

MINERAL LAND SURVEYING

BY

JAMES UNDERHILL, PH. D.
MINING ENGINEER

U. S. Mineral Surveyor for Colorado

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CHAPTER IV

LOCATION SURVEYS

Lode Location

About the simplest survey that the western surveyor is called on to make is that of a lode location. It is, however, somewhat complicated by the fact that, as a rule, he is assisted in the work by the claimant himself, and thus often lacks an efficient assistant.

Usually the survey is begun at the discovery point, which may be a shaft, cut, adit, or even a point in the tunnel or other underground workings. We will begin with the survey of a straight claim as in Fig. 19. (See

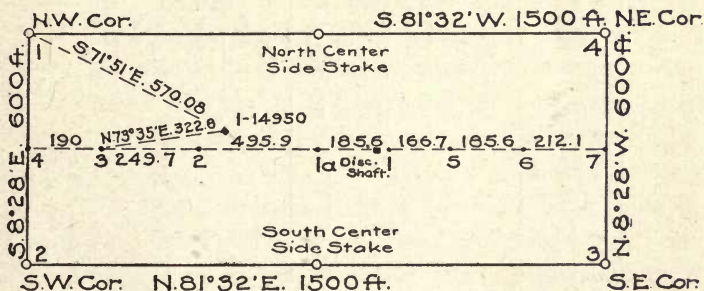


Fig. 19

also page of notebook.) The first set-up, in this particular case, is just 30 feet from the center of the discovery shaft. After the direction of the center line has been determined — and, in unimportant work, this may often be

GOOD SAMARITAN LODE, GOLD DIRT MINING DISTRICT.
Monday, May 29, 1920
RUDOLF GALE

At station	B. S. station.	Angle.		Vert. angle	Slope dist.	Hor. dist.	Mag. course.	True course.	To station.	Remarks.
		A. ver.	B. ver.							
1	...	.....	.....	2°	496.2	495.9	S. 81° W.	S. 81° 32' W.	2	No. 1 = 30 E. of dis. shaft.
2	1	.....	.....	5 30'	250.9	249.7	S. 81 30' W.	S. 81 32 W.	3	
3	2	.....	.....	0	190.0	190.0	S. 81 30 W.	S. 81 32 W.	4	
1	...	.....	.....	0	185.6	185.6	.....	S. 81 32 W.	1a	
1	...	.....	.....	3 30	167.1	166.7	N. 81 15 E.	N. 81 32 E.	5	End line. Center side stakes.
5	1	.....	.....	10	188.5	185.6	N. 81 30 E.	N. 81 32 E.	6	
6	5	.....	.....	8	214.1	212.1	N. 81 15 E.	N. 81 32 E.	7	
3	2	352° 3'	172° 3'	6 30	325.0	322.8	N. 74 E.	N. 73 35 E.	I-14950	
2°	490.0 = 489.7			5° 30'	250.0 = 248.8			495.9	1500.0	
	6.2 = 6.2				0.9 = 0.9			249.7	1287.9	
	496.2 = 495.9				250.9 = 249.7			190.0	212.1	
3° 30'	160.0 = 159.7			10°	180.0 = 177.3			166.7		
	7.1 = 7.0				8.5 = 8.3			185.6		
	167.1 = 166.7				188.5 = 185.6			1287.9		
	8°				210.0 = 208.0					
	4.1 = 4.1				214.1 = 212.1					

Dis. 16th March, 1920.

done with the magnetic needle — a measurement is made as before explained under measurements, to station No. 2. It will save the transit-man a set-up if a measurement is taken at the same time to No. 5. In a rough country, however, this will give the chainman more work. From station No. 2 the line is extended through No. 3 to No. 4, at which point the claimant desires to end his claim. A right angle is therefore turned off, and the stakes set, we will say, 300 feet on each side of the center line. These stakes, the best obtainable, are marked Cor. No. 1, N. W. Cor., Good Samaritan Lode; and Cor. No. 2, S. W. Cor., Good Samaritan Lode, respectively. From No. 3 a tie is made to Cor. No. 1, Sur. No. 14950 Columbus Lode, as shown in the notes. As we have now measured 935.6 feet, we know that we have passed the point for setting center side stakes, so we return to No. 1 and measure back 185.6 feet to No. 1a, whence the center side stakes are set at right angles to the center line. They are marked North and South Center Side Stakes, Good Samaritan Lode, respectively. Of course, it frequently happens that the position of the center side stakes is known in advance, and in this case a measurement would have been made in the beginning to No. 1a. In this case No. 1a would have been called No. 2 and the next sight might have been made to No. 3, etc.; but in the case of the Good Samaritan Lode the center side stakes could not be placed till the claimant had decided where the claim was to end in its westerly course. We now extend the line through No. 5 and No. 6 and here, knowing that the survey can be completed with another sight, the previous measurements are reduced to horizontals, the total subtracted from 1,500 and the result laid out. Corners No. 3 and No. 4 are then set as for the westerly end. If a tie has not been made to a patent cor-

ner, or some other proper monument, as above, the instrument is set up at some corner of the claim, preferably Cor. No. 1, and bearings to two or more mountain peaks or other permanent points taken and recorded. The surveyor then makes sure that he has the name of the lode, a description of the discovery, whether shaft, cut, etc., the correct name of the locators, the name of the mining district and the date. At his office the surveyor figures the tie to the patented claim as given below, writes out the certificate, usually signs it for the claimant, and sends it for record to the county recorder. Several styles of blank forms for location certificates are sold by different publishers, but they are all essentially the same. The location certificate of above is as follows:

STATE OF COLORADO, }
 County of Teller, } ss.

Know All Men by These Presents: That **Rudolf Gale**, the undersigned, has this **29th day of May, 1920**, located and claimed, and by these presents does locate and claim by right of discovery and location, in compliance with the Mining Acts of Congress, approved May 10, 1872, and all subsequent acts, and with local customs, laws and regulations, **1,500** linear feet and horizontal measurement on the Good Samaritan lode, vein, ledge or deposit, along the vein thereof, with all its dips, angles and variations as allowed by law, together with 300 feet on each side of the middle of said vein at the surface, so far as can be determined from present developments; and all veins, lodes, ledges, or deposits and surface ground within the lines of said claim **594.4** feet running **N. 81° 32' E.** from center of discovery shaft and **905.6** feet running **S. 81° 32' W.** from center of discovery shaft, said discovery shaft being situ-

ate upon said lode, vein, ledge or deposit, and within the lines of said claim in **Gold Dirt Mining District**, County of **Teller**, and State of Colorado, described by metes and bounds as follows, to-wit:

Beginning at Cor. No. 1, whence Cor. No. 1, Sur. No. 14950, Columbus lode, bears S. 71° 51' E. 570.05 feet, thence S. 8° 28' E. 600 feet to Cor. No. 2, thence N. 81° 32' E. 750 feet to south center side stake, thence N. 81° 32' E. 750 feet to Cor. No. 3, thence N. 8° 28' W. 600 feet to Cor. No. 4, thence S. 81° 32' W. 750 feet to north center side stake, thence S. 81° 32' W. 750 feet to Cor. No. 1, the place of beginning.

Said lode was discovered on the 16th day of **March**, A.D. 1920.

Date of location, **May 29**, A.D. 1920.

Date of certificate, **May 29**, A.D. 1920.

RUDOLF GALE. (Seal.)

It is not necessary to mention the center side stakes in the description. Should several claimants desire to be recorded as possessing unequal shares, the names may be arranged as follows, at the bottom:

J. P. Smith, $\frac{1}{2}$ interest.
 L. S. Weaver, $\frac{1}{4}$ interest.
 L. J. Walter, $\frac{1}{4}$ interest.

For a company, the name may simply be placed at the bottom, with or without the addition of the name of an agent or attorney in fact.

Other examples of location certificates will be given under field notes of patent survey.

The above simple straight location may be varied in many ways. The end lines may not be at right angles to

the center, but made to fit some other claim; in this case the end line is longer than the width of the claim, and is figured in the same way as the end line of an angular claim given later. In order to avoid conflicts, the claim is frequently made narrower than the legal width, sometimes on one side of the center, sometimes on both sides, and the side lines may even be broken lines. In this latter case they are figured as examples of mill sites or intersections of patents, etc., which will be given later. There is probably no legal objection to having the end line even longer than the side line, as is the case in Fig. 20. In this example, were a mistake made and the vein placed as shown in the figure, the claimant would get over 3,000 feet of vein in one location, provided the vein was

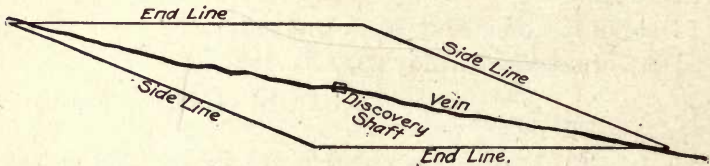


Fig. 20

perpendicular, so as not to require extralateral rights. At the time of issuance of patent, of course, this could not be known, as the vein is required, as far as known, to be not more than 150 or 300 feet from either side line, according to the district.

Angular Claims

In the case of angular claims the conditions given above are more or less complicated. The simplest angular claim is one whose one angle is at or near the discovery and therefore known in advance, or at least before either end line is laid out. This is easily surveyed, as follows: See

Fig. 21, the angle a being determined as 40° . The angle b is equal to 140° . In placing the angle stakes the angle b is bisected, that is, 70° is turned from either the foresight or the backsight on the southerly side, or 110° turned from

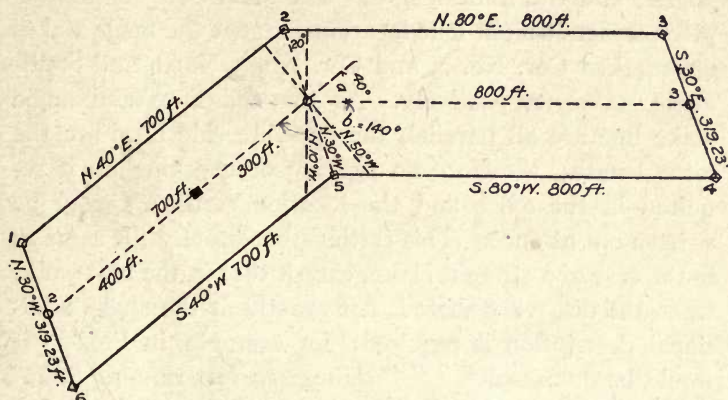


Fig. 21

either the foresight or backsight on the northerly side. The bisecting line is therefore 20° in each case from a line at right angles to the lines 1 — 2 and 1 — 3. The direction of this line is seen at once to be in the figure above, S. 30° E. ($90^\circ - 80^\circ = 10^\circ + 20^\circ = \text{S. } 30^\circ \text{ E.}$ $90^\circ - 40^\circ = 50^\circ - 20^\circ = \text{S. } 30^\circ \text{ E.}$) As one-half of this line is the hypotenuse of a right triangle whose base is 150 feet (or, as the case may be, 75 or 300 feet), and whose angle A is 20° , its length is found from a traverse table, or table of natural secants, to be:

	Lat.	Distance or nat. secant.	
20°	141.0 =	150.0	20° = 1.0641
	9.0 =	9.6	300
	<hr/>	<hr/>	<hr/>
	150.0 =	159.6	2)319.23 end line
			159.61

which is the true distance from No. 1 to the angle corner S. 30° E., and also, of course, in the other direction N. 30° W. These lines in turn must be corrected for slope of hill. The end lines are then placed parallel to the line of the angle stakes, and the same length. The stakes are marked as given under straight lode locations, except the angle stakes are marked Cor. No. 2, and Cor. No. 5 North and South angle stakes, respectively. As the end lines and angle stake line are all parallel, the opposite side lines are the same length; therefore no figuring or checking up is required in the office and the location certificate may be written out at once. This certificate is exactly the same as in the case of a straight claim, except that in the best work, when the discovery shaft is not exactly at the angle, additional description is required; for example, in Fig. 20 it would be described " " " " claims 400 feet running S. 40° W. from center of discovery shaft and 300 feet running N. 40° E., thence 800 feet running N. 80° E., etc.

