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THESIS
FOR THE DEGREE
OF
ENGINEER OF MINES

E.R.WASH
T 244

"SURVEYING PRACTICE"

June 1910

Field Notes of the Survey of
Ramsey Canyon Pipe Line
and
Reservoir Sites
of the
----- Cattle Company,
Huachuca Mountains,
Cochise County, Arizona,
By
E.R. Wash.
Surveyed Oct. 15 - Nov. 3, 1910.

Survey executed with a Young & Sons Mountain Transit (6855)
provided with a Smith Solar Attachment.

The horizontal circle reads to single minutes of arc.

The courses were deflected from true meridian as determined by
direct solar observations.

The distances were measured with 100ft. and 500ft. steel tapes.

Purpose of Survey: To Obtain the Benefits of the Act of
Feb. 15, 1901 (30 Stat. 790) entitled, "An Act Relating to Rights of Way
through certain Parks, Reservations and other Public Lands".

Beginning at initial point, a cross(x) and I.P. chiseled on a limestone outcrop above a large cut from which issues a spring of water: this is station 1.

Whence:

- 1) The approximate center of the spring bears N.7°21'W.20.6ft.
- 2) The $\frac{1}{4}$ Cor. between secs.9-10,5wp.23S.,R.20 E.,bears N.88°09'E.,1120.3 ft.

Ft.		Thence N.21°13'W
147.2	To Sta. No.2	" N.21° 12' W
13.5	" " " 3	" N.68°47' E.
49.3	" " " 4	" N.81°52'E.
79.4	" " " 5	" N 7 x °50'E.
166.2	" " " 6	" N.74°57' E.
124.9	" " " 7	" N.78°37'E.
131.7	" " " 8	" N.78°04'E.
229.7	" " " 9	" N.63°54'E.
161.3	" " " 10	" N.66°36'E.
114.2	" " " 11	" N.65°46'E.
71.4	" " " 12	" N.55°03'E.
127.5	Intersect line between Secs. 9-10,Twp.23S.,R.20E. at North 515.5 ft. from $\frac{1}{4}$ Cor.	
139.3	To Sta. No.13.	Thence N.35°50'E.
90.4	" " " 14.	" N.31°21'E.
38.3	" " " 15.	" N.41°58'E.
99.8	" " " 16.	" N.43°27'E.
177.1	" " " 17.	" N.43°15E.
176.7	" " " 18.	" N.41°14'E.
132.3	" " " 19	" N. 45°23'E.

Ft.

81.9	To Sta.No.20	Thence	N.36°52'E.
167.6	" " " 21	"	N.37°37'E.
52.2	" " " 22	"	N.61°19'E.
55.0	" " " 23	"	N.68°45' E.
118.5	" " " 24	"	N. 61°51'E.
96.9	" " " 25	"	N.53°33'E.
114.3	" " " 26		
	Whence a tap to pipes bears		N.54°30'E.-91.6ft.

		Thence	N.54°59'E.
147.2	To Sta.No. 27	"	N.60°03E.
116.6	" " " 28	"	N.41°26'E.
216.2	" " " 29	"	N.49°26'E.
214.7	" " " 30	"	N.47°36' E.
253.7	" " " 31	"	N.40°55'E.
174.0	" " " 32	Whence	

Meter and branch running to house bears N.38°30'E.56.2 ft.

		Thence	N.38°00' E.
118.2	To Sta. No. 33	"	N.38°38'E.
79.8	" " " 34	"	N.50°20'E.
233.6	" " " 35	"	N.52°01'E.
123.5	Intersect line between Secs. 3-10 at S89°59'W.-455.9 ft. from $\frac{1}{4}$ Cor.		
240.7	To Sta. No. 36.	Thence	N.49°09'E.
220.4	" " " 37.	"	N.62°44'E.
194.3	" " " 38.	"	N.60°09'E.
229.5	" " " 39.	"	N.56°40'E.
230.0	" " " 40.	"	N.31°56'E.
160.7	" " " 41.	"	N.53°41'E.
301.3	" " " 42.	"	N.54°09'E.
352.0	" " " 43.	"	N.22°56'E.
320.6	" " " 44.	"	N.28°44'E.

Ft.

354.9	To Sta. No.45	Thence	N.28°19'E.
255.0	" " " 46	"	N.25°49'E.
145.6	" " " 47.	"	N.25°37'E.
518.3	" " " 48.	"	N.26°34'E.
107.3	" " " 49	"	N.50°05'E.
177.1	" " " 50	"	N.60°42'E.
321.8	" " " 51	"	N.73°10'E.
190.1	" " " 52	"	N.86°32'E.
213.5	" " " 53.	"	S.83°41'E.

51.5 Intersect line between Secs. 2-3 ar North 0° 01' W.-300.9ft.
 from 1/2 Cor.

864.5 To Sta. No. 54 Thence S.84°08'E

2118.0 " " " 55 " S.84°20'E.

