H
5-8

H

I N D E X .

Page.

Establishment of point of beginning at Easternmost point of Yellowstone Lake.

Parallel of Latitude 44° 20' 12" N. run E. from point of beginning on Yellowstone Lake.

Unmeasured East Bdy. of Yellowstone National Park.

Measured East Bdy. of Yellowstone National Park.

North Bdy. Yellowstone Park Timber Land Reserve.

East Bdy. " " " " "

South Bdy. " " " " "

East Bdy. Yellowstone National Park. Supplemental.

North Bdy. Yellowstone Park Timber Land Reserve. Supplemental.

East Bdy. " " " " " "

South Bdy. " " " " " "

East Bdy. Yellowstone National Park.

East Bdy. " " "

South Bdy. " " "

(4—679.)

RECEIVED WITH
SUR. GEN'L'S. LETTER.
JUL 17 1894

FIELD NOTES

OF THE ~~SURVEY OF~~

Establishment of point of Beginning at the easternmost point of Yellowstone Lake and the survey of Parallel of Latitude 44° 20' 12" N. run east from point of Beginning on Yellowstone Lake, the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park; the north boundary of Public Forest Reservation the east boundary of Public Forest Reservation and the south boundary of Public Forest Reservation

~~Of the~~ in the ~~Meridian,~~

State of Wyoming

AS SURVEYED BY

Philip W. Gallaher, U. S. Deputy Surveyor,

Under his Contract No. 263 Montana, dated October 17, 1891.

Survey commenced August 3rd, 1893

Survey completed October 22nd, 1893

(1293—2,000.)

Names and Duties of Assistants.

Charles La Blanc	Chainman
Jno. E. Shaw	Chainman
Clarence T. Forsker	Chainman
Chas. L. Sawyer	Chainman
John Sheridan	Axeman
Joseph Willey	Axeman

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MEASURED EAST B'DY OF YELLOWSTONE NAT. PARK

CORNER	PAGE	CORNER	PAGE	CORNER	PAGE
0 M	23	5 M + 71.05 chs	35	8 M	39
0 M + 2.12 chs	25	6 M	35	8 M + 31.30 chs	39
½ M	25	6½ M	34	8½ M	40
1 M + 62.04 "	27	6 M + 65.39 chs	34	8 M + 73 "	40
3 M + 68.41 "	31	7 M	37	10 M + 38.89 "	43
4½ M	36	7 M + 7 "	38	11 M	44
5 M	36	7 M + 37.16 "	38	11½ M	44
5½ M	35	7½ M	38	12 M	44

12 M + 6.65 chs - N.W. Cor P.F.R. - page 46

NORTH B'DY PUBLIC FOREST RESERVATION

CORNER	PAGE	CORNER	PAGE	CORNER	PAGE
4½ M	57	17 M + 29.57 chs	71	20 M + 46.20 chs	73
4 M + 44.10 chs	57	17½ M	70	21 M + 72.30 "	74
11 M + 18.50 chs	64	18 M	70	22 M	75
11½ M	64	18½ M	69	22 M + 11 "	75
12 M	64	19 M	69	22½ M	75
12 M + 17.17 chs	64	19½ M	69	23 M	75
12 M + 38 "	65	19 M + 52 chs	66	24 M	77
17 M + 5 "	71	20 M	72	24 M + 02.55 "	79

24 M + 40 chs - N.E. Cor. P.F.R. - page 81

EAST B'DY PUBLIC FOREST RESERVATION

CORNER	PAGE	CORNER	PAGE	CORNER	PAGE
25 M + 70.44 chs	86	49½ M	109	67 M	125
26 M	87	50 M	108	67½ M	126
26½ M	90	50 M + 35.06 chs	110	67 M + 73.50 chs	126
27 M	90	50½ M	111	68 M	126
27½ M	90	50 M + 67.82 "	112	69 M + 64.32 "	127
28 M	91	51 M	112	72 M + 58.86 "	133
28½ M	92	51½ M	113	73 M	133
28 M + 50.38 chs	92	61 M + 7 chs	121	73½ M	133
29 M + 53.70 "	93	61½ M	120	74 M	134
30 M	94	62 M	120	74½ M	134
30½ M	94	62½ M	120	75 M	134
31 M	94	63 M	120	75 M + 54.88 chs	132
31 M + 31.44 chs	95	63½ M	119	77 M + 38.02 "	136
31½ M	96	63 M + 51 chs	119	80 M + 25.54 "	141
40 M + 54.50 chs	100	64 M	119	80½ M	141
43 M	104	64 M + 28 chs	118	81 M	141
43 M + 35.20 "	104	64½ M	122	81 M + 75.62 "	140
43½ M	105	65 M	122	82 M + 02.71 "	143
44 M	105	65½ M	122		
48 M + 50.50 "	110	66 M	123		
49 M	109	66½ M	125		

SOUTH B'DY PUBLIC FOREST RESERVATION

CORNER	PAGE	CORNER	PAGE	CORNER	PAGE
82 M + 14.71 chs	147	115 M + 54.61 chs	172	133 M + 68.88 chs	184
86 M + 32 "	150	116 M	173	134 M	185
88 M + 36.89 "	153	116½ M	173	134½ M	185
89 M	156	117 M	173	135 M	185
89 M + 28.84 "	156	117½ M	174	135½ M	186
89½ M	156	118 M	174	136 M	186
95 M	159	118½ M	175	136 M + 4 chs	186
95½ M	159	119 M	175	136½ M	187
95 M + 54.03 "	158	119½ M	176	137 M	187
96 M	159	120 M	176	137½ M	187
101 M + 52.82 "	163	120 M + 22.70 chs	177	137 M + 52 chs	188
106 M + 24.88 "	166	120½ M	177	138 M	188
106½ M	166	121 M	177	138½ M	188
107 M	167	121½ M	178	138 M + 65.08 chs	188
107½ M	167	122 M	178	139 M	189
108 M	167	122½ M	178	139½ M	189
108½ M	167	123 M	178	139 M + 58.80 "	189
109 M	168	123½ M	179	140 M	190
109½ M	168	124 M	179	140 M + 42.74 "	190
110 M	168	124½ M	180	141 M	190
110½ M	168	125 M	180	147 M + 11.44 chs	194
111 M	169	125½ M	180	152 M + 53.57 "	196
111½ M	169	126 M	180	157 M + 63.53 "	199
112 M	169	126½ M	181	158 M	199
112 M + 21.50 chs	170	127 M	181	158 M + 43 chs	200

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Township ....., *Range* .....

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19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Meanders Page .....

Preliminary Oaths of Assistants.

WE, Charles La Blanc, Jno. E. Shaw, Clarence T. Foraker and Chas. L. Sawyer

do solemnly swear that we will well and faithfully execute the duties of chain carriers; that we will level the chain over even and uneven ground, and plumb the tally-pins either by sticking or dropping the same; that we will report the true distance to all notable objects, and the true lengths of all lines that we assist in measuring, to the best of our skill and ability, and in accordance with instructions given us in the ~~survey of the~~ establishment of point of beginning at the easternmost point of Yellowstone Lake and the survey of Parallel of Latitude 44° 20' 12" N. run east from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park, and the north east and South boundaries of Public Forest Reservation in the state of Wyoming

(signed) Charles La Blanc, Chainman.
(signed) Jno. E. Shaw, Chainman.
(signed) Clarence T. Foraker, Chainman.
(signed) Chas. L. Sawyer, Chainman.

Subscribed and sworn to before me this 20th day of July, 1893.

U.S. Commissioner's Seal

(signed) A. P. Hart
U. S. Commissioner

WE, John Sheridan and Joseph Willey

do solemnly swear that we will well and truly perform the duties of axemen in the establishment of corners and other duties, according to instructions given us, and to the best of our skill and ability, in the ~~survey of the~~ establishment of point of beginning at the easternmost point of Yellowstone Lake and the survey of Parallel of Latitude 44° 20' 12" N run east, from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park and the north east and south boundaries of Public Forest Reservation in the state of Montana

Subscribed and sworn to before me this 20th day of July, 1893.

(signed) John Sheridan, Axeman.
(signed) Joseph Willey, Axeman.

U.S. Commissioner's Seal

(signed) A. P. Hart
U. S. Commissioner

6—151

ESTABLISHMENT OF POINT OF BEGINNING AT THE EASTERNMOST POINT OF YELLOWSTONE LAKE

I arrived at the mouth of Beaver-dam creek on the evening of August 3rd.1898. Having followed the Yellowstone river down from a point some 20 miles above its mouth to the lake, I am certain that there are no arms of the lake further south than the one into which Beaver-dam creek empties, which is known as the south east arm of Yellowstone lake.

On the evening of August 3rd.1898, at the mouth of Beaver-dam creek, I observe Polaris at its eastern elongation, at 10h.34m.P.M., and find its magnetic bearing to be N 16° 45′ W.

North end of needle	16° 45′ East.
The azimuth, by table in Manual, is	1° 46′ East.
the sum is the variation	18° 31′ East

I lay off the azimuth to the west and mark the true meridian, so determined, by driving a picket 3.00 chs. N. of hub.

On the morning of August 4th.1898, having tested my Solar on the meridian, and put it in perfect adjustment, I set the telescope on the meridian and, the whole southern portion of the lake being in sight, ascertain that no portion of it lies further east than the instrument. I then run north on the meridian about 80 chs. without chaining, to a point from which the entire northern portion of the lake lies exposed to view and find that the meridian will touch the lake only at a point near the mouth of Beaver-dam creek. I then return to the point of my original observation and carefully inspect the surrounding country, which is flat and marshy, with a view of determining the proper boundaries of Yellowstone lake at high water. This I find more or less difficult to decide, from the fact that when Beaver-dam creek is high, it spreads out near the mouth and covers a large area. I find however that there is a low gravel bar, or reef, extending from the main land at a point N. 9° E. from the instrument, between the creek and lake, and by means of the drift wood landed on this reef from the lake on the west and from the

creek on the east, I am enabled to decide upon the proper location of the first monument to be established, which is in the center of the reef, at its junction with the main land, 28 chains N. 8° E. of the mouth of Beaver-dam creek, from which point the line of demarcation between Yellowstone lake, at high water, and the main land, extends in north westerly and south westerly directions. At this point, which is about 4 ft. above the present water level of the lake and at the upper edge of the lake drift, I establish the corner to mark the point of beginning as follows; Set a flint stone 50x20x18 ins., with granite boulder 5ins. diam. marked with a x, 20 ins. in the ground, marked P.B. on E. face, from which a pine tree 10 ins. diam. bears N. 52° 30' E. 90 lks. dist., marked P.B. 1895. B.T. and a pine tree 10 ins. diam. bears N. 55° W. 4.00 chs. dist. marked P.B. 1895. B.T. Over the corner I constructed a conical mound of stone 8 ft. base and 4 ft. high; in east side of which I place, near the bottom, a granite stone 50x20x20 ins. marked P.B. 1895. At a point exactly 3.26 ft. due south of corner, I set agranite stone 10x4x4 ins. marked with a X on top, 8 ins. in the ground, for T.P. (transit point) marked T.P. on N. face, on secant; called Sta. A.

On the evening of Aug. 4th. 1895 at the T.P., I observe Polaris at its eastern elongation, at 10h. 50m. P.M. Mean Local Time and find its magnetic bearing to be N. 16° 44' W.

North end of needle	16° 44' East.
Azimuth, by table in Manual, is	1° 46' East
the sum is the variation	18° 30' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by driving a large hub in the ground and setting a tack in it on the meridian, 4.00 chs. N. of instrument.

At apparent noon of August 5th. 1895, by Solar observation, I make the latitude of the T.P. to be 44° 20' 12" N.

On the evening of August 5th. 1895, at the T.P., I again observe Polaris at its eastern elongation, at 10h. 26m. P.M.

and find its magnetic bearing to be N.16° 44' W.

North end of needle	16° 44' East.
The azimuth, by table in Manual, is	1° 46' East.
the Sum is the variation	18° 30' East.

I lay off the azimuth to the west and find the tack in the hub, 4.00 chs.N., to be exactly on line and on the meridian.

On the evening of August 6th.1898, at the T.P. I again observe Polaris at its eastern elongation, at 10 h. 22 m.P.M. and find its magnetic bearing to be N.16° 44' W.

North end of needle	16° 44' East.
The azimuth, by table in Manual, is	1° 46' East.
the sum is the variation	18° 30' East

I lay off the azimuth to the west and find the tack in the hub, 4.00 chs.N., to be exactly on line and on the meridian.

SURVEY COMMENCED Aug.8th.1898 and made with Young & Sons' transit No.8588, with Smith's Solar attachment. Measurements made with Gunter's steel chains 66 ft. in length, compared and adjusted, before I begin, to the standard steel tape appoved by the Surveyor-general for Montana.

During the past two days I have critically examined the country over which the line, 10 miles east of Yellowstone lake, will run and find it not only exceedingly rough, rugged and mountainous but, for the most part, heavily timbered. It will therefore be impossible to run a hub line and chain it, without cutting considerable timber. This I am strictly forbidden to do in my special instructions, and I am therefore compelled to arrange a set of triangulations as hereinafter described; for particulars of which reference is hereby made to figs. 1, 2, 3 & 4, and to diagram A, page 16 of these notes.

At a point corresponding to A, of diagram A, I set my transit over the X on top of the triangulation point, established on secant 3.26 ft. south of the Point of Beginning Corner, marked T.P. (triangulation point) and, with the vernier at zero, direct the telescope to tack in hub established on the meridian, 4.00 chs.N. and deflect the azimuth

4.

PARALLEL OF LATITUDE 44°20'12"N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

88°57'30" from the north towards the east, and set a flag on the secant thus laid off, on the top of a bald mountain, at a point corresponding to Sta. D, fig. 1, page 5, with instrument at Sta. A, vernier at zero, I

Set on Sta. D. Unclamp plates and
Set on tack in hub, 4.00 chs. N. on the meridian.
Vernier reads 89°57'30"

I then establish a double base-line AB and AC, as follows -

With instrument at Sta. A, fig. 1, page 5, vernier at zero, I direct the telescope to flag on bald mountain at Sta. D. Unclamp plates and deflect 81°20' to the south and, in that direction, measure a base-line along the lake shore. At 9.95 chs. set a sandstone 7x4x4 ins., 6 ins. in the ground, for Sta. B, upon the top of which I mark a X on line and exactly 9.95 chs. from the triangulation point at A. I prolong this base-line to the most southern point from which I can see the flag on bald mountain, at Sta. D, and set a sandstone 9x6x5 ins. 7 ins. in the ground, for Sta. C. upon the top of which I mark a X on line and exactly 25.67 chs. from the T.P. at A.

I then verify the angle included between the base line and the flag on bald mountain, as follows -

Instrument at secant point, Sta. A, vernier at zero
Set on flag on bald mountain at Sta. D.
Unclamp plates and set on flag at Sta. C.
Vernier reads 81°20'
Unclamp below and set on flag at Sta. D.
Unclamp plates and set on Sta. C.
Vernier reads 162°40'
Angle BAD = DAC = 81°20'

Instrument at south end of base-line, Sta. C.
Test alignment of base-line by fore sight and find stations A, B & C to be on the same straight line.
Vernier at zero.
Set on Sta. D. Unclamp plates and set on Sta. A.
Vernier reads 95°18'
Unclamp below and set on Sta. D.
Unclamp plates and Sta. A.
Vernier reads 190°52'
The angle ACD is 95°18'

Instrument at Sta. B, vernier at zero.
Set on Sta. A. Unclamp plates.
Set on Sta. D.
Vernier reads 97°21'
Unclamp plates and set on Sta. C.
Vernier reads 180°00'
Unclamp below and set on Sta. A.
Unclamp plates and set on Sta. D.
Vernier reads 277°21'
Unclamp above and set on Sta. C.
Vernier reads 360°00'
Angle ABD is 97°21'
Angle ACD is 95°18'
Angle CBD is 82°39'

PARALLEL OF LATITUDE 44° 20' 12"N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

Owing to the configuration of the country, the heavy timber intervening and the swampy nature of the ground immediately surrounding the point of beginning corner, it is not possible to lay out any other base-line by which to measure the distance to Sta. D, on bald mountain.

The barometer indicates 7700 ft.

Erecting back sights at Stations A, B and C, I proceed to the flag at Sta. D, on bald mountain and, at exact point where flag stood, I set up the instrument and measure the angles ADB, BDC and ADC, as follows -

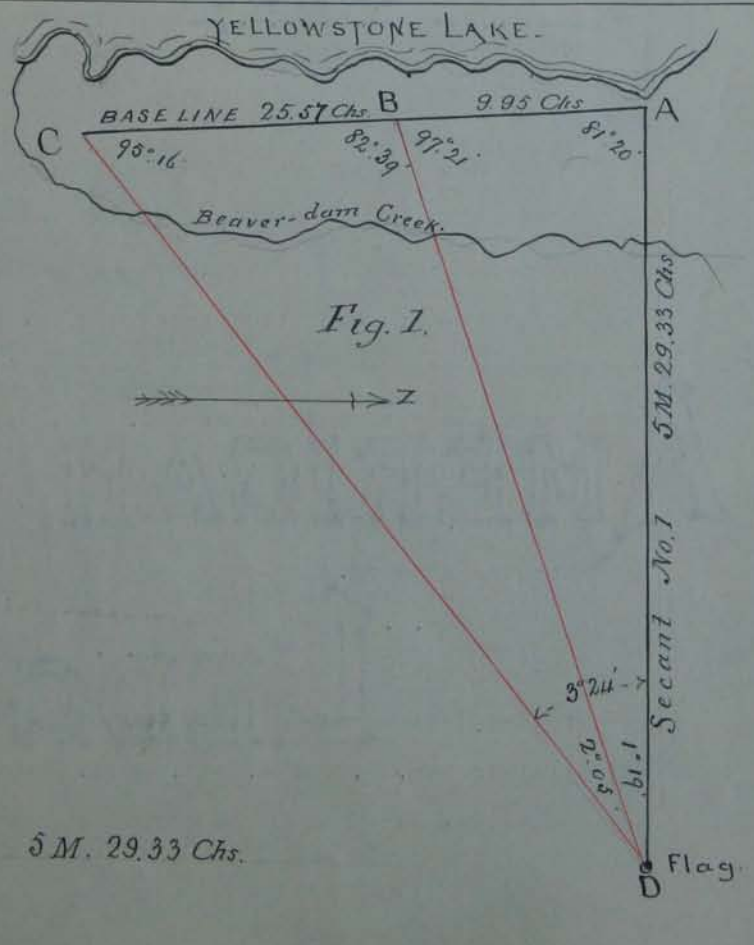
Instrument at Sta. D, vernier at zero.
Set on Sta. A.
Unclamp plates and set on Sta. B.
Vernier reads 1° 19'
Unclamp plates and set on Sta. C.
Vernier reads 5° 24'
Unclamp below and set on Sta. A.
Unclamp plates and set on Sta. B.
Vernier reads 4° 48'
Unclamp plates and set on Sta. C.
Vernier reads 6° 48'

In the triangle ABD,

Angle ABD	=	97° 21'
Angle BAD	=	81° 20'
Angle ADB	=	1° 19'
the sum is		180° 00'

In the triangle ACD,

Angle ACD	=	95° 16'
Angle CAD	=	81° 20'
Angle CDA	=	5° 24'
the sum is		180° 00'



PARALLEL OF LATITUDE 44°20'12"N. RUN EAST FROM THE POINT OF BEGINNING ON YELLOWSTONE LAKE.

As near as I can read my instrument the triangles ACD and ABD are in perfect balance and there is no closing error.

Solving the triangle ACD. for AD = x.

25.57 : Sin 5 24 :: x : Sin 95° 16'

Log. 25.57	1.4077607
Log. Sin 95° 16'	9.9981828
	11.4059435
Log. Sin 5° 24'	8.7731014
	2.6328419

X = AD = 429.66 chs.

Solving the triangle ABD. for AD = x.

9.96 : Sin 1° 19' :: X & Sin 97° 21'

Log. 9.96	0.9978261
Log. Sin 97° 21'	9.9964167
	10.9942428
Log. Sin 1° 19'	8.3613150
	2.6329278

X = AD = 429.46 chs.

The difference between the two solutions for the distance AD, between the P.B. corner, Sta.A and the flag, Sta. D, is therefore 18 lks., but on account of the shorter base-line AB, of the triangle.ABD, I conclude that the most of the error exists in that triangle, and decide to assume the distance AD to be 429.56 chs., and Sta.D, on the secant, is at 5m.29.53 chs.

The barometer indicates 9500 ft.

Aug.8th.1895.

On the evening of August 8th.1895, at Sta.D, just described, I take an observation on Polaris at its eastern elongation, at 10h.15m.P.M. and find its magnetic bearing to be N.16°41'W.

North end of needle	16°41' East.
The azimuth, by table in Manual, is	1°46' East.
the sum is the variation	18°27' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by a mark on a rock, 2.78 chs.N.

I make the latitude of the place 44°20'N.

On the morning of August 9th.1895, with my instrument over the exact point at Sta.D, I verify the true bearing of secant AD, as follows -

Vernier at zero.
Set on meridian established on rock, 2.78 chs. N. of Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 89°58'

The interpolation value (Table XI) of offset from secant to parallel for 5m.29.53 chs.is 1.09 ft.North, and the offset from parallel to point from which to project a new

secant is 3.26 ft. south. Station D being 1.09 ft. south of parallel, 3.26 ft. minus 1.09 ft. equals 2.17 ft. the distance I must measure from center of instrument south, to establish a point from which to project new secant. At 2.17 ft. south of instrument cut a deep X in the rock for new Transit point, corresponding to Sta. E, fig. No. 2. With instrument over said point, vernier at zero, set on meridian established last night and deflect 89° 57' 30" from the north towards the east and set a flag on the secant thus laid off, near the extreme top of Mt. Humphries, at a point corresponding to Sta. H, fig. 2. I verify the correctness of the secant as follows -

Instrument at E, vernier at zero.
Set on flag at H.
Unclamp plates and set on meridian established on rock N.
Vernier reads 89° 57' 30"
Unclamp below and set on flag, Sta. H.
Unclamp plates and set on meridian.
Vernier reads 179° 55'

The point at Sta. E is on the top of a mountain composed of crags and peaks without any particular form and between it and the flag at Sta. H, there lies an impassible canyon, 2000 ft. or more deep, and chaining across it is impossible; neither is there room on this mountain to lay off a base line in any direction, of sufficient length, from which to measure the distance to the flag on top of Mt. Humphries, Sta. H, and I therefore, by means of a short base-line laid off from the point E (on the new secant), measure the distance across a deep chasm to the top of another peak from which Sta. E can be seen; for a second and longer base line from which to calculate the distance EH, on the secant. The operation is illustrated in fig. 2, and is as follows -

E. Transit point on secant No. 2.
G. Transit point established at S. end of base-line EG.
H. Flag and transit point at base of Mt. Humphries, on secant.
EF. Short base from which to measure distance EG.
EG. Base-line from which to measure secant distance EH.

Instrument at T.P. Sta. E, vernier at zero
Set on flag Sta. H. Deflect 78° 04' towards the south and in this direction carefully measure exactly 5.00 chs. for base-line EF, and mark a X on the rock exactly on line. Sta. F.

Verify the angle FEH, as follows, vernier at zero.
Set on flag Sta. H.
Unclamp plates and set on Sta. F.
Vernier reads 78° 04
Unclamp below and set on Sta. H.
Unclamp plates and set on Sta. F.

8. PARALLEL OF LATITUDE 44°20′12″N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

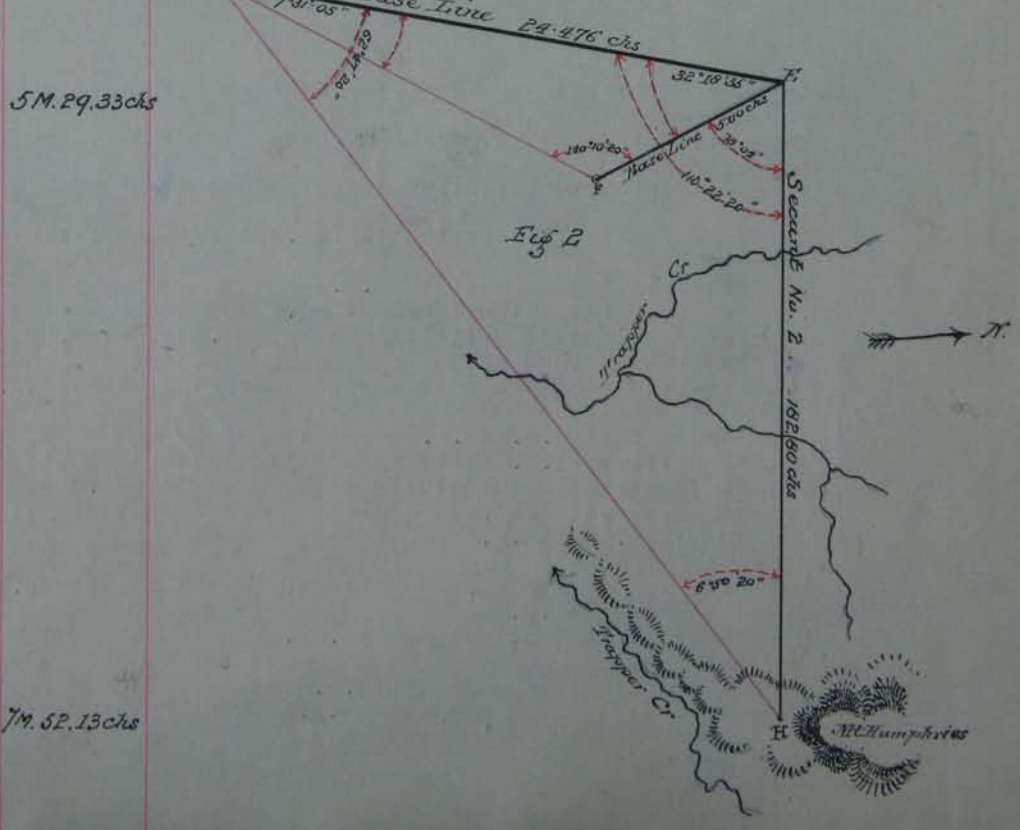
Vernier reads 156°08′
Vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.G.
Vernier reads 110°25′
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.G.
Vernier reads 220°45′
Vernier at zero.
Set on Sta.G.
Unclamp plates and set on Sta.F.
Vernier reads 52°18′50″
Unclamp below and set on Sta.G.
Unclamp plates and set on Sta.F.
Vernier reads 64°57′00″
Angle GEH is 110°22′50″ mean value.
Angle GEF is 52°18′50″ ..
Angle FEH is 78°04′00″ ..

Instrument at Sta.F, vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.G.
Vernier reads 140°10′
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta. G.
Vernier reads 280°20′50″
Angle GFE is 140°10′15″ mean value.

Instrument at Sta.G., vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 7°51′00″
Unclamp plates and set on Sta.H.
Vernier reads 62°47′00″
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.F.
Vernier reads 70°18′00″
Unclamp plates and set on Sta.H.
Vernier reads 125°55′00″
Angle FGE is 7°51′00″ mean value.
Angle EGH is 62°47′50″ ..

FIGURE 2.

In the following diagram ~~and relations~~ the adjusted angles of pages 9 & 10 are used.



PARALLEL OF LATITUDE 44° 20′ 12″ N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

Solving triangle EFG. ~~for~~ for EG = x.

5.00 : Sin 7° 51′05″ :: x : Sin 140° 10′ 20″

Log. 5.00	0.6989700
Log. Sin 140° 10′ 20″	9.8068070
	10.5054770
Log. Sin 7° 51′ 05″	9.1167359
	1.3887411

x = EG = 24.476 chs.

Solving triangle EGH. for EH = x.

24.476 : Sin 6° 50′ 20″ :: x : Sin 62° 47′ 20″

Log. 24.476	1.3887411
Log. Sin 62° 47′ 20″	9.9490618
	11.3378029
Log. 6° 50′ 20″	9.0758312
	2.2619717

x = EH = 182.80 chs.

EH	=	2m. 22.80 chs.
E	=	5m. 29.33 chs.
		7m. 52.13 chs. = Line distance of Sta. H

Sta. F cannot be seen from Sta. H, niether can I, in any manner, obtain another base-line, of any considerable length, from which to measure the secant distance EH. Proceeding to the flag at Sta. H, I set the instrument over the exact point at which the flag stood (marked by a X cut in the rock) and, with vernier at zero,

Set on flag on Sta. E.
Unclamp plates and set on Sta. G.
Vernier reads 6° 50′ 00″
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. G.
Vernier reads 13° 41′ 00″
Angle EHG, is 6° 50′ 30″

Closing Error, Triangle GFE.

Angle FGE	7° 31′ 00″
Angle GFE	140° 10′ 15″
Angle GEF	32° 18′ 30″
the sum is	179° 59′ 45″

Closing error, minus 15″

Closing Error, Triangle GEH.

Angle EGH	62° 47′ 30″
Angle GEH	110° 22′ 30″
Angle EHG	6° 50′ 30″
the sum is	180° 00′ 30″

Closing error, plus 30″

I consider the observation taken at each of the different stations to be equally accurate, the correction to be applied to each angle is therefore ⅓d. of difference between the sum of the angles and 180° 00′, to be added to, or subtracted from, the approximate angles.

PARALLEL OF LATITUDE 44° 20' 12"N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

The corrected angles of triangles are as follows -

Triangle GEH.		Triangle GFE.	
Angle EGH	62°47'20"	Angle FGE.	7°51'05"
Angle GEH	110°22'20"	Angle GFE	140°10'20"
Angle EHG	6°50'20"	Angle GEF	32°18'35"
the sum	180°00'00"	the sum	180°00'00"

I find that the Station H is located on a rocky point at the south end of Mt. Humphries, and 50 ft. south of a perpendicular cliff 500 ft. high. From this point the line drops off nearly perpendicular, about 2000 ft., into the head of Trapper creek canyon. Chaining ahead on the secant is impossible, and it is equally impossible to lay off a base-line at this point, for the reason that there is no room. I therefore send a flag into the head of Trapper creek canyon and, by double back and fore sights from Sta. H, establish a point on the secant, corresponding to Sta. J of diagram A, and fig. 3, page 12, which point I establish by setting a sandstone 9x5x4 ins., 7 ins. in the ground, and marking a X on top of it, exactly on line of secant.

The barometer at Sta. H indicates 10,000 ft.

Leaving a back sight at Sta. H, I then proceed to the flag Sta. J and, setting the instrument directly over the X, with vernier at zero, direct the telescope to the back sight at Sta. H, and deflect 90°00' towards the south. On this course I measure a base-line, and at 8.00 chs. set a granite boulder 10 ins. diam. level with the top of the ground; upon the top of which I mark a cross at exactly 8.00 chs. from Sta. J. I verify the angle included between this Sta. corresponding to J of diagram, as follows -

Instrument at Sta. J, vernier at zero
Set on flag at St. H.
Unclamp plates and set on Sta. I.
Vernier reads 90°00'
Unclamp below and set on Sta. H.
Unclamp plates and set on Sta. I.
Vernier reads 180°00'
Instrument at Sta. I, vernier at zero.
Set on Sta. J.
Unclamp plates and set on Sta. H.
Vernier reads 80°57'50"
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. H.
Vernier reads 161°15'00"
Angle HIJ, 80°57'15"

PARALLEL OF LATITUDE 44°20'12"N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

Instrument at Sta.H, vernier at zero.
Set on Sta.I.
Unclamp plates and set on Sta.J.
Vernier reads 9°28'
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.J.
Vernier reads 18°46'
Angle JHI, 9°28'
The barometer at Sta.J indicates 8000 ft.
August 9th.1895.

On the evening of August 9th.1895 from Sta.J, just established, I observe Polaris at its eastern elongation, at 10h. 12m.P.M., and find its magnetic bearing to be N.16°42'W.

North end of needle 16°42'East.
The azimuth, by table in Manual, is 1°46'East
the sum is the variation 18°28'East.

I lay off the azimuth to the west and mark the true meridian, so determined, by driving a hub, with tack, 5.00chs.N.

I make the latitude of the Sta. 44°20'N.

On the morning of August 10th.1895, with instrument over the exact point at Sta.J, I verify the true bearing of the secant JH, as follows -

Vernier at zero.
Set on meridian established 5.00chs.N.
Unclamp plates and set on Sta.H, on Mt.Humphries.
Vernier reads 90°03'

Sending a flag ahead to the top of a high ridge, or back bone, constituting the divide between the waters flowing into the Yellowstone and Clarks Fork rivers, I establish a point by cutting a X in the solid rock, exactly on secant produced by careful back and fore sights from Sta.H. This point corresponds to Sta.K of diagram.

Vernier at zero, Instrument at Sta.J.
Set on Sta.I.
Unclamp plates and set on Sta.K.
Vernier reads 90°00'
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.K.
Vernier reads 180°00'
Angle IJK, 90°00'

Instrument at I, vernier at zero.
Set on Sta.J.
Unclamp plates and set on Sta.K.
Vernier reads 74°18'30"
Unclamp below and set on Sta.J
Unclamp plates and set on Sta.K.
Vernier reads 148°52'30"
Angle JIK, 74°18'15" mean value.

The barometer indicates 8050 ft.

I proceed to the flag at St.K and, setting the instrument

over the X,
place vernier at zero, and set on Sta. J.
Unclamp plates and set on Sta. I.
Vernier reads 15° 45' 30"
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. I.
Vernier reads 31° 27' 30"
Angle JKI, = 15° 45' 45"

Closing Error, triangle HIJ.

Angle JIH	80° 37' 15"
Angle IJH	90° 00' 00"
Angle IHJ	9° 22' 00"
	180° 00' 15"

closing error, plus. 15"

Closing error, triangle JIK.

Angle IJK	90° 00' 00"
Angle JIK	74° 16' 15"
Angle JKI	15° 45' 45"
	180° 00' 00"

closing error, zero.

The flag at Sta. H and that at Sta. J, tested by direct fore sight from St. K, show these three points to be in exactly the same straight line and, as a double test at Sta. J has shown, the angles IJH and IJK to be exact right angles, I conclude that the closing error of 15" existing in the triangle HIJ is entirely in two angles JIH and IHJ, and distribute it accordingly.

The corrected angles of triangles are as follows -

Triangle HIJ.		Triangle JIK.	
Angle JIH	80° 37' 07"	Angle IJK	90° 00' 00"
Angle IJH	90° 00' 00"	Angle JIK	74° 16' 15"
Angle IHJ	9° 22' 53"	Angle JKI	15° 45' 45"
	180° 00' 00"		180° 00' 00"

7M. 52.13 Chs

8M. 20.55 Chs

8M. 48.95 Chs.

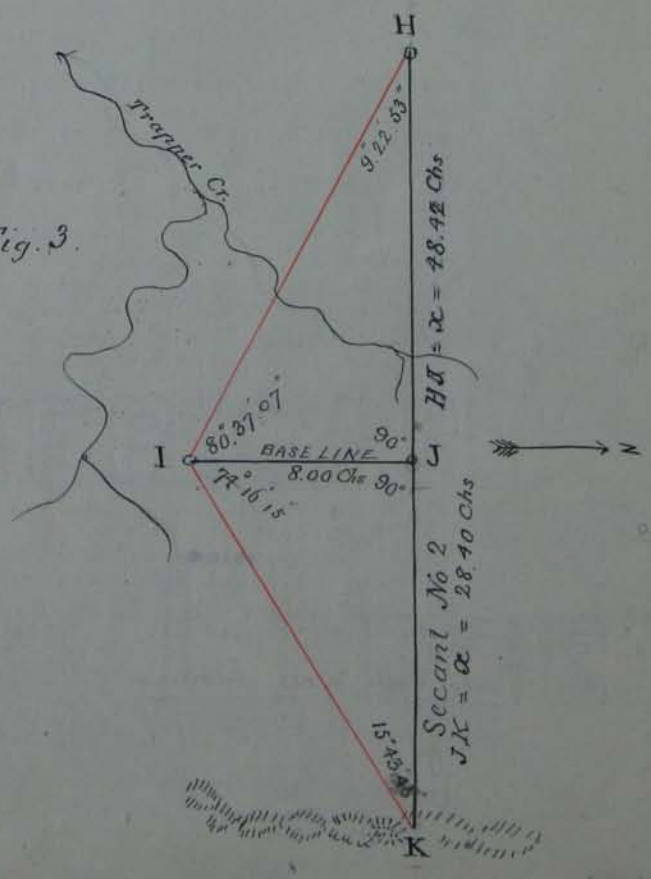


Fig. 3.

PARALLEL OF LATITUDE 44° 20' 12" N. RUN EAST FROM POINT OF BEGINNING ON YELLOWSTONE LAKE.

Solving Triangle JIH. for HJ = x.

8.00 X Tan 80° 57' 07" = HJ.

Log. 8.00	0.9030900
Log. Tan 80° 57' 07"	0.7819499
	1.6850399

HJ = 48.42 chs.

Secant distance of H,	7m. 52.13 chs.
Secant distance HJ,	48.42 chs.
Sum, secant distance of J,	8m. 20.55 chs.

Solving Triangle IJK. for JK = x.

8.00 X Tan 74° 16' 15" = JK.

Log. 8.00	0.9030900
Log. Tan 74° 16' 15"	0.5505107
	1.4554007

JK = 28.40 chs.

Secant distance of Sta. J,	8m. 20.55 chs.
Secant distance JK,	28.40 chs.
Sum, = secant distance of Sta. K,	8m. 48.95 chs.

Station K is located on top of the divide, which is simply a very narrow rock ledge, extending along the top of the mountain north and south, and in places rising into peaks. One of these is located 50 ft. south of the station and is a granite rock, nearly circular in form, and about 40 ft. in diam. It is about 50 ft. high and, standing as it does at a very high altitude, is a very prominent feature of the surrounding country.

The barometer indicates 10,100 ft.

From this point the mountain breaks off nearly perpendicularly towards the east, into the head of a creek, the course of which is N. 60° E.

There is no room whatever on the mountain for triangulating, and chaining ahead on the secant is out of the question. I therefore send a flag ahead into the canyon and, by double back and fore sights, establish a point on the secant by driving a stake and setting a tack in it, exactly on line. Sta. L. I establish a second point, about due north from it, by marking a X on a rock. Sta. M.

Instrument at Sta. K, vernier at zero.
Set on Sta. L.
Unclamp plates and set on Sta. M.
Vernier reads 6° 57' 50"
Unclamp below and set on Sta. L.
Unclamp plates and set on Sta. M.
Vernier reads 13° 15' 00"
Angle LKM, 6° 57' 50"

At apparent noon I take a solar observation at Sta. K, and make the latitude 44° 20' 12" N.

I then proceed to the flag at Sta. L and, with instrument

over the tack in hub, vernier at zero,

Set on flag at Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 92° 10' 00"
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 184° 21' 00"
Angle KLM, 92° 10' 50" mean value.

In this direction I carefully chain to Sta. M for a base-line, and make the distance LM, 9.42 chs.

With instrument at Sta. M, fig. 4, vernier at zero.
Set on Sta. L.
Unclamp plates and set on Sta. K.
Vernier reads 81° 12' 50"
Unclamp below and set on Sta. L.
Unclamp plates and set on Sta. K.
Vernier reads 162° 25' 00"
Angle LMK, 81° 12' 50"

Closing Error, Triangle KLM.

Angle LKM	6° 57' 50"
Angle KLM	92° 10' 50"
Angle LMK	81° 12' 50"
	180° 00' 30"

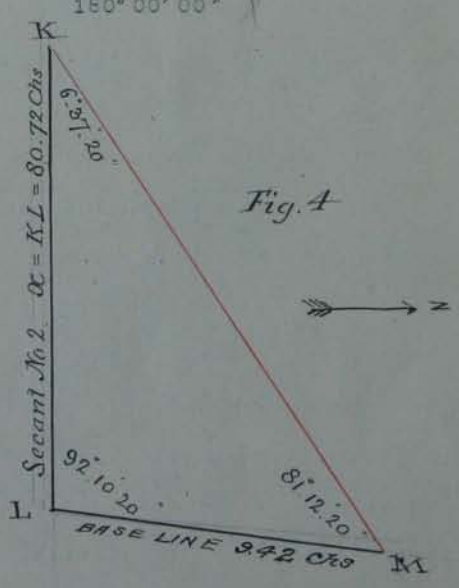
Closing error, 30" plus.

Equally distributed between angles.

Corrected Angles, as follows -

Angle LKM	6° 57' 20"
Angle KLM	92° 10' 20"
Angle LMK	81° 12' 20"
	180° 00' 00"

8M. 48.95 Chs.



9M. 49.67 Chs.

Solving Triangle LMK. for KL = x.

9.42 : Sin 6° 57' 20" :: x : Sin 81° 12' 20"

Log. 9.42	0.9740509
Log. Sin 81° 12' 20"	9.9948638
	10.9689147
Log. Sin 6° 57' 20"	9.0619135
	1.9070009

X = KL. = 80.72 chs. = 1m 00.72 chs

Secant distance of K,	8m. 48.95 chs.
Secant distance KL,	1m. 00.72 chs.
Sum, = secant distance of L,	= 9m. 49.67 chs.

It is impossible to lay off another base-line from this

Chains. point from which to re-measure the secant distance KL, on account of the exceedingly rough character of the country and the difficulty of securing a point, at any considerable distance from Sta.L, from which Sta.K can be seen.

The barometer indicates 8500 ft.

From Sta.L on secant, at 9m.49.69 chs. I extend the secant by double back and fore sights, chaining the distance.

South 89° 59′ E., on secant.
Var. 18° 27′ E.

Descend rapidly along steep slope to north east, over broken rocky ground, 200 ft. to

19.00 Foot of slope. Barometer indicates 8300 ft. Thence ascend steep slope to N., over loose slide rock, 100 ft.

50.55. The CORNER 10 MILES EAST OF YELLOWSTONE LAKE.

CORNER AND MONUMENT,
10 miles east of Yellowstone Lake.

At 0.80 ft. south of secant

Set a granite stone 42x18x7 ins., with granite stone 7x6x6 ins. marked with a X, 30 ins. in the slide rock, for corner on east boundary of Yellowstone National Park, marked E.B. Y.N.P. 10 M.E.Y.L. on W. and

P.P.R. 1893. on E. faces.

Over the corner built a stone mound in the form of the frustrum of a square pyramid, 4 ft. high, 6 ft. base, with its sides directed N.S.E.& W., in the east and west sides of which I place stones marked as follows -

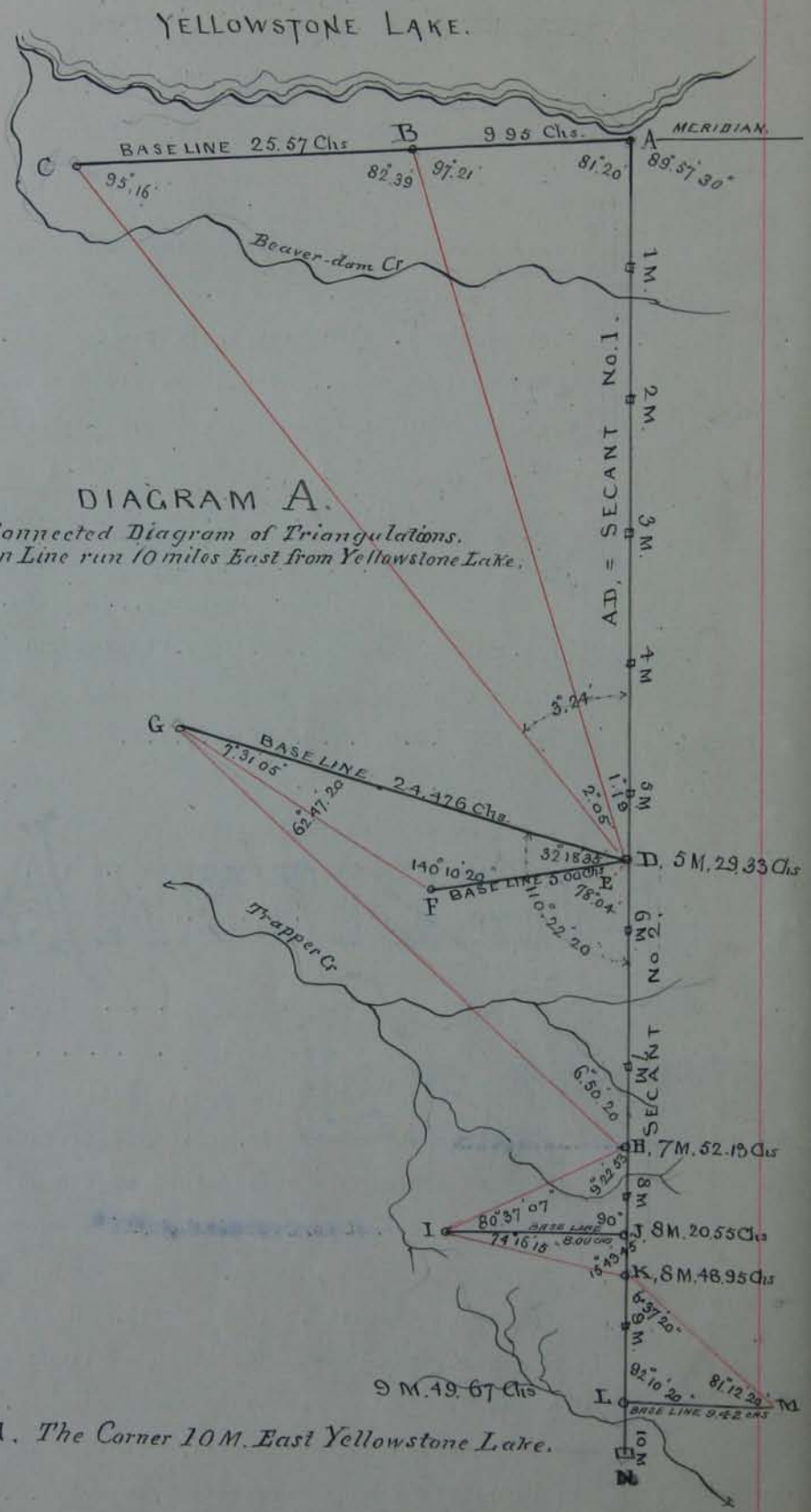
Stone in east side P.P.R. 1893.

Stone in the west side E.By.Y.N.P. 10M.E.Y.L.

There are no bearing trees within limits and nothing else, of a permanant character, which might be marked.

This corner is on a steep slope to the north, on slide rock from the overhanging mountain, which extends around the corner from south to west. The corner is difficult to get at and was difficult to build, and is not of a permanent character on account of snow slides and avalanches, evidences of which are seen on every hand. There seems however to be no point, within a long distance, any less liable to such visitations where W.C. might be estab-

lished, and I am obliged to let it go as it is. The monument is well constructed out of large shapely rocks. The Barometer indicates 8400 ft.



N. *The Corner 10 M. East Yellowstone Lake.*

GENERAL DESCRIPTION

of LINE run 10 Miles East from Yellowstone Lake.

The first mile and a half of the line runs over a low, flat, marshy county, covered with a dense growth of willow brush 8 to 10 ft. in height, and showing indications that it is covered with water, a foot or two deep, for a considerable portion of the year. This water is the overflow of Beaver-dam creek, which heads in high mountains and down which vast quantities of water pour into Yellowstone lake.

Leaving the willow marsh the line enters a dense growth of pine timber and ascends rapidly to the tops of high, rugged mountains, the timber disappearing gradually. Near the top of which all vegetation and timber disappears entirely and the mountains stand out alone, a broken series of bare crags and peaks, cut and furrowed in every direction by canyons from one to two thousand feet deep.

It is from these high peaks that I make my triangulations, which have been very difficult from the fact that none of the mountains have any room on the top of them, to speak of, and it is only with great danger to life and limb that one can crawl around among these rocky, precipitous peaks, made slippery by the melting of snow, with which they are still covered in many places.

This kind of country extends from the 4th. mile through to the corner 10 m. east of the lake without variation, crossing the divide between the waters flowing into the Yellowstone Lake and those flowing, north and east, into the Clark's fork and Stinking water rivers, at 8 m. 48.97 chs. This divide is very narrow and rocky, and while the general course of is north it is, in its details, exceedingly crooked and winding, and is so narrow and rugged that it cannot be followed any considerable distance.

August 10th. 1895.

On the evening of August 10th.1898, from terminal point of secant, I observed Polaris at its eastern elongation, at 10h.05m.P.M. and find its magnetic bearing to be N.16°41'W.

North end of needle	16°41' East.
The azimuth, by table in Manual, is	1°46' East.
The sum is the variation	18°27' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by making a mark on a rock in place, 4.00 chs.N.

I make the latitude of the station 44°20'N.

On the morning of August 11th.1898 I set my instrument over the terminal point of secant and, with the vernier at zero, direct the telescope to the mark on the rock 4.00 chs. North, which is on true meridian.

Unclamp plates and direct the telescope to flag at last station on secant
Vernier reads 89°57'

From the corner just established I run NORTH on East Boundary of Yellowstone National Park, without chaining, using double back and fore sights,

Var.18°27'E.

I continue running north, blazing the line wherever I can get to it, during the 11th.12th.and 13th.of August, not taking any observations on Polaris on account of the cloudy condition of the weather in the evenings during the interim. The line extends over a series of ridges extending in nearly an east and west direction, exceeding rough, rocky and rugged, and difficult of access.

On the evening of August 13th., in latitude 44°38'N., I observed Polaris from the line, at 9h.55m.P.M. and find its magnetic bearing to be N.16°40'W.

North end of needle	16°40' East.
The azimuth, by table in Manual, is	1°47' East.
The sum is the vartation	18°27' East

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack 4.00 chs.N.

UNMEASURED EAST BOUNDARY OF YELLOWSTONE NATIONAL PARK.

On the morning of August 14th.1895, with instrument over the point of last night's observation, I verify my work of yesterday as follows -

Vernier at zero
Set on tack in hub 4.00 chs.N.
Reversing telescope strike flag held on last transit point to the south, set yesterday.

At apparent noon, on top of the divide between the waters flowing into the Yellowstone and those flowing into the Clarkes fork and Stinking water rivers, I took an observation for latitude and obtained 44° 57' 50" N.

The barometer indicates 9700 ft.

Thence I run NORTH, descending towards Lamar river

On the evening of August 14th.1895, near the head waters of Lamar river, in latitude 44° 40' N., I observed Polaris at its eastern elongation, from the end of [illegible] meridian, at 9h. 50m. P.M. and find its magnetic bearing to be N. 16° 41' W.

North end of needle	16° 41' East.
The azimuth, by table in Manual, is	1° 47' East.
The sum is the variation	18° 28' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by nut and tack, 4.00 chs.N.

On the morning of August 15th.1895, with instrument over point of last night's observation, I verify the meridian south as follows -

Set on tack in nub on meridian 4.00 chs.N.
Reversing telescope stike flag held on last transit point to the south, set yesterday.

Barometer indicates 7500 ft.

Thence I run NORTH.
Var. 18° 28' E.

Ascending south slope of high mountain.

The line passes 10 chains west of the highest part of the mountain, which the barometer indicates to be 10,100 ft.

At highest point reached by line the barometer indicates 9850 ft.

On the evening of August 15th.1895, in latitude 44° 45' N.

from the end of meridian, I observed Polaris at its eastern elongation, at 9h.46m.P.M. and find its magnetic bearing to be N.16° 41' W.

North end of needle	16° 41' East.
The azimuth, by table in Manual, is	1° 47' East.
The sum is the variation	18° 28' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N.

On the morning of August 18th.1898, with instrument over the point of last night's observation, I verify the meridian south as follows -

Set on tack in hub, on meridian 4.00 chs.N.
Reversing telescope strike flag held on last transit point to the south, set yesterday.

Thence I run NORTH
Var.18° 28' E.

The line, from this point on to the Montana State line, was run through entirely by careful double back and fore sights, the condition of the weather preventing observations on Polaris. It was carefully blazed in accordance with the provisions of my special instructions, except in such places as I find it impossible to carry the transit line, and am obliged to sight over. In this manner I proceed. Intersect the Boundary Line between Montana and Wyoming at a point which is 14.06 chs. east of the 52M. Corner, on the said State Line, which is a pine tree 7 ins. diam. cut off 4 ft. above the ground, and partially squared; marked on the north MONT. on the east 45° N.L. on the south WYO. and on the west 52M., and other indistinguishable characters. I drive a stake at the exact point of intersection.

August 20th.1898.

GENERAL DESCRIPTION OF LINE.

The line along the eastern boundary of the Park, throughout its entire length, runs over mountains as rough, rocky and rugged as mountains can possibly be. The southern portion of it runs through what is commonly known as the Hoodoo region, so called on account of the very broken character of the coun-

try, and the apparent lack of trend to the mountains which, while not so high as those surrounding this region, appear to be more broken and cut up by canyons, and do not seem to conform to any system or range. Each particular mountain (and there are hundreds of them), being independent of the rest. These mountains range in altitude from 8000 to 8500 ft. in height, and the canyons, which cut them in almost every direction, are as a rule about 1000 ft. lower; rendering the country a most difficult and tedious one to traverse. Upon approaching latitude 44 56 N. however the country changes and the mountains assume a more regular appearance and rise to higher altitudes, the summits of most of the approximating 10,000 ft.

At about latitude 44°57′N. the line crosses the divide between the waters flowing into the Yellowstone on the west and those flowing into the Clark's fork and Stinkingwater rivers on the east. This divide takes an exceedingly sinuous course from a point near the corner established 10 miles east of Yellowstone lake to this point, being in places several miles to the west of the line, and in others approaching close to it, but being up to this point, alalways to the west of it, and always well defined by rough and rugged peaks. From the point where the line crosses this divide it lies entirely to the east of the boundary, and winds its course northward in a very zigzag manner, until joined to the heavy group of mountains ~~jus~~ just east of Cook city, of which group Index and Pilot peaks are prominent features. The entire country adjoining the line is, in its lower altitudes, covered with a dense growth of small, but remarkably healthy and shapely, growth of pine timber, while the tops of the mountains are either bare or support only a scanty growth of scrubby Nut pine and cedar, and are mostly barren, though in places there are parks on them well covered with grass.

The water throughout is sweet and pure.

On the evening of August 20th.1898, at the point of intersection already established, I observe Polaris at its eastern elongation, at 9h.26m.P.M. and find its magnetic bearing to be N.16°44'W.

North end of needle	16°44' East.
The azimuth, by table in Manual, is	1°47' East.
The sum is the variation.	18°31' East.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N. -

I make the latitude of the place 45°00' strong.

On the morning of August 21st.1898 I proceed to the point of last night's observation, and setting the instrument over the tack, verify yesterday's work as follows -

Set on tack in hub on the meridian, 4.00 chs. N.
Reverse telescope and strike flag on last transit point, established yesterday.

Knowing, from my experience on the line just run north to this point, that it will be necessary to triangulate from some point near here to the top an exceedingly high and rocky mountain lying to the south, on account of the impassable nature of the country intervening and the steepness of the mountain in question, I now proceed to establish a base-line on the south slope of a mountain lying to the north of this point and across Soda Butte creek, for future use. This line is located in the position hereinafter described for the reason that it is the only available ground from which to make the triangulation to the aforesaid mountain. With instrument set over the tack at the point of intersection, corresponding to Sta.D, fig.5 page27,

Set a tack on hub on meridian 4.00 chs.N. and by foresight set a stone firmly in the ground on the south slope of mountain to N., on the top of which mark a X exactly on the meridian. Sta.A.
With instrument at Sta.A, vernier at zero,
Set on Sta.D.
Unclamp plates and deflect 103°48' from the south towards the west, and on this course carefully measure baseline AB, fixing the point B, at west end, by planting a stone firmly in the ground, on top of which I mark a deep X at exactly 9.52 chs. from Sta.A, for Sta.B.

I then verify the angle as follows, Vernier at zero
Set on Sta.D.
Unclamp plates and set on Sta.B.

Vernier reads 108°48′
Unclamp below and set on Sta.D.
Unclamp plates and set on Sta.B.
Vernier reads 207°88′
Angle BAD, 108°48′

Having sent a flag around to the top of Abithar mountain I then, by means of a foresight on Sta.D, set it on the meridian and establish Sta.C by marking a X on the solid rock, at exact point where flag stood, Verifying the meridian AC by foresight, I find that the stations A, D and C are in the same straight line.

Instrument at Sta.B. Vernier at zero.
Set on Sta.A
Unclamp plates and set on Sta.D.
Vernier reads 50°51′50″
Unclamp plates and set on Sta.C.
Vernier reads 72°55′50″
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.D.
Vernier reads 123°27′00″
Unclamp plates and set on Sta.C.
Vernier reads 145°50′50″
Angle ABD, 50°51′50″ mean value.
Angle ABC, 72°55′15″ ..

Instrument at Sta.D, vernier at zero.
Set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 25°40′50″
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 51°21′00″
Angle ADB, 25°40′50″

There is no other ground in the neighborhood on which I could lay out a second base-line, from which to measure the distances AD and AC, neither are there any other points, on the base-line AB from which I can see stations D and C.

At point of intersection of Montana and Wyoming State Line, and East Boundary of Yellowstone National Park, I then establish the Closing Corner, as follows -
Finding that there are no stones within reach of the corner except the small, round boulders in Soda Butte creek, which runs 50 lks. north of the corner, which are entirely too small to put in the sides of a mound, and mark as provided in special instructions, and out of which it would be impossible to construct a monument that would stand and be durable, I am obliged in this case to exercise the privilege granted me in the special instructions (Article 15, page 15) of exercising my own best judgement in the

construction of this corner. Inasmuch as it is impossible for me to construct it as provided in said special instructions, the one which I do construct is plain and will last hundreds of years.

Removing the hub I deposit a granite boulder 8 ins. diam. marked with a X, 20 ins. in the ground.

I then cut off a pine tree 20 ins. diam. (the center of which is 20 ins. north east of corner), 6 ft. above ground, and square the top half of the stump to 12 ins., hewing the top of it into the form of a square pyramid. Marked

on the north face	MONT. 1893
on the east face	P.L.
on the south face	C.C. WYO. Lat.45 0½, and
on the west face	Y.N.P. 52m.14.06 c ..

from which

A pine 20 ins. diam. bears N.72°E. 66 lks. dist. marked C.C. P.L. MONT. 1893. B.T.

A pine 20 ins. diam. bears S.77°E. 71 lks. dist. marked C.C. P.L. WYO. 1893. B.T.

A pine 20 ins. diam. bears S.86°W. 70 lks. dist. marked C.C. Y.N.P. 52M.14.06 c . B.T.

Dug 3 pits 30x24x12 ins.deep, S.E.and W.of corner, crosswise on line and 7 ft. from center of pit to corner.

Raised a mound of earth, in the form of the frustrum of a square pyramid, 6 ft. base, 4 ft. high, over the corner and around the post. In north side of mound insert a granite stone marked MONT. 1893. T.P. 16.96 chs. N.

Barometer indicates 7450 ft.

The stone set in north side of the mound bears the ~~mound bears the~~ marks T.P.16.98 ch.N.in addition to those provided for in special instructions, for the reason that the triangulation to the north of Closing Cor. is something which, while necessary under the circumstances, could not be foreseen, and was not provided for in the special instructions, and it seemed to me necessary in some way to leave a record at this point which would indicate to any one following the line without notes, what was done at this point; otherwise the triangulation thus made, lying entirely outside of the bounds of the survey, would never be suspected.

Stones were not set in the E.& W.sides of the mound for the reason that I could not obtain any large enough to put

Chains.

necessary marks upon.

At apparent noon I obtained the latitude of the Closing Corner and make it to be 45° 00′ 25″ N.

Thence I run on

FIRST MILE.

SOUTH, on a true line.
Var. 18° 51′ E.

0.00 Abithar peak bears S. 17° 30′ W. Thence over level ground, through pine timber already blazed.

2.12 Set a limestone 30x12x8 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for Special Corner, marked

O.M. 2.12 chs. on N.
P.L. on E. and
Y.N.P. on W. faces, from which

A pine 18 ins. diam. bears S. 82° W. 57 lks. dist. marked O.M. 2.12 chs. Y.N.P. 1893. B.T.

A pine 18 ins. diam. bears S. 29° E. 88 lks. dist. marked O.M. 2.12 chs. P.L. 1893. B.T.

Raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

2.25 Cross Cinnabar and Cooke City wagon road, course E. & W.

20.00 Foot of mountain slope to N., and ascend 350 ft. to top of rock wall of canyon, at

40.00 Set a limestone 30x16x8 ins. on top of solid rock, marked

½M. on N.
P.L. on E. and
Y.N.P. on W. faces, from which

A pine 10 ins. diam. bears N. 55° W. 21 lks. dist. marked ½M. Y.N.P. 1893. B.T.
A pine 15 ins. diam. bears N. 59° E. 43 lks. dist. marked ½M. P.L. 1893. B.T.

Barometer indicates 7900 ft.

From this point the line, after crossing the canyon above noted which extends N. 20° W., stikes a nearly perpendicular wall rock 200 ft. high, impossible to ascend, and then rises over impassible rocky ledges, over which chaining is impracticable, into the Abithar Mountain range lying to the south, which is very high and rocky, and sufficiently near perpendicular to render its ascent impossible, and on to the top of which I have found no means of access except by going many miles around to the west, and I find no place north of this mountain (except that at which I have already es-

tablished a base-line), from which I could make a triangulation to Sta. C on top of the Abitnar range. This condition arises not only from the lay of the ground, but from the fact that the whole country is covered with heavy timber, making triangulation an impossibility.

August 21st. 1895.

The evening of Aug. 21st. was stormy and no observation was obtained on Polaris.

On the morning of Aug. 22nd. 1895

With instrument over X, Sta. C, vernier at zero, I direct the telescope to flag at Sta. A.
Unclamp plates and set on Sta. B.
Vernier reads 5° 17′ 00″
Unclamp below and set on Sta. A
Unclamp plates and set on Sta. B.
Vernier reads 6° 34′ minus
Unclamp below and set on Sta. A
Unclamp plates and set on Sta. B.
Vernier reads 9° 50′ 50″
Angle ACB, 3° 16′ 50″

Closing Error of triangles

Triangle ABD.		Triangle ABC.	
Angle ABD,	50° 51′ 50″	Angle BAC,	103° 48′ 00″
Angle BAD,	103° 48′ 00″	Angle ABC,	72° 55′ 15″
Angle ADB,	25° 40′ 50″	Angle ACB,	3° 16′ 50″
The sum is	180° 00′ 00″	The sum is	180° 00′ 05″
Closing error, zero.		Closing error, 05″ plus	

Since the angle at Sta. A checks out the same in both triangles I conclude that the error in triangle ABC, of 05″, is entirely in the angles ABC and ACB, and therefore correct the angles by deducting 3″ from ABC and 2″ from ACB, the triangle ABD being in perfect balance.

Corrected Angles of Triangles.

Triangle ABD.		Triangle ABC.	
Angle ABD,	50° 51′ 50″	Angle BAC,	103° 48′ 00″
Angle BAD,	103° 48′ 00″	Angle ABC,	72° 55′ 12″
Angle ADB,	25° 40′ 50″	Angle ACB,	3° 16′ 48″
the sum is	180° 00′ 00″	the sum is	180° 00′ 00″

Solving Triangle ABD. for AD = x.