In surveying an angular claim where the angle is not known when the first end line is reached, or when there are two or more angles in the claim, this first end line is usually put in at right angles to the center line. In the case of a claim having only one angle, the setting of the end line may often be postponed till the angle of the center line is determined. When the end line is set at right angles one or more sets of angle stakes are placed on lines bisecting the angles, as given above; but these lines are not parallel to the end lines, nor are they necessarily parallel to each other. As the end lines of the claim must be parallel to each other, this requires that the end line for No. 4 be turned from a line at right angles to its center line over an angle equal to the algebraic sum of all the angles entering into the broken center line of the claim, or from the

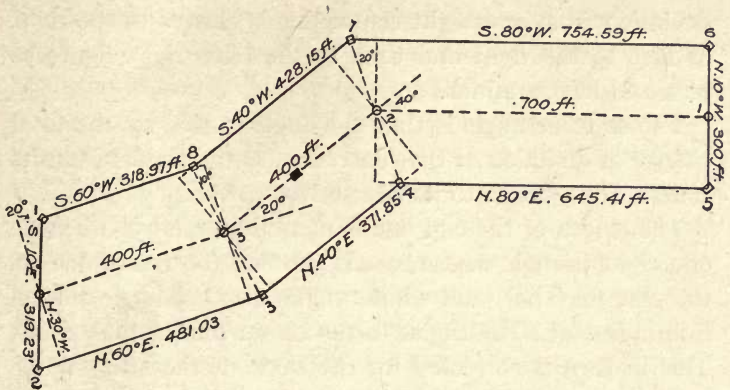


Fig. 22

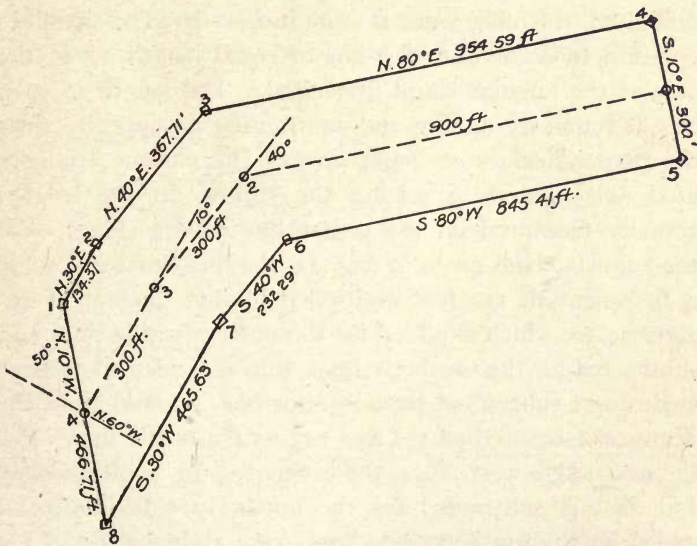


Fig. 23

backsight on the center line over the complement of this algebraic sum. This is shown in the two figures above, Fig. 22 and Fig. 23, to be 20° and 50° , respectively, as the

deviation from a straight center line is always to the right or first to the right and then to the left; right figure as plus and left as minus.

The end line angle is thus the angle caused by the total change of direction of the center line of the claims from its course No. 1-No. 2 to its course No. 3-No. 4.

The length of the end line is figured as the hypotenuse of a right triangle whose base is 300 feet (or 150 or 600, as the case may be), and whose angle A is the angle turned from a line at right angles to the center line at that point. This in turn is corrected for the slope of the hill. While it is no more difficult to stake out this kind of an angular claim in the field than in the case of the angular claim first cited, the office work is more involved. The side lines opposite to each other are not of equal length, as in the case of the angular claim first cited. The length in each case is found by adding and subtracting on opposite sides the perpendiculars or departures of the various triangles used and figured in setting the stakes, to the lengths actually measured on the center line of the claim. For the angular claim given in Fig. 22, the most easterly angle is first figured, 150 feet multiplied by the tangent of 20° gives 54.59, which is added for the northerly side lines and subtracted for the southerly lines, that is, added to exterior angles and subtracted from interior ones, to and from the distances measured on 1-2 and 2-3 on the center line. For the next angle west 26.44 , the tangent of 10° multiplied by 150 feet, is subtracted for the northerly side lines, and added for the southerly side lines, from and to 2-3 and 3-4 on the center line, remembering that 54.59 feet have already been subtracted from or added to 2-3. Finally 54.59, tangent 20° multiplied by 150, is subtracted for the northerly side line and added for the southerly side line to and from

3-4, from and to which 26.44 feet have already been subtracted and added. In Fig. 23 the same method is pursued. On the northerly side line the tangents are added until the end line is reached, then subtracted from the center line distances, while for the southerly side line the tangents are subtracted until the end line is reached and then added. To be sure that the work has been done correctly and that the boundary lines close, a traverse is made as in the following examples. While the traverse may be made in the usual way, the labor is greatly decreased by subtracting the length of the corresponding side lines and end lines from each other, using the direction in each case of the longer line. We thus find latitudes and departures for only half the courses and for smaller numbers. The closing of the traverse round the claim proves the correctness of the previous work.

Example:

	Course.	Distance.	N. lat.	S. lat.	E. dep.	W. dep.
.....	S. 10° E.	19.23	.....	18.93	3.32	.....
Fig. 22..	N. 60 E.	162.06	81.05	.....	140.32	.....
.....	S. 40 W.	56.30	.....	43.11	.....	36.18
.....	S. 80 W.	109.18	.....	18.95	.....	107.52
			81.05	80.99	143.64	143.70

	Course.	Distance.	N. lat.	S. lat.	E. dep.	W. dep.
.....	N. 10° W.	166.71	164.16	.....	.....	28.94
Fig. 23..	S. 30 W.	331.26	.....	286.86	.....	165.63
.....	N. 40 E.	135.42	103.72	.....	87.04	.....
.....	N. 80 E.	109.18	18.95	.....	107.52	.....
			286.83	286.86	194.56	194.57

	Course.	Distance.	N. lat.	S. lat.	E. dep.	W. dep.
.....	N. 15° E.	25.72	24.85	.....	6.65	.....
Fig. 25..	S. 82 W.	60.82	.....	8.46	.....	60.22
.....	S. 73 E.	56.04	.....	16.38	53.58	.....
			24.85	24.84	60.23	60.22

Another method of checking an angular claim, when one end line is at right angles to the center line, is to turn the

claim so that the end line is described as north and south. The adjacent side lines at right angles are then east and west, and only the latitudes and departures of the differences in distances of the other lines have to be calculated. Taking the claim in Fig. 24a, we place the end lines North and South as in Fig. 24b. The latitude and departure of the distance N. 33° W. 62.88 feet, changed to N. 68° W. 62.88, is the only latitude and departure to be calculated.

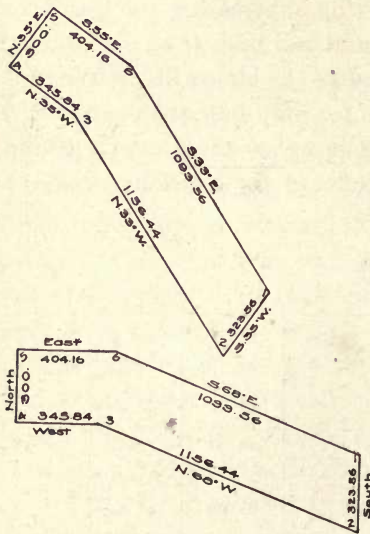


Fig. 24 a and b

Course.	Distance.	N. lat.	S. lat.	E. dep.	W. dep.
South.....	23.56	.....	23.56	.....	.....
N. 68° W.....	62.88	23.56	.....	.....	58.31
East.....	58.32	.....	.....	58.32	.....
		23.56	23.56	58.32	58.31

It frequently happens that in case of angular claims the end lines must be made to fit prior claims. In this case the calculations for the amounts to be added to the length of the center line must be made at each end of the claim as well as at the angles, and the amounts to be added and the lengths of the line will vary according to the angle at which the latter are set. (See Fig. 25.) Angular claims

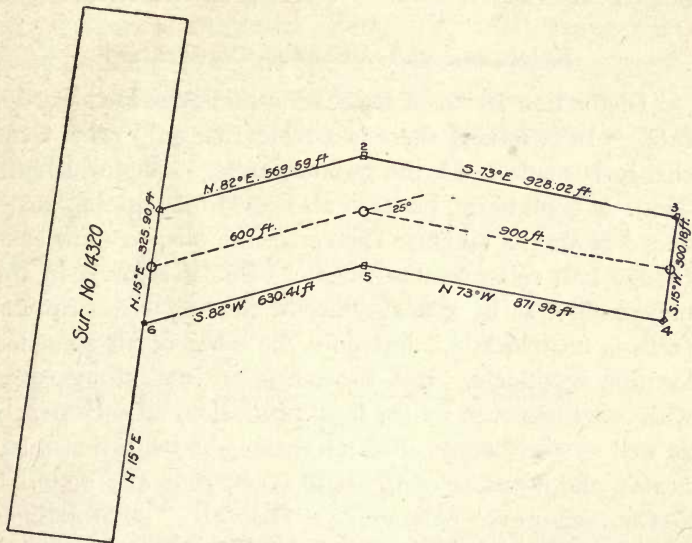


Fig. 25

may also be narrowed down and located with irregular side lines, but the figuring of these variations is only a form of the figuring done in such work as patent intersections, treated later on.

In all lode locations, the setting of end lines is of great importance. The end lines should be placed as a rule as nearly as possible at right angles to the strike of the vein, while the location survey covers the apex.

The dip of the lode and the extralateral rights desired should always be kept in mind by the surveyor. Thus, in Fig. 25, the arrangement of end lines, placed so as to avoid conflict with the prior location, may not be the best, or may be extremely bad, when the question of extralateral rights is considered. It is therefore often best not to survey to avoid a conflict, but to make the best possible arrangement of end lines to cover the ground desired.

