0 12287.3 11570.8	4.2511167 3.9127038 3.7196642 4.1951240 4.0894549 4.0633635

[1] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.							
St. Louis—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Second Presbyterian Church spire 1871	38 37 56.190	1732.6	36 51 19.0	216 46 47.6	Kleinschmidt	17578.1	4.2449718
	90 12 14.534	351.6	64 13 00.7	244 10 12.6	Insane Asylum	7240.6	3.8597775
			104 52 52.3	284 45 37.6	Morgan	17425.0	4.2411723
			138 46 08.3	318 43 19.6	Minoma	9902.4	3.9957385
			174 53 12.4	354 53 02.6	Standpipe	4253.1	3.6287093
			257 50 01.8	77 57 04.7	American Bottom upper base	16751.3	4.2240495
			282 59 03.7	103 04 48.2	American Bottom lower base	13706.0	4.1369112
			296 41 21.9	116 46 22.6	Clarks Mound	13056.5	4.1158273
St. John's Church 1871	38 38 08.461	260.9	295 35 16.7	115 40 52.6	Clarks Mound	14449.5	4.1598516
	90 13 11.005	266.2	352 52 32.6	172 53 20.4	Dreyer	14982.8	4.1755919
			32 25 18.8	212 21 22.7	Kleinschmidt	17112.7	4.2333188
			55 35 53.4	235 33 40.4	Insane Asylum	6245.8	3.7955874
Sacred Heart Convent 1871	38 34 43.886	1353.2	43 27 59.1	223 24 40.8	Kleinschmidt	11213.8	4.0497509
	90 14 11.288	273.2	126 56 37.7	306 55 02.5	Insane Asylum	4622.8	3.6649080
			193 30 52.9	13 31 56.0	Standpipe	10455.8	4.0193575
			269 43 24.6	89 49 38.0	Clarks Mound	14491.7	4.1611181
			338 48 13.9	158 49 39.3	Dreyer	9179.5	3.9628202
Marine Hospital 1871	38 35 13.007	401.1	45 24 36.1	225 20 40.4	Kleinschmidt	12870.0	4.1095797
	90 13 11.400	275.9	110 05 21.9	290 03 09.4	Insane Asylum	5477.1	3.7385473
			273 38 37.7	93 44 13.7	Clarks Mound	13068.3	4.1162184
			348 49 39.7	168 50 27.9	Dreyer	9639.6	3.9840606
Bohemian Church 1871	38 36 44.602	1375.3	81 39 00.6	261 36 15.0	Insane Asylum	6487.5	3.8120801
	90 12 18.710	452.6	177 31 43.3	357 31 36.1	Standpipe	6449.6	3.8095341
			287 15 51.7	107 20 54.9	Clarks Mound	12321.6	4.0906680
			357 14 41.6	177 14 56.9	Dreyer	12295.7	4.0897525
First Presbyterian Church 1871	38 37 53.156	1639.0	37 56 51.7	217 52 11.4	Kleinschmidt	17717.0	4.2483904
	90 12 00.020	0.5	66 01 29.6	245 58 32.4	Insane Asylum	7519.8	3.8762066
			170 25 51.2	350 24 32.3	Standpipe	4390.9	3.6425513
			297 01 34.5	117 06 26.1	Clarks Mound	12701.1	4.1038400
St. Francis Church 1871	38 34 48.784	1504.2	41 57 34.3	221 54 22.5	Kleinschmidt	11148.2	4.0472052
	90 14 22.041	533.4	127 24 52.4	307 23 23.8	Insane Asylum	4324.2	3.6359040
			195 06 20.3	15 07 30.1	Standpipe	10373.7	4.0159350
			270 18 48.0	90 25 08.0	Clarks Mound	14752.0	4.1688497
			337 39 28.6	157 41 00.6	Dreyer	9416.4	3.9738828
Holy Cross Church 1871	38 35 22.875	705.3	274 42 52.6	94 48 46.7	Clarks Mound	13792.7	4.1396490
	90 13 40.490	979.8	345 14 04.3	165 15 10.5	Dreyer	10094.4	4.0040806
			42 10 14.9	222 06 37.3	Kleinschmidt	12602.4	4.1004519
Centenary Methodist Church 1871	38 38 11.688	360.4	58 20 46.9	238 18 15.1	Insane Asylum	6913.0	3.8396685
	90 12 40.785	986.4	183 53 23.8	3 53 30.4	Standpipe	3767.0	3.5759914
			355 41 52.3	175 42 21.2	Dreyer	15009.0	4.1763526
Church, corner Manchester and Ballas Roads 1871	38 36 13.312	410.5	207 42 40.6	27 44 24.1	Morgan	8619.1	3.9354617
	90 26 36.969	894.6	250 02 21.0	70 11 09.7	Standpipe	21778.4	4.3380256
			269 52 05.7	89 58 15.7	Insane Asylum	14348.6	4.1568108
Church, corner Smith Street and Ballas Road 1871	38 37 57.634	1777.1	221 59 58.6	42 01 41.2	Morgan	5939.2	3.7737279
	90 26 35.565	860.2	258 20 18.6	78 29 06.6	Standpipe	20806.8	4.3194568
			282 32 22.2	102 38 31.5	Insane Asylum	14664.4	4.1662653
Tower, corner Grand Street and La Fayette Avenue 1871	38 36 58.897	1816.1	285 35 19.1	105 41 37.2	Clarks Mound	15230.3	4.1827089
	90 14 18.667	451.6	344 37 35.7	164 39 05.8	Dreyer	13193.6	4.1203638
			68 30 17.6	248 28 47.0	Insane Asylum	3779.0	3.5773760
Northwest corner [1] 1874	38 36 28.476	878.1	24 50 29	204 50 26	Tavern Rock	317.91	2.502310
	90 45 03.939	95.3					
Poleman's House [1] 1874	38 28 33.20	1023.8	189 28 11.0	9 29 04.4	Dieckhaus	12610.9	4.100747
	90 58 05.78	140.2	281 24 27.2	101 26 07.3	Halleck	3978.2	3.599687
Corner fifth meridian [1] 1874	38 28 37.95	1170.3	60 55 10	240 55 03	Poleman's House	301.31	2.47902
	90 57 54.92	1331.2					
Dutzow Catholic Church, east gable [1] 1874	38 35 33.08	1019.9	278 19 06.7	98 20 36.1	Dieckhaus	3504.1	3.544577
	90 59 03.32	80.2	25 29 38.7	205 26 42.5	Peters	15933.4	4.202309
St. Gertrude's Church 1874	38 29 50.196	1547.7	71 13 32.5	251 05 20.9	Jacobs	20242.5	4.306264
	91 02 59.827	1449.8	118 25 40.8	298 16 30.8	Berger	23888.8	4.378194
			140 19 53.2	320 16 39.9	Enoch Knob	11764.6	4.070578
Doermann Hill 1878	38 30 19.368	597.2	61 28 55.1	241 24 00.9	Geyer	13051.3	4.115654
	91 27 55.953	1355.8	134 11 40.5	314 07 27.4	Turnpike Bluff	13707.8	4.136968
			178 51 24.7	358 51 19.7	Gasconade	9682.6	3.985992
			235 27 34.1	55 34 05.5	Berger	18447.9	4.265946
			330 38 35.7	150 39 46.0	Winter	5589.4	3.747367

[1] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
L'Ours Creek spire [1]	38 30 35.10	1082.3	35 53 38.5	215 48 09.9	Kennedy	21894.9	4.340342
1879	91 56 55.54	1345.8	112 46 48.1	292 32 16.5	Medlock	36670.3	4.564314
Koeltztown spire	38 19 31.445	969.5	99 57 36.75	279 44 04.66	Belshe	32256.5	4.5086177
1879	92 02 29.450	715.4	119 52 56.03	299 50 55.24	Kennedy	5453.8	3.7366965
			163 41 14.40	343 37 24.16	Cedar	31890.2	4.5036576
			221 56 53.15	42 02 37.13	McDaniel	20089.7	4.3029735
			266 36 59.89	86 46 01.90	Pilot Knob	21261.7	4.3275985
Jefferson City capitol, rod on dome	38 34 46.970	1448.3	113 57 27.72	293 51 17.65	Medlock	15696.2	4.1957965
1879	92 10 20.392	493.6	225 47 19.19	45 48 22.05	Cedar	3402.2	3.5317576
Jefferson City, astronomic	38 33 41.161	1269.2	157 26 01.53	337 25 39.81	Jefferson City capitol	2197.5	3.3419289
1879	92 09 45.553	1103.1	199 55 34.35	19 56 15.47	Cedar	4681.7	3.6703979
California Church spire	38 38 00.610	18.8	5 20 51.53	185 20 13.59	High Point	15831.89	4.1995327
1879	92 33 58.858	1423.7	38 35 45.87	218 28 01.46	Hunter	28987.21	4.4622065
			90 49 30.46	270 43 27.91	Cole	14046.11	4.1475560
			292 28 46.73	112 29 29.43	Christian	1790.48	3.2529707
			313 39 21.83	133 44 40.81	Moreau	17125.08	4.2336326
			333 49 29.67	153 55 31.12	Belshe	31947.44	4.5044361
Tipton Church spire	38 39 17.953	553.6	278 37 54.79	98 46 32.51	Christian	20284.95	4.3071739
1879	92 46 39.559	956.6	296 44 26.67	116 46 19.09	Cole	4875.51	3.6880204
			316 54 35.60	137 01 51.95	High Point	24826.14	4.3949093
			359 09 28.68	179 09 38.15	Hunter	25063.29	4.3990381
Hunter latitude	38 25 45.210	1394.0	270	90	Hunter	6.43	0.80828
1880	92 46 24.637	597.6					
Sedalia Church spire	38 42 21.887	674.9	238 13 05.62	58 13 50.09	Heard	2020.96	3.3055567
1880	93 13 37.428	904.3	276 12 16.51	96 25 55.79	Hubbard	31868.80	4.5033657
			319 34 56.82	139 46 01.02	Hughes	39854.03	4.6004722
Green Ridge Congregational Church chimney [1]	38 37 04.13	127.3	72 03 02.7	251 56 56.1	High Point Tebo	14952.7	4.174721
1882	93 24 32.53	787.0	156 15 27.3	336 14 33.1	Kendrick	5215.5	3.717294
Lamont Campbellite Church spire [1]	38 46 39.36	1213.6	3 44 03.8	183 43 41.9	Kendrick	12991.1	4.113646
1882	93 25 24.39	588.7	89 25 23.1	269 20 33.3	Knob Noster	11169.7	4.048041
Tomlin's house, southeast chimney [1]	38 37 55.14	1700.2	55 45 33.8	235 41 39.4	High Point Tebo	10998.2	4.041321
1882	93 28 04.59	111.2	223 23 44.2	43 25 02.4	Kendrick	4406.0	3.644048
Shoemaker's house, cupola, lightning rod [1]	38 44 19.27	594.2	147 17 33.1	327 16 23.2	Knob Noster	4991.1	3.698200
1882	93 31 15.36	371.1	318 31 01.5	138 34 19.1	Kendrick	11533.5	4.061959
Windsor public school flagstaff [1]	38 31 44.13	1360.7	102 16 20.4	282 07 42.2	Caldwell	20602.4	4.313918
1882	93 31 30.87	747.7	142 00 24.7	321 58 39.2	High Point Tebo	6658.4	3.823370
Cooks Knob, ice house [1]	38 51 57.15	1762.2	13 02 51.5	193 01 51.8	Knob Noster	10182.4	4.007852
1882	93 31 31.86	768.2	57 21 35.2	237 13 36.0	Normal	21922.9	4.340899
Warrensburg Presbyterian Church spire	38 45 52.680	1624.4	4 10 08.44	184 09 27.41	Caldwell	21868.83	4.3398255
1883	93 44 16.769	404.8	89 08 48.68	268 56 19.67	Baker	28887.70	4.4607129
			120 47 02.33	300 34 59.99	Chapel Hill	32301.75	4.5092260
			265 16 38.57	85 23 37.92	Knob Noster	16220.47	4.2100634
			359 15 13.82	179 15 14.03	Normal	606.99	2.7831833
Hazel Hill [1]	38 53 42.09	1297.8	307 05 20.5	127 12 51.9	Knob Noster	21783.4	4.338126
1882	93 45 06.94	167.2	355 22 38.7	175 23 10.4	Normal	15130.7	4.179860
Centerview Cumberland Presbyterian Church, cupola [1]	38 44 32.64	1006.4	95 51 15.7	275 42 47.6	Baker	19702.1	4.294513
1883	93 50 41.34	998.4	135 44 46.5	315 36 45.5	Chapel Hill	26489.3	4.423071
Holden Methodist Church spire	38 42 56.102	1729.9	41 45 24.47	221 38 15.70	Hutton Mound	24973.27	4.3974754
1883	93 59 23.318	563.4	125 21 48.76	305 18 47.43	Baker	8579.30	3.9334521
			164 55 11.69	344 52 37.96	Chapel Hill	22712.79	4.3562705
			257 27 56.67	77 37 24.15	Normal	22431.00	4.3508486
			308 45 13.43	128 53 58.52	Caldwell	26103.81	4.4167040
Kingsville public school, cupola	38 44 36.602	1128.6	23 15 42.39	203 11 41.38	Hutton Mound	23663.98	4.3740878
1883	94 04 24.185	584.1	62 09 30.87	242 00 39.38	Fulton	23251.00	4.3664416
			188 10 51.69	8 10 58.64	Baker	1882.49	3.2747316
Hicks City Christian Union Church spire [1]	38 53 30.97	954.9	60 05 35.0	240 00 48.5	Thornton	12701.2	4.103844
1883	94 07 10.64	256.4	246 15 22.5	66 17 41.9	Chapel Hill	5844.8	3.766768

[1] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Thirty-ninth parallel—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Gunn City flouring mill, iron chimney [1] 1883	38 39 58.34 94 09 55.15	1798.9 1333.3	79 38 27.1 218 19 31.8	259 33 02.8 38 23 05.7	Fulton Baker	12763.9 13317.9	4.105984 4.124436
Staley Mound, Staley's house chimney 1883	38 42 15.391 94 12 07.268	474.6 175.6	55 07 09.32 165 06 10.84 241 27 44.74 353 52 05.65	235 03 07.43 345 04 30.73 61 32 41.42 173 52 53.79	Fulton Thornton Baker Hutton Mound	11410.8 14996.8 13032.1 17491.3	4.0573153 4.1759999 4.1150152 4.2428222
Austin Methodist Church spire [1] 1883	38 30 08.99 94 17 53.58	277.2 1298.4	176 26 41.5 243 56 45.2	356 26 16.1 64 01 09.0	Fulton Hutton Mound	15898.1 11414.6	4.201345 4.057461
Harrisonville, Cumberland Presbyterian Church spire 1883	38 39 14.918 94 21 00.613	460.0 14.8	108 11 29.0 135 30 36.2 171 35 54.9 285 15 49.6	287 58 55.0 315 22 45.0 351 34 15.4 105 17 21.0	Haskin Berry Bowler Fulton	30660.1 25924.2 26220.0 3666.5	4.486573 4.413706 4.418633 3.564256
Lees Summit South Methodist Church cupola [1] 1883	38 54 43.58 94 22 31.89	1343.8 768.4	307 24 05.7 31 09 18.2	127 28 57.4 211 08 35.7	Thornton Bowler	14111.4 3152.7	4.149569 3.498682
Raymore Hill, Butler's barn cupola [1] 1883	38 46 47.53 94 26 01.11	1465.6 26.8	195 51 12.9 249 17 05.2	15 52 41.7 69 24 07.6	Bowler Thornton	12487.7 17379.8	4.096484 4.240046
Independence courthouse high cupola or tower 1884	39 05 32.741 94 24 57.613	1009.7 1384.6	355 15 58.35 22 25 22.42 62 44 18.46	175 16 47.46 202 19 57.94 242 34 40.59	Bowler Berry Marty	22794.0 32639.3 24838.7	4.3578212 4.5137405 4.3951284
Kansas City:							
Catholic Cathedral, Eleventh Street between Broadway and Washington Streets 1884	39 06 03.118 94 35 20.437	96.2 491.1	273 31 36.5 324 26 47.9 355 16 08.7 29 52 35.9 79 49 21.0	93 38 09.4 144 34 08.9 175 17 16.1 209 49 30.3 259 33 44.4	Independence courthouse Bowler Berry Marty Eckman	14996.2 29051.1 31224.1 14233.6 36306.0	4.175980 4.463162 4.494490 4.153315 4.559978
Second Presbyterian Church spire 1884	39 05 55.813 94 35 13.448	1721.2 323.2	272 41 54.75 30 55 25.85 80 13 08.76	92 48 23.10 210 52 15.87 259 57 27.81	Independence courthouse Marty Eckman	14816.3 14124.3 36432.3	4.1707387 4.1499661 4.5614868
Astronomic 1882	39 05 50.40 94 35 22.16	1554.1 532.7					
Westport, College of the Redemptionist Fathers 1884	39 04 01.546 94 35 19.549	47.7 470.0	319 41 24.6 354 40 08.6 39 36 41.0	139 48 44.9 174 41 15.2 219 33 34.9	Bowler Berry Marty	26078.4 27487.7 11154.1	4.416281 4.439138 4.047434
State line 3, stake 1885	38 46 20.761 94 36 30.102	640.2 726.7	61 36 44.4 167 20 53.5 218 32 17.7	241 33 51.4 347 18 32.3 38 34 08.4	Haskin Marty Berry	7592.3 24716.8 6830.8	3.880372 4.392993 3.834472
Belton South Methodist Church spire 1884	38 48 32.756 94 31 49.882	1010.0 1203.5	60 17 46.1 116 55 47.0 148 46 25.9 233 29 49.6 313 19 22.9	240 11 57.4 296 54 41.9 328 41 08.7 53 34 57.2 133 27 40.6	Haskin Berry Marty Bowler Fulton	15481.2 2808.8 23451.5 14701.4 26444.8	4.189806 3.448518 4.370170 4.167359 4.422341
Missouri and Kansas State line 3, stone 1885	38 46 02.85 94 36 30.10	87.9 726.7	179 59 23.0	359 59 23.0	State line 3, stake	552.2	2.74207
State line 1 1885	38 53 01.80 94 36 28.69	55.5 691.6	328 59 26.0 22 47 35.0	149 01 16.0 202 44 41.0	Berry Haskin	8194.7 17329.3	3.913532 4.238782
Missouri and Kansas State line 1, Missouri stone [1] 1885	38 53 01.56 94 36 28.11	48.1 677.6	117 32 54.0	297 32 54.0	State line 1	15.8	1.19931
Base 1 [1] 1885	38 59 27.48 94 36 56.18	847.3 1352.1	345 31 14.0 88 17 00.0	165 33 20.9 268 14 55.0	Berry Marty	19536.9 4788.2	4.290856 3.680172
Base 2 [1] 1885	38 59 19.15 94 36 59.80	590.5 1439.3	198 43 06.0	18 43 08.0	Base 1	271.2	2.43336
State line 2 1885	38 59 10.30 94 36 29.52	317.6 710.5	110 31 44.0 129 32 31.0	290 31 25.0 309 32 14.0	Base 2 Base 1	778.2 832.2	2.89111 2.92022
Missouri and Kansas State line 2, stone 1885	38 59 10.39 94 36 29.49	320.4 709.8	11 08 31.0	191 08 31.0	State line 2	2.9	0.4617

[1] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Louisville connection.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Blocher	38 43 33.837	1043.4	111 35 15.60	291 20 55.58	Miller	35608.84	4.5515578
1914	85 39 15.877	383.5	205 00 56.02	25 03 47.52	Stout	15610.45	4.1934153
Finley	38 38 07.321	225.7	149 58 00.14	329 52 13.43	Miller	26696.15	4.4264487
1914	85 52 54.807	1325.6	227 22 05.76	47 33 29.61	Stout	35812.44	4.5540339
			242 58 10.12	63 06 41.93	Blocher	22207.96	4.3465086
Summit	38 34 15.852	488.8	135 40 23.82	315 37 23.91	Finley	9981.41	3.9991921
1886	85 48 06.444	156.0	216 39 57.45	36 45 28.81	Blocher	21462.62	4.3316828
Marysville	38 35 20.932	645.4	81 32 33.22	261 26 47.51	Summit	13567.75	4.1325077
1914	85 38 52.075	1260.3	104 11 50.22	284 03 04.32	Finley	21024.89	4.3227337
			177 50 00.87	357 49 46.00	Blocher	15209.71	4.1821210
O. & M.	38 29 00.278	8.6	130 15 56.43	310 11 00.59	Summit	15067.79	4.1780496
1884	85 40 11.497	278.7	189 18 01.27	9 18 50.75	Marysville	11893.86	4.0753229
Popp	38 25 14.301	441.0	184 03 19.35	4 03 49.79	Summit	16740.35	4.2237646
1914	85 48 55.348	1342.7	217 57 16.13	38 03 31.72	Marysville	23739.21	4.3754662
			241 12 29.15	61 17 54.91	O. & M.	14487.91	4.1610058
Lutz	38 24 34.310	1057.9	95 32 28.19	275 26 59.94	Popp	12875.57	4.1097669
1884	85 40 07.062	171.3	179 14 56.82	359 14 54.06	O. & M.	8201.57	3.9138971
Six Mile	38 22 37.953	1170.2	178 06 54.44	358 06 50.38	Popp	4823.43	3.6833556
1884	85 48 48.808	1184.7	226 44 29.60	46 49 51.14	O. & M.	17216.60	4.2359474
			254 08 04.39	74 13 28.42	Lutz	13160.02	4.1192566
Sims	38 20 35.973	1109.2	105 55 13.62	285 49 35.53	Six Mile	13750.91	4.1383314
1884	85 39 44.027	1069.2	175 39 03.70	355 38 49.40	Lutz	7370.05	3.8674702
Bangs	38 19 36.717	1132.1	212 47 08.86	32 48 40.88	Six Mile	6647.95	3.8226878
1879	85 51 17.115	415.8	263 44 44.46	83 51 54.29	Sims	16931.95	4.2287069
Blind Asylum	38 15 24.227	747.0	122 11 06.35	302 05 50.40	Bangs	14633.41	4.1653456
1879	85 42 47.242	1148.6	146 44 02.92	326 40 18.74	Six Mile	15999.81	4.2041149
			204 50 08.28	24 52 01.83	Sims	10593.06	4.0250216
Williams	38 10 24.695	761.4	196 44 43.75	16 46 54.29	Bangs	17775.95	4.2498327
1879	85 54 47.969	1167.6	242 09 37.93	62 17 03.78	Blind Asylum	19816.79	4.2970333
Cox	38 09 24.220	746.8	98 35 57.29	278 30 42.69	Williams	12533.44	4.0980701
1879	85 46 18.845	458.8	159 00 53.52	338 57 48.90	Bangs	20230.13	4.3059988
			204 51 50.71	24 54 01.59	Blind Asylum	12235.80	4.0876324
Louisville north base	38 13 29.002	894.3	326 05 53.97	146 08 02.74	Cox	9091.26	3.9586240
1879	85 49 47.122	1146.2	52 12 14.05	232 09 08.01	Williams	9267.16	3.9669467
Louisville south base	38 09 03.583	110.5	109 32 49.77	289 29 50.75	Williams	7483.76	3.8741201
1879	85 49 58.232	1417.9	181 53 28.93	1 53 35.80	Louisville north base	8188.057	3.9131808
			263 11 16.62	83 13 32.15	Cox	5379.29	3.7307253
Riley	38 05 30.379	936.7	117 28 28.99	297 21 05.38	Williams	19709.80	4.2946821
1879	85 42 49.556	1207.6	154 43 10.61	334 37 56.67	Bangs	28869.19	4.4604346
			180 10 33.87	0 10 35.30	Blind Asylum	18309.97	4.2626876
Potts	38 05 23.771	732.9	191 48 02.82	11 48 52.00	Williams	9478.78	3.9767523
1880	85 56 07.608	185.4	269 19 52.86	89 28 05.19	Riley	19448.31	4.2888818
Mountain Top	37 55 23.277	717.7	144 15 53.64	324 10 16.84	Potts	22821.92	4.3583522
1880	85 47 00.641	15.7	157 44 48.80	337 40 00.78	Williams	30037.61	4.4776654
			198 05 57.36	18 08 31.97	Riley	19694.81	4.2943519
Dobbins	37 52 45.983	1417.7	113 13 30.78	293 08 46.08	Mountain Top	12317.53	4.0905236
1883	85 39 17.189	420.1	167 36 58.78	347 34 48.08	Riley	24130.66	4.3825691
Keith	37 48 01.841	56.8	152 03 08.18	332 00 06.69	Mountain Top	15410.29	4.1878107
1883	85 42 04.937	120.8	205 04 30.72	25 06 13.63	Dobbins	9673.01	3.9855618
Jackson	37 56 43.903	1353.6	31 38 32.68	211 36 39.05	Dobbins	8614.80	3.9352454
1883	85 36 12.256	299.3	149 11 44.26	329 07 39.56	Riley	18905.07	4.2765783
White Lick	37 51 41.882	1291.3	64 07 34.52	244 01 44.46	Keith	15518.66	4.1908542
1882	85 32 34.189	835.8	101 22 46.87	281 18 39.48	Dobbins	10046.17	4.0020004
			150 14 36.60	330 12 22.63	Jackson	10727.95	4.0305169
Willett	37 41 37.409	1153.3	128 17 43.34	308 11 27.31	Keith	19147.30	4.2821074
1883	85 31 50.687	1241.8	176 44 03.29	356 43 36.64	White Lick	18666.59	4.2710651
Thompson	37 37 36.327	1120.0	148 04 32.63	327 59 32.06	Keith	22731.70	4.3566318
1883	85 33 53.594	1314.2	202 03 10.88	22 04 25.97	Willett	8019.84	3.9041659
Burkett	37 46 36.074	1112.2	57 00 23.11	236 54 29.29	Willett	16887.06	4.2275540
1883	85 22 12.568	307.6	121 51 25.54	301 45 04.38	White Lick	17889.90	4.2526079
Rohan	37 41 09.220	284.2	97 02 21.75	276 59 25.51	Willett	7116.10	3.8522422
1883	85 27 02.419	59.3	120 00 22.01	299 51 09.56	Keith	25496.91	4.4064876
			157 25 39.37	337 22 16.15	White Lick	21127.76	4.3248535
			215 08 02.72	35 11 00.10	Burkett	12325.68	4.0908110

GEOGRAPHIC POSITIONS—Continued.

Louisville connection—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Principal points—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Ferriell	37 37 25.342	781.3	91 46 09.30	271 41 30.24	Thompson	11214.32	4.0497730
1883	85 26 16.488	404.4	133 31 10.98	313 27 46.80	Willett	11291.31	4.0527442
			170 44 21.83	350 43 53.77	Rohan	6993.34	3.8446848
			199 22 03.89	19 24 33.06	Burkett	17999.89	4.2552698
Penick	37 33 18.697	576.4	105 58 06.79	285 47 02.04	Ferriell	27796.15	4.4439847
1883	85 08 06.736	165.3	117 36 31.10	297 24 57.84	Rohan	31402.38	4.4969626
			133 32 28.39	313 17 30.83	White Lick	49485.36	4.6944768
			139 55 53.72	319 47 16.87	Burkett	32156.95	4.5072748
Supplementary points.							
Haystack	38 25 14.272	440.1	184 03 53.56	4 04 24.07	Summit	16741.46	4.2237934
1884	85 48 55.466	1345.5	241 12 37.27	61 18 03.10	O. & M.	14490.85	4.1610939
Bartle	38 30 21.028	648.4	217 06 17.15	37 08 38.15	Summit	9081.20	3.9581434
1886	85 51 52.750	1278.1	278 16 29.06	98 23 45.55	O. & M.	17175.42	4.2349073
			335 32 48.69	155 34 38.96	Haystack	10389.34	4.0165881
Anchorage[1]	38 16 40.379	1245.1	80 25 32.0	260 19 39.2	Blind Asylum	14045.5	4.147537
1880	85 33 17.599	427.8	127 45 49.5	307 41 49.9	Sims	11870.5	4.074470
Jeffersonville, Government tower[1]	38 17 00.199	6.1	115 50 53.3	295 46 38.8	Bangs	11083.1	4.044063
1880	85 44 26.478	643.5	148 33 47.0	328 31 04.3	Six Mile	12208.7	4.086668
New Albany Second Presbyterian Church[1]	38 17 03.779	116.5	146 53 55.9	326 52 37.4	Bangs	5629.9	3.750498
1880	85 49 10.536	256.1	182 55 48.8	2 56 02.3	Six Mile	10317.2	4.013563
New Albany waterworks tower[1]	38 16 53.922	1662.6	165 01 00.6	345 00 26.3	Bangs	5196.3	3.715693
1880	85 50 21.807	530.0	192 00 48.0	12 01 45.7	Six Mile	10845.5	4.035249
Louisville:							
St. Martin's Church[1]	38 14 43.761	1349.3	241 19 09.1	61 20 07.2	Blind Asylum	2600.4	3.415042
1880	85 44 21.074	512.5	16 13 38.3	196 12 25.5	Cox	10260.6	4.011172
Cave Hill Cemetery[1]	38 14 37.221	1147.7	218 35 57.9	38 36 27.4	Blind Asylum	1854.6	3.268244
1880	85 43 34.830	847.0	22 28 49.8	202 27 08.4	Cox	10443.3	4.018837
Bonifacius Church[1]	38 15 04.125	127.2	256 54 49.5	76 55 57.5	Blind Asylum	2739.3	3.437644
1880	85 44 36.984	899.3	13 18 48.9	193 17 45.9	Cox	10769.3	4.032186
Christ Church[1]	38 15 07.345	226.5	261 40 17.3	81 41 48.0	Blind Asylum	3598.9	3.556168
1880	85 45 13.703	333.2	8 31 33.3	188 30 53.0	Cox	10697.6	4.029284
St. Paul's Church	38 15 06.651	205.1	5 12 49.7	185 12 25.2	Cox	10601.9	4.025383
1880	85 45 39.274	955.0	63 28 44.0	243 26 10.6	Louisville north base	6737.6	3.828507
			135 26 00.1	315 22 30.7	Bangs	11694.0	4.067962
			262 36 11.2	82 37 57.7	Blind Asylum	4217.7	3.625080
Catholic Cathedral	38 15 06.791	209.4	6 11 09.7	186 10 40.6	Cox	10624.2	4.026296
1880	85 45 31.823	773.8	64 07 10.6	244 04 32.6	Louisville north base	6902.1	3.838983
			134 47 39.1	314 44 05.1	Bangs	11818.8	4.072572
			262 20 03.0	82 21 44.9	Blind Asylum	4037.6	3.606120
Baptist Church	38 15 04.837	149.2	6 45 27.7	186 44 56.1	Cox	10575.5	4.024302
1880	85 45 27.732	674.3	64 55 22.8	244 52 42.3	Louisville north base	6966.0	3.842984
			134 39 49.1	314 36 12.6	Bangs	11931.8	4.076707
			261 16 32.5	81 18 11.9	Blind Asylum	3947.7	3.596343
Second Presbyterian Church[1]	38 14 41.085	1266.8	249 56 48.6	69 58 21.5	Blind Asylum	3881.8	3.589029
1880	85 45 17.219	418.7	8 43 51.5	188 43 13.4	Cox	9884.2	3.994942
Broadway Baptist Church	38 14 45.102	1390.7	9 52 22.7	189 51 39.0	Cox	10042.2	4.001829
1880	85 45 08.121	197.5	135 06 26.1	315 02 37.4	Bangs	12699.1	4.103773
			250 35 14.3	70 36 41.5	Blind Asylum	3631.7	3.560109
German Methodist Church	38 15 12.198	376.1	13 44 53.5	193 43 46.8	Cox	11045.1	4.043171
1880	85 44 31.029	754.5	129 36 24.8	309 32 13.2	Bangs	12802.8	4.107305
			261 37 47.0	81 38 51.3	Blind Asylum	2550.6	3.406638
Waterworks tower	38 16 49.856	1537.2	21 34 01.2	201 33 34.6	Blind Asylum	2838.9	3.453154
1880	85 42 04.320	105.0	111 00 23.7	290 54 41.2	Bangs	14383.2	4.157856
			206 02 27.1	26 03 54.1	Sims	7760.5	3.889889
Courier-Journal office, pole[1]	38 15 10.430	321.6	6 58 00.9	186 57 27.7	Cox	10753.9	4.031567
1880	85 45 25.268	614.4	63 52 01.2	243 49 19.1	Louisville north base	7094.6	3.850925
Malt House elevator[1]	38 14 43.406	1338.4	56 28 50.0	76 31 03.5	Blind Asylum	5391.1	3.731678
1880	85 46 22.833	555.2	359 26 04.8	179 26 07.3	Cox	9841.9	3.993077
City Hall[1]	38 15 15.808	487.4	266 24 12.5	86 25 58.1	Blind Asylum	4154.7	3.618541
1880	85 45 37.788	918.8	5 16 05.9	185 15 40.5	Cox	10886.4	4.036883

[1] No check on this position.