9.52 : Sin 25° 40′ 50″ :: x :: Sin 50° 51′ 50″

Log. 9.52	0.9786369
Log. Sin 50° 51′ 50″	9.8875622
	10.8661991
Log. Sin 25° 40′ 50″	9.6367548
	1.2294443

X = AD, = 16.96 chs.

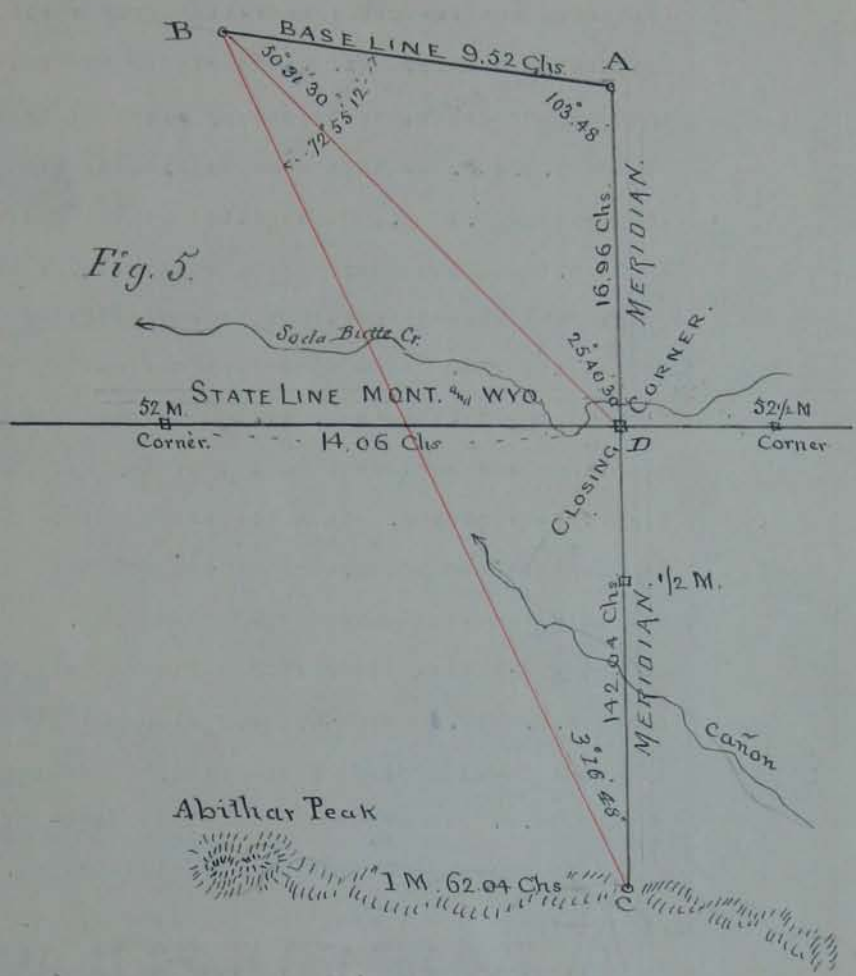
Solving Triangle ABC. for AC = x.

9.52 : Sin 3° 16′ 48″ :: x : Sin 72° 55′ 12″

Log. 9.52	0.9786369
Log. Sin 72° 55′ 12″	9.9804105
	10.9590474
Log. Sin 3° 16′ 48″	8.7576609
	2.2013865

x = AC = 159.00 chs.
Less AE, 16.96 chs.
Diff. 142.04 chs. = 1m.62.04 chs. = DC =

the meridian distnce from Closing Corner to Sta.C.



1M.62.04 chs.STATION C. Established a Special Corner as follows - Cut a deep X in the solid rock. Marked 1M.62 04 ch. N. of, P.L. E.of, and Y.N.P. W.of the cross.

Barometer indicates 9900 ft.

Land, mountainous.

Soil, mostly rocky, 4th. rate.

Timber, pine.

This corner is located on a very narrow rim of rock, extending, in a generally easterly direction, from the main peak of Abithar mountain. This rim breaks off, both north and south of the corner, nearly perpendicular, for many hundreds of feet, and then more gradually, but still so

rapidly as to be impassible, for 2000 to 2500 ft., rendering chaining in either direction out of the question. I find also that this rim is so narrow, crooked and irregular that I cannot lay off a base-line from which to make a triangulation ahead from St. C. The rim to the south breaks into the head of Amphitheater creek, a kind of basin surrounded on the N.E. & S. by this same high rocky rim and some 5 miles across from N. to S., the bottom of the basin being some 3000 ft. below the surrounding mountains, rocky and cut up by canyons and heavily timbered, and I can find no way to get into it. I am therefore obliged to send a flag around to the west and, by double back and fore sights, set it on the meridian, on top of the rim on the south side of the canyon. This rim extends from St. C around to the east and south, surrounding the head of the canyon, or basin, in the shape of a horse shoe. I mark the point at which the flag was set by making a deep X in the rock, for Sta. E. fig. 6 page 32, and also establish a T.P. to the north east of it (on the rim), by marking a X in the rock, Sta. F. in order to secure a base- line, EF, from which to measure the meridional distance CE.

At apparent noon I make the latitude of St. C, 44° 58' 52" N.

Instrument at Sta. C, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. F.
Vernier reads 4° 24' 00"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. F.
Vernier reads 8° 49' 00"
Angle FCE, 4° 24' 30"

August 22nd. 1893.

The evening of August 22nd. being cloudy I was unable to observe Polaris.

On the morning of August 23rd. 1893 I set the instrument over the X at Sta. E and, as I cannot chain the base-line EF on account of intervening cliffs, I proceed to measure it by triangulation, as follows

Set on Sta. E, and deflect 10° 00' towards the north, carefully chaining, in this direction, the base-line EG, 4.80 chs. long, the N. end of which falls exactly at

a X marked in the rock, for Sta.G.
Vernier at zero, I verify the Angle GEF, as follows -
Set on Sta.F.
Unclamp plates and set on Sta.G.
Vernier reads 10° 00'
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.G.
Vernier reads 20° 00'
Angle FEG, 10° 00'

Vernier at zero, Set on Sta F.
Unclamp plates and set on Sta.C.
Vernier reads 80° 19' 30"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.C.
Vernier reads 160° 39' 00"
Angle FEC, 80° 19' 30"

Instrument at Sta.G, vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 163° 56' 30"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 327° 55' 50"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 181° 50' 50," or 491° 50' 50"
Angle EGF, 163° 56' 50"

Instrument at Sta.F, vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.G.
Vernier reads 6° 05' 00"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.G.
Vernier reads 12° 06' 15"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.C.
Vernier reads 18° 09' 30"
Angle GFE, 6° 03' 10" mean value.

Vernier at zero, Set on Sta.E.
Unclamp plates and set on Sta.C.
Vernier reads 95° 15' 20"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.C.
Vernier reads 190° 31' 00"
Angle EFC, 95° 15' 30"

Finding that it will be impossible to chain from Sta.E south, for reasons hereafter explained, I send a flag ahead on line to a mountain top on the south side of the north fork of Cache creek, and set it on the meridian at Sta.H; marking the Sta. by cutting a X in the rock, I also establish a transit point to the east of Sta.H; by marking ~~by cutting~~ a X in the rock, for Sta.I. Then with

Instrument at Sta.E, vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.I
Vernier reads 7° 56' 00"
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.I.
Vernier reads 15° 52' 50" *minutes*
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.I.
Vernier reads 23° 48' 50"
Angle HEI, 7° 56' 10"

Vernier at zero,
Set on Sta. H.
Unclamp plates and set on Sta. F.
Vernier reads 99° 41' 00" plus
Unclamp below and set on Sta. H.
Unclamp plates and set on Sta. F.
Vernier reads 199° 22' 50"
Unclamp below and set on Sta. H.
Unclamp plates and set on Sta. F.
Vernier reads 299° 04' 00"
Angle FEH, 99° 41' 20"

Instrument at Sta. F, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. H.
Vernier reads 77° 17' 00"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. H.
Vernier reads 154° 34' 00"
Angle EFH, 77° 17' 00"

From Sta. E the meridian, both north and south, drops off the narrow rim upon which the Special Corner is located, almost perpendicularly, a thousand feet or more, and then keeps on descending precipitously over rocky crags and peaks for a long distance in each direction and, as the lower altitudes are reached, entering heavy timber. Immediately to the north of Sta. E lies the Amphitheater creek canyon, before mentioned and as I can find no way of getting the line into it, I am obliged to call it an impenetrable country.

To the south of Sta. E the line, after dropping over the nearly perpendicular cliff (on which Sta. E is located), keeps on descending very rapidly, over cliffs and rocks some 1200 or 1500 ft. lower. Chaining over this ground is impracticable and impossible, and there is no point on the meridian (that is accessible) which can be seen from Sta. E, until the south side of Cache Cr. is reached. It is on this account that I have set the stations H and I in such positions that triangulation can be made from E to H, and afterwards be checked back from H to E, as there is no possible chance for laying out any other base- line from Sta. E (than that already used) by which means the work might be checked.

Closing Errors of Triangles.

Triangle GEF.		Triangle EGF.	
Angle EGF,	4° 24' 50"	Angle GEF,	10° 00' 00"
Angle GEF,	80° 19' 30"	Angle EGF,	165° 56' 50"
Angle GFE,	95° 15' 50"	Angle GFE,	6° 05' 10"
the sum is	179° 59' 30"	the sum is	180 00 00
Closing error,	30"	Closing error,	zero.

CORRECTED ANGLES of Triangle ECF,
distributing the closing error of 15″
equally between the angles.

Angle ECF,	4° 24′ 40″
Angle CFE,	95° 15′ 40″
AngleCEF,	80° 19′ 40″
the sum is	180° 00′ 00″

3m.68.41 chs. Established Sta.E, as Special Corner, as follows -

I cut a deep X in the solid rock, which is marked 3M.68.41 chs. T.P. N.of, P.L. E.of, and Y.N.P. W. of cross.

There are no stones procurable with which to build a mound or monument.

SOLVING triangle EGF. *for EF = x*

4.90 : Sin 6°03′10″ :: x : Sin 165°56′50″

Log. 4.90	0.6901961
Log. Sin 165°56′50″	9.4417308
	10.1319269
Log. Sin 6°03′10″	9.0280240
	1.1089029

x = EF = 12.85 chs.

SOLVING triangle CEF. *for CE = x*

12.85 : Sin 4°24′40″ :: x : Sin 95°15′40″

Log. 12.85	1.1089029
Log. Sin 95°15′40″	9.9981665
	11.1070694
Log. Sin 4°24′40″	8.8859963
	2.2210731

x = CE = 166.57 chs.

LINE DISTANCE of Sta.C,	1M.62 04 chs.
MERIDIONAL DISTANCE CE,	2M. 6.37 chs.
The sum is Line distance Sta.E.	3M.68.41 chs.

August 23rd.1893

On the evening of August 23rd.1893, from a point on the north fork of Cache Cr. (Sta.J.) nearly north of Sta.H, I observe Polaris at its eastern elongation, at 8h.15m.P.M. and find its magnetic bearing to be N.16°41′W.

North end of needle	16°41′East
The azimuth, by table in Manual, is	1°47′East.
The sum is the variation	18°28″East

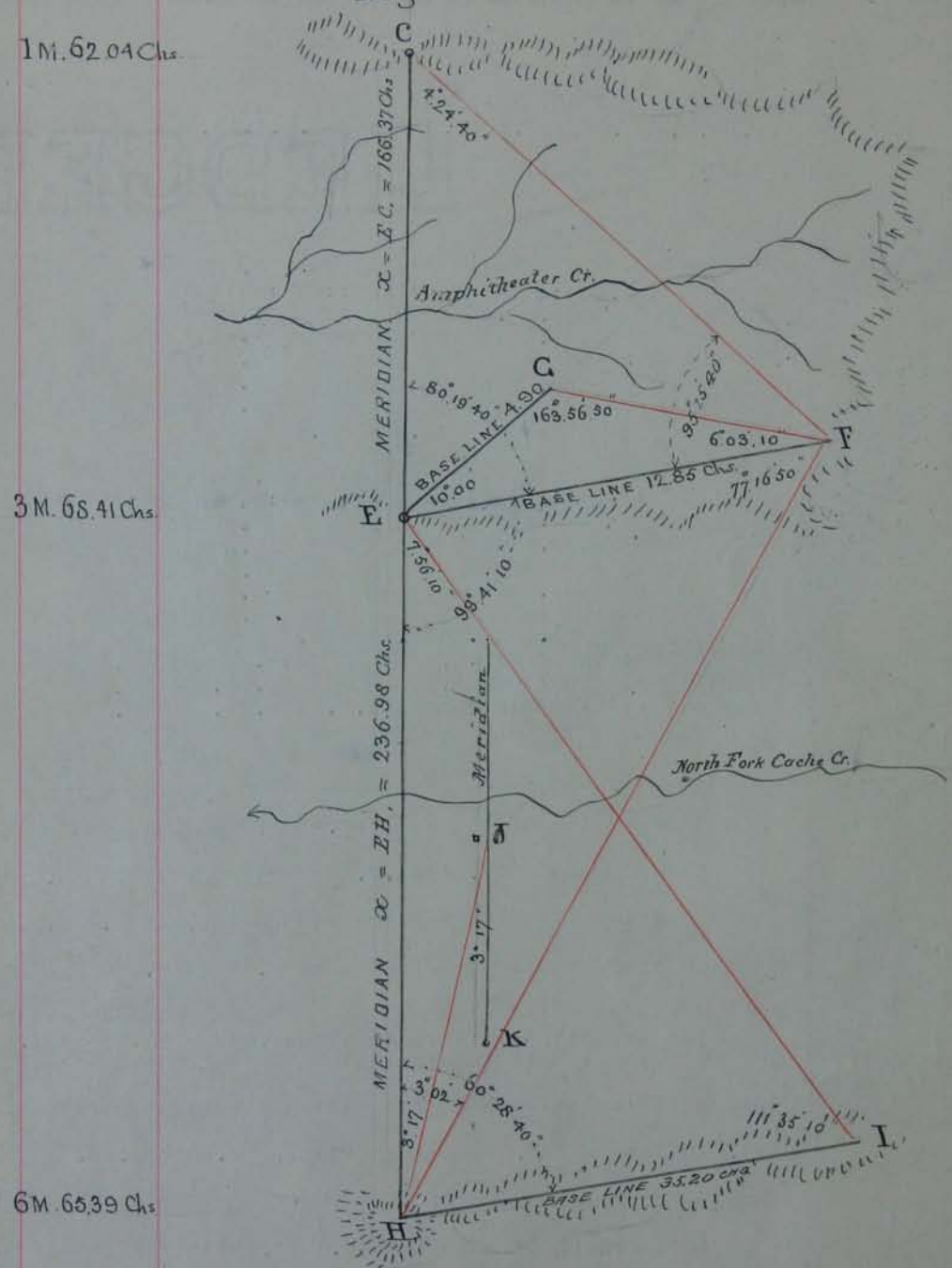
I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N.

On the morning of August 24th.1893, with instrument over the point of last night's observation, Sta. J, vernier at zero, I direct the telescope to tack in Hub 4.00 chs.N., on the meridian and, by double back and fore sights, set flag on the meridian 5.00 chs. to south, at Sta.K.

Vernier at zero.
Set on Sta.K.
Unclamp plates and set on Sta.H.

vernier reads 3° 17' 00"
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. H.
Vernier reads 6° 34' 00"
Angle KJH is 3° 17' 00"

Fig. 6.



Leaving flag at point of observation corresponding to J, I proceed to Sta. H and, setting instrument over the X in rock,

Vernier at zero
Set on flag at J.
Unclamp plates and set on flag at Sta. H
Vernier reads 3° 17' 00"
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. H.
Vernier reads 6° 34' 00", verifying

yesterday's work in the establishment of the meridian EH.

The observations on Polaris, just recorded, could not be taken at Sta.H, on account of the narrowness of the ledge of rock on which it is situated and the fact that, from the location of ground at that point, I could not have set a hub over 30 or 40 lks. north of the instrument on the meridian.

Vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 3°02'00" plus
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 6°04'15"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 9°06'30"
Angle EHF, 3°02'10"

Set on STA.E, vernier at zero.
Unclamp plates and set on Sta.I.
Vernier reads 60°28'30"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.I
Vernier reads 120°57'30"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta. I.
Vernier reads 181°26'00"
Angle EHI, 60°28'40"

Instrument at Sta.I, vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.E.
Vernier reads 111°35'00" plus
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.E.
Vernier reads 223°10'30" minus
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.E.
Vernier reads 334°45'30"
Angle EIH, 111°35'10"

Carefully chaining the base-line, HI, I make it to be 35.20 chs.

Closing Error of Triangles EFH and EHI.

Triangle EFH,		Triangle EHI.	
Angle EFH,	77°17'00"	Angle EIH,	111°35'10"
Angle FEH,	99°41'20"	Angle IHE,	60°28'40"
Angle EHF,	3°02'10"	Angle HEI,	7°56'10"
the sum is	180°00'30"	the sum is	180°00'00"
Closing error 30"		Closing error, zero.	

In the triangle EFH, dividing the error equally between angles -

Corrected Angles of Triangles EFH and EHI.

Triangle EFH.		Triangle EHI.	
Angle EFH,	77°16'50"	Angle EIH,	111°35'10"
Angle FEH,	99°41'10"	Angle IHE,	60°28'40"
Angle EHF,	3°02'00"	Angle HEI,	7°56'10"
the sum is	180°00'00"	the sum is	180°00'00"

Solving the Triangle EFH. for $EH = x$

12.85 : Sin 3°02' :: x :: Sin. 77°16'50"
Log. 12.85 1.1089031

Log.Sin 77° 16' 50" 9.8892094
11.0981125
Log.Sin 5°02' 00" 8.7255946
X .. 236.87 chs = EH. 2.3745179

Solving the triangle HIE. = for EH = x
35.20 : Sin 7°56' 10" :: x : Sin 111° 55' 10"
Log. 35.20 1.5465427
Log. Sin 111° 55' 10" 9.9684202
11.5149629
Log.Sin 7°56' 10" 9.1400955
2.3748674
X = 237.06 chs. = EH.

The difference in the two triangulations, for the distance EH, is therefore 19 lks. but as I consider the triangulation from the triangle HIE slightly the best, on account of the longer base, I decide to assume the meridional distance EH to be 236.98 chs. Therefore I have

Line distance to Sta.E.	5M.68.41 chs.
Meridional distance HE,	2M.76.98 chs.
the sum is the line dist.Sta.H	6M.65.39 chs.

The barometer, Sta.H, indicates 8900 ft.

6M.65.39 chs. Establish Special Corner as follows -

Set a sandstone on top of the rock 30x7x7 ins., and piled stone around it, marked 6M.65.39 chs. T.P. on N.
P.L. on E. and
Y.N.P. on W. faces,

and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Chains. Thence I run NORTH. 7TH. MILE.

Var.18° 27' E.

Descending 30 ft. to

00.50 Edge of steep slope to north, and descend.

4.00 Enter pine timber, and descend 250 ft. to

25.39 Set a sandstone 30x10x8 ins., with marked stone 4 ins. square, 20 ins. in the ground, for 6½ mile corner,

marked 6½M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 10 ins. diam. bears N.16° W. 150 lks. dist. marked 6½M. Y.N.P. 1893. B.T.

A pine 8 ins. diam. bears N.31° E. 170 lks. dist. marked 6½ M. P.L. 1893. B.T.

Barometer indicates 8600 ft.

Thence descend 1000 ft., over broken mountain slope to N.

~~Head Chain 25.39 chs. Hind Chain 25.30 chs.~~ The difference in chaining is 11 lks.. At middle point of difference

MEASURED EAST BOUNDARY OF YELLOWSTONE NATIONAL PARK.

Chains.

65.59 Set a granite stone 30x12x8 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for 6 Mile corner, marked 6M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 20 ins. diam. bears S.87° W. 17 lks. dist. marked 6M. Y.N.P. 1893. B.T.

A pine 24 ins. diam. bears S. 7° W. 70 lks. dist. marked 6M. Y.N.P. 1893. B.T.

A pine 20 ins. diam. bears East 39 lks. dist. marked 6M. P.L. 1893. B.T.

A pine 16 ins. diam. bears N.52° E. 47 lks. dist. marked 6M. P.L. 1893. B.T.

and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

5TH. MILE.

NORTH, on a true line.
Var. 18° 27' E.

Descend 100 ft. to

5.50 South bank of north fork of Cache Cr., course S.60° W.

6.50 North bank, and ascend 50 ft. to

6.90 Cross Cache Cr. trail to Cooks City.

Barometer indicates 7500 ft.

8.95 Pine tree 8 ins. diam. on line, which I cut off 6 ft. above ground and square to 7 ins., for Special Corner, marked 5M.71.05 chs. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 18 ins. diam. bears N.45° W. 18 lks. dist. marked 5M.71.05 chs. Y.N.P. 1893. B.T.

A pine 18 ins. diam. bears S.89° E. 50 lks. dist. marked 5M.71.05 chs. P.L. 1893. B.T.

Pits and mound impracticable.

Thence ascend slope to south, 450 ft., through pine timber.

40.00 Set a fir post 7x7 ins. square, 5 ft. long, with granite boulder 5 ins. diam., marked with a X, 30 ins. in the ground. for 5½ mile corner, marked 5½M. on N.
Y.N.P. on W. and
P.L. on E. faces. from which

A pine 16 ins. diam. bears S.82° E. 39 lks. dist. marked

Measured EAST BOUNDARY OF YELLOWSTONE NATIONAL PARK.

Chains.

5½M. P.L. 1893. B.T.

A pine 20 ins. diam. bears S. 9° W. 27 lks. dist. marked 5½M. Y.N.P. 1893. B.T.

Pits and mound impracticable.

Thence ascend mountain sloping to south, 600 ft., over broken ground.

Barometer indicates 8000 ft.

~~Head chain 60.00, Hind chain 70.00.~~ The difference in chaining is 10 lks.. At middle point of difference

80.00 Set a pitch pine post 7x7 ins. square, 5 ft. long, with granite boulder marked with a X, 30 ins. in the ground, for 5 Mile Corner, marked 5M. on N.
Y.N.P. on W. and
P.L. on E. faces from which

A pine 14 ins. diam. bears S.58° W. 38 lks. dist. marked 5M. Y.N.P. 1893. B.T.

A pine 14 ins. diam. bears N.46° W. 36 lks. dist. marked 5M. Y.N.P. 1893. B.T.

A pine 12 ins. diam. bears N.15° E. 32 lks. dist. marked 5M. P.L. 1893. B.T.

Barometer indicates 8800 ft.

Pits and mound impracticable.

No other suitable trees within limits.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

5TH. MILE.

NORTH, on a true line.
Var. 18° 30' E.

Ascend over broken mountain slope to south, 400 ft. to

40.00 Set a sandstone 30x12x12 ins., with granite boulder 6 ins. diam. marked with a X, 20 ins. in the ground, for 4½ Mile corner, marked 4½M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 12 ins. diam. bears S.24° W. 18 lks. dist. marked 4½M. Y.N.P. 1893. B.T.

A pine 14 ins. diam. bears N.77° E. 38 lks. dist. marked 4½M. P.L. 1893. B.T.

and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Barometer indicates 9000 ft.
Thence ascend broken rocky slope to south 200 ft. to

Chains

60.00 Foot of nearly perpendicular rocky cliff. and from this point to Sta.E, on top of the cliff, the country is totally inaccessible.

August 24th. 1893.

On the morning of August 25th. 1893 I again proceed to the Special corner at Sta.H, 6M.65.39 chs. and setting my instrument over the exact point, proceed to establish a base-line for the purpose of measuring accurately the distance on the meridian to the point of Needle mountain. to the south. The operation is as follows -

Instrument at zero.

By careful double back and fore sights from flag at Sta. E, I set the front flag on the meridian to the south, on the top of a high, rocky point jutting out to west from the most western peak of the Needles;marking the point so established by cutting a deep X in the rock.Sta.L.fig.7. Set on Sta.L and deflect 116° towards the east and north, and on this course carefully measure a base-line 30.00 chs. long, the east end of which I permanently fix by marking a cross in the solid rock. Sta.M., verifying the angle as follows -

Instrument at Sta.H, vernier at zero.
Set on Sta.L.
Unclamp plates and set on Sta.M.
Vernier reads 116°00'00"
Unclamp below and set on Sta.L.
Unclamp plates and set on Sta.M.
Vernier reads 232°00'00"
Angle LHM, 116°00'00"

Instrument at Sta.M, vernier at zero.
Set on Sta.L.
Unclamp plates and set on Sta.H.
Vernier reads 58°58'30"
Unclamp below and set on Sta.L.
Unclamp plates and set on Sta.H.
Vernier reads 117°57'00"
Angle LMH, 58°58'30"

Thence I run remainder of -

7TH.MILE.

SOUTH, on a true line.
Var.18°29' E.

00.80 Top edge of perpendicular cliff, 50 ft. high. Thence descend slope to south over rough broken ground, 500 ft. to corner.

14.61 Set a sandstone 20x10x9 ins., with granite boulder 5 ins.

Chains.

diam., marked with a X, in slide rock marked

7M. on N.
Y.N.P. on W. and
P.L. on E. faces, and raised a mound of stone 2½

ft. high, 5 ft. base, N. of corner. Pits impracticable.

No bearing trees.

This corner falls in a very difficult place to reach, on

slide rock.

Barometer indicates 8500 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

8TH. MILE.

SOUTH, on a true line.
Var. 18° 29' E.

Descending south slope of mountain 900 ft.

5.50 Enter pine timber.

7.00 Set a limestone 30x8x8 ins., with granite boulder 5 ins.

diam. marked with a X, 20 ins. in the ground, for Witness

Corner, marked 7M.07 chs. W.C. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 18 ins. diam. bears N.55° W. 70 lks. dist. marked
7M.07 chs. W.C. Y.N.P. 1893. B.T.

A pine 20 ins. diam. bears S.85° W. 100 lks. dist. marked
7M.07 chs. W.C. Y.N.P. 1893. B.T.

and raised a mound of stone 2½ ft. high, 5 ft. base, N.

of corner.

37.16 Pine tree 12 ins. diam. on line, which I cut off 5 ft.

above the ground and square to 10 ins., Special Corner,

marked 7M.37.16 chs. on N.
Y.N.P. on W. and
P.L. on E. faces from which

A pine 14 ins. diam. bears S.18° W. 28 lks. dist. marked
7M.37.16 chs. Y.N.P. 1893. B.T.

A pine 18 ins. diam. bears S.80° E. 26 lks. dist. marked
7M.37.16 chs. P.L. 1893. B.T.

37.51 Cross blazed trial, course E. & W.

40.00 Set a granite stone 30x18x18 ins., with granite boulder

6 ins. diam. marked with a X, 20 ins. in the ground, for

for 7½ Mile Corner, marked 7½M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 16 ins. diam. bears N.60° W. 9 lks. dist. marked

Chains.

7½M. Y.N.P. 1895. B.T.

A pine 16 ins. diam. bears S.21° E. 17 lks. dist. marked 7½M. P.L. 1895. B.T.

Barometer indicates 7600 ft.

41.00 Cross middle fork of Cache Cr., 30 lks. wide, course E.& W. thence ascend mountain slope to N. 1100 ft. through heavy pine timber.

71.00 Top of mountain, near its western end, course E.& W.

Barometer indicates 8700 ft.

Thence descend steep mountain slope to south, 700 ft. ~~to~~

~~Head chain 80.00, Hind chain 78.75.~~ The difference is 25 lks.. At middle point of difference -

80.00 Set a sandstone 30x12x6 ins., with granite boulder 6 ins. diam. marked with a X, 20 ins. in the ground, for 8 Mile Corner, marked 8M. on N.
Y.N.P. on W. and
P.L on E. faces, from which

A pine 14 ins. diam. bears S.20°E. 48 lks. dist. marked 8M. P.L. 1895. B.T.

A pine 16 ins. diam. bears S.24°W. 61 lks. dist. marked 8M. Y.N.P. 1895. B.T.

A pine 24 ins. diam. bears N.84°W. 180 lks. dist. marked 8M. Y.N.P. 1895. B.T.

and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.
Timber, pine.

9TH. MILE.

SOUTH, on a true line.
Var. 18° 40' E.

Descend slightly to

10.00 Top of nearly perpendicular cliff, 75 ft. high.

10.05 Bottom of cliff, thence descend 300 ft., through heavy pine timber to

25.25 Cross main middle fork of Cache Cr., course S.75° W. and ascend slightly.

Barometer indicates 7500 ft.

51.25 Cross blazed trail, course N.75° E.

51.50 Pine tree 10 ins. diam. on line, which I cut off 5 ft. above ground and square to 8 ins., for Special Corner

MEASURED EAST BOUNDARY OF YELLOWSTONE NATIONAL PARK.

Chains.

marked 8M.51.50chs on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 14 ins. diam. bears N.44° W. 26 lks. dist. marked 8M.51.50 chs. Y.N.P. 1893. B.T.

A pine 10 ins. diam. bears N.82°E. 26 lks. dist. marked 8M.51.50 chs. P.L. 1893. B.T.

Thence ascend steep mountain side sloping to the north, 700 ft. to

40.00 Find a pine tree 17 ins. diam. on line, which I cut off 5 ft. above the ground and squared to 14 ins., for 8½ Mile Corner, marked 8½M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 14 ins. diam. bear S.52° W. 25 lks. dist. marked 8½M. Y.N.P. 1893. B.T.

A pine 16 ins. diam. bears S.12°E. 58 lks. dist. marked 8½M. P.L. 1893. B.T.

Pits and mound impracticable.

Barometer indicates 8500 ft.

Thence ascend 400 ft.

73.00 Top of mountain, near its western end. Cut a deep X in the solid rock, for Special Corner marked

8M.73 chs.N.of, Y.N.P. W. of and P.L. E.of X.

No bearing trees and pits and mound impracticable.

Barometer indicates 8900 ft.

From this point, which stands on the north side of a canyon, the country breaks off nearly perpendicularly into the canyon, which extends in a north westerly direction, and from here on to the top of Needle mountain, at Sta.L, where I have already established a point on the meridian, the line crosses a number of canyons in a diagonal direction, the sides of which are so nearly perpendicular and rocky, as to prevent any thing like accurate chaining, if indeed chaining could be done at all, and which the broken condition of the country, together with the timber, renders triangulation impossible. These gulches or canyons extend in a generally north westerly direction from the Needles, a heavy chain of mountains lying to the south and east, and as I cannot from this point see the flag at Sta.L, I find I can make no connection with that point from this direction. I therefore go ahead and

arriving at the flag I find a point established by a deep cut X, in the rock, by my flagman, at exact point where flag was set from Sta.H. This point is directly under and due west from the most westerly peak of the Needles, and 10 chs.dist.from its base, on a narrow rocky ridge extending from the rocky peak above mentioned towards the west. These needles are a series of bare, peaked rocks, capping the mountain on which they stand and extending in a generally E. & W. direction, some thing over a mile in distance.

Setting my instrument over the X, Sta.L, vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.M.
Vernier reads 5° 02' minus
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.M.
Vernier reads 10° 03' plus
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.M.
Vernier reads 15° 05' 00"
Angle HLM, 5° 01' 40"

Instrument at Sta.L, vernier at zero.
Set on Sta.H and deflect 90° 00' from the north towards the east and in this direction measure a base-line 10.00 chs.long, marking the east end of it by cutting a X in the rock, at exact distance 10.00 chs., Sta. N. Verifying the angle as follows -

Vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.N.
Vernier reads 90° 00' 00"
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.N.
Vernier reads 180° 00' 00"
Angle HLN, 90° 00' 00"

Instrument at Sta.N, vernier at zero.
Set on Sta.L.
Unclamp plates and set on Sta.H.
Vernier reads 88° 05' 00"
Unclamp below and set on Sta.L.
Unclamp plates and set on Sta.H.
Vernier reads 176° 06' 00"
Angle LNH, 88° 05' 00"

Instrument at Sta.H, vernier at zero.
Set on Sta.L.
Unclamp plates and set on Sta.N.
Vernier reads 1° 57' 00"
Unclamp below and set on Sta.L.
Unclamp plates and set on Sta.N.
Vernier reads 3° 54' 00"
Angle LHN, 1° 57' 00"

Closing Error of Triangles.

Triangle HLM.		Triangle HLN.	
Angle HLM,	5° 01' 40"	Angle HLN,	90° 00' 00"
Angle LMH,	58° 58' 50"	Angle LNH,	88° 05' 00"
Angle MHL,	116° 00' 00"	Angle NHL,	1° 57' 00"
the sum is	180° 00' 10"	the sum is	180° 00' 00"
Closing error, 10"		Closing error, zero.	

In the triangle HLM I think most of the error is in the

angle HLM, and therefore give 6"of the 10"error to that angle.

Corrected Angles of Triangles.

Triangle HLM.		Triangle HLN.	
Angle HLM,	5°01'34'	Angle HLN,	90°00'00"
Angle LMH,	58°58'28"	Angle LNH,	88°03'00"
Angle MHL,	115°59'58"	Angle NHL,	1°57'00"
the sum is	180°00'00"	the sum is	180°00'00"

Solving Triangle HLM. for HL = x

30.00 : Sin 5°01'34" :: x : Sin 58°58'28"

Log. 30.00	1.4771213
Log. Sin 58°58'28"	9.9529492
	11.4100705
Log. Sin 5°01'34"	8.9425522
	2.4675183

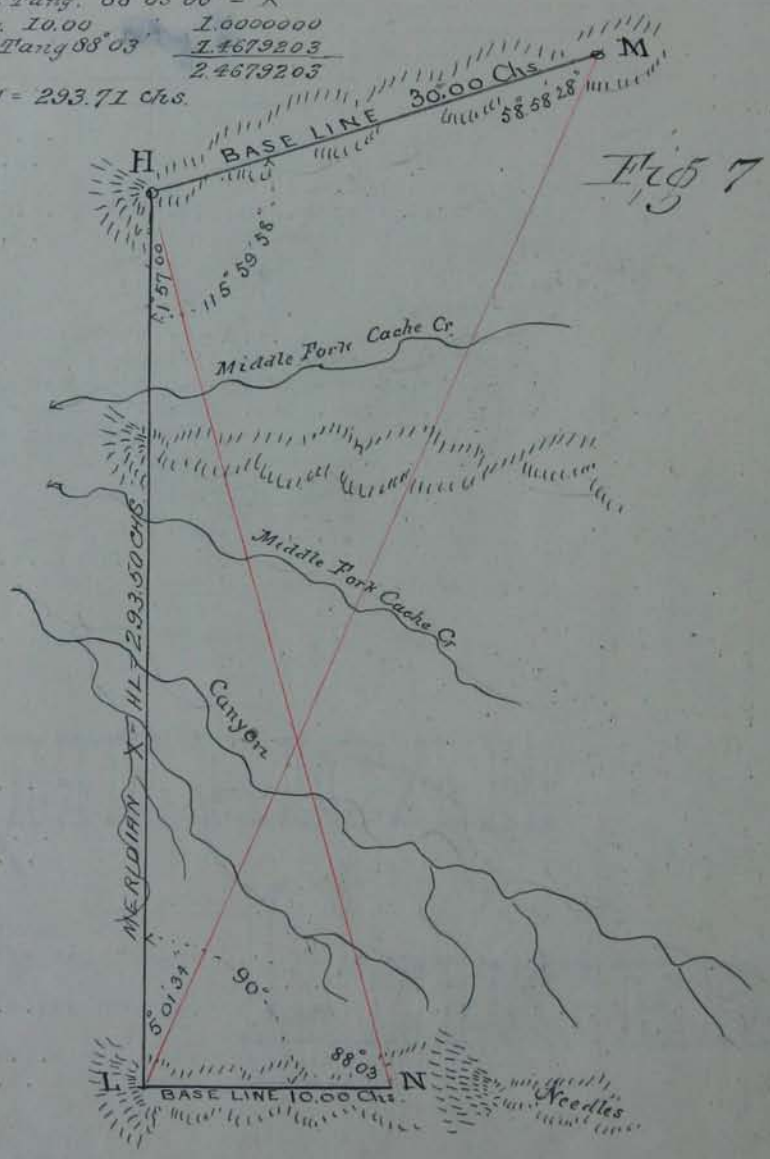
X = HL = 293.44 chs.

Solving Triangle HLN. for HL = x

10 x Tang. 88°03'00" = X

Log. 10.00	1.0000000
Log. Tang 88°03'	1.4679203
	2.4679203

X = LH = 293.71 chs.



The difference in the two triangulations for the distance HL is therefore 27 lks..However on account of the longer base of triangle LMH, I consider it much the best triangulation of the two, and assume the corrected distance, LH, at 293.50 chs. I therefore have -

LINE DISTANCE OF STA. H,	6m.65.39 chs.
MERIDIONAL DISTANCE HL,	3m.53.50 chs.
the sum is LINE DISTANCE of Sta. L.	10m.38.89 chs.

10m.38.89 chs. Established Special Corner as follows -

Set a sanstone 30x10x8 ins. over the X in rock at Sta. L,

for Special Corner, marked 10M.38.89 chs. on N.
Y.N.P. on W. and
P.L. on E. faces, and

built a mound of stone around it. 6 ft. N. of corner built a monument in the form of the frustrum of a square pyramid, 4 ft. high, 6 ft. base. No bearing trees.

Barometer indicates 9800 ft.

The magnetic attraction at this point is exceedingly strong, the needle is flighty and the magnetic bearing of the meridian is 20° 40'

From this point the meridian to the north breaks off, nearly perpendicularly, over a rocky cliff, into a gulch, or canyon running nearly N. and chaining in this direction is impracticable, neither can I see the point at 8m.75 chs. and therefore cannot make any connection with it.

There is but little timber on the line for 40 chs. N.

Land, mountainous.

Soil, mostly rocky.

Timber, pine.

Chains.

Thence I run remainder of

11TH. MILE.

SOUTH, on a true line.
Var. 20° 40' E.

00.50 Edge of almost perpendicular rocky cliff, 50 ft. high, thence descend. The 10½ mile corner falling in such a position on the steep side hill that it has to be omitted.

4.00 Bottom of deep rocky gulch, 150 ft. below last corner. thence ascend 175 ft.

5.00 Enter scattering pine timber.

10.00 Top of ridge, course west and descend 150 ft. to

15.50 Bottom of gulch, course west, and ascend 150 ft. to

21.00 Top of ridge extending west. Thence descend gradually to

30.00 Top edge of deep ravine or canyon.

Barometer indicates 9800 ft.

Thence descend, diagonally, the south slope of ravine 600 ft.

Chains.
41.11 Set a sandstone 30x12x8 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for 11 Mile Corner, marked 11M. on N.
Y.N.P. on W. and
P.L. on E. faces, from which

A pine 16 ins. diam. bears S.4°E. 97 lks. dist. marked 11M. P.L. 1893. B.T.

A pine 12 ins. diam. bears S.69°E. 115 lks. dist. marked 11M. P.L. 1893. B.T.

A pine 14 ins. diam. bears N.50°W. 46 lks. dist. marked 11M. Y.N.P. 1893. B.T.

Raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Barometer indicates 9200 ft.

Land, mountainous.

Soil, mostly rocky, 4th. rate.

Timber, scattering pine.

12TH. MILE.

SOUTH, on a true line.
Var. 19° 00' E.

Descend 150 ft. to

4.00 Bottom of gulch, course S.20°W.

Barometer indicates 9050 ft.

Thence ascend 200 ft.

25.00 Top edge of slope. Leave timber and descend gradually 200 ft. to

40.00 Set a sandstone 36x12x6 ins., with granite boulder 6 ins. diam., marked with a X, 30 ins. in the ground, for 11½ Mile Corner, marked 11½M. on N.
Y.N.P. on W. and
P.L. on E. faces, and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

Thence descend gradually along ridge, course south.

55.00 Top edge of very steep mountain slope to south, and descend 1300 ft.

~~Head chain 80.00. Hind chain 79.50.~~ The difference in chaining is 20 lks. At Middle point of difference

80.00 Set a porphyry rock 35x8x6 ins., with granite boulder 5 ins. diam. marked with a X, 30 ins. in the ground, for 12 Mile Corner, marked 12M. on N.
Y.N.P. on W. and
P.L. on E. faces. from which

A pine 24 ins. diam. bears S.62°W. 24 lks. dist. marked 12M. Y.N.P. 1893. B.T.

A pine 20 ins. diam. bears N.79°E. 34 lks. dist. marked

Chains.

12M. F.L. 1895. B.T. and raised a mound of stone 2½ ft. high, 5 ft. base, N. of corner.

No other suitable trees.

Barometer indicates 7700 ft.

Land, mountainous.

Soil, mostly loam.

Timber, scattering pine.

This mile lies on the south side of the main mountain, the summit of which is capped by the rocky points known as the Needles. These needles are simply a series of sharp rocks from 200 to 500 ft. high, rising nearly or quite perpendicularly from the summit or crest of the main mountain. This chain of ragged peaks extends something more than a mile, nearly E. & W. The mountain is an extremely rough and broken series of rocks and deep canyons, both north and south and a good portion of it is above timber line.

13TH. MILE.

SOUTH, on a true line.
Var. 18° 50' E.

Descend 150 ft. through pine timber.

6.65 Foot of mountain and edge of heavy pine timber. POINT for N.W. CORNER and INITIAL MONUMENT of Public Forest Reservation.

Set a nub with tack at exact point on line.

August 25th. 1895

On the evening of August 25th. 1895, at the nub on the meridian, at 12m. 6.65 chs., I observe Polaris at its eastern elongation, at 9h. 07m. P.M. and find its magnetic bearing to be N. 16° 42' W.

North end of needle	16° 42' East.
The azimuth, by table in Manual, is	1° 47' East
the sum is the variation	18° 29' East

I lay off the azimuth to the west and mark the true meridian, so determined, by nub and tack, 4.00 chs. N.

I make the latitude 44° 50' N.

On the morning of August 26th. 1895 I proceed to the

hub established at 12M.6.65 chs. and setting my instrument over it direct the telescope to the tack in the hub on meridian, 4.00 chs. N., established last night. I find the magnetic bearing to be 18° 30' W and that the line coincides with the last sight taken on the meridian yesterday, verifying the work and making the magnetic bearing 18° 30' W.

I then set stone (marked on top with a X), level with the ground, on the meridian and exactly 5.51 ft. south of the hub, for west end of secant, and proceed to establish the N.W.Corner of the Public Forest Reservation, and INITIAL MONUMENT, as follows -

12M.6.65 chs. Set a porphyry stone 26x16x10 ins., with ghanite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for N.W.Corner and Initial Monument, Public Forest Reservation, marked

12M.6.65 chs.	on N.
In.Mt. P.F.R. 1893	on E.
Lat.44° 50' N.	on S. and
Y.N.P.	on W. faces, from which

A pine 18 ins. diam. bears N.15° E. 150 lks. dist. marked N.W.Cor. P.F.R. 1893. P.L. B.T.

A pine 16 ins. diam. bears S.74° W. 98 lks. dist. marked N.W.Cor. P.F.R. 1893. Y.N.P. B.T.

A pine 17 ins. diam. bears S.83° E. 66 lks. dist. marked N.W.Cor. P.F.R. 1893. B.T.

A pine 20 ins. diam. bears S.25° W. 111 lks. dist. marked N.W.Cor. P.F.R. 1893. Y.N.P. B.T.

Over the corner build a mound of stone in the form of the frustum of a square pyramid, 4 ft. high, 6 ft. base, with its sides directed N.S.E.& W. In the north side of which I insert a porphyry stone 18x12x8 ins., marked 12M.6.65 chs. In the east a porphyry stone 18x10x6 ins., marked In.Mt. P.F.R. 1893. In the south a porphyry stone 26x12x8 ins. marked Lat.44°50' N., and in the west a porphyry stone 24x12x8 ins. marked Y.N.P.

I then measure south, along the blazed East Boundary of the Yellowstone National Park, 5.75 chs. to a point where the meridian crosses a blazed trail, which at a very short distance to the east of the line splits up in the creek bottom and is not distinguishable.

Chains.

5.75 South of the N.W.Cor. I find a pine tree 12 ins.diam. on on line, which I cut off 5 ft.above the ground and square to 9 ins., for Special Corner, marked on E.& W. faces, N.W.Cor. P.F.R. 5.75 chs.N. →

5.79 Crossed blazed trail.

8.00 South fork of Cache Cr., course west.

The 12m.6.65 ch.Cor. is situated just at the foot of the mountain and at the edge of heavy pine timber. This 12 miles just run extends over a very rough and mountainous country, difficult to run a line over, and in many places entirely inaccessible. I have found it necessary to carry a line of triangulations ahead of my work almost the entire distance, having discovered by actual experience that it is impossible to figure how far ahead of any given point I can run before finding myself in a position from which I can neither chain forward nor triangulate.

I have therefore found it more expedient and expeditious, as well as more accurate, to keep a system of triangulations well ahead of the work, on tops of the highest summits crossed by the line, and above timber line, where accurate work can be performed, and then to chain the line and establish corners from these triangulation points, in either direction as the country admits than to take chances on having the work hindered and delayed by going ahead without any triangulation, only to find myself tied up every short distance by inaccessible places where chaining cannot be done, and triangulation, owing to the physical nature of the country and the intervening timber, is impossible, and then having to back up on the line to find a position from which a triangulation can be made.

I am constrained to make this and the following explanations, at this point, for the reason that I have now gotten far enough along with my work to know that the entire line, excepting in a very few places, is going to run over the highest, most inaccessible and dangerous mountains to be found any where in this part part of the country, requiring triangulations constantly, in order to get along at all. From the experience I have had during

the past 25 days I can now realize fully the importance of making every movement through the midst of these mountains and canyons count for something in order to make headway with the work, and I am more especially reminded of the importance of making substantial progress by a letter of the Hon. Commissioner dated Washinton, D.C. July 7th. 1893, to the Sur. General of Montana, a copy of which I received just prior to starting on this survey, in which my attention is especially called to the fact that this survey shoul d be executed, completed, approved and accepted prior to the close of the present fiscal year and stating that the appropriation from which this contract is to be paid would otherwise lapse into the Treasury June 30 th. 1894. rendering it therefore absolutely necessary that the field work of the contract should be finished before the winter of 93 and 94 closes in, which in these high altitudes will certainly occur prior to Nov. 1st.

I therefore find that I cannot reasonably expect to have more than 60 days from this date in which to complete the field work of some 157 miles of line remaining to be done, and knowing that the highest altitudes and most difficult work I will have to encounter are still far in advance on the 44th. parallel, where snow comes early and deep.

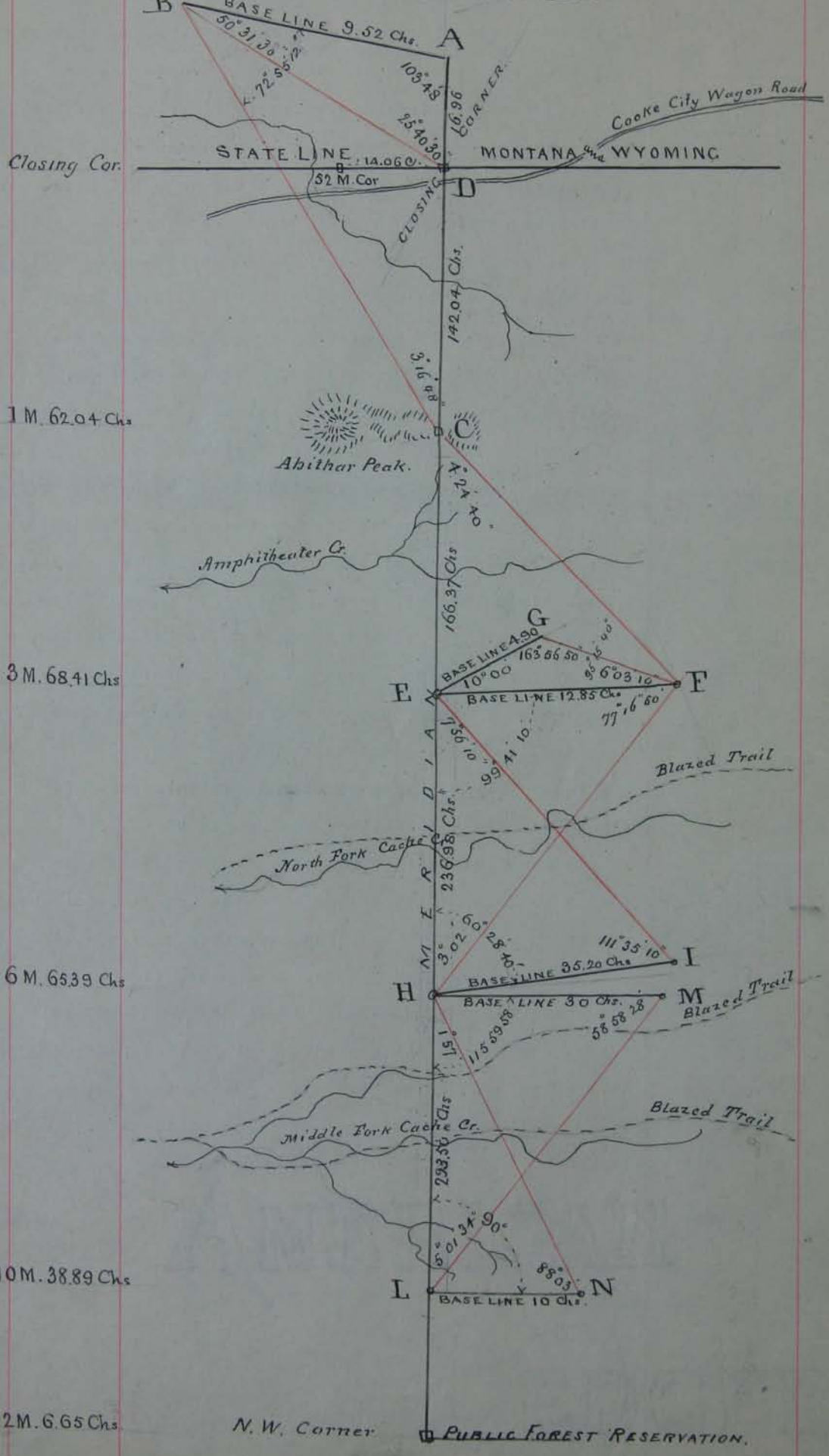
I am strongly impressed with the view that in order to carry through the work accurately, expeditiously and to a successful conclusion, within the time specified, it will be necessary to rely mainly on my triangulations, and push the work forward with all possible dispatch during every hour of daylight, keeping the line in perfect position and the distances accurately measured and, as above stated chaining to and establishing corners from either direction according as the lay of the country admits.

That this is not strictly in accordance with the details of my special instructions I am fully aware , but this line is running over a country much of which mortal man cannot traverse, even by taking any amount of risk and chances, and this is a condition of things which the

special instructions make no provision for. I shall be somewhat hampered on the parallels by the method of secant to the parallel of latitude, adopted as the manner in which the parallels of the survey shall be established. This method and the provisions of my special instructions, necessitates getting to points on the secant for purposes of instrumental work, which in many cases it is absolutely impossible to reach, and I shall be obliged to modify the methods laid down for my guidance to suit the country over which I may be working. I do not consider this any departure from, or breach of, my instructions, but merely a very necessary modification of them, brought about by conditions which I find existing on the ground, that could not have been foreseen by those having charge of the formulation of said instructions, and I therefore feel justified in making such mofifications as I may find absolutely necessary, as per Article 15 of said special instructions. I therefore conclude that the proper course for me to pursue under the circumstances is to push the work ahead, and by careful and accurate work locate the lines in exactly their proper positions, observing the details of my instructions as fully as possible, and in every way fulfilling the spirit of them.

Were it possible, at this time and from this point, for me to communicate with the Department I should certainly do so, but it would necessarily delay the work in all probability 10 or 12 days and would virtually be equivalent to an abandonment of all chance of completing the survey during the present working season, as I could never hope to complete it after having lost this much time, of the best weather I shall probably have.

DIAGRAM B.


B
BASE LINE 9.52 Chs.
A
50° 31' 30"
72° 55' 12"
103° 48'
25° 40' 30"
16.96
CORNER
Cooke City Wagon Road
Closing Cor.
STATE LINE
14.06 Ch.
MONTANA and WYOMING
52 M. Cor
D
CLOSING
142.04 Chs.
3.16.48
1 M. 62.04 Chs
C
Abithar Peak.
Amphitheater Cr.
166.37 Chs
G
BASE LINE 4.90
163° 56' 50"
10° 00'
3° 6' 03" 10"
E
F
BASE LINE 12.85 Ch.
77° 16' 50"
3 M. 68.41 Chs
MERIDIAN
Blazed Trail
99° 41' 10"
North Fork Cache Cr.
236.98 Chs.
3° 02' 60"
28° 40'
111° 35' 10"
I
6 M. 65.39 Chs
H
BASE LINE 35.20 Chs
BASE LINE 30 Chs.
M
Blazed Trail
58° 58' 28"
115° 59' 58"
151
Middle Fork Cache Cr.
Blazed Trail
293.30 Chs
5° 01' 34" 90°
88° 03'
10 M. 38.89 Chs
L
N
BASE LINE 10 Chs.
12 M. 6.65 Chs
N. W. Corner
PUBLIC FOREST RESERVATION.

GENERAL DESCRIPTION.

The country traversed by this line is all extremely mountainous, the tops of the mountains being above timber line.

The lower altitudes are abundantly supplied with small sized timber of healthy growth and appearance, comprising several varieties of pine.

In places there is a good growth of grass, not however of a very good quality.

I have found it necessary to omit the establishment of numerous regular corners, but have established a large number of Special Corners, which are in reality of the most general value to the survey, as they are set on mountain tops and in close proximity to trails crossing the line and over which all travel passes, thereby furnishing a ready reference to the location of the Boundary and one which persons crossing the line cannot help seeing.

52. (blank)

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

At the N.W. Corner of the Public Forest Reservation just established, I set my instrument over the hub 5.51 ft. south of the corner and directing the telescope to the tack in the hub to the north established last night, deflect 89° 57' 50" from the N. towards the east to the secant. I find that this line cannot be carried through as a hub line for the reason that it runs, for several miles, along the N. slope of a large mountain just to the south of Cache creek, so steep and in places rocky and cut up by canyons, that neither chaining nr manipulation of the instrument is practicable; neither will the secant at any point reach the top of the mountain where a flag might be set to which a triangulation could be made, and besides the N.W. corner is situated in the bottom of a canyon, in such a position that it would be impossible to lay off a base-line from it of any considerable length. I am therefore obliged to go back along the East Boundary of the Yellowstone National Park, just established, to a point on top of the ridge at 11M.54.77chs., Sta.C (fig.8) in order to find suitable ground on which to make a triangulation towards the east. At Sta.C, on the East Boundary of Yellowstone National Park, 51.88 chs. N. of N.W. Cor. Public Forest Reservation, Set a sandstone level with the top of the ground, marked on top of which is a X, exactly on the Meridian. From this point I establish a double base-line as follows - Carefully chaining north on the meridian, I set a sandstone level with the top of the ground, on top of which is marked a X on the meridian, and exactly 7.58 chs. from Sta.C, for Sta.D. Thence extending this base-line 10.00 chs. N. to Sta. E, Set a granite stone 30x8x8 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for Special Corner, marked 11M.57.59 chs. T.P. on N. Y.N.P. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. No trees within limits. On the top of corner cut a deep X exactly on the meridian and at 17.55 chs. from Sta.C.

Having sent a flag ahead to a point on top of a high mountain east from the N.W. corner, but which cannot be seen from it (Sta.F) I now proceed to measure the angles and

and make verifications of the work as follows -

Instrumeot at Sta.C, vernier at zero. Set on Sta.E.
Find St.D to be on the same stright line.
Unclamp plates and set on Sta.F.
Vernier reads 94° 21' 00"
Unclamp plates and set on meridian CA.
Vernier reads 180° 00' 00"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 274° 21' 30"
Unclamp plates and set on Sta.A.
Vernier reads 360° 00' 00"
Angle ECF, mean value, 94° 21' 15"
Angle FCA, mean value, 85° 38' 45"

Instrument at Sta.D, vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 95° 31' 00"
Unclamp plates and set on Sta.C.
Vernier reads 180° 00' 00"
Unclamp below and and set on Sta.E.
Unclamp plates and set on Sta.F.
Vernier reads 275° 31' 00"
Unclamp plates and set on Sta.C.
Vernier reads 360° 00' 00"
Angle EDF, mean value 95° 31' 00"
Angle CDF, mean value, 84° 29' 00"

Instrument at Sta.E, vernier at zero.
Set on Sta.C.
Unclamp plates and set on Sta.F.
Vernier reads 82° 55' 00"
Unclamp below and set on Sta.C.
Unclamp plates and set on Sta.F.
Vernier reads 165° 50' 00"
Angle CEF, mean value, 82° 55' 00"

Leaving back sights at Stations E, D and C, I then proceed to Sta.F, which I find marked by a deep X cut in the solid rock by my flagman at the exact spot where the flag stood (Sta.F). I set my instrument over the X, vernier at zero.

Set on flag, Sta.E.
Unclamp plates and set on Sta. C.
Vernier reads 2° 44' 00"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.C.
Vernier reads 5° 28' 00"
Angle EFC, mean value, 2° 44' 00"

Set on Sta.C, vernier at zero.
Unclamp plates and set on Sta.D.
Vernier reads 1° 10' 00"
Unclamp below and set on Sta.C.
Unclamp plates and set on Sta.D.
Vernier reads 2° 20' 50"
Unclamp below and set on Sta.C
Unclamp plates and set on Sta.D.
Vernier reads 3° 31' 00"
Angle CFD, mean value, 1° 10' 20"

Fig.8, page 55, represents the method pursued to ascertain the location of Sta.F with reference to secant AH.

For purposes of calculation I assume Sta.E on the meridian AE, and at the west end of an imaginary secant EF, parallel with AH, and passing through Sta.F, noted in fig.8 as sub-

secant BF.

Closing errors of triangles.

Triangle ECF.		Triangle CDF.	
Angle ECF,	94° 21' 15"	Angle CDF,	84° 29' 00"
Angle CFE,	2 44 00	Angle DFC,	1 10 20
Angle FEC,	82 55 00	Angle FCD,	94 21 15
the sum is	180 00 15	the sum is	180 00 35
Closing error 15" excess		Closing error 35" excess.	

In the triangle ECF I consider all the angles to have been measured with equal accuracy and therefore distribute the 15" closing error equally between them. In the triangle CDF however I think the greatest chance for error was in the small angle DFC, and I therefore equalize the angles as follows -

Corrected angles of triangles.

Triangle ECF.		Triangle CFD.	
Angle ECF,	94° 21' 10"	Angle CDF,	84° 28' 55"
Angle CFE,	2.43 55	Angle DFC,	1 09 55
Angle FEC,	82 54 55	Angle FCD,	94 21 10
the sum is	180 00 00	the sum is	180 00 00

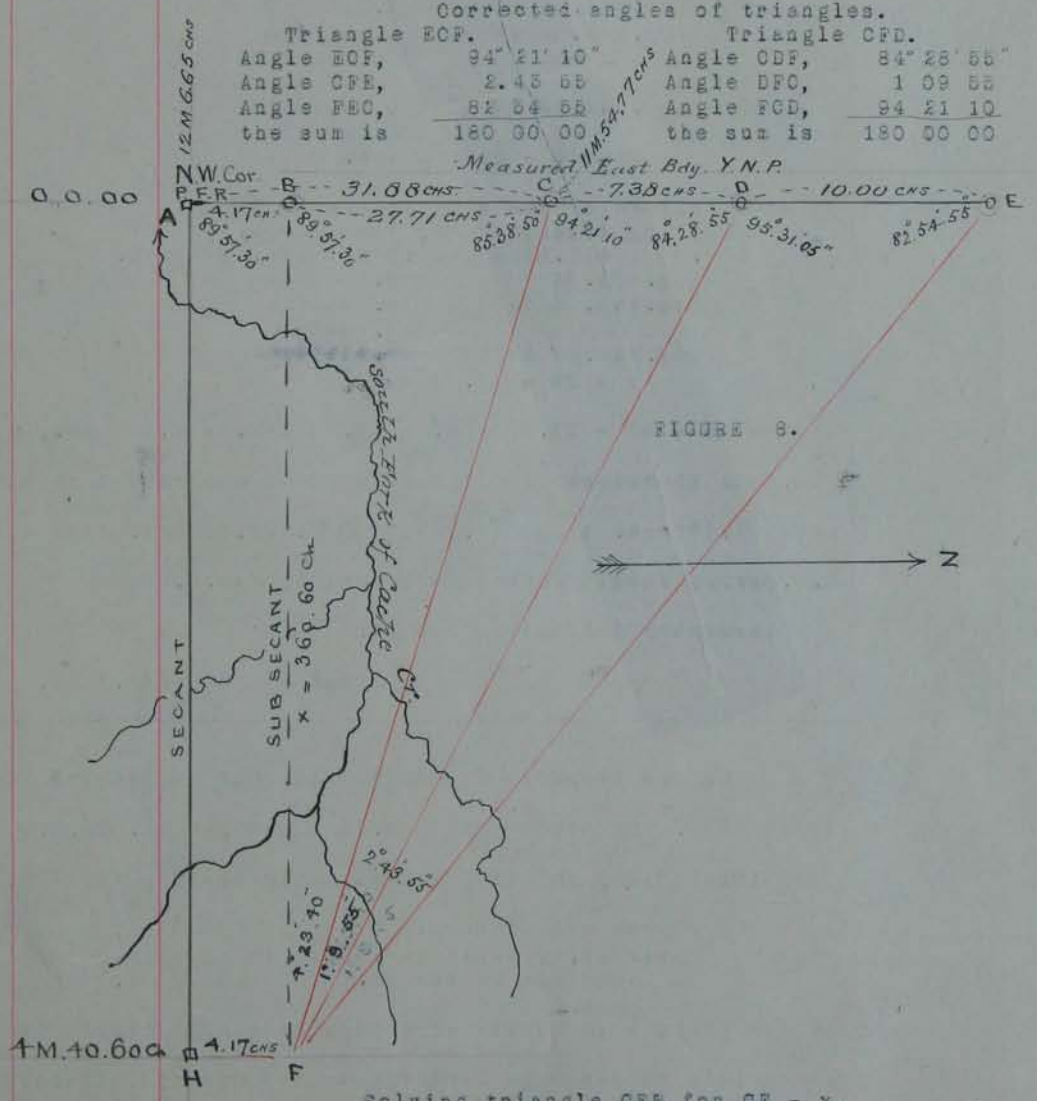


FIGURE 8.

Solving triangle CBF, for CF = x.

17.38 : sin. 2° 43' 55" :: x : sin. 82° 54' 55".