2388.3 Intersect line between Secs. 1-2 at S.0°01'E.-242.0ft. from 1/4 Cor.

2624.0 To Sta. No.56.

Whence:

1) The 1/4 Cor. between Secs. 1-2, Twp. 23S., R.20E. bears
 N.41°28'W.-354.4 ft.

2) The point of discharge at water trough brs. S.84°20'E.35.0ft.

 Reservoir Site.....

Beginning at Pipe Line Sta.No.56.

Whence;

1) The 1/4 Cor. between Secs.1-2, Twp.23S., R.20E. brs. N.41°28'W.
 354.4 ft.

2) The point of discharge from pipe cuts troughs brs. S.84°20'E.
 35.0ft.

Thence North

233.3 ft	To N.W. Corner	Thence East
466.6 ft.	" N.E. Cor.	" South
466.6 ft.	" S.E. Cor.	" West
466.6 ft.	" S.W. Cor.	" North

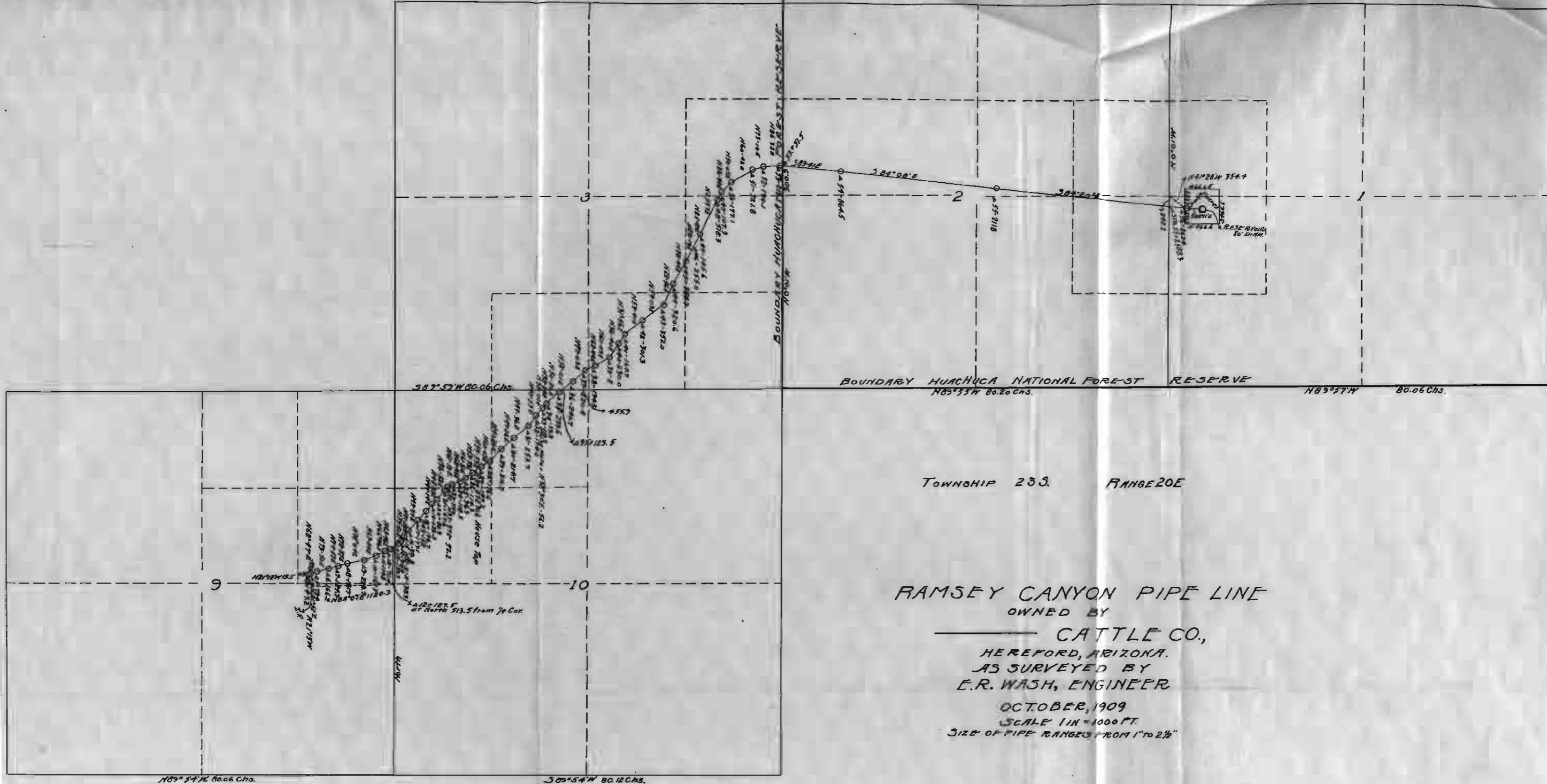
233.3 ft. To place of beginning, containing five(5) acres.