Relocation and Amended Certificates

“Distinction Between Relocation and Amended Certificate. — In strictness there is a relocation only when some change is made upon the ground, as by changing length, width or boundaries, perhaps also when overlapping abandoned ground is taken. The certificate filed to show such change is a relocation certificate. But if error is in the papers only, as by a misleading or too vague description, there is no relocation, but only the filing of an amended location certificate. But the terms are not always used with exactness even by the legal profession, all such papers as well as acts being called relocations or relocation certificates, and a misuse of the term is not generally material. — *Cheeseman vs. Shreeve*, 40 Fed. 789.” — Morrison’s “Mining Rights,” p. 109, 10th ed.

It frequently happens, especially just before surveying for patent, that the descriptions of claims are found to be defective in some respect, and in this case an amended description is filed, and no change is made upon the ground. More often, however, the stakes on the ground are changed somewhat, and the owner takes advantage of a resurvey to take in some abandoned ground, or to alter the lines of his claim slightly one way or the other from the original location. He may even make radical changes in direction

of lines and extent of territory embraced. In this event there is no change in the method of survey from the procedure in the case of the original location, but the certificates are worded to suit the case. Of the two examples of amended and relocation certificates which follow, the first is rarely used, as the second covers almost every possible case. In some cases it is well to state the cause for amending, as, for example, that it is to correct the spelling of the name of the claim or location. This assumes importance when it is desirable to impress suspicious neighbors with the fact that no change has been made in the boundaries of a claim, and that the amendment is made simply to perfect the description.

In the case of a second amendment we add to "This being the same lode, * * *", "and again located on the 18th day of April, 1905, and recorded on the 31st day of April, 1905, in book 160, page 352, in the office of the recorder of Clear Creek county."

Additional and Amended Location Certificate — Law of 1889.

STATE OF COLORADO, }
County of Clear Creek, } ss.

Know All Men by These Presents, That **The Treasure Vault Gold Mining Company** has, this **18th** day of **April**, 1905, amended, located and claimed, and by these presents does amend, locate and claim, by right of the original discovery and this additional and amended location certificate, in compliance with the Mining Acts of Congress, approved May 10, 1872, and all subsequent acts, and with Section 2409 of the General Statutes of Colorado, and with local customs, laws and regulations, **717.2** linear feet and horizontal measurement on the **Boreas** lode, vein, ledge or

deposit, along the vein thereof, with all its dips, angles and variations, as allowed by law, together with **75 feet on each side** of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges or deposits and surface ground within the lines of said claim, **10 feet running northeasterly from center of discovery shaft** and **707.2 feet running southwesterly from center of discovery shaft**, said discovery shaft being situate upon said lode, vein, ledge or deposit, and within the lines of said claim, in **Idaho Mining District, County of Clear Creek and State of Colorado**, described by metes and bounds as follows, to-wit:

Beginning at Corner No. 1, thence **S. 14° 15' E. 152.48 ft. to Cor. No. 2**; thence **S. 65° 24' W. 377.33 ft. to Cor. No. 3**; thence **S. 89° 2' W. 339.79 ft. to Cor. No. 4**; thence **N. 14° 15' W. 154.12 ft. to Cor. No. 5**; thence **N. 89° 2' E. 343.81 ft. to Cor. No. 6**; thence **N. 65° 24' E. 373.47 ft. to Cor. No. 1**, the place of beginning.

From Cor. No. 1, Cor. No. 3, Sur. No. 12276, Bessie lode bears **N. 14° 15' W. 7.66 ft.**

This being the same lode originally located on the **21st day of February, 1901**, and recorded on the **2nd day of March, 1901**, in book **147**, page **319**, in the office of the Recorder of **Clear Creek County**. This further additional and amended certificate of location is made without a waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description or record, and making more specific the boundaries and description of said lode as originally located upon the ground.

THE TREASURE VAULT GOLD MINING CO.

[Seal.]

By J. P. Little, Agent.

Said lode was discovered the **15th day of February, A.D. 1901.**

Date of additional and amended certificate, **April 18th, A.D. 1905.**

Additional and Amended Location Certificate — Law of 1889.

STATE OF COLORADO, }
County of Clear Creek, } ss.

Know All Men by These Presents, That **The Treasure Vault Gold Mining Company** has, this **18th day of April, 1905**, amended, located and claimed, and by these presents does amend, locate and claim, by right of the original discovery and this additional and amended location certificate, in compliance with the Mining Acts of Congress, approved May 10, 1872, and all subsequent acts, and with Section 2409 of the General Statutes of Colorado, and with local customs, laws and regulations, **1014.2** linear feet and horizontal measurement on the **Arc Light** lode, vein, ledge or deposit, along the vein thereof, with all its dips, angles and variations, as allowed by law, together with **75 feet on each side** of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges or deposits and surface ground within the lines of said claim, **21 feet running N. 61° 37' E.** from **face of discovery cut** and **993.2 feet running S. 61° 37' W.** from **face of discovery cut**, said **discovery cut** being situate upon said lode, vein, ledge or deposit, and within the lines of said claim, in **Idaho Mining District, County of Clear Creek** and State of Colorado, described by metes and bounds as follows, to-wit:

Beginning at Corner No. 1, thence S. 28° 23' E. 150 ft. to Cor. No. 2; thence S. 61° 37' W. 1014.2 ft. to Cor. No. 3;

thence N. 28° 23' W. 150 ft. to Cor. No. 4; thence N. 61° 37' E. 1014.2 ft. to Cor. No. 1, the place of beginning.

From Cor. No. 1, Chief Mt. bears S. 5° W. and a prominent peak bears S. 30° W.

This being the same lode originally located on the 21st day of February, 1901, and recorded on the 2nd day of March, 1901, in book 147, page 320, in the office of the Recorder of Clear Creek County. This further additional and amended certificate of location is made without a waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description or record, and of taking in and acquiring all forfeited or abandoned, overlapping ground, and of taking in any part of any overlapping claim which has been abandoned, and of securing all the benefits of said Section 2409 of the General Statutes of Colorado.

THE TREASURE VAULT GOLD MINING CO.

[Seal.]

By J. P. Little, Agent.

Said lode was discovered the 15th day of February, A.D. 1901.

Date of additional and amended certificate, April 18th, A.D. 1905.

Mill Sites and Placers

Mill sites and placers are, for the most part, on streams. Placers are required by the General Land Office to be taken up by legal subdivisions when on surveyed lands. When the land is not surveyed, as is often the case with mineral lands, placers should be surveyed as regularly as possible.

At present the General Land Office requires all placer claims on unsurveyed lands to be laid off as if the land were properly surveyed. In other words, the surveyor is prac-

tically required to survey the whole country, or as much of it as is necessary to establish the legal subdivisions of the placer required. When the nearest surveyed tract is far distant, the department would probably permit a placer to be surveyed with east, west, north and south boundaries.

As a rule the surveyor will lay out a mill site in rectangular form for simplicity, and the following table, taken from Morrison, will often be useful:

“Area in Feet or Acres. — By the following table the number of feet necessary to include any desired number of acres when in the shape of a square or parallelogram may be ascertained:

Claim	660 × 330	feet contains	5	acres.
“	500 × 500	“	“	5.73 “
“	660 × 660	“	“	10 “
“	1320 × 660	“	“	20 “
“	800 × 1089	“	“	20 “
“	933 $\frac{1}{3}$ × 933 $\frac{1}{3}$	“	“	20 “
“	1320 × 1320	“	“	40 “
“	2640 × 2640	“	“	160 “

43,560 square feet = 1 acre. A square 208.71 feet in length and width = 1 acre.” — Morrison’s “Mining Rights,” p. 185, 10th ed.

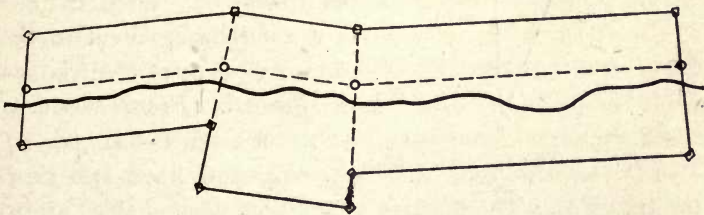


Fig. 26

It may happen that the survey must follow the meandering of a stream, and in this case the rules for angular

claims may often apply. Even when the claim must be widened or narrowed the same rules hold, each portion being figured separately as in Fig. 26, the whole forming 5 acres or less in the case of a mill site, and 20 acres or less for each claimant in a placer. The end lines, if they may be so called, need not, of course, be parallel, as in the case of lode locations. In case it is desired to include all possible ground between two claims, *A* and *B*, Fig. 27, the

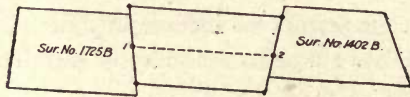


Fig. 27

center line 1-2 is measured and the width of claim then laid out, giving 217,800 square feet (5 acres) when multiplied by the length of 1-2. The end lines are figured as in angular claims.

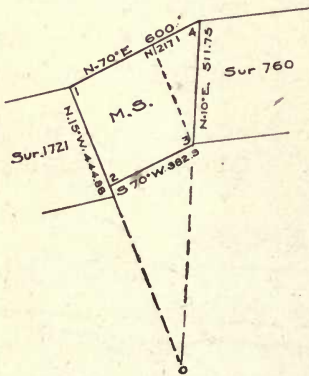


Fig. 28

If the center line of the mill site cannot be used, extend the lines of the bounding claims so as to form a triangle as in Fig. 28. With the line 1-4 as a base, calculate the sides and area of the triangle so formed. From the area subtract 5 acres = 217,800 sq. ft. We now have two similar triangles.

The squares of the homologous sides are to each other as the areas.

$$\text{Area triangle } 1-0-4 = \frac{600^2 \sin 95^\circ \sin 60^\circ}{\sin 25^\circ} = 8.435 \text{ acres.}$$

Area mill site 1-2-3-4 = 5 acres.

Area triangle 2-0-3 = $8.435 - 5 = 3.435$ acres.

Line 2-3 = $600^2 : 8.435 :: x^2 : 3.435 = 382.9 = x$ or line 2-3.

Draw line $N-3$ parallel to line 1-2.

Line $N-4 = 600 - 382.9 = 217.1$.

Solve oblique triangle $N-3-4$.

Line $N-3 = 444.88$.

Line 1-2 = line $N-3 = 444.88$.

Line 3-4 = 511.75.

If it is not desired to have the side lines parallel as in Fig. 29, it is necessary to find the area of the triangle 1-2-3

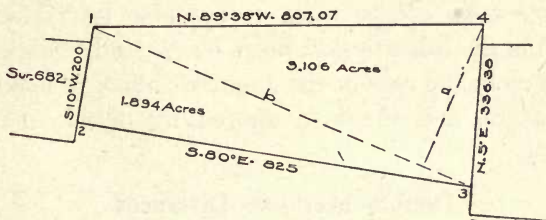


Fig. 29

and the side b . Suppose this area to be 1.894 acres; subtracting this from 5 acres, we have 3.106 acres as the area of the triangle 1-3-4. Find the altitude a , which, multiplied by b and divided by 2, will give 3.106 acres. From this altitude calculate 3-4 and 1-4.