Log. 17.38	1.2400498
Log. sin. 82° 54' 55"	9.9986714
	11.2387212
Log. sin. 2° 43' 55"	8.6781847
	2.5585365

x = CF = 361.86 chs.

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Solving triangle CFD, for CF = x.

7.38 : sin. 1°09′55″ :: x : sin. 84°28′55.″

Log. 7.38	0.8680564
Log. sin. 84°28′55″	9.9979528
	10.8660092
Log. Sin. 1°09′55″	8.5082766
	2.5577326

x = CF = 361.21 chs.

The difference in the two triangulations, for the distance CF, is therefore 65 lks. On account of the longer base however I consider the first triangulation the better one and, allowing 1/3 of the error to be in said first triangulation, decide to assume the distance CF to be 361.64 chs. whence it follows -

Solving triangle CBF, for BF = x.

361.64 : sin. 89°57′30″ :: x : 85°35′50″

Log. 361.64	2.5582765
Log. sin. 85°35′50″	9.9987455
	12.5570220
Log. sin. 89°57′30″	9.9999999
	2.5570221

x = BF = 360.60 chs.

It also follows by the same process -

Solving triangle CBF, for CB = x.

361.64 : sin. 89°57′30″ :: x : sin. 4°25′40.″

Log. 361.64	2.5582765
Log. sin. 4°25′40″	8.8843555
	11.4426520
Log. sin. 89°57′30″	9.9999999
	1.4426521

x = CB = 27.71 chs.

Whence AB = BF = 31.88 chs. - 27.71 chs. = 4.17 chs., and Sta. F is therefore situated at a point determined by running north 4.17 chs. thence N. 89° 57′30″ E. 360.60 chs. from the N.W. corner Public Forest Reservation, Sta. A.

The barometer indicates 9900 ft.

August 26th. 1893.

On the evening of August 26th. 1893 I observe Polaris at E. elongation from Sta. F (fig. 8), at 9h. 03m. P.M. mean local time, and find its magnetic bearing to be N. 16° 37′W.

North end of needle	16° 37′ E.
Azimuth, by table in Manual, is	1.47 E.
the sum is the va.	18.24 E.

As the point F is on the very edge of a high cliff it is impossible to mark the meridian to the north; I therefore, by double back and fore sights from the star at its eastern elongation, establish a point to the south and from this point lay off the azimuth to the east and mark the true meridian, so determined, by making a mark on a rock in place 4.30 chs. to the south.

Chains. I make the latitude of the place 44° 50′ N.

On the morning of August 27th. 1892 I set my Instrument over the X, Sta. F, and with vernier at zero, direct the telescope to the mark on the rock, 4.50 chs. south, on the meridian established last night. Unclamp plates and set on Sta. C.
Vernier reads 94° 25′ = angle HFC.

By computation -
Angle HFC = angle HFB + angle BFC.
Angle HFB = 90° 01′ 00″
Angle BFC = 4.25.40
Angle HFC = 94.24.40. My work of yesterday is therefore verified.

From Sta. F, I then measure south 4.17 chs. and make a X on the rock at Sta. H, on true secant, over which I set my instrument and, with vernier at zero, direct the telescope to a flag at Sta. F, and deflect 89° 59′ from the north towards west and, in this direction measure 60 lks. to a point on true secant, thence 1.15 ft. south to a point for 4 1-2 MILE CORNER, which falls on a ledge of rock. At exact point for corner I cut a deep X on rock. This rock is so shaley that it is impossible to cut the proper markings in ledge, so over the X already cut, I set a trap rock 30x12x8 ins., for 4 1-2 MILE CORNER, marked 4 1-2 M. on W. P.F-R. on S. and P.L. on N. faces. Piled rock around it and raised a mound of stone 2 1-2ft. high, 5ft. base, N. of cor. Pits impracticable. At a point 3.31 ft. south of the 4 1/2 mile cor. I deflect the azimuth, 89° 57′ 30″, from the north towards the east & run

N. 89° 57′ 30″ on the secant to the parallel,

Va. 18° 24′ E.

Ascend 200 ft. to

4.10 Point on edge of cliff. Cut a deep X in the rock, for Sta. J, fig. 9. At 3.30 ft. north cut a deep X in the solid rock, for Special Corner, marked 4m. 44.10 chs. T.P. west of, P.F.R. south of, and P.L. north of cross. Mound and pits impracticable.

This point is on the verge of an almost peependicular cliff, from 1000 to 1500 ft. high, which then breaks off a little more gradually another 2000 ft. into a deep canyon. The cliff faces north and extends in a generally easterly direction. It forms the south wall of a canyon through which passes a branch of Crandall creek, heading close up against the divide and running S. 75° E. On the north side

of the creek is another rocky cliff extending in a generally parallel direction. The sides of both are rocky and rugged, and so nearly perpendicular for many miles, that it is impossible to scale them. The creek itself lies about 3000 ft. below. These walls come together and join the main divide 1-2 mile to the north and west of Sta. J. The secant from Sta. J, extended east, runs along the side of a cliff facing north for some two miles and then descends into the bottom of the canyon and, crossing the creek, runs along the side of the other cliff or canyon wall, for some 4 miles, until it reaches the top of a very high peak. This mountain is a prominent feature of the country and has two peaks close together, and closely resembles the tail of a fish, for which reason I designate it Fish Tail mountain in all future references in these notes. The line crosses the most northern of the two peaks. These peaks and most of the surrounding country are far above timber line, though in the lower altitudes, near the bottom of the canyon, there is heavy timber. Chaining any portion of this line between Sta. J and Fishtail mountain is utterly out of the question, and I can find no way by which it is possible to get down into the canyon. I therefore send a flag around to be set on Fishtail mountain, and prepare to triangulate to it as follows

To the east and south of St. J stands a very high peak, on the top of which I mark a deep X in the solid rock, over which I raise a stone monument 5 ft. square, 6 ft. high, Sta K fig. 9. The barometer indicates 11,300 ft.

This peak stands exactly on the main divide between the waters flowing into Crandall creek on the east, and those flowing into the Yellowstone on the west.

To the north and west is another peak, on the top of which I cut a deep X in the rock, over which I build a stone monument 5 ft. square, 6 ft. high. Sta. L, fig. 9.

Barometer 10,700 ft.

Carefully chaining the distance MJ from the 4 1-2 mile corner, for a base-line from which to measure the base-lines JK and JL, I make the distance exactly 4.10 chs. as before.

With Instrument at Sta. J, vernier at zero.
Set on Sta. M.
Unclamp plates and set on Sta. K.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Vernier reads 116° 56′ 00″
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. K.
Vernier reads 232°. 52′. 00″
Angle MJK, mean value, 116° 56′ 00″

Vernier at zero
Set on Sta. M.
Unclamp plates and set on Sta. L.
Vernier reads 56°. 38′. plus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. L.
Vernier reads 113°. 17′. 00″
Angle MJL, mean value, 56° 38′ 30″

Instrument at Sta. M, vernier at zero.
Set on Sta. J.
Unclamp plates and set on Sta. K.
Vernier reads 39°. 27′. 30″
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. K.
Vernier reads 78°. 55′. 30″
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. K.
Vernier reads 118°. 23′. 00″
Angle JMK, mean value, 39° 27′ 40″

Set on Sta. J, vernier at zero.
Unclamp plates and set on Sta. L.
Vernier reads 116°. 54′. plus.
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. L.
Vernier reads 233°. 49′. 00″
Angle JML, mean value, 116° 54′ 30″

Instrument at Sta. K, vernier at zero.
Set on Sta. M.
Unclamp plates and set on Sta. J.
Vernier reads 25° 36′. plus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. J.
Vernier reads 47°. 13′. 00″
Angle MKJ, mean value, 25° 38′ 30″

Instrument at Sta. L, vernier at zero.
Set on Sta. M.
Unclamp plates and set on Sta. J.
Vernier reads 6°. 28′. 00″
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. J.
Vernier reads 12°. 56′. 00″
Angle MLJ, mean value, 6° 28′ 00″

Closing error of triangles.

Triangle JKM.		Triangle MJL.	
Angle JKM,	25° 36′ 50″	Angle MJL,	56° 38′ 30″
Angle KMJ,	39° 27. 40	Angle JLM,	6. 28. 00
Angle MJK,	116. 56. 00	Angle LMJ,	116. 54. 30
the sum is	180. 00. 10	the sum is	180. 01. 00
Closing error 10″		Closing error 1′	

Corrected angles of triangles.

In triangle JKM I consider that all the observations are equally accurate and therefore divide the error of 10″ between the angles. I think perhaps there was somewhat more chance for error in the angle KJM than in the other two and therefore give to it slightly more of the error. The error of 1′ was equally distributed among the angles of triangle MJL.

Corrected angles of triangles.

Triangle JKM		Triangle MJL.	
Angle JKM,	25° 36′ 27″	Angle MJL,	56° 38′ 10″
Angle KMJ,	39. 27. 37	Angle JLM,	6. 27. 40
Angle MJK,	116. 55. 56	Angle LMJ,	116. 54. 10
the sum is	180. 00. 00	the sum is	180. 00. 00

Solving triangle JKM, for JK = x.

4.10 : sin. 25° 36' 27" :: x : sin. 39° 27' 37."

Log. 4.10	0.6127839
Log. sin. 39° 27' 37"	9.8031450
	10.4159289
Log. sin. 25° 36' 27"	9.6025689
	0.8133600

x = JK = 6.507 chs.

Solving triangle JML, for JL = x.

4.10 : sin. 6° 27' 40" :: x : sin. 116° 54' 10."

Log. 4.10	0.6127839
Log. sin. 116° 54' 10"	9.9502556
	10.5630395
Log. sin. 6° 27' 40"	9.0512637
	1.5117758

x = JL = 32.49 chs.

August 27th. 1893.

The night of August 27 th. 1893 was too cloudy to permit observation on Polaris.

On the morning of August 28 th. 1893 I set the instrument over the X at Sta. J, and prolong the secant N. 89° 57' 30" E. and on this line set a flag on the most northern peak of Fishtail mountain, Sta. N, fig. 9.

With Instrument at Sta. J, vernier at zero.

Set on Sta. N.
Unclamp plates and set on Sta. L.
Vernier reads 123° 21' " plus.
Unclamp below and set on Sta. N.
Unclamp plates and set on St. L.
Vernier reads 246°. 44'. 00"
Angle LJN, mean value, 125° 22' 00"

Set on Sta. N, vernier at zero.
Unclamp plates and set on Sta. K.
Vernier reads 65°. 04'. 00"
Unclamp below and set on Sta. N.
Unclamp plates and set on Sta. K.
Vernier reads 126°. 08'. 00"
Angle KJN, mean value, 65° 04' 00."

Instrument at Sta. K, vernier at zero.
Set on Sta. J.
Unclamp plates and set on Sta. N.
Vernier reads 116°. 18'. plus.
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. N.
Vernier reads 232°. 37'. minus.
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. H.
Vernier reads 348°. 55'. 00"
Angle JKN, mean value, 116° 18' 20"

Instrument at Sta. L, vernier at zero.
Set on Sta. J.
Unclamp plates and set on Sta. N.
Vernier reads 53°. 49'. plus.
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. N.
Vernier reads 107°. 58'. plus.
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. N.
Vernier reads 161°. 27'. 30"
Angle JLN mean value 53° 49' 10"

Leaving back sights at Stations J, K and L, I then proceed to the flag at Sta. N.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

On the evening of August 29 th.1898 I observe Polaris at its eastern elongation from a point to the south and east of Sta.N; at 8h.51m.P.M.mean local time, and find its magnetic bearing to be N.16° 37′ N.

North end of needle	16° 37′ E.
The azimuth, by table in Manual is	1·47· E.
the sum is the va.	18.24 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by tack and nub 4.50 chs.N.

On the morning of August 30th.1898, with instrument over the point of last night's observation, Sta.O, fig.9, vernier at zero,

Set on tack in hub, 4.50 chs. N. established last night, on the meridian,
Unclamp plates and deflect from the north towards the west, to Sta.N.
Vernier reads 61° 10′ 00″
Instrument at Sta.N, vernier at zero.
Set on Sta.O, and by careful double back and fore sights set flag at Sta.P.
Instrument at Sta.N, vernier at zero.
Set on Sta.P.
Unclamp plates and deflect 61° 10′ 00″ towards the the N. and set Sta.Q.
Unclamp below and set on Sta.P.
Unclamp plates and set on Sta.Q.
Vernier reads 122° 20′ 00″

This establishes the meridian NQ. It was not possible to take the observation direct at this point, which is 5000 ft. above the point of observation O, in the canyon below.

Barometer at Sta.N indicates 11,500 ft.

Instrument at Sta.N, vernier at zero.
Set on Sta.Q.
Unclamp plates and set on Sta.J.
Vernier reads 89° 57′ 00″
Vernier at zero, Set on Sta.J.
Unclamp plates and set on Sta.K.
Vernier reads 0° 57′ 30″
Unclamp below and set on Sta.J.
Unclamp plates and set on Sta.K.
Vernier reads 1° 15′ 00″
Angle KNJ, mean value, 0° 57′ 30″

Set on Sta.J, vernier at zero.
Unclamp plates and set on Sta.L.
Vernier reads 2° 49′ 00″
Unclamp below and set on Sta.J.
Unclamp plates and set on Sta.L.
Vernier reads 5° 38′ 00″
Angle JNL, mean value, 2° 49′ 00″

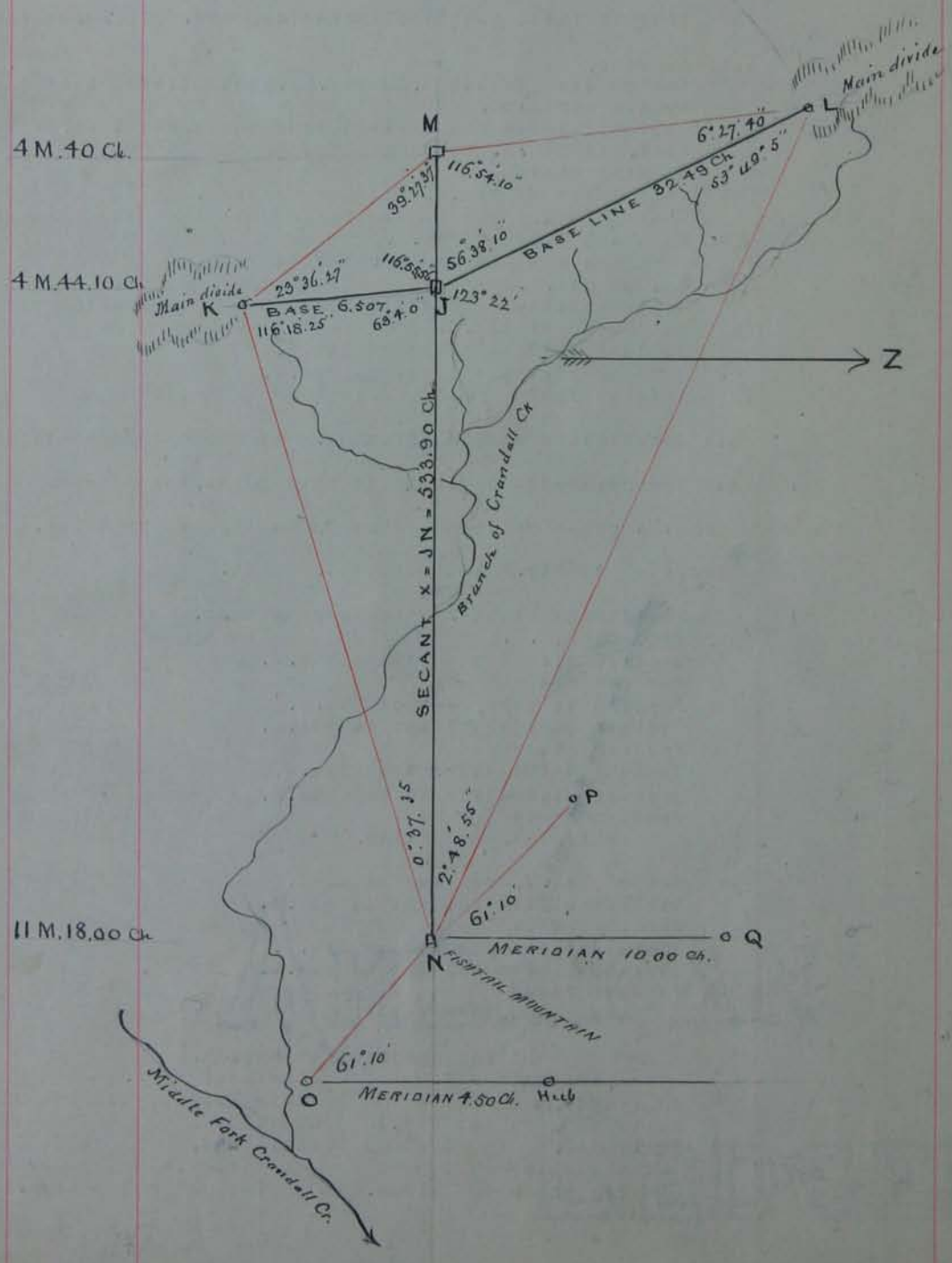
Closing error of triangles.

Triangle NJK.		Triangle NJL.	
Angle NJK,	63° 04′ 00″	Angle NJL,	123° 22′ 00″
Angle JKN,	116.18.20	Angle JLN,	55·49·10
Angle KNJ,	0.57·30	Angle LNJ,	2.49.00
the sum is	179.59·50	the sum is	180.00·10
Closing error 10″ minus.		Closing error 10″ plus.	

NORTH BOUNDARY PUBLIC FOREST RESARVATION.

The angles at the west end of the secant were measured under more favorable conditions than the balance, as the wind was blowing very hard on Fishtail mountain, and at L and K, I therefore conclude that as the closing error is very small it is more likely to be in the angles taken at the Stations N, L and K, and accordingly divide the error of 10", in triangle JNL, between angles JNL and NLJ, and the error of 10" in the triangle JKN, between the angles JNK and JEN.

FIGURE 9.



NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains

Corrected angles of triangles.

Triangle NJK.		Triangle NJL.	
Angle JKN,	116°18'25"	Angle NJL,	128°22'00"
Angle NJK,	63.04.00	Angle JLN,	53.49.05
Angle KNJ,	0.37.35	Angle LNJ,	2.48.55
the sum is	180.00.00	the sum is	180.00.00

Solving triangle KJN, for JN = x.

8.507 : sin. 0°37'35" :: x : sin. 116°18'25"

Log. 8.507 = JK 0.8188600

Log. sin. 116°18'25" 9.9525177

10.7658777

Log. sin. 0°37'35" 8.0887127

2.7271650

x = JN = 533.54 chs.

Solving triangle NJL, for JN = x.

82.49 : sin. 2°48'55" :: x : sin. 53°49'05"

Log. 82.49 1.5117497

Log. sin 53°49'05" 9.9069523

11.4187020

Log. sin. 2°48'55" 8.6912238

2.7274782

x = JN = 533.92 chs.

The difference in the two calculations, for the distance JN, is therefore 38 lks., but owing to the very considerable difference in the length of the base-lines, I consider that the second triangle gives much the more accurate result, and decide to assume the distance JN at 533.90chs.

Parallel + secant distance of Sta. J,	4M.44.10 chs.
Secant distance JN,	6M.53.90 chs.
the sum is the parallel & secant distance of N.	11M.18.00 chs.

The secant distance JN is therefore 6M.53.90 chs., which is not in accordance with the special instructions governing the survey, but as the line for several miles back of Sta. N lies along the side of a rocky canyon wall, 3 to 4 thousand ft. high, and utterly impassible, the proper end of the secant, at 6 miles from Sta. J, cannot be reached, and I am therefore obliged to interpolate for the proper distance to be measured N. from Sta. N, to the parallel of latitude, which I make 6.29 ft. N., and the proper distance for beginning point of new secant is 6.29 ft. - 3.31 ft. = 2.98ft. North. Marking Sta. N by a X cut in the solid rock, I measure north 2.98ft. on the meridian and establish a secant point by cutting a deep X in the rock, over which I set the instrument and, with vernier at zero, set on the meridian and deflect 89°57'50" from the north towards the east to new secant. As the point at which the instrument sets is not exactly on top of the peak, and not in the proper place for a corner, I run N.89°57' E. on the secant to

00.50 Offset 5.29 ft. north, cut a deep X in the solid rock, which is covered with vegetable wash that would obscure markings

Chains.

in a short time, over which I set a porphyry slab 80x12x8 ins., for Special Corner, marked 11M.18.50chs. on W. P.P.R. on S. and P.L. on N. faces, and piled stone around it. Raised a monument of stone, in the form of the frustum of a square pyramid, 6 ft. square, 6 ft. high, W. of corner. Pits impracticable. No timber.

Barometer indicates 11,525 ft.

This monument can be seen for many miles from any direction.

REMAINDER OF 12th. MILE.

N. 89° 57′ E. on the secant.

Va. 18° 24′ E.

Descend 150 ft. to

5.00 Thence descend gradually, over grassy slope, 150 ft. to

21.50 Offset 2.27 ft. N. Set a porphyry rock 86x12x7 ins., with marked stone 5 ins. cube, 24 ins. in the ground, for 11 1/2 Mile Corner, marked 11 1/2M. on W. P.P.R. on S. and P.L. on N. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base W. of corner. Pits impracticable.

Thence descend gradually 800 ft. to mile corner

The difference between chaining is 4 lks. at middle point of difference.

61.50 Offset 0.68 ft. north, and set a porphyry rock 80x12x5 ins., with granite boulder 5 ins. cube marked with a x, 20 ins. in the ground, for 12 Mile Corner, marked 12M. on W. P.P.R. on S. and P.L. on N. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, W. of corner. Pits impracticable.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

13th. MILE.

N. 89° 58′ E. on the secant.
Va. 18° 24′ E.

Descend gradually 150 ft. to

17.17 Offset 0.05 ft. north. Set a porphyry rock 80x8x6 ins., with granite boulder 6 ins. diam. marked with a x, 20 ins. in the ground, for Special Corner marked with a X on top, and 12M + 17.17 chs. T.P. on W. P.P.R. on S. and P.L. on N.

Chains. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base W. of corner.

At a point R, fig. 10, 3.31 ft. south of the special corner, at 12M. 17.17chs., I deflect the azimuth angle 89°57'30" from north towards the east and run on a new secant -

N. 89°57' E. on the secant.
Va. 18° 24' E.

Descend 300 ft. to

20.85 Offset 2.52 ft. north, and set a porphyry rock 40x14x8 ins. with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for Special Corner, marked 12M. 35chs. on W., P.F.R. on S. and P.L. on N. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base W. of corner. Pits impracticable.

Barometer indicates 10,700 ft.

From this point the line drops over a cliff, nearly perpendicularly, into a canyon at the head of one of the forks of Crandall creek, which extends in a generally easterly direction for several miles, and then bears about 10° south of east, the line crossing the creek and running along the side of the cliffs forming the north wall of the canyon. These cliffs on both sides of the creek are from 3 to 4 thousand ft. high; rough, rocky and rugged, and ascent or descent of them is out of the question. It has only been with the greatestest difficulty that I have been enabled to reach the line on Fishtail mountain, and I find no way to get off of it except by the way I made the ascent (up the south side of it), and can in no way get into the canyon ahead, and I am informed by my guide that there is none. I therefore return to the T.P. established at 12M17.17 chs., Sta. R, and make the following triangulation to the nearest accessible point that can be seen, on the secant ahead, to the east.

From a point which is 3.31 ft. south of the special corner at 12M 17.17chs., Sta. R, I deflect 89° 57' 30" from north towards the east, to the secant, and establish the direction of the line by firmly planting a flag 7.00 chs. distant towards the east

Vernier at zero.
Set on flag and deflect 102°02'00" towards the south and west, and in this direction, measure a base-line 25.25

chs. long, at the south end of which I set a stone, level with the top of the ground, on the top of which I mark a X on line, and exactly 25.25 chs. from Sta. R, for Sta. S.

August 30th. 1895.

The evening of August 30th. 1895 proving cloudy no observation on Polaris was possible at this point.

On the morning of August 31st. 1895, with

Instrument at Sta. R, vernier at zero.
Set on flag, on secant.
Unclamp plates and set on Sta. S.
Vernier reads 102°02'00"
Unclamp below and set on flag on secant.
Unclamp plates and set on Sta. S.
Vernier reads 204°04'00"
Angle TRS, mean value, 102°02'00"

Having sent a flag ahead I now set it, by foresight from the flag in the Crandall creek basin at Sta. T.
Instrument at Sta. S, vernier at zero.
Set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 75°47'00" plus.
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 151°35'00" plus.
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 227°23'00" plus.
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 303°11'00"
Angle TSR, mean value 75°47'45"

Leaving back sights at stations R and S, I then proceed to the flag set at Sta. T.

August 31st. 1895.

On the evening of August 31st. 1895 I observe Polaris at eastern elongation from Sta. T, at 8h. 43m. P. M. mean local time, and find its magnetic bearing to be N. 16°33' W.

North end of needle	16°33' E.
Azimuth, by table in Manual, is	1:47 E.
the sum is the Va.	18:20 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N.

On the morning of September 1st. 1895, with
Instrument at Sta. T, vernier at zero, I direct the telescope to tack in hub 4.00 chs. N., on meridian.
Unclamp plates and set on Sta. R.
Vernier reads 89°58'00"
Verifying the secant produced, RT.
Vernier at zero.
Deflect 90°00 from the secant T.R towards the south and in this direction measure a base-line 26.41 chs. long, at south end of which I set a stone level with the top of the ground, Sta. V; on top of which I mark a X on line, and exactly 26.41 chs. from Sta. T.
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. V.

Vernier reads 180°00'00"
Angle VTR, mean value, 90°00 00

Set on Sta.R, vernier at zero.
Unclamp plates and set on Sta.S.
Vernier reads 2°.10'.
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.S.
Vernier reads 4°.20'. plus.
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.S.
Vernier reads 6°.30'.30"
Angle STR, mean value, 2°10'10"

Instrument at Sta.V, vernier at zero.
Set on Sta.T.
Unclamp plates and set on Sta.R.
Vernier reads 87°.27'. plus.
Unclamp below and set on Sta.T.
Unclamp plates and set on Sta.R.
Vernier reads 174°.55'. minus.
Unclamp below and set on Sta.T.
Unclamp plates and set on Sta.R.
Vernier reads 262°.22'.00"
Angle TVR, mean value, 87°27'20"

As the triangulation, VTR, is only taken for the purpose of checking the distance TR, as deduced from the triangulation SRT, and as the angle VRT cannot be measured except by making an extra trip back to Sta.R, involving a loss of two days time, I omit measuring it altogether.

Closing error of triangle TSR.

Angle TSR,	75°47'45"
Angle SRT,	102.02.00
Angle RTS,	2.10.10
the sum is	179 59 55

Closing error, 05" minus.

As I consider the observations taken at stations S & R better, in several respects, than the one taken at Sta.T, I give the whole of this small closing error to the angle RTS.

Corrected angles of triangle TSR.

Angle TSR,	75°47'45"
Angle SRT,	102.02.00
Angle RTS,	2.10.15
the sum is	180.00.00

Solving triangle SRT, for RT = x.

25.25 : sin. 2°10'15" :: x : sin.75°47'45"

Log. 25.25	1.3864250
Log.sin.75°47'45"	9.9865138
	11.3529388
Log.sin. 2°10'15"	8.5764000
	2.7765388

x = RT = 595.05 chs.

Solving triangle TVR, for RT = x.

26.41 x tan.87°27'20" = x.

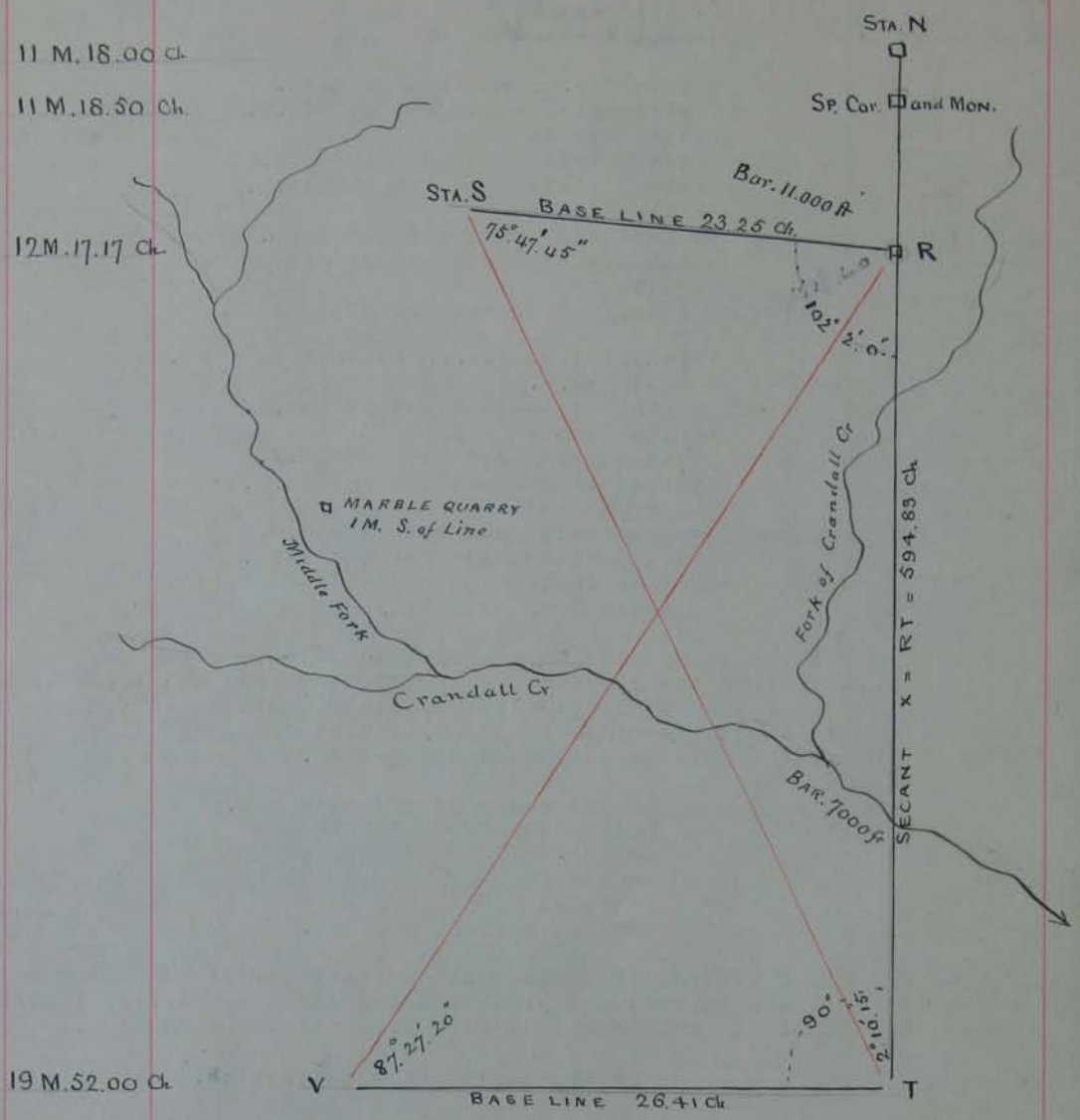
Log. 26.41	1.4217684
Log. tan.87°27'20"	1.3522440
	2.7740124

x = RT = 594.51 chs.

The difference between the two triangulations, for the distance RT, is therefore 72 lks. but on account of the ground being slightly more favorable for chaining over the base-line RS, than over the base-line TV, as well as owing to the fact that I could not measure the angle VRT, and correct any apparent error in the angles of the triangle VRT, I conclude that the first triangulation is

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

FIGURE 10.



somewhat the best and most accurate, and decide to assume the distance RT to be 594.83 chs.

Line distance of sta. R,	12m.17.17 chs.
Secant distance RT, 594.83 chs.	7m.54.83 chs.
Line distance of Sta. T.	19m.52.00 chs.

It follows that Sta. T is 1m.54.83 chs. beyond the proper east end of the secant, which should be at 18m.17.17 chs. and that it is 10.38 ft. south of the parallel at this point. I therefore measure north 10.38 ft. and set a granite rock 40x12x10 ins., with granite boulder 5 ins. diam. marked with a cross, 25 ins. in the ground for Special Corner, marked 19M+52.00 chs. on the N. P.F.R. on the S. and P.L. on N. faces, and raised a stone monument 5 ft. base, 5 ft. high, W. of corner. Pits impracticable.

Barometer indicates 7250 ft.

Chains.

20th. MILE.

With instrument at Sta. T, I then run, by double back and fore sights -

N. 89° 55' W. on secant
Va. 18° 20' E.

Over rolling ground, descending slightly.

12.00 Offset 9.51 ft. N. and set a granite rock 40x10x8 ins., with granite boulder 5 ins. diam. marked with a X, 25 ins. in the ground, for 19 1-2 Mile Corner, marked 19 1/2M. on W. P.F.R. on S. and P.L. on N. faces. Dug 2 pits 36x36x12 ins. N. & S. of stone, 4 ft. dist., and raised a mound of earth 2 1/2 ft. high, 5 ft. base, W. of corner.

Barometer indicates 7200 ft.

From this corner Bear tooth mountain bears N. 6° 55' E. and high peak west of Crandall creek bears N. 57° W.

Thence I run

N. 89° 56' W. on secant.
Va. 18° 20' E.

39.00 Top of bank bears N. & S., and descend 40 ft. to
39.50 Narrow creek bottom, bears N. & S.

40.00 Offset 6.84 ft. north and set a sandstone 30x12x6 ins., with granite boulder 6 ins. diam. marked with a X, 20 ins. in the ground, for 19 Mile Corner, marked 19M. on W. P.F.R. on S. and P.L on N. faces. Dug 2 pits 36x36x12 ins. N. & S of stone, 4 ft. dist., and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, W. of corner, from which a log cabin (unoccupied) bears north 1.00 ch. dist.

Bear tooth mountain bears N. 10° 30' E.

High peak west of Crandall creek bears N. 59° W.

Thence I run 19th. MILE.

N. 89° 56' 30" W. on secant

Va. 18° 20' E.

0.10 Cross Lodge-pole creek, 10 lks. wide, course N. 10° W. thence ascend over broken ground 200 ft.

4.00 Enter pine timber, bears N. & S.

40.00 Offset 4.50 ft. north, and set a granite rock 32x12x8 ins. with granite boulder 5 ins. diam. marked with a X, 20 ins in the ground, for 18 1/2 Mile Corner, marked 18 1/2 M. on W. P.F.R. on S. and P.L. on N. faces, from which A pine 14 ins. diam. bears S. 62 W. 34 lks. dist. marked 18 1/2

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	M. P.F.R. 1893. B.T.
	A pine 16 ins.diam.bears N.42° E. 65 lks.dist. marked 18 1/2 M. P.L. 1893. B.T.
	Barometer indicates 7800 ft.
	Ascend slightly over broken ground.
	The difference in chaining is 11 lks. at middle point of difference.
80.00	Offset 2.49 ft. north, and set a limestone 55x12x8 ins., with granite boulder 5 ins.diam.marked with a X, 24 ins.in the ground, for 18 Mile Corner, marked 18M.on N. P.F.R. on S. and P.L. on N.faces, from which -
	A pine 16 ins.diam.bears N.42°E. 65 lks.dist. marked 18M. P.L. 1893. B.T.
	A pine 12 ins.diam.bears S.10°W. 50 lks.dist, marked 18M. P.F.R. 1893. B.T.
	A pine 20 ins. diam.bears N.89°W. 74 lks.dist.marked 18M. P.L. 1893. B.T.
	A pine 18 ins.diam.bears S.74°W. 51 lks.dist.marked 18M. P.F.R. 1893 B.T.
	Mound and pits impracticable.
	Barometer indicates 7400 ft.
	Land, mountainous.
	Soil, rocky, 4th. rate.
	Timber, pine.

18th. MILE.

N.89°57'W. on secant
Va. 18°20'E.

	Over broken ground.
11.00	Edge of bench, bears N&S., and descend 250 ft. to
18.00	Foot of hill, bears N&S.
24.00	Edge of bench, bears N&S. descend 50 ft. to
24.50	Crandall creek bottom, bears N&S.
34.00	Cross branch of Crandall creek, 30 lks.wide, course N.
36.50	East bank of Crandall creek, course N.42°E.
37.15	West bank of same. Barometer indicates 7000 ft.
40.00	Offset 0.81 ft.north and set a granite rock 40x8x8 ins., with granite boulder 5 ins.diam. marked with a X, 27 ins. in the ground, for 17 1/2 Mile Corner, marked 17 1/2 M. on W. P.F.R.on S. and P.L.on N.faces, from which -
	A pine 14 ins.diam.bears S.18° E. 46 lks.dist. marked 17 1/2 M. P.F.R. 1893. B.T.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

A pine 18 ins.diam. bears N.89 E. 41 lks.dist.marked 17/12
N. P.L. 1895. B.T.

42.00 Leave Crandall creek bottom, and ascend 275 ft. to

50.63 Cross trail up Crandall creek.

Offset 0.29 ft.north and set a granite rock 35x14x8 ins. with granite boulder 5 ins.diam.marked with a X, 24 ins. in the ground, for Special Corner, marked 17M.+ 29.57 chs.on W. P.F.R.on S. and P.L. on N. faces, from which

A pine 18 ins. diam. bears N.82°E. 3.07 chs.dist., marked 17M.+ 29.57 chs. P.L. 1895. B.T.

No other suitable trees within limits.

Barometer indicates 7300 ft. Thence ascend abruptly 500 ft. to

Difference in chaining is 4 lks.at middle point of difference.

75.00 Foot of perpendicular wall rock, up which I can find no way, and I am obliged to stop the line at this point. It runs from here for several miles along a rocky, broken precipitous canyon wall, entirely inaccessible.

Offset 0.59 ft.south, and on the face of the wall rock mark a deep X, above which I mark 17M.+ .05 chs. P.F.R. S.of and P.L. N.of X. No suitable bearing trees within limits. Pits and mound impracticable.

Barometer indicates 7800 ft.

Land, mountainous.

Soil, rocky, 4th.rate

Timber, pine.

September 1st.1895.

I carefully tested my chains on the standard steel tape, and find one .01 ft. too long and the other correct. I adjust the incorrect chain.

On the evening of September 1st.1895, at a point which is 3.51 ft. S.of the special corner at 17M. 52.00 chs. I observe Polaris at its eastern elongation, at 8h.40m.P.M., mean local time, and find its magnetic bearing to be N.16°53'N.

North end of needle	16°53'E.
Azimuth, by table in Manual, is	1.47 E.
the sum is the Va.	18.20 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by nut and tack, 3.90 chs.N.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

On the morning of September 2nd. 1895 with
Instrument over point of last night's observation (Sta.N, fig.11), 5.31 ft. south of special corner at 19M.+52 chs. vernier at zero.
I set on tack in hub on meridian, 5.90 chs.N., and deflect 89° 57' 30" from the north toward the east, to secant, and set a flag on top of a high mountain towards the east, on the secant Sta.X, fig.11
With instrument at Sta.N, I then deflect 90°00 from the flag towards the south, and in this direction measure a base-line 26.26 chs.long, at the south end of which I set a stone level with the top of the ground, on top of which I mark a X on line, and exactly 26.26 chs. from Sta.N, for Sta.Z.
I also deflect 90°00 from the flag at X towards the north, and in this direction measure a base-line of exactly 40.00 chs. to tack in hub, for Sta.6.

Instrument at Sta.N, vernier at zero.
Set on Sta.X.
Unclamp plates and set on Sta.Z.
Vernier reads 90°00'00"
Unclamp below and set on Sta.X.
Unclamp plates and set on Sta.Z.
Vernier reads 180°.00'.00"
Angle XNZ, mean value, 90°00'00"

Set on Sta.X, vernier at zero.
Unclamp plates and set on Sta. 6.
Vernier reads 90°.00'.00"
Unclamp below and set on Sta.X.
Unclamp plates and set on Sta.6.
Vernier reads 180°.00'.00"
Angle 6NX, mean value, 90°00'00"

Instrument at Sta.Z, vernier at zero.
Set on Sta.X.
Unclamp plates and set on Sta.N.
Vernier reads 85°.43'.00"
Unclamp below and set on Sta.X.
Unclamp plates and set on Sta.N.
Vernier reads 171°.26'.20"
Unclamp below and set on Sta.X.
Unclamp plates and set on Sta.N.
Vernier reads 257°.09'.20"
Angle XZN, mean value, 85°43'10"

Instrument at Sta.6, vernier at zero.
Set on Sta.N.
Unclamp plates and set on Sta.X.
Vernier reads 85°.29'.50"
Unclamp below and set on Sta.N.
Unclamp plates and set on Sta.X.
Vernier reads 188°.59'.00"
Angle N6X, mean value, 85°29'50"

Thence I run, Remainder of 20th. MILE.

N.89°57'E. on secant.
Va.18°25'E.
Over gradually descending ground.
15.00 Edge of marshy ground Difference in chaining is 0.
28.00 Offset 2.00 ft. north and set a granite rock 30x12x6 ins. with granite boulder 5ins.diam.marked with a X, 20 ins. in the ground, for 20th.MILE CORNER, marked 20M.on N. P.P.R. on S. and P.L.on N.faces. Dug 2 pits 36x36x12 ins. N.& S.of stone, 4 ft.dist., and raised a mound of earth 2 1/2 ft.high, 5 ft.base, N.of corner.

Land, nearly level.

Soil, black loam, 1st. rate.

No timber.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

21st. MILE.

N.89°57'E. on the secant.
Va.18°25'E.

Descend slightly over marshy ground.

28.00 Foot of granite Butte, 8 chs.diam.at base, Ascend 75 ft. and enter scattering pine.

32.00 Top of Butte, descend 75 ft.

36.00 Foot of Butte.

40.00 The 1/2 Mile Corner falling in marsh cannot be permanently established.

42.00 Foot of granite Butte, ascend 160 ft.

46.20 Top op Butte Offset 0.19 ft. north, and cut a X in the solid rock, As it is difficult to cut legible figures in the rock, over the X I set a granite rock 46x16x8 ins. marked 20M.+46.20 chs. on W. P.F.R.on S. and P.L.on N. faces and piled stone around it for Special Corner from which -

A pine 10 ins.diam. bears N.68° E. 39 lks.dist. marked 20M.+46.20 chs. P.L. 1895. B.T.

A pine 24 ins.diam. bears S.71° E. 180 lks.dist marked 20M.+46.20 chs. P.F.R. 1895. B.T.

No other trees within limits. Raised a mound of stone 2 1/2 ft. high, 5 ft.base, W.of corner. Descend 160 ft.

Barometer indicates 7800 ft.

50.00 Foot of Butte and edge of large lake, bears N.& S. As it is impossible to chain further I return to the cor.,and having sent a flag ahead,set it on the secant at a point towards the east, and beyond the lake and marsh (Sta.1,fig.18,page 74) It being impossible to lay off a base-line from this point, Sta.2, I leave a back sight on the secant at 20M+46.20 chs. and proceed to the flag at Sta.1. Arriving at Sta.1, I set

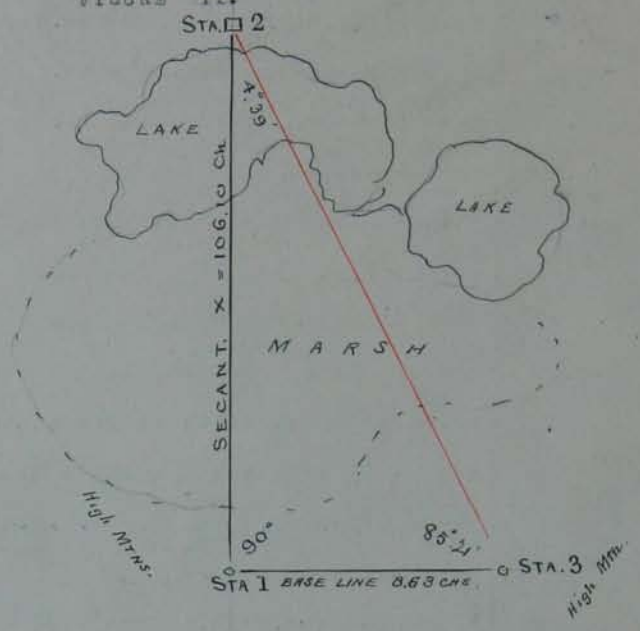
Instrument over the spot at which the flag stood, and with vernier at zero,
Set on Sta.2 and deflect 90°00 from the west towards the north,and in this direction measure a base-line 8.68 chs.long, at the north end of which I set a stone level with the top of the ground, on the top of which I mark a X on line, and exactly 8.68 chs. from Sta. 1, for Sta.3.
Instrument at Sta.1, vernier at zero.
Set on Sta.2.
Unclamp plates and set on Sta.3.
Vernier reads 90°00'00"
Unclamp below and set on Sta.2.
Unclamp plates and set on Sta.3.
Vernier reads 180°00'00"
Angle 2 1 3, mean value, 90°00'00"

Instrument at Sta.3, vernier at zero.
Set on Sta.1.
Unclamp plates and set on Sta.2.

Vernier reads 85° 20' 30"
Unclamp below and set on Sta. 1.
Unclamp plates and set on Sta. 2.
Vernier reads 170° 42' 00"
Angle 1 5 2, mean value, 85° 21' 00"

FIGURE 12.

20 M. 46.20 Ch.



21 M. 72.30 Ch.

Solving Triangle 1 2 3, for 2, 1=x.
x = 8.63 x tan. 85° 21' 00"

Log. 8.63	0.9360108
Log. tan. 85° 21' 00"	1.0897147
	2.0257255

x = 1, 2. = 106.10 chs.

Line distance of Sta. 2,	20M. 46.20 chs.
Secant distance 1, 2,	1M. 26.10 chs.
Line distance of Sta. 1,	21M. 72.30 chs.

In this triangulation, fig. 12, the only place from which a base-line could be measured and laid off is at the point Sta. 1, neither can any other base be obtained on account of the conformation of the country. The angles were measured however with very great care and accuracy, and the base-line particularly well chained, and I know ~~that~~ the distance is correct, and besides the work will all be checked up in triangulation, fig. 11, partly completed from Sta. 1, fig. 12.

21M. 72.30 ch. Offset 2.28 ft. south and set a granite rock 30x8x6 ins. with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for Special Corner, marked 21M.+72.30 chs. on W. P.F.R. on S. and P.L on N. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Remainder of 22nd. MILE.

N. 89° 59' E. on secant.
Va. 18' 20" E.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	Difference in chaining is 0.
7.70	Offset 2.87 ft. south and set a granite rock 30x18x7 ins. with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for 22 Mile Corner, marked 22M. on W. P.F.R. on S. and P.L. on N. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, W. of corner, from which
	Index peak bears N. 57° 24' W.
	Pilot peak bears N. 55° 45' W.
	Land, marsny.
	Soil, mostly bog mold.
	No timber.

23rd. MILE.

East, on the ascent.
Va. 18° 20' E.

	Over slightly rolling ground.
	Difference in chaining is 0.
11.00	Offset 2.48 ft. south, and set a fir post, 12 ins. diam. squared to 10 ins., 6 ft. long, with granite boulder 8 ins. diam. marked with a X, 2 1/2 ft. in the ground, for Special Corner, marked 23M.+11 chs. on W. P.F.R. on S. and P.L. on N. faces, and raised a mound of stone 2 1/2 ft. high, 6 ft. base, W. of corner.
	Barometer indicates 7250 ft.
	The Cooke city and Billings wagon road runs 30 lks. north of this corner. in plain view.
15.00	Enter pine timber and ascend slope to north.
40.00	Point 300 ft. above last corner.
	Offset 2.85 ft. south, and find fir tree 10 ins. diam. which I cut off 5 ft. above ground, and square to 8 ins., for 22 1/2 Mile Corner, marked 22 1/2M. on W. P.F.R. on S. and P.L. on N. faces. from which,
	A pine 18 ins. diam. bears S. 58° E. 60 lks. dist., marked 22 1/2 M. P.F.R. 1898. B.T.
	A pine 12 ins. diam. bears N. 87° E. 56 lks. dist. marked 22 1/2 M. P.L. 1898. B.T.
	Barometer indicates 7050 ft.
	Thence ascend mountain slope to north, 250 ft. to corner.
	Difference in chaining is 8 lks., at middle point of difference
80.00	Offset 2.67 ft. south, and set a granite rock 20x16x6 ins.

Chains.

With granite boulder 5 ins.diam.marked with a X,, 20 ins in the ground, for 23rd.Mile Corner, marked 23M.on W. P.F.R. on S. and P.L. on N. faces, from which,

A pine 12 ins.diam. bears N.9°E. 25 lks.dist.marked 23M. P.L. 1893. B.T.

A pine 16 ins. diam. bears N.41°E. 62 lks. dist. marked 23M. P.L. 1893. B.T.

A pine 8 ins.diam. bears S.8°W. 28 lks.dist marked 23M. P.F.R. 1893. B.T.

No other suitable tree in limits.

Barometer indicates 7800 ft.

Land, mountainous.

Soil, mostly rocky, 4th.rate.

Timber, pine.

24th. MILE.

East, on the secant.
Va.18°15'E.

Ascend 150 ft. to

17.00 Top edge of canyon, descend abruptly. 200 ft. to

21.90 Cross creek, 10 lks. wide, course N.

This creek empties into the Clark's Fork canyon, about 25 chs. N. of line, which is the nearest point to which the line approaches the Clark's Fork river, which takes an abrupt turn to the N.E.at this point.

Thence ascend abruptly to

51.00 Foot of a nearly perpendicular lime stone mountain. Chaining further is impracticable, and triangulation from this point equally so, and as I have a triangulation point ahead, Sta.X, fig.11, page 78 I proceed to the flag at that point. Arriving at the flag, I find a deep X cut in the solid rock by my flagman. At the point where the falg stood, Sta X over which

I set the instrument, and with vernier at zero,
Set on Sta.W.
Unclamp plates and set on Sta.Z.
Vernier reads 4°17'00"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.Z.
Vernier reads 8°34'00"
Angle WXZ, mean value, 4°17'00"

Set on Sta.W, vernier at zero.
Unclamp plates and set on Sta.6.
Vernier reads 6°30'30"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.6.
Wernier reads 15°01' plus.
Unclamp below and set on Sta.W.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains

Unclamp plates and set on Sta.6.
Vernier reads 19°52'00
Angle WX6, mean value, 6°50'40"

Closing error of triangles.

Triangle XWZ,		Triangle WX6.	
Angle XZW,	85°45'10"	Angle 6WX,	90°00'00"
Angle XWZ,	90.00.00	Angle W6X,	83.29 50
Angle WXZ,	4.17.00	Angle WX6,	6.30 40
the sum is	180.00.10	the sum is	180.00 10
Closing error 10" plus.		Closing error 10" plus.	

I consider the observations at Sta.W, of the angles XWZ and 6WX, perfect in every particular. I therefore divide the small closing errors apparent, as follows

Corrected angles of triangles.

Triangle XWZ.		Triangle 6WX.	
Angle XZW,	85°45'05"	Angle 6WX,	90°00'00"
Angle XWZ,	90.00.00	Angle W6X,	83.29.25
Angle WXZ,	4.18.57	Angle WX6,	6.30.35
the sum is	180.00.00	the sum is	180.00.00

This point stands on the very edge of a precipice 800 ft. high, the mountain breaking away almost perpendicularly, towards the east.

Barometer indicates 8900 ft.

Solving the triangles XWZ and 6WX, for WX, page 78 I find that Sta.X is at 24M.+2.55 chs. Thence I run -

On the 25 th. MILE.

N.89°59' W. on the secant.
Va.18°15'E.

Descend 75 ft. to
Difference in chaining is 0
2.55 Offset 1.44 ft. south, and set a lava rock 36x12x7 ins. with granite boulder 5 ins.diam.marked with a X, 24 ins.in the ground, for 24th.Mile Corner, marked 24M.on W. P.P.R.on S. and P.L. on N. faces, and raised a mound of stone 2 1-2 ft. high, 5 ft. base, W.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine 31 chs.

Solving triangle XWZ, for WX = x
26.26 x tan.85°45'05" = WX.

Log.26.26	1.4192947
Log.tan.85°45'05"	1.1256154
	2.5449101

x = WX = 350.68 chs.

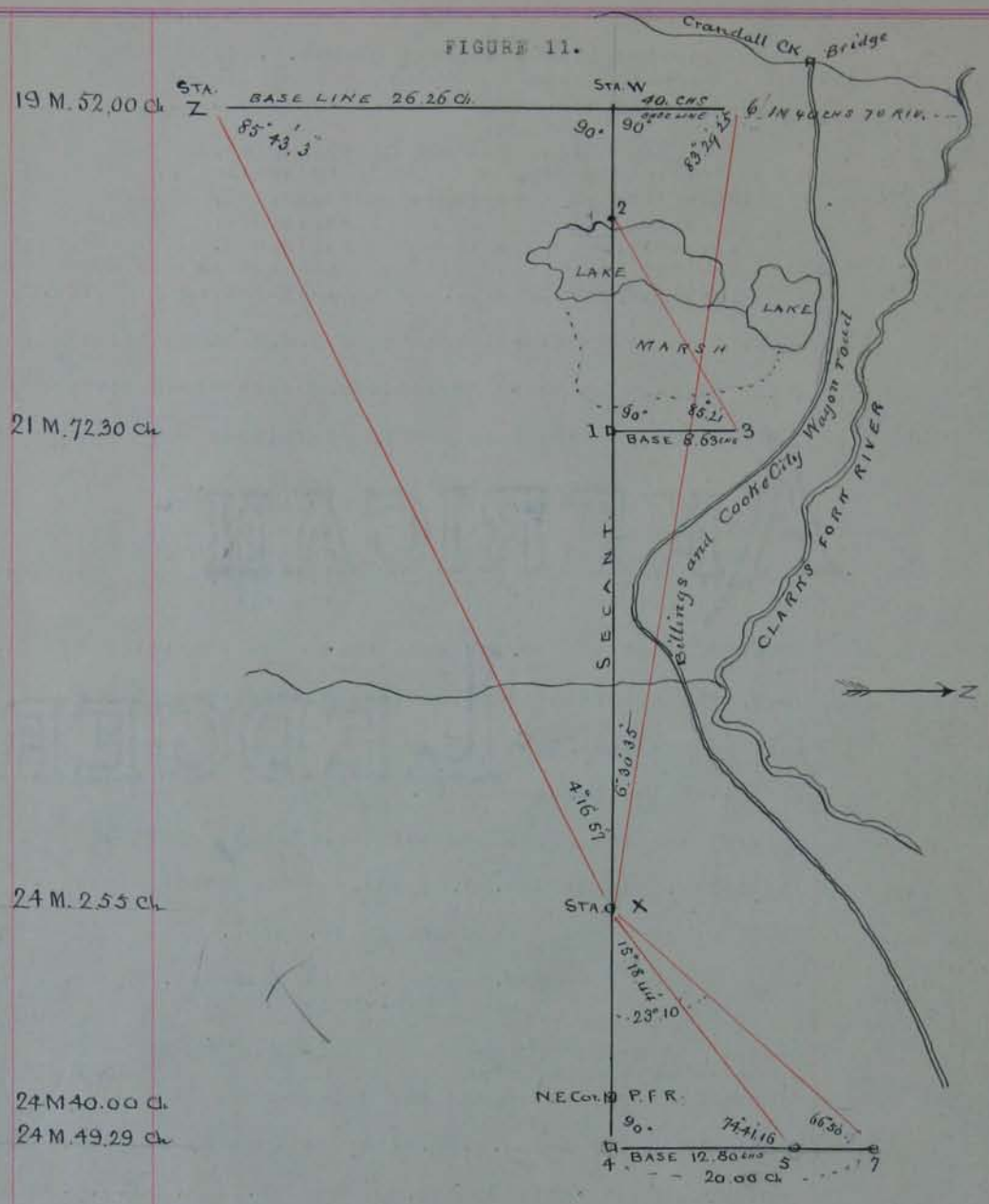
Solving triangle 6WX, for WX. = x
40.00 x tan.83°29'25" = WX.

Log.40.00	1.6020600
Log.tan.83°29'25"	0.9426858
	2.5447458

x = WX = 350.55 chs.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

FIGURE 11.



The difference in the computed values of WX is 15 lks. but as the triangle 8WX has the longer base I assume the distance WX = 850.55 chs.

Line distance Sta. W,	19M. 52.00 chs.
Secant distance WX = 850.55 ch. =	4M. 30.55 chs.
The sum, line distance St. X	24M. 02.55 chs.

Solving triangle X 4 5 for X4. = x

12.80 x tan. 74° 41' 16" = 4 X.

Log. 12.80	1.1072100
Log. tan. 74° 41' 16"	0.5625692
	1.6697792

x = 4X = 46.75 chs.

Solving triangle X47, for X 4. = x

20.00 x tan. 66° 50' 00" = X 4.

Log. 20.00	1.3010300
Log. tan. 66° 50' 00"	0.3866455
	1.6876755

x = X 4 = 48.74 chs.

As the triangle X47 has a longer base than the triangle X45, I assume 48.74 chs. as the correct value od X4.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

NOTE,
Reference is hereby made to page 78 for notes of triangulation 45X and 47X.

Returning now to Sta.X, at 24W.+2.55 chs. I offset 1.39 ft. south and mark a X in ledge of rock, for Special Corner. This ledge is too irregular to inscribe proper marks, so I set a lava rock 30x10x7 ins. over the X, marked 24W. 02.55 chs. on W. P.F.R. on S. and P.L. on N. faces. Piled rock around it and raised a mound of stone 4 ft. high, 5 ft. base, N. of corner. from which

Cupola peak bears S.12°.25' W.

Monument on Fishtail mountain bears N.89°59' W.

As triangulation from this point is not feasible for lack of room, I send a flag ahead and set it on the secant, Sta. 4, fig. 11.

September 2nd. 1893.

I compare my chains with the standard and find them correct.

On the evening of September 2nd. 1893, from Sta. 4 on the secant, I observe Polaris at its eastern elongation, at 8h. 38m. P.M., mean local time, and find its magnetic bearing to be N.18° 31' W.

North end of needle	18° 31' E.
Azimuth, by table in Manual, is	1.47 E.
the sum is the Va.	16.16 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N.

On the morning of September 3rd. 1893, with instrument at point of last night's observation, Sta. 4, fig. 11,

Set on tack in hub, 4.00 chs. N., vernier at zero.
Unclamp plates and set on Sta. X.
Vernier reads 89°59' 00"
verifying the direction of the secant X 4.

Instrument at Sta. 4, vernier at zero.
Set on Sta. X.
Unclamp plates and deflect 90° from west towards north, and in this direction measure a base-line 12.80 chs. At the north end of which I set a stone level with the top of the ground, on the top of which I mark a X on line, and exactly 12.80 chs. from Sta. 4, for Sta. 5. I also extend the base-line in same direction, and at exactly 20.00 chs. from Sta. 4, and on extended line, 4 5 set a tack in hub, for Sta. 7.
Set on Sta. X, vernier at zero.
Unclamp plates and set on Stas. 5 and 7.
Vernier reads 90°00' 00"

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Unclamp below and set on Sta. X.
Unclamp plates and set on Stas. 5 &7.
Vernier reads 180° 00′ 00″
Angle X 4 5, mean value, 90° 00′ 00″

Instrument at Sta. 5, vernier at zero.
Set on Sta. 4.
Unclamp plates and set on Sta. X.
Vernier reads 74°.41′. plus.
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. X.
Vernier reads 149°.23′. minus.
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. X.
Vernier reads 224°.04′.00″.
Angle 4 5 X, mean value, 74° 41′ 20″

Instrument at Sta. 7, vernier at zero.
Set on Sta. 4.
Unclamp plates and set on Sta. X.
Vernier reads 66°.50′.00″.
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. X.
Vernier reads 133°.40′.00″
Angle X 7 4, mean value, 66° 50′ 00″

Instrument at Sta. X, vernier at zero.
Set on Sta. 4.
Unclamp plates and set on Sta. 5.
Vernier reads 15°.19′. minus.
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. 5.
Vernier reads 30°.38′.
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. 5.
Vernier reads 45°.56′.50″
Angle 4 X 5, mean value, 15° 18′ 50″

Set on Sta. 4, vernier at zero.
Unclamp plates and set on Sta. 7.
Vernier reads 25°.10′.00″
Unclamp below and set on Sta. 4.
Unclamp plates and set on Sta. 7.
Vernier reads 46°.20′.00″
Angle 4 X 7, mean value, 25° 10′ 00″

Closing error of triangles.

Triangle X 4 5.		Triangle X 4 7.	
Angle X45,	90°00′00″	Angle X47,	90°00′00″
Angle 4X5,	15.18.50	Angle 4X7,	25.10.00
Angle 45X,	74.41.20	Angle X74,	66.50.00
the sum is	180.00.10	the sum is	180.00.00
Closing error	10″	Closing error	0.

The right angle X45 I consider correct, and the angle 45X a somewhat better observation than the angle 4X5, in triangle X 4 5, and therefore divide the 10″ error between 4X5 and 45X, in the proportion of 6 to 4, as follows

Corrected angles of triangle 4X5.

Angle X45,	90°00′00″
Angle 4X5,	15.18.44
Angle 45X,	74.41.16
the sum is	180.00.00

Reference for solution of triangles 5X4 and X47 is hereby made to fig. 11, page 78 of these notes.

Line and secant distance Sta. X,	24M. 2.55 chs.
Secant distance X 4,	46.74 chs.
Line and secant distance Sta. 4,	24M. 49.29 chs.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

As Sta.4 is 9.29 chs. too far east. From Sta.4, I run-

N.89° 59' W. on the secant,
Va.18° 18' E.

5.50 Enter heavy pine timber and ascend 75 ft. to

Difference in chaining is 0.

9.29 Offset ~~north~~ 0.38 ft. South to N.E.Corner Public Forest Reservation.

24M. 40.00 Set a lava rock 30x10x8 ins. with granite boulder 5 ins.diam. marked with a X, 20 ins.in the ground, for N.E.Corner Public Forest Reservation, marked P.L. on N.W., P.L.on N.E. P.L. Lat.44° 50' N. on S.E. and N.E.Cor.P.F.R. 1893.on S.W. faces, from which,

A pine 12 ins.diam.bears S.55° W. 31 lks.dist. marked N.E.Cor. P.F.R. 1893. B.T.

A pine 18 ins. diam.bears N.37° W. 50 lks.dist.marked N.E.Cor. P.F.R. 1893.PL.B.T.

A pine 18 ins. diam.bears N.46° E.25 lks.dist. marked N.E.Cor. P.F.R. 1893.PL.B.T.

A pine 17 ins.diam.bears S.84° E. 28 lks.dist.marked N.E.Cor. P.F.R. 1893 .PL B.T.