Tombstone, Ariz.

Feb., 16, 1910,

E.R.W./M.E.

North



BOUNDARY HUACHUCA NATIONAL FOREST RESERVE
 N89°53'W 80.20 Chs. N89°57'W 80.06 Chs.

TOWNSHIP 23S RANGE 20E

RAMSEY CANYON PIPE LINE

OWNED BY

CATTLE CO.,

HEREFORD, ARIZONA.

AS SURVEYED BY
 E.R. WASH, ENGINEER

OCTOBER, 1909

SCALE 1 IN = 1000 FT.

SIZE OF PIPE RANGES FROM 1" TO 2 1/2"

N89°54'W 80.06 Chs.

S89°54'W 80.12 Chs.

NOTES

ON THE

SURVEY

OF

DRAGOON TOWNSITE,

BY

E.R.WASH, Engineer,

TOMBSTONE, ARIZ.

DRAGOON TOWNSITE.

Boundary-

At the $\frac{1}{4}$ cor. between Secs. 1₀-20 Twp. 16 S.R.23E.

Thence run due north.

1320.0 Set temporary peg for the S.W. cor. of townsite.

2640.0 " " "

3960.0 " " "

5293.6 Find peg for the $\frac{1}{4}$ cor. between secs.18-19. This shows that this mile is 13.6 feet long.Go back and move the first peg set, north 3.4 ft.;the second peg 6.8 ft.,and the third,10.2 ft. north and set a permanent stone in its place,for the N.W. corner of the townsite.

Set up over this corner and ran N.89°49'E.,1320.9 ft.,this .9 ft. being the amount that each quarter of a mile is long in this east and west mile. Set a stone for the N.E. corner of the townsite.

Set up over the rock set for the S.W. cor. of the townsite and ran N.89°49'E.

1320.9 set a rock for the S.E. cor. of the townsite.

Set up over this S.E. cor. and ran due north.

2183.0 Intersect railroad on curve.

2640.8 strike rock set for the N.E. cor. of townsite.

Back to the S.W. cor. and ran North,859.6 intersect the railroad.

Location-

This locates the townsite definitely in the S.W. $\frac{1}{4}$:N.E. $\frac{1}{4}$ and N.W. $\frac{1}{4}$:S.E. $\frac{1}{4}$ Sec. 19,Twp.16 S.-R.23 E.

Operation-

Arbitrarily,the S.W. edge of the depot platform was taken as the N.E. side of Black Prince Ave. Get on line with this edge of the platform in the center of the R.R. track. Thenc at right angle to the track,measure south 46° 24'E.,200 ft. for the right of way limits,and then 70 ft. on the same course for property line on Fourth street. Set a 4"x4" peg.

Set up over this peg.

Thence at a course parallel to the R.R. track, set pegs for the block corners at their respective distances.

And set pegs for the N.E. side of Black Prince Ave.

Using this line as a base line, set the block corners for the remaining blocks on this side of the track, by setting up on the corner peg on this base line and running lines at right angles to this line, on both sides, setting pegs at their respective distances.

The intersections of the townsite boundary with the irregular lots were made mechanically in the field. For example; with the instrument at the S.W. corner of the townsite and oriented along the south south boundary of the townsite, an assistant by means of two flags, one set at the south east cor. of Block 20 and one at the N.E. cor. of Block 26, lined another assistant so he was able to drive a peg on each side of this line and by means of the transit, I set tacks in these pegs on line with the south boundary of the townsite. With this same set up, two pegs were set where each later intersection would come on this south boundary. Then by means of a string stretched between the centers of the tacks set in the pegs, by means of setting the instrument on the block and alley corners, along the south east side of Fifth Street, and at a course at right angle to this street, was able to set the intersection peg, exactly by the lines furnished by the transit and the string, stretched between the tacks in the peg. Then measured in each case the actual distance, between the last block or alley corner and the intersection peg. This similar operation was performed for all of the intersections.

With the instrument at the point set in the center of the R.R. track on line with the N.E. side of Black Prince Ave. measured N.43°36'E, 670 ft.

Thence at N.46°24'W. set a peg at 250 ft. for the ~~for~~ the S.E. cor. of Block 9.

Set up over this peg. Thence at the same course at 120 ft. set peg for the alley line and at a course parallel to the R.R. set the pegs

for the N.W. side of Third Street.

Set up at the peg at the S.W. cer. of Block 10, and set the pegs on the N.E. side of Centurion Ave. Used this as the base line on this side of the track, and from it set the corners of the remaining Blocks.

The intersections of the townsite boundary with the irregular lots were made, as stated above, in the same manner as on the other side of the track.

After all of the block corners were set, by means of stretching a long tape between the corner pegs, the lot pegs were driven at their proper distances apart, the regular lots being 25 feet wide.



LAT. 32° 01' N. LONG. 110° 02' W.
 ALT. 4620 Ft.