GEOGRAPHIC POSITIONS—Continued.

Louisville connection—Continued.

Station	Latitude and longitude	Seconds in meters	Azimuth	Back azimuth	To station	Distance	Logarithm
Supplementary points—Contd.							
Louisville—Continued.	° ′ ″		° ′ ″	° ′ ″		*Meters*	
Church of the Messiah [1] 1880	38 14 38.523	1187.8	250 21 41.9	70 23 22.5	Blind Asylum	4195.8	3.622816
	85 45 29.777	724.1	7 01 39.8	187 01 09.4	Cox	9764.1	3.989632
Stuart Robinson Church, highest spire [1] 1880	38 14 43.905	1353.8	251 12 33.9	71 14 07.0	Blind Asylum	3862.2	3.586834
	85 45 17.627	428.7	8 35 55.2	188 35 17.3	Cox	9968.7	3.998638
Cedar Glade 1883	37 59 58.167	1793.4	8 12 11.9	188 11 16.4	White Lick	15459.0	4.189181
	85 31 03.952	96.4	51 30 30.6	231 27 20.9	Jackson	9617.6	3.983068
Mount Washington Church spire 1883	38 02 58.581	1806.3	336 36 41.6	156 37 42.3	Cedar Glade	6060.1	3.782480
	85 32 42.550	1037.5	359 26 19.8	179 26 24.9	White Lick	20864.6	4.319411
			23 54 28.4	203 52 19.3	Jackson	12634.4	4.101556
			107 36 19.0	287 30 04.7	Riley	15518.4	4.190847
Bardstown Junction Methodist Church spire [1] 1883	37 56 25.459	784.9	331 49 50.7	151 50 50.3	Britts Knob	5019.5	3.700659
	85 41 58.470	1427.7	26 39 10.7	206 38 40.6	Indian Knob	2669.5	3.426426
Dry Knob 1883	37 55 52.731	1625.6	151 21 29.6	331 17 23.7	Riley	20299.7	4.307490
	85 36 10.251	250.3	178 13 20.8	358 13 19.6	Jackson	1578.5	3.198237
			325 39 54.7	145 42 07.4	White Lick	9363.9	3.971455
Indian Knob 1883	37 55 08.073	248.9	299 44 47.1	119 46 16.9	Britts Knob	4108.8	3.613714
	85 42 47.497	1160.1	310 25 57.1	130 28 06.3	Dobbins	6752.2	3.829447
			94 21 26.8	274 18 51.2	Mountain Top	6200.7	3.792442
Britts Knob 1883	37 54 01.925	59.3	326 08 03.7	146 08 43.2	Dobbins	2819.6	3.450185
	85 40 21.481	524.8	104 27 35.3	284 23 30.0	Mountain Top	10068.0	4.002944
Lebanon Junction Knob [1] 1883	37 50 14.165	436.7	260 08 04.4	80 14 36.9	White Lick	15871.0	4.200604
	85 43 13.860	338.9	337 32 35.6	157 33 17.9	Keith	4414.2	3.644855
Bardstown Catholic Church spire 1883	37 48 37.814	1165.8	292 47 31.5	112 51 14.9	Burkett	9676.3	3.985709
	85 28 17.091	418.0	352 27 50.1	172 28 35.8	Rohan	13950.6	4.144593
			21 59 19.3	201 57 08.6	Willett	13976.2	4.145390
Loretto Convent spire [1] 1883	37 39 51.206	1578.6	37 46 38.5	217 45 11.7	Ferriell	5688.6	3.755003
	85 23 54.384	1332.9	117 34 43.4	297 32 48.5	Rohan	5197.9	3.715827
Gethsemane La Trappe Monastery spire 1883	37 39 53.475	1648.6	177 17 10.9	357 17 07.1	Willett	3207.9	3.506220
	85 31 44.488	1090.3	251 18 33.3	71 21 25.7	Rohan	7296.1	3.863091
			299 33 57.5	119 37 17.8	Ferriell	9247.6	3.966028
Buzzards Roost [1] 1883	37 39 29.648	914.0	283 40 15.0	103 46 45.8	Ferriell	16152.1	4.208230
	85 36 56.491	1384.6	307 54 29.4	127 56 21.1	Thompson	5684.4	3.754681
New Hope Distillery smokestack [1] 1883	37 38 02.631	81.1	220 39 25.4	40 41 28.6	Rohan	7584.8	3.879943
	85 30 24.103	591.0	280 42 01.2	100 44 32.4	Ferriell	6179.6	3.790962
Chicago Catholic Church spire 1883	37 37 33.339	1027.8	69 11 59.5	249 11 43.3	Ferriell	694.2	2.841511
	85 25 50.024	1226.7	130 26 04.7	310 22 24.3	Willett	11609.0	4.064794
			165 04 36.1	345 03 51.9	Rohan	6888.1	3.838099
St. Charles Catholic Church spire [1] 1883	37 35 38.915	1199.7	111 37 59.3	291 34 33.1	Ferriell	8911.2	3.949938
	85 20 38.696	949.3	137 17 56.4	317 14 02.1	Rohan	13863.8	4.141883
Lebanon Catholic Church spire [1] 1883	37 34 05.711	176.1	110 33 39.0	290 26 49.7	Ferriell	17570.6	4.244787
	85 15 05.625	138.0	126 40 00.3	306 32 42.7	Rohan	21895.7	4.340359

[1] No check on this position.

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 directions 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 note 8 consists of a disk and shank, as shown in illustration No. 4 of Special Publication No. 19, made of brass and cast in one piece. The disk is 90 millimeters in diameter, with a small hole at the center surrounded by a 20-millimeter 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 millimeters in diameter and 80 millimeters 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.

The standard disk reference mark referred to in note 8 is similar to the standard disk triangulation station mark described above, except that the center of the disk is inscribed with an arrow instead of with the triangle and that the words "reference mark" replace the words "triangulation station" in the legend. A short perpendicular groove across the shank of the arrow indicates the point to which the measurements are made. The mark is set so that the arrow points toward the station.

NOTES REGARDING STATION AND REFERENCE MARKS.

NOTE 1.—The station is marked by a cross in the top of a sandstone or limestone post about 6 inches square and 30 inches long projecting 4 to 6 inches above the ground. The letters U S are inscribed in the face of the post. The underground mark is the apex of an earthenware pyramid about 30 inches below the ground. The pyramid is about 10 inches on an edge and has on one face the raised letters U. S. C. S.

NOTE 2.—Same as note 1 except that the underground pyramid is 6 inches on an edge and that the post of the surface mark is of white marble inscribed with the letters U S C & G S. In addition there are two or three reference posts also of white marble but slightly smaller than the post marking the station with an arrow in the top of each pointing toward the station. The distance and azimuth to each of these reference posts are given in the description.

NOTE 3.—Same as note 1 except that the post is marked with the letters U. S. C. S. and the underground mark is a bottle filled with ashes instead of the earthenware pyramid. Two other stone posts, slightly smaller than the one marking the station, are respectively 5 feet north and 5 feet south of the station and in the top of each there is an inscribed diagonal cross with an arrowhead at the end of one diagonal pointing toward the station.

NOTE 4.—The station is marked by two stone posts, one at the surface of the ground and the other 3 feet deep directly below the surface mark. Both posts are in an upright position. This type of marking was employed by the United States Engineers.

NOTE 5.—The station is marked by a pine stub about 4 inches square surrounded by a small mound of earth. The underground mark is an earthenware pyramid, measuring 10 inches on each of its edges and having on one face the raised letters U. S. C. S., set about 2½ feet below the surface of the ground.

NOTE 6.—The station is marked by a cross in the top of a stone post 6 inches square and 30 inches long inscribed with the letters U. S. C. & G. S. It is also marked by a bottle set in cement about 2½ feet below the ground. Four other stone posts 6 inches square and 30 inches long are respectively north, east, south, and west from the station at distances given in the description. The top of each of the reference posts is marked with a diagonal cross with an arrowhead at the end of one diagonal pointing toward the station.

NOTE 7.—The station is marked by a nail set in concrete at the center of the top of a tile 6 inches in diameter and 2 feet long. The tile is filled with concrete and is set flush with the surface of the ground. The underground mark is an earthenware pyramid set about 2½ or 3 feet below the surface. There are four reference marks similar to the surface mark at the station, except the tiles are only 4 inches in diameter. They are north, east, south, and west from the station at distances given in the description.

NOTE 8.—The station is marked by a standard disk station mark set in the top of a block of concrete 16 inches square at the bottom, 14 inches square at the top, and 2 feet long, projecting about 6 inches above the ground. The underground mark is similar to the surface mark except that the block of concrete is only 10 inches square and 10 inches deep. It is about 2 feet below the surface of the ground and about 6 inches of soil separates it from the surface mark. Each of the two reference marks consists of a standard disk reference mark set in the top of a block of concrete 6 inches square and 2 feet long set flush with the surface of the ground. The arrow on the disk of each reference mark points toward the station.

NOTE 9.—The marking of the station is the same as described in note 6 except that the underground mark is an earthenware pyramid with edges about 6 inches long marked with the raised letters U. S. C. S. The reference marks are the same as described in note 6 but there are only three of them instead of four.

NOTE 10.—The station is marked by a limestone post 2 feet in length and dressed to 5 inches square at the top inscribed with a cross and the letters U. S. C. & G. S. It is also marked 2 feet below the surface of the ground by a copper wire set in cement in the mouth of a black bottle which in turn is set at the center of a 10-inch tile filled with concrete. There are three reference marks each consisting of a stone similar to the one marking the station, except that the top is inscribed with a diagonal arrow pointing toward the station.

NOTE 11.—The station is marked by a half-inch drill hole in the upper surface of a small bowlder which projects slightly above the surface of the ground. The underground mark is the center of the mouth of a stone jug 5 inches in diameter and 11 inches high 1 foot below the ground. There is a pile of stones over the station mark.

THIRTY-NINTH PARALLEL.

PRINCIPAL POINTS.

Briery (Pocahontas County, W. Va., A. T. M., 1880).—In the southwestern part of the county about 4 miles west of Hillsboro on the highest part of a peak known locally as Briery Knob, a part of the large dividing ridge between the Greenbrier and Gauley Rivers. The station is at the eastern end of the knob about 50 meters west of a clump of pines. It is marked by a cross in the top of a copper bolt set in solid bedrock about 2 feet below the surface of the ground and by a cross in the top of a marble post 6 inches square and 30 inches long which projects a few inches above the ground. The top of the post is inscribed with the letters U. S. C. S. There are four reference marks near the station at the following distances and directions: 2.14 meters north, 2.13 meters east, 2.15 meters south, and 2.14 meters west. The north and south marks consist of iron bolts set in drill holes in bedrock about 18 inches below the ground. A large bowlder with a drill hole in its upper surface is directly above each bolt. The east and west reference marks consist of marble posts 6 inches square and 30 inches long each marked with a diagonal cross and an arrow head pointing toward the station.

Keeney (Summers County, W. Va., A. T. M., 1880).—About 4 miles northwest of Alderson station on the Chesapeake & Ohio Railway, on the extreme northern and highest part of Keeney Mountain. The station is marked according to note 6.[1] The reference marks are located as follows: 2.15 meters north, 2.17 meters east, 2.11 meters south, and 2.15 meters west.

Beech (Greenbrier County, W. Va., A. T. M., 1880).—About 11 miles northeast of Snow Hill post office and 4 miles north of the house of Albert G. Williams, on the highest point of Beech Knob. The station is marked by a cross in the top of a rough sandstone post 6 inches square and 2 feet long. There are four reference marks, each consisting of a rough sandstone post marked with a drill hole, at the following distances and directions from the station: 2.10 meters north, 2.08 meters east, 2.13 meters south, and 2.16 meters west.

Summersville (Nicholas County, W. Va., A. T. M., 1880).—On a ridge about 1 mile west of Summersville and very nearly in the prolongation of the main street of the town. The station is marked according to note 6,[1] except that there are no letters cut in the top of the post. The reference marks are at the following distances and directions from the station: 2.14 meters north, 2.22 meters east, 2.13 meters south, and 2.10 meters west. A large lone tree, visible for 40 miles, is 4.69 meters from the station in azimuth 174° 40′ and is marked with a spike. Two stumps marked with spikes are respectively 4.27 meters from the station in azimuth 330° 17′ and 6.34 meters in azimuth 141° 51′.

Ivy (Raleigh County, W. Va., A. T. M., 1881).—On the highest point of Ivy Knob, one of the peaks of the Cherry Pond Mountains, near the corner of Wyoming and Boone Counties. The station is marked according to note 6 [1] with the exception that the underground mark is an iron spike set with cement in a drill hole in solid bedrock 18 inches below the surface of the ground. The reference marks are at the following distances and directions from the station: 2.15 meters north, 2.13 meters east, 2.12 meters south, and 2.12 meters west. There is a drill hole 4 inches deep in bedrock directly under both the east and south reference posts.

Table rock (Kanawha County, W. Va., A. T. M., 1881).—On the range of hills near the headwaters and between the two forks of Lens Creek which flows into the Kanawha River at Brownstown. The station is on a long ridge, very narrow and steep, and is just above Tea Table Rock. It is marked according to note 6.[1] The reference marks are at the following distances and directions from the station: 2.14 meters north, 2.15 meters east, 2.12 meters south, and 2.13 meters west.

Holmes (Kanawha County, W. Va., A. T. M., 1881).—About 8½ miles by road from Charleston on top of a hill of the ridge forming the divide between Coopers Creek which flows into Elk River and Two Mile Creek which flows into the Kanawha River. The station is on land belonging to S. W. Gibson near the property lines of Marshall P. Holmes and Mason Guthrie. Holmes's house is about one-half mile southwest of the station at the head of the left fork of Two Mile Creek. The station is marked according to note 6.[1] The reference marks are at the following distances and directions from the station: 2.12 meters north, 2.12 meters east, 2.01 meters south, and 2.04 meters west.

Piney (Cabell County, W. Va., A. T. M. 1883; 1891).—On a ridge near Putnam County line about 2 miles northwest of Hurricane Station on the Chesapeake & Ohio Railway. The station was marked originally by an earthenware pyramid 2 feet below the ground with a hexagonal concrete pier built over it. As the pier was built a spike was inserted in the concrete about every 12 inches in height directly above the apex of the pyramid. The pier was found broken off at the surface of the ground in 1891 but by digging down about 6 inches one of the spikes at the center of the pier was found. The station was then re-marked by building a dome of concrete 2 feet in diameter and about 1 foot high on the old foundation and inserting a spike at the center directly above the old spike. The letters U. S. C. & G. S. were

[1] See p. 25.

inscribed in the dome. Four reference marks, consisting of concrete blocks 8 inches square and about 2 feet long, are at the following distances and directions from the station: 1.90 meters north, 1.80 meters east, 1.81 meters south, and 1.84 meters west. A concrete pier used in making time observations in 1883 is 13.64 meters north of the station.

Pigeon (Lincoln County, W. Va., A. T. M., 1883).—On a high ridge at the head of Middle Creek which flows into Mud River about 3½ miles from Hamlin. The station is about 7 miles by road from Hamlin and is on land belonging to Tom Huffman. It is marked according to note 6.[1] The reference marks are at the following distances and directions from the station: 2.76 meters north, 2.76 meters east, 2.76 meters south, and 2.75 meters west.

Big Rocks (Kanawha County, W. Va., A. T. M., 1881; 1891).—On the highest point of Big Rocks Hill, about 5¾ miles in a southwesterly direction from St. Albans. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.86 meters north, 1.50 meters east, 1.88 meters south, and 1.79 meters west.

Simms (Putnam County, W. Va., W. B. F., 1891).—On the west side of the Kanawha River on the highest point of the first river hill about 2 miles north or down the river from Scary. The station is on land belonging to Robert Simms and is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.78 meters north, 2.29 meters east, 1.81 meters south, and 2.09 meters west.

Coal (Kanawha County, W. Va., W. B. F., 1893).—On a sharp rocky point, the highest point of the ridge known as Indian Creek Hills, about 2 miles south of St. Albans. The station is on land belonging to Mr. Vickers and is marked according to note 7,[1] with the exception of the reference marks. There are only three reference marks, each consisting of a 1-inch drill hole 6 inches deep in solid bedrock, and they are at the following distances and azimuths from the station: 5.35 meters, 3° 38′, 2.93 meters, 163° 34′, and 3.96 meters, 212° 20′.

Rogers (Kanawha County, W. Va., W. B. F., 1893).—On a sharp rocky peak with a small top, on land belonging to L. R. Rogers on the west side of the Coal River about one-half mile from St. Albans. The station is marked by a nail set in concrete at the center of the top of a tile 6 inches in diameter, which is filled with concrete. The underground mark is a cross in the top of a copper bolt set in bedrock 15 inches below the surface of the ground. In each of the directions north, east, and south there is a drill hole in bedrock and west of the station there is a 4-inch tile filled with concrete. They are at the following distances from the station: 3.96 meters north, 3.41 meters east, 1.70 meters south, 2.02 meters west.

Ryan (Kanawha County, W. Va., W. B. F., 1892).—On a small rounded hill on the land of Pat Ryan, the highest point of his farm on the north side of the Kanawha River about 2 miles northeast of the town of St. Albans. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.81 meters north, 1.83 meters east, 1.84 meters south, and 1.83 meters west.

St. Albans east base (Kanawha County, W. Va., W. B. F., 1893).—About 2 miles east of the railway station at St. Albans in the southeast corner of a large field belonging to Samuel Shrewsberry about 50 meters west of the west bank of Swindlers Creek and 18.3 meters north of the north rail of the main line of the Chesapeake & Ohio Railway. The station is marked by a small hole in the top of a copper bolt set in the top of a limestone block or post 18 inches square and 4 feet long. The upper end of the block, which projects 1 foot above the ground is cut in a conical form. The block rests on a concrete foundation 4 feet square and 1 foot thick with a hole 9 inches square at the center to give access to the underground mark which consists of a copper bolt marked with a cross and small drill hole set in the top of another limestone post 6 inches square and 2 feet long, 4 feet below the surface of the ground.

St. Albans west base (Kanawha County, W. Va., W. B. F., 1893).—In the fence line on the west side of First Street, St. Albans, 17.85 meters in a northerly direction from the north rail of the Chesapeake & Ohio Railway at a point 268 meters east of the west face of the eastern abutment of the railway bridge over the Coal River. Daniel J. Lewis owns the property just west of First Street and the station is on his east property line. The station is marked the same as *St. Albans east base* described above.

Davis (Cabell County, W. Va., A. T. M., 1883).—About 9 miles by road from Huntington on the ridge forming the divide between Davis Creek and Four Mile Creek. The station is marked by a spike in the top of a concrete post 1 foot square and about 3 feet long which projects 10 inches above the surface of the ground. It is also marked by an earthenware pyramid 3 feet below the ground. The reference marks are four concrete piers at the following distances and directions from the station: 1.86 meters north, 1.86 meters east, 1.88 meters south, and 1.88 meters west. A large pine tree marked with a cross and a spike is 7.97 meters nearly north of the station and an oak tree marked with a spike is 4.75 meters northwest. The marked pine tree, the north and south reference marks, and the station are in range.

Gebhardt (Cabell County, W. Va., A. T. M., 1883).—On Union Ridge about 4 miles from La Sage's Landing on the Ohio River and about 150 meters south of the house of John Gebhardt. The station is markd according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.81 meters north, 1.81 meters east, 1.85 meters south, and 1.80 meters west.

Wray (Lawrence County, Ohio, A. T. M., 1884).—About 16 miles from Huntington, W. Va., and 2½ miles east of Marion post office, on Johnsons Ridge about 250 meters west of the old John Johnson house, which is owned by W. C. Wray. The station is on the highest part of the hill about 50 yards north of the road along the top of the ridge. It is marked according to note 7,[1] except that the tile of the station mark is only 4 inches in diameter. The reference marks are at the following distances and directions from the station: 1.81 meters north, 1.82 meters east, 1.83 meters south, and 1.80 meters west.

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[1] See p. 35.

Oakland (Boyd County, Ky., A. T. M., 1884).—On the highest part of the wooded hill at the headwaters of Chadwicks Creek, on land belonging to Thomas Galligher and only a few feet from the line fence between his property and that of James L. Rucker. The station is marked according to note 7,[1] except that the tile of the station mark is only 4 inches in diameter. The reference marks are at the following distances and directions from the station: 1.82 meters north, 1.83 meters east, 1.53 meters south, and 1.85 meters west.

Fradd (Lawrence County, Ohio, A. T. M., 1884).—On a hill bare of trees near the line between Lawrence and Aid Townships about 3 miles from Marion and about 1 mile west of a schoolhouse on the hill. The station is about 100 meters south of the road from Marion to Vesuvius Furnace, on land belonging to Charles Fradd who lives in a hollow about one-third of a mile southwest of the station. It is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 2.33 meters north, 1.83 meters east, 1.98 meters south, and 1.83 meters west.

Buena Vista (Greenup County, Ky., A. T. M., 1884).—On the highest point of a narrow ridge, known locally as High Knob, about 2½ miles east of Hunnewell furnace and just to the left of the county road to the old Buena Vista furnace at the point where the road crosses the ridge. The station is marked by a spike in the top of a concrete pier which extends about 4½ feet above the surface of the ground. As the pier was built a spike was inserted at the center at the following heights: Six inches below the ground and 6 and 15 inches below the top of the pier. Any one of these spikes will give the true location of the station. The underground mark is an earthenware pyramid 3 feet below the surface. There are four reference marks as follows: A nail in the top of a concrete pier 6 inches square and 2 feet long set flush with the surface of the ground 2.18 meters east and a similar mark 2.13 meters west, and a nail in the top of an oak stub 2.38 meters north, and a similar mark 2.45 meters south. A blazed stump marked with a triangle of nails is 5.88 meters from the station.

Gould (Scioto County, Ohio, A. T. M., 1885).—On a wooded hill east of the Ohio River about 1½ miles from Franklin furnace landing, three-fourths mile from Powellsville, and about one-half mile from Junior furnace. The station is marked according to note 7 [1] with the exception that the west reference mark consists of a brass bolt driven into an oak stump and surrounded by a triangle of nails. The reference marks are at the following distances and directions from the station: 1.85 meters north, 1.76 meters east, 1.86 meters south, and 1.76 meters west.

Howland (Greenup County, Ky., A. T. M., 1885).—Between Tygarts Creek and Shultz Creek and between the right and left forks of Beechy Creek, about 3½ miles west of Liberty post office on a point of land belonging to James Howland, about 400 meters northwest of his house and about 100 meters west of the main county road from Shultz Creek to the mouth of Brushy Creek. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.97 meters north, 1.84 meters east, 1.81 meters south, and 1.86 meters west.

Scioto (Scioto County, Ohio, A. T. M., 1885).—On land belonging to George Davis, about 1½ miles west of his distillery, which is on the west side of the Scioto River about 1½ miles northwest of Portsmouth. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.92 meters north, 1.91 meters east, 1.88 meters south, and 1.86 meters west.

Cave (Greenup County, Ky., A. T. M., 1885).—On the ridge forming the divide between Leatherwood Creek and White Oak Creek on land belonging to the Kenton Iron Co., about 2 miles from the old Kenton furnace. The station is at the head of Peter Cave Creek, a small tributary of White Oak Creek. It is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.86 meters north, 1.51 meters east, 1.99 meters south, and 1.77 meters west.

Round Top (Lewis County, Ky., A. T. M., 1885).—On a river hill known locally as Round Top, the highest point along the Ohio River between Pitts and Cincinnati. The station is about 5 miles west of Quincy, 1 mile from Bevis landing, and just back of L. Johnson's house. It is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.79 meters north, 1.90 meters east, 1.81 meters south, and 1.81 meters west.

Twin Creek (Adams County, Ohio, A. T. M., 1886).—On the ridge forming the divide between Upper Twin Creek and Lower Twin Creek, which flow into the Ohio River, and Churn Creek, which flows into Brush Creek and thence into the Scioto River. The station is on land belonging to Wash McGraw, about one-half mile northwest of his house. It is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 2.28 meters north, 2.13 meters east, 2.17 meters south, and 2.21 meters west.

Peach Mount (Adams County, Ohio, A. T. M., 1886).—On a ridge about 2 miles by road northwest of Mineral Springs, on land belonging to James Miller, a short distance northwest of his house. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.83 meters north, 2.12 meters east, 1.85 meters south, and 2.04 meters west.

Cherry Ridge (Lewis County, Ky., A. T. M., 1886).—On the highest point of a ridge about 2 miles southeast of Concord and 1½ miles south of the south bank of the Ohio River. The station is on land belonging to Miss Wood, just west of the property line between her land and that of Mrs. Lee, which is on the east side of the mountain. There is a quarry on the west slope of the mountain about 200 meters below the station. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 2.30 meters north, 2.47 meters east, 2.40 meters south, and 2.55 meters west.

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[1] See p. 35.

Cave Hill (Adams County, Ohio, A. T. M., 1886).—On the highest point of Cave Hill about 4 miles northwest of the town of West Union. Clark Hill, which is about 8 feet higher than Cave Hill, is about one-fourth mile west. The station is on land belonging to John Drennan about one-half mile north of a schoolhouse. It is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 2.03 meters north, 2.06 meters east, and 2.04 meters south, 2.17 meters west.

Ash Ridge (Brown County, Ohio, A. T. M., 1887).—On a rise of ground 3 miles south of South Fincastle, about 1 mile north of the village of Carlisle and one-fourth mile northwest of a church, on land belonging to Dr. Evans, of Georgetown. The station is marked according to note 7[1] except that the underground mark is a bottle filled with cement. The reference marks are at the following distances and directions from the station: 1.84 meters north, 1.89 meters east, 1.83 meters south, and 1.81 meters west. The following azimuths are from the station: Russellville spire, 25° 42′; James M. Parker's house, 153° 00′; John Schwallies' house, 226° 06′; schoolhouse, 309° 33′; and church mentioned above, 327° 10′.

Minerva (Mason County, Ohio, A. T. M., 1887).—About one-fourth mile north of the crossroads where are located churches, stores, etc., which form the village of Minerva, in a field belonging to George F. Winter directly across the road from Mr. Wilson's house. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.74 meters north, 1.86 meters east, 1.77 meters south, 1.82 meters west. The following azimuths were read at the station: Front gable Christian Church (wood), 348° 59′; back gable Methodist Church (brick), 352° 52′; back gable Catholic Church (wood), 355° 26′; front gable Baptist Church (brick), 1° 54′; east chimney Winter's house, 51° 53′; and front door Wilson's house, 286° 06′.

Tate (Clermont County, Ohio, A. T. M., 1887).—About 1¼ miles north of Saltair, a small crossroads hamlet of three or four houses and a postoffice, one-half mile east of the Tate and Munroe township line, in the fence line forming the boundary between the land of J. Hibbets on the north and that of Mr. Salt on the south. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.84 meters north, 1.86 meters east, 1.83 meters south, and 1.83 meters west. The following azimuths and approximate distances are from the station: E. Frazer's white wooden cottage, east gable, one-half mile, 357° 55′; Salt's brick house, west gable, one-third mile, 3° 53′; John Tatman's house, east gable, one-half mile, 69° 18′; J. Hibbet's house chimney, one-fourth mile, 177° 23′.

Flaugher (Pendleton County, Ky., A. T. M., 1887).—About 1 mile west of Lenoxburg and three-fourths mile west of the county line, on the south side of the Lenoxburg and Falmouth turnpike in an apple orchard belonging to David Flaugher, about 50 meters south of his house and just west of his large tobacco barn. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.80 meters north, 1.85 meters east, 1.84 meters south, and 1.83 meters west. The northwest corner of Flaugher's tobacco barn is 9.37 meters from the station and the southwest corner is 15.68 meters distant.

Stevens (Kenton County, Ky., A. T. M., 1887; 1889).—About 2½ miles east of Independence and 1 mile west of the little hamlet of Staffordsburg in the dooryard near the house of John A. Stevens opposite the forks in the roads leading east to Staffordsburg, north to Covington, and west to Independence. The station is marked according to note 7.[1] The reference marks are at the following distances and azimuths from the station: 1.85 meters, 65° 35′; 1.83 meters, 155° 35′; 1.82 meters, 245° 35′; and near the corner of the house, 11.17 meters, 335° 35′. The northwest corner of the chimney is 12.01 meters from the station in azimuth 327° and the northeast corner of the house is 15.8 meters in azimuth 302°.

Dry Ridge (Grant County, Ky., A. T. M., 1889).—About one-third mile east of the railway station at Dry Ridge on the north side of the turnpike to Knoxville. There is a bend in the road about 150 meters west of the station and but for this bend the station would be in the middle of the road, that is, it is in the prolongation of the straight part of the road west of the bend. The station is marked according to note 7[1] and the surface mark is surrounded by a block of concrete 2 feet deep and 16 inches in diameter. The reference marks are at the following distances and directions from the station: 1.82 meters north, 1.82 meters east, just north of the north road fence 15 meters south, and in the middle of a path 10.45 meters west. There is a house about 150 meters north of the station. An elm tree marked with a blaze is in the hollow on the north side of the turnpike 89.2 meters from the station in azimuth 81° 14′.