At 12 ins.S.and 14 ins.W. stands a spruce tree 18 ins.diam. which I cut off 6 ft. above the ground, and square to 12 ins. with the faces directed NE.SE.SW.and NW., hewing the top into the form of a square pyramid, marked P.L.on N.W. P.L. on N.E. P.L.Lat.44° 50' N.on S.E. and N.C.N.E.Cor.P.F.R., 1893. on S.W.faces. Dug 2 pits 48x48x12 ins. NE.and SW.of corner, 8 ft.dist. and raised a mound of earth, in the form of the frustum of a square pyramid, 6 ft.base, 4 ft.high, over the corner and around the post.

Barometer indicates 7300 ft.

There are no stones in the neighborhood except lava which are so cracked and seamed by heat, that they fall to pieces in handling, and are unfit to construct a mound. I managed to secure one for the corner, harder and more solid than the rest, but it was all I could find of any account,, and I considered the mound of earth preferable to a stone mound built of such material

From the N.E.Corner of the Public Forest Reservation, just established, I run -

Remainder of 24 1/2 MILE.

NORTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	N. 89° 59' W., on the secant Va. 18° 18' E.
	Ascend through heavy pine timber, 500 ft. to
18.00	From this point the line runs along the face of a rocky lava cliff to the point X, at 24M+2.55 chs., 1000 ft. above, and chaining being impracticable any further, I am obliged to discontinue the line

GENERAL DESCRIPTION,
of the North Boundary of the Public Forest Reservation.

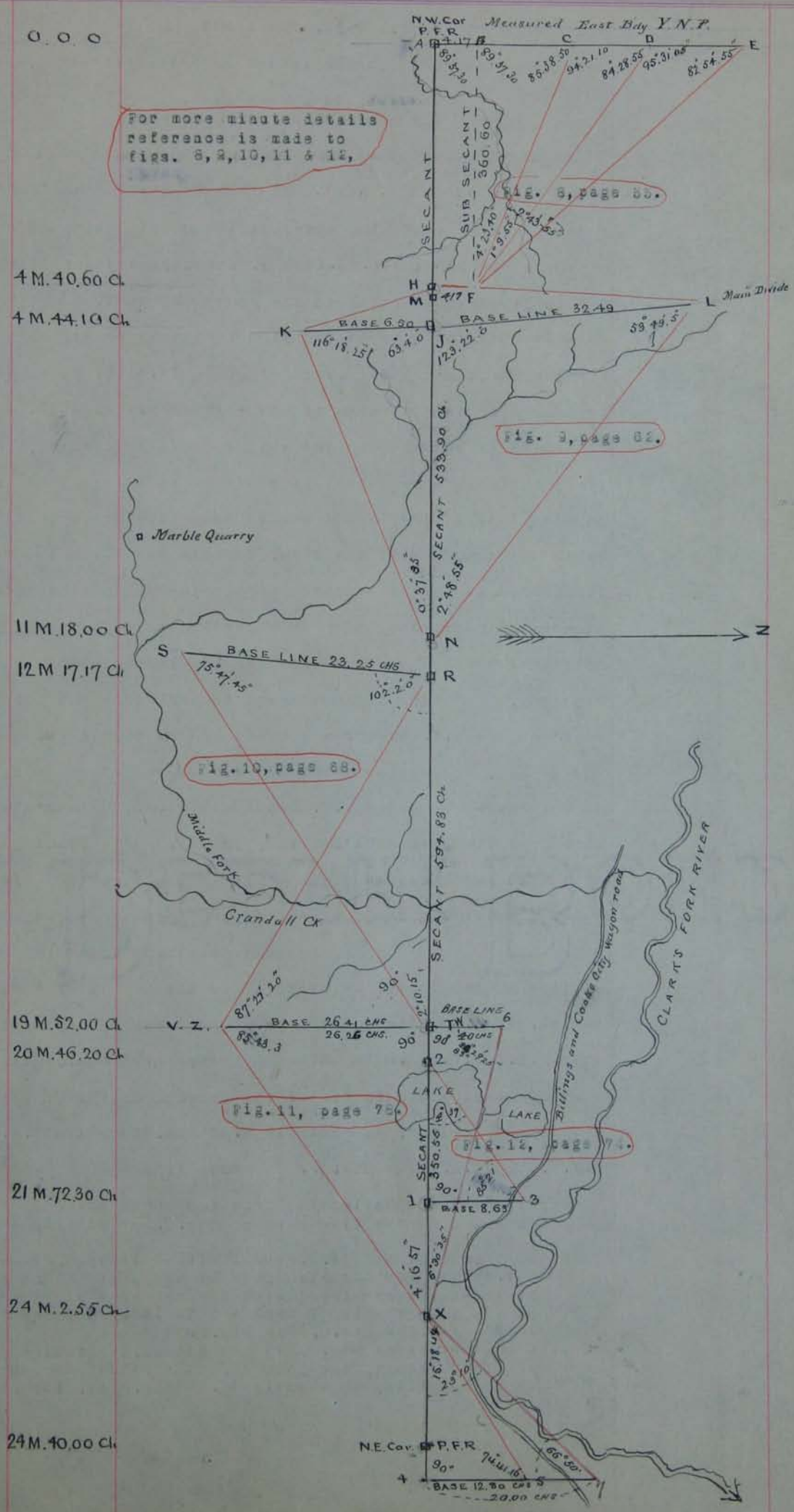
This line, with the exception of a few miles from Crandall creek east, runs for the entire distance, (24 1/2 Miles,) over high, broken and pricipitous mountains, and deep impassible canyons of such rough and rogged character that it is difficult and dangerous to get around among them, and in most places impossible. The tops of the mountains are at an altitude of from 11 to 12 thousand feet, and the canyons cutting through them are from 3 to 4 thousand feet lower.

For a large portion of the distance chaining has been impossible, but a line of triangulations has been carried through almost the entire distance, in the most perfect manner, and corners have been established in their proper locations wherever they could be reached, by any route I could find that did not appear too hazardous, and while quite a number of the regular Mile and half mile corners have been necessarily omitted, a large number of Special Corners have been constructed in the most perfect and enduring manner, in places where they can be more readily seen than though built at the places contemplated in the Instructions, at mile and half mile points. I have no doubt that it would be practically impossible for any one crossing the line, to do so without noticing them.

In all the lower altitudes, i,e, below 8000 ft. the country is covered with a dense growth of timber (mostly pine) except in the Crandall creek basin, where from the 19th. to the 22nd. mile corners there is nothing but scattering timber.

On the middle fork of Crandall creek there is a fine deposit of excellent marble, some work having been done on it to open a quarry. It cannot be seen from any point on the line, but lies about a mile to the south of it.

DIAGRAM 8.
North Boundary Public Forest Reservation.



EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

26th. MILE, continued

From the North East Corner Public Forest Reservation, I run

South, on a true line.
Va. 18°18' E.

Ascending through heavy pine timber, blazing the line.

18.00 Point 800 ft. above N.E.Cor., at foot of steep bluffs, at foot of a high mountain, which is the continuation of that on which Sta.X, at 24M.+2.66 chs. stands, and which from the point X extends around to the south and east.

This line I find upon examination from this point, runs up the face of the mountain, which is 8000 ft. high, rough and broken, with a dense mass of down-timber covering it. I do not think it possible to get a line up it by chaining, and if it could be done at all it would be at the cost of a couple of days time, and I should then have grave doubts as to the accuracy of the work. In this situation I have considered it best to triangulate to the top of the mountain, about a mile distant, thereby assuring the accuracy of the alignment and the distance of this the beginning of this boundary. Triangulation cannot be made from any point south of the N.E.Corner, on account of the conformation of the ground, and timber intervening. I therefore proceed as follows - From the N.E.Corner of P.F.R., just established, I run North on a true line, 13 chs. Finding that I cannot obtain a sight to the south from this direction, I ascertain, by double back and fore sights, that a sharp high point of rock, located on a high mountain some 4 miles to the north, is directly on the meridian, Noted as Sta.B, fig.15, for future use. I then return to the said N.E.Cor. P.F.R. and Offset due east 9.25 chs., setting a stone level with the top of the ground, on top of which I mark a X on line, and exactly 9.25 chs. from the N.E.corner P.F.R., (Sta.A,) for Sta.C., then with

Vernier at zero, deflect 90° from the north towards the east and strike flag held on Sta.C, verifying the angle BAC.

With instrument at Sta.C, extend offset line AC, 18.00 chs. east, for base-line, and at the east end of base line set a stone level with the top of the ground, on the top of which I mark a X on line, and exactly 18.00 chs from Sta.C, for Sta.D.

With instrument at Sta.D, I ~~then~~ extend, by double back and fore sights, the line AD, to the east and set tack in hub on line, and exactly 10.00 chs.dist. for Sta.D.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

I then set a flag on top of the mountain to the south, and on the meridian passing through Sta. C, for Sta. E.

Instrument at Sta. C, vernier at zero.
Set on Stas. D and D′
Unclamp plates and set on flag at Sta. E.
Vernier reads 90° 00′ 00″
Unclamp below and set on Stas. D and D′
Unclamp plates and set on Sta. E.
Vernier reads 180°.00′.00″
Angle ECD, mean value, 90°.00′.00″

Instrument at Sta. D, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. C.
Vernier reads 82°.16′.00″
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. C.
Vernier reads 164°.32′.00″
Angle EDC, mean value, 82° 16′ 00″

Instrument at Sta. D′, vernier at zero.
Set on Sta. C.
Unclamp plates and set on Sta. E.
Vernier reads 77°.14′.30″ plus.
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. E.
Vernier reads 154°.29′.30″
Angle CD′E, mean value 77° 14′ 45″

I then proceed to the flag at Sta. E, leaving back sights at Stas. C, D and D′. Arriving at the flag I find a stone in place, on the top of which is a X marked by my flagman, at exact spot where flag stood, over which I set the instrument.

I set the instrument, vernier at zero.
Set on Sta. D.
Unclamp plates and set on Sta. C.
Vernier reads 7°44′ ″ plus.
Unclamp below and set on Sta. D.
Unclamp plates and set on Sta. C.
Vernier reads 15°.28′.30″
Angle CED, mean value, 7° 44′ 15″

Set on Sta. C, vernier at zero.
Unclamp plates and set on Sta. D′.
Vernier reads 12′.45″. plus.
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. D.
Vernier reads 25°.30′.30″
Angle CED′, mean value, 12° 45′ 15″

Closing errors of triangles.

Triangle CDE.		Triangle CED′.	
Angle DCE,	90° 00′ 00″	Angle D′CE,	90° 00′ 00″
Angle CDE,	82.16.00	Angle CD′E,	77.14.45
Angle DEC,	7.44.15	Angle CED′,	12.45.15
the sum is	180 00 15	the sum is	180 00 00
Closing error 15″		Closing error	0

The error in triangle CDE is small and I think is mostly in the small angle DEC. The angle DCE I consider absolutely correct, I therefore divide the error of 15″ between CDE and DEC, as follows -

Corrected angles of triangle CDE.

Angle DCE,	90° 00′ 00″
Angle CDE,	82.16.55
Angle DEC,	7.44.05
the sum is	180.00.00

vernier at zero

Set on Sta.C.
Unclamp plates and deflect 90° towards the west, and in this direction measure 9.25 chs. to the East Boundary Public Forest Reservation. Set a tack in hub on line and exactly 9.25 chs. from Sta.E, for Sta.F.

Vernier at zero.

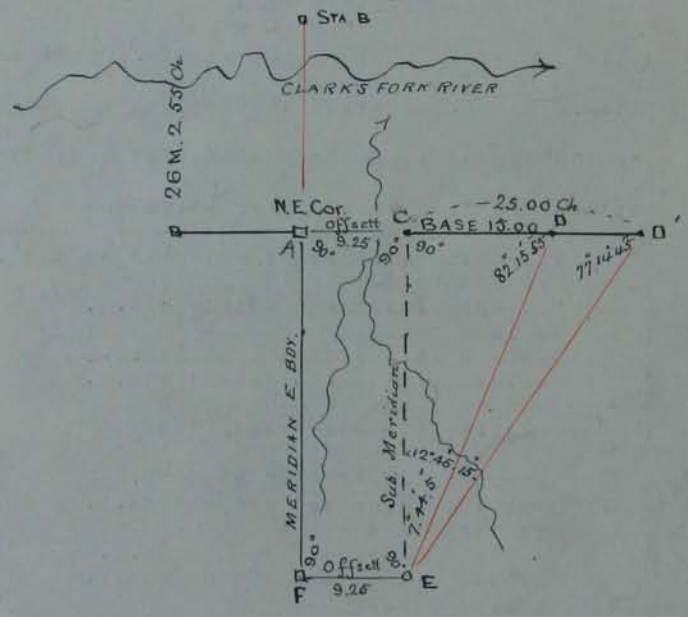
Set on Sta.C.
Unclamp plates and set on Sta.F.
Vernier reads 90°00'00"
Unclamp below and set on Sta.C.
Unclamp plates and set on Sta.F.
Vernier reads 180.00.00
Angle CEF, mean value, 90° 00'00"

Instrument at Sta.F, vernier at zero.
Set on Sta.E, and deflect 90° from north towards east and strike flag held at Sta.E.

Barometer indicates 9800 ft.

The meridian to the north of this point drops off over a very steep bluff 500 ft. high, and chaining north I find impracticable.

FIGURE 15



Solving triangles for CE = x

Triangle CDE.		Triangle CDE
25.00 x tan. 77° 14' 45" = x.		15.00 x tan. 82° 15' 55" = x
Log. 25.00	1.3979400	Log. 15.00 1.1760913
Log. tan 77° 14' 45"	0.6482181	Log. tan. 82° 15' 55" 0.8670284
	2.0461581	2.0431197
x = CE = 110.445		x = CE = AF = 110.44 chs

The mean distance is therefore 110.44 chs = 1M 30.44 chs.

Line distance Sta.A,	24M.40.00 chs.
Meridian distance AF,	1M.30.44 chs
Line distance Sta.F.	25M.70.44 chs.

25M.70.44chs Sta.F. Set a sandstone 30x8x8 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for Special Corner, marked 25M.+ 70.44 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, and a X cut on top of corner, and

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains

raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

The magnetic needle at this point is very flighty, indicating a variation of 25°. Thence I run -

REMAINDER OF 26th. MILE.

South, on a true line.
Va. 25° E.

Descend slope to south, 100 ft. to

Difference in chaining is 1 lk. at middle point of diff.

9.56 Set a cut pine post 8 ins. square, 5 ft. long, with granite boulder 5 ins. diam. marked with a X, 50 ins. in the ground, for 26th. Mile Corner, marked 26M. on N. P.F.R. on W. and P.L. on E. faces. Dug 2 pits 36x36x12 ins. E. & W. of post, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner. from which

Pilot peak bears N.57° 34' W.

Index peak bears N.56° 8' W.

This meridian crosses the highest point of a very high and pointed peak to the south, on the summit of which is a rock directly on the meridian, and as a check, or for future use if necessary, I now make a triangulation to it as follows - Sending a flag across a deep canyon to the west, I set it on the top of a high mountain, and mark the spot with a X in the solid rock. Sta. G, fig. 14, page 89 I then carefully re-chain the distance on the meridian from the 25M. corner, Sta. H, north to the Special corner at 25M + 70.44 chs. and find it to be exactly 9.55 chs., using it as a base from which to measure the distance GH, which distance cannot be accurately chained, and which I propose using as a base-line from which to measure the line distance from Sta. H to the rock on mountain to south, Sta. I, the Special corner at 26M. + 70.44 chs. being taken as Sta. F.

Instrument at Sta. H, vernier at zero.
Set on Sta. F.
Unclamp plates and set on Sta. G.
Vernier reads 76° 23' 00"
Unclamp below and set on Sta. F.
Unclamp plates and set on Sta. G. ° ' "
Vernier reads 152.46.00
Unclamp plates and set on Sta. I ° ' "
Vernier reads 256.23.00

Set on Sta. I *vernier at zero*
Unclamp plates and set on Sta. G. ° ' "
Vernier reads 103.37.00
Unclamp plates and set on Sta. F.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Vernier reads 180°00'00"
Angle JHG, mean value, 105° 57' 00"
Angle GHF, mean value, 78.28.00

Instrument at Sta.F, vernier at zero.
Set on Sta.H.
Unclamp plates and set on Sta.G.
Vernier reads 87°.20'.00"
Unclamp below and set on Sta.H.
Unclamp plates and set on Sta.G.
Vernier reads 174°.40'.00"
Angle HFG, mean value, 87° 20' 00"

Instrument at Sta.G, vernier at zero.
Set on Sta.F.
Unclamp plates and set on Sta.H.
Vernier reads 16°.17'.00"
Unclamp plates and set on Sta.I.
Vernier reads 91°.04'.00"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.H.
Vernier reads 107°.21'.00"
Unclamp plates and set on Sta.I.
Vernier reads 182°.08'.00"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.H
Vernier reads 198°.25'.00"
Unclamp plates and set on Sta.I.
Vernier reads 273°.12'.00"
Angle FGI, mean value, 91° 4' 00"

Set on Sta.F, vernier at zero.
Unclamp plates and set on Sta.H.
Vernier reads 16°.17'.00"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.H.
Vernier reads 32°.34'.00"
Angle FGH, mean value, 16° 17' 00"
Angle HGI, mean value, 74.47.00

Closing error of triangle HGF.

Angle HGF,	16° 17' 00"
Angle GFH,	87.20.00
Angle FHG,	76.25.00
the sum is	180.00.00

Closing error 0.

Solving triangle FGH, for HG = x.

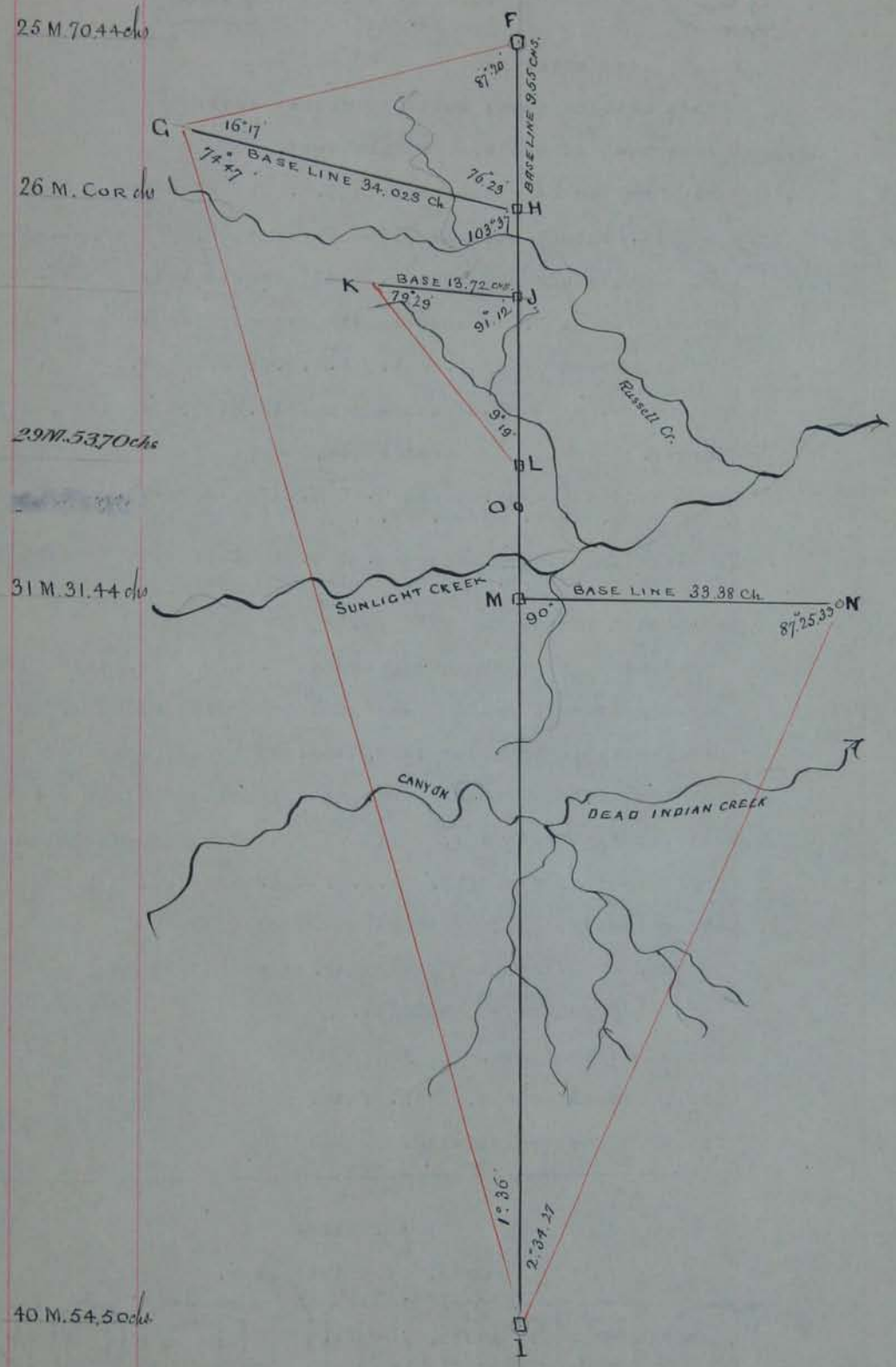
9.55 : sin.16° 17' 00" :: x : sin.87° 20' 00".

Log. 9.55	0.9800054
Log.sin.87° 20' 00"	9.9995295
	10.9795349
Log.sin.16° 17' 00"	9.4477555
	1.5317794

x = GH = 34.023 chs.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

FIGURE 14.



EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	From the 26M. corner I run -
	on 27th. MILE.
	South, on a true line, Va. 25° E.
	Descending slightly.
5.25	Cross head of small gulch, course west.
18.50	Cross head of gulch, course west.
20.00	Point on top of ridge, course S.W. Barometer indicates 9500 ft. Descend abruptly, through scattering pine, 800 ft. to
40.00	Set a sandstone 40x8x8 ins., with granite bould 5 ins. diam. marked with a X, 24 ins. in the ground, for 26 1/2 Mile Corner, marked 26 1/2M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. from which,
	A pine 18 ins. diam. bears S. 10° E. 175 lks. dist., marked 26 1/2M. P.L. 1895. B.T.
	A pine 14 ins. diam. bears S. 80° W. 50 lks. dist., marked 26 1/2M. P.F.R. 1895. B.T.
	Barometer indicates 8700 ft.
58.00	Cross head of a dry gulch, course S.E., 200 ft. below last corner, thence descend over broken ground, 300 ft. to
	Difference in chaining is 15 lks. at middle point of difference
80.00	Set a sandstone 58x10x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 27 Mile corner, marked 27M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. No suitable bearing trees within limits.
	Barometer indicates 8200 ft.
	Land, mountainous.
	Soil, mostly rocky, 4th. rate.
	Timber, scattering pine.

28th. MILE.

South, on a true line. Va. 18° 30' E.

	Descend slope to south, 200 ft. to
16.00	Cross Russell creek, 5 lks. wide, course east, and ascend gradually.
17.00	Enter pine timber, and ascend abruptly.
40.00	Point 800 ft. above creek. Set a pine post 7 ins. square,

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

5 ft. long, with granite boulder 5 ins. diam, marked with a X, 2 1/2 ft. in the ground, for 27 1/2 Mile corner, marked 27 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, from which -

A pine 18 ins. diam. bears S. 18° E. 85 lks. dist., marked 27 1/2M. P.L. 1893. B.T.

A pine 28 ins. diam. bears S. 88° W. 90 lks. dist., marked 27 1/2M. P.F.R. 1893. B.T.

Dug 2 pits 36x36x12 ins. E. & W. of post, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of Cor.

Barometer indicates 3500 ft.

Thence ascend gradually up grassy coulee, course N. 5° E.

52.00 Leave timber, and ascend gradually 500 ft.

Difference in chaining is 5 lks., at middle point of difference

80.00 Set a sandstone 30x3x3 ins., with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for 28 Mile Corner, marked 28M. on N. P.F.R. on W. and P.L. on E. faces, from which -

A pine 12 ins. diam. bears N. 89° W. 12 lks. dist. marked 28M. P.F.R. 1893. B.T. No other trees in limits.

Dug 2 pits 36x36x12 ins. E. & W. of stone, 4 ft. dist. and raised a mound of earth, 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 9600 ft.

Land, mountainous.

Soil, sandy loam, 1st. rate.

Timber, pine.

September 3rd. 1893.

I compare my chains with Standard and find them correct.

On the evening of September 3rd. 1893, from the 28th. Mile corner, I observe Polaris at its eastern elongation, at 8h. 32m. P.M., mean local time, and find its magnetic bearing to be N. 18° 30' W.

North end of needle	18° 30' E.
Azimuth, by table in Manual,	1s.1.47 E.
the sum is the Va.	18.17 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. north

---

On the morning of September 4th. 1893, with instrument at

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

28th. Mile corner, direct the telescope to tack in hub 4.00 chs. north, established on the meridian last night, and sighting north strike flag field on last hub established yesterday, on line, verifying yesterday's work. Thence I run -

29th. MILE.

South, on a true line.
Va. 16° 25' E.

Ascending gradually up grassy coulee, 200 ft. to

14.55 Set a flag as a back sight. Top of narrow divide extending E. & W. Thence descend 300 ft., over broken rocky ground, through scattering pine and cedar of scrubby growth, to

40.00 Set a sandstone 36x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 24 ins. in the ground, for 28 1/2 Mile Corner, marked, 28 1/2M. on N. P.F.R. on W. and P.L. on E. faces, from which -

A fir 14 ins. diam. bears S. 45° W. 100 lks. dist., marked 28 1/2M. P.F.R. 1895. B.T. No other tree in limits.

Dug 2 pits 36x36x12 ins. E. & W. of stone, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner.

Thence ascend 100 ft. to

50.38 Point on top of high rocky ridge extending nearly E. & W. From this point the line crosses two deep canyons, within a mile, the sides of which are so nearly perpendicular that chaining is impracticable, and accuracy impossible. I therefore mark a deep X in the solid rock, and as rock is too seamy to make legible figures, over the X I set a sandstone 30x7x5 ins., for Special corner, marked 28M.+50.38chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, and built stone around it, on the top of which I mark a X, directly over X in solid rock. Sta. J, fig. 15, page 93

Instrument at Sta. J, vernier at zero.
Deflect 91° 12' from the south towards the west, and in this direction measure a base-line 15.72 chs. long, at the west end of which I mark a X in the solid rock on line, and exactly 15.72 chs from Sta. J, for Sta. K. Having set a flag on the meridian to south, Sta. L.
Unclamp plates and set on Sta. K.
Vernier reads 182° 24' 00"
Angle KJL, mean value, 91° 12' 00"

Instrument at Sta. K, vernier at zero.
Set on Sta. J.
Unclamp plates and set on Sta. L.
Vernier reads 79° 29' 00"
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. L.
Vernier reads 158° 58' 00"
Angle JKL, mean value, 79° 29' 00"

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Barometer indicates 8800 ft.

Instrument at Sta.L, vernier at zero.
Set on Sta.J.
Unclamp plates and set on Sta.K.
Vernier reads 9°19'00"
Unclamp below and set on Sta.J.
Unclamp plates and set on Sta.K. .
Vernier reads 18° 38' 00'
Angle JLK, mean value, 9°19'00"

Closing error of triangle JKL.

Angle JKL,	79°29'00"
Angle KLJ,	9.19.00
Angle LJK,	91.12.00
the sum is	180.00.00

Closing error 0.

Solving triangle JKL, for JL = x.

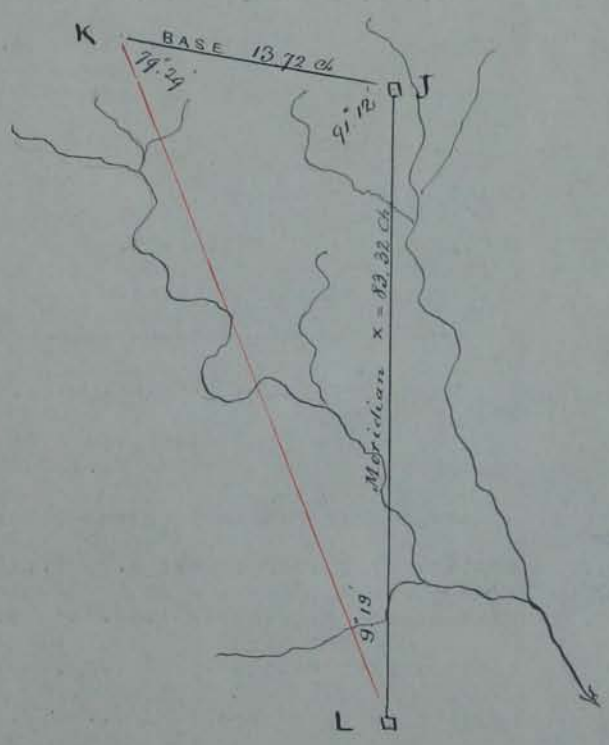
18.72 : sin. 9°19'00 :: x : sin.79°29'00"

Log. 18.72	1.1872841
Log.sin.79°29'00"	9.9926427
	11.1799268
Log.sin. 9°19'00"	9.2092224
	1.9207744

x = JL = 83.32 chs.

FIGURE 18.

28 M. 50.38 ch



29 M. 53.70 ch

As this triangulation will be checked up in the triangulation from 26 Mile corner to 40M.+34.50 chs. I do not make a second triangulation from J to L.

Line distance of Sta.J.	28M.50.38 chs.
Meridian distance of JL,	1M.03.32 chs.
Line distance of Sta.L.	29M.53.70 chs.

Sta.L stands on the point of a high ridge extending west.

Barometer indicates 7800 ft.

29M.53.70ch Sta.L. Marked a X in the solid rock. As the surface is too irregular to permit proper marks, over the X I set a sand-

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

stone 30x7x6 ins., for Special corner, marked 29M.+53.70 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, with a X on top Built a mound of stone around it, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Thence I run -

Remainder of 30th. MILE.

South, on a true line.
Va. 16° 28' E.

Descending over rough and broken ground, 800 ft. to

Difference in chaining is 1 lk. at middle point of difference

26.80 Set a lava rock 30x8x6 ins. with granite boulder 5 ins. diam, marked with a X, 20 ins. in the ground, for 30th. Mile Corner, marked 30M. on N. P.F.R. on W. and P.L. on E. faces, from which

A nut pine 10 ins. diam. bears N. 82° E. 30 lks. dist., marked 30M. P.L. 1893. B.T. No other suitable trees within limits. Dug 2 pits 36x36x12 ins. E. & W. of stone, 4 ft. dist. and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, scattering pine.

31st. MILE.

South, on a true line.
Va. 16° 18' E.

Descend over rough and broken ground, 800 ft. to

24.00 Bottom of gulch, course S. 70° E., thence ascend 200 ft. to
31.80 Top of ridge, Course S 70° E., thence descend 100 ft. to
40.00 Set a lava rock 32x8x6 ins. with granite boulder 5 ins. diam. marked with a X, 20 ins. in the ground, for 30 1/2 Mile corner, marked 30 1/2M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Thence ascend 100 ft. along mountain slope to east, to

74.00 Point of mountain. (Barometer indicates 7900 ft.) thence descend 800 ft. to

79.00 Foot of mountain. Point on Sunlight creek bottom.

Difference in chaining is 10 lks. at middle point of diff.

80.00 Set a granite rock 34x12x8 ins, with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 31 Mile corner, and N. of 31M. on N. P.F.R. on W. and P.L. on E. faces, and

Chains. diam., marked with a X, 20 ins. in the ground, for 51 Mile corner, marked 51M. on N. P.F.R. on W. and P.L. on E. faces, dug 2 pits 36x36x12 ins. E.& N. of stone, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of Cor.

Land, mountainous.

Soil, mostly rocky, 4th. rate.

Timber scattering pine September 4th. 1892.

I compared my chains with the standard and found them correct.

On the evening of September 4th. 1892, at the 51 Mile corner, I observe Polaris at its eastern elongation, at 8h. 28m. P.M. mean local time, & find its magnetic bearing to be N. 16° 50' W

North end of needle	16° 50' E.
Azimuth, by table in Manual, is	1.47 E.
the sum is the Va.	18.17 E.

I lay off the azimuth to the west, and mark the true meridian, so determined, by hub and tack, 5.00 chs. N.

On the morning of September 5th. 1892, with instrument at the point of last night's observation, I direct the telescope to the tack in hub, 5.00 chs. N., and sighting back on the meridian, strike flag held on last point set on the meridian yesterday.

Thence I run -

52nd. MILE.

South, on a true line,
Va. 18° 22' E.

Over bottom.

8.50 North bank of Sunlight creek, course east.

9.75 South bank of same. Enter brush.

14.00 North bank of Sunlight creek, course north west

14.95 South bank of same.

22.70 North bank of Sunlight creek, course east. Leave brush.

25.50 South bank of same.

31.44 Set a pitch pine post 6 ins. square, 5 ft. long,, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for Special corner, marked 51M.+31.44 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, Dug 2 pits 36x36x12 ins. E.& N. of post, 4 ft. dist., and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner, from which -

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Al. Beam's house bears N. 82° E.

40.00 Set a pitch pine post 7 ins. square, 5 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 51 1/2 Mile corner, marked 51 1/2 M on N. P.F.R. on W. and P.L. on E. faces, dug 2 pits 36x36x12 ins. E. & W. of post, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner. From which Al. Beam's house bears N. 23° E. Barometer indicates 7800 ft.

42.00 Foot of perpendicular cliff, 800 ft. high and inaccessible. From this point the line runs along the east face of a rocky cliff, for some 2 miles, then crosses a gulch and runs over the divide between Sunlight creek and Dead Indian creek, crossing the divide at an altitude of 12,000 ft. among precipitous mountains, cut up by canyons from 1 to 2 thousand ft. deep. It then crosses Dead Indian creek canyon, 3000 ft. deep and so steep and rocky that it is impossible to get across it except by going a long distance around, and then runs up the north slope of Bald Top mountain to the point of rock on the extreme summit, to which I have already made a triangulation, Sta. I, page 89 After a very careful examination of the country ahead, I determine that it will be impossible to run the line beyond this point, for the reason that the country is so exceedingly rough, rugged and precipitous that there are only a few points on the entire line that might be reached, and that when reached there would be no room for triangulation from them, and chaining would be impossible. I therefore determine to return to the Speceal corner established at 51M. 51.44 chs., Sta. M, figs. 14 & 18, and make a second triangulation to a flag sent ahead to Sta. I, on Bald Top mountain, as a check on my first triangulation, and then go around in order to reach Sta. I.

September 5th. 1898.

I compare my chains with the standard and find them correct.

On the morning of September 8 th. 1898, with instrument at Sta. M, I deflect 90° from the north towards the east, and in this direction, measure a base-line as follows -

1.00ch. Cross fence, course N&S., thence across meadow land.
8.00 Cross irrigating ditch, course N&S.
88.88 Set a stone level with the top of the ground, on the top of which I mark a X, on line, and exactly 88.88 chs. from St. M., for Sta. N.

Set on meridian north, vernier at zero.
Unclamp plates and set on Sta. N.
Vernier reads 90°00'00"
Unclamp below and set on Meridian North
Unclamp plates and set on Sta N.

Vernier reads 180° 00' 00"
Angle OMN, mean value, 90° 00 00

I then carefully set a flag on the meridian to the north, on the highest point of mountain, marked by a X cut on the rock, Sta. O, fig. 18, high enough to see over the cliff at 51M. + 42 chs.

Instrument at Sta. O,
Set on flag at Sta. I, and strike flag held on Sta. M, verifying the direction of the meridian.
I then make a mark on the cliff south of Sta. M, at 51M. + 42 chs. on the meridian.

Instrument at Sta. M, vernier at zero.
Set on mark on cliff to south.
Unclamp plates and set on Sta. N.
Vernier reads 90° 00' 00"
Unclamp below and set on mark on cliff to S.
Unclamp plates and set on Sta. N.
Vernier reads 180°.00'.00"
Angle IMN, mean value, 90° 00 00

Instrument at Sta. N, vernier at zero.
Set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 87°.25'.50"
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 174°.51'. plus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 262°.17'. plus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 349°.42'. plus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 437°.08'. minus.
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. I.
Vernier reads 524°.35'.50"
Angle INM, mean value, 87° 25' 55"

Leaving back sights at Stas. O & N, I then proceed to Sta. I, on top of Bald Top mountain.

September 6th. 1898.

I compare my chains with the standard and find them correct.

On the evening of September 6th. 1898, from a point near the head of Trout creek, south and east of Sta. I, I observe Polaris at its eastern elongation, at 8h. 12m. P. M., mean local time, and find its magnetic bearing to be N. 18° 45' W.

North end of needle	18° 45' E.
Azimuth, by table in Manual, is	1.47 E.
the sum is the Va.	18.32 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by nub and tack, 4.00 chs. N.

Barometer indicates 9200 ft.

On september 9th., a heavy snow storm prevailing throughout the day, instrument work was not possible.

On the morning of September 10th. 1893, with instrument at point of observation on Sept. 8th., Sta. P, fig. 16, I direct the telescope to tack in hub, 4.00 chs. N., and with vernier at zero, deflect to flag at Sta. I, on Bald Top mountain. Vernier reads N. 87° 20′ 30″ W.

Leaving a back sight at Sta. P. I proceed to flag at Sta. I. Arriving at the flag I find a X marked by my flagman on a small rock in a bunch of sage brush, which I had taken for a rock from Stas. H & O.

Instrument at Sta. I,
Set on Sta. P, and by double back and fore sights, set flag on line at Sta. Q 5.00 chs. dist.
Vernier at zero, set on Sta. Q, and deflect 87° 20′ 30″ towards the N. and strike back sight at Sta. O, on the meridian. I can also see back sight left at 28N. + 14.55chs., on top of high divide between Russell & Sunlight creeks, which I make to be exactly on the meridian.

Set on Sta. O, vernier at zero.
Unclamp plates and set on Sta. N.
Vernier reads 2° 34′ ″ plus.
Unclamp below and set on Sta. O.
Unclamp plates and set on Sta. N.
Vernier reads 5.09.00
Angle OIN, mean value 2.34.30

I am unable to catch the back sight left at Sta. G, fig. 14, page 89 On account of timber back-ground, and I am therefore obliged to assume the angle GIO = GIH, to be the difference between 180° and the sum of the angles HGI and GHI = 178° 24′ 00″, which gives GIH = 1° 36′ 00″

Closing error of triangles.

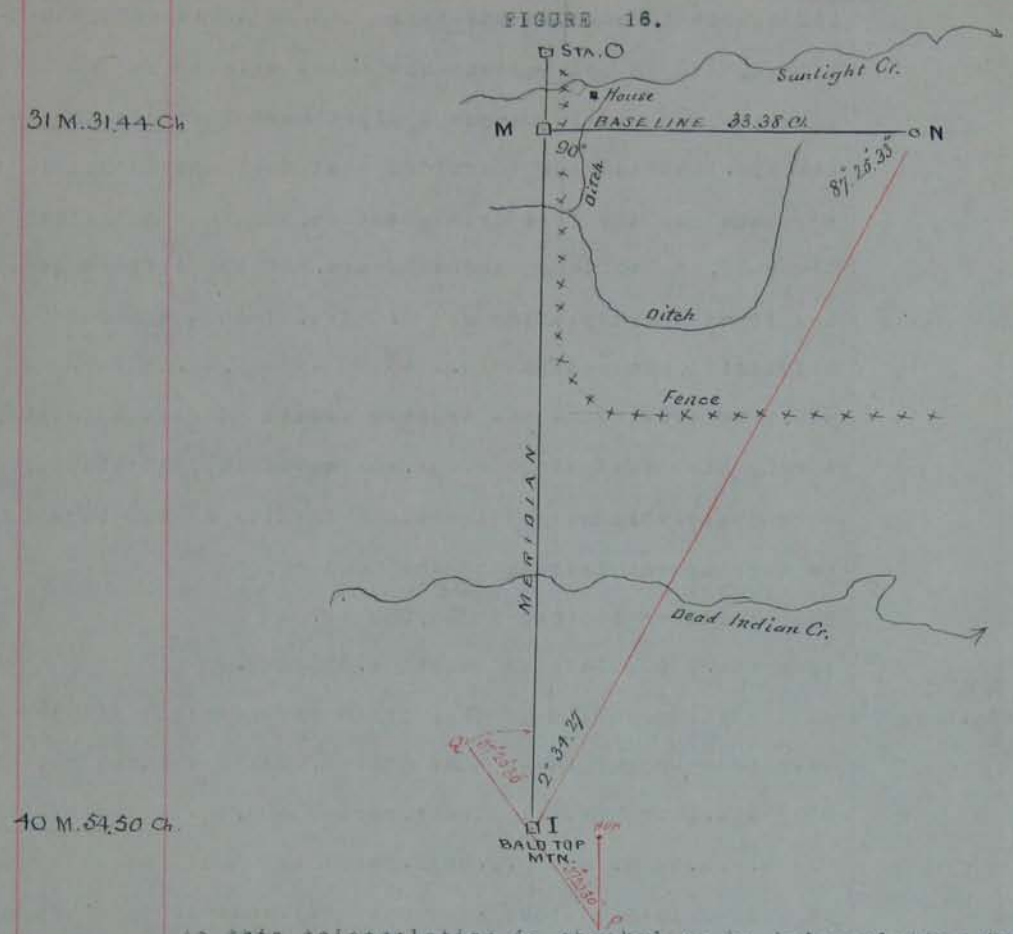
Triangle HGI, p. 89		Triangle MNI.	
Angle GHI,	103° 37′ 00″	Angle MNI,	87° 25′ 35″
Angle HGI,	74.47.00	Angle NIM,	2.54.50
Angle HIG,	1.36.00	Angle IMN,	90.00.00
the sum is	180.00.00	the sum is	180.00.05
Closing error	0.	Closing error	5″

In triangle MNI the error is 5″, but as I consider the greatest chance for error to be in the angle NIM, and as the angle IMN was laid out absolutely at 90°, and double checked, I I conclude to give 3″ of the closing error to the angle NIM, and 2″ to the angle MNI.

Corrected angles of triangle MNI.

Angle MNI,	87° 25′ 33″
Angle NIM,	2.54.27
Angle IMN,	90.00.00
the sum is	180.00.00

FIGURE 16.



As this triangulation is checked up by triangulation from 28th. Mile corner to 40M.+54.50 chs. I do not make a second triangulation.

Solving triangle GHI, for HI = x. page 89
54.028 : sin. 1° 56' 00" :: x : sin. 74° 47' 00"

Log. 54.028	1.5317726
Log. sin. 74° 47' 00"	9.9846004
	11.5163730
Log. sin. 1° 56' 00"	8.4459409

(Log 3.0703321) x = HI = 1175.80 chs. = 14M.55.80 chs.

Solving triangle MNI, for MI = x.
55.56 x tan. 87° 25' 53" = x.

Log. 55.56	1.5234565
Log. tan. 87° 25' 53"	1.3471956
	2.8706799

x = IM = 742.47 chs. = 9M.22.47 chs.

Checking the two triangulation HGI, page 89 and MNI, page 99 we have -

Line distance Sta. H,	26M.00.00 chs.
Meridian distance HM, by chain,	5M.31.44 chs.
Triangulated distance MI, fig. 16,	9M.22.47 chs.
the sum is line distance of Sta. I	40M.53.91 chs

Line Distance Sta. H,	26M.00 00 chs.
Triangulated distance HI, fig 14,, page 89	14M.55.80 chs.
the sum is the line dist. of Sta. I	40M.55.80 chs.

The difference between the two triangulations is 1.89 chs.

This difference is probably to be accounted for, in part, by inaccuracy in chaining, but undoubtedly is mostly due to ba-

ing unable to measure the angle HIG, as hereinbefore mentioned, and in consequence not being able to adjust and equalize any closing error I might have found in the triangle HIG. Considering therefore that most dependence is to be placed in the last triangulation, and in the chained distance HM, I decide to throw 59 lks. of the difference into the first triangulation and 150 lks. into the second triangulation, and assume Sta. I to be at 40M.54.50 chs.

Sta. I is located on the extreme summit of Bald mountain, a very high peak about 4 chs. across on top, and sloping very rapidly in every direction, forming a land mark that is a prominent feature of the country.

The barometer indicates 13,050 ft.

From Sta. I Cupola peak bears N.84° 22′ W.

40M.54.50chs. As it is impossible to dig, or to mark legible figures on surface of rock. over X at Sta. I, set a granite rock 30 x8x7 ins., for Special corner, marked 40M.54.50 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, and built stone around it, and raised a stone monument 6 ft. square, 6 1/2 ft high. N. of corner.

From this point the line to the south drops nearly perpendicularly into a canyon 3500 ft. deep, which is the head of the main fork of Trout creek. Chaining across this canyon is out of the question, and triangulation from the top of the mountain, at Sta. I, is equally so, on account of the small space, I therefore send a flag around and set it on top of Table mountain, on the south side of the canyon, and on the meridian, Sta. R, fig. 17. which I mark by making a deep X on a rock in place. I then mark a X on a rock to the east of Sta. R, on top of Table mountain, Sta. S.

Instrument at Sta. I, vernier at zero.
Set on Sta. R.
Unclamp plates and set on Sta. S.
Vernier reads 8° 58′ 50″
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. S
Vernier reads 13° 56′ 00″
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. S.
Vernier reads 20° 54′ 50″
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. S
Vernier reads 27° 52′ 00″
Angle RIS, mean value, 8° 58′ 00″

Leaving flag at Sta. I, I then proceed to Sta. R, and setting the instrument exactly over the X, vernier

at zero,
Set on Sta.I.
Unclamp plates and set on Sta.S.
Vernier reads 108°05'00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.S.
Vernier reads 206°.10'.00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.S.
Vernier reads 309°.15'.00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.S.
Vernier reads 412°.20'.00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.S.
Vernier reads 515°.25'.00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.S
Vernier reads 618°.30'.00"
Angle IRS, mean value, 108°05'05"

Carefully chaining the distance RS, for a base-line I find it to be exactly 28.49 chs.long.

Instrument at Sta.S, vernier at zero.
Set on Sta.I.
Unclamp plates and set on Sta.R
Vernier reads 69°57'00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.R.
Vernier reads 139°54'00"
Unclamp below and set on Sta.I.
Unclamp plates and set on Sta.R.
Vernier reads 209°51'30"
Angle RSI, mean value, 69°57'10"

With instrument at S, by double back and fore sights on Sta.R, I extend the base-line, RS, easterly and set tack in hub exactly 11.81 chs.dist.for Sta.S'.

Instrument at Sta.S', vernier at zero.
Set on Sta.R.
Unclamp plates and set on Sta.I.
Vernier reads 67°15'30"
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.I.
Vernier reads 134°27'00"
Angle TS'R, mean value 67°15'30"

Instrument at Sta.I, vernier at zero.
Set on Sta.R.
Unclamp plates and set on Sta.S'.
Vernier reads 9°41'30
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.S'.
Vernier reads 19°23'00"
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.S'.
Vernier reads 29°05'00"
Angle RIS', mean value, 9°41'40"

Closing error of triangles.

Triangle IRS.		Triangle IRS'.	
Angle IRS,	108°05'05"	Angle IRS'.	108°05'05"
Angle RSI,	69.57.10	Angle RS'I.	67.15.30
Angle SIR,	6.58.00	Angle RIS'.	9.41.40
the sum is	180.00.15	the sum is	180.00.15
Closing error 15"		Closing error 15"	

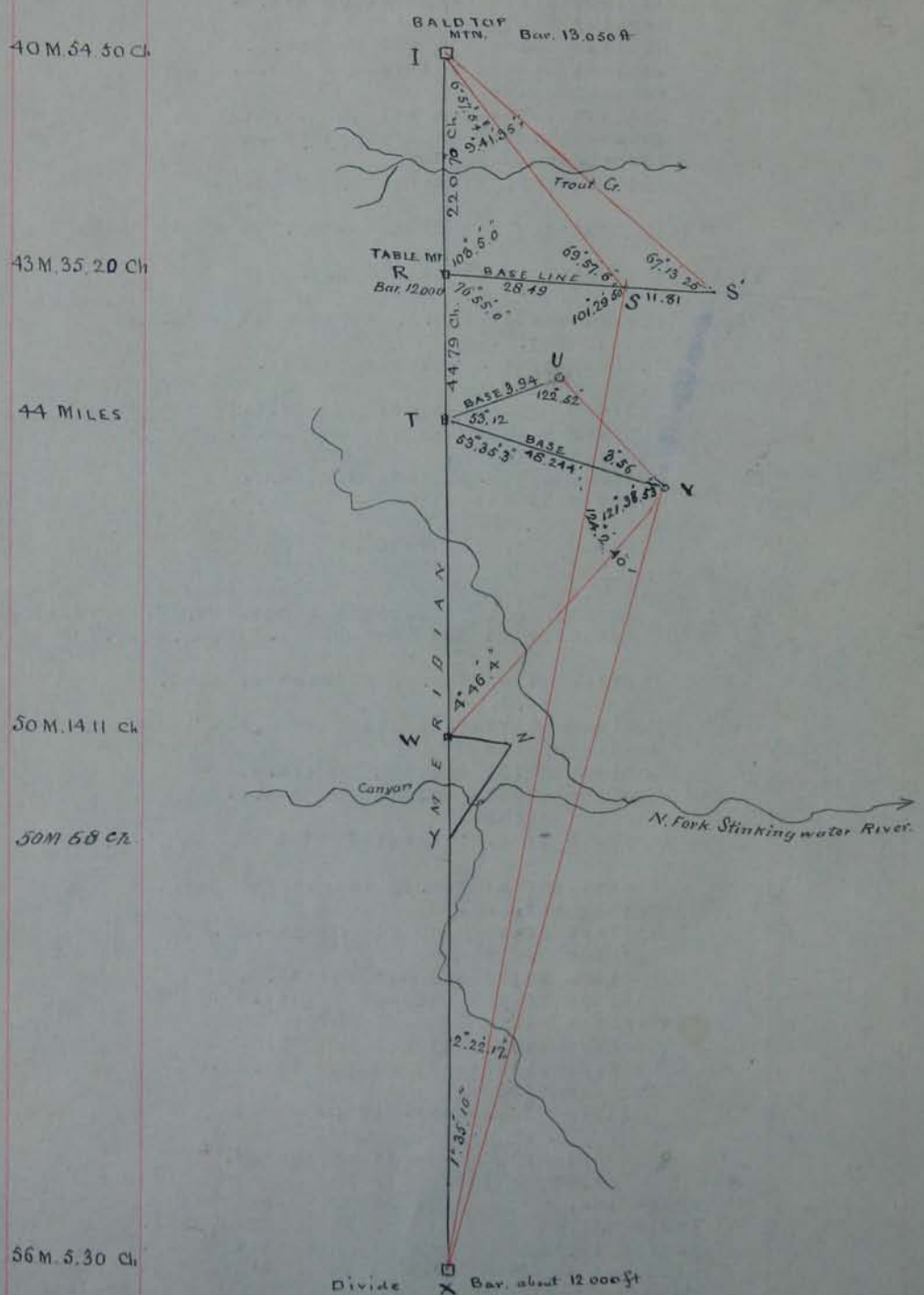
This closing error in triangle IRS, I distribute between the three angles, in the proportion of 4, 5 & 6 seconds, according to how I am satisfied with the different observations.
The closing error in triangle IRS', I distribute equally

between the respective angles.

Corrected angles of triangles.

Triangle IRS.		Triangle IRS'.	
Angle IRS,	105° 02' 00"	Angle IRS'.	105° 05' 00"
Angle RSI,	69.57.06	Angle RS'I,	67.13.25
Angle SIR,	6.57.54	Angle RIS',	8.41.35
the sum is	180.00.00	the sum is	180.00.00

FIGURE 17.



EAST BOUNDARY PUBLIC FOREST RESERVATION.

Solving triangle IRS, for IR = x.
28.49 : sin. 6°57'54" :: x : sin. 89°57'06"

Log. 28.49	1.4546924
Log.sin.89°57'06"	8.9728522
	11.4275447
Log.sin. 6°57'54"	9.0857288
	2.3418164

x = IR = 220.71 chs.

Solving triangle IRS', for IR = x.
40.50 : sin. 9°41'35" :: x : sin.67°18'25."

Log.40.50	1.6055050
Log.sin.67°18'25"	9.9647416
	11.5700466
Log.sin. 9°41'35"	9.2282844
	2.3417622

x = IR = 220.69 chs

Solving triangle RSX, for RX = x.
28.49 : sin. 1°55'10" :: x : sin. 101°29'50."

Log.28.49	1.4546924
Log.sin.101°29'50"	9.9911970
	11.4458894
Log.sin. 1°55'10"	8.4421555
	3.0037339

x = RX = 1008.83 chs.

Solving triangle TVW, for TW = x.
48.244 : sin. 4°46'04" :: x : sin.121°38'53."

Log.48.244	1.6834454
Log.sin. 121°38'53"	9.9300761
	11.6135215
Log.sin 4°46'04"	8.9196920
	2.6938295

x = TW = 494.11 chs.

Solving triangle TVX, for TX = x.
48.244 : sin. 2°22'17" :: x : sin.124°02'40."

Log.48.244	1.6834454
Log.sin.124°02'40"	9.9184468
	11.6017922
Log.sin. 2°22'17"	8.6167561
	2.9850361

x = TX = 966.18 chs.

Solving triangle TUV, for TV = x.
8.94 : sin. 5°56'00" :: x : sin.122°32'00."

Log. 8.94	0.9514962
Log.sin.122°32'00"	9.9242461
	10.8197423
Log.sin. 5°56'00"	8.9562959
	1.6834464

x = TV = 48.244 chs.

The mean of the two triangulations, for the distance IR, is 220.70 chs.

Line distance of Sta.I,	40M.54.50 chs.
Meridian distance of IR,	2M.50.70 chs.
Line distance of Sta.R.	43M.55.20 chs.

Sta.R is located on Table mountain, a flat topped mountain jutting out from a divide betwwen two creeks (having their sources in the main rage to which Bald Top belongs) running nearly south into the north fork of Stinkingwater river. This divide lies from 1/2 to 1 mile west of the line, and extends in a serpentine manner towards the south, until it reaches the north fork of Stinkingwater river, where it comes within a hundred feet of the line, and becomes the

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains

north wall of the North Fork canyon. These mountains are of an extremely rough and broken character, consisting of one cliff after another, nearly or quite perpendicular, and from 1 to 2 thousand feet high, and utterly impassible except in a very few places by going around, and then only with the greatest difficulty. I can see from Table mountain that this same kind of country extends south of the North Fork, and as a considerable portion of the country between Table mountain and the main range between the North and south Forks of Stinkingwater river, seems to be of such a character that it cannot be chained, I prepare for for meeting with such impassible places, by laying out and perfecting a system of treangulations at this place (on top of Table mountain) where ther is room to do accurate work. For a more particular description of these triangulations reference is made to what follows, and to fig. 17, page 102

43M. 35. 20 chs As surface of rock is too irregular to make legible figures. Over the X, Sta. R, I set a lava rock 38x10x6 ins. for Special corner, marked 43M.+35.20 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, with a X on top. Piled stone around it and raised a monument of stone 5 ft. square, 6 ft. high, N. of corner.

Barometer indicates 12,000 ft.

Thence I run 44th. MILE.

North, on a true line.
Va. 16° 32′ E.

Over nearly level ground.

35. 20 Set a lava rock 40x10x8 ins, with lava stone 6 ins. square, marked with a X, 10 ins. in the ground, for 45 Mile corner, marked 45M. on N. P.F.R. on W. and P.L. on E. faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N of corner. Could not set corner required depth on account of rock.

This corner stands 90 lks south of the face of a nearly perpendicular cliff south of Trout creek.

I then return to Sta. R, at 45M.+35.20 chs. and run

Remainder of 44th. MILE.

South, on a true line.

Chains.

Va.18°52'E.

Over nearly level ground.

4.80 Set a lava rock 40x8x8 ins., with lava rock 8 ins. square marked with a X, 10 ins. in the ground, for 43 1/2 Mile Corner, marked 43 1/2M. on N. P.F.R. on W. and P.L. on E. faces, piled stone around it, and raised a mound of stone 2 1/2 ft. high, 5 ft. base. N. of corner. Could not set corner required depth on account of rock.

Thence descend 200 ft., over rough and broken ground, to

44.80 Set a lava rock 38x14x8 ins., with lava stone 5 ins. square marked with a X, 8 ins. in the ground, for 44 Mile Corner, marked 44M. T.P. on N. P.F.R. on W. and P.L. on E. faces. piled stone around it and raised a monument of stone 5 ft. square, 5 ft. high, N. of corner. Could not set corner required depth on account of rock.

Barometer indicates 11,800 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

Instrument at 44th. Mile corner, Sta. T, fig. 17, page 102

This corner stands on the edge of a cliff 2000 ft. high, and nearly perpendicular.

Set on Sta. R, vernier at zero, and by careful back and fore sights, set a flag ahead on the meridian, Sta. W, which I mark by setting a stone level with the top of the ground, on the top of which I mark a X, on meridian.

September 10th. 1893.

I compared my chains with standard and find them correct.

The night of September 10th. 1893 proving cloudy, no observation could be taken on Polaris.

On the morning of September 11th. 1893, with instrument at Sta. T, I proceed to lay off a base-line, TV, as follows - As a portion of ~~the~~ this base-line runs along the face of the cliff, and is inaccessible, I am obliged to make a triangulation to ascertain its length, TV, On eastern end of Table mountain I establish Sta. V by cutting a deep X in

the solid rock. I then establish Sta.U, and mark it by setting a stone level with the top of the ground, on the top of which I mark a X at exactly 8.94 chs dist. from Sta.T. To the south and on top of the range of mountains lying between the N.& S. forks of Stinkingwater river, the meridian TW extended, crosses a very high and rocky ridge, or chain of cliffs, many hundreds of feet in height, and nearly perpendicular, capping the range. Three hundred ft. from the east end of these cliffs (which from Sta.T bears S.0° 20' E.) the line crosses the cliffs exactly in the bottom of a V shaped depression 75 or 100 ft. deep, in the bottom of which is a small cedar tree, taken for Sta.X.

I make the following triangulations to this tree for the reason that I fear the mountains ahead are impassible, and that upon arriving at them I shall find it impossible to chain and run a nub line over them, and equally impossible to find ground suitable for triangulation, while from this point the tree, Sta.X, is perfectly in sight and isolated. Standing in this notch on top of a very narrow divide extending E&W. it is an excellent flag point for future use.

Instrument at Sta.T, vernier at zero.
Set on Sta.W.
Unclamp plates and set on Sta.V
Vernier reads 53°55'00"
Unclamp plates and set on Sta.U.
Vernier reads 106°47'00"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 160°22'30"
Unclamp plates and set on Sta.U.
Vernier reads 213°34'30"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 267°09'30"
Unclamp plates and set on Sta.U.
Vernier reads 320°21'30"
Angle VTW - VTX, mean value, 53°55'10"
Angle VTU, mean value, 53°12'00"

Instrument at Sta.U, vernier at zero.
Set on Sta.T.
Unclamp plates and set on Sta.V.
Vernier reads 122°52'00"
Unclamp below and set on Sta.T.
Unclamp plates and set on Sta.V.
Vernier reads 245°44'00"
Angle VUT, mean value, 122°52'00"

Instrument at Sta.V, vernier at zero.
Set on Sta.U.
Unclamp plates and set on Sta.T.
Vernier reads 5°56'00"
Unclamp plates and set on Sta.W.
Vernier reads 125°55'00"
Unclamp plates and set on Sta.X.

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Vernier reads 127°59'00"
Unclamp below and set on Sta.U.
Unclamp plates and set on Sta.T.
Vernier reads 181°55'00"
Unclamp plates and set on Sta.W.
Vernier reads 255°54'00"
Unclamp plates and set on Sta.X.
Vernier reads 256°57'30"
Unclamp below and set on Sta.U.
Unclamp plates and set on Sta.T.
Vernier reads 259°53'30"
Unclamp plates and set on Sta.W.
Vernier reads 381°52'30"
Unclamp plates and set on Sta.X.
Vernier reads 382°56'00"
Angle UVT, mean value, 8°56'00"
Angle TVW, mean value, 121°39'00
Angle TVX, mean value, 124°02'40

Instrument at Sta.R, at 45M.+55.20 chs., Ver. at zero
Set on Sta.X.
Unclamp plates and set on Sta.S., the east end of a base-line 28.49 chs.dist., see triangulation from 40M.+54.50 chs. to 43M+55.20 chs.
Vernier reads 78°55'00"
Unclamp below and set on Sta.X.
Unclamp plates and set on Sta.S.
Vernier reads 155°50'00"
Angle SRX, mean value, 78°55'00"

Instrument at Sta.S, vernier at zero.
Set on Sta.R.
Unclamp plates and set on Sta.X.
Vernier reads 101°50'00"
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.X.
Vernier reads 202°59'30"
Unclamp below and set on Sta.R.
Unclamp plates and set on Sta.X.
Vernier reads 304°29'50"
Angle RSX, mean value, 101°29'50"

I am unable to see Sta.X from Sta.S .

Carefully chaining the base-line TU, I find it to be 5.94 chs.

Closing error of triangle TUV.
Angle TUV, 122°52'00"
Angle UVT, 5°56'00
Angle VTU, 55°12'00
the sum is 180°00'00
Closing error, 0.

Solving triangle TUV, for TV = x.
See solution page 103 Find that base-line TV = 48.244 chs.

Instrument at Sta.W, vernier at zero.
Set on Sta.T.
Unclamp plates and set on Sta.V.
Vernier reads 4°46' " plus.
Unclamp below and set on Sta.T.
Unclamp plates and set on Sta.V.
Vernier reads 9°32' plus.
Unclamp below and set on Sta.T.
Unclamp plates and set on Sta.V.
Vernier reads 14°18'30"
angle TWV, mean value, 4°46'10"

Closing error of triangle TWV.
Angle TWV, 4°46'10"
Angle WVT, 121°39'00
Angle VTW, 55°55'10
the sum is 180°00'20
Closing error 20," which I distribute equally between the respective angles as follows -

Chains.

Corrected angles of triangle TWV.

Angle TWV,	4°46'04"
Angle WVT,	121.38.58
Angle VTW,	58.55.03
the sum is	180.00.00

Solving triangle TVW, page 103 for x = TW = 494.11chs.
= 8M.14.11 chs.

Line Distance Sta.T,	44M.00.00 chs.
Meridian distance TW,	8M.14.11 chs.
Line distance of Sta.W.	50M.14.11 chs.

September 11th.1898.

I compared my chains with the standard and found them correct.

On the evening of September 11th.1898, at Sta.W, 50M.+14.11 chs., I observe Polaris at its eastern elongation, at 8h. 0m.P.M., mean local time, and find its magnetic bearing to be N.16°24'W.

North end of needle	16°24'E.
Azimuth, by table in Manual, is	1.46 E.
the sum is the Va.	18.10 E.

I lay off the azimuth to the west and mark the true meridian. so determined. by hub and tack. 4.00 chs.N.

Barometer indicates 6500 ft.

On the morning of September 12th.1898, with instrument at point of last night's observation, Sta.W., I direct the telescope to tack in hub, 4.00 chs.N., and in this direction strike slightly east of Sta.T.