DRAGON
 COCHISE COUNTY ARIZONA
 SITUATE IN
 S.W. 1/4 N.E. 1/4; N.W. 1/4 S.E. 1/4 SEC. 13
 TWP. 16S. RANGE 23E.
 AS SURVEYED BY
 E. R. WASH, ENGINEER
 OCTOBER 1909.

LEGEND
 ALL REGULAR LOTS FACING RAILROAD 25' x 120'
 " OTHER " " " 25' x 155'
 " REGULAR " STREETS AND AVENUES 70' WIDE
 " ALLEYS " PARALLEL TO RAILROADS " 30' "

SCALE 1" = 100 Ft.

A PRACTICAL MINING PROBLEM,

BY

E.R.WASH,

Equations Given.

1. Tunnel course N.63°54'E.
2. Strike of foot wall of ledge N.50°30'E.
3. Dip of foot wall 53°.
4. Approximate rise of tunnel 15.61 feet.
5. Elevation of station designated as 3rd. drill is approximately 797.33 feet above station 1.
6. Elevation of point on foot wall, from which observations on the ledge were taken, is approximately 17.16 feet lower than the station designated as 3rd. drill.

Equations Sought.

Location of the foot wall of the ledge at the tunnel level, in respect to the face of the tunnel, using the crosscut just started on the course of S.30°30'E.

Solution.

Elevation of third drill above sta. 1.	797.33 ft.
" " pt. of observation below 3rd. drill	17.16 "
" " " " " above sta. 1.	780.17 "
Approximate rise of tunnel	15.61 "
Elev. of pt. observation above tunnel level	764.56 "
	Use 765.0 ft.

By solving the triangle,

$$(1) \log.765. + \log.\tan.37^\circ = \log.A.$$

$$\log.765 = 2.88366$$

$$\log.\tan.37^\circ = 9.87711$$

$$\log.A. = 12.76077$$

$$A. \text{ equals } 576.5 \text{ ft.}$$

$$(2) \log.765 - \log.\cos.37^\circ = \log.B.$$

$$\log.765 = 2.88366$$

$$\log.\cos.37^\circ = 9.90235$$

$$12.98131$$

$$\log.B. =$$

$$B \text{ equals } 957.9 \text{ ft.}$$

In the triangle ABC(found on the plan of the point of observation), we have the line BC perpendicular to the tunnel tangent and angle (b) equal to 9°52' with the relation of,

AB sin (b) = AC.	AB cos.(b) = BC.
log 382.4 = 2.58252	log.382.4 = 2.58252
log.sin (b) = 9.23390	log.cos.(b) = 9.99353
-----	-----
11.81642	12.57605
AC = 65.5 ft.	BC = 376.75 ft.

Since BC in the same figure represents a line in the foot wall projected in the same horizontal plane as the tunnel level and perpendicular to the tunnel tangent, and equals 376.75 ft. = BD-OD

and since BD = 576.5'

then CD = BD - 376.75 = 199.8 ft. ?

In the same figure, let CF be a line drawn through pt. C and parallel to the presumed strike of the foot wall.

From actual measurement AG = 348 ft. and from solution of triangle ABC, AC = 65.5 ft. Then CG = 413.5 ft.

In the triangle GCF we have the angle at C equal to 4°24'

"	"	F	"	90°
"	"	G	"	85°36'