It sometimes happens that very irregular tracts must be laid out, and there is no escape from more or less extensive figuring to get the correct boundaries for the number of acres to be included. It will then be necessary to divide the area under consideration into rectangles or triangles, or both, or calculate the area by double meridian distances. The method of surveying will also vary according to the circumstances of the case. It may be possible to survey

from a center line, as in Fig. 30, or, in the case of large tracts, it may be necessary to run the exterior boundaries. Ties should be made as for all lode claims.

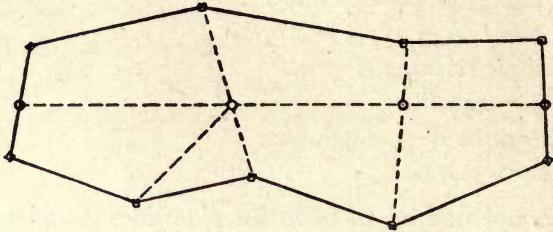


Fig. 30

In any case, except when rectangular tracts are surveyed, the final description must be carefully checked by traverse as in the case of the angular claims, to make sure of a closure, and the area figured by double meridian distances.

Double Meridian Distances

The traverse is begun with the most easterly or westerly station (Fig. 31). Double Meridian Distances = D. M. D., of preceding course plus the departure of that course, plus

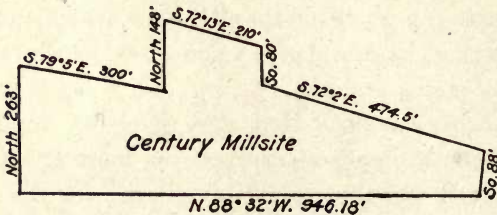


Fig. 31

the departure of the course itself. The first and last D. M. D. are the same as the respective departures. The latitudes are arranged plus and minus North and South respectively, multiplied by their D. M. D. as above. The

CENTURY MILL SITE

LOCATION SURVEYS

Course.	Distance.	N.	S.	E.	W.	D. M. D.	+	-	+ Areas.	- Areas.
S. 79° 5' E.....	300.0	.....	56.81	294.56	.....	294.56	.....	56.81	.....	16733.9
North.....	148.0	148.0	.....	.....	.....	589.12	148.0	.....	87189.8	.....
S. 72° 13' E.....	210.0	.....	64.13	199.96	.....	789.08	.....	64.13	.....	50603.7
South.....	80.0	.....	80.00	.....	.....	989.04	.....	80.0	.....	79123.2
S. 72° 2' E.....	474.5	.....	146.35	451.33	.....	1440.37	.....	146.35	.....	210798.0
South.....	88.0	.....	88.00	.....	.....	1891.70	.....	88.0	.....	166470.0
N. 88° 32' W.....	946.18	24.26	.....	.....	945.85	945.85	24.26	.....	22946.3	.....
North.....	263.0	263.0	.....	.....	.....	.....	263.0	.....	.....	.....
		435.26	435.29	945.85	945.85				110136.1	523728.8
										110136.1
										2)413592.7
										206796.3

4.747 acres.
 $\log 206796.3 = 5.3155427$
 $\text{colog } 43560.0 = 5.3609121$
 $\log 4.747 = 0.6764548$

plus and minus areas resulting are then added and the lesser subtracted from the greater and the result divided by 2. The result is the area in square feet.

Care must be taken, in the case of a mill site that is cut into tracts by other claims, to locate the mill site as one unit not including more than 5 acres, and, during the patent surveying, cut into tracts.

Location Certificate — Mill Site

STATE OF COLORADO, }
 County of Clear Creek, } ss.

To All Whom These Presents May Concern:

Know ye that I, **John T. McDonald**, of **Idaho Springs, Colorado**, do hereby declare and publish as legal notice to all the world that I have a valid right to the occupation, possession and enjoyment of all and singular that tract or parcel of land not exceeding five acres, situate, lying and being in **Montana Mining District**, in the County of **Clear Creek**, in the State of Colorado, bounded and described as follows, to-wit:

The **CENTURY** Mill Site, beginning at Corner No. 1, whence Cor. No. 6, Sur. No. 1465, **Cohos Mill Site**, bears N. $16^{\circ} 42' W.$ 27.6 ft.; thence S. $79^{\circ} 5' E.$ 300 ft. to Cor. No. 2; thence N. 148 ft. to Cor. No. 3; thence S. $72^{\circ} 13' E.$ 210 ft. to Cor. No. 4; thence S. 80 ft. to Cor. No. 5; thence S. $72^{\circ} 2' E.$ 474.5 ft. to Cor. No. 6; thence S. 88 ft. to Cor. No. 7; thence N. $88^{\circ} 32' W.$ 946.18 ft. to Cor. No. 8; thence N. 263 ft. to Cor. No. 1, the place of beginning.

Containing 4.747 acres, together with all and singular the hereditaments and appurtenances thereto belonging or in any wise appertaining.

Witness my hand and seal, this **26th** day of **December**, in the year of our Lord one thousand nine hundred and three.

[Seal.]

JOHN T. McDONALD.

STATE OF COLORADO, }
County of Clear Creek, } ss.

Before me, the subscriber, a Notary Public in and for said County, personally appeared **John T. McDonald**, to me personally known to be the same person described in and who executed the within Declaration of Occupation, and acknowledged that he signed, sealed and published the same as his free and voluntary act and deed, for the uses and purposes therein set forth.

Witness my hand and notarial seal, this **twenty-sixth** day of **December**, A.D. 1903.

My commission expires December 27, 1905.

ROYAL R. GRAHAM, Notary Public.

(*Note.* — The certification before a Notary is not necessary. Another example of Mill Site Certificate will be given under Field Notes of Patent Surveying.)

The following Location Certificate, though not according to the present requirements of the General Land Office, is probably perfectly legal. To avoid trouble, however, it is best to take it up by legal subdivisions:

Placer Location Certificate

Know All Men by These Presents, that **J. M. Cross**, the undersigned citizen of the United States, resident of the County of **Clear Creek**, State of Colorado, having complied with the provisions of Chapter 6, Title XXXII, of the Revised Statutes of the United States, and with the local customs, laws and regulations, claims by right of discovery and location the **Snow Storm** Placer Claim, situate, lying

and being in **Gold Dirt Mining District**, County of **Clear Creek**, and State of **Colorado**, described by metes and bounds as follows, to-wit:

Beginning at Corner No. 1, thence N. 81° 42' E. 329.85 ft. to Cor. No. 2; thence S. 35° 3' E. 227.6 ft. to Cor. No. 3; thence S. 44° 46' W. 213.6 ft. to Cor. No. 4; thence N. 68° 34' W. 422.30 ft. to Cor. No. 1, the place of beginning.

From Cor. No. 1, two prominent peaks bear N. 87° 30' W. and S. 45° W., respectively.

Containing an area of 1.808 acres, said claim was located on the 19th day of November, A.D. 1902.

Date of certificate, December 1st, A.D. 1902.

J. M. CROSS.

(A Placer Location Certificate by legal subdivisions will be given under Field Notes of Patent Surveying.)

Tunnel Sites

There is considerable difference of opinion in regard to the location of tunnel sites, but the best method seems to be the surveying of the proposed line of the tunnel on the surface, and the marking of the exterior boundaries of the tunnel site. The tunnel line is easiest marked by stakes at the various points of set-up, but rather better by stakes set at regular intervals of, say, 500 feet. From the end points, stakes are set 1,500 feet on each side of the tunnel line as shown in Fig. 32. Certain ground is frequently located or staked for dumping purposes.

Location Certificate — Tunnel

To All Whom These Presents May Concern:

Know ye that I, **George E. Plant**, of **Georgetown, Colorado**, on the **20th day of May, 1905**, located, and by these

presents do locate, for the discovery of mines and the development of lodes or veins, the **Tip Top Tunnel** and **Tunnel Site**, and claim the right of occupancy, possession

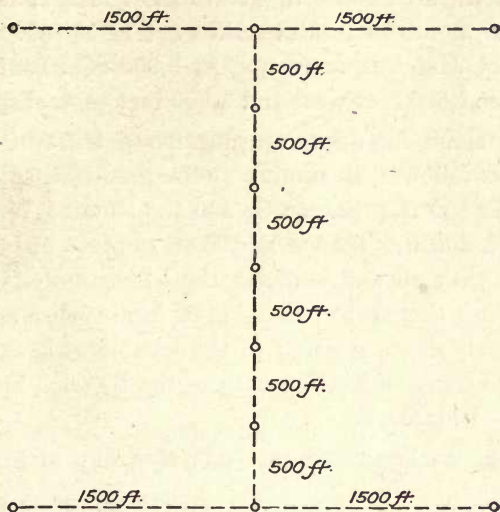


Fig. 32

and enjoyment thereof, together with the right of possession of 1,500 feet in length on all veins or lodes within 3,000 feet from the face of said tunnel, on the line thereof, not previously known to exist, discovered in said tunnel, situate in **Virginia Mining District, Clear Creek County, State of Colorado.**

The mouth of the tunnel (at the point where it enters cover) is located on the **North side of Cold Creek, whence Cor. No. 2, Sur. No. 16521, Colorado lode, bears S. 27° 16' W. 351.5 ft.**

Size of tunnel, **6 feet wide by 8 feet high in the clear.**

Course of tunnel from its mouth is **North 3,000 feet.**

A full description of the stakes set along the line of

tunnel is as follows: **Six stakes set at intervals of 500 feet for 3,000 feet from mouth.**

A full description of the stakes set at the exterior boundaries of the area claimed, 3,000 feet square, is as follows: **From the mouth of tunnel stakes set 1,500 feet west and 1,500 feet east, respectively. At 3,000 feet from mouth, stakes set 1,500 feet west and 1,500 feet east, respectively.**

I also claim for dumping purposes a tract of land described as follows: Beginning at the mouth of said tunnel, **thence E. 100 ft.; thence S. 200 ft.; thence W. 200 ft.; thence N. 200 ft.; thence E. 100 ft. to place of beginning,** together with all and singular the hereditaments and appurtenances thereunto belonging or in any wise appertaining, and all rights granted to the locator as tunnel rights under the terms of Section 2323 of the Revised Statutes of the United States.

Witness my hand and seal this **20th** day of **May**, A.D.

1905.

[Seal.]

GEORGE E. PLANT.

Legal Subdivisions

Locating placers by legal subdivisions of sections is closely connected with the procedure for restoring lost corners of the public survey. The subject is exhaustively handled in "Circular on Restoration of Lost or Obliterated Corners and Subdivision of Sections: General Land Office, March 14, 1901." The pamphlet may be obtained by applying to the General Land Office, Washington, D. C. Following is an account of the most important points to be kept in mind and principles to be applied. An example of the Location Certificate required will be given with the Field Notes of a Patent Survey.

General Rules

1st. That the boundaries of the public lands established and returned by the duly appointed government surveyors, when approved by the surveyors general and accepted by the government, are unchangeable.

2nd. That the original township, section and quarter-section corners established by the government surveyors must stand as the true corners which they were intended to represent, whether the corners be in place or not.