Tanner (Boone County, Ky., A. T. M., 1889).—About 1½ miles from Florence and one-half mile west of the toll-gate, on the Burlington pike, on land belonging to Noah Clore, nearly south of his house. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.84 meters north, 1.84 meters east, 1.83 meters south, and 1.83 meters west. The corner stone at the corner of Noah Clore's and E. K. Tanner's lands is 18.5 meters from the station in azimuth 278° 52′.

Stow (Switzerland County, Ind., A. T. M., 1890).—About 2 miles south of East Enterprise, in the southeast corner of NW. ¼ sec. 9, T. 3 N., R. 2 W., on the west side of the pike between East Enterprise and Markland. The station is on land belonging to Uziel U. Stow, in the cleared field northeast of his house and just north of a clump of timber known as the deer park. It is 21.5 meters from the center of the pike, 32 meters south of the south edge of an apple orchard, and 27 meters northeast of a frog pond. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.83 meters north, 1.83 meters east, 1.83 meters south, and 1.83 meters west.

Reizin (Ripley County, Ind., A. T. M., 1889).—About 1 mile east of Elrod and about 300 meters south of the road from Elrod to Dillsboro, on land belonging to Joseph Beall about 12 meters east of the line fence between his land

[1] See p. 35.

and that of Reizin Johnson. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.82 meters north, 1.84 meters east, 1.82 meters south, and 11.9 meters west. The west reference mark is in the fence line mentioned above. A lone hickory tree, marked with a blaze and a triangle of nails, is 55.3 meters N. 24° 11′ E. from the station.

Culbertson (Switzerland County, Ind., A. T. M., 1890).—About 11 miles by road in a northerly direction from Vevay, in Pleasant Township, in the northwest corner of SE. ¼ sec. 33, T. 5 N., R. 12 E., on land belonging to James Culbertson. The station is on the highest point of a pasture on the opposite side of the pike from Culbertson's house, about 200 meters from the pike, and about 15 meters east of the center of a road running south from the pike. The station is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 1.80 meters north, 1.87 meters east, 1.81 meters south, and 10.86 meters west. The west reference mark is in the fence line on the east side of the road.

Correct (Ripley County, Ind., A. T. M., 1890).—About one-half mile north of Correct post office, in Johnson Township, in the southwest corner of SE. ¼ SE. ¼ sec. 27, T. 7 N., R. 11 E., on the west side of the county road from Correct to Versailles. The station is nearly on the line between sections 27 and 34. It is marked according to note 7.[1] The reference marks are located as follows: About 1 foot inside of the fence line on the west side of the road 7.27 meters east of the station, on the east side of the road 19.85 meters east of the station, in the fence line 9.21 meters south of the station, and about 1 foot inside of the fence on the west side of the road 20.25 meters from the station in azimuth 220° 43′. The north gable of Mr. Jackson's barn is 49.4 meters from the station in azimuth 285° 50′, and a walnut tree is 82.3 meters from the station in azimuth 172° 51′.

Glasgow (Ripley County, Ind., A. T. M., 1890; 1906).—About 1¼ miles south of the town of Osgood, on the west side of the continuation of the road to Ashman & Glasgow's quarries on land belonging to Jasper S. Bilby, of the United States Coast and Geodetic Survey. The station is in the SE. ¼ SE. ¼ sec. 28, T. 8 N., R. 11 E., 178.0 meters north and 28.7 meters west of the stone marking the southeast corner of the section. The station is marked according to note 7.[1] The reference marks are located as follows: West side of road 30.63 meters from the station in azimuth 226° 45′, west side of road 22.96 meters in azimuth 271° 37′, east side of road 34.43 meters in azimuth 271° 37′, and west side of road 27.94 meters from the station in azimuth 308° 43′. Five tons of stones were used in anchoring the legs of the tripod and scaffold.

Green (Jennings County, Ind., G. A. F., 1890).—About 5 miles north of the town of Butlerville and 2 miles southwest of the town of Zenas, in Columbia Township near the northeast corner of sec. 34, T. 8 N., R. 9 E., 282.6 meters west and 18.6 meters south of the stone marking the northeast corner of the section. The station is on land belonging to Samuel Rush and is marked according to note 7,[1] except that there are only three reference marks. The reference marks are in the fence line on the south side of the road along the north side of the section and are at following distances and azimuths from the station: 21.13 meters 131°, 13.08 meters 180° 30′, and 20.42 meters 233° 25′.

Holton north base (Ripley County, Ind., A. T. M., 1890).—About 1 mile east of Holton, in Otter Creek Township, in the southeast corner of sec. 2, T. 7 N., R. 10 E., on land belonging to Sam Cox, 28.9 meters south of the south rail of the Baltimore & Ohio Southwestern Railroad track. The station is marked by a cross and small drill hole in the top of a copper bolt set in the center of the top of a block of limestone 3 feet square and 2½ feet thick made up of two parts, one 9 inches thick and the other 21 inches thick, cemented together. This block rests on a concrete foundation 4 feet square and 1 foot thick, with a hole 1 foot square at the center to give access to the underground mark, which consists of a copper bolt in the top of a limestone post 6 inches square and 2 feet long. The surface mark projects about 6 inches above the ground and has its upper edges beveled. It was intended to mount a shaft on this monument, but there is no record of its having been done. Four reference marks, each consisting of a stone post 6 inches square and 2 feet long, with a copper bolt at the center of the top, are at the following distances and azimuths from the station: 15.0 meters 85° 54′, 14.95 meters 175° 54′, 15.00 meters 265° 54′, and 15.01 meters 355° 54′.

Holton south base (Ripley County, Ind., A. T. M., 1890).—About 1½ miles north of New Marion, in Center Township, in the northwest corner of sec. 25, T. 7 N., R. 10 E., on land belonging to Mr. Hilson. The station is marked exactly the same as *Holton north base*, described above. The reference marks are at the following distances and azimuths from the station: 13.02 meters 54° 37′, 16.67 meters 138° 34′, 15.73 meters 214° 39′, 11.75 meters 306° 56′. The second and third reference marks are in the fence line on the south side of the public road north of the station.

Mud Lick (Jefferson County, Ind., A. T. M., 1890).—About 7 miles from Madison and one-half mile south of Mud Lick post office, in the southeast corner of NW. ¼ sec. 26, T. 5 N., R. 10 E., on land belonging to William H. Buckhannon. The station is on the west side of the Michigan road, which is very nearly on the half-section line north and south of section 26, and is just north of the county road to Lancaster, which is on the half-section line east and west of section 26. The station is marked according to note 7.[1] The reference marks are at the following distances and azimuths from the station: 32.7 meters 8° 08′, 44.16 meters 8° 08′, 50.44 meters 278° 04′, and 57.82 meters 305° 00′. The east edge of the chimney on Buckhannon's house is in azimuth 190° 15′ from the station, the east edge of the chimney on Denney's house is in azimuth 212° 38′, and the east edge of the chimney on a house south of the station is in azimuth 355° 28′.

Stout (Jefferson County, Ind., G. A. F., 1890; 1914).—About 5 miles southwest of the town of Dupont, about the same distance northeast of the town of Paris, and about 1 mile north of Neils Creek post office, on land belonging to Mr. Shawhan, a son-in-law of A. O. Stout, who owned the land when the station was established. The station is about one-third mile north of Shawhan's house, near the northeast corner of sec. 25, T. 5 N., R. 8 E. The north line of this

[1] See p. 35.

section is also the county line between Jefferson and Jennings Counties. The station is marked according to note 7,[1] except that there are only three reference marks and they have the numbers 1, 2, and 3 cut in the tops. They are in the fence line west of the station and are at the following distances and magnetic bearings from the station: No. 1, 12.48 meters S. 43° 12′ W.; No. 2, 8.45 meters S. 86° 48′ W.; and No. 3, 14.00 meters N. 36° 41′ W. The stone marking the northwest corner of NE. ¼ NE. ¼ sec. 25 is 13.16 meters N. 39° 55′ W. (mag.) from the station.

Tripp (Jennings County, Ind., G. A. F., 1890; 1914).—About 1 mile southwest of North Vernon, 100 meters southeast of the North Vernon-Seymour pike on land belonging to Thomas Noon, about 100 meters south of his house and 100 meters east of an old barn. The station is about 10 meters south of the north line of sec. 4, T. 6 N., R. 8 E., and is marked according to note 8.[1] The reference marks are in the fence line north of the station at the following distances and azimuths from the station: 34.56 meters 110° 38′, and 29.93 meters 257° 08′. Other azimuths were read as follows: Large concrete post at eastern end of a row of posts, about 100 meters distant, 98° 38′; William Day's house, about 150 meters distant, 127° 08′; Noon's house, 193° 08′.

Miller (Jennings County, Ind., G. A. F., 1889; 1914).—About 2½ miles south of Brownstown in a small clearing known as the "Old Ike Miller peach orchard," on top of a ridge about 1 mile east of the main road from Brownstown, on land belonging to Miss Caroline Sanders. The station is in the SW. ¼ SW. ¼ NW. ¼ sec. 25, T. 5 N., R. 4 E., about 100 meters northwest of a small cabin on the Sanders place. The station is marked according to note 9.[1] When visited in 1914 one reference mark was found in good condition and another was found with the top broken off 6 inches below the surface of the ground, but the third one could not be found. The broken mark is 11.67 meters S. 10° 52′ E. (mag.) from the station, and the other is 11.73 meters N. 16° 20′ W. (mag.) from the station.

Weed Patch (Brown County, Ind., G. A. F., 1889).—On Weed Patch Hill, claimed by some, though incorrectly, to be the highest point of land in the State, about 3 miles south-southeast of Nashville. The station is in the northern part of the SW. ¼ SE. ¼ SE. ¼ sec. 32, T. 9 N., R. 3 E., in a peach orchard belonging to Rufus W. Reddick, just north of the road running east and west across the top of the hill. The station is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: 32.7 meters S. 37° 44′ E.; near the corner of a log barn, 37.8 meters S. 14° 00′ W.; and near an apple tree, 15.0 meters N. 7° 02′ W.

Fountain (Jackson County, Ind., G. A. F., 1887).—About 2½ miles from the town of Clear Springs, in the NW. ¼ sec. 24, T. 6 N., R. 2 E., on land belonging to Thomas Fountain, a short distance northwest of his house and barn. The station is in an open field near the edge of a beech woods. It is marked according to note 9.[1] The reference marks are at the edge of the woods at the following distances and magnetic bearings from the station: 26.88 meters S. 62° 36′ W., 22.89 meters N. 55° 04′ W., and 19.00 meters N. 18° 41′ E. A lone beech tree 6.7 meters southeast of the first reference mark bears S. 48° 16′ W. (mag.) from the station.

Rariden (Lawrence County, Ind., G. A. F., 1887).—About 3 miles from Mitchell on the top of a hill on the farm of S. R. Rariden, about one-fourth mile west of his house. The hill is wooded except near the station. The station is in the northwest corner of sec. 27, T. 4 N., R. 1 W., and is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: 6.73 meters N. 0° 43′ W., 9.14 meters S. 89° 23′ E., and 8.26 meters N. 86° 56′ W. Three trees marked with spikes are at the following distances and magnetic bearings from the station: Oak, 14.5 meters N. 45° 43′ E.; poplar, 15.7 meters S. 26° 35′ E.; and oak with broken top, 20.6 meters S. 68° 04′ W.

Leonard (Monroe County, Ind., G. A. F., 1887).—About 7 miles southwest of Bloomington, on the crest of a hill on the south side of the Stamford road, in the NE. ¼ NW. ¼ sec. 26, T. 8 N., R. 2 W. The station is on the north edge of a young orchard belonging to Thomas Ragan just north of his house. It is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: 21.43 meters N. 83° 30′ W., 17.10 meters north, and 33.18 meters N. 78° 13′ E. The first and third marks are in the fence line on the south side of the Stamford road, and the second mark is near the fence line on the north side of the road. There is a stump just south of the first reference mark.

Beard (Lawrence County, Ind., G. A. F., 1887).—About 7 miles from Harrodsburg and 2½ miles from Springville, on a hill near the center of a cultivated field owned by J. T. Beard. The station is in Perry Township in the SE. ¼ sec. 10, T. 6 N., R. 2 W. It is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: 37.98 meters N. 17° 00′ E., 51.17 meters S. 42° 28′ E., and 71.14 meters S. 66° 28′ W. The second reference mark is in line with a mulberry tree about 125 meters from the station. A large oak is near the section line just east of the mulberry tree.

Calvary (Greene County, Ind., G. A. F., 1886).—In the extreme northwest corner of Center Township about 10 miles east of Worthington and about the same distance northeast of Bloomfield in the NE. ¼ NE. ¼ sec. 2, T. 7 N., R. 4 W., on the highest point of a high hill on land owned by Westley Gaston who lives about one-fourth mile northeast of the station. The station is marked according to note 9.[1] The reference marks are near the fence line on the north side of the road south of the station and are at the following distances and magnetic bearings from the station: On the line between sections 1 and 2, 209.5 meters S. 62° 18′ E.; in range with a large tree on the opposite side of the road, 107.7 meters S. 1° 20′ E.; and 143.3 meters S. 30° 30′ W.

Osborn (Martin County, Ind., G. A. F., 1886).—About 4 miles south and 1 mile east of Scotland, in the northwest corner of the SW. ¼ NE. ¼ sec. 20, T. 5 N., R. 4 W., on top of a hill on land owned by James Osborn. There is a road which makes a right-angled bend to the north a short distance southwest of the station and another right-angled bend

[1] See p. 35.

to the east just northwest of the station. The home of H. T. Sumerville is on the west side of the north-and-south section of this road about 100 meters west of the station. The station is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: Near the fence east of the station, 30.5 meters N. 70° 30′ E.; near the corner of the field where the two fence lines intersect, 56.2 meters S. 43° 45′ E.; and near the fence line west of the station, 65.4 meters S. 23° 30′ W.

Sisson (Sullivan County, Ind., G. A. F., 1885).—About 2 miles from Pleasantville just south of the road to Carlisle and south of a small dwelling house occupied by James L. Anderson which is on the north side of the road. The station is in Jefferson Township in the SW. ¼ NE. ¼ sec. 10, T. 6 N., R. 8 W., on land belonging to Mr. Sisson, an old man living about three-fourths mile north of the station. The station is marked according to note 9.[1] The reference marks are at the following distances and magnetic bearings from the station: In the fence corner where the fence west of the station joins the road fence, 67.5 meters N. 76° 00′ W.; in the yard of Anderson's house, 52.7 meters N. 15° 05′ W.; and on the inside of the fence along the south side of the road, 61.8 meters N. 52° 51′ E. The second reference post is in line between the southeast corner of the house and the well, 4.85 meters from the house and 2.59 meters from the well.

Wright (Greene County, Ind., G. A. F., 1886).—In Wright Township near the center of sec. 21, T. 8 N., R. 7 W., on land owned by W. H. Smith whose house and barns are about 150 meters in a northwesterly direction from the station. The station is on the crest of the highest ground in the neighborhood and is marked according to note 9.[1] The reference marks are near the fence along the west side of the road east of the station at the following distances and magnetic bearings from the station: Just south of the driveway to Smith's house, 98.7 meters N. 47° 30′ E.; 77.7 meters N. 88° 30′ E.; and near the southeast corner of the quarter section, 137.6 meters S. 38° 30′ E.

Summit (Knox County, Ind., G. A. F., 1884).—About 2½ miles from Bruceville on the northwest side of the road from that place opposite the point where the road to Bicknell branches to the southeast. The station is in Washington Township in plat 122 near the southern end of a large field owned by Peter Fox who lives southeast of the station on the southwest side of the Bicknell road. There is a schoolhouse at the junction of the two roads and its northwest corner is 91.4 meters S. 68° 30′ E. from the station. The station is marked according to note 9.[1] The reference marks are just inside the fence line on the north side of the Bruceville road at the following distances and magnetic bearings from the station: 79.74 meters S. 68° 30′ E., 49.28 meters S. 12° 52′ E., and 52.8 meters S. 42° W. There is a lone black walnut tree 27.4 meters N. 85° W. of the station and a similar tree on A. Green's land 71.6 meters N 70° E. The northwest corner of a house in ruins on the opposite side of the road is 83.8 meters S. 47° W. from the station.

Merom College (Sullivan County, Ind., G. A. F., 1885).—The center of the spire on the cupola of Merom College. The station was marked on the inside of the cupola by a cross and a copper tack in the top of the center post of the spiral stairway leading from the attic to the cupola.

Honey Creek (Crawford County, Ill., G. A. F., 1884).—In Honey Creek Township in an open field belonging to J. W. Love in the southwest corner of NE. ¼ NW. ¼ NE. ¼ sec. 35, T. 6 N., R. 12 W. The station is 157.6 meters south of the fence along the south side of the section-line road and is marked according to note 2.[1] Three reference posts are located as follows: In the fence line 157.6 meters north, 214.2 meters west, and 264.7 meters N. 54° 15′ W. The northeast corner of the section mentioned above is 616.0 meters distant N. 74° 10′ E.

Belle Air (Clark County, Ill., G. A. F., 1884).—This station was established by the United States Engineers in 1879. It is in Orange Township in section 32, T 9 N, R. 13 W., 23.5 meters north of the fence on the south side of the section-line road dividing Clark and Crawford Counties, and 66.9 meters N. 53° 17′ E. from the northeast corner of a house belonging to Isaac Hart. The station is marked according to note 4.[1] Three stone reference posts with the letters U. S. inscribed in the tops are located as follows: In the fence line on the south side of the road, 41.4 meters S. 38° 7′ W.; in the same fence line 56.6 meters S. 58° 8′ E.; and in the fence line on the north side of the road, 17.8 meters S. 49° 50′ E. The section corner between sections 4 and 5 is 559 meters S. 86° 28′ W.

Hunt City (Jasper County, Ill., G. A. F., 1884).—This station was established in 1879 by the United States Engineers. It is in Grandville Township, in the NE. ¼ NW. ¼ sec. 7, T. 7 N., R. 14 W., about 10 miles northeast of Newton and three-fourths mile northeast of Hunt City, a small station on the Danville, Olney and Ohio River Railroad. The station is marked according to note 4.[1] Three stone reference posts are located as follows: One on the east side of the section-line road west of the station, 678.88 meters S. 85° 32′ W., and two on the south side of the section-line road north of the station, one distant 334.71 meters N. 33° 52′ E., and the other distant 282.62 meters N. 9° 54′ W. The northwest corner of the section mentioned above is 749.0 meters N. 66° 46′ W.

Claremont (Richland County, Ill., G. A. F., 1884).—This station was established in 1879 by the United States Engineers. It is in German Township, in sec. 29, T. 4 N., R. 14 W., on land belonging to the Brinkley heirs, about 3 miles in a northwesterly direction from the town of Claremont. The station is marked according to note 4.[1] Three stone reference posts are located as follows: 23.1 meters N. 67° 33′ W., 7.8 meters N. 0° 39′ W., and 24.6 meters N. 71° 45′ E. The northwest corner of the section mentioned above is 847 meters N. 60° 03′ W. from the station.

Oblong (Crawford County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in Oblong Township, in the SE. ¼ SE. ¼ sec. 32, T. 7N., R. 13 W., and is marked according to note 4.[1] Three stone reference posts are along the east side of the road west of the station at the following distances and bearings from the station: 125.7 meters S. 44° 15′ W., 90.0 meters S. 78° 32′ W., and 97.7 meters N. 65° 13′ W. A land-survey stone is on the south line of section 32, one-fourth mile west of the southeast corner of the section, 131 meters S. 46° 23′ W. from the station. The southeast corner of section 32 is 325.6 meters S. 73° 42′ E. from the station.

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[1] See p. 35.

Buffalo Mound (Jasper County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in Fox Township, on a hill known as Buffalo Mound, about 2½ miles southwest of the village of St. Marie, in section 1 near the line between sections 1 and 2, T. 5 N., R. 10 E. The station is marked according to note 4.[1] Three stone reference posts are on the west side of the section-line road west of the station at the following distances and bearings from the station: 44.4 meters S. 40° 46′ W., 28.9 meters N. 87° 19′ W., and 45.3 meters N. 38° 54′ W. The corner of sections 1, 2, 11, and 12 is 966 meters S. 1° 29′ W. from the station.

Newton (Jasper County, Ill., F. W. P., 1883).—In Smallwood Township, about 4½ miles south of the town of Newton, in the northwest corner of the SE. ¼ SW. ¼ sec. 25, T. 6 N., R. 9 E. The station is marked according to note 2[1] except that the marble post is encased in the foundation of a brick pier which extends about 3 feet above the ground and is capped with a marble slab 2 inches thick and 16½ inches square, with a small drill hole at the center directly above the cross on the post. The pier is hollow above the top of the post and has openings in the side to allow access to the station mark on the post. The reference posts are in range directly west of the station at distances of 67.48 meters and 459.88 meters, respectively. Another brick pier, used for latitude work, similar to the one described above, is 15 meters due west of the station. The following azimuths and distances are from the station: Southwest corner of section 25, 607.4 meters, 50° 59′; McMurray's house chimney, about one-third mile, 125° 34′; schoolhouse chimney, about two-fifths mile, 133° 39′; Weaver's house chimney, about three-fourths mile, 157° 27′; I. Wilson's house east lightning rod, about one-half mile, 9° 13′.

Denver (Richland County, Ill., G. A. F., 1883).—This station was established in 1879 by the United States Engineers. It is in Denver Township, about 5½ miles north of the town of Noble in the NW. ¼ NE. ¼ sec. 21, T. 4 N., R. 9 E., on the eastern edge of a timber lot belonging to Mr. Kinkade, whose home is a little more than one-fourth mile east of the station. The station is marked according to note 4.[1] Three stone reference posts are at the following distances and bearings from the station: On the north side of the road north of the station, 344.92 meters N. 15° 27′ E.; on the east side of the road east of the station, 578.78 meters N. 69° 35′ E.; and on the west side of the road east of the station, 568.15 meters S. 70° 01′ E. The corner of sections 15, 16, 21, and 22 is 628.32 meters N. 58° 52′ E. from the station.

Onion Hill (Richland County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is on Onion Hill, in Denver Township, about 5 miles southwest of the town of West Liberty, in the NE. ¼ sec. 2, T. 4 N., R. 9 E. The station is marked according to note 4.[1] Three stone reference posts are located as follows: On the south side of the road north of the station, 205.68 meters N. 33° 02′ E.; on the north side of the same road, 181.04 meters N. 25° 31′ W.; and on the west side of the road west of the station, 354.02 meters N. 84° 35′ W. The northeast corner of section 2 is 502.7 meters N. 69° 25′ E. from the station.

Olney west base (Jasper County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in Fox Township, in the NW. ¼ NE. ¼ sec. 21, T. 5 N., R. 10 E. The station is marked by a stone post surrounded by a bed of brickwork 3 feet square, 4 feet below the surface of the ground. Two other stones similar to the station mark but without the brickwork are 4 feet below the ground, one 8.02 meters north of the station and the other 8.06 meters south. Three stone reference posts are located as follows: Two on the south side of the road north of the station, one 246.7 meters N. 2° 45′ W., and the other 356.0 meters N. 45° 32′ E., and the third 302.0 meters S. 61° 00′ E. An oak post used for a latitude pier in 1880 is 16.19 meters S. 88° 36′ E. The northeast corner of section 21 is about 727 meters N. 67° 19′ E. from the station.

Olney check base (Richland County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in Preston Township, in sec. 6, T. 4 N., R. 11 E., 20.1 meters S. 53° 10′ E. from the southeast corner of the German Reformed Church. The station is marked according to note 4.[1] Three stone reference posts are located as follows: On the south side of the road south of the station, 22.6 meters S. 12° 12′ W.; at the northeast corner of the cemetery just west of the station, 73 meters N. 3° 35′ W.; on the north side of the above road, 53.5 meters S. 80° 21′ E. The quarter-section stone on the west line of section 6 is 943.9 meters N. 31° 44′ W. from the station.

Olney east base (Jasper County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in St. Marie Township, about 3⅓ miles east and one-half mile north of the town of West Liberty, in sec. 19, T. 5 N., R. 11 E. The station is marked by a brass bolt set in a drill hole in the top of a stone post 2½ feet below the surface of the ground. The post is surrounded by a bed of brickwork. Two other stone posts are 2½ feet below the ground, one 7.91 meters north and the other 8.04 meters south. Three stone reference posts are located as follows: 3.61 meters N. 49° 49′ E., 322 meters S. 58° 02′ E., and 208 meters S. 35° 50′ W. The northwest corner of section 19 is about 1,054 meters N. 77° 12′ W. from the station.

Olney middle base (Jasper County, Ill., U. S. E., 1879).—This station was established by the United States Engineers. It is in Fox Township, near the middle of the Olney base, in the NW. ¼ sec. 23, T. 5 N., R. 10 E., about 1.1 miles east and 0.5 mile north of the town of West Liberty. The station is marked by a stone post 2½ feet below the surface of the ground. The northeast corner of section 23 is about 712 meters N. 66° 18′ E. from the station.

Island Creek (Jasper County, Ill., G. A. F., 1883).—In Grove Township near the southwest corner of SW. ¼ sec. 28, T. 8 N., R. 8 E., 2½ miles east and 4 miles south of the town of Montrose, on cultivated land belonging to the Caldwell estate. The station is marked according to note 2.[1] One reference mark is just inside the hedge which bounds the road and section to the westward, distant 11.11 meters, and the other is just inside the road fence to the southward, distant 37.4 meters. The southwest corner of section 28 is 58.4 meters distant in azimuth 22° 12′ and the west chimney of

[1] See p. 35.

Caldwell's house, which is nearly across the road from the station, is in azimuth 146° 56′. The Catholic Church is just across the road south of the station, and the cross on the church is in azimuth 355° 18′.

Lucas (Effingham County, Ill., G. A. F., 1883).—In Lucas Township, 8 miles south and 2¾ miles west of the town of Deiterich, in the NW. ¼ SE. ¼ NW. ¼ sec. 28, T. 6 N., R. 7 E., on cultivated land, slightly elevated, belonging to Louis Joergens. The station is marked according to note 2.[1] Broken crockery and glass were mixed with the soil about the station mark. One reference mark is in the fence line on the south side of the road north of the station 495.95 meters distant in azimuth 180° 00′, and the other is in the fence line on the east side of the road west of the station 492.9 meters distant in azimuth 90° 00′. The corners of section 28 are at the following distances and azimuths from the station: Southwest corner, 1,302.8 meters 22° 32′; northwest corner, 715.3 meters 135° 14′; northeast corner, 1,221.2 meters 247° 35′; and southeast corner 1,629.5 meters 315° 16′.

Parkersburg (Richland County, Ill., U. S. L. S., 1879).—About 11 miles south of Olney on a rise of ground about 80 feet above the general level. Near the northeast corner of fractional section 30, T. 2 N., R. 11 E. The station is marked by two stone posts, one at the surface and the other directly below it. There are four stone reference posts at the following distances and directions from the station: 48.7 meters S. 69° 54′ E., 74.0 meters N. 68° 27′ W., 44.7 meters N. 83° 22′ E., and 93.0 meters N. 28° 40′ E. The first two are on the south side of the road north of the station, and the third on the north side of the same road. The northwest corner of section 30 is 848.5 meters N. 55° 40′ W. from the station. *Parkersburg latitude* station is 34.68 meters N. 87° 44′ W. from the station.

Holtzhausen (Clay County, Ill., G. A. F., 1883).—About 5 miles by road east-southeast of Farina, in Oskaloosa Township in the NE. ¼ NW. ¼ SW. ¼ sec. 7, T. 4 N., R. 5 E., on a prominent hill in a pasture owned by William Holtzhausen and about 930 meters north-northeast from his house. The station is probably marked according to note 2.[1] The corners of section 7 are at the following distances and azimuths from the station: Southwest corner, 408.1 meters 21° 12′; northwest corner, 1255.25 meters 174° 24′; northeast corner, 2013.84 meters 232° 28′; and the southeast corner 1627.95 meters 284° 12′. Other distances and azimuths were measured as follows: Large black oak, 218.0 meters 64° 48′; large elm tree, 151.8 meters 85° 33′; north chimney of C. Moor's house, about one-half mile 254° 54′; and east chimney of Holtzhausen's house, about 930 meters 30° 45′.

Mound (Effingham County, Ill., G. A. F., 1883).—In Mound Township, 1 mile west and three-fourths mile north of the village of Altamount, very nearly in the center of the SW. ¼ NE. ¼ sec. 8, T. 7 N., R. 4 E., on a hill in cultivated land belonging to John Ehlers. The station is marked according to note 2,[1] except that there is only one reference mark. Broken crockery was mixed with the earth around the station mark. The reference post is in the fence line north of Ehlers's house in range with the west end of the house and the station 602.23 meters from the station in azimuth 179° 30′. The corners of section 8 are at the following distances and azimuths from the station: Southwest corner, 1468.48 meters 43° 38′; northwest corner, 1160.38 meters 129° 42′; northeast corner, 891.64 meters 224° 55′; and the southeast corner, 1194.51 meters 328° 14′. The southwest corner of Ehlers's house is 494.5 meters from the station in azimuth 179° 30′ and Bucholtz's barn is in azimuth 257° 32′.

Sturgess (Fayette County, Ill., G. A. F., 1883).—About 1 mile south of the town of Vandalia, near the southeast corner of the SW. ¼ NW. ¼ sec. 21, T. 6 N., R. 1 E., on a hill in cultivated land about 30 meters north by east from the northwest corner of Col. Sturgess's house. The station is marked according to note 2 [1] except there are three reference marks instead of two. One reference mark is near the northwest corner of the house 29.37 meters from the station, another one is in this same direction at a distance of 15.62 meters, and the third is in a direction perpendicular to the above direction east by south from the station at a distance of 14.43 meters.

Hartlin (Marion County, Ill., G. A. F., 1882).—About three-fourths mile south and 1 mile west of the town of Alma, in the SW. ¼ SE. ¼ sec. 12, T. 3 N., R. 2 E., 12 meters north of the section line, on a hill in cultivated land known as the old Hartlin place but owned in 1882 by T. W. Purcell. The station is 32 meters north of the barn and 72 meters east-northeast from the front door of the house both of which buildings are across the road from the station. The station is marked according to note 3 [1] except there are three reference marks instead of two at the following distances from the station: 15.2 meters east, 15.2 meters west, and 20.9 meters south.

Bording (Clinton County, Ill., G. A. F., 1882).—About 1½ miles east of the town of Carlyle, in the SE. ¼ SW. ¼ sec. 17, T. 2 N., R. 2 W., on Bording Hill, in the middle of a cultivated field owned by Mrs. Corcoran whose house is just south of the station. The station is about 200 meters north of the road and is marked according to note 2.[1] One reference mark is just east of the house, 216.88 meters south by east from the station and the other is near the road fence, southeast of the house, 248.77 meters from the station and in range with the first reference mark and the station.