Then by solving the equation, CG sin angle at C, equals to FG,

log.CG = 2.61648
log.sin C = 8.88490

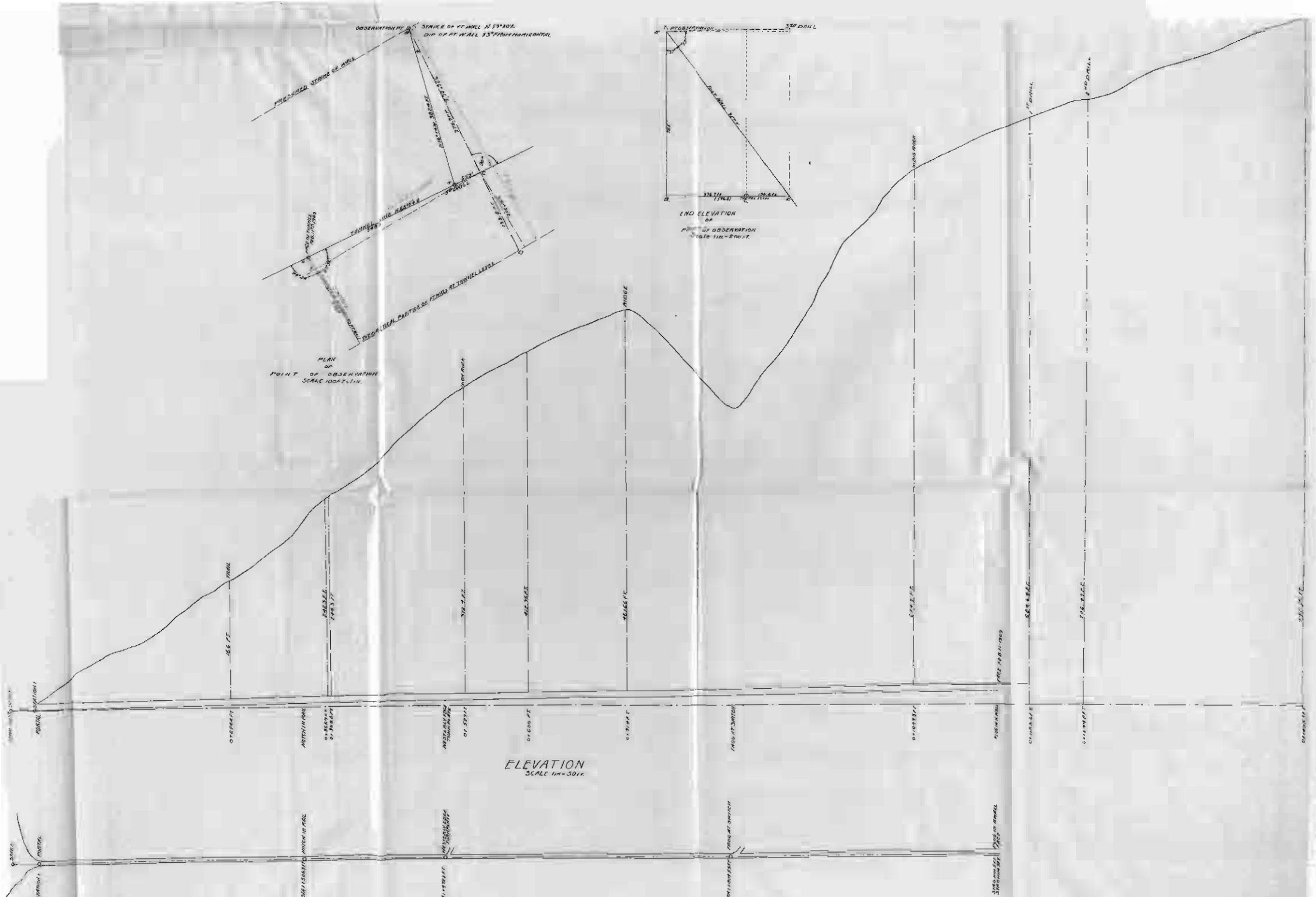
log.FG = 11.50138
FG = 31.72

In triangle CDD', we have CD' drawn parallel to GF and equal to CD cos.C = 199.2

log.199.8 + log. cos.C = 199.2
log.199.8 = 2.30060
log.cos.C = 9.99872

12.29932
GF = 199.2 ft.

And from the figure we see that the distance from point, along line GF extended, equals to $CD' + GF = 199.2 + 31.7 = 230.9$ which is the distance that the crosscut GF will have to be driven to strike the foot wall of the ledge.



ELEVATION
SCALE 1 IN = 30 FE.

PLAN OF TUNNEL NO 1 OF - COPPER CO
SCALE 1 IN = 30 FE.
A PRACTICAL MINING PROBLEM
OF
G. WASH. ENGINEER.

PRELIMINARY

SURVEY

OF THE

MINING CLAIMS

OF THE

HAZLEWOOD&YECKLEY GROUP.

OWNED BY

THE

CICERO SMITH MINING CO.

SITUATED IN THE

TEVIS MINING DISTRICT.

As surveyed by,

E.R.Wash, Engineer,

Tombstone, Ariz.

This survey was executed with a Young and Sons Mountain Transit not provided with a solar attachment, the true meridian being determined by observations on Polaris.

Selected a point on the "Joe Bowers Lode" as the center of the ledge, which was satisfactory to Mr.-----, its owner. Set a flag in the ground at this point.

Set up on a peg on the meridian established the night before, by observations on Polaris, the data of which may be found on the last page of this manuscript. With the vernier clamped at zero and the lower motion clamped on the northerly peg of the meridian, the flag just set on the lode line of the "Joe Bowers Lode" bears $N.86^{\circ}26'W.$

Set up on this peg and find the course of the "Joe Bowers Lode" to be $N.82^{\circ}08'W.$ The "Joe Bowers Lode" by reasons of its priority of date of location, holds sway over the claims of this group and for this reason, its rights have to be recognized.

Thence $S.7^{\circ}52'W.$ 300ft. Set a rock in the ground for the S.E. corner of the "Joe Bowers Lode".

Set up over this point. Thence $S.51^{\circ}20'W.$ Set a peg.

" " " " " " $S.53^{\circ}09'W.$ to peg set near the center of the workings on the "Philadelphia".

Set up over this peg which is on the ledge of the "Philadelphia Lode". Whence; 1. Face of open cut brs. $S.77^{\circ}11'W$ 19.5' (16'x3'x8 $\frac{1}{2}$ 'dp.)