Set on tack in hub, vernier at zero.
Unclamp plates and set on Sta.T, deflecting towards W.
Vernier reads 0°00'50"
Unclamp below and set on tack in hub.
Unclamp plates and set on Sta.T.
Vernier reads 0°01'00"
Angle of last meridian, established with yesterday's line, TW, 0°00'50"

From Sta.W, at 50M.+14.11 chs., I run -

51st. MILE.

North, on a true line.
Va.18°15'E.

Over broken ground along foot of cliff 600 ft.high, and 100 ft.to the west, bearing N.5°0'W.

14.11 Set a sandstone 40x12x8 ins., with granite boulder 8 ins. diam., marked with a X, 24 ins.in the ground, for 50 MILE Corner, marked 50M. on N. P.F.R.on W.and P.L on E.faces, and raised a mound of stone 2 1/2 ft. high, 5 ft

Chains.

base, N. of corner. from which

Cedar mountain bears N.84°08'E. and

Ranch cabin bears S.83°40'E.

Barometer indicates 6500 ft.

50th. MILE.

North, on a true line.
Va. 18° 15' E.

Over rough broken ground.

12.00 Cross stream 10 lks. wide, course S.80°E. Ascend 500 ft. to

30.00 Top of ridge, course SE. Barometer 6800 ft., thence over rocky broken ground, descending slightly to

40.00 Set a sanstone 35x12x8 ins., with granite boulder 6 ins. diam., marked with a X, 24 ins. in the ground, for 49 1/2 Mile corner, marked 49 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. from which

Cedar mountain bears N.85 45' E. and

Ranch cabin bears S.61°19'E.

Thence ascend over broken rocky ground, 200 ft., to

Difference in chaining is 12 lks. at middle point of difference

80.00 Set a lava rock 38x12x7 ins., with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for 49 Mile corner, marked 49M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 6950 ft.

Land, mountainous.

Soil, rocky, 4th. rate.
No timber

49th. MILE.

North, on a true line.
Va. 18° 10' E.

Over broken rocky ground, ascending slightly.

4.00 Cross dry gulch, course S.60° E., 30 ft. deep.

20.00 Cross small stream, 8 lks. wide, course S.50° E.

~~Head chain 29.81chs., hind chain 28.49 chs.~~

29.50 Foot of perpendicular cliff 500 ft. high, on to which I can find no means of getting. From here on to the point at Sta.

Chains. T, at 44M., is simply one mass of deep canyons and rocky cliffs. These cliffs rise to from 500 to 1000 ft. in height and extend in nearly an E. & W. direction, and the whole country between here and St. T, rises rapidly 4600 ft. and is impassible in the direction of the line. I am therefore unable to connect the line, by chaining, with Sta. T, and investigating the country ahead with a view to triangulating in some Special corners, I am obliged to abandon the intention on account of the precipitous character of the mountains, and the fact that the cliffs are so steep and rocky and wet from melting snow, I cannot get up them. I therefore, on the face of the cliff, mark a deep X on line, for Special corner, marked 46M.+50.50chs. above, P.F.R. W. of, and P.L. E. of X, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, under it

Barometer indicates 7000 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber. *Sept. 12th 1893*

I compare my chains with the standard and find them .05 ft. too long, and adjust them both.

On the morning of September 13th. 1893, instrument at Sta. N, 50M.+14.11 chs., and getting direction by double back and fore sights from meridian established on night of Sept. 11th. 1893, I run

Remainder of 51st. MILE.

South, on a true line.
Va. 18° 15' E.

Descend 100 ft. over broken rocky ground, to

11.09 North bank of North Fork of Stinkingwater river, course east.

13.10 South bank of same. Line crosses river 200 ft. east of the mouth of Box canyon.

Barometer indicates 6450 ft.

20.00 Cross creek, 15 lks. wide, course N. 48° W.

20.89 Cross trail up North Fork.

20.95 Pine tree 10 ins. diam. on line, which I cut off 5 ft. above ground and square to 8 ins, for Special Corner, marked 50M.+35.06chs. on N.. P.F.R. on N. and P.L. on E. faces, and

Chains. raised a mound of stone 2 1/2 ft. high, 5 ft. base N. of corner.

ascend 150 ft. to

25.89 Set a lava rock 40x14x8 ins., with granite boulder 5 ins. diam., marked with a X, 24 ins. in the ground. for 50 1/2 Mile corner, marked 50 1/2M on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 5 ft. high, 5 ft. base, N. of corner. Thence ascend 100 ft. to

28.90 foot of nearly perpendicular rock cliff, 500 ft. high. Not being able to chain further nor to triangulate from this point on account of the ground. I return to Sta. W, at 50M. +14.11 chs., and with instrument over the X, set a flag ahead on line, on top of the rocky point south of the creek, Sta. Y, fig. 18, page 112

Instrument at Sta. W, vernier at zero.
Set on Sta. Y, and deflect 86° 30' from the south towards the east, and in this direction measure a base-line 5.82 chs. long, at the east end of which I set a stone level with the top of the ground, on top of which I mark a X on line, and exactly 5.82 chs. from Sta. Sta. W, for Sta. Z.
Set on Sta. Z, vernier at zero.
Unclamp plates and set on Sta. Y.
Vernier reads 86° 30' 00"
Unclamp below and set on Sta. Z.
Unclamp plates and set on Sta. Y.
Vernier reads 175.00.00
Angle YWZ, mean value, 86° 30' 00"

Instrument at Sta. Z, vernier at zero.
Set on Sta. W.
Unclamp plates and set on Sta. Y.
Vernier reads 87.18.30
Unclamp below and set on Sta. W.
Unclamp plates and set on Sta. Y.
Vernier reads 174.37.00
Angle WZY, mean value, 87° 18' 30"

Instrument at Sta. Y, vernier at zero.
Set on Sta. W.
Unclamp plates and set on Sta. Z.
Vernier reads 8.11.30
Unclamp below and set on Sta. W.
Unclamp plates and set on Sta. Z.
Vernier reads 12.23. plus.
Unclamp below and set on Sta. W.
Unclamp plates and set on Sta. Z.
Vernier reads 18.35.00
Angle ZYW, mean value, 8° 11' 40"

Closing error of triangle WYZ.

Angle WYZ,	8° 11' 40"
Angle YZW,	87.18.30
Angle ZWY,	86.30.00
the sum is	180.00.10

Closing error, 10"

Considering the observations for angles equally correct, I divide the error as follows -

Corrected angles of triangle WYZ.

Angle WYZ,	8° 11' 35"
Angle YZW,	87.18.27
Angle ZWY,	86.29.57

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Chains.

the sum is 180° 00' 00"

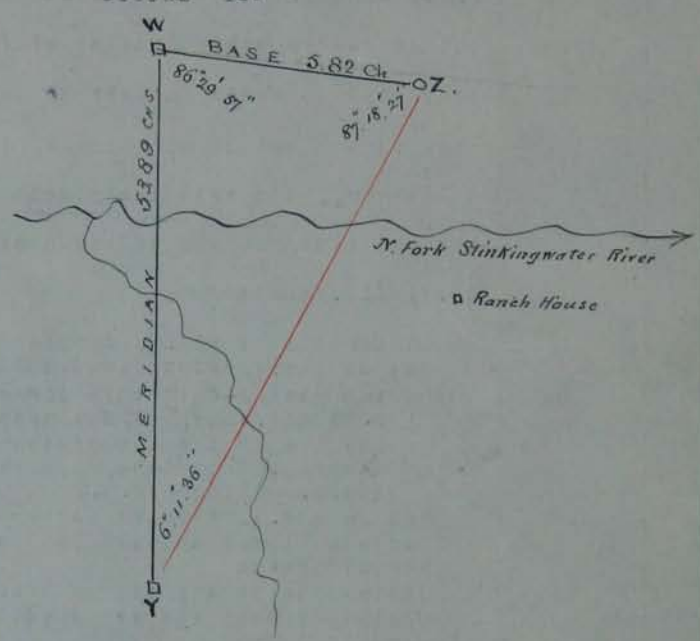
Solving triangle WZY, for WY = x.
5.82 : sin. 6° 11' 36" :: x : sin. 87° 18' 27."

Log. 5.82	0.7649250
Log. sin. 87° 18' 27"	9.9995208
	10.7644458
Log. sin. 6° 11' 36"	9.0329583
	1.7314875

x = WY = 55.89 chs.

FIGURE 18.

50M.14.11 Ch.



50M.68.00 Ch.

Line distance Sta.W,	50M.14.11 chs.
Meridian distance WY,	0M.55.89 chs.
Line distance Sta.Y,	50M.68.00 chs.

Sta.Y not being a practicable place for a corner, I run 18 lks. north therefrom and mark a X in the solid rock the surface of it being too rough to cut legible figures on, over the X at -

50M.67.82ch. Set a lava rock 30x10x6 ins. for special corner, marked 50M. +67.82 chs. on N. P.F.R. on W. and P.L. on E. faces, Piled stone around it and raised a monument of stone 6ft. base, 6 ft. high, W. of corner. from which -

Cedar mountain bears N. 81° 26' E.

Barometer indicates 7500 ft.

This monument can be seen from any part of the country.

Thence I run -

South, on a true line on 51st. MILE.
Va. 18° 10' E.

Descending abruptly 500 ft., over broken rocky ground to

12.18 Mark a X in solid rock, the surface of rock being too irregular to cut legible figures over the X I set a lava rock

Chains.

40x10x8 ins.,

for 61 Mile corner, marked 61M. on N. P.F.R. on N. and P.L. on E. faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 7000 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

62nd. MILE.

South, on a true line,
Va. 18° 10' E.

Descend 200 ft. over rocky broken country, to

18.00 Cross creek 15 lks. wide, course N. 50° E. Thence ascend 100 ft. over very broken rocky country, to

40.00 Mark a X in solid rock, the surface of rock being covered with vegetable growth, rendering figures and letters illegible, over the X I set a lava rock 30x10x10 ins, for 61 1/2 Mile Corner, marked 61 1/2M. on N. P.F.R. on W. and P.L. on E. faces. Built stone around it.

This corner stands on a ledge of rock in such position that a mound cannot be built, and pits are impracticable.

Thence over broken rocky ground to

60.25 Foot of rocky cliff, nearly perpendicular, 50 ft. high.

From this point I investigate the country to the south and find that the line runs along cliffs on the east side of the creek just crossed, for a half mile or more, to where it forks, one fork coming in from the south west and the other from the south east. The line then crosses the east fork, in deep canyon, and runs up the rocky cliffs between the creeks, ascending into mountains of such rough, rugged and slippery character that I can see no safe way of getting a line through them, except over them. In fact this whole chain of mountains, lying between the north and south forks of the Stinkingwater river, are at this point (and to the west) and on this line impassible at any time, more especially so now, being slippery from the melting of the recently fallen snow. Chaining could only beperfor-

med in places, and triangulation is impracticable for lack of room to work on, and intervening timber. I am certain, after having examined the country to the top of the mountain, that I could not with ordinary appliances and reasonable risk to life and limb, put in more than 2 or 3 corners between the last one established and the top of the mountain, in a week. I also find that the point X, triangulated to , fig.17, page 102 is entirely inaccessible, and that the mountain upon which it stands breaks off sharply to the south, and descends precipitously over such terrible cliffs and canyons for several miles, that to attempt to traverse them would be practical suicide. In fact this country is of such a character that I know if I attempted to locate the line on the ground, further through it, I should only succeed in getting some of my men, or myself, killed or injured, without accomplishing any practical improvement of it as it now stands. I do not understand that I am called upon in making this survey to take more than a reasonable amount of risk to myself or men, and therefore decide that I have done all that can reasonably be expected of me at this place.

September 15th.1898.

I compared my chains with the standard and find one correct, and one .01 ft.long, I adjust the latter to standard

On the evening of September 14th.1898, from a point on the South Fork of the Stinkingwater river, Sta.A', fig.19, page 116 I observe Polaris at its eastern elongation, at 7h.48m.P.M. mean local time, and find its magnetic bearing to be N.15°50'N.

North end of needle	15°50' E.
Azimuth, by table in Manual, is	1.48 E.
the sum is the Va.	17.38 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by hub and tack, 4.00 chs. N.

Barometer indicates 7000 ft.

On the morning of September 15th.1898, instrument at point of last night's observation, Sta.A', fig.19, page 116 , vernier at zero,

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Set on tack in hub on meridian, established last night, 4.00 chs. N., Sta. B′, and deflect from the north towards the west and set on tree on top of mountain, Sta. X, figs. 174 13

Vernier reads 8° 50′ 00″

Unclamp below and set on Sta. B′.

Unclamp plates and set on Sta. X.

Vernier reads 13°.00′.50″

Angle B′ A′ X, mean value, 5° 50′ 15″

I then endeavor unsuccessfully to reach Sta. X, for the purpose of continuing the line from that point, and after a day spent in this attempt am obliged to give up the undertaking, as it appears to be inaccessible. I am therefore unable to measure the angles VXT and SXT, fig. 17, page 102. However as the angles from the ends of the base-lines TV and RS were very carefully measured under favorable circumstances, and the angle VTN has been corrected (page 108) I have confidence in being able to locate the point X correctly, which I proceed to do as follows -

For solution of triangles RSX & TVX, see fig. 17, page 102

from which -

Triangle SRX gives x = RX = 1008.88 chs

Triangle TVX gives x = TX = 966.15 chs.

Chained distance RT = 44.79 chs

the sum is 1010.92 chs.

the difference in triangulations for

the distance RX is 2.29 chs

On account of the base TV, of triangle TVX, being considerably longer than the base RS, of triangle RSX, I am inclined to believe the triangulation TVX somewhat the most accurate, and decide to give 82 lks. of the difference to TX, and 148 lks. to RX, thereby locating Sta. X at -

Line Distance of Sta. T, 44M.00 00 chs.

Meridian distance TX, 965.50 chs. = 12M.05.50 chs.

Line distance Sta. X, 56M.05.50 chs.

September 16th. 1898.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

On the morning of September 16th.1895 I proceed to Sta.A′, and chain due west, and ascertain by means of the compass that Sta.A′, is approximately 75 chs.east of the east boundary Public Forest Reservation extended from St.X, from which data I figure that a line run from Sta.A′, in order to be at right angles to the east boundary, must be run N89° 59′ 14″ W from Sta.A′. Returning to Sta.A′, I set instrument exactly over the X, and deflect 89° 59′ 00 from the north towards the west, and in this direction chain very carefully 40.00 chs. to a point fig.19, page 116 which I mark by setting a stone level with the top of the ground, on top of which I mark a temporary X on line, and exactly 40.00 chs. from Sta.A′. To insure this angle I set it off twice more, and each time fall on the temporary X. From the temporary x I measure south -

x = 40.00 chs. x, tan. 0° 0′ 14″	
Log. 40.00	1.6020600
Log. tan. 0° 0′ 14″	5.8517029
Log. (x = .002715 chs)	-3.4537629
Log. 7.92 ins.	2 8987252
Log. x	0.2524881
x = 2.15 ins	

and cut a X in rock for Sta.D′ fig.19, page page 116

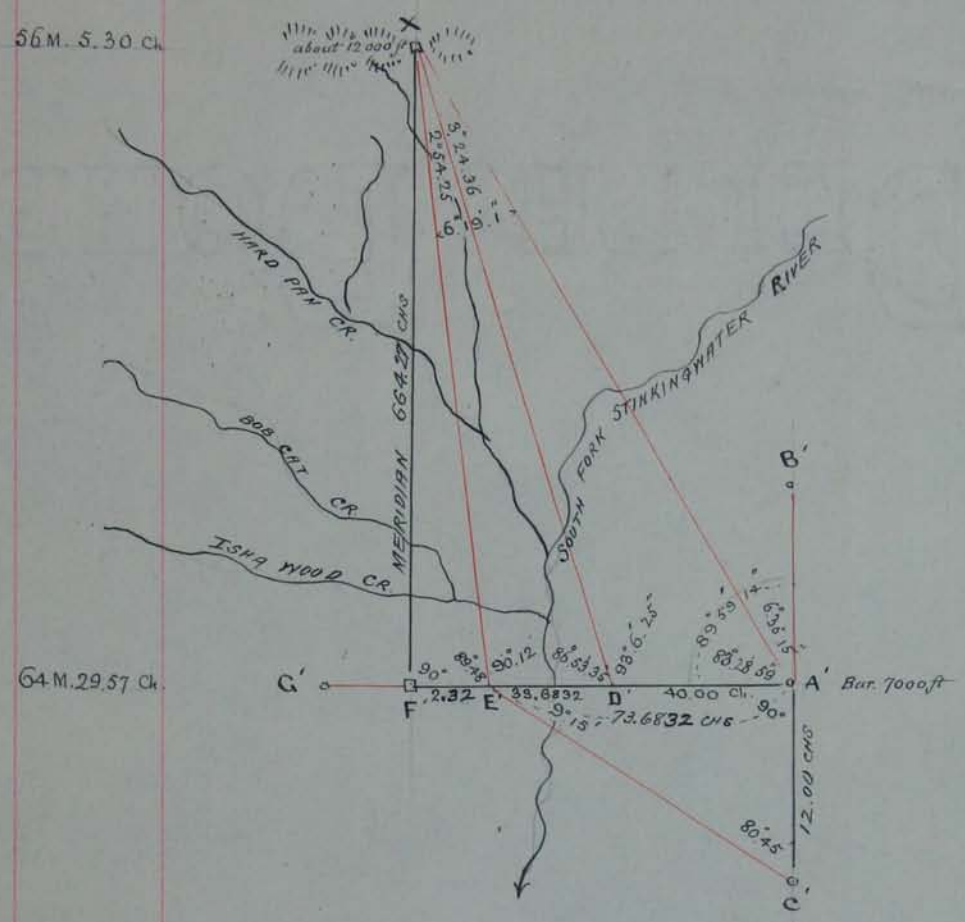
Instrument at Sta.A′

Set on Sta.D′, and deflect 90° from the west towards the south, and in this direction measure a base-line 12.00 chs.long, at the south end of which I set a stone level with the top of the ground, on the top of which I mark a X on line, and exactly 12.00chs dist.from from Sta.A′, for Sta.C′. I then extend the line A′D′ westerly westerly by foresight on Sta.D′, and set stones level with the top of the ground, on the top of each of which, on line, I mark a X, for Stas.E′ & G′.

Instrument at Sta.A′, vernier at zero.
Set on Sta.B′.
Unclamp plates and set on Sta.X.
Vernier reads 6° 30′ 30″
Unclamp plates and set on Sta.D′.
Vernier reads 89° 59′ 30″
Unclamp plates and set on Sta.C′.
Vernier reads 179° 59′ 30″
Unclamp below and set on Sta.B′.
Unclamp plates and set on Sta.X.
Vernier reads 186° 29′ 30″
Unclamp plates and set on Sta.D′.
Vernier reads 269° 58′ 30″
Unclamp plates and set on Sta.C′.
Vernier reads 359° 58′ 30″
Angle B′ A′ X, mean value, 6° 30′ 16″
Angle X A′ D′, mean value, 88 29 00
Angle D′ A′ C′, mean value, 90 00 00

(Figure 19 faces this page)

FIGURE 19. after page 118.



Solving triangle A''B''C', for A''E''.=x
12.00 x tan. 80° 45' = x.

Log. 12.00	1.0791812
Log. tan. 80° 45'	0.7881847
	1.8673659

x = A''E'' = 73.6832 chs.

Solving triangle A''E''X, for E''X.=x
73.6832 : sin. 6° 19' 01"
:: x : sin. 83° 28' 59."

Log. 73.6832	1.8673659
Log. sin. 83° 28' 59"	9.9971847
	11.8645506
Log. sin. 6° 19' 01"	9.0415042
	2.8230464

x = E''X = 665.34 chs.

Solving triangle D''E''X, for E''X.=x
33.6832 : sin. 2° 54' 25"
:: x : sin. 86° 53' 35."

Log. 33.6832	1.5274154
Log. sin. 86° 53' 35"	9.9983611
	11.5257765
Log. sin. 2° 54' 25"	8.7061277
	2.8216488

X = E''X = 668.20 chs.

Solving triangle E''F''X, for F''X.=x
x = 664.27 x cos. 0° 12' 00"

Log. 664.27	2.8225448
Log. Cos. 0° 12' 00"	9.9999974
	2.8225420

X = xF'' = 664.27 chs

Solving triangle E''F''X, for F''E''. = x
x = 664.27 x sin. 0° 12' 00"

Log. 664.27	2.8225420
Log. sin. 0° 12' 00"	7.5429065
	0.3654485

X = E''F'' = 2.319 chs.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Instrument at Sta. C′, vernier at zero.
Set on Sta. A′.
Unclamp plates and set on Sta. E′.
Vernier reads 80° 45′ 00″
Unclamp below and set on Sta. A′.
Unclamp plates and set on Sta. E′.
Vernier reads 161° 30′ 00″
Angle A′ C′ E′, mean value, 80° 45′ 00″

Instrument at Sta. D′, vernier at zero.
Set on Sta. A′,
Unclamp plates and set on Sta. X.
Vernier reads 93° 06′ 30″
Unclamp below and set on Sta. A′.
Unclamp plates and set on Sta. X.
Vernier reads 186° 12′ 00″
Angle A′ D′ X, mean value, 93° 06′ 30″

Set on Sta. E′, vernier at zero.
Unclamp plates and set on Sta. X.
Vernier reads 88° 53′ 20″
Unclamp below and set on Sta. E′.
Unclamp plates and set on Sta. X.
Vernier reads 178° 47′ plus.
Unclamp below and set on Sta. E′.
Unclamp plates and set on Sta. X.
Vernier reads 268° 41′ 00″
Angle X E′ E′, mean value, 88° 53′ 40″
Instrument at Sta. E′, vernier at zero.
Set on Sta. C′.
Unclamp plates and set on Sta. A′.
Vernier reads 9° 15′ 00″
Unclamp below and set on Sta. C′.
Unclamp plates and set on Sta. A′.
Vernier reads 18° 30′ 00″
Angle A′ E′ C′, mean value, 9° 15′ 00″

Set on Sta. A′, vernier at zero.
Unclamp plates and set on Sta. X.
Vernier reads 90° 12′ 00″
Unclamp plates and set on Sta. G′.
Vernier reads 180° 00′ 00″
Unclamp below and set on Sta. A′.
Unclamp plates and set on Sta. X.
Vernier reads 270° 12′ 00″
Unclamp plates and set on Sta. G′.
Vernier reads 360° 00′ 00″
Angle A′ E′ X, mean value, 90° 12′ 00″
Angle G′ E′ X, mean value, 89° 48′ 00″

Closing error of triangle E′ A′ C′.

Angle A′ E′ C′,	9° 15′ 00″
Angle E′ C′ A′,	80.45.00
Angle C′ A′ E′,	90.00.00
the sum is	180.00.00

Closing error 0.

For solution of triangle E′ A′ C′, see fig. 19, page 116

By triangulation, I have the base line, A′ E′, 73.8852 chs.

By measurement, the distance A′ D′, is 40.00 00 chs.

the difference is the base line D′ E′, 33.8852 chs

Closing error of Angles.

Angle S′ A′ X,	6° 30′ 15″	
Angle X A′ D′,	83.29.00	
the sum is	89.59.15,	Closing error 1″
Angle X D′ A′,	93° 06′ 30″	
Angle X D′ E′,	86.53.40	
the sum is	180.00.10,	Closing error 10″
Angle X E′ D′,	90.12.00	
Angle X E′ F′,	89.48.00	
the sum is	180.00.00,	Closing error 0

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains

Corrected angles.

Angle E'A'X,	6° 50 15
Angle XA'D',	83.28.59
Angle XD'A',	98.06.25
Angle XD'E',	86.53.35
Angle XE'D',	90.12.00
Angle XE'F',	89.48.00
the sum is	449 59 14

For solution of triangles E''A''X, E''D''X and E''F''X, see page 116

The difference, for the distance, XE', between the two solutions is 2.14 chs., which gives for mean distance , E' X, 684.27 chs.

The solution of triangle E'XF', page 116 gives the point F', on on the east boundary, 2.48 chs. west from Sta. E', and its line distance is as follows -

Line distance of Sta. X,	56M.05.30 chs.
Meridional distance XF',	8M.24.27 chs.
Line distance of Sta. F',	64M.29.57 chs.

Instrument at Sta. E'. I then extend the line A'E', 2.22 chs. west, to

64M.29.57 Set a sandstone level with the top of the ground, on the top of which I mark a X on line, and exactly 2.22 chs. from Sta. E'.

At apparent noon I take a solar observation for latitude, and find the latitude at 64M.+29.57 chs. to be 44° 15' N.

Instrument at Sta. F', vernier at zero. set on Sta. A', and deflect from the east towards the north 90°, and strike on Sta. X. The point F', at 64M.+29.57 chs. is therefore on same meridian as point X.

As the point F' stands in a sometime water course and is not a proper place for a corner, I run north, ascending 25 ft. to

1.57 Set a sandstone 50x8x8 ins., with granite boulder 8 ins. diam., marked with a X, 20 ins. in the ground, for Special corner, marked 64M.+28.00chs. W.C. T.P. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 7000 ft.

Thence I run

65th. MILE.

North, on a true line,
Va. 17° 36' E.

Ascending 200 ft., over rough broken country, sloping to east

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

20.65 Top of ridge jutting out from Isha Wood mountain towards the east, descend 100 ft. to

25.10 Cross trail, ~~course~~ E.& W. Castle mountain bears S.81° 50' E.
ascend 100 ft.
Difference in chaining is 2 lks. at middle point of difference

28.00 Set a sandstone 52x12x8 ins, with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for 84 Mile corner, marked 84M. on N. P.F.R. on W. and P.L. on E. faces, and raised a stone monument 6 ft. square, 6 ft. high, N. of cor- This corner and monument are in plain view from the trail.
Barometer indicates 7200 ft.
Land, mountainous.
Soil, rocky, 4th. rate.
No timber.

84th. MILE.

North, on a true line.
Va. 17° 50' E.

Ascending 150 ft. over ~~rough~~ rough broken ground to

10.10 Top of ridge, course E.& W. "B.N." Ranch bears N.55° E.
descend abruptly 250 ft. to

26.50 Cross trail up Isha Wood creek to National Park.

29.00 Set a sandstone 40x12x10 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Cor- ner, marked 85M.+51 chs. on N. P.F.R. on W. and P.L. on E. faces, and raised a stone monument 5 ft. square, 5 ft. high, N. of corner. Corner and monument in plain view from trail.

29.20 Top edge of perpendicular cliff 70 ft. high, descend

31.00 Cross Isha Wood creek, 15 lks. wide, course E. 4.00 chs. east of the mouth of small stream emptying into Isha Wood creek, thence ascend along east side of small stream.

31.50 Enter cottonwood timber, bears N.10° E. and S.10° W.

35.50 Leave timber bears N.10° W. and S.10° E.

40.00 Set a sandstone 40x14x8 ins., with granite boulder 5 ins. diam, marked with a X, 20 ins. in the ground, for 85 1/2 Mile corner, marked 85 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. from which
Castle mountain bears S.28° 38' E.

45.00 Foot of steep slope, and ascend 300 ft. to

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
64.00	Thence over rough broken ground to
	Difference in chaining is 10 lks. at middle point of difference
80.00	Set a sandstone 26x14x12 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 65 MILE corner, marked 65M. on N. P.F.R. on W. and P.L on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.
	Land, mountainous.
	Soil, rocky, 4th. rate.
	Timber, cottonwood, 5.00 chs.

66rd. MILE.

North, on a true line.
Va. 17° 56' E.

	Over nearly level ground.
17.00	Enter cottonwood timber, bears S. 60° E. & N. 60° W.
22.00	Cross Bob Cat creek, 10 lks. wide, course S. 65° E. Leave timber.
26.00	Foot of mountain, ascend 700 ft. to
40.00	Set a sandstone 27x10x9 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 62 1/2 Mile corner, marked 62 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. Barometer indicates 7700 ft. Thence ascend south slope of rough broken mountain side 800 ft.
	Difference in chaining is 7 lks. at middle point of difference
80.00	Marked a X in solid rock. As surface is too rough to make legible figures on, over the X I set a sandstone 32x8x9 ins. for 62 Mile Corner, marked 62M. on N. P.F.R. on W. and P.L. on E. faces, Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.
	Barometer indicates 8500 ft.
	Land, mountainous.
	Soil, rocky, 4th. rate.
	Timber, cottonwood, 5.00 chs.

62nd. MILE.

North, on a true line,
Va. 17° 50' E.

	Ascend 1000 ft. over broken rocky slope to S. & E.
40.00	Mark a X in solid rock. As surface of rock is covered by

Chains.

a wash, over the X I set a granite rock 88x10x8 ins. for 61 1/2 Mile Corner, marked 61 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 9500 ft.

Thence ascend 1000 ft. over rough, broken rocky mountain side, sloping to south.

78.00 Point 10,500 ft. high, on top of rocky cliff which forms part of the south wall of Hard Pan creek canyon. From this point the line crosses the canyon, the course of which is S.80° E. The canyon is 2000 ft. deep, and in the direction of the line impassible for 3 miles, and from that point to Sta. X, at 58M.+5.50 chs., crosses a series of cliffs and deep impassible canyons, over which chaining is impossible, and triangulation on account of the impossibility of getting base-lines over 2 or 3 chains long, would be impracticable and uncertain. From this point Sta. X cannot be seen on account of a cliff to the north, 50 ft. high, very narrow on top, the course of which is S.80° E. and I can find no suitable ground on which to triangulate, to make a further connection with Sta. X

~~Rear chain 73.05, mind chain 72.25, mean distance~~

78.00 On the face of the cliff mark a X, for Special Corner, marked 61M.+07.00chs. over, P.F.R. N. of, and P.L. E. of X, and raised a monument of stone 8ft. base, 5ft. high, under the corner.

Land, mountainous.

Soil. rocky, 4th. rate.

No timber.

September 16th. 1893.

I test my chains on the standard and find them correct.

On account of cloudy weather it was impossible to take an observation on Polaris on the evening of September 16th. 1893.

On the morning of September 17th. 1893, instrument at Sta. X, 64M.+29.67 chs., I run -

Remainder of 65th. MILE.

South, on a true line.
Va. 17° 40' E.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Ascending 100 ft. over broken slope to east.

10.45 Set a sandstone 36x10x8 ins, with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 64 1/2 Mile Corner, marked 64 1/2M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 6 ft base, N. of corner.

Thence over broken rocky slope to east, ascending 100 ft. to

19.50 Top of ridge, course E. & W. from which "B.N." Ranch bears N. 80° 14′ E.

Cabin on south fork bears N. 82° 11′ E. Descend 150 ft. to

34.00 Thence ascend, over broken hills, 200 ft. to

Difference in chaining is 4 lks. at middle point of difference

50.45 Set a sandstone 30x10x10 ins, ~~with granite boulder 5 ins.~~, with granite boulder 5 ins. diam, marked with a X, 20 ins. in the ground, for 65th. Mile Corner, marked 65M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

66th. MILE.

South, on a true line
Va. 17° 30′ E.

1.00 Cross head of gulch, course east.

5.00 Cross head of gulch, course east, and ascend 200 ft. to

37.80 Top of Butte capped with rocky needles, and descend 80 ft. to

40.00 Set a sandstone 30x12x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 65 1/2 Mile Corner, marked 65 1/2M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. Thence ascend 100 ft. to

48.82 Top of Butte. (Barometer indicates 7800 ft.) Hub and tack, at which I leave a flag.

Cabin No. 1 bears S. 46° 28′ E. Cabin No. 2 bears S. 5° 15′ E.

Cabin No. 3 bears S. 57° 28 W.

Castle mountain bears S. 41° E.

Cedar mountain bears N. 45° 06′ E.

54.00 Foot of Butte, on south fork bottom. Barometer 6500 ft.

Difference in chaining is 10 lks. at middle point of difference

Chains.
80.00
2

Set a sandstone 30x12x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 66th. Mile Corner, marked 66M.T.P. on N. P.F.R. on W. and P.L. on E. faces from which -

A cottonwood tree 40 ins. diam. bears S.75° W. 80 lks. dist. marked 66M. P.F.R. 1895. B.T. No ther trees within limits. Dug 2 pits 36x36x12 ins. E. & W. of stone, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 6500 ft.

Land, mostly mountainous.

Soil, rocky, 4th. rate, and loam, 1st. rate.

No timber.

Seeing that I will soon reach a portion of the line impossible to chain, I prepare for a triangulation as follows - Marking a X on the top of the 66th. Mile corner (at exact corner), just established, I then make the following triangulations -

With instrument over the X, Sta. I', fig. 20, and exactly on the meridian set a flag on the meridian to the south, Sta. H', vernier at zero, Deflect 65° 41' from the south towards the west, and in this direction, measure a base-line 10.00 chs. long, at the west end of which I set a stone level with the top of the ground, on the top of which I mark a X on line, and exactly 10.00 chs. from Sta. I', for Sta. J'.

With Sta. J' for a foresight I extend the base line to Sta. K', and mark the station by setting a stone level with the top of the ground, on the top of which I mark a X on line. Carefully chaining the distance J'K', I find it to be 20.525 chs. long.

Instrument at Sta. I', vernier at zero.
Set on Sta. H'.
Unclamp plates and set on Sta. J'.
Vernier reads 65° 41' 00"
Unclamp below, and set on Sta. H'.
Unclamp plates and set on Sta. J'
Vernier reads 131° 22' 00"
Angle H'I'J', mean value, 65° 41' 00"

Instrument at Sta. J', vernier at zero.
Set on Sta. I'.

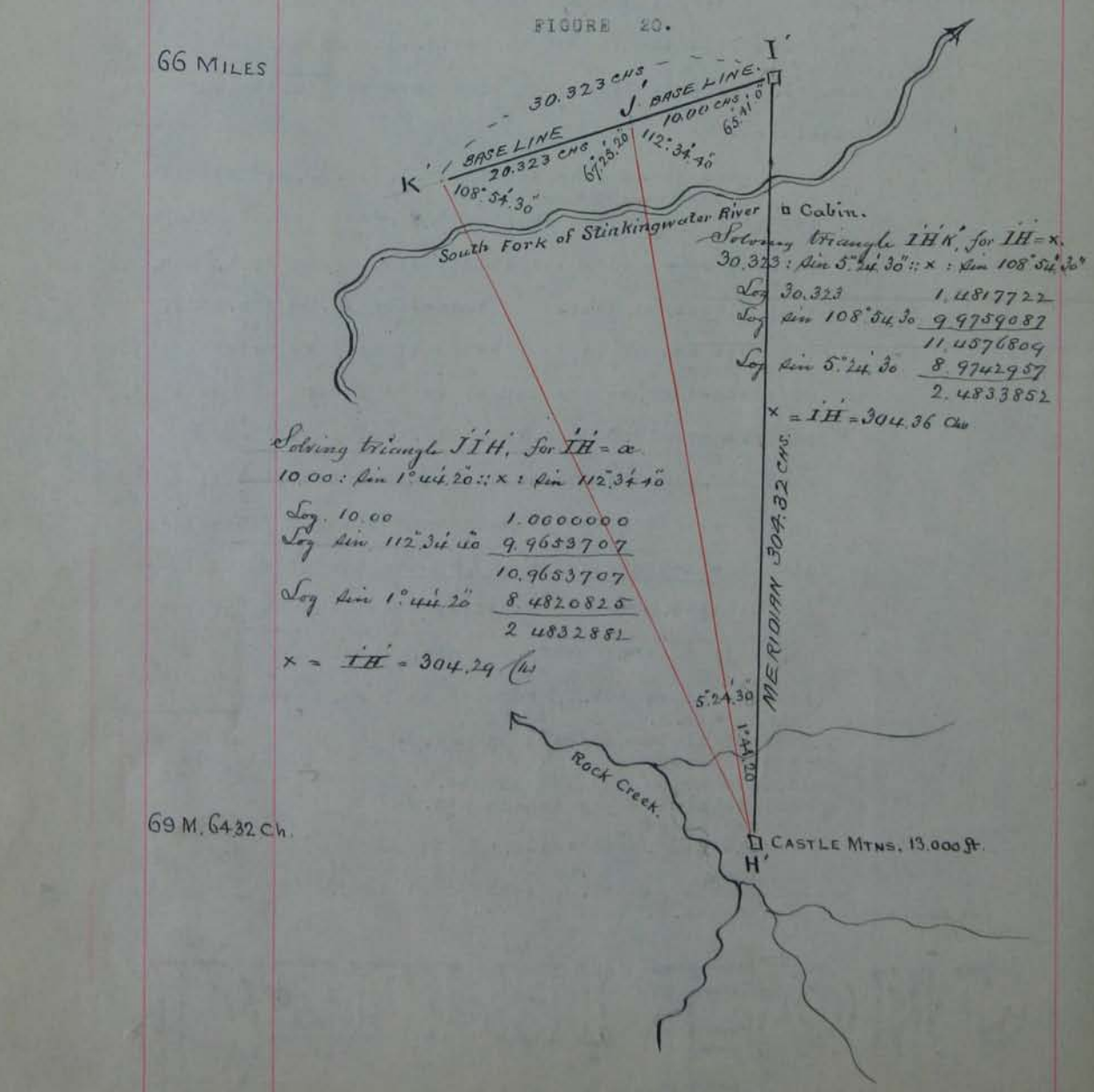
EAST BOUNDARY PUBLIC FOREST RESERVATION.

Unclamp plates and set on Sta. H'.
Vernier reads 112° 34' 30"
Unclamp below and set on Sta. I'.
Unclamp plates and set on Sta. H'.
Vernier reads 225°.09'. plus.
Unclamp below and set on Sta. I'.
Unclamp plates and set on Sta. H'.
Vernier reads 337°.44'.00"
Angle I'JH', mean value, 112° 34' 40"

Vernier at zero.
Set on Sta. H'.
Unclamp plates and set on Sta. K'.
Vernier reads 67°. 25'. plus.
Unclamp below and set on Sta. H'.
Unclamp plates and set on Sta. K'.
Vernier reads 134°.51'.00".
Unclamp below and set on Sta. H'.
Unclamp plates and set on Sta. K'.
Vernier reads 202°.16'.00".
Angle K'JH', mean value, 67° 25' 20"

Instrument at Sta. K', vernier at zero.
Set on Sta. I'.
Unclamp plates and set on Sta. H'.
Vernier reads 108°.54'.30"
Unclamp below and set on Sta. I'.
Unclamp plates and set on Sta. H'.
Vernier reads 217°.49'.00"
Angle I'K'H', mean value, 108° 54' 30"

FIGURE 20.



EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	67th. MILE.
	South, on a true line, Va. 17° 30′ E.
5.00	Enter cottonwood timber, bears E&W.
25.00	Leave timber, bears N. 60° E. & S. 30° W.
27.15	North bank of South Fork of Stinkingwater River, course N80°E.
28.00	South bank of same.
32.00	Enter willow brush, bears E&W.
39.00	Leave brush, bears E&W.
40.00	Set a dry cottonwood post 6 ft. long, 8 ins. square, with granite boulder 5 ins. diam., marked with a X, 30 ins. in the ground, for 66 1/2 Mile Corner, marked 66 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, dug 2 pits 36x36x12 ins. E. & W. of corner, 4 ft. dist., and raised a mound of earth 2 1/2 ft. high, 5 ft. base, N. of corner. from which -
	Log house No. 1 bears N. 58° 27′ E.
	Log cabin No. 2 bears S. 24° 45′ E.
	Castle peak bears S. 49° 45′ E. Corner stands in meadow.
45.50	Cross log fence, course S. 24° E.
58 50	Cross wagon road, course E&W.
62.10	Cross log fence, course E&W., and ascend 150 ft. to
	Difference in chaining is 6 lks. at middle point of difference
80.00	Set a sandstone 38x14x10 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 67th. Mile Corner, marked 67M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.
	Barometer indicates 6500 ft.
	Land, mountainous and level.
	Soil, mostly rocky, 4th. rate, but some good land on level part.
	Timber, cottonwood, 20.00 chs.

	68th. MILE.
	South, on a true line, Va. 17° 25′ E.
	Ascend gradually 100 ft., over rolling country to
12.00	Thence ascend 200 ft. to
25.00	Thence ascend, over foot hills, 100 ft. to

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
35.00	Thence over broken ground to
40.00	Set a sandstone 36x12x10 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 67 1/2 Mile Corner, marked 67 1/2 M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. Thence ascend 700 ft. to
73.50	Large rock in place, on the top of which I mark a X, at exact point, for Special Corner, marked 67 M. 73.50 chs. N. of, P.F.R. W. of, and P.L. E. of X, from which Cabin bears S.75°25' W. Barometer indicates 7500 ft. thence descend 50 ft. to
	Difference in chaining is 5 lks. at middle point of difference
80.00	Set a sandstone 40x18x9 ins., with granite boulder 5 ins. diam., marked with a X, 24 ins. in the ground, for 68th Mile Corner, marked 68M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.
	Land, mountainous and rolling.
	Soil, rocky, 4th. rate.
	No timber.

68th. MILE.

South, on a true line,
Va. 17°20' E.

	Ascending 800 ft., over broken rocky ground, to
80.00	Foot of perpendicular cliff, 800 ft. high, extending from the main range of Castle mountains towards the west. From this point on to the point of Sta. H', the line crosses a series of these high, precipitous, narrow cliffs, extending from the east towards the west, and cut by deep canyons. I find it impossible to establish any more corners between the station at H' and this point, as these cliffs can neither be chained, triangulated or offsetted.

September 17th. 1896.

I test my chains on the standard and find them correct. No observation on Polaris was possible on the evening of September 17th. on account of cloudy weather.

On the morning of September 18th.1898 I proceed to Sta. Sta.H', fig.20, which I find my flagman has marked with a X at exact point where flag stood. This point is located on the outside edge of a cliff which juts out from the main range of Castle mountains towards the west. The corner is on the outside edge of an almost perpendicular cliff, 200 ft.high at this point, and there is no possible chance to set up the instrument on line, or at the station, and consequently the angles K''H''I'' and J''H''I'' cannot be measured, solving the triangles K''H''I'' and J''H''I'', fig.20, page 124, however, I find that the former gives the distance, I''H'', 204.56 chs.

and the latter gives it 204.29 chs.

The difference is 7 links,

and as the work done at at I', J', K', was on excellent ground and very satisfactory, I conclude that these distances are as close to theoretical exactness as it is possible to do work, and decide to assume the exact length of the line H''I'' to be 204.22 chs. I then have -

Line distance of Sta. I',	66M.00.00 chs.
Meridian distance I'H',	5M.64.52 chs.
The sum = line distance of Sta. H',	69M.64.52 chs.

The X, Sta.H', is marked on a projection of the cliff & is at 69M.64.52chs. marked, for Special Corner, 69M.+64.52 chs. N.of, P.P.R. W. of, and P.L. E.of X. There is no room to build a monument. Barometer indicates 10,500 ft.

Inasmuch as I cannot set up the instrument on line on this mountain, and as the line, from this point south, drops over nearly perpendicular rock cliffs into Rock Creek canyon 1500 to 2000 ft.deep, and then runs for several miles along the broken canyon walls, in such a manner as to render work on the line impossible, I ascertain that the meridian prolonged from St.H' will cross near the top of a very high mountain to the south. I leave a flag at Sta.H', and proceed to the mountain referred to, towards the south.

September 18th.1898.

I test my chains on the standard and find them correct.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

On the morning of September 20th.1898 I arrived at the top of the mountain above referred to, and find that from it I can see back towards the north as far as Bald Top mountain, at 40M.+54.50 chs. That I can see Sta.X, fig.19, at 55M. 05.30 chs. That I can see back sight left at 65M.+46.52 chs., and that I can see flag at 69M.+64.82 chs., all of which points are on the same straight line, which straight line crosses the mountain I am on 80 ft. west of the highest part of the peak, and 70 ft. lower than the top of it, and which line is the true meridian defining the east boundary of the Public Forest Reservation. I ascertain by foresight on these several stations to the north, the exact spot at which the meridian crosses the peak, and there mark a deep X in the solid rock, Sta. L', fig. 21, page 129

From this point the meridian towards the south crosses a deep canyon, the head of one of the many forks of the west fork of the Grey Bull river. This canyon is 2000 ft. deep, with rocky, precipitous sides, and is impassible. The line crosses the canyon 40.00 chs east of its head.

This mountain peak stands exactly on the divide between the waters of the Grey Bull and Stinkingwater Rivers, and extends in a very crooked manner towards the south, with many long points extending out from it towards the east, for long distances, between which lie deep canyons like the one immediately in advance, rocky and precipitous to such an extent as to render them impassible.

I now send a flag around to the south and set it on the meridian, Sta. M', on south wall of the canyon, and make the following triangulations -

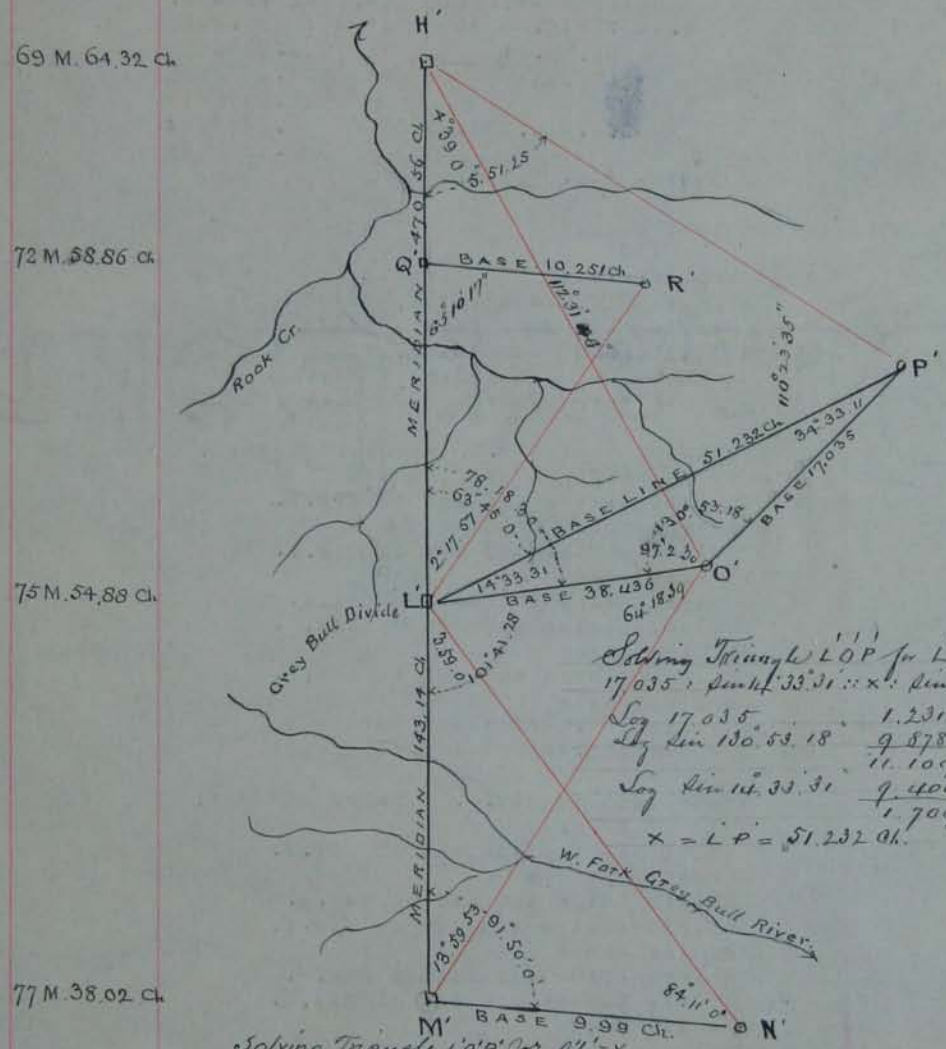
At points to the east, O' and P', I establish stations by setting stones level with the top of the ground, on the tops of which I mark a X, and at a point to the east of Sta. M' I establish Sta. N', by setting a stone level with the top of the ground, on the top of which I mark a X, Then with instrument at Sta. L', vernier at zero.

Set on Sta. H'.	
Unclamp plates and set on Sta. P'.	
Vernier reads	65°.45'.00"
Unclamp plates and set on Sta. O'.	
Vernier reads	75°.18'.30"
Unclamp plates and set on Sta. N'.	
Vernier reads	176°.01'.00"
Unclamp plates and set on Sta. M'.	
Vernier reads	180°.00'.00"
Unclamp below and set on Sta. H'.	
Unclamp plates and set on Sta. P'.	
Vernier reads	245°.45'.00"

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Unclamp plates and set on Sta. O'.
Vernier reads 258° 18' 20"
Unclamp plates and set on Sta. N'.
Vernier reads 358°. 01'. 00"
Unclamp plates and set on Sta. M'.
(continued on next page)

FIGURE 21.



Solving Triangle L'O'P' for L'P' = x
17.035 : sin 14°33'31" :: x : sin 130°53'18"

Log 17.035	1.2313421
Log sin 130°53'18"	9.8785142
	11.1098563
Log sin 14°33'31"	9.4003139
	1.7095424

x = L'P' = 51.232 Ch.

Solving Triangle L'O'P' for O'L' = x
17.035 : sin 14°33'31" :: x : sin 34°33'11"

Log. 17.035	1.2313421
Log sin 34°33'11"	9.7537126
	10.9850547
Log sin 14°33'31"	9.4003139
	1.5847408

x = O'L' = 38.4436 chs.

Solving triangle L'O'H', for L'H' = x.
38.436 : sin. 4°59'00" :: x : sin. 97°02'30."

Log. 38.436	1.5847408
Log. sin. 97°02'30"	9.9967118
	11.5814526
Log. sin. 4°59'00"	8.9088535
	2.6725991

x = L'H' = 470.54 chs.

Solving triangle L'P'H', for L'H' = x.
51.232 : sin. 5°51'25" :: x : sin. 110°23'35."

Log. 51.232	1.7095424
Log. sin. 110°23'35"	9.9718899
	11.6814323
Log. sin. 5°51'25"	9.0087918
	2.6726405

$x = L'H' = 470.59$ chs.

Solving triangle O'L'M', for L'M' = x.

58.486 : sin.13°59'53"::: x : sin.64°18'39."

Log.58.486	1.5847408
Log.sin.64°18'39"	9.9548014
	11.5395422
Log.sin.13°59'53"	9.3836160
	2.1559262

$x = L'M' = 148.19$ chs.

Solving triangle L'M'N', for L'M' = x.

9.99 : sin. 5°59'00"::: x : sin.84°11'00."

Log. 9.99	0.9995655
Log.sin.84°11'00"	9.9977582
	10.9973237
Log.sin. 5°59'00"	9.8417741
	2.1555496

$x = L'M' = 148.07$ chs.

(continued from last page)

Vernier reads 360°00'00"

Angle H'L'P', mean value, 55°45'00"

Angle H'L'O', mean value, 78°18'.30"

Angle P'L'O', mean value, 14°33'.30"

Angle O'L'M', mean value, 101°41'.30"

Angle M'L'N', mean value, 3°59'.00"

Instrument at Sta.O', vernier at zero.

Set on Sta.L'.

Unclamp plates and set on Sta.H'.

Vernier reads 97°02'.30"

Unclamp plates and set on Sta.P'.

Vernier reads 150°53'.00"

Unclamp below and set on Sta.L'.

Unclamp plates and set on Sta.H'.

Vernier reads 227°55'.30"

Unclamp plates and set on Sta.P'.

Vernier reads 261°46'.30"

Angle L'O'H', mean value, 97°02'30"

Angle L'O'P', mean value, 150°53'.15"

Instrument at Sta.P', vernier at zero.

Set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 110°25'.30"

Unclamp below and set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 220°47'. plus.

Unclamp below and set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 331°11'. minus.

Unclamp below and set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 441°34'. plus.

Unclamp below and set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 551°58'. minus.

Unclamp below and set on Sta.H'.

Unclamp plates and set on Sta.L'.

Vernier reads 662°21'.30"

Angle L'P'H', mean value, 110°25'55"

Vernier at zero,

Set on Sta.L'.

~~Unclamp plates and set on Sta.L'.~~

Unclamp plates and set on Sta.O'.

Vernier reads 34°,55'. plus.

Unclamp below and set on Sta.L'.

Unclamp plates and set on Sta.O'.

Vernier reads 69°,06'. plus.

Unclamp below and set on Sta.L'.

Unclamp plates and set on Sta.O'

Vernier reads 103°,39'.30"

Angle L'P'O', mean value, 34°55'10."

Closing error of triangle L'P'O'.

Angle L'P'O',	84° 88' 10"
Angle L'O'P',	180.88.15
Angle P'L'O',	14.88.30
the sum is	179.59.55

Closing error 5," which I divide between the angles as follows -

Corrected angles of triangle L'P'O'.

Angle L'P'O',	84° 88' 11"
Angle L'O'P',	180:88.18
Angle P'L'O',	14.88.31
the sum is	180 00 00

Carefully chaining the distance P'O', which is over good ground along the top of a narrow ridge, or divide, I make the distance to be exactly 17.035 chs., which distance I use as a base-line from which to calculate the length of the base-lines O'L' and L'P'.

For solution of triangles P'O'L', L'P'H' and L'O'H', see page 129

The difference in the two triangulations, for the distance L'H', is 5 lks., and I assume the distance L'H' to be 470.56 chs. whence -

Line distance of sta. H',	69M.84.32 chs.
Meridian distance H'L',	5M.70.86 chs.
Line distance of Sta. L',	75M.54.88 chs.

At apparent noon September 20th.1893 I took a solar observation from Sta. L', and find the latitude of Sta. L' to be 44° 05' 80" N.

The Barometer indicates 12,600 ft.

I then set a flag on the meridian to the north, and mark the point by setting a stone level with the top of the ground, on top of which I mark a X on the meridian, Sta. Q', and also establish a station to the east of Sta. Q', on the same divide, and mark it by setting a stone level with the top of the ground, on the top of which I mark a X, Sta. R'. I also, by double back and fore sights, establish a point on the meridian to the south, and mark it by setting a stone level with the top of the ground, on top of which I mark a X, exactly on line, for Sta. W'.

Instrument at L', vernier at zero.
Set on Sta. R'.
Unclamp plates and set on Sta. Q'.
Vernier reads 2° 18' 00"
Unclamp below and set on Sta. R'.
Unclamp plates and set on Sta. Q'.
Vernier reads 4° 36' 00"
Angle R'L'Q, mean value, 2° 18' 00"

Instrument at Sta. O', vernier at zero.
Set on Sta. L'.
Unclamp plates and set on Sta. M'.
Vernier reads 64° 18' 80"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. M'.
Vernier reads 128°.37'. plus.
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. M'.
Vernier reads 192°.56'.00"
Angle L'O'M', mean value 64° 18' 40"

75M.54.88chs As the surface of rock is too rough to permit legible marks, over the X, at Sta. L', I set a porphyry stone 8Qx10x9 ins. for special corner, marked 75M.+54.88chs.T.P.on N. P.F.R. on W. and P.L. on E.faces. Piled stone around it and raised a stone monument 5 ft.square, 5 ft.high, N.of corner. I also mark a X on top of stone, exactly over the X cut in the solid rock underneath.

Instrument at Sta. Q', vernier at zero.
Set on Sta. L'.
Unclamp plates and set on Sta. R'.
Vernier reads 65° 10' plus.
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. R'.
Vernier reads 130°.20'.80"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta R'.
Vernier reads 195°.31'.00"
Angle L'Q'R', mean value, 65° 10' 20"

Instrument at Sta. R', vernier at zero.
Set on Sta. L'.
Unclamp plates and set on Sta. Q'.
Vernier reads 112°.52'. minus.
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. Q'.
Vernier reads 225° 03'.50"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta Q'.
Vernier reads 337° 35' 30"
Angle QRL, mean value 112° 31' 50"

Carefully measuring the base-line QR, I find it to be 10.257 chains.

Closing error of triangle Q'R'L'		Corrected angles of same.	
Angle Q'R'L',	112° 51' 50"	Angle Q'R'L',	112° 51' 46"
Angle R'L'Q',	112.18.00	Angle R'L'Q',	2.17.57
Angle L'Q'R',	65.10.20	Angle L'Q'R',	65.10.17
the sum is	180 00 10	the sum is	180.00.00
Closing error 10"		dividing the closing error as equally as possible.	

Solving triangle Q'R'L', fig. 21, p. 129 for Q'L' = x.
10.257: sin. 2° 17' 57" :: x : sin. 112° 51' 46."

Log. 10.257	1.0107652
Log. sin. 112° 51' 46"	9.9665828
	10.9782890
Log. sin. 2° 17' 57"	8.6058515
	2.3729577

x = Q'L' = 238.02 chs.

Line distance of Sta. L',	75M.54.88 chs.
Meridian distance Q'L',	2M.76.02 chs.
The difference is the line distance of Sta. Q',	72M.58.86 chs.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

72M.58.86 Set a sandstone 40x10x5 ins., with granite boulder 5 ins diam., marked with a X, 24 ins. in the ground, for Special Corner, marked 72M.+58.86 chs. T.P.on N. P.P.R.on W. and P.L. on E.faces. Dug 2 pits 36x36x12 ins. E.& W.of stone, 4 ft.dist. and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, N.of corner.

From this corner the meridian towards the north breaks off, almost perpendicularly, into a deep canyon, and thence runs along . rocky, precipitous mountain side to the Special Corner at Sta.H', and cannot be chained.

Thence I run -

Remainder of 72rd. MILE.

South, on a true line,
Va.17°25'E.

Descending abruptly over broken rocky mountain side, sloping W.

8.00 Enter dead pine timber, bears E&W.

21.14 Point 500 ft.below last corner. Set a sandstone 36x12x8 ins with granite bould 5 ins.diam., marked with a X, 20 ins. in the ground, for 73rd.Mile Corner, marked 73M. on N. P.P.R. on W.and P.L. on E.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft. base, N.of corner. No living trees suitable for marking within limits.

Barometer indicates 8500 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine

74th. MILE.

South, on a true line,
Va.17°20'E.

Descending rapidly, through dead pine timber.

7.00 Enter pine timber.

35.00 Leave timber., bears E&W.

38.10 Cross small stream, 4 lks.wide, course N.30° W. Barometer indicates 8000 ft. Thence ascend along north east slope of mountain, 100 ft. to

40.00 Set a sandstone 30x8x6 ins., with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for 73 1/2 Mile Corner, marked 73 1/2 M.on N. P.P.R.on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

N. of corner. Thence ascend along broken mountain side sloping to east, 800 ft.

Difference in chaining is 5 lks. at middle point of difference

80.00 Set a sandstone 40x8x6 ins., with granite boulder 5 ins. diam., marked with a X, 24 ins. in the ground, for 74th. Mile Corner, marked 74M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 8800 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine, 55.00 chs.

75th. MILE.

South, on a true line,
Va. 17° 20' E.

Ascending 100 ft. to

10.00 Top of spur from SW., thence descend over broken rocky mountain slope to south east.

31.50 Bottom of dry gulch, 700 ft. below last summit, course N. 20 E. thence ascend 400 ft. to

40.00 Marked a X in solid rock, at exact corner point. As surface of rock is too rough to permit legible markings, over the X I set a porphyry rock 32x12x6 ins. for 74 1/2 Mile Corner, marked 74 1/2 M. on N. P.F.R. on W. and P.L. on E. faces. Piled rock around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner. Thence ascend broken rocky mountain slope to north 1600 ft. to

Difference in chaining is 10 lks. at middle point of difference

80.00 Set a porphyry rock 30x10x6 ins., with porphyry rock 6 ins. ~~diam.~~ cube, marked with a X, 20 ins. in slide rock, for 75th. Mile Corner, marked 75M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

From this corner to Sta. L, at 75M.+54.88 chs. on the top of the high peak to south, the ascent is so abrupt as to render

chaining impossible.

September 20th. 1898.

I compared my chains with the standard and found them correct

On the evening of September 20th. 1898 a heavy snow storm prevailed and an observation on Polaris could not be taken.

On the morning of September 21st. 1898, with

Instrument at Sta. M', vernier at zero,
Set on Sta. L'.
Unclamp plates and set on Sta. O'.
Vernier reads 14° 00' 00"
Unclamp plates and set on Sta. N'.
Vernier reads 81°.50'.00"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. O'.
Vernier reads 105°.50'.00"
Unclamp plates and set on Sta. N'.
Vernier reads 185°.40'.00"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. O'.
Vernier reads 197°.40'. minus.
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. O'.
Vernier reads 211°.29'.30"
Unclamp below and set on Sta. L'.
Unclamp plates and set on Sta. O'.
Vernier reads 225°.39'.30"
Angle L'M'O', mean value, 13° 59' 54"
Angle L'M'N', mean value, 81° 50' 00"

Carefully measuring the base-line M'N', I find it to be 9.99 chs. long.

Instrument at Sta. N', vernier at zero.
Set on Sta. M'.
Unclamp plates and set on Sta. L'.
Vernier reads 84° 11' 00"
Unclamp below and set on Sta. M'.
Unclamp plates and set on Sta. L'.
Vernier reads 168°.22'.00"
Angle M'N'L', mean value, 84° 11' 00"

Closing error of triangle L'M'N'.		Closing error of triangle L'M'O'.	
Angle L'M'N',	81° 50' 00"	Angle L'M'O',	13° 59' 54"
Angle M'N'L',	84.11.00	Angle M'O'L',	64.18.40
Angle N'L'M',	3.59.00	Angle O'L'M',	101.41.30
the sum is	180.00.00	the sum is	180.00.04
Closing error 0.		Closing error 4"	

Distributing the closing error of 4" in triangle L'M'O' as near equally as possible between the angles, I have -

Corrected angles of triangle L'M'O'.

Angle L'M'O',	13° 59' 55"
Angle M'O'L',	64.18.39
Angle O'L'M',	101.41.25
the sum is	180.00.00

For solution of triangles N'M'L' and O'L'M', see page 130

The difference between the two triangulations, for the meridian distance L'M', is 12 lks. Considering the triangulation O'L'M', on account of the extra length of the base, somewhat the

best, I assume the distance L'M' to be 148.14 chs.

Line distance of Sta. L',	75M.54.88 chs.
Meridian distance L'M',	1M.83.14 chs.
Line distance of Sta. M',	77M.38.02 chs.

77M.38.02chs. Set a granite stone 24x16x8 ins., with granite bouder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 77M.+38.02 chs. T.P. on N. P.F.R. on W. and P.L. on E. faces, and raised a monument of stone 6 ft. square, 6 ft. high, N. of corner. from which -

High peak bears S.71° 09' W. Very high peak bears S.89° 28' W.

Barometer indicates 12,500 ft.