Hoile (Bond County, Ill., G. A. F., 1882).—On the north side of the town of Greenville, in the SE. ¼ NE. ¼ sec. 10, T. 5 N., R. 3 W., on the top of a high hill, in the yard northeast of the dwelling house of C. Hoile. The station is marked according to note 2 [1] except there are no reference posts. The following distances and azimuths were measured: Southeast corner of Hoile's house, 28.71 meters 27° 00′; northeast corner of Hoile's house, 25.69 meters, 44° 55′; oak tree, 13.00 meters 44° 55′; oak tree, 9.11 meters 79° 05′; cherry tree, 8.50 meters 162° 36′; elm tree, 4.91 meters, 285° 33′; elm tree, 12.54 meters 298° 16′; oak tree, 14.90 meters 342° 35′; and hickory tree, 14.08 meters 8° 27′.

Geoffrey (Clinton County, Ill., G. A. F., 1881).—In Santa Fe Township, near the center of the NE. ¼ NE. ¼ sec. 8, T. 1 N., R. 3 W. The station is marked according to note 2.[1] One reference mark is near the fence line on the south side of the road north of the station, just west of the road leading to Mr. Geoffrey's house, 223.8 meters west of the stone at the northeast corner of section 8 and 144.5 meters from the station in azimuth 179° 27′. The other reference

[1] See p. 35.

mark is in the fence line on the west side of the road east of the station, 148.3 meters south of the stone at the northeast corner of section 8 and 217.8 meters from the station in azimuth 269° 07′.

Parkinson (Madison County, Ill., G. A. F., 1881).—About 1½ miles west by south from the town of Highland, near the middle of the NE. ¼ sec. 12, T. 3 N., R. 6 W., on land owned by A. J. Parkinson and a short distance east of his house and barns. The station is near the southeast corner of an apple orchard on the north side of a plank fence and about 14 feet west of an osage orange hedge. It is marked according to note 2.[1] Each of the two reference marks is about 1 foot west of the hedge, one 5.70 meters northeast of the station and the other the same distance southeast. A rock used as a surveyor's mark is 1.07 meters north of the latter and 5.02 meters from the station.

Berger (St. Clair County, Ill., G. A. F., 1881).—In Summerfield Township, about 1 mile north of the village of Summerfield and about 3 miles east and one-half mile north of the village of Lebanon, near the northwest corner of the NE. ¼ NW. ¼ NW. ¼ sec. 22, T. 2 N., R. 6 W., on land owned by Dr. A. Berger. The station is marked according to note 2.[1] The two reference marks are on the north boundary of section 22 as near as could be determined, one in range with the east row of trees in Dr. Berger's orchard, 82.6 meters from the station, in azimuth 146° 26′, and the other 124.5 meters from the station, in azimuth 236° 59′. Other azimuths were observed as follows: Tree at southwest corner of Dr. Berger's orchard, 12° 38′; cherry tree at east end of eighth row from north end of orchard, 49.6 meters from the station, 72° 26′; south chimney of J. Whittaker's house, 241° 13′; and southwest corner of Whittaker's land, 244° 37′.

Turkey Hill (St. Clair County, Ill., G. A. F., 1880).—Near the middle of the south line of the NW. ¼ sec. 5, T. 1 S., R. 7 W., in an orchard belonging to Mack Champion (negro) and about 75 meters west of his house. The station is on the top of a small cultivated hill near the north end of the third row of trees counting from the east side of the orchard and is marked according to note 2.[1] One reference mark is near the foot of a walnut tree in the southwest corner of an adjoining field 40.50 meters N. 84° 30′ E. from the station. The other reference mark is near a pear tree 10.75 meters N. 28° 00′ W. from the station.

Clarks Mound (St. Clair County, Ill., R. E. H., 1871; 1880).—On the bluffs overlooking the American Bottom, three-fourths mile south of French Village, near the middle of the south line of the NW. ¼ sec. 35, T. 2 N., R. 9 W., on land belonging in 1880 to William Clark. The station is on the top of a prominent mound known locally as Clarks Mound, a short distance northwest of Mr. Ogles's house, and is marked according to note 2,[1] except that the underground mark is a bottle. One reference mark is 15.24 meters (inclined distance) from the station in azimuth 21° 54′, and the other is 15.24 meters (inclined distance) in azimuth 278° 34′. Three trees, each marked with a triangular blaze, are at the following distances and magnetic bearings from the station: Hickory, 19.6 meters, N. 41° 30′ E.; white oak, 12.0 meters, S. 57° 30′ E.; and hickory, 28.1 meters, S. 51° 30′ E.

Sugar Loaf Mound (Madison County, Ill., R. E. H., 1871; 1880).—About 3 miles northwest of Collinsville near the middle of the north line of the NE. ¼ sec. 20, T. 3 N., R. 8 W., on land belonging in 1880 to Conrad Witte, whose house is east of the station. The station is on the north side of the top of a very prominent mound, known locally as Sugarloaf Mound, which is on the edge of the bluff overlooking the American Bottom and about 150 or 200 feet above the general level to the westward and 50 feet above that to the eastward. The station is marked according to note 2,[1] except that there are no reference marks. A small private cemetery is just south of the station.

Insane Asylum (St. Louis County, Mo., R. E. H., 1871).—This asylum, known also as the County Lunatic Asylum, is situated on the county farm, which forms part of a larger tract of land known as Gratiot League Square. It is about 5 miles in a southwesterly direction from the courthouse at St. Louis and about 150 meters south of the Arsenal Street road at a point about one-half mile westerly from its intersection with the Kings Highway. The station is the finial of the cupola of the building.

American Bottom upper base (Madison County, Ill., C. H. B., 1872).—On the west slope of the Illinois bluffs on the east side of the American Bottom about one-fourth mile north of the Collinsville road and just east of the road along the foot of the bluffs on land belonging to A. Sumner. The station is marked at the surface by a cross in a copper bolt set in the top of a limestone post 12 by 14 inches and 40 inches long and underground by the apex of an earthenware pyramid 4 feet below the surface. Two limestone reference posts 5 inches square and 30 inches long are at the following distances and azimuths from the station: 7.3 meters, 204° 40′ (in prolongation of base); and 7.3 meters, 294° 40′ (right angles to base line).

American Bottom lower base (St. Clair County, Ill., C. H. B., 1872).—On the west slope of the Illinois bluffs on the east side of the American Bottom about 1 mile north of the Belleville Rock road and about one-fourth mile north of a small settlement called French Village. The station is on land belonging to Frances Simoin, 4 meters from the fence along the west side of the road, which extends north and south along the foot of the bluffs. The station is marked the same as *American Bottom upper base* described above, and the post containing the surface mark is inscribed on three sides as follows: U. S. C. S., 1872, BASE. One reference stone is 12.0 meters from the station in azimuth 24° 38′ (prolongation of base) and the other 19.2 meters in azimuth 294° 38′ (perpendicular to direction of base).

Dreyer (St. Clair County, Ill., R. E. H., 1871; 1880).—On the bluffs about 6 miles northwest of the town of Centerville and about 1½ miles a little west of south of Falling Springs in the southern part of sec. 27, T. 1 N., R. 10 W. The station is about 17 meters north of the Carondolet road near where it strikes the bluffs, in a field belonging to Freidrick Dreyer, about 370 meters west by north from his house. The station is marked according to note 2,[1] except that the surface mark is a spike in the top of a cedar post projecting about 4 inches above the ground and that the top of the second reference post is inscribed with the letters U. S. C. & G. S. Three reference posts are in the fence line on the north side of the road at the following distances and azimuths from the station: 23.33 meters, 325° 59′;

[1] See p. 35.

19.64 meters, 11° 08′; and 32.90 meters, 56° 17′. The second or center reference post (described above) is 368.8 meters from the northwest corner of Dreyer's corn house.

Minoma (St. Louis County, Mo., C. H. B., 1872).—The flagstaff on the cupola of the residence of Jefferson Clark about 7 miles from St. Louis and one-half mile north of the Natural Bridge road.

Kleinschmidt (St. Louis County, Mo., R. E. H., 1871).—In T. 44 N., R. 6 E., on an eminence known as Terrills Hill in the southwest part of the commons of Carondolet, south of the River des Peres, on a lot belonging to Henry Kleinschmidt at the northeast corner of the intersection of Lemar Ferry and Sappington Barracks roads. The station is marked according to note 5.[1] Two cedar reference stubs 12.5 meters apart are near the fence line on the north side of the Sappington Barracks road, one 12.6 meters due south of the station and 40.2 meters from the east corner of the lot and the other 11.5 meters west of the station and 68.7 meters from the west corner of the lot. The rock foundation at the southeast corner of Kleinschmidt's house is 45.4 meters northwest of the station and the rock foundation at the northeast corner of Bauer's house south of the Sappington Barracks road is 50.4 meters southwest.

Morgan (St. Louis County, Mo., R. E. H., 1871).—About 11 miles in a northwesterly direction from St. Louis in the NE. ¼ sec. 1, T. 45 N., R. 5 E., on the highest point of the tract of land lying southwest of the intersection of Olive Street and Warson road. The station is marked according to note 5.[1]

Patterson (Jefferson County, Mo., R. E. H., 1873).—About 7 miles in a southwesterly direction from the town of Fenton, one-fourth mile west of the Hillsborough road and just north of the Old State road, in an open field belonging to a Mr. Patterson. The station is marked according to note 5.[1]

Kessler (St. Louis County, Mo., R. E. H., 1871).—In T. 45 N., R. 4 E., on land belonging to Louis Kessler, on a summit covered with timber just northwest of the intersection of Smith and Kehr's mill roads. The station is quite near the Kehr mill road just west of an angle in the road and is marked according to note 5.[1] The house of Henry Pope is on the south side of the Smith road south by east from the station.

Tavern Rock (Franklin County, Mo., C. H. B., 1873).—On the south bank of the Missouri River about 1 mile west of the St. Louis County line, on the top of a small hill 141 meters west by south from the northwest corner of Mr. Godair's house. The station is marked according to note 1.[1]

Lynch (Jefferson County, Mo., C. H. B., 1873).—About 3½ miles from the town of Catawissa and one-half mile north-northeast from a stone Catholic Church known locally as the Rock Church on a high hill nearly east of Mr. Lynch's house. The station is just east of a winding road or lane which passes over the top of the hill and is marked according to note 1.[1]

Halleck (Franklin County, Mo., C. H. B., 1873).—About 7½ miles west of Grays Summit on the north side of the State or Manchester road directly opposite Mr. Breitenbach's store which is also the Halleck post office. The station is 2 meters north of the fence on the north side of the road and is marked according to note 1.[1] The northeast corner of the store is 20.91 meters from the station and the northwest corner, 20.45 meters.

Dieckhaus (St. Charles County, Mo., C. H. B., 1873).—In Fenme Osage Township about 6 miles northeast of the town of Washington and 2 miles north of the Missouri River on the top of a hill a short distance northeast of the house of Mr. Dieckhaus and on the opposite side of the road. The station is marked according to note 1.[1]

Peters (Franklin County, Mo., C. H. B., 1874).—In the western part of Union Township about 4 miles west of the courthouse and 3 miles west of Mann's store, on the top of a cultivated hill on the farm of Henry Peters on the opposite side of the road and about 400 meters south of his house. The station is marked according to note 1.[1] An oak tree marked with a triangular blaze is beyond the fence 53 meters southeast of the station and a lane leading to a spring is about 114 meters (paced) south.

Enoch Knob (Franklin County, Mo., C. H. B., 1874).—In sec. 3, T. 44 N., R. 2 W., about 1¼ miles from the town of Newport on a mound known as Enochs Knob the property of Mr. Sellmeyer and just west of his cultivated lands. The station is about 80 meters west of the fence on the east side of the road east of the mound and is marked according to note 1.[1]

Berger (Franklin County, Mo., C. H. B., 1874; 1907).—About 4 miles west by south from the town of New Haven, in the SW. ¼ sec. 32, T. 45 N., R. 3 W., on land belonging to Andrew J. Hale. It is on a hill known locally as Kaisers Hill, the highest one of several prominent hills in the northwestern part of Franklin County. Berger Knob is the most northern one of four hills forming the group of which Kaisers Hill is the most southern. The top of the hill is cultivated and the station is on the southeastern extremity of the top of the knoll, at the southern edge of the clearing, about 30 meters to the left of where the road enters the clearing, and is marked according to note 1.[1] A latitude pier constructed in 1906 is 16.69 meters N. 9° 46′ W. from the station, and a longitude pier constructed in 1907 is 19.89 meters north and 2.90 meters west of the station.

Jacobs (Franklin County, Mo., C. H. B., 1874; 1878).—About 15 miles from the town of New Haven and 20 miles from the town of Washington, in the extreme southeast corner of the NW. ¼ SW. ¼ sec. 28, T. 43 N., R. 3 W., on land belonging to E. B. Jacobs (nonresident) and immediately west of the cultivated land owned by J. Schmidt, who lives one-third mile northeast of the station. The station is northwest of the Canaan road on the western edge of a branch road leading to the State road, 17 meters west of the fence along the east side of the road, and 97 meters north of a right-angled bend in the road. The station is marked according to note 1.[1] Two oak trees, each marked with a triangular blaze and a notch, are at the following distances and azimuths from the station: 12.92 meters 166° 59′, and 13.41 meters 195° 42′.

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[1] See p. 35.

Winter (Gasconade County, Mo., C. H. B., 1874; 1878).—Near the fence line on the south side of the State road, about 1¾ miles east of Drake post office, which is at the intersection of the State road and Iron road. The station is on the edge of a small orchard on the farm of Henry Winter, nearly across the road from his house and 31 meters (paced) east of the east line of his barns. It is marked according to note 1.[1] The southeast corner of Mr. Winter's house is 30.54 meters from the station in azimuth 166° 24′, and the southeast corner of the NE. ¼ NW. ¼ sec. 24, T. 43 N., R. 5 W., is 71.93 meters distant in azimuth 290° 28′.

Gasconade (Gasconade County, Mo., C. H. B., 1874; 1878).—On a wooded hill about 250 meters east of the Iron road about one-sixth mile south of its junction with the Mount Sterling road, on land owned by J. Boesch, sr., just south of F. Oschner's land. The station is about 20 meters south of the center of the north side of the NW. ¼ SE. ¼ sec. 3, T. 44 N., R. 5 W., and is marked according to note 1.[1] The stone marking the northeast corner of the NW. ¼ SE. ¼ sec. 3 is 217 meters from the station in azimuth 264° 06′. Three oak trees, each marked with a triangular blaze and one, two, or three notches corresponding with the number, are at the following distances and azimuths from the station: No. 1, 16.33 meters 58° 51′; No. 2, 8.81 meters 228° 36′; and No. 3, 11.66 meters 301° 12′.

Turnpike Bluff (Gasconade County, Mo., H. W. B., 1878).—On a prominent bluff of the same name in the western part of Gasconade County, overlooking the Gasconade River, which skirts the southwest base of the bluff about 360 feet below the station. The station is near the center of sec. 3, T. 44 N., R. 6 W., at the center of a small Indian mound about 10 meters in diameter and 1½ meters high, made of stones roughly piled together. Two or three similar mounds are a short distance down the slope of the bluff. The station is probably marked according to note 3.[1] The house of Charles Brieske is at the foot of the hill on the northeast side, and the best approach to the station is from this direction.

Geyer (Gasconade County, Mo., H. W. B., 1878).—In the NE. ¼ sec. 28, T. 43 N., R. 6 W., on land belonging to the heirs of C. Geyer, about 2 miles south by west from a small church at the intersection of the Mount Sterling road and the State road. The station is marked according to note 3.[1]

Bradford (Osage County, Mo., H. W. B., 1879).—About 2 miles northwest of Mint Hill post office and 1¼ miles south by west of Bailey Creek post office, in the SE. ¼ sec. 14, T. 44 N., R. 8 W., on the land of T. J. Bradford, on the northwest side about 30 meters distant from the Linn and Chamois road. The station is marked according to note 3.[1] Three trees, marked with one, two, or three notches, according to the number, are at the following distances and azimuths from the station: No. 1, 6.95 meters 99° 05′; No. 2, 17.53 meters 209° 20′; and No. 3, 8.53 meters 271° 45′.

Pilot Knob (Osage County, Mo., H. W. B., 1879).—On the northern one of the two summits of a prominent hill, known locally as Pilot Knob, in the southeastern part of Osage County, about 5 miles from Rollin's ferry on the Gasconade River. The station is near the middle of the northern part of sec. 3, T. 41 N., R. 8 W., or possibly just across the line in sec. 34, T. 42 N., and is marked according to note 3.[1]

McDaniel (Osage County, Mo., H. W. B., 1879).—On a high point of the prominent ridge running nearly north and south through the middle of Osage County, about 3 miles by road southwest by south from the town of Linn. The station is about midway between the towns of Richfountain and L'Ours Creek, on the northeast side of the road connecting those two places, about one-fourth mile southeast of the junction of this road with the Linn and Westphalia road, on the edge of a cleared field belonging to John N. McDaniel. It is in the southeast corner of the NW. ¼ SE. ¼ sec. 23, T. 43 N., R. 9 W., and is marked according to note 3.[1]

Kennedy (Osage County, Mo., H. W. B., 1879).—In the southwestern part of the county on land belonging to Bernard Schwartze about 20 meters east of the Vienna and Castle Rock road and near the center of the north side of the NE. ¼ sec. 36, T. 42 N., R. 11 W. Mr. Schwartze lives about one-third mile south of the station. The station is marked according to note 3.[1]

Cedar (Callaway County, Mo., H. W. B., 1879; 1887).—On the central and highest one of the three points of the prominent bluff on the north side of the Missouri River directly opposite Jefferson City. The station is at the center of a small Indian mound about 12 meters in diameter and 2 meters high. It was marked originally according to note 3,[1] but in 1887 it was reported that the surface marks had been removed leaving only the underground mark, a bottle of ashes.

Belshe (Cole County, Mo., H. W. B., 1879).—In the southwestern part of Cole County on the road from Jefferson City to Tuscumbia, about 1 mile southeast of Spring Garden Hill, a little more than one-half mile northeast of Locust Mound post office and 50 meters east of the county line, near the center of the N. ½ SW. ¼ sec. 19, T. 42 N., R. 13 W. The station is in the yard near the house of August Pfitzer and is marked according to note 3.[1] The northeast corner of Pfitzer's house is 7.96 meters from the station in azimuth 46° 05′ and a prominent tree used as a gatepost in the northeast corner of the yard is 16.52 meters distant in azimuth 187° 35′.

Moreau (Cole County, Mo., H. W. B., 1879).—In the western part of the county about 7 miles south of Centerville and 1 mile northeast of the village of Russellville, about 150 meters south of the first road north of the State road and about 300 yards east of the road leading northeast from Russellville. The station is near the center of the NW. ¼ NE. ¼ sec. 35, T. 44 N., R. 14 W., on land belonging to John Neederweiner who lives on the State road about one-third mile south. It is marked according to note 3.[1]

Medlock (Cole County, Mo., H. W. B., 1879).—About 2 miles north-northwest of Elton and 6 miles east-northeast of Centertown, in the northeast corner of the SW. ¼ sec. 37, T. 45 N., R. 13 W., in the southwest corner of a cultivated field where the road makes a right angled turn to the north. The station is on land belonging to Noah Hoover and is marked according to note 3.[1] The west gable of Hoover's house is about 150 meters from the station in azimuth 283°.

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[1] See p. 35.

Christian (Moniteau County, Mo., H. W. B., 1879).—About 1 mile east-southeast of the courthouse in the town of California, on a narrow strip of land between the State road and the Missouri Pacific Railroad belonging to the heirs of J. J. Christian, near the center of the southern edge of the NE. ¼ sec. 27, T. 45 N., R. 15 W. The station is about 75 meters south of the railroad and about 40 meters north of the road and is marked according to note 3.[1] The southwest corner of the Christian house is about 300 meters from the station in azimuth 249° 28′ and the northeast corner of H. Boepler's house is about 150 meters distant in azimuth 40° 22′.

High Point (Moniteau County, Mo., H. W. B., 1880; 1902).—In the southern part of the county about 12 miles south of the town of California and one-half mile northeast of the village of High Point, near the middle of the southern edge of the W. ½ sec. 9, T. 43 N., R. 15 W. The station is on the estate of George Radcliff, sr., and is marked according to note 3.[1] It was found in 1902 that the surface marks had been removed.

Hunter (*Versailles south base*) (Morgan County, Mo., F. D. G., 1880; 1897).—In Moreau Township about 4 miles east of Versailles, in the SE. ¼ SW. ¼ sec. 2, T. 42 N., R. 17 W., on land owned (1897) by the estate of D. C. Hale. The station is marked by a cross in the top of a copper bolt set in a rough-dressed block of Warrensburg sandstone 0.65 meter square and 0.24 meter deep inscribed "U. S. C. & G. S. 1897" and the block in turn is set in concrete. The underground mark is similar except that the sandstone block is 0.54 meter deep by 0.28 meter square. The reference posts are the same as described in note 3.[1]

Cole (Moniteau County, Mo., F. D. G., 1880).—About 3 miles east-southeast of the town of Tipton, in the northern part of sec. 30, T. 45 N., R. 16 W., on land owned by Mrs. S. F. Cole. The station is at the center of an old windmill which was used in place of an observing scaffold. It is marked according to note 3[1] except the reference marks are only 4 feet from the station.

Versailles north base (Morgan County, Mo., F. D. G., 1880; 1902).—About 5 miles north-northeast of the town of Versailles in the southern part of the W. ½ SW. ¼ sec. 9, T. 43 N., R. 17 W., on land belonging to Moses H. Tipton. The station is just east of Tipton's house about midway between the north road fence and the southwest one of his three barns. It is marked the same as *Hunter* (*Versailles south base*) described above. In 1902 it was found that a rail fence had been built over the station.

Hubbard (Morgan County, Mo., F. D. G., 1880; 1891).—About three-fourths mile northeast of Syracuse near the center of the SE. ¼ sec. 11, T. 45 N., R. 18 W., on land owned in 1891 by Joseph James. The station was marked originally according to note 3.[1] In 1891 it was learned that at some previous date the owner of the land had removed the surface marks by mistake but later had replaced them as near as possible in their original positions. The underground mark was not disturbed and should be used to check the position of the surface marks when the station is recovered.

Hughes (Morgan County, Mo., F. D. G., 1880; 1902).—On the Warsaw road about 5 miles nearly due west of Versailles, near the center of sec. 5, T. 42 N., R. 18 W., on land owned by Robert Hughes. The station is marked according to note 3.[1] When recovered in 1902, the station mark was found to be badly defaced but still in place. The reference marks could not be found.

Schnackenburg (Benton County, Mo., F. D. G., 1882).—About 3 miles northeast of Cole Camp, in the SE. ¼ NW. ¼ sec. 13, T. 43 N., R. 20 W., on land owned by C. Schnackenburg. The station is marked according to note 3.[1]

Heard (Pettis County, Mo., F. D. G., 1880; 1891).—In the northeast quarter of Sedalia, just east of the cemetery, 2.7 meters south of the south line of Tower Avenue (named for the signal which stood over the station) and about 40 meters east of New York Avenue, on land belonging to George Heard, who lives on the north side of the street nearly opposite the station. The station is marked according to note 3.[1]

Kendrick (Pettis County, Mo., F. D. G., 1882).—About 4 miles northwest of Green Ridge, in the NW. ¼ sec. 26, T. 45 N., R. 23 W., in an orchard belonging to John Kendrick about 30 meters east of his house. The station is marked according to note 3.[1]

High Point Tebo (Johnson County, Mo., F. D. G., 1882).—About 6 miles northwest of the town of Windsor in the NW. ¼ SE. ¼ sec. 21, T. 44 N., R. 24 W., on land belonging to General ———, of New York. The station is marked according to note 3.[1]

Knob Noster (Johnson County, Mo., F. D. G., 1882; 1907).—On a prominent hill known as Knob Noster in 1882, but since called Price or Guihen's Hill after the names of successive owners, about two-thirds mile north by east from the railway station called Knob Noster. The station is in the SW. ¼ NW. ¼ sec. 15, T. 46 N., R. 24 W., and is marked according to note 3.[1] A concrete longitude pier built in 1907 is 3.62 meters directly south of the station.

Normal (Johnson County, Mo., F. D. G., 1883; 1906).—On the chimney at the southeast corner of the Missouri State Normal School building at Warrensburg. The chimney is 12 feet square and in 1883 was capped with four heavy blocks of sandstone. The station is at the center of the stone at the northwest corner of the chimney and is marked by a drill hole at the center of a triangle cut in the stone. A regular station mark, described in note 3,[1] used as a reference mark is in the yard 57.57 meters directly south of the station. In 1906 it was found that a brick superstructure had been built on the top of the chimney and in order to recover the station it was necessary to remove a few of the bricks just above the sandstone block at the northwest corner. The bricks were replaced, but two sets of ranges were set to indicate the position of the station. One range of the first set consists of a stone post 6 inches square marked with a cross and drill hole set flush with the ground 7.80 meters north of the fence along the south side of the grounds and 25.46 meters west of the west edge of a north-and-south walk on the campus; and of a cross cut in the stone foundation of the building on the south face of the pilaster on the south side of the basement entrance at the southeast

[1] See p. 35.

corner of the south wing of the building. This range bears S. 7° 55′ W. from the station. The second range of the first set consists of another stone post marked with a drill hole and the letters U. S. C. & G. S. and projecting 3 inches above the ground, on the east side of the ball grounds 20.55 meters south of an east-and-west walk and 32.20 meters west of the east fence; and of another cross cut in the east face of the main building south of the steps at the northeast corner and 0.75 meter north of the southeast corner of the building. This range bears a little south of east from the station. The second set of ranges is on the chimney itself. The first range of this set consists of a copper nail cemented in each of two drill holes on the north side of the chimney on top of the projecting part of the sandstone block containing the station mark. The second range of this set consists of similar marks, one in the west projection of this same stone and the other in the east face of the chimney 1.43 meters above the roof and 0.34 meter from the southeast corner of the chimney. The intersection of the two lines of either set of ranges described above gives the exact position of the station.

Caldwell (Johnson County, Mo., F. D. G., 1882).—In a pasture belonging to Henry Caldwell almost directly across the road south of his house and a short distance west of the Clinton road which forms the boundary between Johnson and Henry counties. The station is in the northeast corner of the W. ½ SE. ¼ sec. 26, T. 44 N., R. 25 W., about 50 meters south of the road in front of Caldwell's house, and is marked according to note 3.[1]

Baker (Johnson County, Mo., F. D. G., 1883).—On the highest part of a prominent hill about 1 mile north of the town of Kingsville, on land belonging to Edward Baker and close to his house. The station is in the S. ½ E. ½ SE. ¼ sec. 25, T. 46 N., R. 29 W., and is marked according to note 3.[1]

Hutton Mound (Cass County, Mo., F. D. G., 1883.)—About 14 miles southeast of the town of Harrisonville, on a hill known locally as the Big Mound belonging to Thomas Hutton, who lives about five-eighths of a mile west of the station. The station is in the NE. ¼ NW. ¼ SE. ¼ sec. 1, T. 43 N., R. 30 W., and is marked according to note 3.[1]

Chapel Hill (Johnson County, Mo., F. D. G., 1883).—About one-fourth mile south-southwest from the village of Chapel Hill, on land belonging to Dr. Joseph Ragsdale about 125 meters south-southeast of his house. The road in front of Dr. Ragsdale's house is the boundary line between Johnson and Lafayette counties, and a new range line leads north from this road. The station is in the NE. ¼ SE. ¼ sec. 1, T. 47 N., R. 29 W., about 2 meters south of the middle of the line bounding the 40-acre division and is marked according to note 3.[1] In 1883 Dr. Ragsdale contemplated moving his house to a site about 30 meters southeast of the station.

Thornton (Cass County, Mo., F. D. G., 1883).—About 4 miles northeast of the town of Pleasant Hill, 3 meters south of the fence on the south side of the county line road between Cass and Jackson counties, on land belonging to Charles Thornton. The station is in the NE. ¼ NW. ¼ NW. ¼ sec. 4, T. 46 N., R. 30 W., and is marked according to note 3.[1]

Fulton (Cass County, Mo., F. D. G., 1883).—About 2½ miles east-southeast of Harrisonville, in sec. 2, T. 44 N., R. 31 W., 51.4 meters east-southeast of the northwest corner of the northeast quarter of the section, 21.7 meters south of the fence on the south side of the road along the north side of the section, and 21.8 meters east of a small house. The station is on land belonging to L. G. Fulton and is marked according to note 3.[1]

Bowler (Jackson County, Mo., F. D. G., 1884).—On a small hill about 2½ miles southwest of the town of Lees Summit, on land belonging to J. O. Bowler about one-third mile west of his house. The station is in the NW. ¼ SW. ¼ sec. 18, T. 47 N., R. 31 W., about 20 meters south of an apple orchard. It is marked according to note 3.[1]

Berry (Cass County, Mo., F. D. G., 1884).—About 1½ miles west of the town of Belton, in the SW. ¼ sec. 10, T. 46 N., R. 33 W., near the east center of a cultivated field belonging to Mrs. R. C. Berry. The station is about midway between the Santa Fe Railroad to the north and the Belton wagon road to the south, and is marked according to note 3.[1] A forked cottonwood tree marked with a triangular blaze is 85.2 meters from the station in azimuth 93° 23′.

Marty (Johnson County, Kans., F. D. G., 1884).—About 4 miles northeast of the town of Lenexa in the SE. ¼ sec. 19, T. 12 S., R. 25 E., in an open field about one-fourth mile southeast of John Marty's house, 11 meters north of a farm road, and 20 meters west of a hedge. The station is marked according to note 3,[1] except that the reference posts are 6 feet distant. The station post is surrounded with charcoal.

Haskin (Johnson County, Kans., F. D. G., 1885).—About 7½ miles east of the town of Spring Hill, in the SW. ¼ sec. 18, T. 15 S., R. 25 E., 13.9 meters northeast of the northeast corner of U. A. Haskin's barn and nearly due south of his dwelling house. The station is marked according to note 3,[1] except that the reference posts are 6 feet distant. The station post is surrounded with charcoal. The southwest corner of section 18, which is at the intersection of two roads, is 202.84 meters south-southwest from the station. The southeast tree in a small orchard between Haskin's house and barn is 7.2 meters northwest of the station.

SUPPLEMENTARY POINTS.

Creed (Kanawha County, W. Va., A. T. M., 1881).—On the western point of a hill known as Coopers Hill about 11 miles from Charleston and 1¼ miles from the mouth of Coopers Creek, on land belonging to the Bliss Merrill estate. The station is marked by a 1-inch drill hole 4 inches deep in a large rock, one of a group of rocks. Three other drill holes 1 inch in diameter and 3 inches deep are in rocks at the following distances and azimuths from the station: 3.70 meters 141° 13′, 1.93 meters 335° 33′, and 1.52 meters 52° 29′.