2. Mouth of tunnel brs. $S.87^{\circ}30'E$ 38.7'

3. Open cut brs. $N.80^{\circ}33'E$ 102' (21'x4'x9')

Thence $S82^{\circ}08'E.$

450.9' Set a peg.

" up over this peg. Thence same course.

98.8' " peg.

280.2' " "

36.4' " peg for the East center end of the "Philadelphia".

" up over this peg. Thence $N.7^{\circ}52'E.$

224.0' " peg. Thence same course.

76.0' " rock for the N.E. cor. of the Philadelphia, and also make it

the S.E. cor. of the "Hattie Lode" (a fraction 261 ft. wide.)

Set up over rock set for the S.E. cor of the "Joe Bowers Lode" which is also now made the N.E. cor of the "Hattie" and the N.W. cor. of the "Oversight". Whence;

1. Lone tree in saddle brs. S. 4° 19' E.
2. X-B.R. brs. N. 14° 40' E., 13.4'
3. X-B.R. brs. N. 83° 23' W. 11.6'

Thence 582° 08' E.

162.0 Set peg. Thence same course.

138.0 " rock for the N.C. End "Oversight".

Thence same course

300.0' " rock for the N.E. cor. of "Oversight".

Set up at the ^{E.C. End} ~~N.E. cor.~~ of the ^{"Hattie Lode"} "Philadelphia".

Whence shaft brs. N. 71° 15' W. 190.9'

" up at the East Center End of the ^{"Hattie Fraction"} "Philadelphia"

Thence S. 7° 52' W.

238.8 " peg. Set up over this peg. Thence same course

61.2' " rock for the S.E. cor. Philadelphia.

Whence; X-B.R. brs. N. 37° 49' W. 12.5'

Thence same course (S. 7° 52' W.)

199.8' " peg. Set up over this peg. Thence same course.

100.2' " rock for the East Center End of the "Mollie Modenia"

Whence point for work brs. N. 82° 08' W. 96.9'

Thence S. 7° 52' W.

300.0 Chiseled a cross on a rock in place for the S.E. cor of the "Mollie Modenia" and the N.E. cor "Nancy Jane".

Whence; 1. Lone tree in saddle brs. S. 7° 46' E.

2. X-B.R. brs. S. 58° 51' W. 20.7'

3. X-B.R. brs. N. 10° 08' E. 28.5'

Thence same course

39.0' Set rock for the S.W. cor. "Oversight". And at

300.0' " " " " E.C.E. "Nancy Jane"

Whence point for work bears N. 82° 08' W. 402.6'

Thence S. 7° 52' W.

- 300.0' Set rock for the S.E.Cor."Nancy Jane".
Whence;lone tree in saddle brs.S.10°02'E.
2.X-B.R. brs.N.27°24'W.6.3'
3.X-B.R. brs N.73°59'E.16.3'
Set up at the S.W. cor. "Oversight"
Thence582°08'E.
- 300.0' Set rock for the S.C.End of "Oversight".
Thence same course
- 182.9' Set peg. Set up over this peg. Thence same course.
- 118.0 " rock for the S.E.cor "Oversight".
Set up over this cor.
Whence the point set for the N.E.cor."Oversight brs.
exactly,N.7°52'E.,1500 ft.
And,2.Lone tree in saddle brs. S.1°00'E.
3.X-B.R. brs.N.50°33'E.23.0'
4.X-B.R. brs.S.75°04'W.8.5'
- Back to peg set on lode line of the"Philadelphia"
Thence N.82°08'W.
- 141.2' Set peg. Thence same course
- 116.0 " " " " "
- 385.0 " rock for the W.C.End of the Philadelphia.
Whence;lone tree in saddle brs.S.8°52'E.
Thence N.7°52'E.
- 300.0 Set peg for the N.W.cor of the Philadelphia.
Whence;lone tree in saddle brs.S.17°41'E.
2.X-B.R.brs.N.59°28'W.5.0'
3. X-B.R." S.7°44'E. 22.7'
Thence N.7°52'E.
- 130.5 Set rock for the W.C.End of the Philadelphia.
Set up over this point. Thence same course
- 130.5' Set rock for the N.W.cor Hattie.
Set up at the West Center End of the Philadelphia
Thence S.7°52'E.
- 151.2' Set peg. Set up over this peg. Thence same course.
- 148.8 " rock for the S.W.cor.Philadelphia.

Set up over-~~this~~ point. Thence same course.

300.0 Set rock for W.C.End of Mollie Modenia.

Thence same course.

300.0 Set rock for the S.W.cor.of Mollie Modenia.

Thence same course.

300.0 Set rock for the W.C.End Nancy Jane.

Thence same course.

300.0 ft. Set rock for the S.W.cor Nancy Jane.

Set up at this point and ran S.82°08' E. and at 1500.0

Find stone set for the S.E. cor. Nancy Jane.