3rd. That quarter-quarter corners not established by the government surveyors shall be placed on the straight lines joining the section and quarter-section corners and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on other lines between fractional sections.

4th. That all subdivisional lines of a section running between corners established in the original survey of a township must be straight lines running from the proper corner in one section line to its opposite corresponding corner in the opposite section line.

5th. That in a fractional section where no opposite corresponding corner has been or can be established, any required subdivision line of such section must be run from the proper original corner in the boundary line due east and west, or north and south, as the case may be, to the water course, Indian reservation or other boundary of such section, with due parallelism to section lines.

From the foregoing it will be plain that extinct corners of government surveys must be restored to their original locations whenever it is possible to do so; and hence resort should always be first had to the marks of the survey in the field. The locus of the missing corner should be first

identified on the ground by the aid of the mound, pits, line trees, bearing trees, etc., described in the field notes of the original survey.

The identification of mounds, pits, witness trees or other permanent objects noted in the field notes of survey, affords the best means of relocating the missing corner in its original position. If this cannot be done, clear and convincing testimony of citizens as to the locality it originally occupied should be taken if such can be obtained. In any event, whether the locus of the corner be fixed by the one means or the other, such locus should always be tested and confirmed by measurements to known corners. No definite rule can be laid down as to what shall be sufficient evidence in such cases, and much must be left to the skill, fidelity and good judgment of the surveyor in the performance of his work.

Subdivision of Sections

1. *Subdivision of Sections into Quarter Sections.* — Under the provisions of the Act of Congress approved February 11, 1905, the course to be pursued in the subdivision of sections into quarter sections is to run straight lines from the established quarter-section corners, United States surveys, to the opposite corresponding corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or, in other words, the legal center of the section.

(a) Upon the lines closing on the north and west boundaries of a township, the quarter-section corners are established by the United States deputy surveyors at 40 chains to the north or west of the last interior section corners, and the excess or deficiency in the measurement is thrown

into the half mile next to the township or range line as the case may be.

(b) Where there are double sets of section corners on township and range lines, the quarter corners for the sections south of the township lines and east of the range lines are not established in the field by the United States deputy surveyors, but in subdividing such sections said quarter corners should be so placed as to suit the calculations of the areas of the quarter sections adjoining the township boundaries, as expressed upon the official plat, adopting proportionate measurements where the new measurements of the north and west boundaries of the section differ from the original measurements.

2. *Subdivision of Fractional Sections.* — Where opposite corresponding corners have not been or cannot be fixed, the subdivision lines should be ascertained by running from the established corners due north, south, east or west lines, as the case may be, to the water course, Indian boundary line or other boundary of such fractional section.

(a) The law presumes the section lines surveyed and marked in the field by the United States deputy surveyors to be due north and south or east and west lines, but in actual experience this is not always the case. Hence, in order to carry out the spirit of the law, it will be necessary in running the subdivisional lines through fractional sections to adopt mean courses where the section lines are not due lines, or to run the division line parallel to the east, south, west or north boundary of the section, as conditions may require, where there is no opposite section line.

3. *Subdivision of Quarter Sections into Quarter-Quarters.* — Preliminary to the subdivision of quarter sections, the quarter-quarter corners will be established at points mid-

way between the section and quarter-section corners, and between quarter corners and the center of the section, except on the last half mile of the lines closing on the north or west boundaries of a township, where they should be placed at 20 chains, proportionate measurement, to the north or west of the quarter-section corner.

(a) The quarter-quarter section corners having been established as directed above, the subdivision lines of the quarter section will be run straight between opposite corresponding quarter-quarter section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the place for the corner common to the four quarter-quarter sections.

4. *Subdivision of Fractional Quarter Sections.* — The subdivision lines of fractional quarter sections will be run from properly established quarter-quarter section corners (paragraph 3) due north, south, east or west, to the lake, water course or reservation which renders such tracts fractional, or parallel to the east, south, west or north boundary of the quarter section, as conditions may require. (See paragraph 2-a.)

5. *Proportionate Measurement.* — By “proportionate measurement,” as used in this circular, is meant a measurement having the same ratio to that recorded in the original field notes as the length of chain used in the new measurement has to the length of chain used in the original survey, assuming that the original and new measurements have been correctly made.

For example: The length of the line from the quarter-section corner on the west side of Sec. 2, T. 24 N., R. 14 E., Wisconsin, to the north line of the township, by the United States deputy surveyor's chain, was reported as 45.40 chains, and by the county surveyor's measure is reported

as nearly direct from A to G as possible. This line will probably fall somewhat to the east or west of G , say at G' . From G' the course and distance are measured to G . At a point halfway between A and G' on the line AG' run a line parallel to $G'G$ and half the length of $G'G$ to H . Thus H is on line AG equidistant from A and G .

In rough country it will often be easier or even necessary to run a traverse from A to G , figure the missing course, and thus find the course and distance directly from A to G . Half of this distance is the distance from G to H . This may either be run directly on the ground from G or A , or, better still, the position for H may be found by figuring the course and distance from the nearest station used on the traverse from A to G , for which all the latitudes and departures have been previously figured in order to determine AG .

In a similar way the line between H and D is run, and its interior corner I is established at the point of its intersection with the line BF . Midway between B and I , K is established, and J between A and H . Halfway between A and B establish L and similarly M between H and I . This same principle will determine the reestablishment of lost corners, or the subdivision of the whole section.

Should the section be on the western tier of the township, it must be remembered that the eastern portions of the sections are subdivided as nearly as possible according to the dimensions of a perfect section, and all the error thrown into the western portion.

Tracing Extensions of Veins on the Surface

On the borderland between surface and underground surveying, one of the operations that a western surveyor is frequently called upon to perform is tracing the extension

of a known vein or finding from underground workings the probable outcrop of a vein. This may be done with various solars with great ease, as afterwards described, but with an ordinary transit it requires considerable calculation.

Let Fig. 34 in plan, vertical and longitudinal section, represent the simplest possible case, a vein striking due north and running up a regularly sloping hillside. The problem is to find the direction of the apex and the point on the surface approximately 600 feet away where the vein outcrops. From the tunnel the strike of the vein is found to be north, or assumed to be so for simplicity, and the dip is found to be $55^{\circ} 30'$. Measuring 600 feet up the hill, north, the same direction as the tunnel is assumed, the angle of elevation is found to be $30^{\circ} 33'$, which gives us a perpendicular height of 304.9. From this, with the angle of dip $55^{\circ} 30'$, we find we have to measure 209.5 feet at right angles to the strike to reach the apex. Should only the course of the apex be desired, we have only

$$\begin{array}{r} 516.7 \\ \hline 209.5 \end{array} = \text{cot course} \qquad \begin{array}{l} \log 516.7 = 2.713238 \\ \log 209.5 = 2.321184 \\ \hline 0.392054 = \log \cot 22^{\circ} 4' \\ \text{or N. } 22^{\circ} 4' \text{ W.} \end{array}$$

It will usually happen, however, that A is not on a level with B , and therefore some correction must be added to or subtracted from 209.5 feet, as the point A is above or below B , as shown in Fig. 34*d*. This correction, of course, varies as the height varies above or below B , and is figured from this height with an angle of $55^{\circ} 30'$, as the 209.5 feet was figured from 304.5 feet in Fig. 34*c*.

This work may be greatly simplified by the use of spherical trigonometry. In a spherical right triangle (Fig. 35) take A as the dip of the vein, b as the angle between

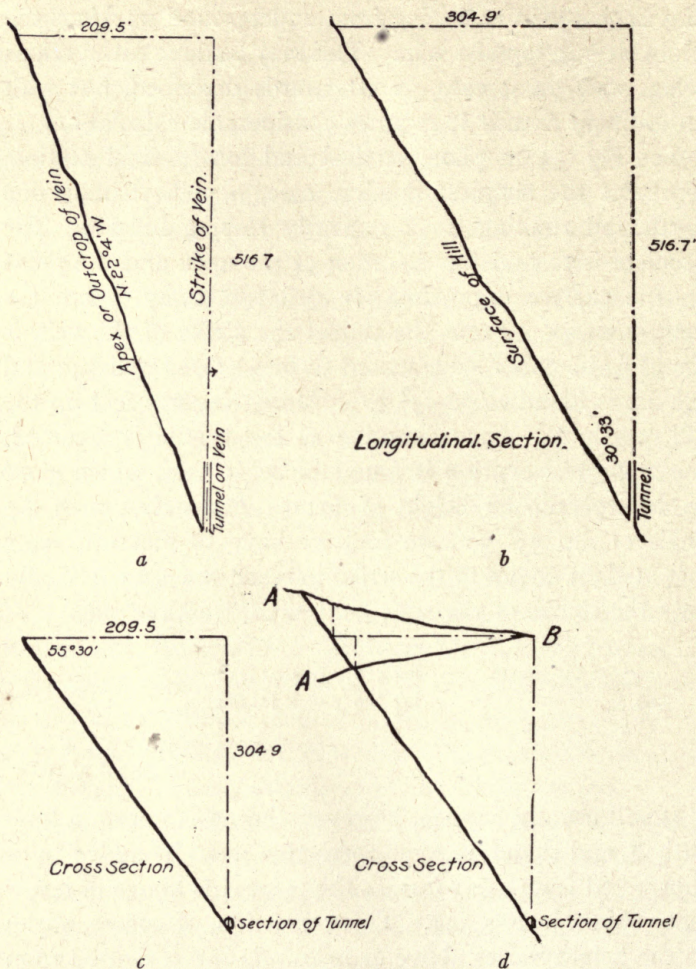


Fig. 34

direction of outcrop and strike of vein and a dip of line of outcrop or slope of hill on line of outcrop. Then

$$\sin b = \tan a \cot A;$$

that is, sine of angle between direction of outcrop and

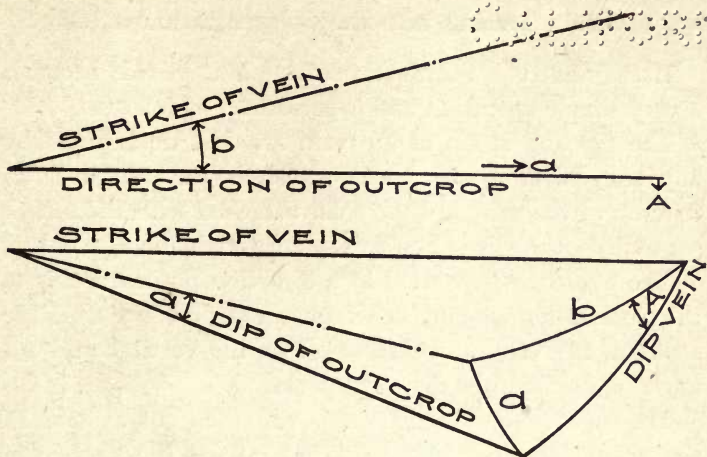


Fig. 35

strike of vein is equal to tangent dip of line of outcrop by cotangent dip of vein.

The following table gives the values of $\sin b$ for various dips of vein and outcrop.