Elk (Kanawha County, W. Va., A. T. M., 1881).—About 2 miles from Charleston and 1 mile west of Elk River on a ridge extending west from the river just north of Magazine Creek. The station is on land belonging to the Brigham heirs and is marked by a nail in the top of a stake. The underground mark is an earthenware pyramid 2 feet below the surface. Five stumps marked with nails are at the following distances and magnetic directions from the station:

[1] See p. 35.

White oak stump with one nail, 5.82 meters S. 74° 43′ E.; white oak stump with one nail, 7.22 meters S. 4° 05′ W.; chestnut oak stump with two nails 7.41 meters S. 57° 20′ W.; stump with three nails 4.15 meters N. 68° 52′ W.; and a chestnut oak stump with two nails, 7.22 meters N. 23° 18′ W.

Martin (Kanawha County, W. Va., A. T. M., 1881).—About 1½ miles from Charleston and just north of Cemetery Hill, on a hill known as Martin's Hill. The station is not on the highest part of the hill but about 2 meters south of the line fence between the land of Dick Martin and that of William Melton. It is marked by a nail in the top of a stake and 2 feet underground by an earthenware pyramid. A stump marked with 2 nails is 9.98 meters S. 37° E. (mag.) from the station and another stump marked with 4 nails is 3.69 meters S. 31° 08′ W. (mag.). A lone chestnut oak is N. 89° 35′ E. (mag.) from the station.

Ferguson (Kanawha County, W. Va., A. T. M., 1881).—On the south side of the Kanawha River opposite Charleston, on land belonging to Judge Ferguson and near the northwest corner of his office. The station is in line between the southwest corner of the office and the corner of the yard fence to the northwest and is 4.04 meters directly west of the northwest corner of the office. The station is marked by a stake and 20 inches underground by an earthenware pyramid. The following distances are from the station: North fence, 7.1 meters; west fence, 4.2 meters; northwest corner of fence, 9.1 meters; and southwest corner of office, 6.7 meters.

Fort Scammon (Kanawha County, W. Va., A. T. M., 1881).—On a high hill opposite the mouth of Elk River. There was a battery here during the Civil War and the hill is sometimes called Battery Hill. The old ramparts are on the highest part of the hill and the station is at the northeast corner just outside the ditch and just inside of the fence separating a cleared field from the old fort which is overgrown with trees and bushes. The station is marked by a nail in the top of a stake and 2 feet underground by an earthenware pyramid. A black walnut tree in the cleared field is about 50 meters N. 69° 47′ E. (mag.) from the station and a hole drilled in a rock is 3.05 meters S. 48° 07′ E. (mag.). Four oak trees, each marked with a blaze and a nail, are at the following distances and magnetic directions from the station: 4.48 meters S. 24° 15′ E., 11.1 meters S. 5° 42′ W., 11.9 meters N. 71° 20′ W., and 14.25 meters N. 50° 32′ W.

Charleston astronomic (Kanawha County, W. Va., G. W. D., 1881; 1883).—In the northwestern part of the statehouse grounds at Charleston. The station is marked by a sandstone pier resting on a heavy masonry foundation. It was learned in 1883 that the statehouse was to be remodeled. Measurements were made to the location of a proposed new cupola. The station is 41.94 meters west and 5.10 meters south of this cupola.

Springville (Greenup County, Ky., A. T. M., 1885).—On the highest part of the river hills just back of the town of Springville and directly across the Ohio River from the city of Portsmouth, Ohio. The station is close to the brow of the hill on the highest part of the hill as seen from Portsmouth and about 15 minutes' walk from the ferry landing. It is on land belonging to the Scioto Fire Brick Co. and is marked according to note 7.[1] The reference marks are at the following distances and directions from the station: 2.03 meters north, 2.73 meters east, 2.00 meters south, and 1.54 meters west.

Portsmouth north meridian (Scioto County, Ohio, A. T. M., 1885).—In the grounds of the Children's Home in the southeast part of the city of Portsmouth. The station is marked by a brass bolt in the top of a stone post 12 inches square and 8 feet long which projects 3½ feet above the surface of the ground.

Portsmouth south meridian (Scioto County, Ohio, A. T. M., 1885).—In the grounds of the Children's Home in the southeast part of the city of Portsmouth, a short distance south of *Portsmouth north meridian* described above. The station is marked by a brass bolt in the top of a stone post 12 inches square and 8 feet long which projects 2 feet above the surface of the ground.

Lookout House (Kenton County, Ky., A. T. M., 1889).—About 2½ miles from the customhouse at Covington on the top of the cupola of the Lookout House, a German beer garden owned by Alois Hempel.

Observatory, Cincinnati (Hamilton County, Ohio, A. T. M., 1889).—On the southwest corner of the square or central part of the Cincinnati Observatory on Mount Lookout. The station is just southwest of the dome and is marked by a copper tack surrounded by three other tacks in the form of a triangle.

Mount Lookout transit pier (Hamilton County, Ohio, G. W. D., 1881; 1889).—In the grounds of the Cincinnati Observatory on Mount Lookout, 24.87 meters N. 5° W. from the northwest corner of the observatory, and 12.8 meters west and 29.6 meters north of the center of the dome. The station is marked by a sandstone pier built of three pieces cemented together in the form of an H. The pier is inscribed as follows: "U. S. Coast and Geodetic Survey, 1881."

Price Hill (Hamilton County, Ohio, A. T. M., 1889).—On the top of Price Hill in the city of Cincinnati, at the center of the tower at the southeast corner of the brick building of the Price Hill incline engine house.

Mount Adams Convent (Hamilton County, Ohio, A. T. M., 1889).—The center of the belfry on the roof of the Passionist Monastery on Mount Adams, Cincinnati, just back of the Highland House and the Mount Adams incline. This monastery was formerly the old Cincinnati Observatory.

Fort Thomas[2] (Kenton County, Ky., 1912).—On the roof of the stone water tower on the military reservation at Fort Thomas, Ky. Station is in northwest angle of parapet walls, and is marked by reference to two cross marks cut in the top of the parapet wall. One in the west end of the north wall is 1.95 feet from the station; the other in the north end of the west wall is 2.01 feet from the station.

Brothers Protectory[2] (Hamilton County, Ohio, 1912).—Center of cross on steeple on southeast part of main buildings of the Mount Alverno Protectory for Boys on the river bluff southwest of Price Hill.

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[1] See p. 35.

[2] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

Warsaw School [1] (Hamilton County, Ohio, 1912).—On the south side of the apex of the roof of the Warsaw public school on Glenway Avenue, at the end of the Warsaw car line. This building is an old one and has been condemned. The station was marked by a copper tack surrounded by eight other copper tacks, and referenced to four chimneys as follows (in each case the near angle of chimney is point measured to): Chimney to east is distant 24.5 feet; chimney southeast of station is distant 11.5 feet; chimney to southwest is distant 8.0 feet; chimney west of station is distant 18.8 feet.

Eden Park water tower [1] (Hamilton County, Ohio, 1912).—The tip of the spire of the water tower in the northern part of Eden Park.

Hughes High School [1] (Hamilton County, Ohio, 1912).—On the tar and gravel roof of the high tower on Hughes High School, on the west side of Clifton Avenue, opposite Calhoun Street. Center is marked (in temporary manner) by a spike driven in the roof, and is referenced in permanent manner by two bronze disks set, one in the north and the other in the west parapet wall. From the center to the disk in the north wall is 16.03 feet, and to the disk in the west wall is 12.86 feet. These disks are of bronze, 3¾ inches across, and bear the inscription "City of Cincinnati—Topographic Survey of 1912." In the center of each disk is a triangle and a cross cut with a chisel indicates the exact point on the disk used.

Westwood School [1] (Hamilton County, Ohio, 1912).—On the highest part of the roof of the Westwood public school, closely in line with the south edge of the large chimney, and about 25 feet to the east of it. Marked by a large nail driven into the tar and gravel roof and referenced as follows: A bronze disk (see description of Hughes High School) set in the east face of large chimney is 25.21 feet from the station; a similar disk set in the vertical face of the brick parapet wall on south side of roof is 39.02 feet from the station. A cross inside a triangle cut in a brick in southwest corner of base of small chimney is 10.41 feet east of station, and a similar mark cut in the east tile pillar over the main entrance to school is 47.53 feet from the station.

Stross [1] (Hamilton County, Ohio, 1912).—On top of the ridge west of Cumminsville, on a rent farm belonging to the Emery estate, and about 800 feet southwest of the barn. Station is marked by bronze disk (see description of Hughes High School, above) in the upper face of a concrete block. This block is triangular in plan, 1½ feet thick, its upper face being 2 feet below the surface of the ground. No surface mark was set at the center, but two reference marks were set as follows: Concrete post with nail in top was set alongside wire fence on west side of road; it is 151.12 feet from station in bearing north 46° west. The other reference mark is a similar concrete post on east side of road, 101.9 feet from station in bearing south 57° west.

Clifton School [1] (Hamilton County, Ohio, 1912).—On the roof of Clifton School, west side of Clifton Avenue, opposite Woolper Avenue. Station is south of the ventilator on the south half of the roof and is marked by a copper tack surrounded by three other tacks in form of a triangle. The station was referenced as follows: Reference No. 1 is a copper tack surrounded by four others driven in the northwest corner of a projection on the south cupola of the building. Mark is 1.7 feet above the roof and 14.95 feet from the station. Reference No. 2 is a copper tack surrounded by four others, driven in the vertical face of the ridge of the roof, over which the roof tiling projects. It is 6.68 feet from the station. Reference No. 3 is a copper tack surrounded by four others, driven in the west edge of the tin roof directly west of small ventilator, and 16.65 feet from the station. Reference No. 4 is a copper tack surrounded by four others, driven in the tin roof 4 feet from its west edge and 8 feet from its south edge. Mark is 12.72 feet from the station.

College Hill Methodist Home [1] (Hamilton County, Ohio, 1912).—The tip of the cupola on the large brick building, the Methodist Home for the Aged, on the west side of Hamilton Avenue in the southern part of College Hill.

Observatory [1] (Hamilton County, Ohio, 1912).—In the grounds of the Cincinnati Observatory on Mount Lookout, in the western part of the grounds, about 275 feet west of the west side of the main building of the observatory. Marked by a bronze disk in a concrete block similar to the one placed at Norwood Station.

Norwood [1] (Hamilton County, Ohio, 1912).—In the lot on Mound Street, city of Norwood, in which stands the large black water tank. Station is 69.3 feet from center of tower in bearing south 12° west. Center is marked by a cross cut in bronze disk (see description of Hughes High School) set in top of a concrete block. This block, which was molded in place, is triangular in form, extends 3 feet below surface of ground, about 1½ feet above, is 2 feet on an edge, and has in each of its three vertical faces a triangle cast sunken.

Longview [1] (Hamilton County, Ohio, 1912).—The lowest portion of the flagpole on Longview Asylum for the Insane, just east of the former village of Carthage.

Mount Washington School [1] (Hamilton County, Ohio, 1912).—On the roof of the tower of the Mount Washington public school on Beechmont Avenue, corner Campus Lane. Station is marked by a single copper tack. It is 1.5 feet inside west rail; 5.1 feet from northwest railing corner; 8.3 feet from southwest railing corner; and 3.3 feet from the northwest and 5.1 feet from the southwest corners of the trap door.

Madisonville School [1] (Hamilton County, Ohio, 1912).—On the roof of the Madisonville public school, near its southern end, the exact point being marked by a wire nail driven into the tar and gravel roof. Station is 13.9 feet from the southeast and southwest corners (close to roof) of large ventilator. Bronze disks such as are described for Hughes High School were placed as follows: In the vertical face of the brick parapet wall rising above the south end of the roof; a cross cut in this disk is 10.84 feet from the station. A similar disk was set in the vertical face of the west parapet wall near south end of building. This disk is 48.33 feet from the station.

[1] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

Kennedy [1] (Hamilton County, Ohio, 1912).—In Kennedy Heights on the brow of the hill, 250 feet south of the center line of Davenant Avenue, and 100 feet west of center line (produced) of Kinell Avenue. In a brush covered lot belonging to the Bullock estate. Marked by a disk in a concrete block similar to the one placed at Norwood (see p. 51).

St. Joe [1] (Hamilton County, Ohio, 1912).—Center of cross on steeple of Mount St. Joseph, the mother house of the Sisters of Charity, on the river bluff, 2 miles east of the former village of Delhi.

Reading [1] (Hamilton County, Ohio, 1912).—A braced pole close to fence along west side of an open field on brow of hill, north of Hamel Road and east of the village of Reading. Not permamently marked.

Vincennes latitude and longitude (Knox County, Ind., E. S., 1881).—In the courthouse yard at Vincennes, 55.58 meters east and 14.78 meters north of the cupola of the clock tower of the courthouse, about 6 meters from the iron fence along Broadway Street and about midway between Seventh and Eighth Streets. The station is marked by a cross in the top of a short stone post projecting 2 or 3 inches above the surface of the ground. On either side of this is a longer stone post projecting about 3 feet above the ground and used for supporting the instrument. The two high posts are inscribed as follows: "U.S. Coast and Geodetic Survey, 1881."

Forder (St. Louis County, Mo., C. H. B., 1873).—Within the common of Carondolet, south of the River des Peres, about 250 meters south-southwest of the intersection of the telegraph road and the Jefferson Barracks road, on a gentle rise a few meters north of a 20-foot road near its intersection with the telegraph road. The station is marked by an iron nail in the top of a stake with a mound of dirt thrown up over it. The underground mark is an earthenware pyramid with edges about 6 inches long and having on its southern face the letters U.S.C.S., set 2 feet below the general surface of the ground.

St. Louis standpipe (St. Louis City, Mo., C. H. B., 1871).—On the top of the cap of the standpipe, 180 feet high, at the corner of Grand Avenue and Fourteenth Street, St. Louis. The station is marked by a nail in a plank nailed to the timbers which are framed in the brick masonry at the top of the standpipe. There are four arrows pointing toward the station cut in the top of the iron cap of the standpipe.

Northwest corner (Franklin County, Mo., C. H. B., 1874).—The stone at the northwest corner of sec. 36, T. 45 N., R. 2 E., about 318 meters north-northeast of station *Tavern Rock*.

Polemann's house (Franklin County, Mo., C. H. B., 1874).—Near the intersection of the South Point road and the county rock road to Union, about 2 miles west of station *Halleck*. The station is the northeast corner of the chimney at the south end of Henry Polemann's house. Station *Corner fifth meridian* described below is 263.33 meters east and 146.45 meters north of the station.

Corner fifth meridian (Franklin County, Mo., C. H. B., 1874).—The stone marking the half section corner at the east side of sec. 13, T. 43 N., R. 1 W., 263.33 meters east and 146.45 meters north of station *Polemann's house*, described above. There are two white oak witness trees near the station, one east and the other west. The original marks on the trees, "S. IIIX," were discovered in 1874 by cutting out a section of each tree.

Doermann Hill (Gasconade County, Mo., F. D. G., 1878).—Two miles north of Drake and one-fourth mile south of Doermann's house on the west side of the iron road about 200 meters north of where the Millers Landing road branches from the iron road. The station is marked by a stone post 3 feet long, dressed to 6 inches square at the top, projecting about 3 inches above the ground, and marked with a cross and the letters U. S. C. S. The stone at the southeast corner of sec. 34, T. 44 N., R. 5 W., is 363.6 meters N. 59° E. (mag.) from the station. The signal used at this station was a barrel on the top of a pole fastened in the top of a tree.

L'Ours Creek spire (Osage County, Mo., H. W. B., 1879).—The 50-foot spire of the small brick Roman Catholic Church at L'Ours Creek.

Koeltztown spire (Osage County, Mo., H. W. B., 1879).—The 125-foot spire of the large brick Roman Catholic Church at Koeltztown.

Jefferson City astronomic (Cole County, Mo., H. W. B., 1879).—On a hill in the extreme southeastern part of Jefferson City, on the east side of the Castle Rock road, about one-fourth mile south of the national cemetery and about the same distance north of the fair grounds, in the front yard of the house of E. T. Manchester, on the right-hand side of the walk leading from the front gate to the house. The station is marked by a cross in the top of a stone post, 6 inches square and 2½ feet long, projecting about 2 inches above the ground. The letters U. S. C. S. are inscribed in the top of the post.

Cooks Knob ice house (Johnson County, Mo., F. D. G., 1882).—In the northwest corner of SE. ¼, NE. ¼ sec. 14, T. 47 N., R. 24 W., on a knob about 7 miles north of station *Knob Noster*. The station is the center of a pole on the ridge of E. Cook's ice house, 9 inches south of the ventilator on the building.

Hazel Hill (Johnson County, Mo., F. D. G., 1882).—About 11 miles north of Warrensburg on the highest part of Hazel Hill, in the northwest corner of SE. ¼, SW. ¼ sec. 2, T. 47 N., R. 26 W. The station is marked by a nail in the top of a 3-foot stake. It is also marked 2½ feet below the ground by a small bottle of ashes.

Kansas City astronomic (Jackson County, Mo., C. H. S., 1882; 1907).—This station has been destroyed by building operations.

State line 3 (Johnson County, Kans., F. D. G., 1885).—On the west side of the State line road about one-half mile north of the road from Aubry. The station is marked by a nail in the top of a stake. The State boundary stone at the southeast corner of the NW. ¼ sec. 26, T. 14 S., R. 25 E., is 552.16 meters south of the station.

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[1] Copied from "Report on a plan of sewerage, city of Cincinnati." See p. 5.

State line 1 (Johnson County, Kans., F. D. G., 1885).—About 1½ miles south of New Santa Fe, on the north side of the Belton-Olathe road, just west of the State line road. Missouri stone, which is at the southeast corner of SW. ¼ sec. 35, T. 13 S., R. 25 E., at the intersection of the two roads, is 15.82 meters from the station in azimuth 297° 33′. No description of the marking of the station is available.

Base 1 (Johnson County, Kans., F. D. G., 1885).—About 760 meters west of the State line road and 205 meters south of an east-and-west road on land belonging to Tryon brothers. The station is marked by a bottle 2½ feet below the surface of the ground.

Base 2 (Johnson County, Kans., F. D. G., 1885).—This station is 271.24 meters from *Base 1*, described above, in azimuth 18° 43′.

State line 2 (Johnson County, Kans., F. D. G., 1885).—On the State line road about midway between two east-and-west roads. The stone marking the northeast corner of the NW. ¼ sec. 26, T. 12 S., R. 25 E. is 2.90 meters from the station in azimuth 191° 09′. No description of the marking at this station is available.

LOUISVILLE CONNECTION.

PRINCIPAL POINTS.

Blocher (Scott County, Ind., E. H. P., 1914).—About three-fourths mile north-northeast of the town of Blocher, 250 meters east of the Baltimore & Ohio Southwestern Railroad, 120 meters northeast of a concrete culvert on the Deputy-Madison pike, and directly opposite the house of Mrs. Elizabeth J. Brinton, which is on the west side of the pike. The station is 70 meters east of the pike, on land belonging to D. R. Chasteen, who lives one-half mile southeast of the station, and is 5 meters south of Chasteen's north line fence. It is marked according to note 8.[1] Both reference marks are in the fence line north of the station, one between two small cedars, about 20 meters apart, 100 meters east of the pike, and 32.08 meters from the station in azimuth 261° 31′. The other reference mark is 30 meters east of the pike and 34.62 meters from the station, in azimuth 99° 25′.

Finley (Scott County, Ind., E. H. P., 1914).—About 9 miles southwest of Scottsburg and 2½ miles west-southwest of the Leota store, on the eastern edge of the flat-topped hills known locally as Finley Knobs, about three-fourths mile south of the Scottsburg-Salem road and one-fourth mile east of the Scott-Washington county line. The station is on the highest ground in the most northeasterly cultivated field on the hill, on land belonging to Mrs. Sarah Wolfe, one-fourth mile northeast of her house. A spur begins 250 meters north of the station and extends in a northeasterly direction, ending in a knob three-fourths mile from the station. The station is marked according to note 8.[1] One reference mark is in a fence line 60 meters west of the timber line and 30.30 meters from the station, in azimuth 24° 00′. The other reference mark is on the timber line on the east brow of the hill, 3 meters lower than the station and 41.88 meters distant, in azimuth 271° 43′.

Summit (Clark County, Ind., J. B. B., 1886; 1914).—On the Indiana State Forest Reservation, 2 miles west of the administration building of the reservation, 3 miles northwest of Henryville, and one-half mile south of the Henryville-Brownstown wagon road, on the top of a timbered knob known locally as Salaam Knob. The station is on the east slope of the top, about 1 meter below the highest point, and is marked according to note 10.[1] A lone pine tree 10 inches in diameter towers above the small trees which cover the top of the hill and is visible from Henryville. It stands on the highest point of the knob, 17.42 meters from the station, and is marked with a triangular blaze on the east side. The reference marks are at the following distances and directions from the station: 1.83 meters north (azimuth 193°), 1.86 meters east (azimuth 281°), and 1.84 meters south.

Marysville (Clark County, Ind., E. H. P., 1914).—About one-half mile northwest of the depot at Marysville, 300 meters northwest of the schoolhouse and 150 meters east of the house of George Harmon, on land belonging to Samuel W. Taflinger, of Jefferson. The station is in an open field 8.1 meters from the fence on the southwest side of the Marysville-Lexington pike, and is marked according to note 8.[1] The reference marks are in the fence line on the northeast side of the pike, one 25.77 meters from the station, in azimuth 280° 53′, and the other 33.13 meters, in azimuth 173° 54′.

O. & M. (Clark County, Ind., J. L. C., 1884; 1914).—About 3 miles north of Charlestown, 4 miles south of Otisco, about 300 meters west of the Baltimore & Ohio Southwestern Railroad, and 50 meters west of the Charlestown-Lexington wagon road. The station is 150 meters north of schoolhouse No. 9 of Charlestown Township and 50 meters northwest of a large beech tree standing at the head of a ravine close to the road, on land belonging to Mrs. Magdalene Flinchbaugh. The ground to the westward slopes down to a narrowing ridge and to the northeastward spreads out into a flat field, the highest point of which is about 100 meters north of the station. The station is marked according to note 8,[1] with the exception of the reference marks, which are the same as described in note 10.[1] They are at the following distances and directions from the station: 1.75 meters north, 1.82 meters east, and 1.87 meters south.

Popp (Clark County, Ind., E. H. P., 1914).—About three-fourths mile southwest of Bennettsville, a station on the Chicago, Indianapolis & Louisville Railway, and 2½ miles northwest of St. Joseph, on the top of a timbered hill known locally as Haystack Knob, on land belonging to George Popp, who lives three-eights of a mile northeast. Rock has been quarried on the top of the hill, leaving it a nearly flat, rocky surface, with a rim of earth on the outer edge. The station is on the highest ledge of rock 3 meters from the northeast end and 1 meter from the east side of the rim.

[1] See p. 35.

It is marked by a standard disk station mark set in the concrete, which fills in a hole 7 inches square and 10 inches deep, dug in the soft sandstone ledge. The subsurface mark is the point of a nail projecting one-fourth inch above the cement, which fills a hole 1 inch in diameter and 6 inches deep drilled in the bottom of the larger hole. The reference marks are stone posts 5 inches square and 2 feet long projecting 4 inches above the ground and marked in the top with a cross-lined arrow pointing toward the station. One reference mark is on the south rim at the brow of the hill, 8.56 meters from the station, in azimuth 42° 20′, and the other is on the rim on the west brow of the hill, 1 meter lower than the station and 12.24 meters distant, in azimuth 102° 10′. The station is about 2 meters east of the old station *Haystack*, which was established in 1884 and destroyed later by the quarrying.

Lutz (Clark County, Ind., J. L. C., 1884; 1914).—About 2 miles south-southwest of Charlestown and one-half mile east of the Baltimore & Ohio Southwestern Railway and the Louisville & Northern Electric Railway, 200 meters southeast of the Clark County poorhouse, 200 meters west of the farmhouse on the old Lutz farm now owned by John E. Long, The station is in the northwest corner of a field, 5.4 meters east of the west fence and 3.4 meters south of the north fence, 10 meters east of the pike, and 6 meters south of the road leading to the Long house. It is marked according to note 10.[1] The reference marks are at the following distances and directions from the station: 1.79 meters north, 1.81 meters east, and 1.86 meters south.

Six Mile (Floyd County, Ind., J. L. C., 1884; 1914).—About 6 miles north of New Albany, 2 miles south of St. Joseph, and one-fourth mile west of Six Mile switch on the Chicago, Indianapolis & Louisville Railway, on land belonging to Peter Weber, about 250 meters east of the house of Jacob Eberly, and 100 meters east of his east line. The land near Eberly's house is about 90 feet higher than the station. The station is on the footpath leading up the timbered spur from Six Mile switch to the top of the "Knobs" and to Eberly's house. It is marked according to note 10.[1] The reference marks are at the following distances and directions from the station: 1.91 meters north, 1.83 meters east, and 1.85 meters south. The east reference mark is on the trail described above. The station is about 75 meters east of an old stone quarry.

Sims (Jefferson County, Ky., J. L. C., 1884).—There is no description available for this station. It is probably marked according to note 10,[1] that is, the same as the other stations established in this locality by Prof. J. L. Campbell in 1884.

Bangs (Floyd County, Ind., G. A. F., 1879).—Near the State Street turnpike on land belonging to J. B. Bangs, a short distance northeast of his house on the point of the range of hills on which his house stands. The hill is wooded except that part immediately surrounding the station, which is clear of both trees and stumps. The station is marked according to note 9,[1] except that the tops of the stone posts are dressed to 4 inches square instead of 6. The reference marks are 1.83 meters from the station, north, east, and south (magnetic), respectively.

Blind Asylum, Louisville (Jefferson County, Ky., G. A. F., 1879).—In the cupola on top of the dome of the Kentucky Institution for the Blind, on Franklin Avenue near Pope Street, Louisville. The station is marked by a copper nail in the top of the circular cover of the ventilator. As reference marks there are four copper nails in the balustrade of the cupola, so placed that the diagonal lines joining them intersect at the station. They are at the following distances and directions from the station: 1.231 meters north, 1.250 meters east, 1.301 meters south, and 1.280 meters west.

Williams (Harrison County, Ind., G. A. F., 1879).—On a hill near Bridgeport, on land belonging to Frank Williams, on the highest ground of a cultivated field south of his house. The station is in the SW. ¼ SE. ¼ sec. 12, T. 4 S., R. 5 E., and is marked according to note 9,[1] except that the tops of the stone posts are dressed to 4 inches square instead of 6, and that the underground mark is a copper nail in the stopper of a glass bottle filled with ashes. The reference marks are 1.83 meters from the station north, east, and south (magnetic), respectively.

Cox (Jefferson County, Ky., G. A. F., 1879).—About 5 miles from Louisville, on the highest point of a prominent knob known as Cox's Knob, on land belonging to Ben Figgs. The station is about 30 meters back of an old sandstone quarry on the northern point of the knob, and is marked according to note 9,[1] except that the tops of the stone posts are dressed to 4 inches square instead of 6. The reference marks are 1.83 meters from the station, north, east, and south (magnetic), respectively.

Louisville north base (Jefferson County, Ky., G. A. F., 1879).—In the outskirts of Louisville, three-fourths mile south of the southern boundary of the fair grounds and 100 meters north of Bells Lane, known locally as Gravel Pit Lane. The station is on the farm of Joseph Oechsli, and 25 meters north of his barn. It is marked by a cross in the top of a copper bolt set in a drill hole in the top of a granite post 4 feet 10 inches long and about 10 or 12 inches square. The top of the post is dressed in the form of a pyramid, with the inscription "U. S. C. & G. S., N. Base 1879," cut in the south face, and projects 1½ feet above the ground. The underground mark is an earthenware pyramid with edges about 4 inches long and with the letters U. S. C. S. cut in the four faces, buried about 3½ feet below the surface of the ground. There are three reference marks, each consisting of a stone post 2½ feet long dressed to 4 inches square at the top, marked with a cross and an arrowhead pointing toward the station, and they are located as follows: 1.83 meters north, in the prolongation of the base line; 1.83 meters east, at right angles to the base line; and 1.83 meters south, in the line of the base.

Louisville south base (Jefferson County, Ky., G. A. F., 1879).—About 7 miles from Louisville, a short distance east of the Salt River turnpike and a few meters east of the Cecilian branch of the Louisville & Nashville Railroad, just north of a farm road crossing. The station is in a cultivated field on land belonging to B. H. Kerrick, whose house is on the opposite side of the railroad a short distance north. It is marked the same as the *Louisville north base*, described above, except that "S. Base" replaces "N. Base" in the inscription. The reference marks are located as

[1] See p. 35.

follows: 1.83 meters north, in the line of the base; 1.83 meters east, at right angles to the base line; and 1.83 meters south, in the prolongation of the base line.

Riley (Jefferson County, Ky., G. A. F., 1879).—Near the Blue Lick pike, about 3½ miles from the Preston Street turnpike, on land belonging to W. H. Riley, on the only cleared knob of several knobs north of his house. The station is marked according to note 9,[1] except that the tops of the posts are dressed to 4 inches square instead of 6. The reference marks are 1.83 meters from the station north, east, and south, respectively.

Potts (Harrison County, Ind., C. S., 1880; 1882).—South-southwest of Bridgeport and southeast of Elizabeth, in the NW. ¼ SW. ¼ sec. 11, T. 5 S., R. 5 E., on land belonging to J. Potts. The station is marked by a granite post 2.8 feet long, dressed to 4 inches square at the top, and marked with a cross and the letters U. S. C. G. S. The underground mark is a glass bottle filled with ashes about 3.1 feet below the ground. Four hard-burned bricks, each marked with an arrow head pointing toward the station, are 2.3 feet below the ground and 2.5 feet from the station north, east, south, and west (magnetic), respectively. The station is surrounded by a concentric ring of charcoal 1 foot wide, 0.9 foot deep, and 8.4 feet in diameter, about 2 feet below the surface of the ground. The following distances and magnetic bearings are from the station: Chestnut tree, 28.7 meters N. 66° 50′ E.; nearest corner of barn, 53.2 meters S. 31° 12′ E.; nearest corner of dwelling, 39.7 meters; lightning rod on dwelling, N. 87° 09′ W.; nearest corner of small shed, 22.5 meters.

Mountain Top (Bullitt County, Ky., C. S., 1880).—On the top of the most easterly high point of a hill known as Dawsons Knob, which is on the south side of the Salt River between Bardstown Junction on the east and Pitts Point on the west, the latter place being at the junction of Salt River and Rolling Fork. The station is about 9 meters south of the road along the top of the ridge on land belonging to W. H. Holsklaw. It is marked by a granite post 2.8 feet long dressed to 4 inches square at the top and marked with a cross and the letters U. S. C. G. S. The underground mark is a glass bottle filled with ashes 3.1 feet below the ground. Three reference marks, each consisting of a granite post 2 feet long dressed to 4 inches square at the top and marked with a diagonal cross with an arrowhead at the end of one diagonal pointing toward the station, are 1.83 meters from the station north, east, south, and west (magnetic), respectively.