Data For "Polaris" observations.

Time of upper culmination of "polaris" Apr.15,1909-----
23hrs.49.3m.

Change for 1 day-----3.93m.

Equation to be subtracted for Apr.~~15~~²⁵; 10x3.93m.---- 39.3m.

Time of upper culmination for Apr.25,1909-----23hrs.10m.

Equation of time to be subtracted for E.Elong. 5 " 55 "

Astronomical time 17 " 15 "

12 "

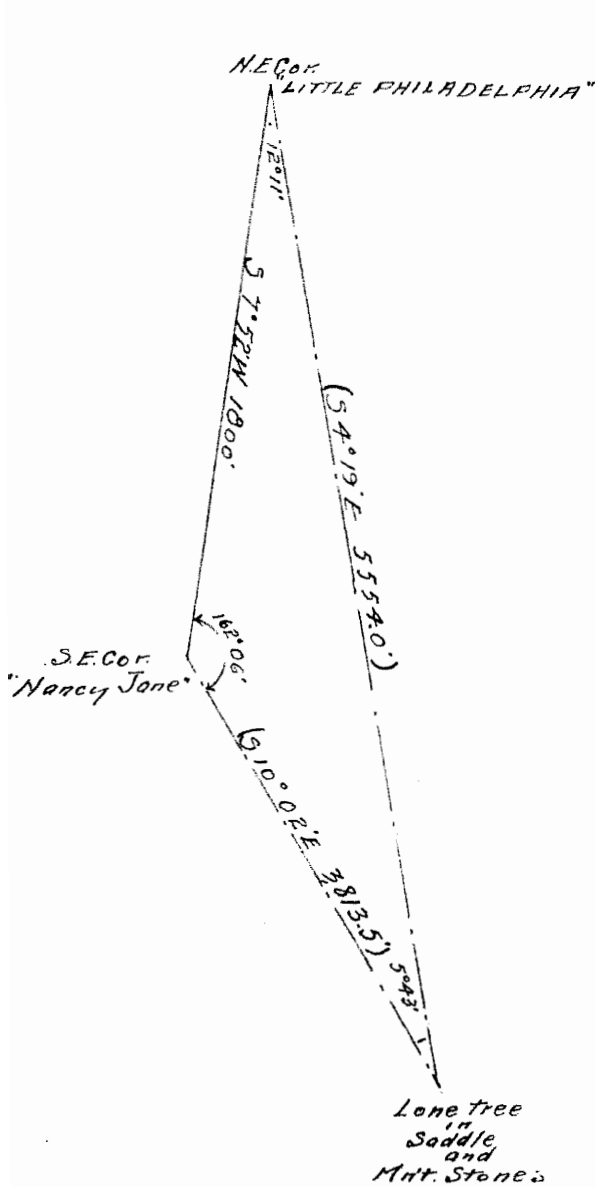
Civil time A.M. 5 " 15 "

At 4:30 a.m. on the 25th., set the instrument over a peg driven in the ground. Levelled it carefully, direct the telescope on "polaris". In the usual manner at the time of elongation, plunged the telescope and set a tack in a running board, firmly fastened to the ground. Revolved the instrument in azimuth and repeated the operation. The two points varied slightly. Took the mean distance and drove a permanent tack.

Since the azimuth of polaris at this latitude(approx.32°18'N.) is according to "U.S. Manual of Instructions for the Survey of Mineral Lands" 1°23.4'. This makes the course of this line just laid off, N.1°23'E. and from this the courses of the boundary lines on the claims were obtained.

In order to more definitely locate this group and permanently fix it, built a large monument of stones around the "lone tree" mentioned so frequently in these note and scribed it "L.T.XBR". The topography of the country would not permit a measurement to be made to this tree, so by using the Easterly end lines of the claims as shown on the accompanying map, as a base line the distance to this tree and

and monument from the N.E.cor of the Little Philadelphia and the S.E.cor of the Nancy Jane Claims was obtained by triangulation, the solution of which may be found below.



$$\frac{\sin 12^{\circ} 11'}{X} = \frac{\sin 5^{\circ} 43'}{1800}$$

$$X = \frac{1800 \sin 12^{\circ} 11'}{\sin 5^{\circ} 43'}$$

$$\log .1800 \quad 3.25527$$

$$\log .\sin 12^{\circ} 11' \quad \frac{9.32437}{12.57964}$$

$$\log .\sin 5^{\circ} 43' \quad \frac{(8.99830)}{3.58134}$$

$$X \quad 3813.5$$

$$\frac{\sin 162^{\circ} 06'}{X} = \frac{\sin 5^{\circ} 43'}{1800}$$

$$X = \frac{1800 \sin 162^{\circ} 06'}{\sin 5^{\circ} 43'}$$

$$\log .1800 \quad 3.25527$$

$$\log \sin 162^{\circ} 06' \quad \frac{9.48764}{12.74291}$$

$$\log \sin 5^{\circ} 43' \quad \frac{8.99830}{3.74461}$$

$$X \quad 5554$$

Tombstone, Arizona.
March 5, 1910.