This corner stands on a narrow rocky ridge, extending from the main Grey Bull divide about 1 mile to the west. In an easterly direction to about 1 mile east of line. To the north the meridian drops almost perpendicularly into the canyon just triangulated over, 3000 ft. deep, and to the south there are two mountain ridges, high rocky and narrow, similar to the one I am now on, which the line crosses in about the same relative position from the main range as this one. The canyons between these ridges are all about 3000 ft. deep, and the sides are rocky, precipitous and impassible. I endeavor to establish points on both of these ridges by going around on the main divide to the west, but find I cannot get to the point where the ridges branch off, as there are places where the main divide is very narrow, andcapped with rocky points 1 to 2 hundred ft. high, that I cannot get over, and I will have to go back to Rock creek and find a way further south, where I can scale the main range and get down on to the Grey Bull side, meantime I locate the two ridges, above noted, very accurately, as follows, Instrument at Sta. M', at 77M.+38.02 chs. I direct the telescope to the south, and find on the first ridge a narrow crevice on the meridian, and in the top of the ridge, Sta. U', fig. 22, page 138 and on ridge No. 2, on the extreme top, a sharp point of rock is on the meridian, Sta. V, fig. 22 p. 138

Vernier at zero.	
Set on Sta. U'.	
Unclamp plates and set on Sta. N'.	
Vernier reads	88° 10' 00"
Unclamp below and set on Sta. U'.	
Unclamp plates and set on Sta. N'.	
Vernier reads	176° 20' 00"
Angle U'M'N', mean value, 88° 10' 00"	

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Instrument at Sta.N', vernier at zero
Set on Sta.M'.
Unclamp plates and set on Sta.U'.
Vernier reads 88° 08' 00"
Unclamp plates and set on Sta.V'.
Vernier reads 88°.15.00"
Unclamp below and set on Sta.M'.
Unclamp plates and set on Sta.U'.
Vernier reads 176°.25.00"
Unclamp plates and set on Sta.V'.
Vernier reads 176°.30.00"
Angle U'N'V', mean value, 88° 08' 00"
Angle V'N'M', mean value, 88.15.00
Angle M'U'N', computed, 5.42.03
Angle M'V'N', computed, 5.55.03

For solution of triangles M'U'N' and M'V'N', see pages 137 & 138

September 21st.1898.

I compare my chains with the standard and find them correct.

On the evenings of September 21st.and 22nd.1898, the weather being cloudy, no observations on Polaris were possible.

With great difficulty I succeed, on the morning of September 23rd.1898, from Sta.M', in establishing a flag on the meridian at Sta.N', fig.22, page 138 which point I mark by setting a stone level with the top of the ground, on top of which I mark a X exactly on the meridian. I also set a stone level with the top of the ground, to the west of Sta.N', on the top of which I mark a X, for Sta.X'.

Instrument at Sta.M', vernier at zero.
Set on Sta.N'.
Unclamp plates and set on Sta.X'.
Vernier reads 1° 40' " plus.
Unclamp below and set on Sta.N'.
Unclamp plates and set on Sta.X'.
Vernier reads 5°.20'. plus.
Unclamp below and set on Sta.N'.
Unclamp plates and set on Sta.X'.
Vernier reads 5°.00.50"
Angle X'M'N' mean value 1°40'10"

Solving triangle M'N'U', for M'U' = x.

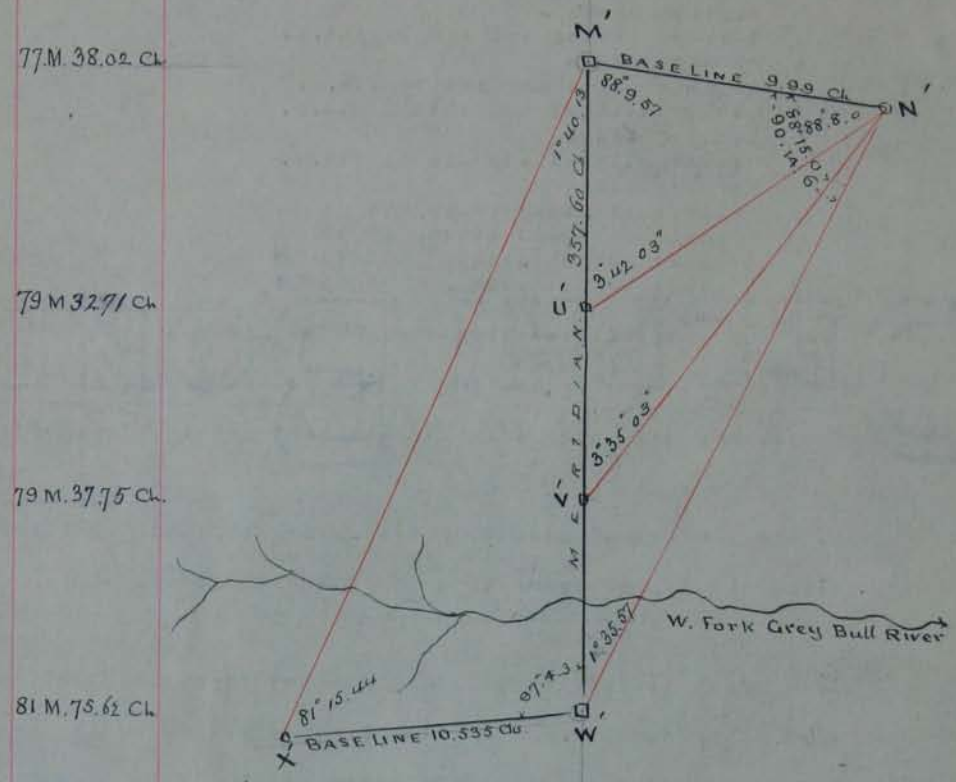
9.99 : sin. 5°42'03" :: x : sin.88° 08' 00"

Log. 9.99	0.9995655
Log.sin.88° 08'	9.9997895
	10.9993550
Log.sin. 5°42'03'	8.8098759
	2.1894791

x - M'U' = 154.69 chs.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

FIGURE 22.



Solving triangle M'N'V', for M'V' = x.

9.99 : sin. 3° 35' 03" :: x : sin. 88° 15' 00".

Log. 9.99	0.9996666
Log. sin. 88° 15' 00"	9.9997974
	10.9996829
Log. sin. 3° 35' 03"	8.7959622
	2.2037207

x = M'V' = 159.73 chs.

Solving triangle X'W'M, for M'W' = x.

10.555 : sin. 1° 40' 13" :: x : sin. 81° 15' 44".

Log. 10.555	1.0236345
Log. sin. 81° 15' 44"	9.9940301
	11.0176646
Log. sin. 1° 40' 13"	8.4646047
	2.5529599

x = M'W' = 357.24 chs.

Solving triangle M'N'W, for M'W' = x.

9.99 : sin. 1° 55' 57" :: x : sin. 90° 14' 06".

Log. 9.99	0.9996666
Log. sin. 90° 14' 06"	9.9999955
	10.9996618
Log. sin. 1° 55' 57"	8.4457150
	2.5539468

x = M'W' = 357.97 chs.

Instrument at Sta. N', vernier at zero.
Set on Sta. M'.
Unclamp plates and set on Sta. W'.
Vernier reads 90°14'00"
Unclamp below and set on Sta. M'.
Unclamp plates and set on Sta. W'.
Vernier reads 180°28'. plus.
Unclamp below and set on Sta. M'.
Unclamp plates and set on Sta. W'.
Vernier reads 270°42'.30"
Angle W'N'M', mean value, 90°14'10"

September 25rd. 1895.

Leaving back sights at stations M' and N', I proceed to the flag at Sta. W'.

The weather being stormy no observation on Polaris was possible on the night of September 25rd. 1895.

On the morning of September 26th., with

Instrument at Sta. W', vernier at zero.
Set on Sta. N'.
Unclamp plates and set on Sta. M'.
Vernier reads 1°56'00"
Unclamp plates and set on Sta. X'.
Vernier reads 99°40'.00"
Unclamp below and set on Sta. N'.
Unclamp plates and set on Sta. M'.
Vernier reads 100°16'.00"
Unclamp plates and set on Sta. X'.
Vernier reads 197°20'.00"
Angle N'W'M', mean value, 1°56'00"
Angle M'W'X', mean value, 97·04·00

Carefully measuring the base-line X'W', I find it to be 10.555 chs. long.

Instrument at Sta. X', vernier at zero.
Set on Sta. W'.
Unclamp plates and set on Sta. M'.
Vernier reads 81°15'60"
Unclamp below and set on Sta. W'.
Unclamp plates and set on Sta. M'.
Vernier reads 162°31'. plus.
Unclamp below and set on Sta. W'.
Unclamp plates and set on Sta. M'.
Vernier reads 243°47'.00"
Angle W'X'M', mean value, 81°15'40"

Closing error of triangle X'W'M'.		Closing error of triangle M'W'N'.	
Angle X'W'M',	97°04'00"	Angle M'W'N',	1°56'00"
Angle W'M'X',	1·40.10	Angle W'M'N',	90.14.10
Angle M'X'W',	81.15.40	Angle W'N'M',	88.10.00
the sum is	179.59.50	the sum is	180.00.10
Closing error 10"		Closing error 10"	

Dividing the closing errors as evenly as possible between the angles, I have -

Corrected angles of triangle X'W'M'.		Corrected angles of trian. M'W'N'.	
Angle X'W'M',	97°04'05"	Angle M'W'N',	1°55'57"
Angle W'M'X',	1.40.15	Angle W'M'N',	90.14.08
Angle M'X'W',	81.15.44	Angle W'N'M',	88.09.57
the sum is	180.00.00	the sum is	180.00.00

For solution of triangles X'W'M' and M'W'N', see page 138

from which the difference, for the distance W'W', is 73 lks.

As I consider the two triangulations equally accurate I assume the meridian distance, W'N', 357.60 chs.

Line distance of Sta. M',	77M.58.02 chs.
Meridian distance MU',	1M.74.69 chs.
Line distance of Sta. U',	79M.32.71 chs.
Meridian distance U'V',	5.04 chs.
Line distance of Sta. V',	79M.37.75 chs.
Meridian distance V'W',	2M.37.87 chs.
Line distance of Sta. W',	81M.75.62 chs.

81M.75.62 chs. Set a granite stone 40x8x8 ins., with granite boulder 5 ins. diam, marked with a X, 20 ins. in the ground, for Special Corner, marked 81M.+75.62 chs. T.P. on N. P.P.R. on W. and P.L. on E. faces. Marked a X on top of stone at exact point, and raised a monument of stone 6 ft. high, 6 ft. square, N. of corner.

Barometer indicates 18,100 ft.

From this corner stations as follows, can be seen, and are on the same straight line.

Station M', at	77M.58.02 chs.
Station L', at	75M.64.66 chs.
Station X, at	66M.05.50 chs.
Station I, at	40M.54.50 chs.

Instrument at Sta. W', 81M.+75.62 chs.
With Sta. M' as a foresight I set a flag on the meridian to the north, Sta. Z', fig. 28.

Instrument at Sta. X', vernier at zero.
Set on Sta. W'.
Unclamp plates and set on Sta. Z'.
Vernier reads 78° 23' 00"
Unclamp below and set on Sta. W'.
Unclamp plates and set on Sta. Z'.
Vernier reads 156°,46',00"
Angle W'X'Z', mean value, 78° 23' 00"

Instrument at Sta. Z', vernier at zero.
Set on Sta. W'.
Unclamp plates and set on Sta. X'.
Vernier reads 4°.33'.00"
Unclamp below and set on Sta. W'.
Unclamp plates and set on Sta. X'.
Vernier reads 9°.06'.00"
Angle X'Z'W', mean value, 4° 33' 00"

Closing error of triangle.

Angle X'W'Z',	78° 23' 00"
Angle W'Z'X',	4.33.00
Angle Z'X'W',	97.04.03
the sum is	180.00.03
Closing error 3".	

Solving triangle X'W'Z', for Z'W' = x.

10.555 : sin. 4° 33' 00" : x : sin. 78° 23' 00"

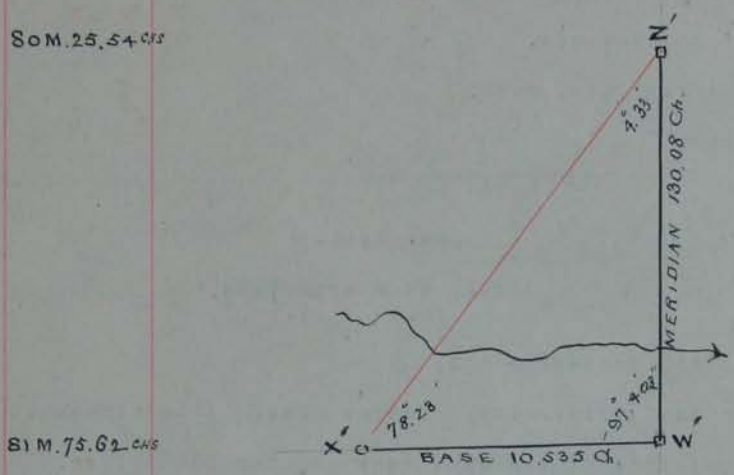
Log. 10.555	1.0226545
Log. sin. 78° 23' 00"	9.9910119
	11.0136664
Log. sin. 4° 33' 00"	8.8994322
	2.1142142

x = Z'W' = 180.08 chs

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Line distance of Sta. N', 81M. 75. 62 chs.
Meridian distance N'Z', 1M. 50. 08 chs.
the difference is the line distance of Sta. Z' } 80M. 25. 54 chs.

FIGURE 25.



80M.25.54 On solid rock I cut a X at exact point, and as rock is too brittle to cut legible figures upon, over the X I set a granite stone 30x12x6 ins. for Special Corner, marked 80M.+25.54 chs. T.P. on N. P.P.R. on W. and P.L. on E. faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 10,500 ft.

Thence I run -

Remainder of 81st. MILE,

South, on a true line,
Va. 17° 20' E.

The special corner just established stands on the south slope of a ~~700~~ high rocky ridge, and is as high up on the mountain as it is possible to get. From this point I descend abruptly over broken, rocky ground

14.46 Set a granite rock 38x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 80 1/2 Mile Corner, marked 80 1/2 M. on N. P.P.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 10,000 ft.

Thence descend over broken, rocky mountain slope to south, 700 ft. to

Difference in chaining is 15 lks. at middle point of difference

80.00 Set a granite stone 30x12x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 82 Mile

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Corner, marked S/M. on N. P.F.R. on W. and P.L. on E. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, N. of corner.

Barometer indicates 9800 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

82nd. MILE.

South, on a true line,
Va. 17° 15' E.

Over rough, broken ground.

5.50 Cross creek 10 lks. wide, course east. This stream is the principal fork of the west fork of Grey Bull river. The line crosses it about 1/2 mile east of the extreme head in the Grey Bull divide.

5.90 Perpendicular cliff. From this point south the Table mountain, on which Sta. W', fig. 22 stands, rises so nearly perpendicularly that no part of it is accessible on the line, and the point Sta. W' is only accessible by going a long way around.

September 25th. 1898.

I tested my chains on the standard and found them correct.

During the entire evening and night a heavy snow storm prevailed around Table mountain, and no observation could be obtained on Polaris.

On the morning of September 26th. 1898 I proceed to the special corner established on Table mountain yesterday, Sta. W'. This corner stands 5 chs. south of the face of the mountain, which breaks off perpendicularly 2000 ft. and then descends very abruptly to the creek below. With the instrument at the special corner at 81M. + 75.62 chs., Sta. W', I extend the meridian south, descending over rough, broken slope to south, 75 ft.

4.38 Point for 82nd. Mile Corner falls in a washout and is liable to be destroyed, and as the S.E. Corner of Public Forest Reservation falls only 2.71 chs. ahead I omit this corner.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

The difference in chaining is 0.

7.09 The point for the establishment of the South East Corner Public Forest Reservation. This point is on the top of a very high mountain extending out from the Grey Bull divide towards the east for 7 or 8 miles, between the west and south forks of Grey Bull river. The mountain from the north appears nearly perpendicular, the upper portion of it quite so, and lokks flat on top: it is not however but breaks away towards the south very abruptly, from a point a few chains south of the said S.E.Corner.

82W.2.71 chsA point 57M.+42.71 chs. south of the S.E.Corner Public Forest Reservation. Set a granite rock 40x12x10 ins., with granite boulder 5 ins.diam., marked with a X, 20 ins. in the ground, for South East Corner Public Forest Reservation, marked P.L.on N.E.and S.E. P.L.Lat.44° N.on S.W. and S.E. Cor.P.F.R. 1898, on N.W.faces. Over the corner I construct a monument of stone 6 ft.square, 5 ft.high, in the form of the frustum of a square pyramid, with its diagonals directed to the Cardinal points.

In N.E.side set a granite stone 20x10x8 ins., marked P.L.

In S.E.side set a granite stone 18x12x8 ins., marked P.L.

In S.W.side set a granite stone 24x12x10 ins.marked P.L. Lat.44°N., and

In N.W.side set a granite stone 24x12x8 ins., marked S.E.Cor. P.F.R. 1898.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

Sept 26, 1898

I tested my chains on the standard and found them correct.

GENERAL DESCRIPTION OF LINE.

This line runs, almost the entire length of it, over extremely rough mountains, very rugged and very high. There is but little timber along the line, which runs at an altitude above timber, and the only portion of the whole line where there is timber of any consequence is on the north slope of the mountain, south od Sunlight creek. In general terms it may be stated that the country bordering the line is poorly timbered. In fact from all appearances the country for 10 miles west of the line contains but little timber,

DIAGRAM D.

EAST BOUNDARY PUBLIC FOREST RESERVATION.

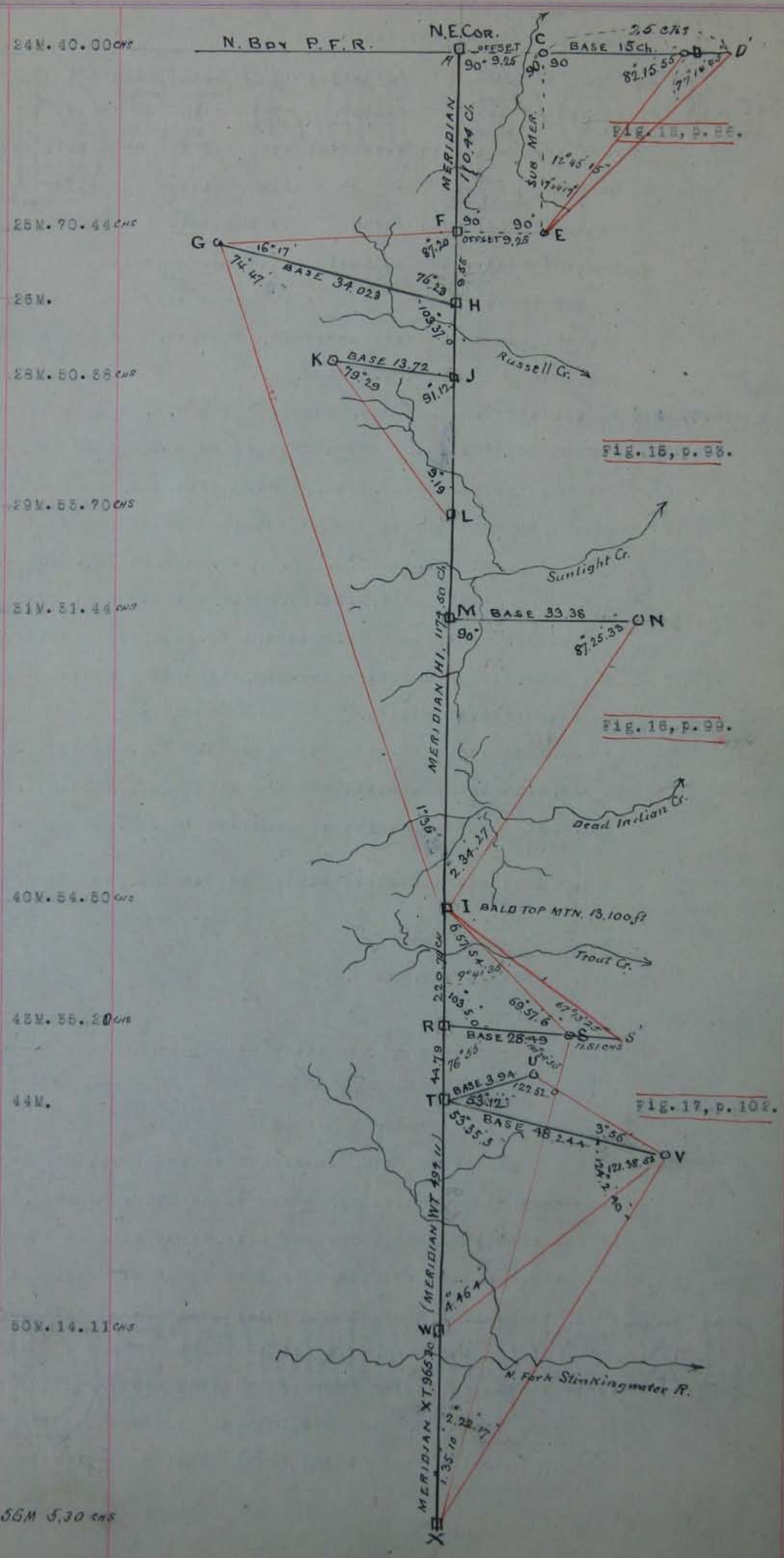
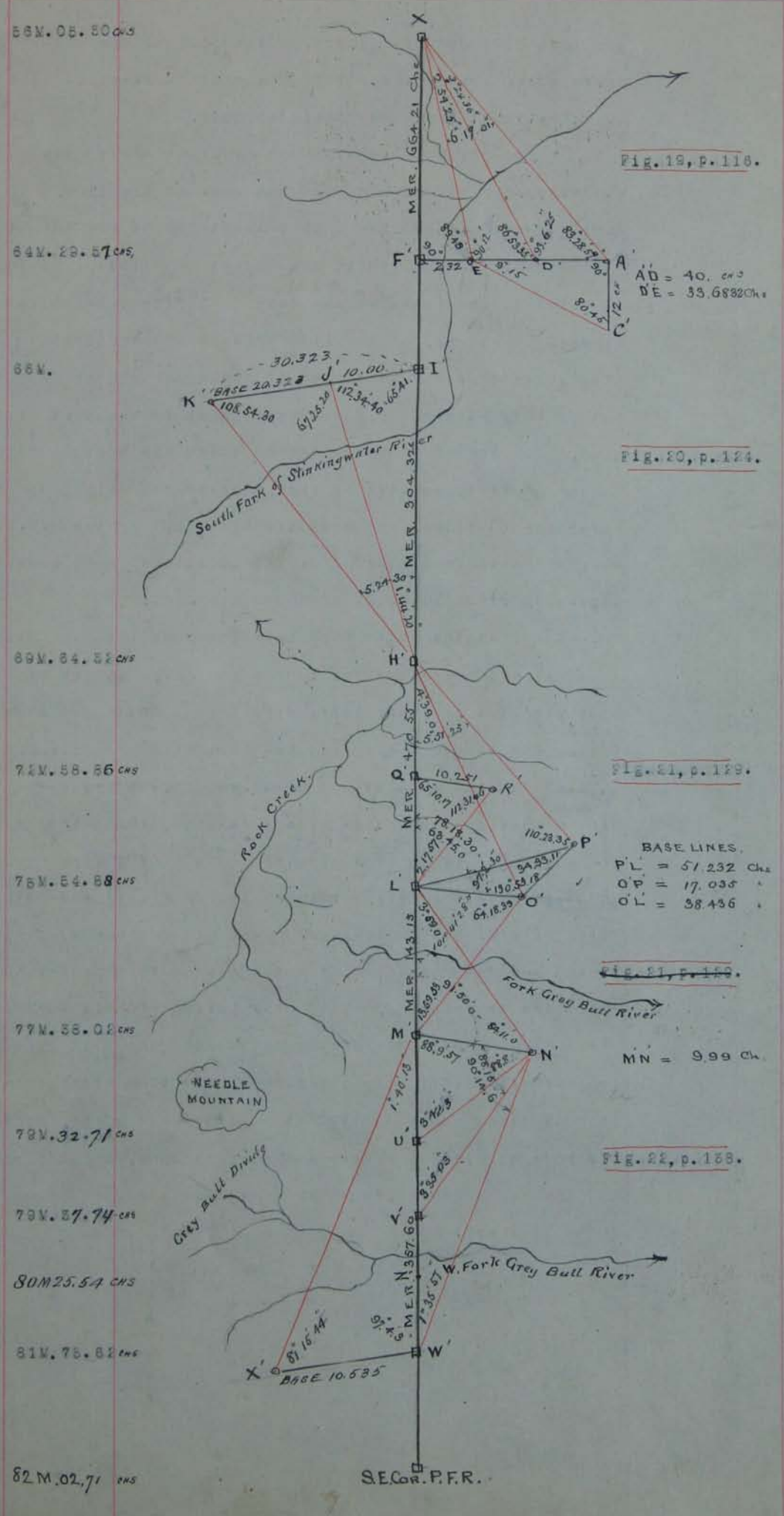


DIAGRAM E.

EAST BOUNDARY PUBLIC FOREST RESERVATION.



and that of a scrubby growth, and so far as the Timber Reserve goes, I should say that the east 10 miles of this Reservation is of but very little account.

There are some settlers on Sunlight creek and on the Stinkingwater river, both east and west of the line. On Sunlight creek there are 3 or 4 locations of ranches west of the line, which I could not locate from line, and some 10 miles up the creek, at the head of it, there are numerous mineral locations. The line crosses the north fork of Stinkingwater river just east of the mouth of the Box canyon, and on this stream the settlement is all to the east of the line. On the south fork however there are quite a large number of settlers west of line, scattered along up the river for 20 miles, and same distance up, near the S.E. Corner, are a large number of mining locations, more particularly described in Notes of South Boundary.

From the south fork the line runs into and over the roughest, highest mountains in the country, and it has been only with the greatest difficulty that I could get over them. The line crosses the Grey Bull divide at Sta. L', 75W. + 54.88 chs., at an altitude of 13,100 ft. and preserves this high situation, excepting in the canyons, clear through to the end, which is located directly on top of a very high mountain near the divide between the Grey Bull and Stinkingwater rivers, and in the very heart of tremendous mountains of the roughest character, of which the South Boundary Notes will give description. This Grey Bull divide is very precipitous, and there are only a few places where it can be crossed with difficulty and danger. The line after crossing it runs along about 1/2 to 1 1/2 miles east of it, crossing numerous high, rocky ridges and deep canyons, and the whole country is as barren, rocky and desolate a region as can be found anywhere.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION

Chains.

On the evening of SEPTEMBER 26th.1898 I observe Polaris at its eastern elongation, from the south east corner of the Public Forest Reservation, at 7h. . P.M. mean local time, and find its magnetic bearing to be N.15° 45′ W.

North end of needle,	15° 45′ E.
Azimuth, by table in Manual, is	1.45 E.
The sum is the variation.	17.30 E.

I lay off the azimuth to the west and mark the true meridian, so determined, by nub and tack, 4.00 chs. north.

On the morning of September 27th.1898 with instrument over the point of last night'g observation, at S.E Corner Public Forest Reservation, I direct the telescope to the tack in nub established last night on the meridian, 4.00 chs. north, and find that the line of sight corresponds with the meridian just run from the north. Thence I run -

Remainder of 82nd. MILE.

At a point 8.22 ft. south of the S.E. Corner of the Public Forest Reservation I deflect the azimuth angle of 89° 57′ 30″ from the north towards the west, and run -

N. 89° 57′ 30″ W., on the secant to the Parallel.
Va. 17° 30′ E.

Over nearly level ground to

12.00 Offset 2.65 ft. north and set a granite stone 36x12x6 ins. with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 82M.+14.71chs., on E. P.F.R. on N. and P.L on S. faces and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

This Special Corner stands on the edge of a canyon 2000 ft. deep, which is one of the numerous forks of the Grey Bull river, the general course of which is S.80° E., which heads in the main divide about 1/2 mile west, which divide is inaccessible, and the line then drops off into the canyon formed by the south fork of Needle creek 3000 ft. deep, both sides of which are rocky and precipitous, and the nearest point on line which I can in any way reach is on the top of Crater mountain, and having sent a flag around, I now set it on the secant, on the top of Crater mountain, Sta. D, fig. 24, and mark the point by cutting a X in the rock. I then make the following triangulations -

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Instrument at 82M.+14.71chs., Sta.A, vernier at zero,
Deflect from the secant west, towards the north, and in this direction measure a base line 6.00chs. long, the N. end of which I mark by cutting a X in the solid rock, Sta.B.
I then sent a flag to a high peak to the north and west, and establish a station by cutting a X in the solid rock, Sta.C.

Instrument at Sta.A, vernier at zero.
Set on Sta.D
Unclamp plates and set on Sta.C.
Vernier reads 21° 40' 30"
Unclamp below and set on Sta.D
Unclamp plates and set on Sta.C.
Vernier reads 43°.20'.30"
Unclamp below and set on Sta.D.
Unclamp plates and set on Sta.C.
Vernier reads 65°.01'.00"
Angle CAD, mean value, 21° 40' 20."

Vernier at zero, set on Sta.C.
Unclamp plates and set on Sta.B.
Vernier reads 24°.06'.00"
Unclamp below and set on Sta.C.
Unclamp plates and set on Sta.B.
Vernier reads 48°.12'.00"
Angle CAB, mean value, 24° 06' 00"

Instrument at Sta.B, vernier at zero.
Set on Sta.A.
Unclamp plates and set on Sta.C.
Vernier reads 150°.41'.00"
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.C.
Vernier reads 301°.22'.00"
Angle ABC, mean value, 150° 41' 00"

Instrument at Sta.C, vernier at zero.
Set on Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 156°.05'.30"
Unclamp below and set on Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 312°.10'.30"
Unclamp below and set on Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 468°.16'.00"
Angle ACD, mean value, 156° 05' 20"

Vernier at zero, set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 5.15.00
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 10.26.00
Angle ACB, mean value 5° 15' 00"

There is no other possible way by which I can make the triangulation DA, on account of the conformation of the country, surrounded on all sides by canyons from 2 to 3 thousand ft. deep.

Closing error of trian. CBA.

Angle CBA,	150° 41' 00"
Angle BAC,	24.06.00
Angle ACB,	5.15.00
the sum is	180.00.00
Closing error 0.	

Solving trian. ABC, for AC = x.

6.00 : sin. 5° 15' 00" :: x : sin. 150° 41' 00"

Log. 6.00	0.7781513
Log. sin. 150° 41'	9.6898734
	10.4680247
Log. sin. 5° 15'	8.9586703
	1.5093544

x = AC = 32.5106chs.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

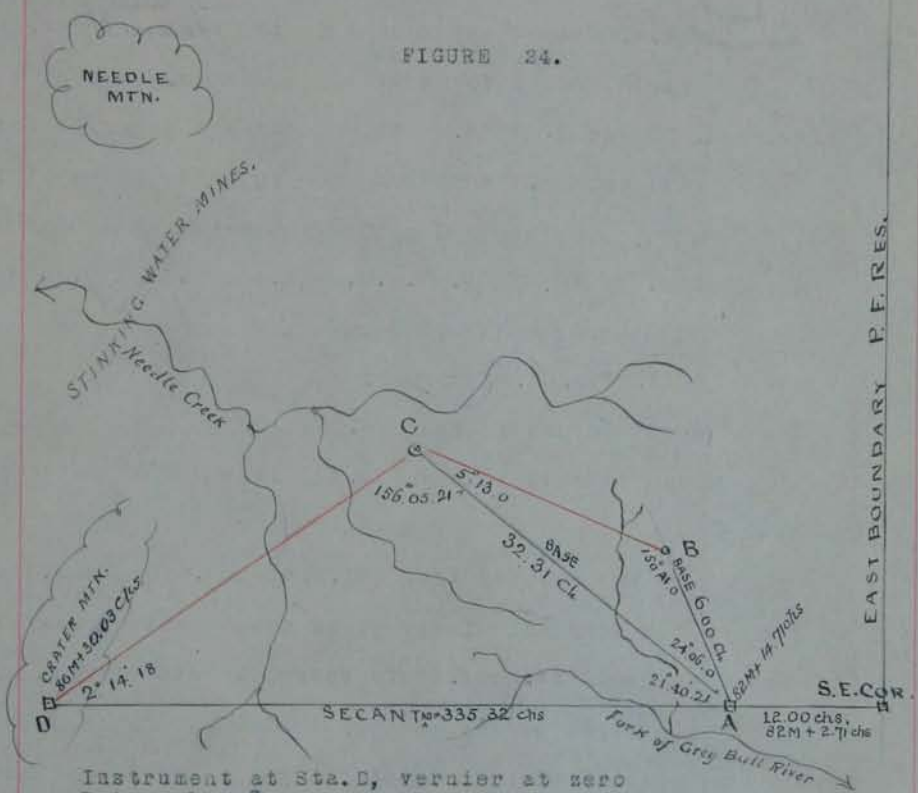
Solving triangle ACD, for AD = x.

52.5106 : sin. 2°14'18" :: x : sin. 156°05'21."

Log. 52.5106	1.5093544
Log. sin. 156°05'21"	9.6077920
	11.1171464
Log. sin. 2°14'18"	8.5916921
	2.5254543

x = AD = 335.52chs.

FIGURE 24.



Instrument at Sta. D, vernier at zero
Set on Sta. C.
Unclamp plates and set on Sta. A.
Vernier reads 2°14'00" plus.
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. A
Vernier reads 4°28.50
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. A.
Vernier reads 6°43.00"
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. A.
Vernier reads 8.57.00 minutes
Unclamp below and set on Sta. C.
Unclamp plates and set on Sta. A.
Vernier reads 11°11.50
Angle ADC, mean value, 2°14'18"

Closing error of triangle ACD. Corrected angles of same.

Angle ACD,	156°05'20"	Angle ACD,	156°05'21"
Angle CDA,	2.14.18	Angle CDA,	2.14.18
Angle DAC,	21.40.20	Angle DAC,	21.40.21
the sum is	179.59.58	the sum is	180.00.00

Closing error 2"

I divide the closing error of 2" equally between the angles ACD and DAC.

For solution of triangle ACD, see above.

Line distance of Sta. A,	82M. 14.71chs.
Secant distance AD,	4M. 15.32chs.
The sum is Line distance of Sta. D.	86M. 30'03chs.

I compared my chains with the standard and found them correct.

Sept. 27 1893

The evenings of September 27th. and 28th. were unfavorable and no observations on Polaris could be obtained.

On the morning of September 29th. 1893 I proceed to Sta. D on Crater mountain, and by double back and foresights from Sta. A, extend the secant to the west 1.97chs. to more favorable ground for building a corner, and at

86M. 52.00ch. Offset 1.87 ft. south and cut a X in solid rock for Special Corner. As rock is too rough to cut legible figures upon, over the X I set a granite stone 40x8x6 ins., marked 86M.+52chs. on E. P.F.R. on N. and P.L. on S. faces. Piled stone around it and raised a monument of stone 6 ft. square, 6 ft. high, E. of corner.

Needle mountain bears N. 0° 45′ W.

Barometer indicates 18,100 ft.

The country from Sta. D, at 86M.+50.08chs. breaks off almost perpendicularly into the Saddle Creek canyon course N&S, 4000 ft. deep. This canyon is utterly impassible in the direction of the secant. In fact there is only one route by which it is possible to get to Sta. D, on Crater mountain, very roundabout and extremely dangerous climbing. I therefore send a flag ahead, and by double back and fore sight set it on the secant at Sta. E, fig. 25, on the top of Saddle mountain and make the triangulations fig. 25. I establish stations F and G to the north of secant, on the top of Crater mountain, by cutting a deep X in the solid rock at each station, then with

Instrument at Sta. D, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. F.
Vernier reads 81° 55′ 00″
Unclamp plates and set on Sta. G.
Vernier reads 102° 54′ 00″
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. F.
Vernier reads 184° 09′ 00″
Unclamp plates and set on Sta. G.
Vernier reads 205° 08′ 00″
Angle GDE, mean value, 102° 54′ 00″
Angle FDE, mean value, 81.55.00
Angle FDG, mean value, 20.59.00

Instrument at Sta. F, vernier at zero.
Set on Sta. D
Unclamp plates and set on Sta. G.
Vernier reads 86° 15′ 00″
Unclamp below and set on Sta. D.
Unclamp plates and set on Sta. G.

Vernier reads 172° 26′ 00″
Angle GFD, mean value, 86° 15′ 00″

Instrument at Sta. G, vernier at zero.
Set on Sta. F.
Unclamp plates and set on Sta. D.
Vernier reads 72°.48′.00″ plus.
Unclamp below and set on Sta. F.
Unclamp plates and set on Sta. D.
Vernier reads 145°.36′.30″
Angle FGD, mean value, 72° 48′ 15″

Carefully chaining the distance FG, for an auxiliary base line, I find it to be 15.855chs.

Closing error of Trian. FGD.		Corrected angles of same.	
Angle FGD,	72° 48′ 15″	Angle FGD,	72° 48′ 10″
Angle GDF,	20.59.00	Angle GDF,	20.58.55
Angle DFG,	86.13.00	Angle DFG,	86.12.55
the sum is	180.00.15	the sum is	180.00.00

Closing error 15″

As the observations at stations D, F and G were all equally satisfactory I divide the closing error equally between the angles.

For solution of triangle GFD, to determine the length of the base line DG, see page 152.

Instrument at Sta. G, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. D.
Vernier reads 63° 42′ 00″
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. D.
Vernier reads 127°.24′.30″
Angle DGE, mean value, 63° 42′ 15″

Needle mountain bears N. 2° 29′ W.

September 29th. 1895.

I compare my chains with the standard and find them correct.

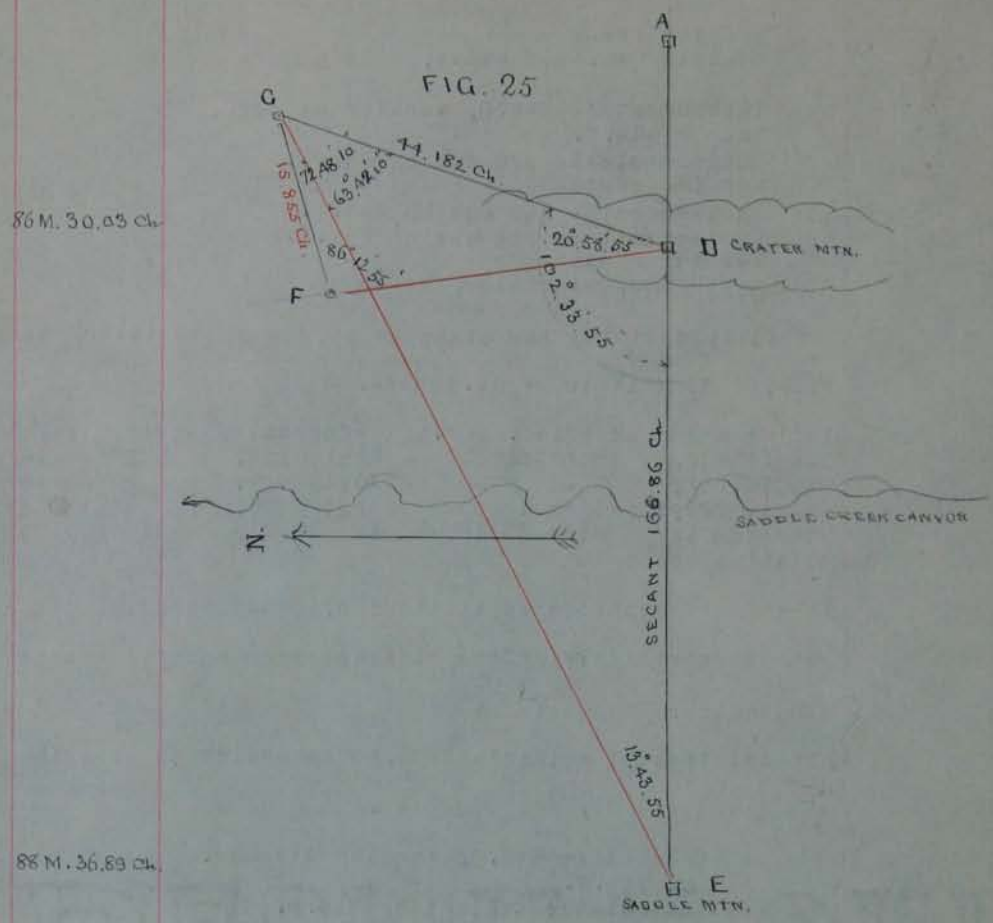
On the morning of September 30th. 1895 I proceed to the flag at Sta. E on Saddle mountain, and set my instrument over the X in the solid rock, marked by my flagman at the exact spot where the flag stood.

Vernier at zero, set on Sta. D.
Unclamp plates and set on Sta. G.
Vernier reads 15° 44′ 00″
Unclamp below and set on Sta. D.
Unclamp plates and set on Sta. G.
Vernier reads 27°.28′.00″
Angle GED, mean value, 15° 44′ 00″

Closing error of Trian. GED.		Corrected angles of same.	
Angle GED,	15° 44′ 00″	Angle GED,	15° 43′ 55″
Angle EDG,	102.34.00	Angle EDG,	102.33.55
Angle DGE,	63.42.15	Angle DGE,	63.42.10
the sum is	180.00.15	the sum is	180 00 00

Closing error 15″ which I distribute equally betwwen the respective angles.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.



Solving triangle GFD, for GD = x.

15.855 : sin. 20° 58' 55" :: x : sin. 86° 12' 55."

Log. 15.855	1.2001662
Log. sin. 86° 12' 55"	9.9990518
	11.1992180
Log. sin. 20° 58' 55"	9.5539724
	1.6452456

x = GD=base line = 44.182chs.

Solving triangle GED, for DE = x. Log x : 44.182 :: sin 15°43'55" :: x : sin 63°42'10"

Log. 44.182	1 6452456
Log. sin. 63° 42' 10"	9.9525541
	11.5977997
Log. sin. 15° 43' 55"	9.3754437
	2.2223560

x = DE = 166.86chs.

Line distance Sta. D,	86M. 30.03chs.
Secant distance DE,	2M. 6.86chs.
Secant distance Sta. E,	88M. 36.89chs.

I therefore find that the length of the secant from the starting point at S.E Corner is 8M. 34.18 chs., which is more than the distance I am directed to run, and for which data has been furnished me, from which to make my calculations. However there is no help for it, as the points I have made on the secant are the only ones possible to establish. By calculation I make the offset from the secant, at Sta. 2, to the parallel of latitude 4.99 ft. north.

Offset 4.99 ft. north, and at -

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

88M.56.89ch. Cut a X in solid rock. As rock is too rough to mark letters upon, over the X I set a granite stone 30x8x6 ins., for Special Corner, marked 88M.+56.89ch. on E. P.F.R. on N. and P.L. on S. faces. Piled stone around it and raised a stone monument 6 ft. square, 5 ft. high, E. of corner. Barometer indicates 15,100 ft.

This point is on the top of Saddle mountain, a very difficult one to scale, and the line from the station towards both the east and west descends (almost perpendicularly over granite slopes that cannot be traversed) on the east into the canyon of Saddle creek, and on the west into the south fork of Stinkingwater river, 5000 ft. below the corner. Looking towards the west, on the line as it will approximately lay, I find that it will not be possible to establish another point much beyond the river in the canyonbelow, for a very long distance, as the mountains to the west of the Stinkingwater river are equally as high as the one I am nowon, and cannot be scaled. Having already investigated the country ahead I am satisfied I shall not be able to establish a point on line except at a distance considerably over 8 miles, the distance for which the data furnished me is intended to be used under the secant method of running parallels, and as I have no data authorized by the instructions by which longer triangulations than 8 miles may be made, I find myself in a dilemma which I can see no way out of except to fall back on the old method of running parallels of latitude given in the Manual, of Surveying, a copy of which I have with me. I can establish some corners below in the canyon of the south fork of the Stinkingwater river from this point on top of Saddle mountain, but the mountains west of the river are very high and precipitous and cannot be traversed. I am therefore compelled, at this point at least, to abandon the secant system and adopt that of running a tangent to the parallel of latitude as laid down in the Manual of instructions.

I therefore proceed to prepare for a triangulation ahead, as follows -

I mark a X on top of the special corner, just established, at exact point, and establish stations H & I, on top of the

mountain to the south, by cutting a X in the rock at each point, fig. 26. I then carefully measure the base line, EH, and find it to be exactly 11.305chs. long. Then with

Instrument at Sta. E, vernier at zero.
Set on Sta. I.
Unclamp plates and set on Sta. H.
Vernier reads 10° 20' 50"
Unclamp below and set on Sta. I.
Unclamp plates and set on Sta. H.
Vernier reads 20°.41'.00"
Angle HEI, mean value, 10° 20' 50"

Instrument at Sta. H, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. I.
Vernier reads 168°.11'.00"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. I.
Vernier reads 336°.22'.50"
Angle EHI, mean value, 168° 11' 15"

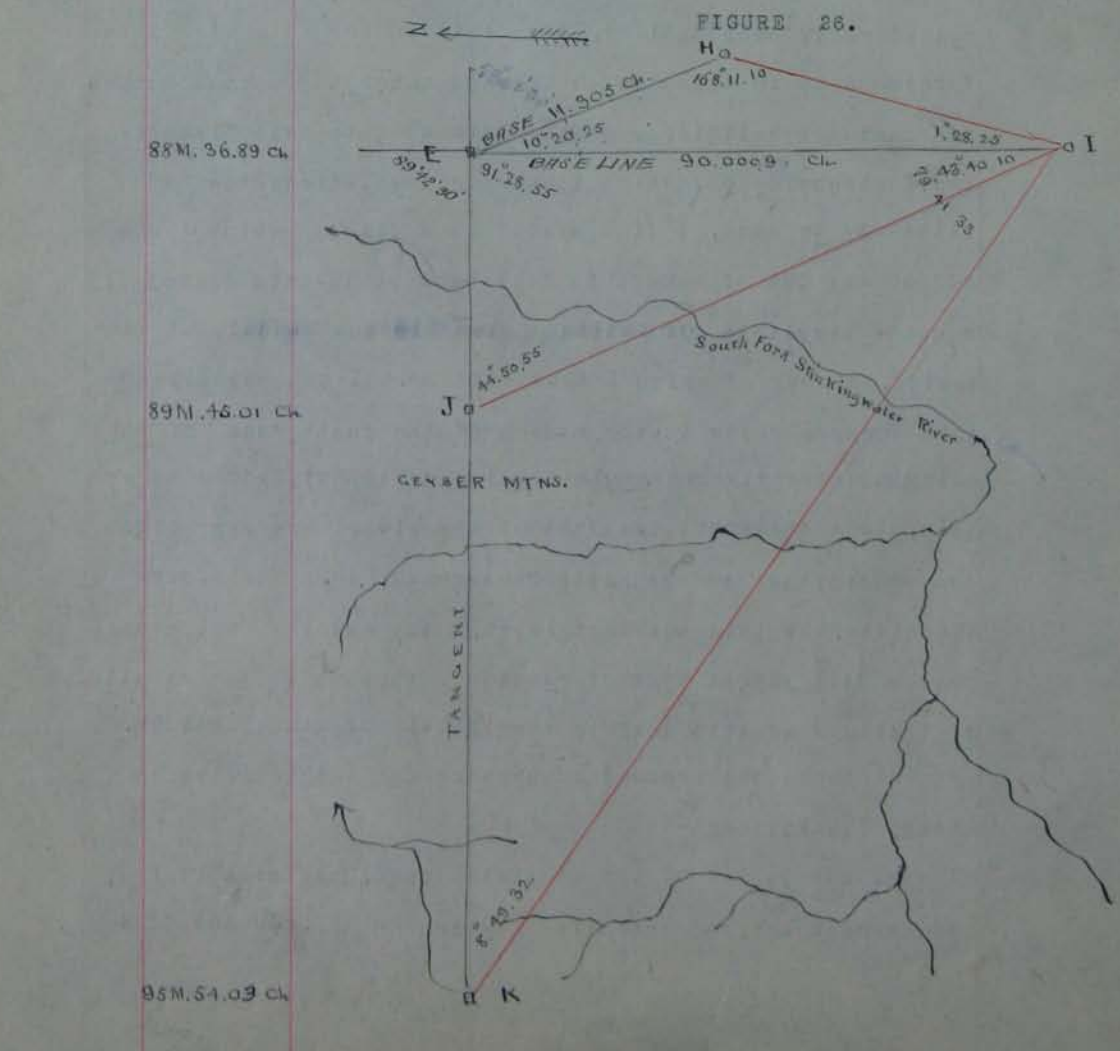
Instrument at Sta. I, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. H.
Vernier reads 1°.28'.50"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. H.
Vernier reads 2°.57'.00"
Angle HIE, mean value, 1° 28' 50"

Closing error of triangle HIE. Corrected angles of same.

Angle HIE,	1° 28' 50"	Angle HIE,	1° 28' 25"
Angle IEH,	10.20.50	Angle IEH,	10.20.25
Angle EHI,	168.11.15	Angle EHI,	168.11.10
the sum is	180.00.15	the sum is	180.00.00

Closing error 15", divided equally between the angles.

FIGURE 26.



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Solving triangle EHI, for EI = x.
11.505 : sin. 1°28'25" :: x : sin. 168°11'10."

Log. 11.505	1.0582706
Log. sin. 168°11'10"	9.8111886
	10.3644592
Log. sin. 1°28'25"	8.4102124
	1.9542468

x = base line = EI = 90.0009chs.

September 30th. 1893.

I compared my chains with the standard & found them correct.

On the evening of September 30th. 1893 I observed Polaris from Sta. E, at its eastern elongation at 8h. 45m. P.M., mean local time, and found its magnetic bearing to be N. 15° 55' W.

North end of needle,	15° 55' E.
Azimuth, by table in Manual, is	1.45. E.
the sum is the Var.	17.40. E.

I lay off the azimuth to the west and mark the true meridian, so determined, by a mark on the rock, 4.00chs. north.

On the morning of October 1st. 1893, with instrument at Sta. E, fig. 26, the point of last night's observation, I lay off the tangent to the 44th. Parallel of Latitude, by deflecting 90° from the north towards the west, and set a flag on the tangent so laid off to the west, on the side of the mountain west of south fork, Sta. J, fig. 26.

Vernier at zero, set on Sta. J.
Unclamp plates and set on Sta. I.
Vernier reads 91° 28' 50" *plces*
Unclamp below and set on Sta. J.
Unclamp plates and set on Sta. I.
Vernier reads 182°.57'.50"
Angle JEI, mean value, 91° 28' 45."

Instrument at Sta. I, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. J.
Vernier reads 45°.40'.00"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. J
Vernier reads 87°.20'.00"
Angle EIJ, mean value, 43° 40' 00"

Instrument at Sta. J, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. I.
Vernier reads 44°.51'.00"
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. I.
Vernier reads 89°.41'.50"
Angle EJI, mean value, 44° 50' 45"

Closing error of triangle *EJI*. Corrected angles of same.

Angle EJI,	44° 50' 45"	Angle EJI,	44° 50' 55"
Angle JIE,	43.40.00	Angle JIE,	45.40.10
Angle IEJ,	91.28.45	Angle IEJ,	91.28.55
the sum is	179.59.50	the sum is	180.00.00

Closing error 50". As all the observations were equally satisfactory I distribute the 50" equally between the angles.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Solving triangle EJI, for EJ = x, fig. 26, page 154.
90'0009 : sin. 44° 50' 55" :: x : sin. 45° 40' 10"

Log. 90.0009	1.9542488
Log. sin. 45° 40' 10"	9.8391816
	11.7934084
Log. sin. 44° 50' 55"	9.8483344
	1.9450740

x = JE = 88.12chs.

Line distance Sta. E,	88M. 36.89chs.
Tangent distance JE,	1M. 8.12chs.
Line distance Sta. J,	89M. 45.01chs.

Proceeding to the flag at Sta. J, I set the instrument over the exact spot where the flag stood, and run -

90th. MILE.

N 89°59' E on tangent to the parallel.
Va. 17° 45' E.

Descend abruptly 500 ft. to

5.01 Offset 0.66 ft. north, and set a porphyry rock 30x12x8 ins. with granite boulder 6 ins. diam., marked with a X, 20 ins in the slide rock, for 89 1/2 Mile Corner, marked 89 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 20 ins. diam. bears S. 12° E. 125 lks. dist. marked 89 1/2 M. P.L. 1895. B.T. and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

No other trees within limits.

Thence descend abruptly over slide rock 400 ft. to 13.00 chs.

8.12 East on tangent to parallel

13.00 West edge of south fork of Stinkingwater river, course north.

13.55 East edge, at low water.

15.50 East edge at high water. Enter timber and ascend 6 ft. to
16.17 Pine tree 18 ins. diam., on line, Which I cut off 6 ft. above ground and square to 12 ins., for Special Corner marked 89M.+ 28.84chs. on E. P.F.R. on N. and P.L. on S. faces, from which —

A pine 18 ins. diam. bears S. 20° W. 10 lks. dist. marked 89M.+ 28.84chs. P.L. 1895. B.T.

A pine 16 ins. diam. bears N. 28° E. 18 lks. dist. marked 89M.+ 28.84chs. P.F.R. 1893. B.T.

Raised a mound of stone 2 1/2 ft. high, 5 ft. base, east of corner.

Barometer indicates 8500 ft.

16.19 Cross blazed pack trail.

16.50 Foot of mountain. ascend through pine timber, 800 ft. to

Difference in chaining is 5 lks. at middle point of difference

45.01 Offset 0.17 ft. north and set a granite stone 40x15x6 ins with granite boulder 5 ins. diam., marked with a X, 20 ins

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Chains.

in the ground, for 89th. Mile Corner, marked 89M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 10 ins. diam. bears S. 15° 30′ E. 40 lks. dist., marked 89M. P.L. 1893. B.T.
A pine 11 ins diam. bears N. 51° E. 28 lks. dist. marked 89M. P.F.R. 1893. B.T.

No other suitable trees within limits. Raised a mound of stone 6 ft. base, 5 ft. high, east of corner

Barometer indicates 9100 ft.

Land, mountainous. Soil, rocky 4th. rate.

Timber, pine.

89th. MILE.

East, on the tangent to parallel.
Va. 17° 40′ E.

Ascend rapidly through scrubby pine, 100 ft. to

5.00 Foot of almost perpendiculdar granite mountain. From here to the top of the mountain there is no possibility of running a line.

October 1st. 1893.

I compared my chains with the standard and found them correct.

On the morning of October 2nd. 1893 I proceed to the corner established at 88M.+56.89chs., and setting the instrument over the corner, sight to a flag at Sta. J on the tangent, with which foresight I set a flag on top of a high mountain to the west, Sta. K, fig. 26, page 154.

Instrument at Sta. I, vernier at zero.
Set on Sta. E.
Unclamp plates and set on Sta. K.
Vernier reads 79° 42′ 00″ plus.
Unclamp below and set on Sta. E.
Unclamp plates and set on Sta. K.
Vernier reads 159°. 23′. 00″
Angle EIK, mean value, 79° 41′ 50″

There is no other ground on top of this mountain on which a second base line could be laid off of any length, as it is extremely rough and broken. I am therefore obliged to rely entirely on the triangulation just made, for getting the tangent distance EK. Leaving flag at stations E & I, I then proceed to the flag at Sta. K.

October 2nd. 1893.

I test my chains on the standard and find them correct.

A heavy snow storm prevailed during the 3rd. 4th. 5th. 6th. and 7th. of October without interruption day or night, rendering it impossible to take a sight or do any work, and making it necessary to gather boughs to feed the pack stock.

During this time I was camped on the head of a small stream about 1/2 mile south of the flag at Sta. K, at an altitude of 10,500 ft.. The snow fall at this time was in the neighborhood of 5 ft.

Arriving at the flag at Sta. K, on the morning of October 8th. 1893, I find it marked by a X cut in the rock by my flagman On same morning I observed Polaris from this Sta. K, at its western elongation, at 6h. 3m. A.M. mean local time, and find its magnetic bearing to be N. 19° 55′ W.

North end of needle,	19° 55′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17.50 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00chs. north.

Instrument at Sta. K, Vernier at zero.
Set on Sta. I.
Unclamp plates and set on Sta. E.
Vernier reads 8° 49′ 50″
Unclamp below and set on Sta. I.
Unclamp plates and set on Sta. E.
Vernier reads 17° 39′ 00
Angle EKI, mean value, 8° 49′ 50″

Closing error of triangle EIK.		Corrected angles of same.	
Angle EIK,	79° 41′ 50″	Angle EIK,	79° 41′ 53″
Angle IKE,	8.49.50	Angle IKE,	8.49.52
Angle KEI,	91.28.55	Angle KEI,	91.28.55
the sum is	179.59.55	the sum is	180.00.00

Closing error 5″. As the angle KEI has already been corrected I divide the 5″ between the other two angles.

Solving triangle EKI, for EK = x.
90.0009 : sin. 8° 49′ 52″ :: x : sin. 79° 41′ 53.″

Log. 90.0009	1.9542468
Log. sin. 79° 41′ 53″	9.9929340
	11.9471808
Log. sin. 8° 49′ 52″	9.1859005
	2.7612803

x = EK = 577.14chs. = 7M. 17.14chs.

Line distance Sta. E,	88M. 36.89chs.
Tangent distance, EK	7M. 17.14chs.
Line distance Sta. K,	95M. 54.03chs.

From Sta. K offset 55.45 ft. north, by deflecting azimuth 89° 54′ from east towards north

95M. 54.03ch. Set a granite stone 30x12x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 95M. 54.03chs. On E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, east of corner.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Barometer indicates 12,500 ft.

Thence I run -

96th. MILE.

N.89°54' E. , on the tangent to parallel.
Va.17°50' E.

Descending, abruptly, slope to east, 400 ft. to

14.03 Offset 31.85 ft. to north, by deflecting 89°54' from east towards north, and set a porphyry rock 35x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 95 1/2 Mile Corner, marked 95 1/2M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Descend 500 ft. to

34.00 Foot of slope and cross head of a gulch, course N.5° E.

Thence ascend abruptly 700 ft. to

Difference in chaining is 3 lks. at middle point of difference

34.03 Offset 27.48 ft. to north, by deflecting 89°54' from east towards north, and set a porphyry rock 30x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 95th. Mile Corner, marked 95M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Barometer indicates 12,100 ft.

From this point east on the tangent the country breaks off into a deep canyon that is impassible, the course of which is east, and the whole region between this point and the Stinkingwater river, in the direction of the tangent, is so extremely rough and broken that I find it impossible to extend the line further in this direction, either by chaining or triangulation. I therefore return to the special corner at 95M.+54.03chs. Thence I run -

Remainder of 96th. MILE

S.89°54' W. on tangent to the parallel.
Va.17°50' E.

Descending rapidly mountain slope to west, 800 ft.

Difference in chaining is 2 lks. at middle point of difference

25.97 Offset 36.58 ft. north, by deflecting 89°53'50" from the east towards north, and set a porphyry rock 35x10x5 ins., with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for 96th. Mile Corner, marked 96M. on E. P.F.R. on

on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

From this point the parallel produced drops into the Thoroughfare creek canyon 1500 ft. deep, and then rises over perpendicular rocky cliffs lying north of Yountz peak, inaccessible. I therefore send a flag around to a point that appears to be accessible on the divide between the Yellowstone river and Thoroughfare creek, and returning to the special corner at 95M.+54.03chs., Sta. K, arrange a system of triangulations as follows -

Instrument at Sta. K, fig. 26, vernier at zero.

Set on meridian already established from this point, and deflect 5°20' from the north towards the west, and in this direction measure a base line 38.00chs. long, at the north end of which I set a stone, on the top of which is marked a X on line and exactly 86.00chs. from Sta. K., for Sta. L.

October 8 th. 1893

I test my chains on the standard and find them correct.

On the morning of October 9th. 1893, with instrument at Sta. K, I lay off a tangent to the parallel of latitude at this point, in accordance with instructions contained in the Manual, and set a flag to the west, on the tangent, at Sta. N. Sta. M, fig. 27, is a monument on the extreme top of Yountz peak, 13,600 ft. high.

Vernier at zero, set on Sta. L.
Unclamp plates and set on Sta. N.
Vernier reads 86°59'00"
Unclamp plates and set on Sta. M.
Vernier reads 108°46'30"
Unclamp below and set on Sta. L.
Unclamp plates and set on Sta. N.
Vernier reads 195°25'30"
Unclamp plates and set on Sta. M.
Vernier reads 217°55'00"
Angle LKN, mean value, 86°59'00"
Angle LKM, mean value, 108.46.30
Angle NKM, mean value, 22.07.30

Instrument at Sta. L, vernier at zero.
Set on Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 65°54'30"
Unclamp plates and set on Sta. N.
Vernier reads 88°48'00"

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below
Unclamp ~~plates~~ and set on Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 152°42′50″
Unclamp plates and set on Sta. N.
Vernier reads 177°.56′.00″
Angle KLM, mean value 63°54′50″
Angle KLN, mean value, 88°48′00″

Instrument at Sta. M, vernier at zero.
Set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 7°.18′.50″
Unclamp plates and set on Sta. N.
Vernier reads 134°.12′.30″
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 141°.51′.50″
Unclamp plates and set on Sta. N.
Vernier reads 268°.25′.00″
Angle KML, mean value, 7°18′45″
Angle KMN, mean value, 134.12.30

October 9th. 1893.

I test my chains on the standard and find them correct.

Arriving at the flag, Sta. N, fig. 27, I find it marked by a X cut in the rock by my flagman.

On the morning of October 10th. 1893 I observe Polaris from Sta. N, at its western elongation, at 5h 56m. A. M., mean local time, and find its magnetic bearing to be N. 19°52′ W.

North end of needle.	19°52′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17.47 E

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack 4.00chs. N.

Instrument at Sta. N, vernier at zero.
Set on Sta. M.
Unclamp plates and set on Sta. K.
Vernier reads 25°40′00″ minutes
Unclamp below and set on Sta. M.
Unclamp plates and set on Sta. K.
Vernier reads 47°.20′.50″
Angle MNK, mean value, 25°40′15″

Vernier at zero, set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 4°.55′.00″
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 9°.06′.00″
Angle KNL, mean value, 4°55′00″

Closing error of triangle LKM.

Angle LKM,	108°46′50″	Angle LKM,	108°46′55″
Angle KML,	7.18.45	Angle KML,	7.18.50
Angle MLK,	63.54.50	Angle MLK,	63.54.55
the sum is	179.59.45	the sum is	180 00 00

Closing error 15″. As the observations were all equally satisfactory I divide the error equally between the angles.

Closing error of triangle MKN.

Angle MKN,	22°07′50″	Angle MKN,	22°07′25″
Angle KNM,	23.40.15	Angle KNM,	23.40.10
Angle NMK,	134.12.50	Angle NMK,	134.12.25
the sum is	180.00.15	the sum is	180 00 00

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Closing error 15″. The observations being equally satisfactory at K, M & N, I divide the closing error equally between the angles.

Closing error of triangle KLN.

Angle KLN,	88°48′00″
Angle LNK,	4.55.00
Angle NKL,	86.59.00
the sum is	180.00.00

Closing error, 0.

Solving triangle KLM, for MK = x.

58.00 : sin. 7°18′50″:: x : sin. 65°54′55.″

Log. 58·00	1.5797836
Log. sin. 65°54′55″	9.9555257
	11.5351093
Log. sin. 7° 18′ 50′	9.1048456
	2.4282637

x = base line MK = 268.08chs.