Dobbins (Bullitt County, Ky., J. F. P., 1883).—About 3 miles southwest of Belmont furnace and 1 mile southwest of the house of Joseph L. Dobbins, on the highest knob in the vicinity, on land belonging to the Tilden brothers. The station is marked by an iron bolt set in a drill hole in a bowlder about 3 inches below the surface of the ground. The bolt projects 4 inches above the surface of the bowlder and there is a pile of stones built around and over it. There are three reference marks, each consisting of a bowlder with an inscribed arrow pointing toward the station, 1.83 meters from the station north, east, and south, respectively.

Keith (Nelson County, Ky., J. F. P., 1883).—About 5 miles by road northwest of Boston, on the northeast end of a large flat appearing hill known locally as Keiths Knob. The station is on land belonging to George M. Miller, on the end of the ridge directly back of his house. It is marked according to note 11.[1] Three reference marks, each consisting of a bowlder with an arrow pointing toward the station chiseled in its upper surface, are 1.83 meters from the station north, east, and south, respectively.

Jackson (Bullitt County, Ky., J. F. P., 1883).—About 7 miles from Bardstown Junction and about 1¼ miles east of Big Springs station on the Bardstown branch of the Louisville & Nashville Railroad, on land belonging to Dora Jackson, on the top of a rounded knob about one-fourth mile to the northward of his house. The station is marked according to note 11.[1] Three reference marks, each consisting of a bowlder with an arrow pointing toward the station chiseled in its upper surface, are 1.83 meters form the station north, east, and south, respectively.

White Lick (Nelson County, Ky., C. S., 1882).—A short distance south-southwest of Samuels, a small town on the Louisville & Nashville Railroad, on the highest point of a hill known locally as Hays Knob, White Lick, or Stone-Quarry Hill, the second hill from the north end of a group of hills on the west side of the railroad. The station is near the east end of the top of the hill on land belonging to R. Simmons. It is marked by a limestone post 3 feet long with the top dressed to 5 inches square with a cross and the letters U. S. C. S. cut in the upper surface. The underground mark is a bottle buried about 4 feet deep and protected by a thin block of sandstone resting on four sandstone pillars. Four reference marks, each consisting of a hard-burned brick with a cross and an arrowhead pointing toward the station cut in the upper surface, are about 2 feet below the ground and 1 meter from the station north, east, south, and west, respectively.

Willett (Nelson County, Ky., J. F. P., 1883).—About 4 miles north by west from the monastery of La Trappe and about 1 mile southwest of the house of William Peak, on the highest knob in the vicinity, on land belonging to James Willett. The station is marked according to note 11.[1] A white oak tree marked with a triangular blaze is 13.7 meters S. 3° W. from the station and a hickory marked in a similar manner is 13.6 meters S. 68° W.

Thompson (Nelson County, Ky., J. F. P., 1883).—About 5 miles southeast of the town of New Haven and 2 miles south of the Louisville & Nashville Railroad on the northwest end of a long timbered ridge overlooking the Rolling Fork of the Salt River. The station is on land belonging to James Thompson about three-fourths mile southeast of his house. It is marked according to note 11.[1] A reference mark consisting of a bowlder with an arrow pointing toward the station cut in the upper surface is 1.83 meters east of the station. A similar mark cut in the highest rock on the hill is 7.36 meters S. 28° E. from the station and a chestnut tree marked with a triangular blaze is 7.6 meters S. 57° W.

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[1] See p. 35.

Burkett (Nelson County, Ky., J. F. P., 1883).—About 7 miles from Bardstown, 1 mile east of Botland post office and 1 mile west of the Beech Fork of the Salt River, on the north side of the Bardstown-Springfield turnpike. The station is on land belonging to A. Burkett on the highest ground between his house and the pike, just northeast of a clump of small cedars. It is marked according to note 11.[1] The following distances and directions are from the station: Red oak stump, 19.1 meters N. 42° W.; white oak stump, 13.9 meters N. 34° E.; white oak tree marked with a triangular blaze, 17.4 meters S. 28° E.; and a cedar tree marked with a triangular blaze, 12.1 meters S. 46° W.

Rohan (Nelson and Marion Counties, Ky., J. F. P., 1883).—On the county line on the top of the most conspicuous knob in either county, known very generally as Rohans Knob. The station is marked according to note 11.[1] Three reference marks, each consisting of a bowlder with an arrow pointing toward the station cut in the upper surface, are 1.83 meters from the station north, east, and south, respectively. An oak stump is 9.1 meters N. 10° E. from the station and a similar stump is 6.2 meters S. 9° E.

Ferriell (Marion County, Ky., J. F. P., 1883).—About one-half mile southwest of Chicago, on the top of a hill overlooking the village, on land belonging to Mr. Ferriell. The station is marked according to note 11.[1] Three reference marks, each consisting of a bowlder with an arrow pointing toward the station cut in the upper surface, are 1.83 meters from the station north, east, and west, respectively.

Penick (Marion County, Ky., J. F. P., 1883).—About 3 miles from Penick, three-fourths mile west of Asbury Church and about one-half mile south of the Lebanon branch of the Louisville & Nashville Railroad on the end of a hill extending north toward the railroad. The station is on land belonging to the Penick estate and is marked according to note 11.[1]

SUPPLEMENTARY POINTS.

Haystack (Clark County, Ind., J. L. C., 1884, 1914).—Lost.

Bartle (Clark County, Ind., J. L. C., 1886).—There is no description available for this station. It is probably marked according to note 10,[1] that is, the same as the other stations established in this locality by Prof. J. L. Campbell.

St. Martin's Church (Jefferson County, Ky., C. S., 1880).—The spire of St. Martin's Church which is on Shelby Street between Kellar Street and Broadway, Louisville.

Cave Hill Cemetery (Jefferson County, Ky., C. S., 1880).—The pedestal of the angel on top of the stone spire at the entrance to Cave Hill Cemetery, Louisville.

Bonifacius Church (Jefferson County, Ky., C. S., 1880).—The spire of Bonifacius Church, which is on Green Street between Jackson and Hancock Streets, Louisville.

Christ Church (Jefferson County, Ky., C. S., 1880).—The spire of Christ Church, which is on Second Street between Green and Walnut Streets, Louisville.

St. Paul's Church (Jefferson County, Ky., C. S., 1880).—The cross on top of the spire of St. Paul's Church at the corner of Sixth and Walnut Streets, Louisville.

Catholic Cathedral (Jefferson County, Ky., C. S., 1880).—The cross on top of the spire of the Catholic Cathedral, which is on Fifth Street between Walnut and Green Streets, Louisville.

Baptist Church (Jefferson County, Ky., C. S., 1880).—The spire of the Baptist Church at the corner of Fourth and Walnut Streets, Louisville.

Second Presbyterian Church (Jefferson County, Ky., C. S., 1880).—This church is at the corner of Second and College Streets, Louisville.

Broadway Baptist Church (Jefferson County, Ky., C. S., 1880).—The spire of the Baptist Church on Broadway between First and Brook Streets, Louisville.

German Methodist Church (Jefferson County, Ky., C. S., 1880).—The spire of the German Methodist Church at the corner of Market and Hancock Streets, Louisville).

City Hall (Jefferson County, Ky., C. S., 1880).—The pole on top of the tower of the City Hall, Louisville.

Malt House elevator (Jefferson County, Ky., C. S., 1880).—The grain elevator of the Malt House at the corner of Thirteenth and Maple Streets, Louisville.

Church of the Messiah (Jefferson County, Ky., C. S., 1880).—The spire of the Church of the Messiah, or Unitarian, Church at the corner of Fourth and York Streets, Louisville.

Cedar Glade (Bullitt County, Ky., J. F. P., 1883).—About 5¼ miles from Mount Washington village, on land belonging to H. H. Swieringen on the highest point of an elongated hill about 1¼ miles from his house. Cedar Glade schoolhouse is on the south end of the same hill, about one-eighth mile from the station. The station is marked by a drill hole in a stone about 14 inches below the surface of the ground and by a pile of earth and stones around the base of the signal pole.

Mount Washington Church spire (Bullitt County, Ky., J. F. P., 1883).—The white spire on the red brick Baptist Church in Mount Washington village.

Bardstown Junction Methodist Church (Bullitt County, Ky., J. F. P., 1883).—The very small spire of the only Methodist church in Bardstown Junction. The church is a small wooden structure.

Dry Knob (Bullitt County, Ky., J. F. P., 1883).—On the northwest side of a clearing on the top of Dry Knob, on land belonging to Henry Trunnel, of Bardstown Junction. The station is a pole in the top of a hickory tree marked with a triangular blaze. Three other small trees marked with triangular blazes are at the following distances and directions from the station: Red oak, 6.86 meters N. 6° W.; red oak, 7.32 meters S. 80° W.; and a hickory tree, 6.71 meters N. 70° W.

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[1] See p. 35.

Indian Knob (Bullitt County, Ky., J. F. P., 1883).—About 1½ miles south-southwest of Bardstown Junction on the summit of a conspicuous knob known locally as Indian Knob. The station is a pole in the top of a pine tree marked with a triangular blaze. Three other trees, each marked with a blaze and nails, are at the following distances and directions from the station: Pine tree, 6.25 meters N. 55° E.; chestnut oak tree, 4.72 meters N. 24° W.; and a pine tree, 1.98 meters S. 6° W.

Britts Knob (Bullitt County, Ky., J. F. P., 1883).—About 3 miles southeast of Bardstown Junction, on the highest point of a knob about three-fourths mile south of Thomas Britt's house. The station is on land belonging to the Tilden brothers, who live at Belmont Furnace, and is marked by a pile of stone around the base of the signal pole.

Lebanon Junction Knob (Bullitt County, Ky., J. F. P., 1883).—About 1 mile from Lebanon Junction, near the road to Belmont Furnace, on the top of the most conspicuous knob in the vicinity, on land belonging to Mr. Thompson, who lives near the base of the hill. The station is a pole in the top of a hickory tree which is marked with a triangular blaze on the east side. Three other small hickory trees, each marked with a blaze, are at the following distances and directions from the station: 3.7 meters N. 45° W, 2.9 meters S. 85° W., and 4.6 meters S. 83° E.

Bardstown Catholic Church spire (Nelson County, Ky., J. F. P., 1883).—The spire of the St. Joseph Catholic Church at Bardstown. It is the most conspicuous spire in the town.

Loretto Convent spire (Marion County, Ky., J. F. P., 1883).—The only spire on the convent and academy of the Loretto sisterhood.

Gethsemane La Trappe monastery spire (Nelson County, Ky., J. F. P., 1883).—The only spire on the Trappist abbey at Gethsemane.

Buzzards Roost (Larue County, Ky., J. F. P., 1883).—On the top of a rocky point of Muldaughs Hills, known locally as Buzzard Roost, nearly opposite and overlooking the town of New Haven. The station is a pole in the top of an oak tree marked with a triangular blaze.

New Hope Distillery smokestack (Nelson County, Ky., J. F. P., 1883).—The smokestack of the distillery at New Hope and the only tall chimney in the town.

Chicago Catholic Church spire (Marion County, Ky., J. F. P., 1883).—The only spire in the town of Chicago.

St. Charles Catholic Church spire (Marion County, Ky., J. F. P., 1883).—About 3 miles from St. Marys, a station on the Louisville & Nashville Railway. The station is the cross on the southeast one of the two spires on the St. Charles Roman Catholic Church.

Lebanon Catholic Church spire (Marion County, Ky., J. F. P., 1883).—The large gilt cross on the top of the spire of the large Roman Catholic Church in Lebanon.

COMPUTATION, ADJUSTMENT, AND ACCURACY OF THE ELEVATIONS.

The zenith distances directly observed at the primary triangulation stations were first computed. These zenith distances were corrected for height of the object observed and of the 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 of primary triangulation 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 two or more lines to each new station, many rigid conditions exist between the observed differences 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 necessity of determining the elevations of points in the triangulation is apparent in connection with the six base lines, as these elevations furnish the means to refer the base lengths to the same average level of the ocean.

The elevations of the stations at the higher levels must be known at least approximately in order to reduce the horizontal measures to what they would have been if the stations *observed upon* had been at the sea level. This reduction is ordinarily but a small fraction of a second of arc and was ignored for all the triangulation in this publication. From a geographical point of view it is important that the third or height coordinate of points in the triangulation should be determined. The foundation for the elevations is furnished by the adjusted precise

level net,[1] one line of which follows closely the thirty-ninth parallel, near which lies the triangulation under discussion.

A continuous series of zenith distances of any magnitude exists only in Missouri from stations Jacobs and Berger in the eastern part to Bowler near the Kansas line. The first adjustment fixed these elevations. In a second adjustment all the stations occupied in 1914 to connect the thirty-ninth parallel triangulation with the scheme in the vicinity of Louisville are involved. In the third adjustment the stations of the Louisville base net with the three adjoining stations are fixed in elevation.

FIRST ADJUSTMENT.

In the first adjustment all stations of the primary scheme are involved. The elevations of stations Bowler, Baker, Knob Noster, Heard, Hubbard, Cole, Versailles north base, Hunter, Christian, and Medlock were held fixed at 330.97, 306.20, 279.40, 281.29, 294.80, 281.48, 322.30, 319.47, 278.90, and 266.90 meters, respectively. These elevations were determined by lines of spirit leveling which connected them with the precise leveling net. In addition, some spirit leveling in 1878, by the party while engaged on the reconnoissance, fixed the differences of elevation between the stations Bradford, Turnpike, Bluff, Geyer, Gasconade, and Winter. The elevations of this group of five stations and of the remaining 19 stations connected by the observations are unknowns to be determined by least squares from the 67 observed differences of elevation indicated below.

In the following tabulation the observed differences of elevation treated in the first adjustment are shown, 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 corresponding adjusted difference.

Adjustment of elevations—thirty-ninth parallel.

Station 1	Station 2	Weight p	Observed difference of elevation, h_2-h_1	Adjusted difference of elevation, h_2-h_1	Adjusted minus observed v	pvv
			Meters	*Meters*	*Meters*	
Bowler	Chapel Hill	1.16	− 1.15	− 1.28	−0.13	0.020
Do	Thornton	5.01	−11.03	−11.29	− .26	.339
Do	Fulton	1.28	− 8.64	− 9.11	− .47	.283
Chapel Hill	Normal	.94	−61.89	−61.97	− .08	.006
Do	Baker	3.46	−23.35	−23.49	− .14	.068
Do	Thornton	2.91	−10.16	−10.01	+ .15	.066
Thornton	Baker	3.31	−13.35	−13.48	− .13	.056
Do	Hutton Mound	.95	−17.73	−18.09	− .36	.123
Do	Fulton	2.12	+ 2.20	+ 2.18	− .02	.001
Fulton	Baker	1.68	−15.13	−15.66	− .53	.472
Do	Hutton Mound	4.10	−20.32	−20.27	+ .05	.010
Baker	Normal	1.20	−38.62	−38.48	+ .14	.024
Do	Caldwell	.83	− .45	− .98	− .53	.233
Do	Hutton Mound	1.54	− 4.96	− 4.61	+ .35	.188
Hutton Mound	Caldwell	.73	+ 3.05	+ 3.63	+ .58	.245
Normal	Knob Noster	3.78	+11.66	+11.68	+ .02	.002
Do	High Point Tebo	1.61	+36.66	+36.70	+ .04	.003
Do	Caldwell	2.21	+37.54	+37.50	− .04	.004
Caldwell	Knob Noster	1.17	−26.07	−25.82	+ .25	.073
Do	High Point Tebo	3.88	− .70	− .80	− .10	.039
Knob Noster	Kendrick	3.68	+ .52	+ .67	+ .15	.083
Do	High Point Tebo	2.01	+24.95	+25.02	+ .07	.010
Kendrick	Heard	2.36	+ .70	+ 1.22	+ .52	.637
Do	Schnackenberg	1.29	+52.93	+52.50	− .43	.239
Do	High Point Tebo	4.25	+24.39	+24.35	− .04	.007
Heard	Hughes	.64	+56.72	+57.28	+ .56	.201
Do	Schnackenberg	1.70	+51.04	+51.28	+ .24	.098
Schnackenberg	High Point Tebo	.85	−28.51	−28.15	+ .36	.110
Do	Hubbard	.83	−37.96	−37.77	+ .19	.030
Do	Hughes	1.76	+ 6.34	+ 6.00	− .34	.204

[1] See Special Publication No. 18, U. S. Coast and Geodetic Survey.

Adjustment of elevations—thirty-ninth parallel.

Station 1	Station 2	Weight p	Observed difference of elevation, h_2-h_1	Adjusted difference of elevation, h_2-h_1	Adjusted minus observed v	pvv
			Meters	*Meters*	*Meters*	
Hubbard	Hughes	1.32	+43.99	+43.77	−0.22	0.064
Hughes	Cole	1.22	−56.97	−57.09	− .12	.018
Do	Versailles north base	6.11	−16.08	−16.27	− .19	.221
Do	Hunter	5.27	−19.26	−19.10	+ .16	.135
Cole	Moreau	1.19	− .91	− 1.72	− .81	.781
Do	High Point	2.42	+13.11	+12.74	− .37	.332
Versailles north base	do	2.64	−28.42	−28.12	+ .30	.238
Christian	Moreau	4.18	+ .55	+ .86	+ .31	.402
Do	Belshe	1.07	+32.78	+33.00	+ .22	.052
Do	High Point	4.22	+15.13	+15.32	+ .19	.152
Hunter	do	3.09	−25.03	−25.25	− .22	.150
Do	Belshe	.93	− 8.20	− 7.57	+ .63	.369
High Point	Moreau	4.81	−14.47	−14.46	+ .01	.000
Do	Belshe	2.44	+17.65	+17.68	+ .03	.002
Moreau	Medlock	4.83	−13.13	−12.86	+ .27	.352
Do	Cedar	1.51	−10.02	− 9.96	+ .06	.005
Do	Kennedy	.83	+ 8.76	+ 8.81	+ .05	.002
Do	Belshe	3.49	+32.47	+32.14	− .33	.380
Medlock	Cedar	3.36	+ 2.66	+ 2.90	+ .24	.194
Do	Belshe	1.14	+45.63	+45.00	− .63	.453
Belshe	Cedar	.87	−41.55	−42.10	− .55	.263
Do	Kennedy	1.35	−22.99	−23.33	− .34	.157
Cedar	Bradford	.97	+16.71	+17.14	+ .43	.179
Do	McDaniel	1.34	+22.50	+22.16	− .34	.155
Do	Kennedy	1.26	+18.39	+18.77	+ .38	.181
McDaniel	Bradford	4.36	− 5.00	− 5.02	− .02	.002
Do	Pilot Knob	4.03	+ 6.39	+ 6.31	− .08	.026
Do	Kennedy	2.09	− 3.34	− 3.39	− .05	.005
Bradford	Pilot Knob	1.53	+11.62	+11.33	− .29	.129
Pilot Knob	Kennedy	1.48	− 9.74	− 9.70	+ .04	.002
Do	Turnpike Bluff	.85	−30.01	−29.86	+ .15	.019
Do	Geyer	2.14	− 2.18	− 2.63	− .45	.433
Gasconade	Berger	4.21	− 3.94	− 4.11	− .17	.122
Do	Jacobs	1.69	− 5.08	− 5.11	− .03	.002
Winter	Berger	2.56	+ 2.78	+ 2.81	+ .03	.002
Do	Jacobs	4.69	+ 1.67	+ 1.81	+ .14	.092
Berger	do	3.09	− .79	− 1.00	− .21	.136

The probable error of an observation of weight unity derived from the preceding adjustment is ±0.31 meter. In other words, the reciprocal observations over a line 31.7 kilometers (19⅔ miles) long, this being the length of 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 0.31 meter. The probable errors for lines of other than unit length were assumed to be proportional to their lengths.

The probable errors of the elevations fixed by precise leveling are about 0.05 meter. The lines of spirit leveling connecting the precise leveling with the stations of the triangulation are so short that their probable errors do not exceed 0.10 meter. Station Jacobs was assumed to be the least accurately determined station in the scheme under discussion. The probable error computed for it from the vertical angle observations alone is ±0.23 meter. The probable error of this elevation when combined with the probable error due to the spirit leveling and precise leveling became ±0.25 meter.

SECOND ADJUSTMENT.

In the second adjustment the elevation of station Lutz was determined by precise leveling, and its elevation, 183.376 meters, was held fixed. The elevations of 9 remaining stations connected by the observations are unknowns to be determined by a least square adjustment from the 21 observed differences of elevation indicated below. In this tabulation the observed differences of elevation are treated as in the first adjustment.

Adjustment of elevations—Louisville connection.

Station 1	Station 2	Weight, p	Observed difference of elevation, h_2-h_1	Adjusted difference of elevation, h_2-h_1	Adjusted minus observed, v	pvv
			Meters	*Meters*	*Meters*	
Lutz	Six Mile	5.78	+101.38	+101.34	−0.04	0.01
Do	Popp	6.05	+ 97.97	+ 98.05	+ .08	.04
Do	O. & M	14.9	+ 14.47	+ 14.45	− .02	.00
Six Mile	Popp	43.0	− 3.28	− 3.28	.00	.00
Do	O. & M	3.37	− 86.84	− 86.88	− .04	.01
O. & M	Popp	4.76	+ 83.92	+ 83.60	− .32	.49
Do	Summit	4.41	+ 97.34	+ 97.33	− .01	.00
Do	Marysville	7.08	+ 18.43	+ 18.59	+ .16	.18
Popp	Summit	3.56	+ 13.85	+ 13.74	− .11	.05
Do	Marysville	1.78	− 64.59	− 65.01	− .42	.31
Marysville	Summit	5.42	+ 78.62	+ 78.74	+ .12	.08
Do	Finley	2.26	+ 96.69	+ 96.53	− .16	.06
Do	Blocher	4.32	− 2.64	− 2.61	+ .03	.00
Summit	Finley	10.03	+ 17.82	+ 17.79	− .03	.01
Do	Blocher	2.17	− 81.61	− 81.35	+ .26	.14
Blocher	Miller	.79	+ 68.23	+ 68.09	− .14	.02
Do	Stout	4.11	+ 11.71	+ 11.88	+ .17	.12
Finley	Miller	1.41	− 30.80	− 31.05	− .25	.09
Do	Stout	.23	− 86.31	− 87.26	− .95	.21
Stout	Miller	.63	+ 55.46	+ 56.21	+ .75	.35
Blocher	Finley	2.02	+ 99.08	+ 99.14	+ .06	.01

The probable error of an observation of weight unity derived from the preceding adjustment is ±0.29 meter.

The probable error of the elevation of station Lutz was found to be about ±0.05 meter from the precise leveling. The probable error approaches this value for stations adjacent to Lutz and is greatest for the most remote station. Station Miller was assumed to be the one least accurately determined and its probable error was therefore computed as a limiting value and found to be ±0.21 meter from the vertical angles alone or, when combined with the probable error of the elevation fixed by the precise leveling, it was ±0.22 meter.

THIRD ADJUSTMENT.

In the third adjustment the elevation of Louisville north base as determined by precise leveling, 136.55 meters, was held fixed. The elevation of Louisville south base was determined by the leveling along the base at the time of measurement. Its elevation was held fixed at 144.44 meters. The elevations of the 5 remaining stations connected by the observations are unknowns to be determined by a least square adjustment from the 13 observed differences of elevation indicated below. In this tabulation the observed differences of elevation are treated as in the first adjustment.

Adjustment of elevations—Louisville base net.

Station 1	Station 2	Weight p	Observed difference of elevation, h_2-h_1	Adjusted difference of elevation, h_2-h_1	Adjusted minus observed v	pvv
			Meters	*Meters*	*Meters*	
Louisville north base	Louisville south base					
Do	Williams	11.6	+160.24	+160.22	−0.02	0.0046
Louisville south base	do	17.9	+152.41	+152.33	−0.08	.1146
Louisville north base	Cox	12.1	+ 93.26	+ 93.41	+0.15	.2722
Louisville south base	*do*	34.6	+ 85.52	+ 85.52	0.00	.0000
Williams	do	6.4	− 66.63	− 66.81	−0.18	.2074
Cox	Blind Asylum	6.7	− 71.07	− 70.88	+0.19	.2419
Williams	do	2.5	−137.60	−137.69	−0.09	.0202
Cox	Bangs	2.4	+ 49.69	+ 49.34	−0.35	.2940
Williams	do	3.2	− 17.67	− 17.47	+0.20	.1280
Blind Asylum	do	4.7	+120.10	+120.22	+0.12	.0677
Williams	Riley	0.77	− 18.33	− 19.42	−1.09	.9148
Bangs	do	0.36	− 3.06	− 1.95	+1.11	.4436
Blind Asylum	do	0.89	+117.77	+118.27	+0.50	.2225

The probable error of an observation of weight unity derived from the preceding adjustment is ±0.33 meter.

The probable error of the elevation of Louisville north base was found to be about ±0.10 meter from the precise leveling. Riley was assumed to be the station least accurately determined and its probable error was computed as a limiting value and found to be ±0.24 meter from the vertical angles alone, or when combined with the probable error of the elevation fixed by the precise leveling it was ±0.26 meter.

ACCURACY OF VERTICAL ANGLE RESULTS IN THE UNITED STATES.

The best test of accuracy is believed to be the probable error of an observation of unit weight. Such an observation is here considered to be the reciprocal nonsimultaneous observation over the length of line corresponding to unit weight, considered as 31.7 kilometers (19⅔ miles).

The vertical angle results of the two sections of triangulation considered in this publication have such accuracies that they would appear in the third, fourth, and fifth place of a table like the one on page 63, Special Publication No. 13, in which 25 sections of vertical angle results of triangulation in the United States, having separate least square adjustments, have been arranged in order of accuracy, the most accurate being placed first.

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, whose elevations are subject to a probable error varying from ±0.06 to ±0.35 meter; second, the stations in the main scheme, fixed by reciprocal measures of vertical angles and subject to probable errors varying from ±0.1 to ±1.8 meters; and, third, the intersection stations, of which the elevations are fixed by measurements of vertical angles which are not reciprocal, the intersection stations not being occupied, and having their elevations subject to probable errors which may be as great as ±6 meters in some cases.

The accuracy with which the elevation of a station in the main scheme is determined depends mainly upon the distance of that station from the nearest station whose elevation is fixed by spirit leveling. The spirit-leveling stations are given in the following table, under the heading "Class 1." Station Jacobs is probably the least accurately determined of all the stations in the main scheme.

TABLE OF ELEVATIONS

Thirty-ninth parallel.

WEST VIRGINIA STATIONS.[1]

Station	Point to which elevation refers	Elevation		Station	Point to which elevation refers	Elevation	
		Meters	Feet			Meters	Feet
Class 2.				*Class 3*—Continued.			
Briery	Station mark	1379.0	4524.3	Wray	Station mark	310.8	1019.7
Keeney	do	1199.5	3935.4	Oakland	do	333.1	1092.8
Beech	do	1265.1	4150.6	Creed	do	352.5	1156.5
Ivy	do	1091.4	3580.7				
Table Rock	do	535.0	1755.2	Elk	do	347.8	1141.1
				Martin	do	353.1	1158.5
Summersville	do	783.9	2571.8	Townsend Mountain	Tree tops	962	3156
Paint Creek	Ground	993.4	3259.2	Big Clear Creek Mountain.	Ground	1270	4167
Holmes	Station mark	406.3	1333.0				
Piney	do	335.8	1101.7	Grassy Knob	Trees	1353	4439
Pigeon	do	387.7	1272.0				
Davis	do	322.4	1057.7	Big Sewall Mountain	Trees [80 ft. (?)]	1069	3507
Gebhardt	do	317.9	1043.0	Coal River Mountain, long flat.	Trees	1044	3425
Class 3.				Coal River Mountain	Ground	1022	3353
				Cold Knob	Trees	1035	3396
St. Albans west base	do	180.3	591.4	Jobs Knob	Ground	1326	4350
Big Rocks	do	356.2	1168.6				

[1] These stations form a part of an adjustment not published here. This adjustment will be given when the Maryland and Virginia parts of the thirty-ninth parallel are printed.

TABLE OF ELEVATIONS—Continued.

Thirty-ninth parallel—Continued.

INDIANA STATIONS.

Station	Point to which elevation refers	Elevation		Station	Point to which elevation refers	Elevation	
		Meters	Feet			Meters	Feet
Class 1.				*Class 1*—Continued.			
Holton north base	Top of surface stone	281.46	923.44	Glasgow	Top of surface stone	302.39	990.21
Holton south base	do	278.72	914.44				

ILLINOIS STATIONS.

Class 1.				*Class 2.*			
Berger	Surface mark	172.857	567.12	Clarks Mound	Surface mark	206.6	677.8
Bording	do	164.49	539.96	Turkey Hill	do	198.9	652.6
				Sugar Loaf Mound	do	190.0	623.4
				Dreyer	do	213.1	699.1

MISSOURI STATIONS.

Class 1.				*Class 2*—Continued.			
Bowler	Top of surface stone	330.97	1085.86	Jacobs	Station mark	283.5	930.1
Baker	do	306.20	1004.59	Doermann Hill	Ground at station	294.9	967.5
Knob Noster	do	279.40	916.66				
Heard	do	281.29	922.87	*Class 3.*			
Hubbard	Surface of ground	294.80	967.19				
				Koeltztown Church	Top of fourth (upper) step at front door.	286.7	940.6
Cole	Top of surface stone	281.48	923.49				
Christian	Surface of ground	278.90	915.02	Jefferson City astronomic.	Top of station mark	211.3	693.2
Versailles north base	Copper bolt	322.30	1057.41				
Hunter	do	319.47	1048.13	Cooks Knob (ice house).	Top of cupola	266.5	874.3
Medlock	Top of surface stone	266.90	875.65	Hazel Hill	Surface mark	273.1	896.0
				Windsor public school.	Top of cupola	292.7	960.3
Class 2.							
				Holden Methodist Church.	Top of spire	295.8	970.5
Thornton	Station mark	319.7	1048.9				
Fulton	do	321.9	1056.1	Westport College	do	330.6	1084.6
Hutton Mound	do	301.6	989.5	Belton South Methodist Church.	do	358.0	1174.5
Chapel Hill	do	329.7	1081.7				
Normal	do	267.7	878.3	Kansas City Catholic Cathedral.	do	338.2	1109.6
Caldwell	do	305.2	1001.3				
High Point Tebo	do	304.4	998.7	Lees Summit South Methodist Church.	Top of cupola	331.5	1087.6
Kendrick	do	280.1	919.0				
Schnackenberg	do	332.6	1091.2	Independence courthouse.	Top of clock	344.0	1128.6
Hughes	do	338.6	1110.9				
				Harrisonville Cumberland Presbyterian Church.	Top of spire	320.7	1052.2
High Point	do	294.2	965.2				
Moreau	do	279.8	918.0				
Belshe	do	311.9	1023.3	Warrensburg Presbyterian Church.	do	293.0	961.3
Cedar	do	269.8	885.2				
Kennedy	do	288.6	946.8	Centerview Cumberland Presbyterian Church.	Top of cupola	281.3	922.9
McDaniel	do	292.0	958.0				
Pilot Knob	do	298.3	978.7	Kingsville public school	do	291.1	955.1
Bradford	do	286.9	941.3				
Turnpike Bluff	do	268.4	880.6	Staley Mound	Top of chimney	309.6	1015.7
Geyer	do	295.6	969.8	Austin Methodist Church.	Top of spire	295.1	968.2
Gasconade	do	288.6	946.8	Hicks City Christian Union Church.	do	338.7	1111.2
Winter	do	281.7	924.2				
Berger	do	284.5	933.4				

Louisville connection.