I do hereby solemnly swear, that the work herein submitted,
was duly performed, by me, and as far as known, is accurately represented
by the maps and accompanying field notes, herein presented.

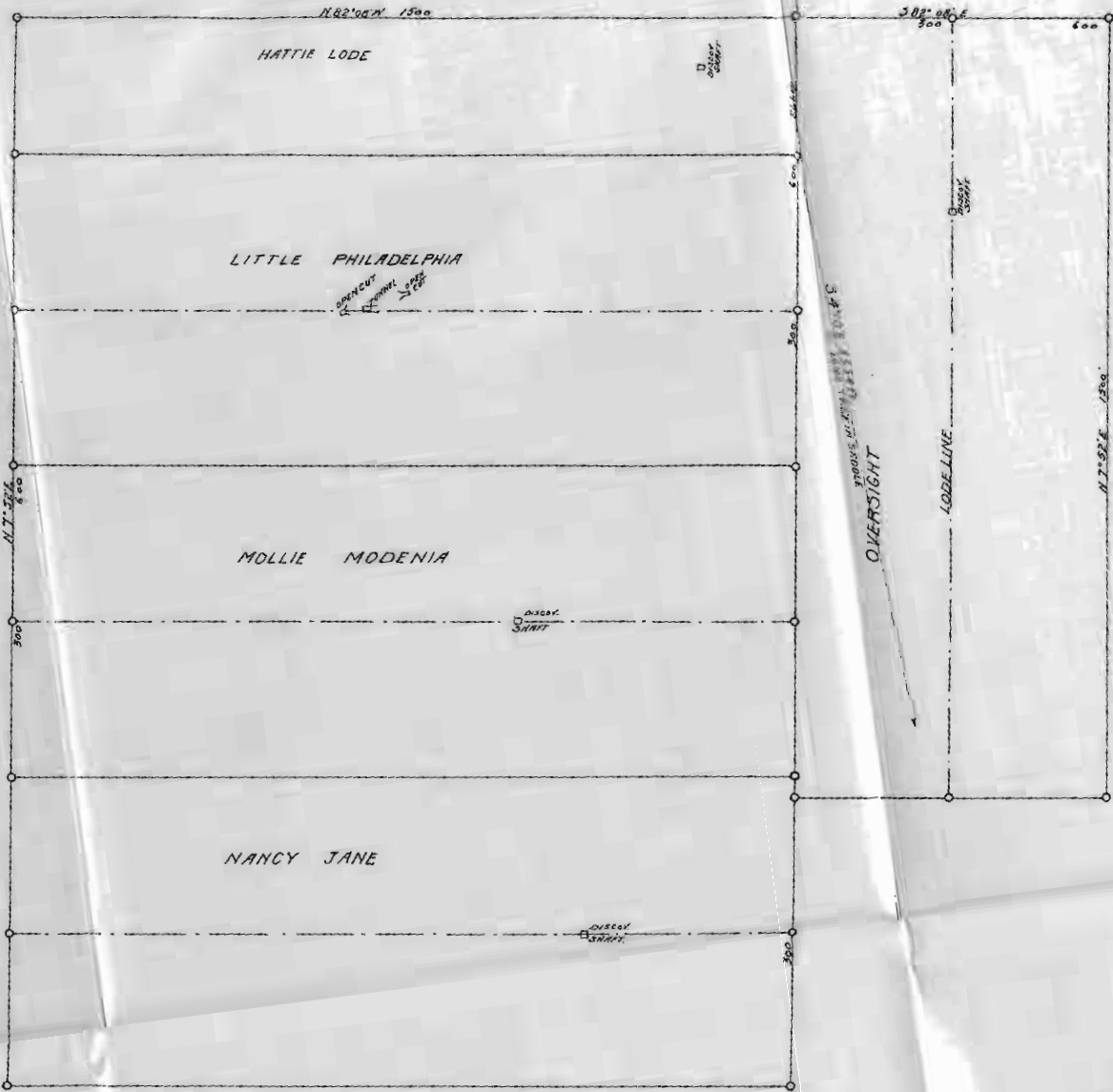
E. R. Nash.

Sworn and subscribed to before me, this 5 day of March in
the year 1910.

My commission expires Feb 14 1911

John A. Rockfellow
Notary Public
Grand in Cochise
County Arizona

JOE BOWERS LODE
(SURVEYED)



North

SCALE 1 IN = 200 FT

MINES

OF THE

HALZEWOOD-YECKLEY GROUP

OWNED BY

CICERO SMITH MINING CO.

SITUATED IN

TEVIS MINING DISTRICT

AS SURVEYED BY

**E.R. WASH, ENGINEER,
TOMBSTONE, ARIZ.**

APRIL 1909.