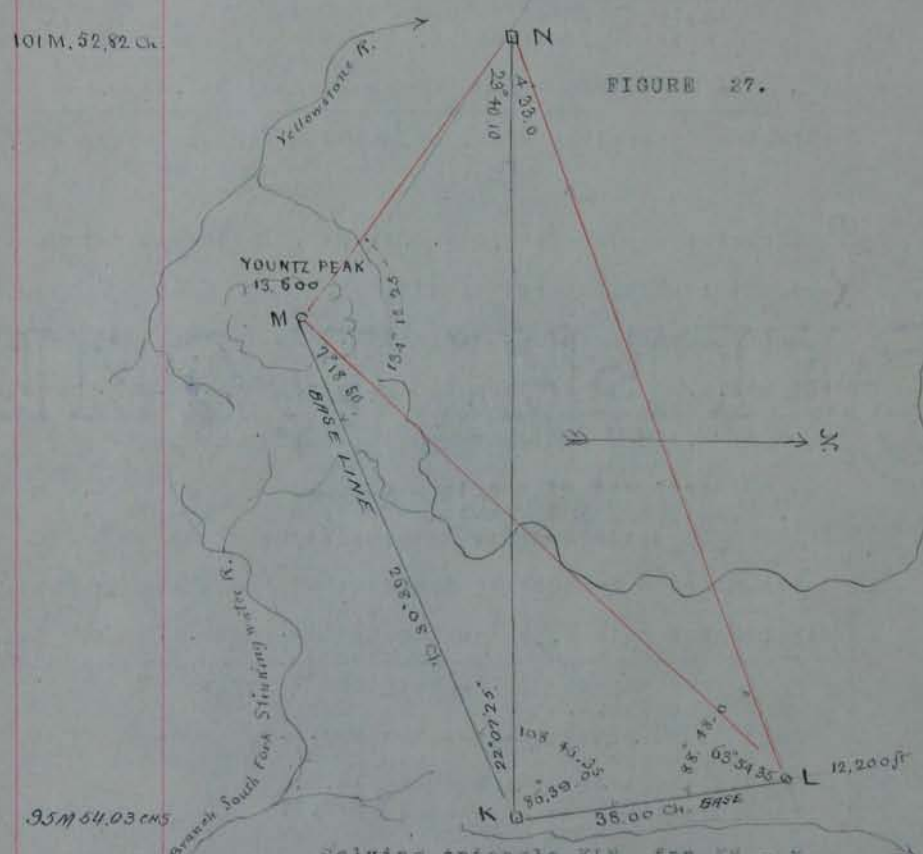

FIGURE 27.

Solving triangle KLN, for KN = x.

58·00 : sin. 4°55′00″:: x : sin. 88°48′00.″

Log. 58·00	1.5797836
Log. sin. 88°48′00″	9.9999047
	11.5796883
Log. sin. 4°55′00″	8.8994522
	2.6802361

x = KN = 478·91chs.

Solving triangle MKN, for KN = x.

268.08 : sin. 25°40′10″:: x : sin. 154°12′25.″

Log. 268.08	2.4282637
Log. sin. 154° 12′ 25″	9.8554138
	12.2836775
Log. sin. 25°40′10″	9.6036416
	2.6800359

x = KN = 478·67chs.

The differenme in the two triangulations, for the distance KN, on the tangent to the parallel, is therefore 24 lks. and the mean of the two triangulations is 478.79 chs. I

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have therefore

Line distance of Sta. K,	95M.54.03chs.
Tangent distance KN,	5M.78.79chs.
the sum is line distance of Sta. N,	101M.52.82chs.

101M.52.82ch. At sta. N. offset 25.1 ft. to north, by deflecting 89°55′ from the east towards the north, and set a porphyry rock 35x10x 6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 101M.+ 52.82chs. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner. Barometer indicates 12,500 ft.

This corner stands on top of a high divide and the country, both to the east and west, is of such an extremely precipitous broken character that chaining over it is impossible, especially now when it is covered with from 2 to 5 ft. of snow. Climbing the rocky slopes is entirely out of the question, and I am admonished by not only the appearance but the reality of winter, that I must make haste over this high country, as it is impossible to remain in it with an outfit. The country towards the west drops off from this point into the canyon of the Yellowstone river, some 5000 ft. below, and is of the roughest and most precipitous character. I therefore send a flag ahead to the west and prepare to triangulate across the canyon to the nearest accessible ground to the west.

From the special corner just established at 101M+52.82chs. Sta. N, fig. 28, on the top of which is marked is marked X, on the meridian established from Sta. N, fig. 27. I establish a base line by carefully measuring in a northerly direction, and setting a stone level with the top of the ground, on the top of which I mark a X exactly 42.21chs. from the cor. for Sta. P fig 28, I then extend the base line 10.50chs. and set a stone level with the top of the ground, on the top of which I mark a X exactly 10.50chs. dist. from Sta. P, for Sta. Q

Instrument at Sta. N

Set on Sta. Q.. Line of sight strikes flag held on Sta. P, verifying the alignment of the double base line NQ.

October 10th. 1893.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

I test my chains on the standard and find them correct

On the morning of October 11th.1893, with instrument over the X on the special corner at 101M.52.82chs., corresponding to Sta.N.fig.28, I lay off a tangent to the parallel of latitude, from the meridian already established passing through this point, in accordance with instructions contained in Manual of instructions, and set a flag to the west, on the tangent so laid off, Sta.O, fig.28.

Instrument at Sta.N, fig.28, vernier at zero.
Set on Sta.O.
Unclamp plates and set on Sta.Q.
Vernier reads 84°30'00"
Unclamp below and set on Sta.O.
Unclamp plates and set on Sta.Q.
Vernier reads 169°.00'.00"
Angle ONQ, mean value, 84°30'00"

Instrument at Sta.P, vernier at zero.
Set on Sta.N.
Unclamp plates and set on Sta.O.
Vernier reads 88°.59'.00" plus.
Unclamp below and set on Sta.N.
Unclamp plates and set on Sta.O.
Vernier reads 177°.58'.30"
Angle NPO, mean value, 88°59'15"

Instrument at Sta.Q, vernier at zero.
Set on Sta.N.
Unclamp plates and set on Sta.O.
Vernier reads 87°.22'.00"
Unclamp below and set on Sta.N.
Unclamp plates and set on Sta.O.
Vernier reads 174°.44'.00"
Angle NQO, mean value, 87°22'00"

October 11th.1893.

I test my chains on the standard and find them correct.

Arriving at the flag, Sta.O, on the morning of October 12th.1893 I find the exact point where the flag stood marked by a X cut in the rock by my flagman. With instrument over the X I observe Polaris at its western elongation, at 5h. 16 m.A.M. mean local time, and find its magnetic bearing to be N.19°30'W.

North end of needle	19°30'E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17.45 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 5.00 chs.N.

Vernier at zero, set on Sta.N.
Unclamp plates and set on Sta.P.
Vernier reads 8°31'30"
Unclamp plates and set on Sta.Q.
Vernier reads 8°.08'.00"
Unclamp below and set on Sta.N.
Unclamp plates and set on Sta.P.
Vernier reads 14°.59'.00"
Unclamp plates and set on Sta.Q.
Vernier reads 16°.16'.30"

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

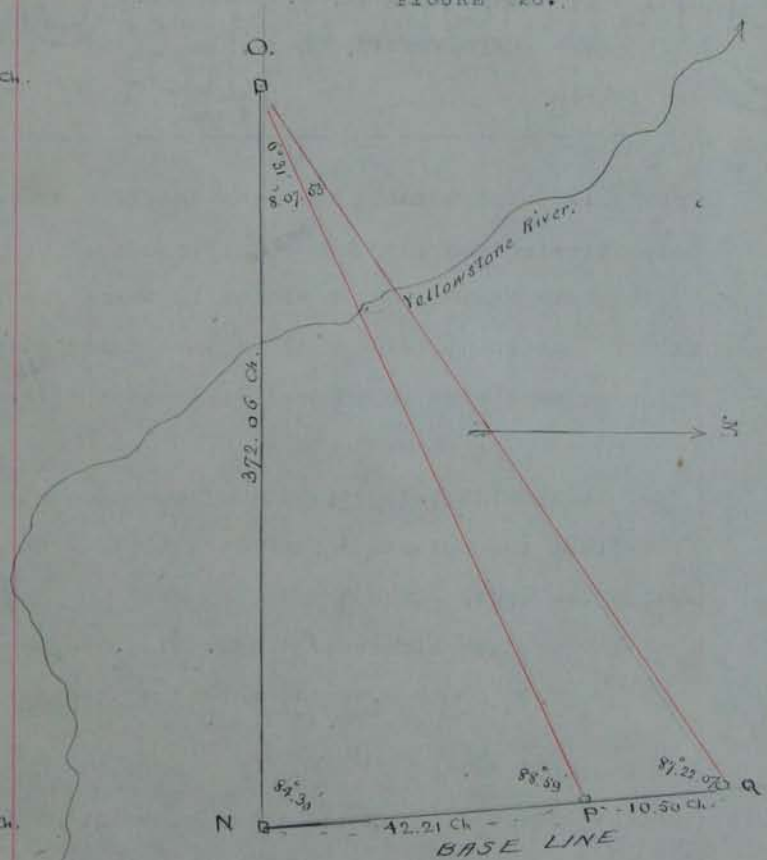
Angle NOP, mean value, 6° 51′ 15.″
Angle NOQ, mean value, 8.07.45.

Closing error of trian. NOP.		Closing error of trian. NOQ.	
Angle NOP,	6° 51′ 15″	Angle NOQ,	8° 07′ 45″
Angle OPN,	88.59.15	Angle OQN,	87.22.00
Angle PNO,	84.30.00	Angle QNO,	84.30.00
the sum is	180.00.30	the sum is	179.59.45
Closing error 30″		Closing error 15″	

I find that an equal division of errors between the two triangles, one would give the corrected angle PNO = QNO = 84° 29′ 50″, and the other would make the same angle 84° 30′ 05,″ while the original reading gave 84° 30′ 00.″ I therefore conclude to assume it to be 84° 30′ 00,″ and to divide the error of each triangle between the other two angles.

Corrected angles of trian. NOP.		Corrected angles of tri. NOQ.	
Angle NOP,	6° 51′ 00″	Angle NOQ,	8° 07′ 53″
Angle OPN,	88.59.00	Angle OQN,	87.22.07
Angle PNO,	84.30.00	Angle QNO,	84.30.00
the sum is	180 00 00	the sum is	180.00.00

FIGURE 28.



Solving triangle NOQ, for NO = x.
52.71 : sin. 8° 07′ 55″ :: x : sin. 87° 22′ 07.″

Log. 52.71	1.7218950
Log. sin. 87° 22′ 07″	9.9995418
	11.7214368
Log. sin. 8° 07′ 55″	9.1505852
	2.5708516

x = NO = 372.27chs.

Solving triangle NPQ, for NO = x.

42.21 : sin. 6°51'00" :: x : sin.88°59'00"

Log.42.21	1.6254154
Log.sin.88°59'00"	9.9999316
	11.6253470
Log.sin. 6°51'00"	9.0549681
	2.5703809

x = NO = 371.88chs.

The difference between the two triangulations, for the distance NO, is therefore 41 lks., and the mean is 372.06chs.

I then have -

Line distance of Sta.N,	101M.52.82chs.
Tangent distance NO,	4M.52.06chs.
Line distance of Sta.O,	106M.24.88chs.

106M.24.88ch. Offset 15.91 ft.north, by deflecting 89°56' from the east towards the north, and set a granite stone 30x9x7 ins., with granite boulder 5 ins.diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 106M.+24.88chs.on E. P.F.R.on N.and P.L on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Barometer indicates 10,000 ft.

No timber.

From this point towards the east the line drops of almost perpendicularly over rough rugged rocks and peaks, into the Yellowstone canyon, and chaining in this direction is impossible. The point is near the top of the Continental divide, which at this time is covered with about 5 ft.of snow.

At a point 5.22 ft.south of the corner just established I deflect the azimuth angle of 89°57'50"from the north towards the west, and run

Remainder of 107th. MILE.

N.89°57'50"W.on the secant to the parallel.
Va.17°45'E.

Descend 500 ft.to

15.12 Offset 2.51 ft.north, and set a pine post 8 ins.square, 8 ft.long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 106 1/2 Mile Corner, marked 106 1/2 M.on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner. Pits impracticable. Thence over slightly rolling ground. To

Difference in chaining is 6 lks.at middle point of difference

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.
55.12 Offset 0.87 ft.north, and set a pine post 6 ins.square, 6 ft.long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 107th. Mile Corner, marked 107M. on E. P.F.R.on N.and P.L on S.faces, and raised a mound of stone and earth 2 1/2 ft.high, 5 ft.base, E.of corner.

Barometer indicates 9400 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

108th. MILE.

N.89°58'W., on secant to the parallel.
Va. 17°40'E

Ascending over rolling ground, 100 ft.to

40.00 Offset 0.46 ft.south, and set a pine post 6 ins.square, 6 ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 107 1/2 Mile Corner, marked 107 1/2 M.on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of earth and stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Thence ascend slightly to 80.00

Difference in chaining is 5 lks.at middle point of difference

80.00 Offset 1.46 ft.south and set a pine post 6 ins.square, 6 ft.long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 108th. Mile Corner, marked 108M. on E. P.F.R.on N.and P.L on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

109th. MILE.

N.89°59'W., on secant to parallel.
Va.17°40'E.

Ascend 50 ft.to

40.00 Offset 2.15 ft.south, and set a pine post 6 ins.square, 6 ft.long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 108 1/2 Mile Corner, marked 108 1/2 M. on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Chains.

Descend 200 ft.

72.00 Cross head of gulch, course south west, and ascend 100 ft. to

Difference in chaining is 8 lks. at middle point of difference

80.00 Offset 2.55 ft. south and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 109th. Mile Corner, marked 109M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Land, mountainous.

Soil, Rocky, 4th. rate.

No timber.

110th. MILE.

West, ., on secant to parallel.
Va. 17°40' E.

Ascending slightly over rolling ground.

40.00 Offset 2.55 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 109 1/2 Mile Corner, marked 109 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone and earth 2 1/2 ft. high, 5 ft. base, E. of Cor.

Thence ascend 500 ft. to 80.00

Difference in chaining is 4 lks. at middle point of difference

80.00 Offset 2.27 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite bouder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 110th. Mile COrner, marked 110M. on E. P.F.R. on N. and P.L. on S. faces and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

111th. MILE.

S. 89°59' W., on the secant to the parallel.
Va. 17°45' E.

Over nearly level ground.

40.00 Offset 1.66 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 110 1/2 Mile Corner, marked

Chains.

110 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Thence nearly level to 80.00

Difference in chaining is 3 lks. at middle point of difference

80.00 Offset 0.74 ft. south and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 111th. Mile Corner, marked 111M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, E. of Cor.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

112th. MILE.

S. 89° 58' W., on secant to parallel.
Va. 17° 45' E.

Over nearly level ground.

40.00 Offset 0.51 ft. north, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 111 1/2 Mile Corner, marked 111 1/2 M. on E. P.F.R. on N. and P.L on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Thence ascend 400 ft. over broken rocky slope to S. to 80.00

Difference in chaining is 7 lks. at middle point of difference

80.00 Offset 2.08 ft. north, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 112th. Mile Corner, marked 112M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Barometer indicates 9700 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

113th. MILE.

S. 89° 57' 30" W. on secant to parallel.
Va. 17° 45' E.

Ascend 100 ft. to top of rocky precipitous ridge, extending N. 86° W.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Barometer indicates 9800 ft.

21.50 Offset 5.06 ft. north, and set a sandstone 30x6x5 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 112M.+21.50chs. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

From this point the line to the west crosses a series of rocky crags, peaks and canyons for several miles, over which chaining is impossible, and triangulation will be necessary.

October 12th. 1893.

I test my chains on the standard and found them slightly long. I adjust them to the correct length.

On the morning of October 15th. 1893, from a point 5.22 ft. south of the special corner established at 112M+21.50chs. I observe Polaris at its western elongation, at 5h. 43m. A.M. mean local time, and find its magnetic bearing to be N. 19° 50′ W.

North end of needle,	19° 50′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17.45 E.

I lay off the azimuth to the east, and mark the ~~true~~ meridian, so determined, by hub and tack, 4.00chs. N.

From the point of observation 5.22 ft. south of the special corner at 112M.+21.50chs., Sta. R, fig. 29, I deflect 89° 57′ 50″ from the north towards the west and set a flag on the secant so established, at Sta. S, on the nearest accessible point towards the west..

Vernier at zero, set on tack in hub to north

From a point on meridian 5.06 ft. south of special corner at 112M.+21.50chs. set on tack in hub on meridian.

Unclamp plates and set on last hub established yesterday on the secant. Vernier reads 89° 57′ 50″, verifying the alignment of last secant.

Instrument at a point 5.22 ft. south of special corner at 112M.+21.50chs., vernier at zero

Set on Sta. S, and deflect 98° towards the south, and in this direction carefully chain a base line 10.00chs. long, at the south end of which I set a stone level with the top

of the ground, on the top of which I mark a X, exactly 10.00 chs. from Sta. R. for Sta. T.

Unclamp below and set on Sta. S.

Unclamp plates and set on Sta. T.

Vernier reads 196°00′00″. Angle SRT, mean value, 98°00′00″

I then extend the base line 5.25chs. and mark the south end of it by setting a stone level with the top of the ground, on the top of which I mark a X exactly 5.25chs from Sta. T

With telescope set on Sta. T, I strike flag held on Sta. U, verifying the alignment of the double base line RTU.

Instrument at Sta. T, vernier at zero.
Set on Sta. R.
Unclamp plates and set on Sta. S
Vernier reads 79°56′00″
Unclamp below and set on Sta. R
Unclamp plates and set on Sta. S.
Vernier reads 159°.52′.00″
Angle RTS, mean value, 79°56′00″

Instrument at Sta. U, vernier at zero.
Set on Sta. R.
Unclamp plates and set on Sta. S.
Vernier reads 78°.51′.50″
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. S.
Vernier reads 157°.45′.00″
Angle RUS, mean value, 78°51′50″

Leaving back sights at stations R, T & U, I then proceed to flag at Sta. S, arriving at which I find it marked by a X on a rock at the exact point where the flag stood.

Instrument at Sta. S, vernier at zero.
Set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 2°04′00″
Unclamp plates and set on Sta. U.
Vernier reads 3°.08′.30″
Unclamp below and set on Sta. R.
Unclamp plates and set on Sta. T.
Vernier reads 5°.12′.50″
Unclamp plates and set on Sta. U.
Vernier reads 6°.16′.30″
Angle TSR, mean value, 2°04′00″
Angle USR, mean value, 3.08.15

Closing error of trian. RUS.		Closing error of trian. RTS.	
Angle RUS,	78°51′50″	Angle RTS,	79°56′00″
Angle USR,	3.08.15	Angle TSR,	2.04.00
Angle SRU,	98.00.00	Angle SRT,	98.00.00
the sum is	179.59.45	the sum is	180 00 00
Closing error 15″.		Closing error 0.	

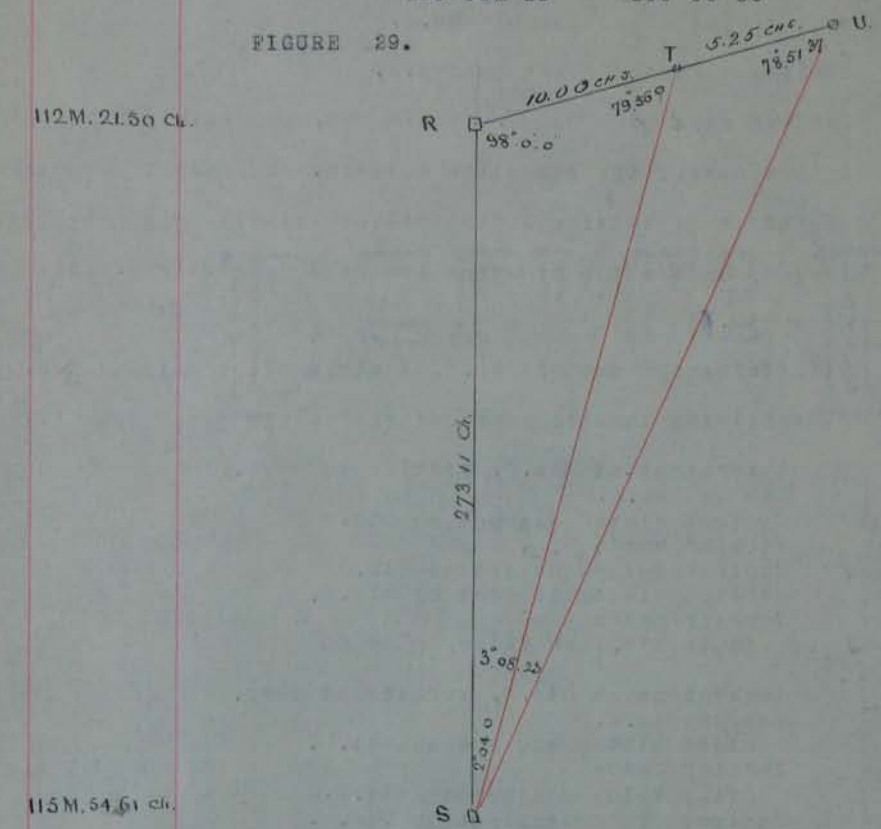
Assuming the angle URS, common to both triangles, to be correct at 98°00′, I correct the triangle RUS by dividing the closing error of 15″ between the other two angles, as follows -

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Corrected angles of triangle RUS.

Angle RUS,	78° 51' 57"
Angle USR,	5.08. 25
Angle SRU,	98.00.00
the sum is	180 00 00

FIGURE 29.



Solving triangle RST, for RS = x.

10.00 : sin. 2°04'00" :: x : sin. 79° 55' 00"

Log. 10.00	1.0000000
Log. sin. 79° 56' 00"	9.9932621
	10.9932621
Log. sin. 2° 04' 00"	8.5570536
	2.4362085

x = SR = 273.03chs.

Solving triangle RSU, for RS = x.

15.25 : sin. 5° 08' 25" :: x : sin. 78° 51' 57"

Log. 15.25	1.1832698
Log. sin. 78° 51' 57"	9.9917393
	11.1750091
Log. sin. 5° 08' 25"	8.7585511
	2.4364580

x = SR = 273.19chs.

The difference in the two triangulations, for the secant distance SR, is therefore 16 lks., which I divide equally between the two, making the corrected distance SR, 273.11chs.

Line distance Sta. R.	112M. 21.50chs.
Secant distance RS,	5M. 33.11chs.
The sum is the line dist. of Sta. S,	115M. 54.61chs.

115M. 54.61ch. Offset 2.46 ft. south, and set a sandstone 30x8x7 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins in the ground, for Special Corner, marked 115M. ~~1~~ 54.61chs. on E. P.F.R on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner

SOUTH BOUNDARY PUBLIC FOREST RESERVATION

Chains.

Barometer indicates 9500 ft.

Thence I run -

Remainder of 116th. MILE.

West, on secant to the parallel.
Va. 17° 45′ E.

Descend abruptly 300 ft. to

9.00 Enter pine timber and descend gradually 150 ft.

Difference in chaining is 2 lks. at middle point of difference

25.89 Offset 2.25 ft. south and set a limestone 30x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 116 Mile Corner, marked 116M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 12 ins. diam. bears S. 14° E. 20 lks. dist. marked 116M. P.L. 1893. B.T.

A pine 12 ins. diam. bears N. 19° 30′ E. 42 lks. dist. marked 116M. P.F.R. 1893. B.T.

A pine 15 ins. diam. bears N. 62° W. 60 lks. dist. marked 116M. P.F.R. 1893. B.T.

No other suitable trees within limits, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber pine.

117th. MILE.

S. 89° 59′ W. on secant to parallel.
Va. 17° 45′ E.

Descend over broken ground, through pine timber, 100 ft. to

40.00 Offset 1.6 ft. south, and set a limestone 30x10x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 116 1/2 Mile Corner, marked 116 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 12 ins. diam. bears N. 20° W. 87 lks. dist. marked 116 1/2 M. P.F.R. 1893. B.T.

A pine 10 ins. diam. bears S. 37° E. 52 lks. dist. marked 116 1/2 M. P.L. 1893. B.T.

Thence descend gradually over broken ground, 100 ft. to 80.00

Difference in chaining is 5 lks. at middle point of difference

80.00 Offset 0.84 ft. south and set a limestone 30x10x5 ins., with granite boulder 6 ins. diam., marked with a X, 20 ins. in the ground, for 117th. Mile Corner, marked 117M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 14 ins. diam. bears S. 61 E. 90 lks. dist. marked 117M.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

A pine 18 ins.diam.bears N.51° E. 20 lks.dist. marked 117M. P.F.R. 1893. B.T.

A pine 12 ins.diam.bears S.20° E. 71 lks.dist. marked 117M. P.L. 1893. B.T.

A pine 15 ins.diam.bears S.70° W.215 lks.dist. marked 117M. P.L. 1893. B.T.

No other suitable trees within limits, and raised a mound of stone 2 1/2 ft.high,5 ft.base, E.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

118th. MILE.

S.89°58′W.,on secant to parallel.
Va.17°40′E.

Descend over rolling ground, 100 ft.to

40.00 Offset 0.68 ft.north,and set a limestone 32x10x7 ins.,with granite boulder 5 ins.diam.,marked with a X, 20 ins. in the ground, for 117 1/2 Mile Corner, marked 117 1/2 M. on E. P.F.R.on N.and P.L.on S.faces, from which

A pine 17 ins.diam.bears N.62° W. 40 lks.dist. marked 117 1/2 M. P.F.R. 1893. B.T.

A pine 15 ins diam. bears S.30° W.59 lks.dist. marked 117 1/2 M. P.L. 1893. B.T.

and raised a mound of stone 2 1/2 ft.high,5 ft.base,E. of corner. Barometer indicates 9000 ft.

70.00 North end of Two ocean lake bears south 32chs. Lake about two miles long north and south,and half a mile wide,E&W.

Thence descend slightly over broken ground to 80.00

Difference in chaining is 8 lks.at middle point of difference

80.00 Offset 2.25 ft.north,and set a limestone boulder 30x12x8 ins. with granite boulder 5 ins.a diam.marked with a X, 20 ins.in the ground,for 118th. Mile Corner, marked 118M.on E. P.F.R. on N.and P.L.on S.faces, from which

A pine 17 ins.diam.bears S.10° W.20 lks.dist. marked 118M. P.L. 1893. B.T.

A balsam 16 ins.diam.bears N.5° E.40 lks.dist.marked 118M. P.F.R. 1893. B.T.

No other suitable bearing trees within limits, and raised a mound of stone 2 1/2 ft.high, 5 ft.base,E.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

119th. MILE.

S.89° 57' W., on secant to parallel.
Va.17°40' E.

0.30 Cross blazed trail, from which corner just established is in plain view.

118M.21.50ch. End of secant. Set a stone level with the top of the ground on the top of which I mark a X, to mark end of secant

October 15th.1893.

I test my chains on the standard and find them correct.

On the morning of October 14th.1893 I observe Polaris from the end of the secant established last night, at its western elongation, at 5h.40m.A.M., mean local time, and find its magnetic bearing to be N.19° 54' W.

North end of needle,	19° 54' E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17 49 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00chs.N.

With vernier at zero, set on tack in hub and deflect 89° 57' 50" towards the east and stike flag held on last hub to the east, verifying the work of yesterday.

I then deflect 89° 57' 50" from the meridian north towards the west, and run -

Remainder of 119th. MILE, on a new secant.

N.89° 57' 50" W., on secant to the parallel.
Va.17°50' E.

Over level bottom land to

15.00 Foot of mountain. Leave timber, and ascend 50 ft. to

18.50 Offset 2.56 ft. north, and set a sandstone 30x12x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 118 1/2 Mile Corner, marked 118 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner. Thence ascend.

34.50 Enter pine timber.

55.00 Cross head of gulch, course N.E. and leave timber.
Difference in chaining is 2 lks. at middle point of difference

58.50 Offset 0.74 ft. north and set a pine post 7 ins. square, 5 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 119th. Mile Corner, marked 119 M. on E. P.F.R. on N. and P.L. on S. faces, from which

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

A balsam 16 ins.diam.bears N.5°W. 52 lks.dist.marked 119M. P.F.R. 1895. B.T.

A balsam 12 ins.diam.bears N.89°W.15 lks.dist.marked 119M. P.F.R. 1895. B.T.

No other trees within limits. Raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Barometer indicates 9000 ft.

Land, mountainous.

Soil, mostly rocky, 4th. rate.

Timber, pine.

120th. MILE.

N.89° 58′ W., on secant to parallel.
Va.17°55′ E.

Ascend 200 ft.to

18.00 Top of mountain, and descend.

36.00 Enter timber

40.00 Offset 0.56 ft.south, and set a pine post 6 ins.square, 5 ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 119 1/2 Mile Corner, marked 119½M on E. P.F.R.on N.and P.L.on S.faces, from which

A pine 14 ins.diam.bears S.80°W.20 lks.dist.marked 119 1/2 M. P.L. 1895. B.T.

A pine 14 ins.diam.bears N.15°E.52 lks.dist.marked 119 1/2 M. P.F.R. 1895. B.T.

Barometer indicates 8700 ft.

Thence ascend through heavy timber, 100 ft.to

50.00 Thence descend 800 ft. to 80.00

Difference in chaining is 11 lks.at middle point of difference

80.00 Offset 1.55 ft.south, and set a pine post 8 ins.square, 5 ft.long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft in the ground, for 120th. Mile Corner, marked 120 M.on E. P.F.R.on N.and P.L.on S.faces, from which

A pine 16 ins.diam.bears N.40°E.16 lks.dist.marked 120M. P.F.R. 1895. B.T.

A balsam 14 ins. diam.bears N.20°W.25 lks.dist.marked 120M. P.F.R. 1895. B.T.

A pine 18 ins.diam.bears S.84°W.48 lks.dist.marked 120M. P.L. 1895. B.T.

A pine 14 ins.diam.bears S.8°W.15 lks.dist.marked 120M. P.L. 1895. B.T.

Raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of Cor.

Barometer indicates 8000 ft.

Land, mountainous.

Chains.

Soil, rocky, 4th. rate.

Timber, pine.

121st. MILE.

N.89°59'W., on secant to parallel.
Va.17°49"E.

Descend 200 ft. to

20.00 Leave timber, bears N&S.

22.70 Cross trail down Pacific creek, Barometer 7800 ft.

22.77 Offset 1.95 ft. south, and set a limestone 40x12x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for Special Corner, marked 120M.+22.77chs. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Thence descend 100 ft. to

40.00 Offset 2.19 ft. south, and set a granite stone 36x18x12 ins. with granite boulder 5 ins. diam., marked with a X, 24 ins. in the ground, for 120 1/2 Mile Corner, marked 120 1/2 M on E. P.F.R. on N. and P.L. on S. faces. Dug 2 pits 36x36x12 ins. N. and S. of corner 4 ft dist. and raised a mound of earth and stone 4 ft high, 6 ft. base, E. of corner.

Thence descend gradually.

54.11 East edge of Pacific creek, course south.

54.38 West edge of same. Enter pine timber and ascend 700 ft. to

70.00 Top of mountain, thence over broken ground to 80.00

Difference in chaining is 10 lks. at middle point of diff.

80.00 Offset 2.62 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 121st. Mile Corner, marked 121M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 10 ins. diam. bears N.5°E. 32 lks. dist. marked 121M.
P.F.R. 1893. B.T.

A pine 8 ins. diam. bears S.42°W. 40 lks. dist. marked 121M.
P.L. 1893. B.T.

No other suitable trees for marking within limits. Raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

122nd. MILE.

West, on secant to parallel.
Va.17°53'E.

Descend over broken ground.

Chains.

15.00 Leave timber and enter burnt district covered, with down timber.

40.00 Offset 2.54 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 121 1/2 Mile Corner, marked 121 1/2 M. on E. P.F.R. on N. and P.L on S. faces. Dug 2 pits 36x36x12 ins. N. and S. of corner, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, E. of corner

Barometer indicates 8200 ft.

Thence over nearly level rocky ground to 80.00

Difference in chaining is 6 lks. at middle point of diff.

80.00 Offset 2.23 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 122nd. Mile Corner, marked 122M. on E. P.F.R. on N. and P.L. on S. faces. Dug 2 pits 36x36x12 ins N. and S. of of corner, 4 ft. dist. and raised amound of earth 2 1/2 ft. high, 5 ft. base, E. of corner.

Barometer indicates 8200 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

123rd. MILE.

S. 89° 59′ W., on secant to parallel.
Va. 17° 55′ E.

Over nearly level ground to

20.00 Gravel mountain 11,500 ft. high, bears due north. Thence descend 500 ft. to

40.00 Offset 1.59 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 6 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 122 1/2 Mile Corner, marked 122 1/2 M. on E. P.F.R. on N. and P.L. on S. faces. Dug 2 pits 36x36x12 ins. N&S. of corner, 4 ft. dist. and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Thence descend 500 ft. to 80.00

Difference in chaining is 9 lks. at middle point of diff.

80.00 Offset 0.84 ft. south, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 6 ins. diam., marked with a X, 2 1/2ft. in the ground, for 123rd. Mile Corner, marked 123M. on

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Chains.

E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36x12 ins N&S.of corner, 4 ft.dist.and raised a mound of earth and stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Barometer indicates 7400 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, burnt and down pine.

October 14th.1893.

I test my chains by the standard and find them correct.

On the morning of October 16th.1893 I observe Polaris from the 123rd.Mile Corner, at its western elongation, at 5h.40m.A.M.mean local time, and find its magnetic bearing to be N.19°44'W.

North end of needle	19°44' E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	17 59 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00chs.N.

From a point 5.22 ft.south of the 123M.corner I deflect 89°57'30"from the north towards the west, and run -

124th. MILE.

N.89°57'30"W.on the secant to the parallel.
Va.18° E.

Over burnt district, descending 100 ft.to

80.00 Cross stream 5 lks.wide, course S.and ascend 100 ft.to

40.00 Offset 1.45 ft.north, and set a pine post 6 ins.square, 6ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 123 1/2 Mile Corner, marked 123 1/2 M.on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36x12 ins.N&S.of post, 4 ft.dist. and raised a mound of earth and stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Thence ascend over broken ground, 400 ft.to 80.00

Difference in chaining is 9 lks.at middle point of diff.

80.00 Offset 0 ft., and set a pine post 6 ins.square, 6 ft.long with granite boulder 6 ins.diam., marked with a X, 2 1/2 ft. in the ground, for 124th. Mile Corner, marked 124M.on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Land, mountainous.

Chains.	
	Soil, rocky, 4th.rate.
	Timber, pine. Burnt, dead and down.

125th. MILE.

N.89°58' W., on secant to parallel.
Va.18°0' E.

	Over nearly level ground, through burnt district.
40.00	Offset 1.12 ft.south, and set a pine post 6 ins.square, 6 ft.long, with limestone boulder 6 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 124 1/2 Mile Corner, marked 124 1/2 M.on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner. Pits impracticable. Thence level to 80.00
	Difference in chaining is 5 lks.at middle point of diff.
80.00	Offset 1.93 ft.south, and set a pine post 6ins.square, 6 ft. long, with limestone boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 125th. Mile Corner, marked 125 M. on E. P F R.on N.and P.L.on S.faces. Dug 2 pits 56x36 X12 ins. N&S.of corner, 4 ft.dist. and raised a mound of earth and stone 2 1/2 ft.high, 5 ft.base, E.of corner.
	Land, mountainous.
	Soil, rocky, 4th. rate.
	Timber, burnt and dead pine.

126th. MILE.

N.89°59' W., on secant to parallel.
Va.17°59' E.

	Over nearly level ground, through burnt district.
15.00	Leave burnt timber.
40.00	Offset 2.41 ft.south and set a sandstone 30x10x6 ins., with granite boulder 5 ins.diam., marked with a X, 20 ins. in the ground, for 125 1/2 Mile Corner, marked 125 1/2 M. on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.
	Thence ascend 500 ft.to 80.00.
	Difference in chaining is 4 lks.at middle point of diff.
80.00	Offset 2.57 ft.south and set a pine post 6 ins.square, 6 ft. long, with granite boulder 5 ins diam., marked with a X, 2 1/2 ft.in the ground, for 126th. Mile Corner, marked 126M.on E. P.F.R. on N. and P.L. on S.faces. Dug 2 pits 56x36x12 ins.

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N&S. of corner, 4 ft. dist. and raised a mound of earth and stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, burnt and down pine.

127th. MILE.

West, on secant to parallel.
Va. 17° 50' E.

Ascend mountain slope to east.

10.00 Enter pine timber.

40.00 Point 400 ft. above last corner. Offset 2.41 ft. south, and set a sandstone 30x8x6 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for 126 1/2 Mile Corner, marked 126 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, from which

A pine 15 ins. diam. bears N. 15° E. 31 lks. dist marked 126 1/2 M. P.F.R. 1895. B.T.

A pine 16 ins. diam. bears S. 21° W. 50 lks. dist marked 126 1/2 M. P.L. 1895. B.T.

Thence ascend.

70.00 Leave timber.

Difference in chaining is 10 lks. at middle point of diff.

80.00 Point 500 ft. above last corner. Offset 1.95 ft. south. Falls on solid rock. I cut a X at exact point for 127th. Mile Corner, and as rock is too rough to cut figures upon, over the X I set a sandstone 32x18x5 ins., marked 127M. on E. P.F.R. on N. and P.L. on S. faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

Barometer indicates 9000 ft.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, pine.

From this point towards the west the line crosses a series of deep canyons, extending from the north towards the south, and the country is so broken up by these impassible canyons and high, inaccessible cliffs intervening, that it is impossible to chain further in this direction.

October 15th. 1895.

I test my chains on the standard and find them correct.

On the morning of October 16th.1898 I observe Polaris from the 127th.Mile Corner, at its western elongation, at 5h.52m.A.M.mean local time, and find its magnetic bearing to be N.19°47'W.

North end of needle,	19°47'E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	18 02 E.

I lay off the azimuth to the east, and mark the true meridian, so determined, by making a X on the rock, 5.00chs.N.

From this point which is on top of a high, narrow and exceedingly rough mountain extending N.20° W., I cannot arrange a satisfactory set of triangulations, on account of not being able to lay off base lines of any considerable length, the mountain being, as stated, rough and broken and covered with 3 to 4 ft.of snow, neither does it appear possible to secure a point to the west suitable for triangulations, within the 6 mile limit for which I have data with which to work the secant method. I am therefore again obliged to fall back on the Manual and proceed to use the tangent to the parallel method for extending the line. I therefore set the instrument over the corner at the point of observation, at the 127th.Mile Corner, Sta.V, fig.50, and directing the telescope to the tack in hub to north, lay off a tangent to the parallel of latitude, in accordance with instructions contained in the Manual. I set a flag to the west on the tangent, at Sta.W, and mark the point by making a X on the rock, I also establish points to the north of Sta. W, by marking a X in the rock, for stations X and Y, fig.50.

Instrument at Sta.V, vernier at zero.
Set on Sta.W.
Unclamp plates and set on Sta.X.
Vernier reads 2°06'50"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.X.
Vernier reads 4.13.00
Angle WVX, mean value, 2°08'50"

Vernier at zero, set on Sta.W.
Unclamp plates and set on Sta.Y.
Vernier reads 2.53.50
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.Y.
Vernier reads 5.47.00
Angle WVY, mean value, 2°56'50"

Leaving a back sight at Sta.V, I then proceed to the flag at Sta.W.

Instrument at Sta.W, vernier at zero.
Set on Sta.V.

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Unclamp plates and set on Sta.X.
Vernier reads 89° 31' 00"
Unclamp below and set on Sta.V.
Unclamp plates and set on Sta.X.
Vernier reads 179°.02'.00"
Angle VWX, mean value, 89° 31' 00"

Vernier at zero, set on Sta.V.
Unclamp plates and set on Sta.Y.
Vernier reads 87°.50'.30"
Unclamp below and set on Sta.V.
Unclamp plates and set on Sta.Y.
Vernier reads 175°.40'.30"
Angle YWV, mean value, 87° 50' 15"

Instrument at Sta.X, vernier at zero.
Set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 88°.23'.00"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 176°.46'.00"
Angle WXV, mean value, 88° 23' 00"

Instrument at Sta.Y, vernier at zero.
Set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 89°.16'.00"
Unclamp below and set on Sta.W.
Unclamp plates and set on Sta.V.
Vernier reads 178°.32'.00"
Angle WYV, mean value, 89° 16' 00"

Closing error of trian. WYV.		Closing error of trian. XWV.	
Angle WYV,	89° 16' 00"	Angle XWV,	89° 31' 00"
Angle YVW,	2.53.30	Angle WVX,	2.06.30
Angle VWY,	87.50.15	Angle VXW,	88.23.00
the sum is	179.59.45	the sum is	180.00.30
Closing error 15"		Closing error 30"	

As I consider the observations equally accurate I divide the closing errors equally between the angles

Corrected angles of trian. WYV.		Corrected angles of Tri. XWV.	
Angle WYV,	89° 16' 05"	Angle XWV,	89° 30' 50"
Angle YVW,	2.53.35	Angle WVX,	2.06.20
Angle VWY,	87.50.20	Angle VXW,	88.22.50
the sum is	180.00.00	the sum is	180.00.00

Carefully measuring the base lins WX and WY, I find WX to be 20.171chs., and WY to be 27.71chs. long.

Solving triangle WYV, for WV = x.
27.71 : sin. 2°53' 35" :: x : sin. 89° 16' 05".

Log. 27.71	1.4426365
Log. sin. 89° 16' 05"	9.9999846
	11.4426011
Log. sin. 2°53' 35"	8.7030495
	2.7395516

x = VW = 548.97chs.

Solving triangle WXV, for WV = x.
20.171 : sin. 2° 06' 20" :: x : sin. 88° 22' 50".

Log. 20.171	1.3047274
Log. sin. 88° 22' 50"	9.9998265
	11.3045539
Log. sin. 2° 06' 20"	8.5851463
	2.7394076

x = VW = 548.79chs.

The difference in the two triangulations, for the distance VW on the tangent, is therefore 18 lks., and as I consider the observations in both triangulations equally satisfactory,

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I decide to divide the error equally, and assume the distanme VW to be 548.88chs.

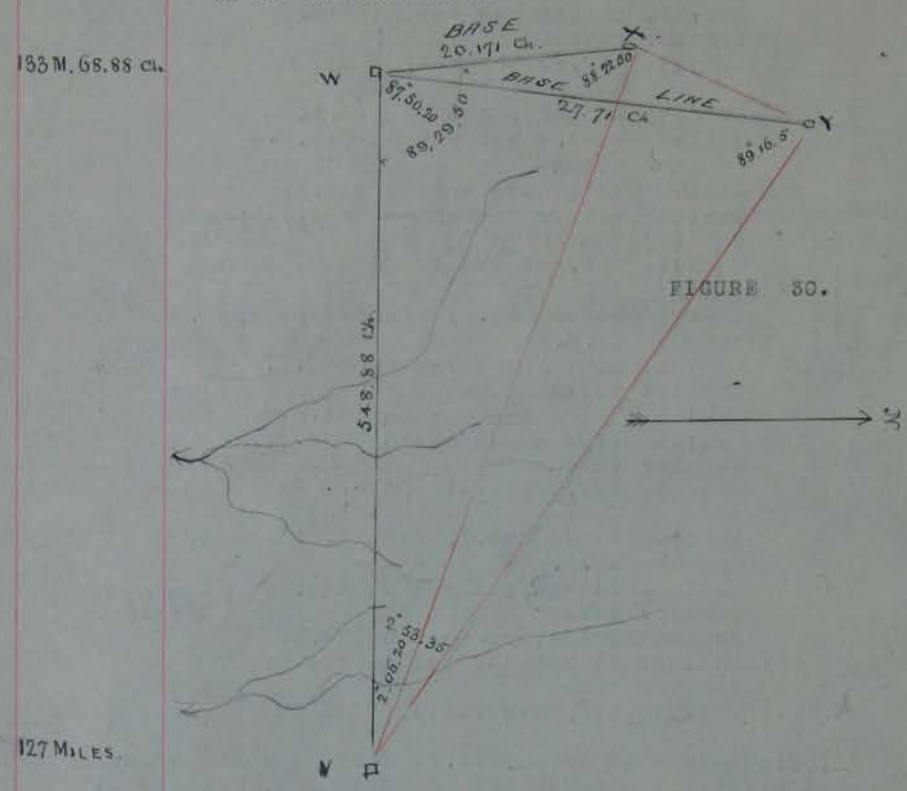

FIGURE 30.

Line distance Sta. V,	127M.00.00chs.
Tangent distance WV,	6M.68.88chs.
The line distance of Sta. W is	133M.68.88chs.

133M.68.88ch. Offset 50.26 ft. north, by deflecting from tangent to the east, toward the north, 89°54'. Cut a X in the solid rock at exact point, for Special Corner. As rock is too rough to cut figures and letters upon, over the X I set a granite stone 40x10x8 ins., for Special Corner, marked 133M.+68.88chs. on E. P.F.R. on N. and P.L. on S. faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

October 16th. 1893.

I test my chains on the standard and find them correct.

On the morning of October 17th. 1893 I observed Polaris from the Special corner at 133M.+68.88chs. established last night, at its western elongation, at 5h.28m. A.M., mean local time, and find its magnetic bearing to be N. 19°50' W.

North end of needle,	19°50' E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	18.05 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by making a mark on a rock, 3.00chs. N.

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155M.68.88ch. From a point S.22 ft.south of the Special Corner at 153M 68.88chs. I turn off the azimuth angle 89° 57' 30" from the north towards the west, and run -

Remainder of 154th. MILE.

N.89° 57' 30" W., on secant to parallel.
Va.18° 15' E.

Descending abruptly 400 ft. to

Difference in chaining is 0.

11.12 Offset 2.7 ft. north and set a sandstone 30x12x10 ins. with granite boulder 5 ins.diam., marked with a X, 20 ins. in the ground, for 154th. Mile Corner, marked 154M.on E. P.F.R on N.and P.L on S.faces, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, scattering pine.

155th. MILE.

N.89° 58' W., on secant to parallel.
Va.18° 05' E.

Descending abruptly mountain slope to west, 250 ft. to

10.00 Enter pine timber, and descend 300 ft. to

40.00 Offset 1.02 ft.north and set a pine post 10 ins.square, 6 ft. long, with granite boulder 6 ins. diam., marked with a X, 2 1/2 ft.in the ground, for 154 1/2 Mile Corner, marked 154 1/2 M. on E. P.F.R. on N.and P.L.on S.faces, from which

A pine 16 ins.diam.bears N.15° W.30 lks.dist.marked 154 1/2 M. P.F.R. 1895. B.T.

A pine 9 ins.diam.bears south, 20 lks.dist.marked 154 1/2 M. P.L. 1895. B.T.

and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner. Thence descend 300 ft.over broken ground to

87.00 Leave timber and descend 100 ft.to 80.00

Difference in chaining is 8 lks.at middle point of diff.

80.00 Offset 0.34 ft.south and set a limestone 30x10x7 ins., with granite boulder 5 ins.diam., marked with a X, 20 ins. in the ground, for 155th. Mile Corner, marked 155M.on E. P.F.R. on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 high, 5 ft.base, E.of corner.

The descent from the

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	156th. MILE.
	N.89°58′W., on secant to parallel. Va.18°05′E.
	Descend 100 ft. to
9.00	Enter pine timber and descend 300 ft. to
40.00	Offset 1.58 ft. south, and set a pine post 11ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 155 1/2 Mile Corner, marked 155 1/2 M. on E. P.F.R. on N. and P.L. on S. faces, from which
	A pine 8 ins. diam. bears S.67° E. 54 lks. dist. marked 155 1/2 M. P.L. 1893. B.T.
	A pine 10 ins. diam. bears N.82° E. 10 lks. dist. marked 155 1/2 M. P.F.R. 1893. B.T.
	Descend gradually 200 ft. to corner.
53.00	Leave timber.
60.00	Enter pine timber.
	Difference in chaining is 8 lks. at middle point of diff.
80.00	Offset 2.09 ft. south and set a pine post 8 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 156th. Mile Corner, marked 156M. on E. P.F.R. on N. and P.L on S. faces, from which
	A balsam 14 ins. diam. bears S.14° E. 54 lks. dist. marked 156M. P.L. 1893. B.T.
	A balsam 10 ins. diam. bears S.79° W. 28 lks. dist. marked 156M. P.L. 1893. B.T.
	No other suitable bearing trees within limits, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.
	Barometer indicates 8000 ft.
	Land, mountainous.
	Soil, rocky, 4th. rate.
	Timber, pine.
	157th. MILE.
	N.89°59′W., on secant to parallel. Va.18°05′E.
	Over broken ground.
1.00	Leave timber, bears N&S.
3.95	Cross trail, course N&S.
4.00	Offset 2.12 ft. south, and set a pine post 8 ins, square, 5 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for Special Corner, marked 156M.+ 4.00chs. on E. F.F.R. on N. and P.L on S. faces. Dug 2 pits

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Chains.	
	36x36x12 ins.N&S.of corner, 4 ft.dist.and raised a mound of earth and stone 2 1/2 ft.high, 5 ft.base, E.of corner.
12.50	Cross small stream, 10 lks.wide, course S.7°W.
	Barometer indicates 8000 ft.
17.00	Enter pine timber, bears N&S. ascend 400 ft. to
51.00	Top of ridge, course N&S. descend 200 ft.to
40.00	Offset 2.49 ft.south,and set a pine post 6 ins.square, 6 ft. long,with granite boulder 5 ins.diam.,marked with a X, 2 1/2 ft.in the ground, for 156 1/2 Mile Corner, marked 156 1/2 M.on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36 x12 ins.N&S.of stone,4 ft.dist.and raised a mound of earth 2 1/2 ft.high,5 ft.base,E.of corner.
	No trees large enough for bearing trees within limits.
	Thence descend 300 ft. to
75.00	Leave timber and ascend slightly to 80.00
	Difference in chaining is 6 lks.at middle point of diff.
80.00	Offset 2.56 ft.south,and set a pine post 7 ins.square,6 ft. long, with granite boulder 5 ins.diam.,marked with a X, 2 1/2 ft. in the ground,for 157th.Mile Corner, marked 157 M.on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36x 12 ins.N&S.of corner,4 ft.dist.and raised a mound of earth 2 1/2 ft.high,5 ft.base,E.of corner.
	Barometer indicates 8000 ft.
	Land, mountainous.
	Soil, mostly rocky, 4th. rate.
	Timber, scrubby pine.

158th. MILE.

West,on secant to parallel.
Va.18°05'E.

	Descend though dead and fallen timber, 700 ft.to
32.00	East edge of marsh, bears N&S.
39.80	West edge of marsh, bears N&S.
40.00	Offset 2.31 ft.south,and set a pine post 6 ins.square, 6 ft. long,with granite boulder 5 ins.diam.,marked with a X, 2 1/2 ft.in the ground, for 157 1/2 Mile Corner, marked 157 1/2 M. on E. P.F.R.on N.and P.L.on S.faces,and raised a mound of stone 2 1/2 ft.high,5 ft.base,E.of corner.
	Barometer indicates 7500 ft.
45.00	Cross Lizzard creek, 20 lks.wide, course south,thence level

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.	
	to 80.00
52.00	Offset 2.17 ft.south, and set a pine post 8 ins.square, 6ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for Special Corner, marked 157M.+52.00chs. on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x26x12 ins.N&S.of post, 4 ft.dist.and raised a mound of earth 2 1/2 ft.high, 5 ft.base, E.of corner.
	Barometer indicates 7300 ft.
52.10	Cross trail, course N&S..Thence ascend gradually 400 ft.
	Difference in chaining is 7 lks.at middle point of diff.
80.00	Offset 1.74 ft.south, and set a pine post 7 ins.square, 6 ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 158th. Mile Corner, marked 158M. on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36x12 ins.N&S.of post, 4 ft.dist. and raised a mound of earth 2 1/2 ft.high, 5 ft.base, E.of corner
	Barometer indicates 7700 ft.
	Land, mountainous.
	Soil, mostly rocky, 4th. rate.
	Timber, dead and fallen pine.

159th. MILE.

S.89°59' W., on secant to parallel.
Va.18°05'E.

	Ascend mountain slope to east, through dead and fallen timber, 500 ft. to
39.60	Top of mountain, course N&S.
40.00	Offset 0.84 ft.south, and set a pine post 8 ins.square, 6 ft. long, with granite boulder 5 ins diam., marked with a X, 2 1/2 ft. in the ground, for 158 1/2 Mile Corner, marked 158 1/2 M.on E. P.F.R.on N.and P.L.on S.faces, from which A pine 18 ins.diam.bears S.46° E.10 lks.dist.marked 158 1/2 M. P.L. 1885. B.T.
	No other suitable bearing trees within limits, and raised a mound of stone 2 1/2 ft.high, 5 ft.base, E.of corner.
	Thence through small pines and brush.
65.00	Leave brush.
65.08	Point on west edge of mountain. Barometer indicates 8000ft.
	Offset 0.12 ft.south, and set a sandstone 40x12x8 ins., with

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Chains.

granite boulder 5 ins.diam., marked with a X, 24 ins. in the ground, for Special Corner, marked 138M.+85.08chs.on E. P.F.R.on N.and P.L.on S.faces, and raised a mound of stone 2 1/2 ft high, 5 ft. base, E.of corner.

Thence descend abruptly mountain slope to west, 800 ft.to Cor.

Difference in chaining is 9 lks.at middle point of diff.

80.00 Offset 0.37 ft.north, and set a pine post 7 ins.square, 6 ft. long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft. in the ground, for 139th. Mile Corner, marked 139 M. on E. P.F.R.on N.and P.L.on S.faces. Dug 2 pits 36x36 x12 ins.N&S.of post, 4 ft.dist. and raised a mound of earth 2 1/2 ft high, 5 ft.base, E.of corner.

Land, mountainous.

Soil, rocky, 4th. rate.

Timber, small pines.

140th. MILE.

S.89°58'W., on secant to parallel.
Va.18°05'E.

Descend 100 ft. to

5.00 Foot of steep slope, thence descend more gradually, through brush and down timber.

40.00 Offset 1.91 ft.north, and set a spruce post 7 ins.square, 6 ft.long, with granite boulder 5 ins.diam., marked with a X, 2 1/2 ft.in the ground, for 139 1/2 Mile Corner, marked 139 1/2 M.on E. P.F.R.on N.and P.L.on S.faces.Dug 2 pits 36x36x12 ins.N&S.of post, 4 ft.dist. and raised a mound of earth and stone, 2 1/2 ft.high, 5 ft.base, E.of corner.

Barometer indicates 6700 ft.

Thence descend trough scattering pine, 150 ft. to

58.80 Cross Snake river trail, course N&S.

58.80 Offset 2.74 ft.north and set a pine post 12 ins.square, 7 ft.long, with granite boulder 5 ins.diam., marked with a X, 3 ft. in the ground, for Special Corner, marked 139M.+58.80 chs. on E. P.F.R.on N.and P.L on S.faces. Dug 2 pits 36x 36x12 ins.N&S.of post, 4 ft.dist.and raised a mound of earth 2 ft.high, 6 ft.base, E.of corner

59.00 Cross wagon road, course N&S.

65.00 Edge of willow marsh, bears N&S.

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Chains.

68.88 West end of secant. At the 6 mile point, and from the secant prolonged I lay off an angle of 5′ 1′ to the N. and run on the

Remainder of 140th. MILE.

N. 89° 57′ 50″ W., on secant to parallel.
Va. 18° 05′ E.

West side of willow marsh.

Difference in chaining is 8 lks. at middle point of diff.

80.00 Point in marsh. Offset 2.7 ft. north and drive a post 6 ins. square, 6 ft. long, 5 ft. in the ground, for 140 th. Mile Corner marked 140M. on E. P.F.R. on N. and P.L. on S. faces. Pits and mound impracticable.

141st. MILE.

N. 89° 57′ W., on secant to parallel.
Va. 18° 05′ E.

9.00 Leave marsh.

35.50 East edge of pond, bears N&S.

40.00 Point for 140 1/2 Mile Corner falls in pond.

42.00 West edge of pond, bears N&S.

42.74 Offset 1.00 ft. north, and set a pine post 7 ins. square 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for Witness Corner to 140 1/2 Mile Corner, marked 140 1/2 M. W.C. on E. P.F.R. on N. and P.L. on S. faces. Dug 2 pits 36x36x12 ins. N&S. of post, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, E. of Cor.

51.20 East bank of Snake river, course south.

53.50 West bank of Snake river.

Difference in chaining is 4 lks. at middle point of diff.

80.00 Offset 0.54 ft. south, and set a pine post 7 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 141st. Mile Corner, marked 141M. on E. P.F.R. on N. and P.L. on S. faces. Dug 2 pits 36x36x12 ins. N&S. of post, 4 ft. dist. and raised a mound of earth 2 1/2 ft. high, 5 ft. base, E. of corner.

Barometer indicates 6550 ft.

Land, mountainous.

Soil, mostly rocky, 4th. rate.

Timber, scattering pine and cottonwood.

This corner stands at the foot of a high and almost perpendicular mountain, and upon investigation I find that

the line passes over it into a deep canyon extending nearly east and west for 4 or 5 miles, and then runs along the steep, rocky north wall of the canyon, to the top of Forellen mountain south of Forellen peak. Chaining any portion of it is out of the question at any time, more especially now as this whole chain of mountains is covered with 4 to 5 ft. of snow which renders even the more accessible portions of them impassible. Triangulation in the canyon, or on the mountain in my immediate front is not practicable, as I cannot find any room to operate on, and it was my conviction of this state of things that led me to establish the Special Corner at 188M. 65.08chs. while there, for future use if necessary in triangulating ahead.

October 17th. 1895.

I test my chains on the standard and find them both to be .01 ft. long, and adjust them both.

On the morning of October 18th. 1895 I observe Polaris from the Special Corner at 188M.+65.08chs, at it western elongation, at 5h. 24m. A. M. mean local time, and find its magnetic bearing to be N. 19° 58′ W.

North end of needle,	19° 58′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	18.13 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 5.00 chs. N.

I then proceed to lay off a double base line as follows, Instrument at Special Corner at 188M.+65.08chs., Sta. A, fig. 81. I measure a carefully chained base line in a northerly direction, and mark the north end by setting a stone level with the top of the ground, at a point exactly 22.51 chs. from Sta. A, on the top of which I mark a X, for Sta. B.

Extending this base line 8.20chs. in same direction, I mark the north end of it by setting a stone level with the top of the ground, on the top of which I mark a X, exactly 30.71chs. from Sta. A, for Sta. C, fig. 81.

Instrument at Sta. A, set on Sta. B, and strike flag held on Sta. C, verifying the alignment of the double base line ABC.

As the point on Forellen mountain, to which I have sent a flag, appears to be more than 8 miles, the longest distance

for which I have any data by which to operate the secant method, I am again obliged to fall back upon the Manual, and use the tangent to parallel method therein contained.

With instrument at Sta.A, I lay off a tangent to the Parallel of latitude, in accordance with the instructions contained in the Manual, and set a flag on the tangent so laid off, on a high mountain towards the W., Sta.D.

Instrument at Sta.A, vernier at zero
Set on Sta.C.
Unclamp plates and set on Sta.D.
Vernier reads 80°14′00″
Unclamp below and set on Sta.C.
Unclamp plates and set on Sta.D.
Vernier reads 160°28′00″
Angle CAD, mean value, 80°14′00″

Instrument at Sta.B, vernier at zero.
Set on Sta.A.
Unclamp plates and set on Sta.D.
Vernier reads 97°51′00″
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.D.
Vernier reads 195°42′00″
Angle DBA, mean value, 97°51′00″

Instrument at Sta.C, vernier at zero.
Set on Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 97°09′00″
Unclamp below and set on Sta.D.
Unclamp plates and set on Sta.A.
Vernier reads 194°18′00″
Angle DCA, mean value, 97°09′00″

Leaving back sights at Stations A, B & C, I then proceed around to the flag at Sta.D.

October 18th.1895.

I test my chains on the standard and find them correct.

On the morning of October 19th.1895 I observe Polaris from the exact point where the flag stood at Sta.D, at its western elongation, at 5h.20m.A.M.mean local time, and find its magnetic bearing to be N.20°05′W.

North end of needle	20°05′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation	18.18 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00chsN.

Instrument at Sta.D, vernier at zero.
Set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 1°55′00″
Unclamp plates and set on Sta.C.
Vernier reads 2.57.50
Unclamp below and set on Sta.A.
Unclamp plates and set on Sta.B.
Vernier reads 4.55.00
Unclamp plates and set on Sta.C.
Vernier reads 5.14.30
Angle ADB, mean value, 1°55′15″
Angle ADC, mean value, 2.57.15

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~~Angle ABD, mean value, 2°57'15"~~

Closing error of triangle ABD. Corrected angles of same.

Angle ABD,	97°51'00"	Angle ABD,	97°50'55"
Angle BDA,	1.55.15	Angle BDA,	1.55.10
Angle DAB,	80.14.00	Angle DAB,	80.13.55
the sum is	180.00.15	the sum is	180.00.00

Closing error 15". Considering as I do that the observations were all equally satisfactory, I decide to allow 1/3rd. of the apparent error to each angle, as per above correction.

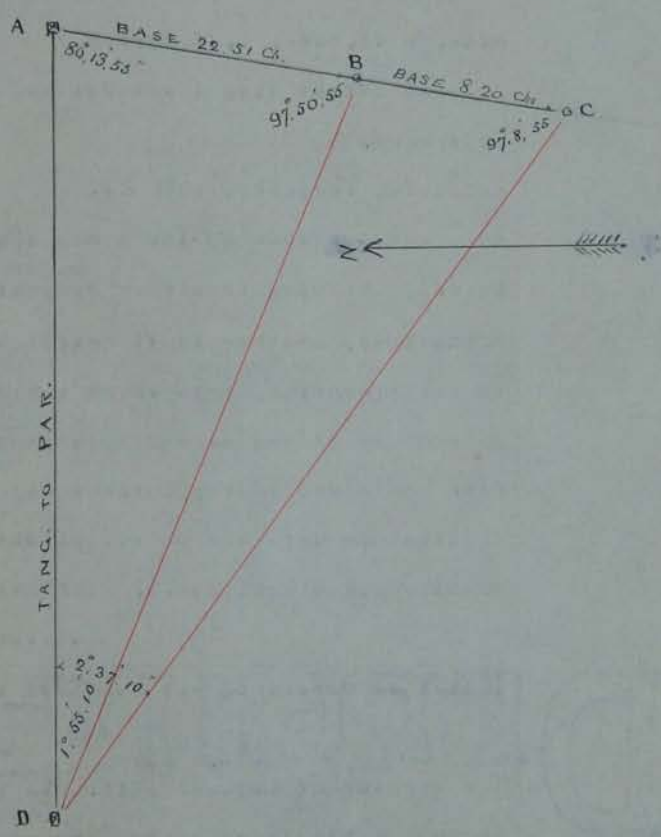
Closing error of triangle ACD. Corrected angles of same.