Class 1.				*Class 2*—Continued.			
Rariden	Surface mark	277.53	910.52	Popp	Surface mark	281.4	923.2
Tripp	do	226.14	741.93	Summit	do	295.2	968.5
Lutz	do	183.376	601.63	Marysville	do	216.4	710.0
Class 2.				Blocher	do	213.8	701.4
				Finley	do	313.0	1026.9
Six Mile	do	284.7	934.1	Stout	do	225.7	740.5
O. & M	do	197.8	648.9	Miller	do	281.9	924.9

Louisville base net.

Class 1.				*Class 2*—Continued.			
Louisville north base	Top of surface stone	136.546	447.98	Cox	Top of surface stone	229.96	754.5
Louisville south base	do	144.440	473.88	Blind Asylum	do	159.1	521.9
				Bangs	do	279.3	916.3
Class 2.				Riley	do	277.3	909.9
Williams	do	296.8	973.7				

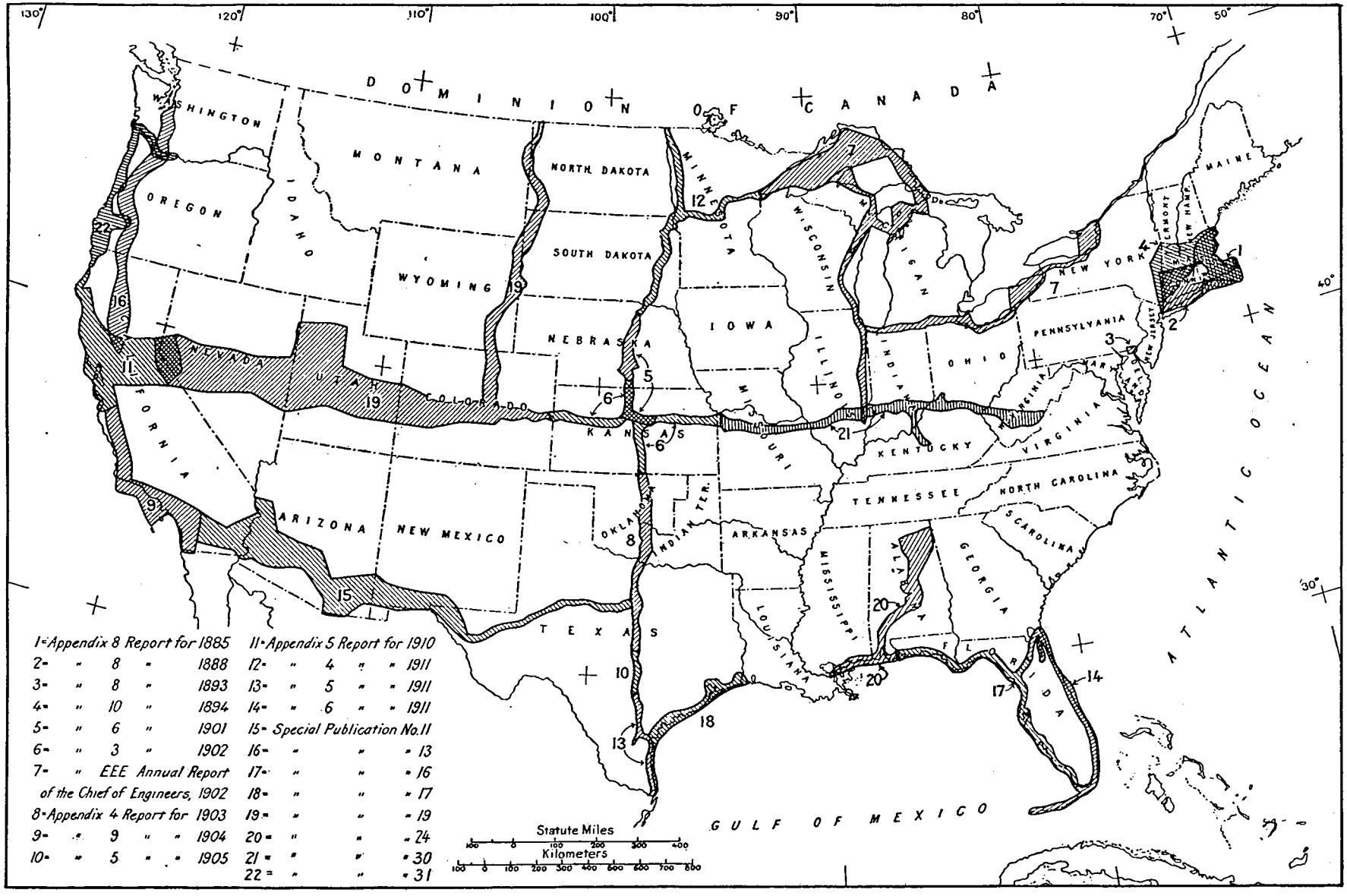

FIG. 1.—INDEX MAP SHOWING AREAS COVERED BY PUBLISHED TRIANGULATION WHICH HAS BEEN RIGIDLY COMPUTED ON THE NORTH AMERICAN DATUM.

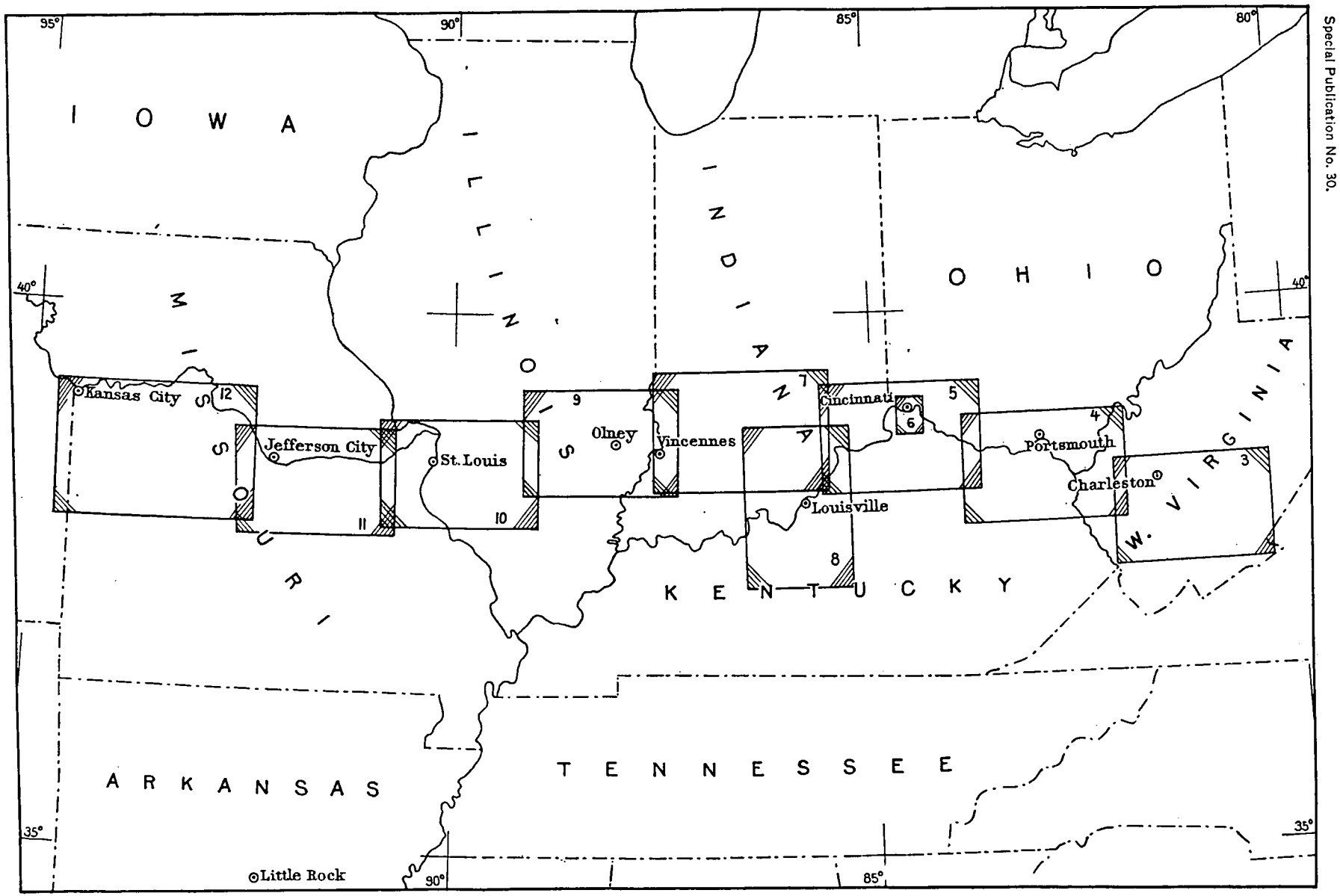

FIG. 2.—INDEX MAP SHOWING THE LIMITS OF EACH OF THE SKETCHES NOS. 3 TO 12.

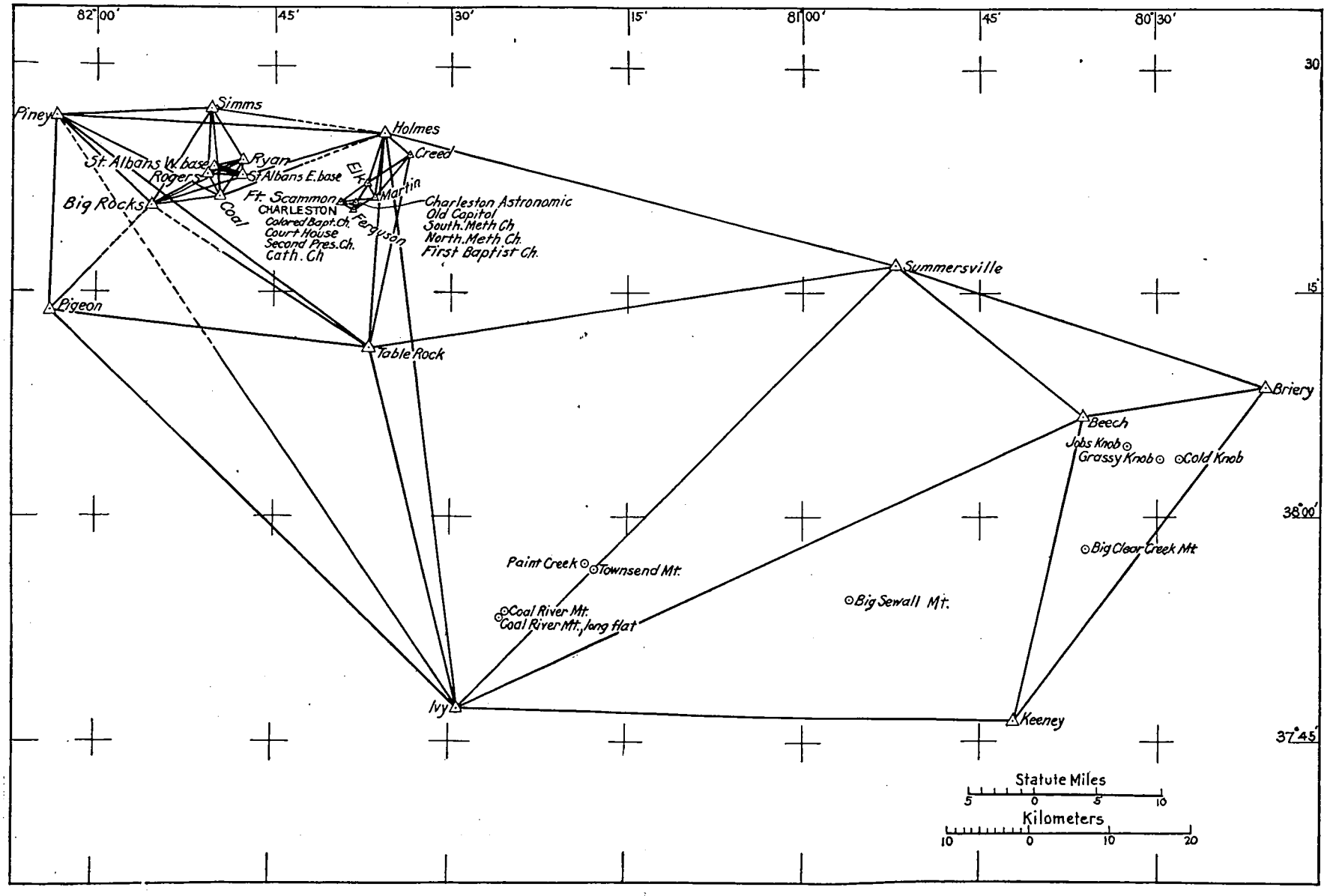

FIG. 3.—TRIANGULATION, THIRTY-NINTH PARALLEL. STATIONS BRIERY AND KEENEY TO ST. ALBANS BASE NET.

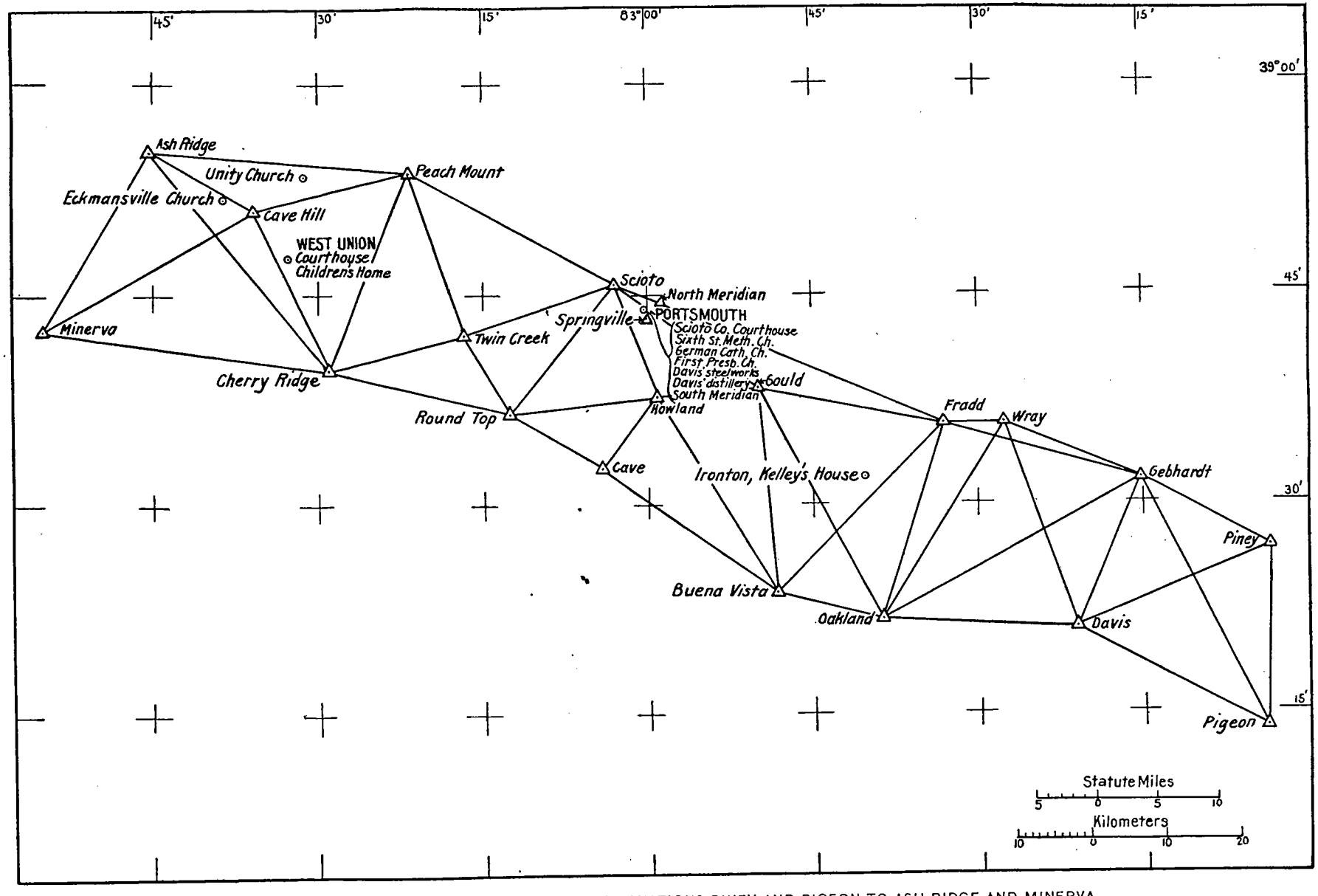

FIG. 4.—TRIANGULATION, THIRTY-NINTH PARALLEL, STATIONS PINEY AND PIGEON TO ASH RIDGE AND MINERVA.

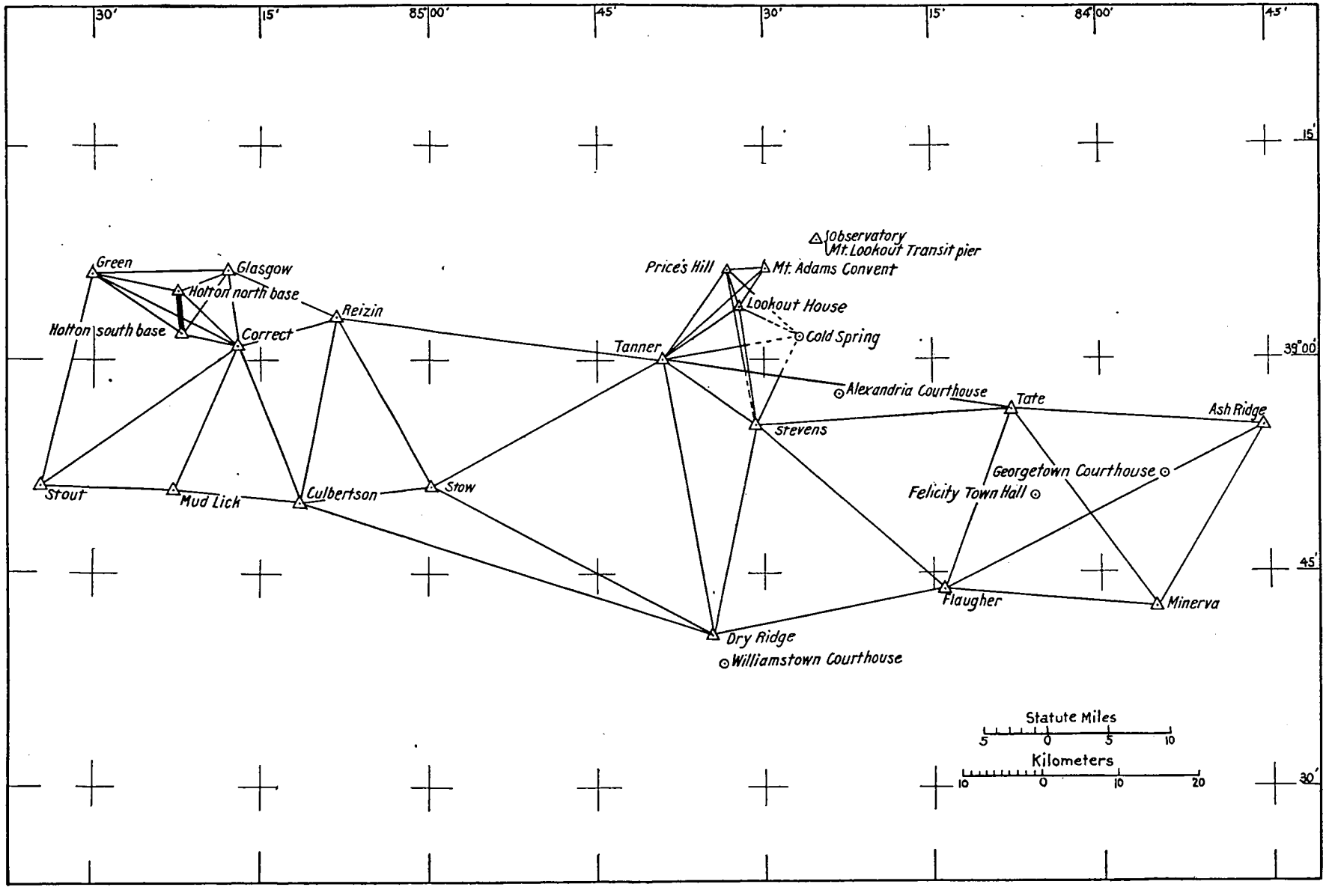

FIG. 5.—TRIANGULATION, THIRTY-NINTH PARALLEL, STATIONS ASH RIDGE AND MINERVA TO HOLTON BASE NET.

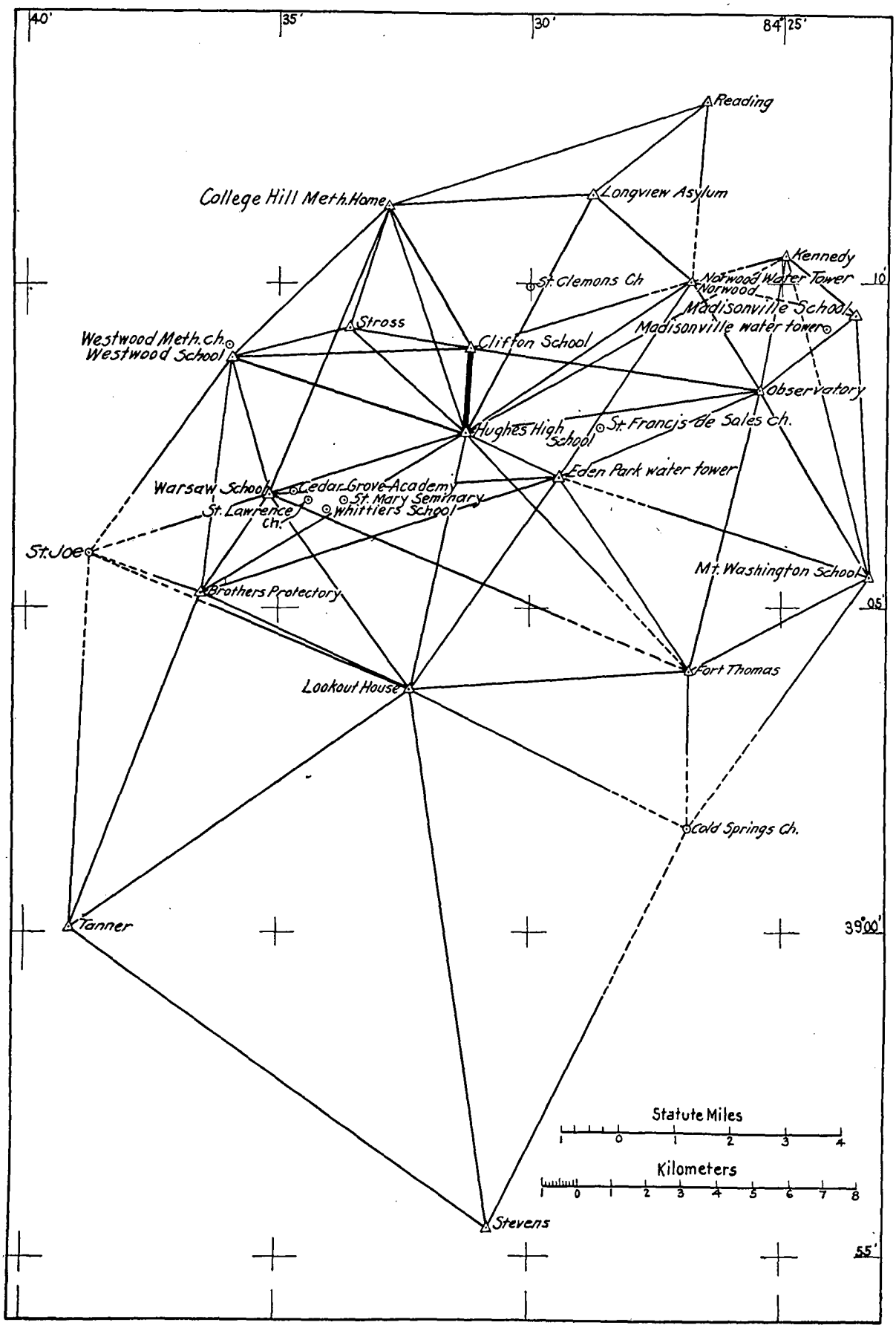

FIG. 6.—TRIANGULATION, THIRTY-NINTH PARALLEL, CITY OF CINCINNATI.

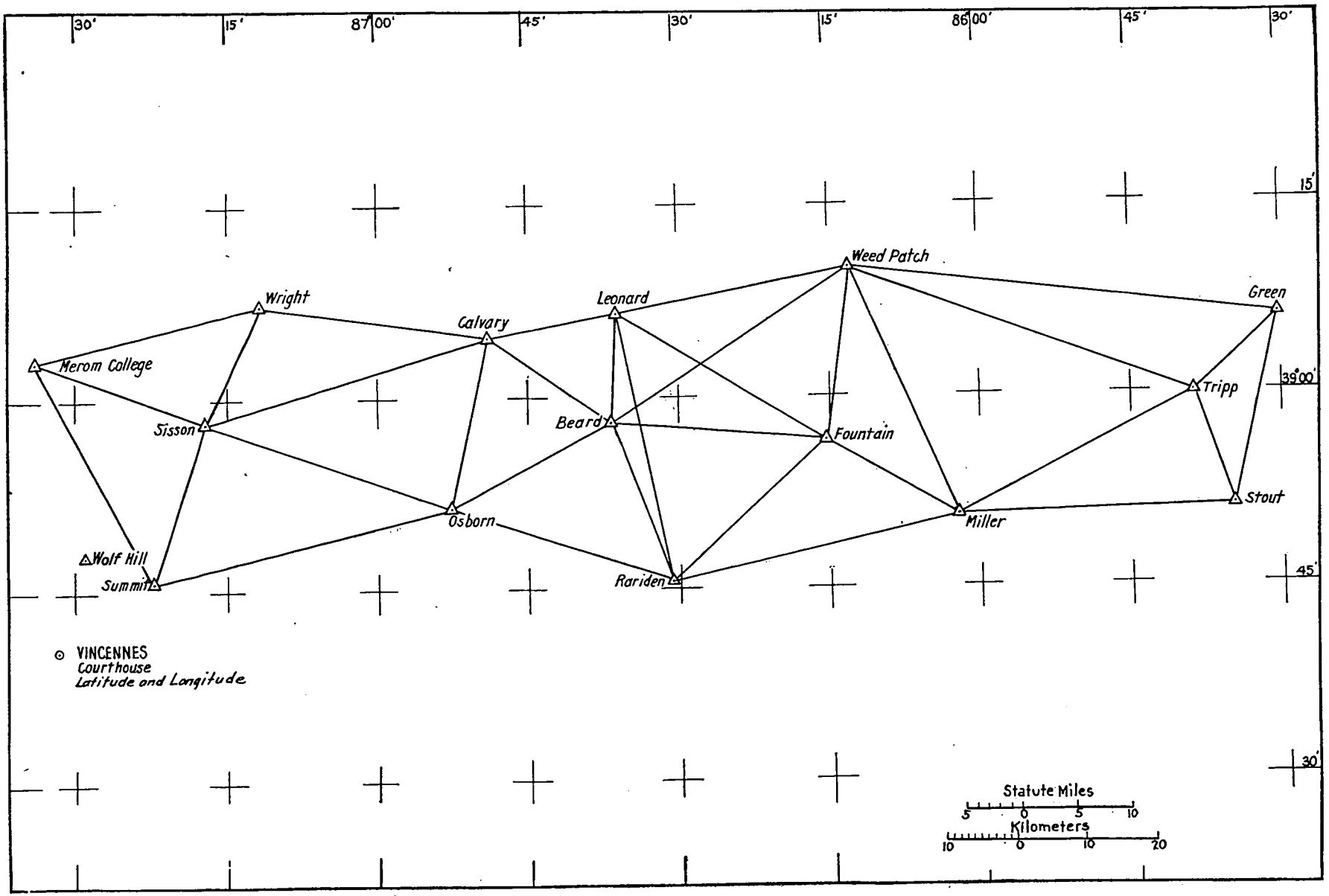

FIG. 7.—TRIANGULATION, THIRTY-NINTH PARALLEL, HOLTON BASE NET TO VINCENNES.

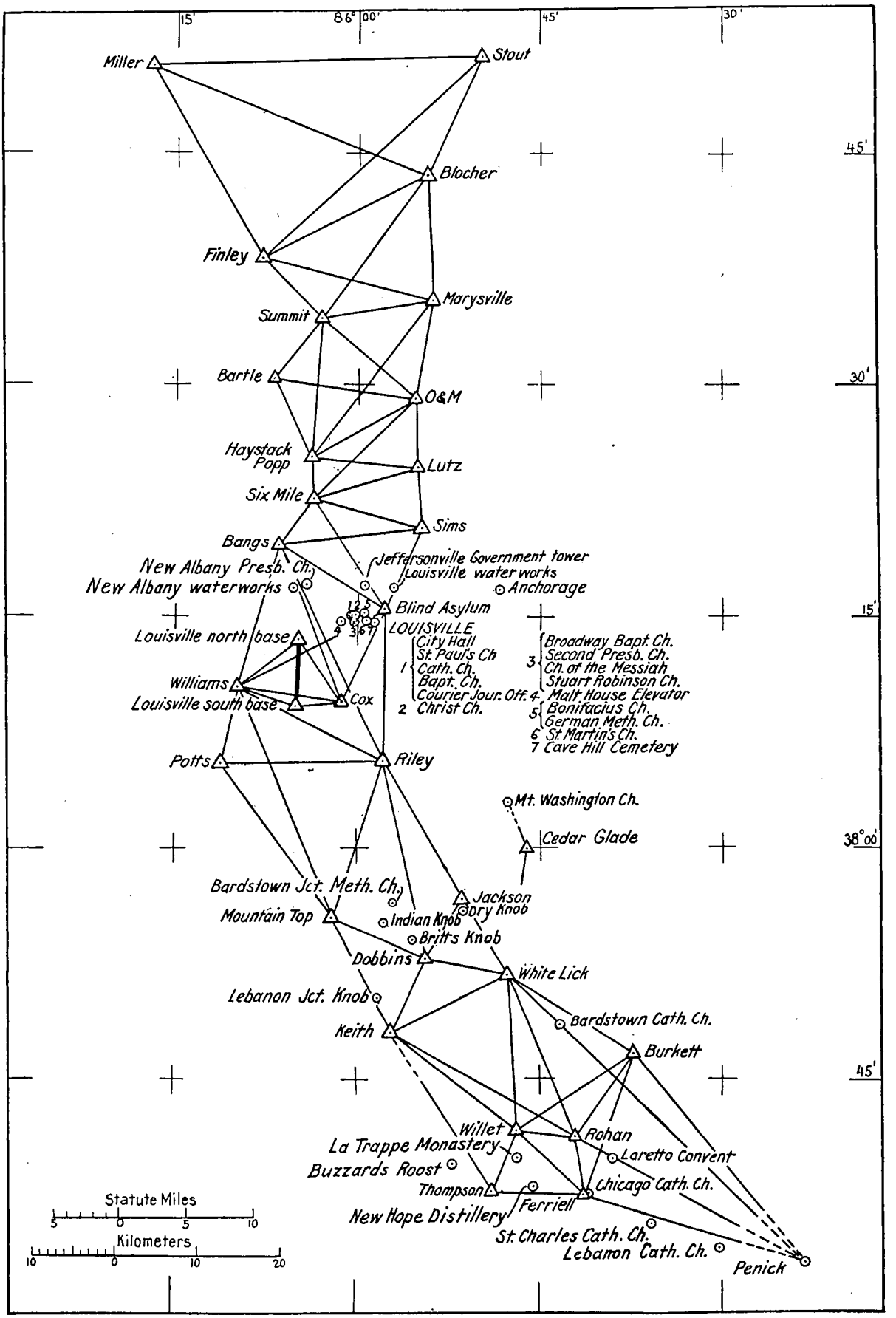

FIG. 8.—TRIANGULATION, LOUISVILLE CONNECTION.