Dip vein.	Dip outcrop.							
	5°	10°	15°	20°	25°	30°	35°	40°
20°	13° 54'	28° 59'	47° 24'	90° 0'				
25	10 49	22 13	35 4	51 18	90° 0'			
30	8 43	17 47	27 39	39 5	53 52	90° 0'		
35	7 11	14 36	22 30	31 19	41 45	55 33	90° 0'	
40	5 59	12 8	18 38	25 43	33 45	43 29	56 34	90° 0'
45	5 1	10 9	15 32	21 22	27 48	35 16	44 27	57 3
50	4 12	8 31	13 0	17 47	23 2	28 59	35 59	44 45
55°	3° 31'	7° 5'	10° 49'	14° 46'	19° 3'	23° 51'	29° 22'	35° 59'
60	2 54	5 50	8 54	12 8	15 37	19 28	23 51	28 59
65	2 20	4 43	7 10	9 46	12 34	15 37	19 3	23 2
70	1 49	3 41	5 36	7 37	9 46	12 07	14 46	17 47
75	1 21	2 42	4 7	5 36	7 10	8 54	10 49	12 59
80	0 53	1 47	2 42	3 41	4 42	5 50	7 5	8 31
85	0 26	0 53	1 21	1 50	2 20	2 54	3 31	4 12

Vein Tracing with the Solar Attachment

If the Shattuck Solar Attachment is used this becomes a very simple operation and is performed as follows:

The dip and strike of the vein are first determined by any convenient means. The transit is then set over an outcrop of the vein and the solar attached with the mirror set to deflect the line of collimation through an angle of 90° .

The telescope is pointed in a direction perpendicular to the plane of the vein, by deflecting an angle of 90° from the strike of the vein, and setting off on the vertical limb an angle of 90° from the dip of the vein.

The solar revolved on its axis will then cut a plane of the vein. The line where this plane cuts the surface of the ground is the line of the apex of the vein, which may be traced by simply sighting through the solar. Its position may be marked with equal facility where it crosses gulches or hillsides.

In case there are two openings at different elevations on the apex of a slanting vein, the strike of the vein may be determined in a similar manner.

Place the transit, with solar attached, over one of the croppings; depress the telescope to an angle of 90° plus the dip of the vein, and direct the telescope toward the footwall of the vein. Sight through the transit and solar at the other outcrop. The vernier reading will then be 90° from the strike of the vein.

The same results may be obtained in a similar way by the use of a solar provided with a telescope, as, for example, the Berger or Saegmuller Solars. For vein tracing the auxiliary telescope of the solar is set exactly parallel to the main telescope of the transit in the same vertical plane. The auxiliary telescope is then pointed in the direction of

the dip, as, for example, down a shaft, and at right angles to the strike of the vein. If the auxiliary telescope is now revolved on the adaptor or whatever device is employed, on a plane parallel to the plane of the vein, it will always point to some spot on the outcrop, provided, of course, the dip and strike are regular. In this way the outcrop may be staked by sighting directly through the telescope, a process somewhat simpler and clearer than the reflections of the Shattuck Solar.

The top telescope alone of a mining transit may be used, provided it will turn on the point of attachment as in the Scott model. This may be turned, after it is tightly set, by loosening the capstan screw.

CHAPTER V

PATENT SURVEYS

Surveying for Patent

We now come to that portion of western mineral surveying where the assistance of a mineral surveyor is required, namely, surveying for patent. As a rule, before beginning patent proceedings, the correctness of the location surveys is carefully verified, or the surveys are corrected and modified as required. In the case of groups it is especially necessary that the exact status of things be known before an order for survey is requested from the surveyor general. This done, the claimant or his attorney deposits the fees for the surveyor general's office at the nearest United States depository, with the name of the claimant and the name of the claim to which the fees are to apply.

Then, using the proper blanks which are supplied by the surveyor general, the claimant applies to the surveyor general to issue an order for survey. This form is given later under Specimen Field Notes. With this application are forwarded certified copies of the location certificates.

At the present writing, the mineral surveyor is strictly forbidden to either send the money to the United States depository, or make out the application to the surveyor general for survey, and is strictly forbidden to act as attorney in any way for the claimant. He may not even make an estimate to the claimant of the probable cost of the complete patent. This also applies to his chainman.

The certified copies of location certificates are carefully examined in the surveyor general's office, and if any mistakes are found; are returned for correction. Here it may be observed that the commonest mistakes found in these certificates are in angular claims which fail to close. If the certificates are satisfactory they are copied in the surveyor general's office and the copies, with the order of survey, are sent to the United States mineral surveyor designated in the application.

This order is also given later under Specimen Field Notes.

The mineral surveyor then surveys the claim exactly as described for a location survey, except that the work is done much more carefully and with greater safeguards. In place of the stakes used in the location survey, stones, rocks in place, substantial posts, or even trees, are used for corners. If the ground is such that it is impossible to set a corner, or if it is seen that a corner cannot possibly be permanent if set, a witness corner is placed on one of the lines of the survey, but not off these lines, except when absolutely necessary. Cor. No. 1 is placed on the end of the claim nearest the section corner or monument of the

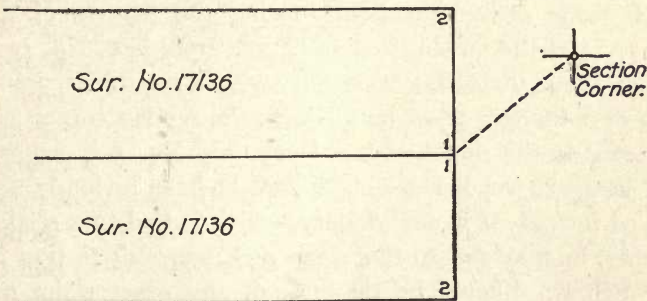


Fig. 36

public survey. Where there is a group of claims with common corners, as shown in Fig. 36, it is customary to

have Cor. No. 1 common to two claims and thus save considerable field work and calculation. Up to the present time this has been permitted by the General Land Office.

In case the surveyor has not carefully verified his location certificates in advance, he may find that the conditions on the ground do not fit the descriptions in the certificates. Usually a slight divergence of a few minutes or a few feet is permitted by the surveyor general. In case the divergence is material, it is necessary to amend the locations, and the claimant must apply for a new order for survey. This new order costs \$5 and results in the issuance of a new number and the cancellation of the old number. Therefore it is stated again that too much care cannot be taken to verify the descriptions in the location certificates before an order is requested.

Wherever possible, bearings are taken from the corners set to blazed trees, rocks in place, boulders, and, lastly, to mountain peaks, or permanent objects. The blazed trees and stakes are marked with a timber scribe, and the rocks and stone corners are chiseled.

The tie to a section corner may often be made directly from some convenient point during the process of the survey and the missing course figured from Cor. No. 1, as given above under Location Surveys. As a rule, more or less of a traverse must be made to the section corner and afterwards the direct course from Cor. No. 1 is figured. When the surveyor has a claim that he has previously surveyed for patent in the vicinity, which is tied to a section corner, he may run to this claim and figure his section tie through it. Should he tie through any other claim not his own survey, the work must be thoroughly checked. This practically means that he can use another's survey only as a help to find the section corner. At present, the

surveyor is required to report all these ties as run directly on the ground, from Cor. No. 1 of the claim to the section corner or locating monument. Ties made to a United States locating monument are in every way the same as ties made to section corners.

A general description of the corner or monument tied to must be given in the notes, examples of which will be given later on.

In many districts, such as the Clear Creek and Gilpin districts, the work of connecting the corners of the public survey is greatly facilitated by a number of triangulation systems in which each station of the system is tied to some corner of the public survey. In some cases these triangulation systems are official, and figure on the maps in the surveyor general's office, but in most cases they are simply private aids. With these systems the mineral surveyor has simply to tie to some triangulation station, and at his office has the bearing and distance from this station (with its latitude and departure) all figured out to the section corner. He has only to add this latitude and departure to this traverse to the triangulation station in order to figure his section tie. The triangulation systems are also useful for deflecting lines.

Thus, one may set up on a triangulation station, sight to some other triangulation station, the course of which is known, and thence run to the claim to be surveyed, carrying the course with him. In this way the figuring of a direct observation is avoided. (Plate I.)

Ties to other claims are made from the most convenient points on the survey, but, as a rule, they are much shorter than the section tie. At the present time, these also are reported as run direct upon the ground. In order that the exact position of each conflicting claim may be known,

ties must be made to every corner terminating a line in conflict with the claim being surveyed. In case some of the required corners on a conflicting claim are missing, the lines are treated in a manner to be described later on. In case no corners at all are to be found, and no bearing trees, bearing rocks, etc., it is necessary to tie to the discovery shaft of the conflicting claim. If the discovery shaft cannot be identified, the claim must be treated descriptively; this case will be taken up under examples of figuring. As with the corner of a public survey, the corners of all claims tied to must be described in a general way as stone, post, etc., and the markings noted.

All workings and improvements, such as shafts, tunnels, adits, buildings, etc., are tied in from convenient points on the survey, and the courses and dimensions taken. They are eventually figured to some corner of the claim.

Roads, gulches, creeks, hill crests, county lines, etc., are picked up in the course of the survey and enough of them run out so that they can be indicated on the map and the general direction and intersection with the boundaries of the claim known.

Up to this time the survey has been treated as though one location at a time were being surveyed, or, in the case of many locations, as if each one were being surveyed as a unit. In the case of groups of claims, the surveying may often be greatly simplified by a little forethought. This is evident in the case of those locations which lie side by side, when one surveyed center line may serve for the whole group, the end lines being run from its two ends.

In the case of a whole group where the claims are irregularly arranged, it is well to make a closed traverse including all the discovery shafts, before an application for an order of survey is made. This traverse is then platted

and the claims arranged in the manner best suited to cover the veins and ground desired. The surveyor then figures out the fewest lines that can possibly be run which will take in all the corners and improvements. In this way the running of the center line of each claim is avoided. If the original traverse stakes have remained in place, it is often possible to put in many of the corners from them without further surveying. This applies only in the preliminary work, as in the final survey the Land Office requires that all boundary lines shall be run out. The surveyor must also make sure that he really has a group before the claimant applies for an order for survey; that is, he must be sure that the claims actually conflict continuously or are contiguous, having boundary lines, and not merely certain corners, in common.

After the survey is completed it is carefully platted, usually on a scale of 200 feet to the inch. The use of drawing paper on which a protractor is engraved greatly facilitates the platting. The lines are carried from the protractor by a parallel rule. The plat made, the figuring of intersections and areas is begun.

Angles from Courses

Before taking up patent figuring it will be well to show how the angles of the various triangles are found.