Angle ACD,	97°09'00"	Angle ACD,	97°08'55"
Angle CAD,	80.14.00	Angle CAD,	80.13.55
Angle ADC,	2.57.15	Angle ADC,	2.57.10
the sum is	180.00.15	the sum is	180.00.00

Closing error 15" I divide the error equally between the three angles, as per above corrected angles.

FIGURE 81.

138M. 65.08 ch.



147M. 11.44 ch.

Solving triangle ABD, for AD = x.

22.51 : sin. 1°55'10" :: x : sin. 97°50'55"

Log. 22.51	1.3522755
Log. sin. 97°50'55"	9.9959125
	11.3481880
Log. sin. 1°55'10"	8.5249717
	2.8232163

x = DA = 665.76 chs.

Solving triangle ADC, for AD = x.

20.71 : sin. 2°57'10" :: x : sin. 97°08'55"

Log. 20.71	1.4672733
Log. sin. 97°08'55"	9.9988109
	11.4660907
Log. sin. 2°57'10"	8.6399353
	2.8259554

x = AD = 666.74 chs.

I consider the triangulation ABC considably the best, on account of the longer base, and conclude to ~~diss~~ divide the dif-

ference given by the two triangulations, for the distance AD, 98 lks, in the proportion 88 to 80. I therefore have the distance AD = 866.56 chs.

Line distance of Sta.A,	138M.65.08 chs.
Tangent distance of AD,	8M.28.36 chs
Line distance of Sta.D,	147M.11.44 chs.

147M.11.44chs. Offset 44.6 ft. north, by deflecting 89°58'02" from tangent, east toward the north, at which point I cut a X in solid rock. As rock is too rough to cut figures upon, over the X, I set a granite stone 30x8x8 ins., for Special Corner, marked 147M.+11.44 chs.on E. P.F.R. on N.and P.L.on S.faces. Piled stone around it and raised a mound of stone 2 1/2 ft. high, 5 ft.base, E.of corner

On same offset line I set hub and tack 4.00 chs.north, for reference.

Barometer indicates 9000 ft.

This point stands on the steep south slope of Forellen mountain. Chaining in either direction, E.Or W. from here is impossible, neither is it practicable to chain a base line in any direction, from which to measure the distance ahead, on account of the exceedingly rough character of the ground, both north and south, which would render the work inaccurate. I therefore mark a X on top of the corner just established exactly north from Sta.D, for Sta.E, fig.32,

October 18th.1898.

I test my chains on the standard and find them correct.

The morning of October 20th.1898 proving too cloudy to observe Polaris, with instrument at Sta.E, the special corner at 147M.+11.44 chs., fig. 32, I set ~~on~~ tack in hub to the north, and carefully lay off a tangent to the parallel of latitude, on which I set a flag to the west, Sta.F, fig. 32. I also establish stations G and H, to the south of Sta. F, marking them all by by setting stones in the ground, on the top of of each of which is marked a X.

Instrument at Sta.E, vernier at zero.
Set on Sta.F.
Unclamp plates and set on Sta.G.
Vernier reads 3°14'30"
Unclamp plates and set on Sta.H.
Vernier reads 4°12'30"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.G.
Vernier reads 7°27'00"

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Unclamp plates and set on Sta.H.
Vernier reads 8°24'30"
Angle FEG, mean value, 5°14'30"
Angle FEH, mean value, 4.12.15

Leaving a back sight at Sta.E, I then proceed to the flag at Sta.F.

October 20th.1895.

On the morning of October 21st.1893 I observed Polaris from Sta.F, fig.82, at its western elongation, at 5h.12m.A.M. mean local time, and find its magnetic bearing to be N. 20°.05' W.

North end of needle	20°05' E.
Aziguth, by table in Manual, is	1.45 W.
The difference is the variation	18.20 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00chs. north.

Instrument at Sta.E, vernier at zero.
Set on Sta.E.
Unclamp plates and set on Sta.G.
Vernier reads 90°51'30"
Unclamp below and set on Sta.E
Unclamp plates and set on Sta.G.
Vernier reads 181°.45'.00"
Angle GFE, mean value, 90°51'30"

Vernier at zero, set on Sta.E.
Unclamp plates and set on Sta.H.
Vernier reads 86°.15'.30"
Unclamp below and set on Sta.E.
Unclamp plates and set on Sta.H.
Vernier reads 172°.30'.30"
Angle EFH, mean value, 86°15'15"

Instrument at Sta.G, vernier at zero.
Set on Sta.F.
Unclamp plates and set on Sta.E.
Vernier reads 85°.54'.00"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.E.
Vernier reads 171°.48'.30"
Angle FGE, mean value, 85°54'15"

Instrument at Sta.H, vernier at zero.
Set on Sta.F.
Unclamp plates and set on Sta.E.
Vernier reads 89°.32'.30"
Unclamp below and set on Sta.F.
Unclamp plates and set on Sta.E
Vernier reads 179°.04'.30"
Angle EHF, mean value, 89°52'15"

Carefully chaining the base lines FG and FH, I make FG 25.06 chs. and FH 32.41chs.

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147M. 11.44 Ch.

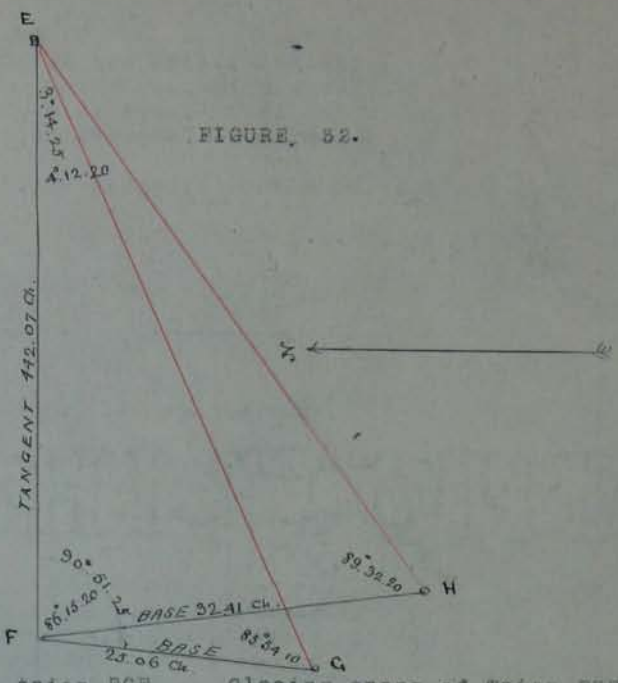

FIGURE. 52.

152 M. 53.51 Ch.

Closing error of trian. FGE.		Closing error of Trian. FHE.	
Angle FGE,	85° 54′ 15″	Angle FHE,	89° 32′ 15″
Angle GEF,	3.14.30	Angle HEF,	4.12.15
Angle EFG,	90.51.30	Angle EFH,	86.15.15
the sum is	180 00 15	the sum is	179.59.45
Closing error 15″		Closing error 15″	

Dividing the closing errors of the triangles equally between the angles, I have

Corrected angles of trian. FGE.		Corrected angles of Tri. FHE.	
Angle FGE,	85° 54′ 10″	Angle FHE,	89° 32′ 20″
Angle GEF,	3.14.25	Angle HEF,	4.12.20
Angle EFG,	90.51.25	Angle EFH,	86.15.20
the sum is	180 00 00	the sum is	180.00.00

Solving triangle FGE, for EF = x.

25.06 : sin. 3°14′25″ :: x : sin. 85° 54′ 10.″

Log. 25.06	1.3989811
Log. sin. 85° 54′ 10″	9.9988886
	11.3978697
Log. sin. 3° 14′ 25″	8.7522281
	2.6456416

x = FE = 442.22chs.

Solving triangle FHE, for EF = x.

32.41 : sin. 4°12′20″ :: x : sin. 89° 32′ 20.″

Log. 32.41	1.5106790
Log. sin. 89° 32′ 20″	9.9999859
	11.5106649
Log. sin. 4° 12′ 20″	8.8655107
	2.6455542

x = FE = 441.93chs.

The difference between the two triangulations, for the tangent distance EF, is therefore 29 lks. which, divided in the proportion of 14 to 15 in favor of the triangle HFE (it having slightly the longer base) gives -

Line distance of Sta. E,	147M. 11.44chs.
Tangent distance EF,	5M. 42.07chs.
Line distance of Sta. F,	152M. 53.51chs.

152M. 53.51ch. Offset 19.65 ft. north, and set a pine post 6 ins. square, 8 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for Special Corner, marked 152M.

55.51chs. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner. Barometer indicates 8000 ft.

From a point 5.22 ft. south of the special corner just established, at 152M.+55.51chs., Sta. K, fig. 55, I lay off the azimuth angle 89° 57′ 30″ from the north towards the west, and set a flag on the secant so established towards the west, at Sta. L, fig. 55, which I mark by setting a stone level with the top op the ground, on the top of which I mark a X. I also set stones level with the top of the ground, and mark a X on the top of each, at M and N, to the north of Sta. L, and prepare to triangulate to Sta. L.

This action is necessary for the reason that the country to the west is very rough and broken, and while parts of might possibly be chained in favorable season, as it now is (covered by 3 to 4 ft. of snow) it cannot be done, and it has come to such a pass with myself and outfit that I have just got to get out of this snowy country as my stock are so run down for lack of food, that it is certain if I don't get out very quickly I will not be able to do so at all.

Instrument at Sta. K, vernier at zero.	
Set on Sta. L.	
Unclamp plates and set on Sta. M.	
Vernier reads	2° 29′ 30″
Unclamp plates and set on Sta. N.	
Vernier reads	4.08.30
Unclamp below and set on Sta. L.	
Unclamp plates and set on Sta. M.	
Vernier reads	6.58.00
Unclamp plates and set on Sta. N.	
Vernier reads	8.17.00
Angle LKN, mean value, 2° 29′ 30″	
Angle LKN, mean value, 4.08.30	

October 21st. 1893.

Arriving at the flag on the morning of October 22nd. 1893 I observe Polaris from Sta. L, fig. 55, at its western elongation, at 5h. 8 m. A.M. mean local time, and find its magnetic bearing to be N. 20° 06′ W.

North end of needle,	20° 06′ E.
Azimuth, by table in Manual, is	1.45 W.
The difference is the variation,	18.21 E.

I lay off the azimuth to the east and mark the true meridian, so determined, by hub and tack, 4.00 chs. north.

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Instrument at Sta. L, vernier at zero,
Set on Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 92°16′50″
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. M.
Vernier reads 184°.33′.00″
Angle MLK, mean value, 92°16′30″

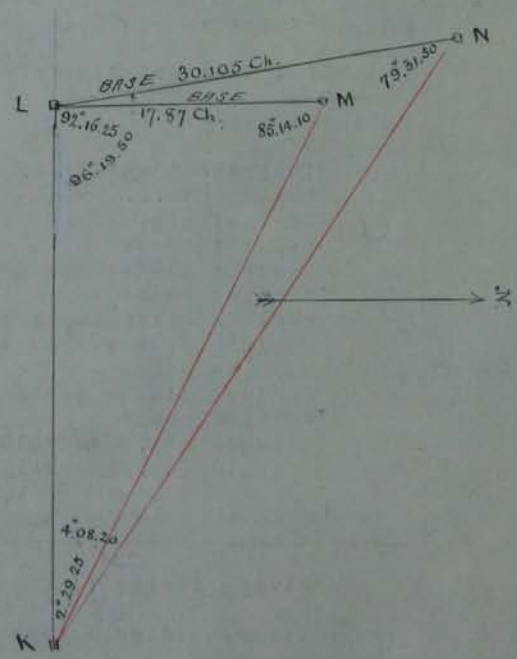
Vernier at zero, set on Sta. K.
Unclamp plates and set on Sta. N.
Vernier reads 96°.20′.00″
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. N
Vernier reads 192°.40′.00″
Angle NLK, mean value, 96°20′00″

Instrument at Sta. M, vernier at zero.
Set on Sta. L.
Unclamp plates and set on Sta. K.
Vernier reads 85°.14′.30″
Unclamp below and set on Sta. L.
Unclamp plates and set on Sta. K.
Vernier reads 170°.28′.30″
Angle LMK, mean value, 85°14′15″

Instrument at Sta. N, vernier at zero.
Set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 79°.32′.00″
Unclamp below and set on Sta. K.
Unclamp plates and set on Sta. L.
Vernier reads 159°.04′.00″
Angle LNK, mean value, 79°32′00″

FIGURE 35.

157 M. 63.53 Ch.



152 M. 53.51 Ch.

Closing error of trian. LMK.		Closing error of trian. LNK.	
Angle LMK,	85°14′15″	Angle LNK,	79°32′00″
Angle MKL,	2.29.30	Angle NKL,	4.08.30
Angle KLM,	92.16.30	Angle KLN,	96.20.00
the sum is	180 00 15	the sum is	180.00.30
Closing error 15″		Closing error 30″	

As the observations were all apparently equally accurate, I divide the closing error in each triangle equally between the angles.

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Corrected angles of trian. LMK.		Corrected angles of tri. LNK.	
Angle LMK,	85° 14' 10"	Angle LNK,	79° 51' 50"
Angle MKL,	2.29.25	Angle NKL,	4.08.20
Angle KLM,	92.16.25	Angle KLN,	96.19.50
the sum is	180.00.00	the sum is	180.00.00

Carefully chaining the base lines LM and LN, I make LM 17.87chs. and LN 50.105chs.

Solving triangle LMK, for LK = x.
17.87 : sin. 2° 29' 25" :: x : sin. 85° 14' 10."

Log. 17.87	1.2521248
Log. sin. 85° 14' 10"	9.9984971
	11.2506217
Log. sin. 2° 29' 25"	8.6379884
	2.6126333

x = KL = 409.56chs.

Solving triangle LNK, for KL = x.
50.105 : sin. 4° 08' 20" :: x : sin. 79° 51' 50."

Log. 50.105	1.4786386
Log. sin. 79° 51' 50"	9.9927090
	11.4713476
Log. sin. 4° 08' 20"	8.8583834
	2.6129642

x = KL = 410.17chs.

The difference in the two traingulations, for the distance LK, is therefore 31 lks., which I divide in the proportion of 15 to 16, favoring the triangulation NLK, it having the longer base. I therefore have -

Line distance Sta. K,	152M. 55.51chs.
Secant distance LK,	5M. 10.02chs.
Line distance Sta. L,	157M. 65.53chs.

157M. 63.53ch. Offset 0.34 ft. north, and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for Special Corner marked 157M. + 65.53chs. on E. P.F.R. on N. and P.L on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner

Barometer indicates 7300 ft.

From a point 5.22 ft. south of the special corner just established at 157M+65.53chs. I lay off the azimuth angle 89° 57' 50" from the tack in hub on meridian north towards the west, and run -

Remainder of 158th. MILE.

N. 89° 57' 50" W. on the secant to parallel.
Va. 18° 21' E.

Descending 100 ft. to

16.47 ch. Offset 2.45 ft. north and set a pine post 6 ins. square, 6 ft. long, with granite boulder 5 ins. diam., marked with a X, 2 1/2 ft. in the ground, for 158th. Mile Corner, marked 158M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2 1/2 ft. high, 5 ft. base, E. of corner.

SOUTH BOUNDARY PUBLIC FOREST RESERVATION.

Chains.

Land, mountainous.

Soil, rocky, 4th. rate.

No timber.

159th. MILE.

N.89° 57' 30" W. on secant to parallel.
Va. 18° 21' E.

Descending gradually along slope to north, 300 ft. to 45chs. This should be the end of the survey, and I endeavor to make a closing on the Wyoming-Idaho line, but after a fruitless search I am obliged to give it up. There is so much snow in the country that even if near the line it would be impossible to find a corner. I therefore at

43.00 Offset 0.71 ft. north, and set the SOUTH WEST CORNER of the Public Forest Reservation, as follows -

Set a porphyry stone 30x10x8 ins., with granite boulder 5 ins. diam., marked with a X, 20 ins. in the ground, for S.W. Corner, marked

S.W.Cor.P.F.R.	1895	on N.
C.C. 158M.+45ch.		on E,
Lat. 44°		on S. and
Idaho		on W. faces.

Over the corner build a stone mound in the form of the frust um of a sqare pyramid, 4 ft. high, 6 ft. base, with its sides directed N.S.E.& W., in the sides of which I place stones marked as follows

Stone in north side	S.W.Cor.P.F.R. 1895.
Stone in east side	C.C. 158M.+45chs.
Stone in south side	Lat. 44°
Stone in west side	Idaho.

There are no trees to mark for bearing trees.

Barometer indicates 6750 ft.

October 22nd. 1895.

GENERAL DESCRIPTION OF SOUTH BOUNDARY.

This line, like all the other portions of the survey, lies over high broken and precipitous mountains for almost the entire distance, and I found it necessary to triangulate almost the entire distance. There is no level land or river bottoms on it, except a very small quantity where the line crosses the Snake river. The line throughout was covered with snow and was exceedingly difficult to traverse.

EXTERIOR BOUNDARIES OF PUBLIC FOREST RESERVATION.

SUPPLEMENTAL REPORT, TO ACCOMPANY RETURNS OF SURVEYS MADE UNDER CONTRACT NO. 283.

****

When I signed this contract in September 1891 I supposed I should have two seasons in which to do the work, but for reasons unknown to me the contract was not approved by the Department until 1893, and the Special Instructions and order to proceed with the work reached me July 20, 1893.

At same time I also received copy of letter from the Acting Commissioner stating that it was absolutely necessary that I complete the field work, notes and maps, prior to June 30th. 1894, otherwise the contract would lapse and the appropriation go back into the Treasury. This of course required that the field work be completed in full before the winter of 1893-4 set in, and left with a long distance to travel to the work, over difficult trails and with some 215 miles of rough, mountainous work to complte, with a certainty that it must be done within a peroid of three months, as it was certain that I could not stay in the mountains after November 1st.

Realizing fully the importance of getting to work as speedily as possible, and of pushing the work, I immediately took the field with a large and well equipped force of men, and on August 3rd. 1893 commenced work at Yellowstone lake. I soon discovered that the entire survey would be over the roughest, most inaccessible and dangerous mountains in the whole country, and that if I completed the survey agreeably to the original design during the short season, I should have to make great efforts to complete it before November 1st. 1893, up to which time I then expected it would be possible to work.

Proceeding with the survey of the line 10 miles east of Yellowstone lake, and the unmeasured E. boundary of the Park, according to instructions, I found before completing that portion of the contract, that I should encounter the highest, roughest and worst portion near the S.E. Corner and along the south boundary. I therefore bent every energy to get over that portion of the work before snow began to fall, well knowing the utter impossibility of scaling these heights when covered with snow. I therefore worked during every hour of daylight, and succeeded in getting the line run to the south boundary before encountering any very serious difficulty from snow, although it began to fall on September 12th. while I was still on the east boundary, near the north fork of the Stinking water river and kept the mountains in such a wet and slippery condition as to materially impede progress.

On first of October bad weather began in earnest and from that date I experienced plenty of it. The first snow-fall on the south boundary began Oct. 1st. and continued without cessation for 7 days. The fall during that time would probably aggregate 5 feet which, while it settled down considerably, never went off, but kept steadily grow-

ing by additions almost every day. Through this mass of snow and ice I struggled along the best way I could (determined not to give up) to the end of the survey, putting in all the corners possible under the existing circumstances and conditions, and finally re-crossed the range near the head of Ishawood creek, through 6 ft. of snow, on my return route, with as badly a used-up outfit as probaly ever came out of any country. The season proved a very remarkable one, not only commencing very early to merge into winter, but in an unprecedented snow fall. Never before had the oldest settlers seen half so much snow up to Nov. 1st.

In handing in the notes of this survey I therefore beg to state that it has been made under the most adverse and trying circumstances possible, the work to be done was of the worst possible character, being entirely over rough, rugged and precipitous mountains, the time entirely too limited for the amount of work to be done, and the season most unpropitious. Our casualties were numerous, but I do not intend to detail them, wishing only fully to impress upon the Department that, in executing this contract, I have done all that mortal man could do. In some respects which were beyond my power to remedy or improve, the survey has not been made quite up to the standard of the Special Instructions, and therefore disappointing to me. I have done my level best to work up to the said Special Instructions, and no one could have come any nearer doing so, in toto. The survey is in many respects admirable, and I think the Government never had one so well executed, over the same character of country. The corners are well marked, and the distances and alignment perfect, almost the entire line having been triangulated, as well as chained. There are quite a number of corners which I found impossible to establish, on account of the rough character of the country, but on my own suggestion, afterwards incorporated in Supplemental Instructions received through the Surveyor general, I have established quite a large number of Special Corners, more than making up in value to the survey for the necessary omission of such regular corners as I found inexpedient or impossible to locate and establish.

These special corners are located and constructed in prominent places crossed by the line, such as tops of mountains, trails, &c. and will be found very convenient in case, for some special reason, it ever becomes necessary to ReRun or Re-establish any portion of the line. They are in all cases placed in such position, and so constructed as to be practically indestructible, easily found, and plainly marked. Every trail, leading into the Park, crossed by the line has one of these Special Corners located in such a manner "near it" that it would be impossible for any one to pass along it without noticing the corner, and I do not believe that it would be possible for any one

travelling across the lines to do so without knowing it, for the reason that every point or trail over which it may be practicable to pass, is so marked by one of these Special Corners, that they could not avoid seeing it.

These Special Corners are in fact the back bone of the whole survey and of more value, on account of the very prominent positions they occupy than all the rest. I myself suggested their use and value to the Surveyor-general after the Special Instructions had been prepared and he, agreeing with me as to their value, prepared the Supplemental Instructions accompanying this contract to allow of their use, and therefore, as I have found it necessary in the execution of this contract to omit more of the regular corners than I myself liked, I think I deserve full credit for these Special Corners which are, in point of fact, of the greatest value to the survey, and will always remain the most prominent points of the Boundary Line.

Philip S. McGaffey
U.S. Deputy Surveyor.

FINAL OATHS FOR SURVEYORS.

A list of the names of the individuals employed by .....

U. S. Deputy Surveyor, to assist in running, measuring, and marking the lines and corners described in the foregoing field notes of the survey of the .....

lines of .....

.....

showing the respective capacities in which they acted:

....., Compassman.

....., Chainman.

....., Chainman.

....., Chainman.

....., Chainman.

....., Axeman.

....., Axeman.

....., Flagman.

FINAL OATHS OF ASSISTANTS.

I ~~We~~ hereby certify that ~~we~~ assisted Philip M. Gallacher, U. S. Deputy Surveyor,

in ~~surveying all those parts or portions of~~ the establishment of point of beginning at the easternmost point of Yellowstone lake, and the survey of Parallel of latitude 44° 20' 12" N. thru east from point of beginning on Yellowstone Lake, the unmeasured east boundary of Yellowstone National Park; the measured ~~s~~ east boundary of Yellowstone National Park, and the north east and south boundaries of Public Forest Reservation in the State of Wyoming.

as are represented in the foregoing field notes as having been surveyed by him and under his direction; and that said survey has been in all respects, to the best of ~~our~~ my knowledge and belief, well and faithfully surveyed, and the corner monuments established, according to the instructions furnished by the U. S. Surveyor General of Montana

.....

....., Compassman.

(signed) Chas. L. Sawyer, Chainman.

....., Chainman.

....., Chainman.

....., Chainman.

....., Axeman.

....., Axeman.

....., Flagman.

Subscribed and sworn to before me at Billings, Yellowstone Co. Montana

this 13 day of July, 1894.

(signed) A. P. Hart

U. S. Commissioner
Dist. of Montana

U.S. Commissioner's [SEAL.]

(4—680.)

FINAL OATH OF DEPUTY SURVEYOR.

I, ..., United States Deputy Surveyor, do solemnly swear that in pursuance of instructions received from ..... United States Surveyor General for ....., bearing date of the ..... day of ....., 188 , I have well, faithfully, and truly, in my own proper person, and in strict conformity with the instructions furnished by the U. S. Surveyor General for ..... the Surveying Manual, and the laws of the United States, surveyed all those parts or portions of .....

.....

.....

.....

in the .....,

as are represented in the foregoing field notes as having been surveyed by me and under my directions; and I do further solemnly swear that all the corners of said survey have been established and perpetuated in strict accordance with the Surveying Manual, printed instructions, the special written instructions of the U. S. Surveyor General for .....

....., and in the specific manner described in the field notes, and that the foregoing are the *true* field notes of such survey, and should any fraud be detected I will suffer the penalty of perjury under the provisions of an Act of Congress approved August 8, 1846.

.....

U. S. Deputy Surveyor.

Subscribed and sworn to before me at ..... this ..... day of ....., 188 .

.....

.....

[10382—1,000.]

List of Names.

A list of the names of the individuals employed by Philip M. Gallaher, U. S. Deputy Surveyor, to assist in running, measuring, and marking the lines and corners described in the foregoing field notes of the ~~survey of the~~ establishment of point of beginning at the easternmost point of Yellowstone Lake, and the survey of Parallel of Latitude 44° 20' 12" N, run east from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park, and the north, east and south boundaries of Public Forest Reservation ~~Meridian~~, in the state of Wyoming, showing the respective capacities in which they acted:

Charles La Blanc	Chainman
Jno. E. Shaw	Chainman
Clarence T. Foraker	Chainman
Chas. L. Sawyer	Chainman
John Sheridan	Axeman
Joseph Willey	Axeman

Final Oath of Assistants:

We hereby certify that we assisted Philip M. Gallaher, U. S. Deputy Surveyor, in ~~surveying all these parts or portions of~~ the establishment of point of beginning at the easternmost point of Yellowstone Lake, and the survey of Parallel of Latitude 44° 20' 12" N run east from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park, and the north east and south boundaries of Public Forest Reservation in the ~~Meridian~~, State of Wyoming, as are represented in the foregoing field notes as having been surveyed by him and under his direction; and that said survey has been in all respects, to the best of our knowledge and belief, well and faithfully surveyed, and the corner monuments established, according to the instructions furnished by the U. S. Surveyor General for Montana

(signed) Jno. E. Shaw
(signed) Clarence T. Foraker
(signed) Charles La Blanc
(signed) John Sheridan
(signed) Joseph Willey

Subscribed and sworn to before me this 20th day of November, 1893.

U.S. Commissioners SEAL

(signed) F. P. Hart
U. S. Commissioner

6—151

Final Oath of U. S. Deputy Surveyor.

I, Philip M. Gallaher, U. S. Deputy Surveyor, do solemnly swear that, in pursuance of instructions received from Geo. D. Eaton, U. S. Surveyor General for Montana, bearing date of the 17th day of Oct. 1891 and June 15th, 1893, I have well, faithfully, and truly, in my own proper person, and in strict conformity with the instructions furnished by the U. S. Surveyor General for Montana, the surveying manual, and the laws of the United States, ~~surveyed all those parts or portions of~~ established point of beginning at the easternmost point of Yellowstone Lake, and surveyed Parallel of Latitude 44°20'12"N. run east from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park, and the north, east and south boundaries of Public Forest ~~Meridian, in the~~ Reservation in the state of Wyoming, as are represented in the foregoing field notes as having been surveyed by me, and under my directions; and I do further solemnly swear that all the corners of said survey have been established and perpetuated in strict accordance with the surveying manual, printed instructions, the special written instructions of the U. S. Surveyor General for Montana and in the specific manner described in the field notes, and that the foregoing are the true field notes of such survey; and should any fraud be detected, I will suffer the penalty of perjury under the provisions of an Act of Congress approved August 8, 1846.

(signed) Philip M. Gallaher
U. S. Deputy Surveyor.

Subscribed and sworn to before me this 20th day of November, 1893.

U.S. Commissioners SEAL

(signed) A. P. Hart
U.S. Commissioner

Approval.

Office of the U. S. Surveyor General,

Helena, Montana, July 17, 1894

The foregoing field notes of the ~~survey of~~ establishment of point of beginning at the easternmost point of Yellowstone Lake, and the survey of Parallel of Latitude 44°20'12"N. run east from point of beginning on Yellowstone Lake; the unmeasured east boundary of Yellowstone National Park; the measured east boundary of Yellowstone National Park, and the north, east and south boundaries of Public Forest Reservation in the state of Wyoming executed by Philip M. Gallaher, U.S. Deputy Surveyor in the months of Aug, Sept & Oct. 1893 under his Contract No. 263, dated October 17, 1891, having been critically examined, the necessary corrections and explanations made, the said field notes, and the surveys they describe, are hereby approved.

(signed) Jno. S. M. Veill
U. S. Surveyor General.

I certify that the foregoing transcript of the field notes of the above-described surveys in the state of Wyoming, has been correctly copied from the original notes on file in this office.

Jno S. Veill
U. S. Surveyor General.

6—151

358

(4—679.)

RECEIVED WITH
SUR. GEN'S. LETTER.
OCT 4 1895

Supplemental

FIELD NOTES

OF THE SURVEY OF

the East boundary Yellowstone National Park

and the

North, East and South boundaries of

Public Forest Reservation

in

Wyoming

Of the ..... Meridian,

AS SURVEYED BY

Philip M. Gallaher, U. S. Deputy Surveyor,

Under his Contract No. 263, dated October 17th 1891.

Supplemental
Survey commenced August 26th, 1894.

Survey completed September 22d, 1894.

Names and Duties of Assistants.

Nove E. Brown	Chairman
Frank Legg	"
Alonzo J. Legg	"
John L. Dorsh	"
William H. Edick	Assman

INDEX DIAGRAM. See next page

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Meanders Page .....

Preliminary Oaths of Assistants.

We, Rove E. Brown, Frank Legg
Alonzo J. Legg and John L. Dorsh

do solemnly swear that we will well and faithfully execute the duties of chain carriers; that we will level the chain over even and uneven ground, and plumb the tally-pins either by sticking or dropping the same; that we will report the true distance to all notable objects, and the true lengths of all lines that we assist in measuring, to the best of our skill and ability, and in accordance with instructions given us in the ~~survey of the~~ Improvement of the evidences of Survey of the East Boundary of the Yellowstone National Park, and the North, East and South Boundaries of the Public Forest Reservation in Wyoming

Rove E. Brown, Chainman.
Frank Legg, Chainman.
Alonzo J. Legg, Chainman.
John L. Dorsh, Chainman

Subscribed and sworn to before me this 10th day of August, 1894

A P Hart
Seal
U.S. Commissioner
Billings Mont

A. P. Hart
U.S. Commiso

I, William H Edick

do solemnly swear that we will well and truly perform the duties of axemen in the establishment of corners and other duties, according to instructions given us, and to the best of our skill and ability, in the ~~survey of the~~ Improvement of the evidences of Survey of the East Boundary of the Yellowstone National Park, and the North, East and South Boundaries of the Public Forest Reservation in Wyoming

Subscribed and sworn to before me this 10th day of August, 1894

William H Edick, Axeman.
, Axeman.

A P Hart
Seal
U.S. Commiso
U.S. Commissioner
Billings Mont

1st Copy

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Supplemental Notes of Survey of East and South Bds. Public Forest Reservation

On account of the short working season and remoteness of supplies, I deem it best to proceed as rapidly as possible to that portion of the line most difficult of access and finish up necessary work, leaving the more accessible portions until my return.

I therefore proceed directly to where the East boundary of Public Forest Reservation crosses the South fork of Stinkingwater River at 66 M + 28 ch. I arrived at this point on August 26th 1894

From the 67th Mile Corner I carefully retraced the East boundary of Public Forest Reservation South, to the S.E. corner thereof. Wherever it was possible for a party to go I cleared the undergrowth fully and blazed additional trees as instructed. I carefully examined the line to see if by any means it was possible to set more of the regular mile and half mile corners, but failed to see how it could be done

From the S.E. corner Public Forest Reservation I carefully retraced the South boundary Public Forest Reservation West. Wherever it was possible I cleared the undergrowth fully and blazed additional trees as instructed. I carefully examined the line to see if it was possible to set more of the regular Mile and half mile corners. East of about where the 132nd mile point should be I saw made no improvement in the line, except as indicated by clearing and blazing. I therefore proceed to the Special corner at 133 M + 68.88 ch arriving there on the evening of September 4th 1894. On the night of September 4th 1894 with instrument over Special Corner at 133 M + 68.88 chs. I observe Polaris at eastern elongation at 8 h. 28 m PM. mean local time, and find its magnetic bearing to be N 16° 20' W.

North end of needle	16° 20' E
Azimuth, by table in Manual	1° 45' E
the sum is the declination	18° 05' E

Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains	
	Ascend gradually to
7.00	Top of divide, Course SW + NE, descend to
10.00	Thence descend rapidly 100 ft to
14.00	Bottom of gulch, Course N. ascend 100 ft to
18.00	Top of ridge, slopes N. thence descend through dead and fallen timber
32.00	Ascend gradually.
36.00	Ascend rapidly over almost perpendicular E. slope
40.00	Point for 151½ Mile Corner falls on ground too steep to establish it
42.40	Offset 1.36 ft north and set a porphyry stone 36 × 12 × 8 ins. with granite boulder 5 ins. diam marked with a cross (×) 20 ins in the ground for Witness Corner to 151½ Mile Corner, marked W.C. 151 M + 42.40 Ch. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 5 ft high, 5 ft base, east of corner
	Barometer indicates 8.400 ft.
	The Special Corner at 149 M + 14.33 Ch. can be seen plainly from this corner
	This Witness Corner is on a high, rocky elevation which breaks off perpendicularly on the east, and gradually on the West, and extends N 20 W To the South it curves around easterly and then north, forming the divide crossed at 151 M + 7 Ch.
	Descend gradually through scattering dead timber to
65.00	Descend rapidly to 80.00 Ch. The difference in chaining is 5 Lks. At middle point of difference
80.00	Offset 0.0 ft and set a pine post 8 ins. square 6 ft long, with granite stone 5 ins. diam. marked with a cross (×) 2½ ft in the ground for 152nd Mile Cor. marked 152 M. on E. P.F.R. on N and P.L. on S. faces, from which
	A pine 18 ins. diam. bears N 54° W. 47 Lks dist. marked 152 M. P.F.R. 1894 B.T.
	A pine 14 ins. diam. bears N 4° W. 52 Lks dist marked 152 M. P.F.R. 1894. B.T.
	A balsam 20 ins diam. bears S 13° E. 25 Lks dist marked 152 M. P.L. 1894. B.T.

Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains | A balsam 18 ins diam. bears S54°W. 85 lks dist. marked
152 M. PL. 1894. RT.
Barometer indicates 7700 ft
Land, mountainous
Soil, rocky, 4th rate.
Timber, dead pine

153rd Mile
N89.55W on secant to parallel
Va 18°20'E

Descend through living timber
14.00 Ascend
10.00 Descend through burnt timber
15.00 Ascend
24.00 Descend
35.00 Ascend to
40.00 Offset 1.12 ft. South and set a pine post 6 ins square, 6 ft long, with granite boulder 5 ins. diam. marked with a cross (+) 12½ ft in the ground, for 152½ Mile Corner, marked 152½ M. on E. & W. faces and PL on S. faces, from which
A pine 10 ins. diam. bears S53°W. 103 lks dist. marked
152½ M. PL. 1894. RT.
No other tree within limits and raised a mound of stone 2½ ft high, 5 ft base, east of corner.
A small butternut bears North, 10 lks dist
Barometer indicates 7400 ft.
Ascend rapidly
43.50 Foot of pine root 40 ft high.
44.00 Top of same
52.70 Corner marked 152 M + 53.31 Chs. Stands 1 ft South
Descend through live timber
70.00 Leave live, and enter dead timber. Descend to 80.00 Chs. The difference in chaining is 41 lks.
At middle point of difference
80.00 Offset 1.93 ft South and set a pine post 6 ins square, 6 ft long, with granite boulder 5 ins. diam. marked with a cross (+) 12½ ft in the ground, for 153rd Mile Corner, marked 153 M. on E. & W. and PL on S. faces, from which
A fir 30 ins. diam. bears N78°W. 198 lks, marked

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Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains

153 M. P.F.R. 1894. B.T.
A fir 10 ins. diam. bears S 26° W. 112 lks. dist. marked
153 M. P.L. 1894. B.T.
A balsam 10 ins. diam. bears S 4° W. 107 lks dist. marked
153 M. P.L. 1894. B.T.
No other tree within limits, dug 2 pits 36×36×12 ins.
N & S. of post, 4 ft. dist. and raised a mound of earth 2½ ft high, 5 ft base, east of corner.
Barometer indicates 7150 ft.
Land, sloping West.
Soil. Sandy loam. 2nd rate
Timber, pine

154th Mile
N 89° 59' W. on Descent to parallel
Va 18° 17' E
Descend over rolling ground, through dead timber to

40.00 Offset 2.41 ft South, and set a pine post 8 ins. square, 6 ft. long, with granite boulder 5 ins. diam. marked with a cross (×) 2½ ft in the ground, for 153½ Mile Corner, marked 153½ M. on E. P.F.R. on N. and P.L. on S. faces, from which
A pine 10 ins. diam. bears S 76° E. 126 lks. dist. marked
153½ M. P.L. 1894. B.T.
No other tree within limits, dug 2 pits 36×36×12 ins
N & S. of post, 4 ft. dist. and raised a mound of earth 2½ ft high, 5 ft. base east of corner.
Barometer indicates 6900 ft.
Descend rapidly 100 ft. to

43.60 Brook, 4 lks wide, course N. stream along foot foot of N. slope through dead and fallen timber to 80.00 Chs. The difference in chaining is 2 lks.
At middle point of difference

80.00 Offset 2.57 ft South and set a pine post 8 ins square, 7 ft long, with granite boulder 5 ins. diam. marked with a cross (×) 2½ ft in the ground, for 154th Mile Corner, marked 154 M. on E. P.F.R. on N. and P.L. on S. faces, and raised a mound of stone 2½ ft high, 5 ft base, east of corner.

2

Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains Barometer indicates 6900 ft.
Land. Rolling.
Soil. Sandy loam. 2d Rate
Timber. dead pine.

September 11th 1894

I tested my chains on the Standard and found them correct. The night of September 11th 1894 was too cloudy to observe Polaris.

155th Mile
West, on Secant to parallel.
Va 18° 19' E.

Descend gradually to
7.68 Brook, 6 lks wide, Ascend through dense small pines.
16.00 Descend
140.00 Offset 2.44 ft South and set a charred pine post 8 ins square, 7 ft long, with granite boulder 5 ins diam, marked with a cross (x) 2½ ft in the ground for 154½ Mile Corner, marked 154½ M. on E. P.F.R. on N. and P.L. on S. faces, dug 2 pits 36 x 36 x 12 ins. N. & S. of post. 4 ft dist. and raised a mound of earth 2½ ft high, 5 ft base, east of corner.
Barometer indicates 6850 ft.
68.00 Leave small pine and enter dead timber.
77.00 Leave dead timber, descending to 80.00 chs. The difference in chaining is 4 lks. At middle point of difference
80.00 Offset 1.83 ft South and set a granite boulder 32 x 12 x 8 ins. with granite stone 5 ins. diam, marked with a cross (x) 20 ins in the ground, for 155th Mile Corner, marked 155 M. on E. P.F.R. on N. and P.L. on S. faces. and raised a mound of stone 2½ ft high, 5 ft. base, east of corner.
Barometer indicates 6750 ft.
Land. rolling
Soil. Sandy loam, 2d Rate
Timber, dead pine and dense small pines

Supplemental notes of survey of South bdy. Public Forest Reservation

Chains

156th Mile
S89°.59'W on secant to parallel
Va 18°.17' E

Ascend through small aspen and pine, to
20.00 Top of divide, Course N E & S W.
Barometer indicates 6800 ft.
Descend through scattering timber.
26.00 Enter very dense growth of small pine.
40.00 Offset 1.12 ft. north and set a pine post 6 ins. square, 6 ft long, with granite boulder 5 ins. diam. marked with a cross (x) 2½ ft. in the ground. for 155½ Mile Cor. marked 155½ M. on E. P.F.R. on N. and P.L. on S. faces, dug 2 pits 36 + 36 + 12 ins. N & S. of post, 4 ft dist, and raised a mound of earth, 2½ ft high, 5 ft base, E. of Cor.
Barometer indicates 6650 ft
Thence descend along N. slope, through dense pine to 80.00 ch. The difference in chaining is 3 lks.
At middle point of difference
80.00 Offset 0.0 ft and set a pine post 8 ins square, 6 ft long, with granite boulder 5 ins. diam. marked with a cross (x) 2½ ft in the ground for 156th Mile Cor. marked 156 M. on E. P.F.R. on N. and P.L. on S. faces, dug 2 pits 36 + 36 + 12 ins. N & S. of post, 4 ft dist. and raised a mound of earth 2½ ft high. 5 ft base, east of Cor.
Barometer indicates 6400 ft.
Land, rolling
Soil, sandy loam, 2d rate.
Timber, dense small pine and scattering timber

157th Mile
S89°.58'W. on secant to parallel.
Va 18°.20' E

Descend along N. slope, through small pine
22.00 Leave small pine and enter timber, Descend rapidly to
28.50 Creek, 6 lks. wide, Course W.
Barometer indicates 6200 ft.
Ascend rapidly, through timber, slope east.
40.00 Offset 1.45 ft. north and set a pine post 8 ins.

Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains Square. 6 ft long. with granite boulder, 5 ins. diam. marked with a cross (x) 1½ ft in the ground, for 156½ Mile Cor. marked 156½ M. on E. PFR on N. and PL on S. faces. from which
A pine 8 ins. diam. bears N 18° E. 16 lks. dist. marked 156½ M. PFR. 1894. DJ.
A pine 10 ins. diam. bears S 74 E. 53 lks. dist. marked 156½ M. PL. 1894. DJ.
dug 2 pits 36 × 36 × 12 ins. N & S. of post. 4 ft dist. and raised a mound of earth 2½ ft high. 5 ft base, east of corner.
Thence ascend, through timber, to 80.00 chs
The difference in chaining is 7 lks. At middle point of difference
80.00 Offset 3.22 ft. north and set a pine post 8 ins diam. 7 ft long, with granite boulder 5 ins diam. marked with a cross (x) 1½ ft in the ground, for 157th Mile Cor. marked 157 M. on E. PFR on N. and PL on S. faces. from which
A pine 10 ins. diam. bears N 81° E. 38 lks. dist. marked 157 M. PL. 1894. DJ.
A pine 8 ins. diam. bears S 67 W. 36 lks. dist. marked 157 M. PL. 1894. DJ.
No other tree within limits, dug 2 pits 36 × 36 × 12 ins. N & S. of post, 4 ft dist. and raised a mound of earth 2½ ft high, 5 ft base, east of Cor.
Barometer indicates 6700 ft
Land. Rolling
Soil. Sandy loam. 1st Rate.
Timber. pine.

September 12th 1894

I tested my chains on the standard and found them correct.
Owing to unfavorable weather I could not observe Polaris on the evening of September 12th 1894
From the end of last record I therefore deflect 0.05.01" to the north, by laying off 5.8 ins South from last record, at a distance of 5.00 chs. from instrument point 3.22 ft. South of 157th Mile Corner, reversing my telescope and run

Supplemental notes of Survey of South bdy. Public Forest Reservation.

Chains	
	158th Mile
	N 89° 57' 30" W on recent to parallel
	Va 18° 17' E
	Over rolling ground, through timber.
40.00	Offset 1.45 ft north and set a pine post 8 ins square, 7 ft long, with granite boulder 5 ins diam. marked with a cross (x) 2½ ft. in the ground, for 157½ Mile Cor. marked 157½ M. on E. PFR. on N. and PL. on S. faces. From which
	A pine 16 ins diam. bears N 48° E. 53 lks. dist. marked 157½ M. PFR. 1894. BT.
	A pine 14 ins. diam. bears S 54° E. 6 lks dist. marked 157½ M. PL. 1894. BT.
	dug 2 pits 36+36+12 ins. N & S of post 4 ft dist. and raised a mound of earth, 2½ ft high, 5 ft base, east of Corner.
	Barometer indicates 6700 ft.
	Thence descend, through timber, to 80.00 Ch. The difference in chaining is 3 lks. At middle point of difference
80.00	Offset 0.0 ft and set a sandstone 34 x 10 x 6 ins with sandstone 5 ins. diam. marked with a cross (x) 20 ins in the ground, for 158th Mile Corner marked 158 M on E. PFR. on N. and PL. on S. faces. Old Cor. destroyed and set a stone as more permanent. From stone Cor.
	A pine 12 ins. diam. bears N 16° E. 21 lks. dist. marked 158 M. PFR 1894. BT.
	A pine 10 ins. diam. bears N 47° E. 23 lks dist. marked 158 M. PFR 1894. BT.
	A pine 10 ins. diam. bears S 81° E. 40 lks dist. marked 158 M. PL. 1894. BT.
	A pine 12 ins diam bears S 7° W. 47 lks dist. marked 158 M. PL. 1894. BT.
	dug 2 pits 36+36+12 ins. N & S of stone, 4 ft dist. and raised a mound of earth, 2½ ft high, 5 ft base, east of Corner.
	Barometer indicates 6500 ft
	Land. rolling.
	Soil, sandy loam, 2nd Rate
	Timber, pine.

Supplemental notes of Survey of South bdy. Public Forest Reservation

Chains

159th Mile

Bg. 58 W. on descent to parallel
Ia 18' 21 E.

Descend to

3.30 A dog run, course S.E. Ascend to 11.60 Ch at which point I intersect the boundary line bet. Wyoming and Idaho, at 21.67 Ch north of the 28th Mile Cor. which is a pine post One Square, 5 ft above ground, marked 34 N.L. on N. 28 M. Wyoming on E. Idaho on W. No other marks noticeable.

11.60 Offset 0.36 ft South and establish the S.W. Corner of Public Forest Reservation as follows, having first destroyed the Cor. established by me at 158 M + 43 Ch. Set a Sandstone 30 x 12 x 10 ins. with Sandstone 5 ins. diam. marked with a Cross (x) 20 ins. in the ground, for S.W. Cor. Public Forest Reservation, marked S.W. Cor. P.F.R. 1894, on N. C.C. 158 M + 11.60 Ch. on E. Lat. 44° N. on S. and Idaho on W. faces, dug 3 pits 40 x 30 x 24 ins. N. S. & E. and raised a mound of earth in the form of the frustrum of a Square Pyramid, 4 ft high, 6 ft base, edge of pits 1 ft from base of mound, which have its sides facing N. S. E. & W. In the N. side of mound placed a Sandstone 24 x 14 x 6 ins. marked S.W. Cor. P.F.R. 1894.

In E. side Set a Sandstone 20 x 16 x 6 ins. marked C.C. 158 M + 11.60 Ch.

In S. side Set a Sandstone 16 x 8 x 4 ins. marked Lat. 44° N. and in W. side Set a Sandstone 20 x 14 x 3 ins. marked Idaho. From which

A pine 10 ins diam. bears N. 67° E. 13 links dist. marked S.W. Cor. P.F.R. 1894. B.T.

A pine 10 ins diam. bears S. 33° E. 113 lks dist. marked S.W. Cor. P.F.R. 1894. Wyo. B.L. B.T.

There are no trees west

September 12th 1894.

Supplemental notes of Survey of East & North bds. Public Forest Reservation and East bdy Yellowstone National Park 26

Chains

I was return to the Special Corner on the East boundary Public Forest Reservation at 6.00 M + 28 lks, arriving on September 18th 1894 and take up the East boundary Public Forest Reservation, retracing same in the reverse direction from that in which it was run last year, blazing and clearing line wherever possible to take my party. I carefully examine the line to see if it is possible to set more of the regular mile and half mile corners, and in no instance am I able to set more of said corners, owing to the rugged and inaccessible character of the country. I find all the corners described in my principal field notes to be in good order until I arrive at the 5th Mile Corner on E. boundary Yellowstone National Park

On September 21st 1894 I re-establish Seric 5th Mile Cor. as follows

Set a pine post 8 ins square, 5 ft long, with granite boulder 5 ins. diam. marked with a cross (x) 2½ ft in the ground, at exact point where original Cor. stood, marked 5 M. on N. & W. and S.L. on E. face, from which

A pine 14 ins. diam. bears S 53° W 38 lks, dist. marked 5 M. & M.P. 1893 B.T.

A pine 14 ins diam. bears N 46° W. 36 lks, dist. marked 5 M & M.P. 1893. B.T.

A pine 12 ins. diam. bears N 15° E. 32 lks dist. marked 5 M S.L. 1893. B.T.

A pine 20 ins diam bears S 84° E. 10 lks dist. marked 5 M. S.L. 1893. B.T.

5th Mile

North, on a true line

Var 18° 30' E

Through timber

110.00 The 11½ Mile Cor. which I find well established, as described in my principal field notes.

119.50 Gulch, 110 ft deep. Course S.E. Leave timber and ascend rapidly.

Supplementary Notes of Survey of East bdy. Yellowstone National Park.

80.00 Set a granite boulder 30×16×12 in. with granite stone 5 in. deep marked with a cross (×) 20 in. in the ground, for 4th Mile Corner, marked 4 M. on N. & W.P. on W. and P.L. on E. faces, and raised a mound of stone 2½ ft high, 5 ft base, north of corner.

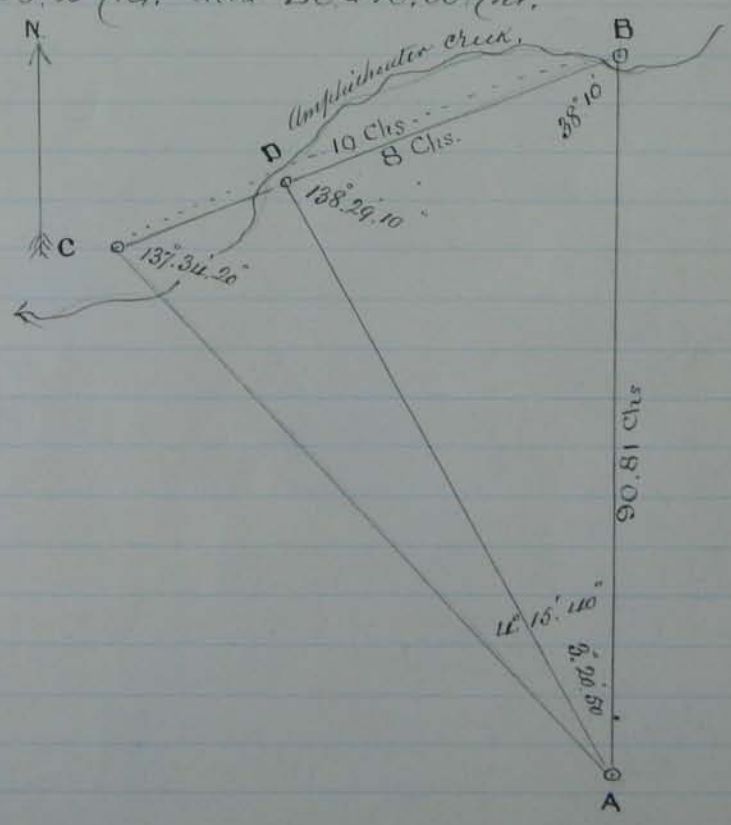
Barometer indicates 7900 ft.

It is impossible to follow the line further north, as it runs up against perpendicular mountain.

I then go around, on top of mountain, to a point at 3 M. 68+41 Chs. From here it is impossible to chain further north and I therefore send flagman and chainmen north, down to Amphitheater Creek. I set flag on line, by double back and fore sights, using point at 0+65.57 Chs. for a backsight. My chainmen select two triangulation points to the west (see following figure) from which to make triangulation.

With instrument at Sta A I measure the angles as follow, subsequently carefully measuring the base lines BD and BC and finding BD = 8.00 Chs. and BC = 10.00 Chs.

2 M+57.60 Chs



3 M. 68.41 Chs

Supplemental Notes of Survey of East bdy. Yellowstone National Park.

Instrument at Sta. A, at 3M.+68.41 Ch.
Vernier at zero.
Set on Sta. B.
Unclamp plates and set on Sta. C.
Vernier reads 4°. 15'. 30" +
Unclamp below and set on Sta B
Unclamp plates and set on Sta C
Vernier reads 8°. 31'. 0
Unclamp below and set on Sta B.
Unclamp plates and set on Sta C.
Vernier reads 12°. 47'. 0"
Angle BAC, mean value 4°. 15'. 40"

Vernier at zero.
Set on Sta. B.
Unclamp plates and set on Sta D
Vernier reads 3°. 21'. 0" –
Unclamp below and set on Sta. B.
Unclamp plates and set on Sta D
Vernier reads 6°. 41'. 30"
Unclamp below and set on Sta B
Unclamp plates and set on Sta D
Vernier reads 10°. 02'. 20" –
Angle BAD, mean value 3°. 26'. 50"

I then go to Sta B and find that points B, D & C are in the same straight line and that the base lines, 8.00 Ch and 10.00 Ch are correct.
Instrument at Sta. B, Vernier at zero.
Set on Sta. A.
Unclamp plates and set on Sta. C & D.
Vernier reads 38°. 10'. 0"
Unclamp below and set on Sta. A.
Unclamp plates and set on Sta. C.
Vernier reads 76°. 20'. 0"
Angle ABC, mean value, 38°. 10'. 0"

Instrument at Sta. D, Vernier at zero.
Set on Sta. B.
Unclamp plates and set on Sta. A.
Vernier reads 139°. 29'. 0" +

Supplementary Notes of Survey of East. bdy. Yellowstone National Park

Unclamp below and set on Sta B.
Unclamp plates and set on Sta A.
Vernier reads. 276°. 58'. 0" +
Unclamp below and set on Sta B.
Unclamp plates and set on Sta A.
Vernier reads 415°. 27'. 30"
Angle BDA, mean value 138°. 29'. 10"

Instrument at Sta. C, Vernier at zero
Set on Sta B.
Unclamp plates and set on Sta. A.
Vernier reads 137°. 34'. 30" –
Unclamp below and set on Sta B.
Unclamp plates and set on Sta. A.
Vernier reads 278°. 8'. 30" +
Unclamp below and set on Sta. B.
Unclamp plates and set on Sta A
Vernier reads 412°. 43' 0"
Angle BCA, mean value 137°. 34'. 20"

Summary of Angles.

Triangle ABC.		Triangle ABD.	
Angle ABC	38°. 10'. 0	Angle ABD.	38°. 10'. 0"
Angle BAC.	4° 15' 40"	Angle BAD.	3°. 20'. 50"
Angle BCA	137°. 34'. 20"	Angle BDA.	138°. 29'. 10"
	180°. 0' 0"		180°. 0' 0"

Solving Triangle ABC, for AB = x.
10.00 : Sin. 4°. 15'. 40" :: x : 137°. 34'. 20".

Log. 10.00	1.000000
Log Sin 137°. 34'. 20"	9.829085
	10.829085
Log. Sin 4°. 15'. 40"	8.870999
	1.958086 = log AB. or 90.80 ft.

Solving Triangle ABD for AB = x.
8.00 : Sin 3°. 20'. 50" :: x : Sin. 138°. 29'. 10"

Log. 8.00	0.903090
Log. Sin. 138°. 29'. 10"	9.821384
	10.724474
Log Sin 3°. 20'. 50"	8.766315
	1.958159 = log AB. or 90.82 ft.

Supplemental Notes of Survey of
East bdy. Yellowstone National Park

The mean of the two determinations, for A B, is 90.81 Chs.

September 21st 1894

Station A is 3 M + 68.44 Chs. less 1 M + 10.80 Chs distance from A to B gives –
2 M + 57.60 Chs for Sta. B. At which point I set a granite boulder 30 + 12 + 8 ins with granite boulder 5 ins. diam. marked with a Cross (+) 20 ins in the ground, for Special Corner, marked 2 M + 57.60 Chs. on N. YNP. on W. PL. on E. and TP. on S. faces and raised a mound of stone 2½ ft high, 5 ft base, North of Corner.
Thence I run –

On 3rd Mile
North, on Meridian
Va. 19° E

4.00 Enter timber and ascend.
17.60 Set a pine post 6 ins Square, 6 ft long, with granite boulder, 5 ins. diam, marked with a Cross (+) 2½ ft in the ground, for 2½ Mile Corner, marked 2½ M. on N. YNP. on W. and PL. on east faces., from which
A pine 20 ins. diam. bears N 74° E. 13 lks dist. marked 2½ M. PL. 1894. BT.
A pine 22 ins. diam. bears S 39° W. 41 lks dist. marked 2½ M. YNP. 1894. BT.
Barometer indicates 9100 ft
Ascend through timber to
31.00 Foot of Abiathar mountain, Impossible to chain further, so I return to the Special Corner at 2 M + 57.60 Chs, and run

Remainder of 3rd Mile
South, on Meridian
Va 19° E.

0.30 Amphitheater Creek, 30 lks wide, Course SW.

Supplemental Notes of Survey of East bdy. Yellowstone National Park

Ch.	
6.10	Brook, 8 lks wide, Course SW.
22.40	A pine tree, 8 ins diam, on line, Cut off to 5 ft. high, and square to 6 ins. for 3rd Mile Corner, marked 3 M. on N. YNP. on W. and PL. on east faces, from which
	A pine 10 ins diam. bears N 31° E. 9 lks dist. marked 3 M. PL. 1894. BT.
	A pine 10 ins. diam. bears S 40° E. 24 lks dist. marked 3 M. PL. 1894. BT.
	A pine 10 ins diam. bears N 74° W. 26 lks dist. marked 3 M. YNP. 1894. BT.
	A pine 8 ins. diam, bears S 24° W. 44 lks dist. marked 3 M. YNP. 1894. BT.
	Barometer indicates 9100 ft.
	Sand, Rolling.
	Soil, Rocky, 4th Rate,
	Timber, pine.

4th Mile.

South, on Meridian.

Var. 18° 50' E.

	Ascend rapidly, through timber.
28.00	Leave timber.
29.00	Foot of perpendicular mountain. Impossible to chain further
	Barometer indicates 9.900 ft.

September 22d 1894

I test my chains on the Standard, and find them correct.

I go around and on to the North side of Abiather mountain, and on the morning of September 23d 1894. I proceed to the 1/2 Mile Corner, which I find in good condition, and run

On 1st Mile

South, on Meridian

Var. 18° 50' E.

	Descend rapidly, 200 ft. to
11.30	Creek, 10 lks wide, Course NW. Ascend rapidly through timber, to 110.00 Ch. The difference in chaining is 4 lks. At middle

Supplemental notes of Survey of East bdy. Yellowstone National Park.

Chains	Point of difference
40.00	Set a balsam post 6 ins Square, 6 ft long, with granite boulder 5 ins diam. marked with a cross (x) 2½ ft. in the ground for 1st Mile Corner, marked 1M on N. YNP. on W. and PL. on E. faces
	From which
	A pine 10 ins. diam. bears S38°E. 35 lks dist. marked 1M. PL. 1894. BT.
	A pine 12 ins. diam. bears N84°E. 27 lks dist. marked 1M. PL. 1894. BT.
	A balsam 8 ins. diam. bears N81°W. 13 lks dist. marked 1M. YNP. 1894. BT.
	A pine 12 ins. diam. bears S3°W. 27 lks dist. marked 1M. YNP. 1894. BT.
	Barometer indicates 9300 ft.
	Land, mountainous.
	Soil, rocky. 4th Rate.
	Timber, pine

1st Mile
South, on Meridian
Va 19° E

A band rapidly.

5.50	Foot of perpendicular Rim. 60 ft high. Can find no way of getting over it, so I am compelled to stop.
	September 23rd 1894

Signed Philip M Gallaher
U.S. Dept. Surveyor

List of Names.

A list of the names of the individuals employed by Philip M Galluher, U. S. Deputy Surveyor, to assist in running, measuring, and marking the lines and corners described in the foregoing field notes of the ~~survey of the~~ improvement in the evidences of survey of the East Boundary of the Yellowstone National Park and the North, East and South Boundaries of the Public Forest Reservation, in Wyoming

~~Meridian, in~~, showing the respective capacities in which they acted:

Nove E Brown, Frank Legg, Alonzo J Legg, John L Dosh, William H Edick

Final Oath of Assistants:

We hereby certify that we assisted Philip M Galluher, U. S. Deputy Surveyor, in surveying all those parts or portions of the East Boundary of the Yellowstone National Park, and the North, East and South Boundaries of the Public Forest Reservation in Wyoming

~~Meridian~~, as are represented in the foregoing field notes as having been surveyed by him and under his direction; and that said survey has been in all respects, to the best of our knowledge and belief, well and faithfully surveyed, and the corner monuments established, according to the instructions furnished by the U. S. Surveyor General for Montana

Nove E Brown	Chainman
Frank Legg	"
Alonzo J Legg	"
John L Dosh	"
William H Edick	Axeman

Subscribed and sworn to before me this 6th day of November, 1894

SEAL

H P Hart
U S Commissioner

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Final Oath of U. S. Deputy Surveyor.

I, Philip M. Gallaher, U. S. Deputy Surveyor, do solemnly swear that, in pursuance of instructions received from John S. M. Neill, U. S. Surveyor General for Montana, bearing date of the 16th day of August, 1894, I have well, faithfully, and truly, in my own proper person, and in strict conformity with the instructions furnished by the U. S. Surveyor General for Montana, the surveying manual, and the laws of the United States, ~~surveyed all those parts or portions of~~ Improved the widening of Survey of the East Boundary of the Yellowstone National Park, and the North, East and South Boundaries of the Public Forest Reservation in Wyoming ~~Meridian, in the~~, as are represented in the foregoing field notes as having been surveyed by me, and under my directions; and I do further solemnly swear that all the corners of said survey have been established and perpetuated in strict accordance with the surveying manual, printed instructions, the special written instructions of the U. S. Surveyor General for Montana and in the specific manner described in the field notes, and that the foregoing are the true field notes of such survey; and should any fraud be detected, I will suffer the penalty of perjury under the provisions of an Act of Congress approved August 8, 1846.

Philip M. Gallaher
U. S. Deputy Surveyor.

Subscribed and sworn to before me this 6th day of November, 1894

SEAL

U. S. Hart
U. S. Commissioner

U. S. Hart
Seal
U. S. Commissioner
Philipsburg Mont.

Approval.

Office of the U. S. Surveyor General,

Helena, Montana, Oct. 4, 1895.

The foregoing ~~field notes of the survey of~~ supplemental field notes of the survey of the East boundary of the Yellowstone National Park, and of the North, East, and South boundaries of the Public Forest Reservation in Wyoming.

executed by Philip M. Gallaher U. S. Deputy Surveyor under his Contract No. 263, dated October 17, 1891, having been critically examined, the necessary corrections and explanations made, the said field notes, and the surveys they describe, are hereby approved.

Jno. S. M. Neill
U. S. Surveyor General.

I certify that the foregoing transcript of the field notes of the above-described surveys ~~in~~ of Public Forest Res. in Wyo., ~~has been~~ is a correctly copied from the original notes on file in this office.

Jno. S. M. Neill
U. S. Surveyor General.

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