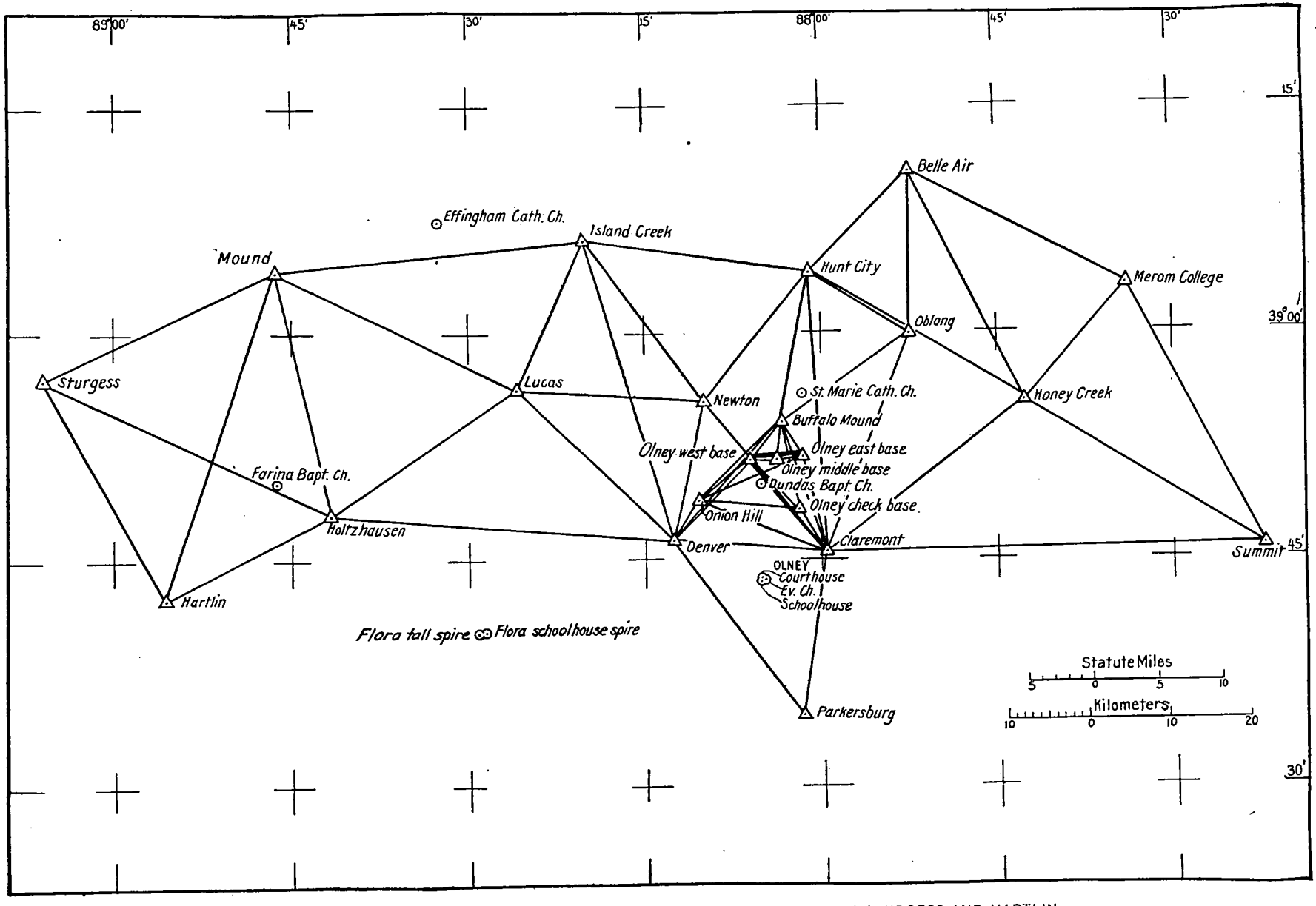

FIG. 9.—TRIANGULATION, THIRTY-NINTH PARALLEL, VINCENNES TO STATIONS STURGESS AND HARTLIN.

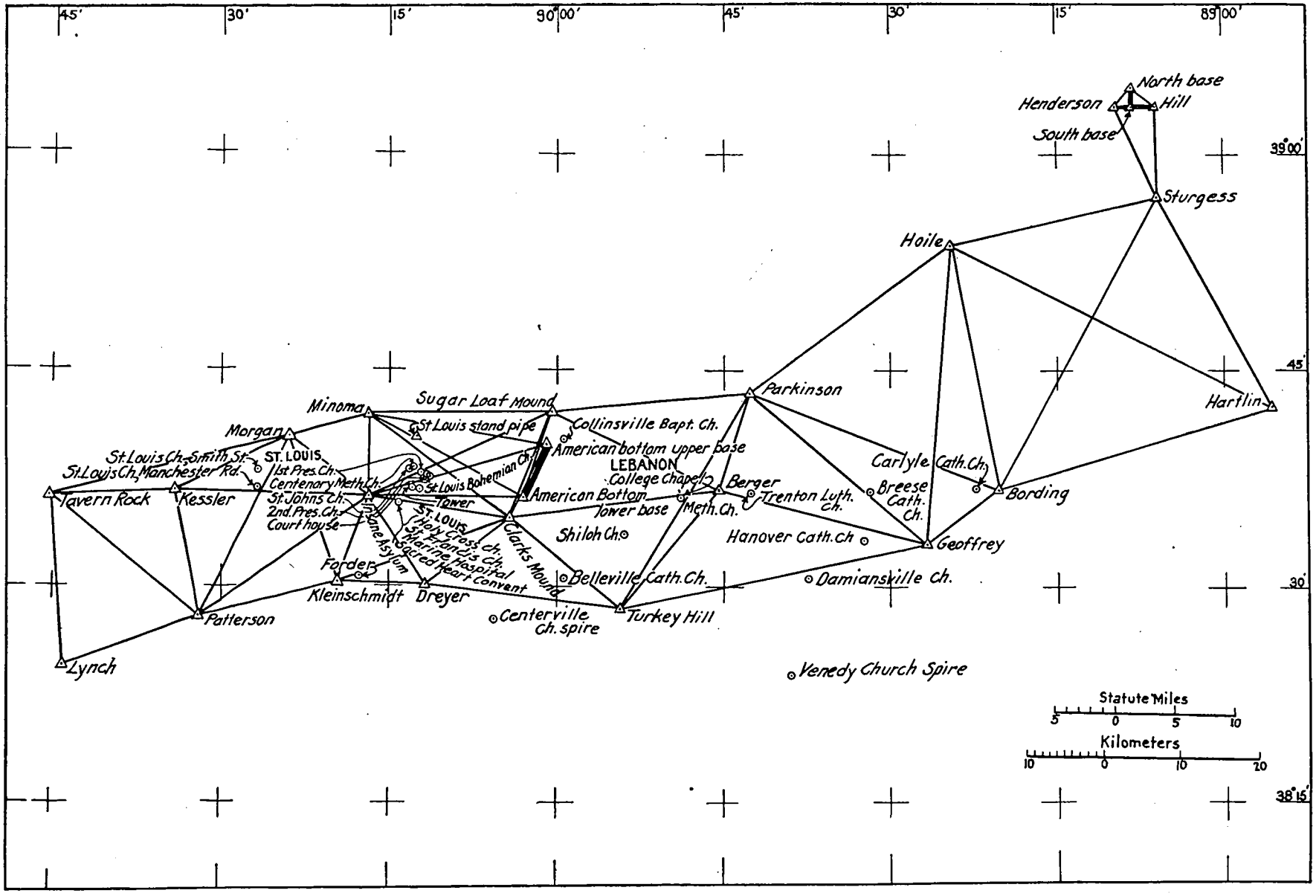

FIG. 10.—TRIANGULATION, THIRTY-NINTH PARALLEL, STATIONS STURGESS AND HARTLIN TO TAVERN ROCK AND LYNCH.

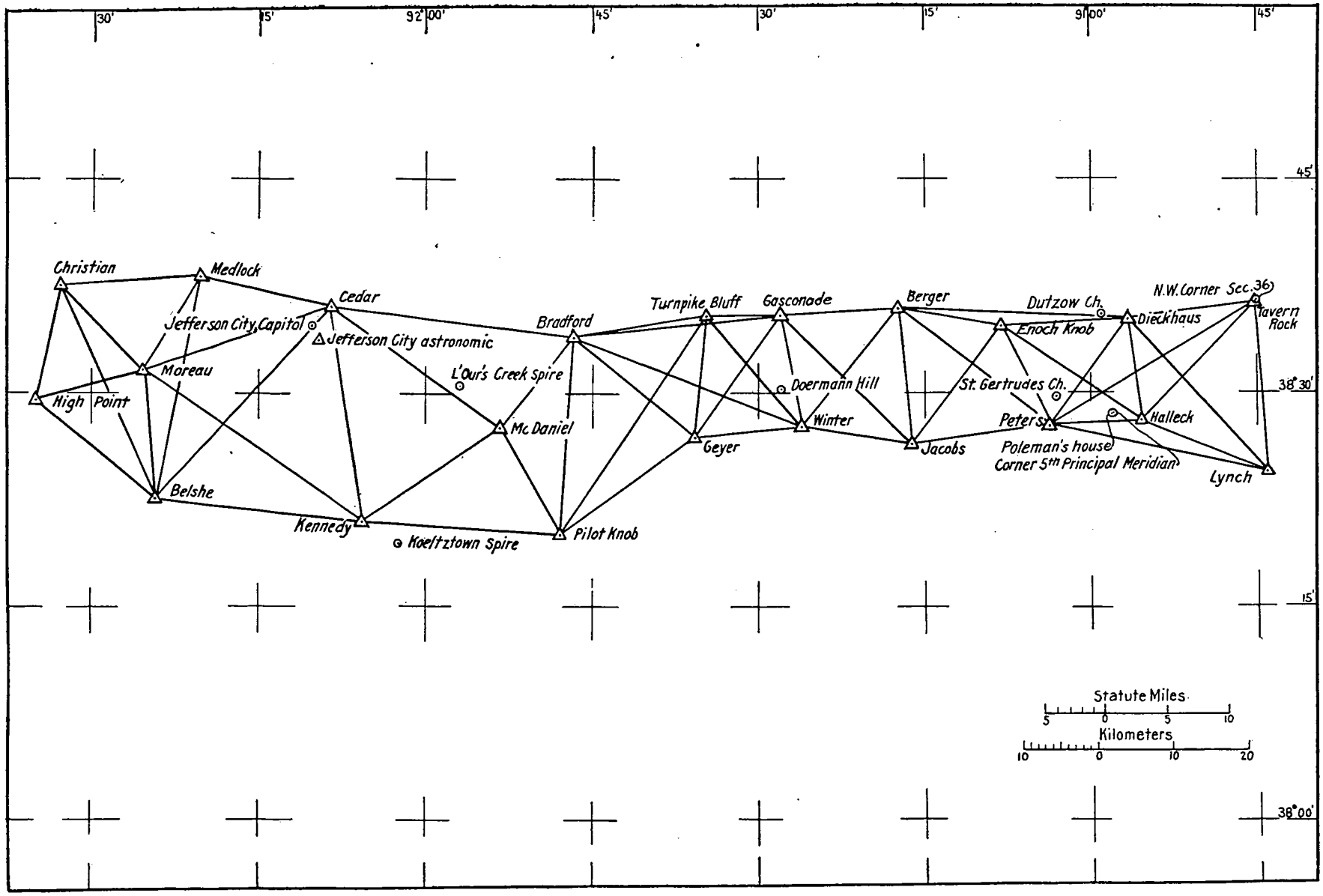

FIG. 11.—TRIANGULATION, THIRTY-NINTH PARALLEL, STATIONS TAVERN ROCK AND LYNCH TO CHRISTIAN, HIGH POINT, AND BELSHE.

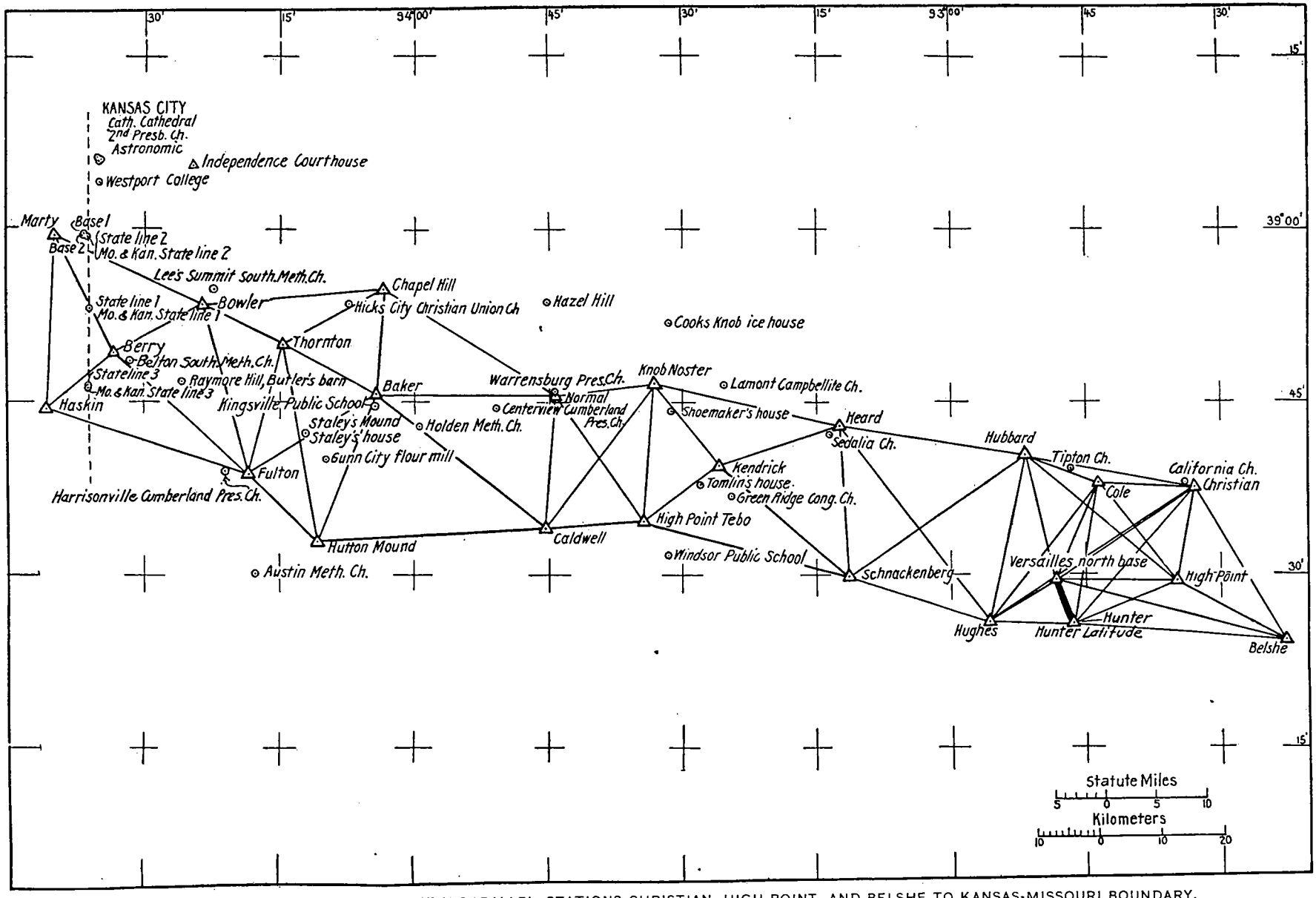

FIG. 12.—TRIANGULATION, THIRTY-NINTH PARALLEL, STATIONS CHRISTIAN, HIGH POINT, AND BELSHE TO KANSAS-MISSOURI BOUNDARY.

INDEX TO POSITIONS, DESCRIPTIONS, ELEVATIONS, AND SKETCHES.

Station	Position	Description	Elevation	Sketch
	Page	*Page*	*Page*	*Number*
Alexandria courthouse	25			5
American Bottom lower base	21	45		10
American Bottom upper base	21	45		10
Anchorage	33			8
Ash Ridge	19	39		4,5
Astronomic:				
Charleston	24	50		3
Kansas City	31	52		12
Austin Methodist Church spire	31		62	12
Baker	23	49	62	12
Bangs	32	54	62	8
Baptist Church, Louisville	33	56		8
Bardstown Catholic Church spire	34	57		8
Bardstown Junction Methodist Church spire	34	56		8
Bartle	33	56		8
Base 1	31	53		12
Base 2	31	53		12
Beard	20	41		7
Beech	18	36	61	3
Belle Air	20	42		9
Belleville Catholic Church spire	28			10
Belshe	22	47	62	11,12
Belton South Methodist Church spire	31		62	12
Berger	21	45	62	10
Berger	22	46	62	11
Berry	23	49		12
Big Clear Creek Mountain	23		61	3
Big Rocks	18	37	61	3
Big Sewall Mountain	23		61	3
Blind Asylum, Louisville	32	54	62	8
Blocher	32	53	62	8
Bohemian Church, St. Louis	29			10
Bonifacius Church, Louisville	33	56		8
Bording	21	44	62	10
Bowler	23	49	62	12
Bradford	22	47	62	11
Breese Catholic Church spire	28			10
Briery	18	36	61	3
Britts Knob	34	57		8
Broadway Baptist Church, Louisville	33	56		8
Brothers Protectory, Cincinnati	25	50		6
Buena Vista	18	38		4
Buffalo Mound	20	43		9
Burkett	32	56		8
Buzzard Roost	34	57		8
Caldwell	23	49	62	12
California Church spire	30			12
Calvary	20	41		7
Carlyle Catholic Church spire	28			10
Catholic Cathedral, Eleventh Street, between Broadway and Washington Streets, Kansas City	31		62	12
Catholic Cathedral, Louisville	33	56		8
Catholic Church cross, Charleston	24			3
Cave	19	38		4
Cave Hill	19	39		4
Cave Hill Cemetery, Louisville	33	56		8
Cedar	22	47	62	11
Cedar Glade	34	56		8
Cedar Grove Academy cupola, Cincinnati	27			6
Centenary Methodist Church, St. Louis	29			10
Centerview Cumberland Presbyterian Church cupola	30		62	12
Centerville Church spire	28			10
Chapel Hill	23	49	62	12
Charleston:				
Astronomic	24	50		3
Catholic Church cross	24			3
Colored Baptist Church spire	24			3
Courthouse spire	24			3
First Baptist Church spire	24			3
North Methodist Church spire	24			3
Old Capitol, top of belfry	24			3
Second Presbyterian Church spire	24			3
South Methodist Church spire	24			3
Cherry Ridge	19	38		4
Chicago Catholic Church spire	34	57		8
Christ Church, Louisville	33	56		8
Christian	22	48	62	11,12
Church, corner Manchester and Ballas Roads, St. Louis	29			10
Church, corner Smith Street and Ballas Road, St. Louis	29			10
Church of the Messiah, Louisville	34	56		8
Cincinnati:				
Brothers Protectory	25	50		6
Cedar Grove Academy cupola	27			6
Clifton School	26	51		6
Cold Spring Church spire	25			6
Cold Spring larger spire	25			5
College Hill Methodist Home	26	51		6
Eden Park water tower	25	51		6
Fort Thomas	25	50		6
Hughes High School	26	51		6
Kennedy	26	52		6
Longview	26	51		6
Lookout House	25	50		5,6
Madisonville School	26	51		6
Madisonville water tower	26			6
Mount Adams Convent	25	50		5
Mount Lookout transit pier	25	50		5
Mount Washington School	26	51		6
Norwood	26	51		6
Norwood water tower	26			6
Observatory, 1889	25	50		5
Observatory, 1912	26	51		6

INDEX TO POSITIONS, DESCRIPTIONS, ELEVATIONS, AND SKETCHES—Continued.

Station	Position	Description	Elevation	Sketch
	Page	*Page*	*Page*	*Number*
Cincinnati—Continued.				
Reading	26	52		6
St. Clemons Church spire	27			6
St. Francis de Sales Church spire	26			6
St. Joe	26	52		6
St. Lawrence Church spire	27			6
St. Mary Seminary flagstaff	27			6
Stross	26	51		6
Warsaw School	25	51		6
Westwood Methodist Church spire	27			6
Westwood School	26	51		6
Whittiers School flagstaff	27			6
City Hall, Louisville	33	56		8
Claremont	20	42		9
Clarks Mound	21	45	62	10
Clifton School, Cincinnati	26	51		6
Coal	18	37		3
Coal River Mountain	24		61	3
Coal River Mountain, long flat	24		61	3
Cold Knob	23		61	3
Cold Spring Church spire, Cincinnati	25			6
Cold Spring larger spire, Cincinnati	25			5
Cole	22	48	62	12
College Hill Methodist Home, Cincinnati	26	51		6
Collinsville Baptist Church spire	28			10
Colored Baptist Church spire, Charleston	24			3
Cooks Knob	30	52	62	12
Corner fifth meridian	29	52		11
Correct	19	40		5
Courier-Journal office, pole, Louisville	33			8
Courthouse dome, Olney	27			9
Courthouse, St. Louis	28			10
Courthouse spire, Charleston	24			3
Cox	32	54	62	8
Creed	24	49	61	3
Culbertson	19	40		5
Damiansville Church spire	28			10
Davis	18	37	61	4
Davis Distillery chimney, Portsmouth	25			4
Davis Steel Works chimney, Portsmouth	25			4
Denver	20	43		9
Dieckhaus	22	46		11
Dobbins	32	55		8
Doermann Hill	29	52	62	11
Dreyer	21	45	62	10
Dry Knob	34	56		8
Dry Ridge	19	39		5
Dundas Baptist Church tower	27			9
Dutzow Catholic Church, east gable	29			11
Eckmansville Church spire	25			4
Eden Park water tower, Cincinnati	25	51		6
Effingham Catholic Church spire	27			9
Elk	24	49	61	3
Enoch Knob	22	46		11
Evangelical Church spire, Olney	27			9
Farina Baptist Church	27			9
Felicity town hall	25			5
Ferguson	24	50		3
Ferriell	33	56		8
Fifth Meridian, corner	29	52		11
Finley	32	53	62	8
First Baptist Church, spire, Charleston	24			3
First Presbyterian Church, corner Third and Court Streets, Portsmouth	25			4
First Presbyterian Church, St. Louis	29			10
Flaugher	19	39		5
Flora schoolhouse spire	27			9
Flora tall spire	27			9
Forder	28	52		10
Fort Scammon	24	50		3
Fort Thomas, Cincinnati	25	50		6
Fountain	20	41		7
Fradd	18	38		4
Fulton	23	49	62	12
Gasconade	22	47	62	11
Gebhardt	18	37	61	4
Geoffrey	21	44		10
Georgetown courthouse dome	25			5
German Catholic Church, west gable of tower, Portsmouth	24			4
German Methodist Church, Louisville	33	56		8
Gethsemane La Trappe Monastery spire	34	57		8
Geyer	22	47	62	11
Glasgow	19	40	62	5
Gould	18	38		4
Grassy Knob	23		61	3
Green	19	40		5,7
Green Ridge Congregational Church, chimney	30			12
Gun City flouring mill, iron chimney	31			12
Halleck	22	46		11
Hanover Catholic Church spire	28			10
Harrisonville Cumberland Presbyterian Church spire	31		62	12
Hartlin	21	44		9,10
Haskin	23	49		12
Haystack	33	56		8
Hazel Hill	30	52	62	12
Heard	23	48	62	12
Henderson	27			10
Hicks City Christian Union Church spire	30		62	12
High Point	22	48	62	11,12
High Point Tebo	23	48	62	12
Hill	27			10
Hoile	21	44		10
Holden Methodist Church spire	30		62	12
Holmes	18	36	61	3
Holton north base	19	40	62	5
Holton south base	19	40	62	5
Holtzhausen	21	44		9

INDEX TO POSITIONS, DESCRIPTIONS, ELEVATIONS, AND SKETCHES—Continued.

Station	Position	Description	Elevation	Sketch
	Page	*Page*	*Page*	*Number*
Holy Cross Catholic Church, St. Louis	29			10
Honey Creek	20	42		9
Howland	19	38		4
Hubbard	23	48	62	12
Hughes	23	48	62	12
Hughes High School, Cincinnati	26	51		6
Hunt City	20	42		9
Hunter latitude	30			12
Hunter or Versailles south base	22	48	62	12
Hutton Mound	23	49	62	12
Independence courthouse, high cupola or tower	31		62	12
Indian Knob	34	57		8
Insane Asylum	21	45		10
Ironton, Kelly's house cupola	24			4
Island Creek	21	43		9
Ivy	18	36	61	3
Jackson	32	55		8
Jacobs	22	46	62	11
Jefferson City astronomic	30	52	62	11
Jefferson City Capitol, rod on dome	30			11
Jeffersonville Government tower	33			8
Jobs Knob	23		61	3
Kansas City astronomic	31	52		12
Kansas City, Catholic Cathedral, Eleventh Street, between Broadway and Washington Streets	31		62	12
Kansas City, Second Presbyterian Church spire	31			12
Keeney	18	36	61	3
Keith	32	55		8
Kendrick	23	48	62	12
Kennedy	22	47	62	11
Kennedy, Cincinnati	26	52		6
Kessler	21	46		10
Kingsville public-school cupola	30		62	12
Kleinschmidt	21	46		10
Knob Noster	23	48	62	12
Koeltztown spire	30	52	62	11
Lamont Campbellite Church spire	30			12
La Trappe Monastery spire, Gethsemane	34	57		8
Lebanon Catholic Church spire	34	57		8
Lebanon College chapel spire	28			10
Lebanon Junction Knob	34	57		8
Lebanon Methodist Church spire	28			10
Lees Summit South Methodist Church cupola	31		62	12
Leonard	20	41		7
Longview, Cincinnati	26	51		6
Lookout House, Cincinnati	25	50		5, 6
Loretto Convent spire	34	57		8
Louisville:				
Baptist Church	33	56		8
Blind Asylum	32	54	62	8
Louisville—Continued.				
Bonifacius Church	33	56		8
Broadway Baptist Church	33	56		8
Catholic Cathedral	33	56		8
Cave Hill Cemetery	33	56		8
Christ Church	33	56		8
Church of the Messiah	34	56		8
City Hall	33	56		8
Courier-Journal office, pole	33			8
German Methodist Church	33	56		8
Malt House elevator	33	56		8
North base	32	54	62	8
St. Martins Church	33	56		8
St. Pauls Church	33	56		8
Second Presbyterian Church	33	56		8
South base	32	54	62	8
Stuart Robinson Church, highest spire	34			8
Waterworks tower	33			8
L'Ours Creek spire	30	52		11
Lucas	21	44		9
Lutz	32	54	62	8
Lynch	22	46		10, 11
McDaniel	22	47	62	11
Madisonville school, Cincinnati	26	51		6
Madisonville water tower, Cincinnati	26			6
Malt House elevator, Louisville	33	56		8
Marine Hospital, St. Louis	29			10
Martin	24	50	61	3
Marty	23	49		12
Marysville	32	53	62	8
Medlock	22	47	62	11
Merom College	20	42		7, 9
Methodist Church, Bardstown Junction	34	56		8
Miller	19	41	62	7, 8
Minerva	19	39		4, 5
Minoma	21	46		10
Missouri and Kansas State line 1, Missouri stone	31	53		12
Missouri and Kansas State line 2, stone	31	53		12
Missouri and Kansas State line 3, stone	31	52		12
Moreau	22	47	62	11
Morgan	21	46		10
Mound	21	44		9
Mount Adams Convent, Cincinnati	25	50		5
Mountain Top	32	55		8
Mount Lookout transit pier, Cincinnati	25	50		5
Mount Washington Church spire	34	56		8
Mount Washington school, Cincinnati	26	51		6
Mud Lick	19	40		5
New Albany Second Presbyterian Church	33			8
New Albany waterworks tower	33			8
New Hope Distillery smokestack	34	57		8
Newton	20	43		9

INDEX TO POSITIONS, DESCRIPTIONS, ELEVATIONS, AND SKETCHES—Continued.

Station	Position	Description	Elevation	Sketch
	Page	*Page*	*Page*	*Number*
Normal	23	48	62	12
North base	27			10
North base, Louisville	32	54	62	8
North Meridian, Portsmouth	24	50		4
North Methodist Church spire, Charleston	24			3
Northwest corner	29	52		11
Norwood, Cincinnati	26	51		6
Norwood water tower, Cincinnati	26			6
O. & M	32	53	62	8
Oakland	18	38	61	4
Oblong	20	42		9
Observatory, Cincinnati, 1889	25	50		5
Observatory, Cincinnati, 1912	26	51		6
Old Capitol, top of belfry, Charleston	24			3
Olney:				
Check base	20	43		9
Courthouse dome	27			9
East base	20	43		9
Evangelical Church spire	27			9
Middle base	20	43		9
Schoolhouse tower	27			9
West base	20	43		9
Onion Hill	20	43		9
Osborn	20	41		7
Paint Creek, east tree	24		61	3
Parkersburg	21	44		9
Parkinson	21	45		10
Patterson	21	46		10
Peach Mount	19	38		4
Penick	33	56		8
Peters	22	46		11
Pigeon	18	37	61	3, 4
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Davis Steel Works chimney	25			4
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Rariden	20	41	62	7
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St. Clemons Church spire, Cincinnati	27			6
St. Francis Church, St. Louis	29			10
St. Francis de Sales Church spire, Cincinnati	26			6
St. Gertrude's Church	29			11
St. Joe, Cincinnati	26	52		6
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First Presbyterian Church	29			10
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Sims	32	54		8
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