To determine the value of the various angles of triangles, the directions of whose sides are designated by courses, is somewhat confusing to the beginner, especially if he is not thoroughly familiar with field methods. Fig. 37, *A*, *B*, *C* and *D*, shows the four possible cases, the angles in question being the interior angles between solid lines. *A* shows the simplest possible case. Each course being S. W., we simply subtract 20° from 60° and get the angle 40° . In

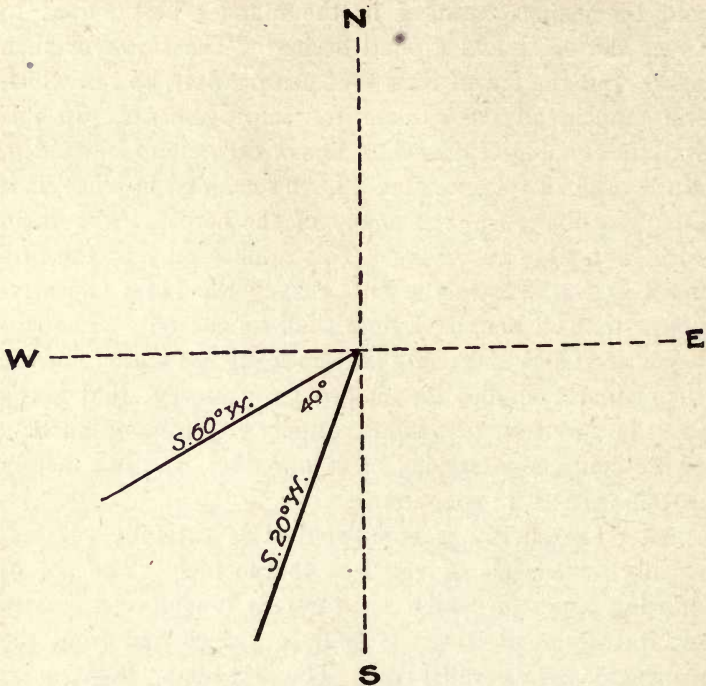


Fig. 37 A

B we have a case, on each side of the north and south line, and the amounts of the two courses have simply to be added to obtain the required angle. Thus $70^\circ + 34^\circ = 104^\circ$. In *C* the amounts of the two courses are added and the sum subtracted from 180° . Thus, $40^\circ + 55^\circ = 95^\circ$, $180^\circ - 95^\circ = 85^\circ$, or $90^\circ - 40^\circ = 50^\circ$, and $90^\circ - 55^\circ = 35^\circ$, $35^\circ + 50^\circ = 85^\circ$, the angle required. For *D* the included angle may be obtained in three different ways. The difference in course may be obtained and then subtracted from 180° , as $60^\circ - 20^\circ = 40^\circ$, $180^\circ - 40^\circ = 140^\circ$, or $180^\circ - 60^\circ = 120^\circ + 20^\circ = 140^\circ$, or $90^\circ - 60^\circ = 30^\circ + 90^\circ + 20^\circ =$

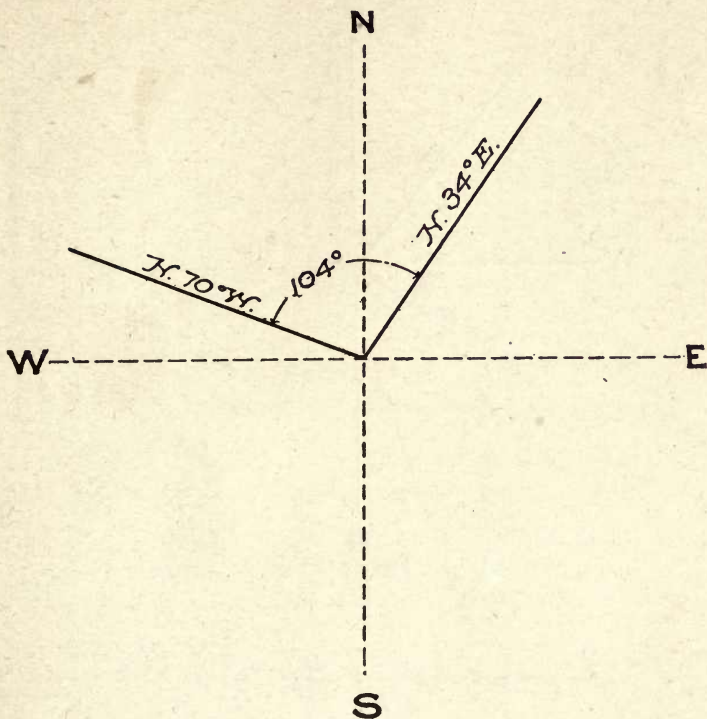


Fig. 37 B

140° , the angle required. The reverse of these methods may of course be used in deriving courses from angles.

Patent Figuring of Survey No. 17846

Taking Sur. No. 17846 in Plate II as the claim to be patented, the section tie from Cor. No. 1 of the claim is figured by means of the missing course of the traverse actually measured from the end center. Thus, beginning at Cor. No. 1, thence to No. 1, thence to No. 2, thence to No. 3, or the section corner, thence by missing course to Cor. No. 1.

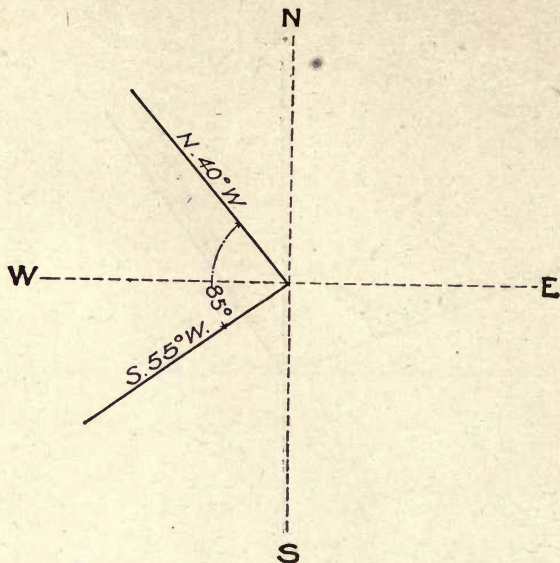


Fig. 37 C

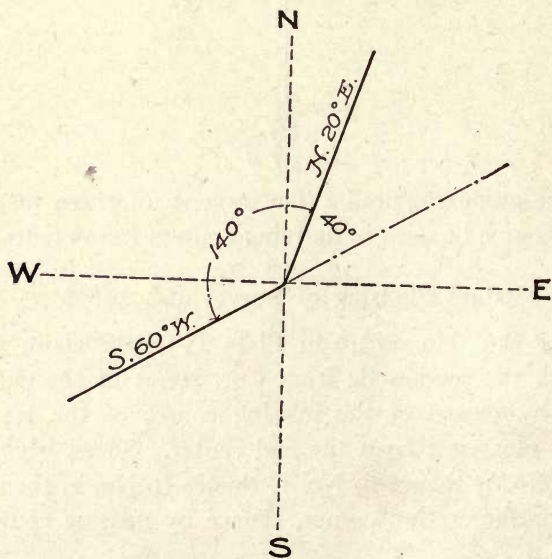


Fig. 37 D

At station.	B. S. station	Vert angle.	Slope dist.	Hor. dist.	True course.	To station.	Remarks.
1	0	0°		335.6	N. 75° E.	4	1 = on end line.
4	1	10	294.6	290.1	N. 75 E.	7	
7	4	11 15'	424.5	416.3	N. 75 E.	8	
8	7	6 30	461.0	458.0	N. 75 E.	9	On end line.
			1500.0				
1	0	12	405.2	396.2	N. 81 W.	2	For sec. tie.
2	1	9	333.7	329.5	N. 50 W.	3	= sec. cor. 6 X 9 X 16 ins. above ground, IIII So.
1	0	0	110.0		N. 75 E.		Dis. 4 X 6, 65 deep. Timbered 30 feet.
4	1	10	482.1	474.8	N. 14 46' E.	5	
5	4	5	218.8	217.9	N. 29 39 W.		1 — 16591 stone
5	4	5	232.5	231.5	N. 54 3 E.	6	2 — 16591 stone.
4	1	0		703.3	S. 4 2 W.		
6	4	4	240.6	240.0	S. 58 19 W.		4 — 16591 stone.
6	4	4	201.7	201.2	S. 26 53 E.		3 — 16591 stone.
4	1	3	87.5	87.4	S. 50 16 E.		1 — 17541 stone.
7	4	0	56.6	56.6	N. 89 22 E.		2 — 17541 stone.
8	7	0	62.3	62.3	N. 40 32 W.		(No cors. at S. end.)
2.12716			300.0	300.0	N. 39 W.		2 — 12716 stone.
8	7	8	151.0	149.5	S. 45 10 E.		1 — 12716 stone.
							4 — 17650 stone.

(Note Cors. 3 and 4 — 12716; Cors. 1, 2, 3, 5, 6 — 17560; known by previous official work.) No cors. or disc found on 1462.

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
Cor. 1 — No. 1.....	S. 15° E.	150.00	.....	144.88	38.82	.....
No. 1 — No. 2.....	N. 81 W.	396.2	61.98	.....	.....	391.31
No. 2 — 3, Sec. Cor...	N. 50 W.	329.5	211.79	.....	.....	252.41
			273.77	144.88	38.82	643.72
			144.88			38.82
			128.89			604.90

$$\log 128.89 = 2.110220$$

$$\log 604.90 = 2.781684$$

$$9.328536 = \cot 77^\circ 58'$$

$$\log 604.90 = 2.781684$$

$$\sin 77^\circ 58' = 9.990351$$

$$2.791333 = \log 618.49$$

$$\text{Missing course} = \text{S. } 77^\circ 58' \text{ E. } 618.49$$

$$\text{Sec. tie N. } 77^\circ 58' \text{ W. } 618.49 \text{ feet.}$$

For the conflicting claim, Sur. No. 16591, the missing courses (the side and end lines) of the line actually traversed show us that the claim is surveyed and described correctly, with an error of not more than 1 foot in 2,000.

PATENT SURVEYS

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
1-16591 — No. 5	S. 29° 39' E.	217.9	.....	189.35	107.78	.....
No. 5 — No. 4.....	S. 14 46 W.	474.8	.....	459.11	.....	121.01
No. 4 — No. 6.....	S. 4 2 W.	703.3	.....	701.55	.....	49.46
No. 6 — 4-16591	S. 58 19 W.	240.0	.....	126.05	.....	204.23
4-16591 — 1-16591	N. 10 15 E.	1500.0	1476.06	.....	266.92	.....
			1476.06	1476.06	374.70	374.70

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
2-16591 — No. 5	S. 54° 3' W.	231.5	.....	135.91	.....	187.40
No. 5 — No. 4.....	S. 14 46 W.	474.8	.....	459.11	.....	121.01
No. 4 — No. 6.....	S. 4 2 W.	703.3	.....	701.55	.....	49.46
No. 6 — 3-16591	S. 26 53 E.	201.17	.....	179.42	90.95	.....
3-16591 — 2-16591 ...	N. 10 15 E.	1500.0	1476.06	.....	266.92	.....
			1476.06	1475.99	357.87	357.87

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
1-16591 — No. 5.....	S. 29° 39' E.	217.9	.....	189.35	107.78	.....
No. 5 — 2-16591.....	N. 54 3 E.	231.54	135.91	.....	187.42	.....
2-16591 — 1-16591.....	N. 79 45 W.	300.00	53.38	.....	.....	295.21
			189.29	189.35	295.20	295.21

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
3-16591 — No. 6.....	N. 26° 53' W.	201.2	179.45	.....	.....	90.97
No. 6 — 4-16591.....	S. 58 19 W.	240.00	.....	126.05	.....	204.23
4-16591 — 3-16591.....	S. 79 45 E.	300.00	.....	53.38	295.21	.....
			179.45	179.43	295.21	295.20

Conflict with Sur. No. 16591

We are now in a position to figure the tie from Cor. No. 1, Sur. No. 17846, to Cor. No. 1, Sur. No. 16591, by missing course as follows:

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
1-17846 — No. 1.....	S. 15° E.	150.00	.....	144.88	38.82	.....
No. 1 — No. 4.....	N. 75 E.	335.6	86.86	.....	324.15	.....
No. 4 — No. 5.....	N. 14 46' E.	474.8	459.11	.....	121.01	.....
No. 5 — 1-16591.....	N. 29 39 W.	217.9	189.35	.....	.....	107.78
			735.32	144.88	483.98	107.78
			144.88		107.78	
			590.44		376.20	

$$\log 590.44 = 2.771176$$

$$\log 590.44 = 2.771176$$

$$\log 376.20 = 2.575419$$

$$\log \cos 32^\circ 31' = 9.926029$$

$$\cot 32^\circ 30' = 0.195757$$

$$\log 700.08 = 2.845147$$

Tie N. 32° 30' E. 700.08 feet.

$$32^\circ 30' \quad 700.0 \quad 590.37 \quad 376.11$$

$$\quad \quad \quad 0.08 \quad \quad \quad 0.06 \quad \quad \quad 0.04$$

$$\text{To check} \quad \quad \quad 590.43 \quad \quad \quad 376.15$$

We now figure the triangle abc , in which we have the course and length of ab given, namely, N. 32° 30' E. 700.08 feet. Subtracting courses to find angles, we get:

$$a = 32^\circ 30' \quad b = 75^\circ 00' \quad c = 10^\circ 15' \quad a = 22^\circ 15'$$

$$10^\circ 15' \quad 32^\circ 30' \quad 90^\circ 00' \quad b = 42^\circ 30'$$

$$\hline 22^\circ 15' \quad 42^\circ 30' \quad 15^\circ 00' = (90^\circ - 75^\circ). \quad c = 115^\circ 15'$$

$$\hline 115^\circ 15' \quad \quad \quad 180^\circ 00'$$

$$\sin 115^\circ 15' : 700.08 = \sin 22^\circ 15' : ?$$

$$\sin 115^\circ 15' : 700.08 = \sin 42^\circ 30' : ?$$

$$\log 700.08 = 2.845147$$

$$\log 700.08 = 2.845147$$

$$\log \sin 22^\circ 15' = 9.578236$$

$$\log \sin 42^\circ 30' = 9.829683$$

$$\text{colog } \sin 115^\circ 15' = 0.043613$$

$$\text{colog } \sin 15^\circ 15' = 0.043613$$

$$\log 293.08 = 2.466996$$

$$\log 522.90 = 2.718443$$

By dividing the above triangle into two right triangles, using as the hypotenuse in each case the distance just found, the triangle may be rapidly checked with a traverse table. (See Fig. 38.)

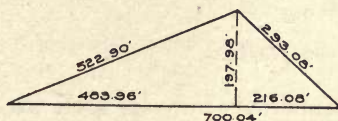


Fig. 38

Angle.	Hypotenuse.	Base.	Perpendicular.
22° 15'	522.90		
	520.00	481.28	196.89
	2.90	2.68	1.09
		<hr/>	<hr/>
		483.96	197.98
42° 30'	293.08		
	290.00	213.81	195.92
	3.00	2.21	2.02
	0.08	0.06	0.05
		<hr/>	<hr/>
		216.08	197.99
483.96			
216.08			
<hr/>			
700.04			

The sum of the two bases of the right triangles equals the length of the original side. The perpendiculars are identical.

The angle e of the right triangle dec is known ($79^\circ 45' + 75^\circ = 154^\circ 45'$; $180^\circ - 154^\circ 45' = 25^\circ 15'$) to be $25^\circ 15'$. We know de is 300 feet, the width of the claim, therefore, 300 is multiplied by the $\tan e$ to get cd . The length of the line ce may be found by multiplying 300 by the nat secant of e , or 300 may be divided by the \cos of $25^\circ 15'$.

log 331.69	= 2.520734	log 331.69	= 2.520734
log 300	= 2.477121	log 300	= 2.477121
colog 43560	= <u>-5.360912</u>		
			4.997855
log 2.284 acres	= 0.358767	log 43560	= <u>4.639088</u>
			log 2.284 acres = 0.358767

The process is somewhat simplified by adding the colog as given above.

Conflict With Sur. No. 17541

In the case of Sur. 17541 we find Cors. Nos. 1 and 2, but not Cors. Nos. 3 and 4. The line 1-2 is found by our survey to be correct and Cors. Nos. 3 and 4 are then placed S. 26° E. 1,500 feet away as given in the notes of the survey for patent of Sur. No. 17541. We then figure the tie from Cor. No. 2, Sur. No. 17846, to Cor. No. 1, Sur. No. 17541.

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
2-17846 — No. 1.....	N. 15° W.	150.00	144.88	.....	.....	38.82
No. 1 — No. 4.....	N. 75° E.	335.6	86.86	.....	324.15	.....
No. 4 — 1-17541.....	S. 50 16' E.	87.4	.....	55.86	67.21	.....
			231.74	55.86	391.36	38.82
			55.86		38.82	
			175.88		352.54	

log 175.88	= 2.245242	log 352.54	= 2.547208
log 352.54	= <u>2.547208</u>	log sin 63° 29'	= <u>9.951728</u>
log cot 63° 29'	= 9.698034	log 393.98	= 2.595480

Tie N. 63° 29' E. 393.98 feet.

63° 29'

300.0	= 133.94	268.44
93.0	= 41.52	83.22
0.98	= <u>0.44</u>	<u>0.88</u>

To check 175.90 352.54

We now find the triangle *jik*:

$$\begin{array}{r}
 j = 63^\circ 29' \\
 \underline{26^\circ} \\
 89^\circ 29'
 \end{array}
 \qquad
 \begin{array}{r}
 i = 75^\circ \\
 \underline{63^\circ 29'} \\
 11^\circ 31'
 \end{array}
 \qquad
 \begin{array}{r}
 k = 26^\circ 180^\circ \\
 \underline{75^\circ 101^\circ} \\
 101^\circ 79^\circ
 \end{array}
 \qquad
 \begin{array}{r}
 j = 89^\circ 29' \\
 i = 11^\circ 31' \\
 k = 79^\circ \\
 \hline
 180^\circ 00'
 \end{array}$$

$$\sin 79^\circ 00' : 393.98 = \sin 11^\circ 31' : ?$$

$$\sin 79^\circ 00' : 393.98 = \sin 89^\circ 29' : ?$$

$$\log 393.98 = 2.595480$$

$$\log \sin 11^\circ 31' = 9.300276$$

$$\text{colog } \sin 79^\circ 00' = 0.008053$$

$$\log 80.13 = 1.903809$$

$$\log 393.98 = 2.595480$$

$$\log \sin 89^\circ 29' = 9.999982$$

$$\text{colog } \sin 79^\circ 00' = 0.008053$$

$$\log 401.34 = 2.603515$$

Then for the triangle *pko'* we have the angle $k = 11^\circ$ ($75^\circ - 64^\circ = 11^\circ$) and as it is a right triangle, we work it as in the case of the triangle *dec* given above.

$$\text{nat tan } 11^\circ = 0.19438$$

$$\underline{300}$$

$$58.314$$

$$\text{nat sec } 11^\circ = 1.0187$$

$$\underline{300}$$

$$305.6100$$

$$\log 300 = 2.477121$$

$$\log \cos 11^\circ = 9.991947$$

$$\log 305.61 = 2.485174$$

With 80.13 from above and 138.44 ($58.31 + 80.13$) we have the two parallel sides of the trapezoid *jkpo*, and the area is found as follows:

$$138.44 \quad \log 109.28 = 2.038541$$

$$80.13 \quad \log 300 = 2.477121$$

$$\underline{2)218.57} \quad \text{colog } 43,560 = \underline{-5.360912}$$

$$109.28 \quad \log 0.7526 = -1.876574$$

$$\log 109.28 = 2.038541$$

$$\log 300 = 2.477121$$

$$\underline{4.515662}$$

$$\log 43560 = 4.639088$$

$$\log 0.7526 = 1.876574$$

To get the net area of the conflict between Sur. No. 17846 and Sur. No. 17541, that is, exclusive of the conflict between Sur. No. 17846 and Sur. No. 16591, we must figure the quadrilateral *jkhr*. From previous figuring we have the distance from Cor. No. 2, Sur. No. 17846, to *k* and *h*, respectively, and by subtracting, we thus get *kh* to be 81.94 feet (483.28 - 401.34). From this we may figure the quadrilateral in two ways: either as two triangles, or by prolonging it to *k'*, and figuring the triangle *jk'r*.

The easiest way to figure *jh* is by missing course as follows:

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
<i>j-k</i>	S. 26° E.	80.13	.....	72.02	35.13	.....
<i>k-h</i>	N. 75 E.	81.94	21.21	.....	79.16	.....
			21.21	72.02	114.29	
				21.21		
				50.81		

log 50.81 = 1.705949	log 114.29 = 2.058007
log 114.29 = 2.058007	log sin 66° 2' = 9.960843
log cot 66° 2' = 9.647942	log 125.07 = 2.097164

Course N. 66° 2' W. 125.07 feet.

66° 2'	100.0 = 40.62	91.38
	25.0 = 10.15	22.84
	0.07 = 0.03	0.06
To check	50.80	114.28

We find the area of *jkh* as follows:

<i>j</i> = 66° 2'	<i>k</i> = 26°	<i>h</i> = 66° 2'	180°	<i>j</i> = 40° 2'
26°	75°	75°	141° 2'	<i>h</i> = 38° 58'
40° 2'	101°	141° 2'	38° 58'	<i>k</i> = 101° 00'
				180° 00'

$$\text{Area} = K = \frac{1}{2} (125.07 \times 80.13 \times \sin 40^\circ 2')$$

log 125.07	=	2.097164
log 80.13	=	1.903795
log sin 40° 2'	=	9.808368
colog 87120	=	<u>-5.059882</u>
log 0.0739	=	-2.869209

log 125.07	=	2.097164
log 80.13	=	1.903795
log sin 40° 2'	=	9.808368
		<hr/>
		3.809327
log 43560	=	<u>4.639088</u>
log 0.1479	=	-1.170239
		2)0.1479
		0.0739 acres

Here it is more convenient to add the colog of 87,120 (43,560 × 2) in place of dividing by 43,560 and afterwards by 2.

In the triangle *jhr* the area is found to be:

$j = 64^\circ$	180°	$h = 10^\circ 15'$	$r = 64^\circ$	$j = 49^\circ 58'$
$66^\circ 2'$	$130^\circ 2'$	$66^\circ 2'$	$10^\circ 15'$	$h = 76^\circ 17'$
<hr/>	<hr/>	<hr/>	<hr/>	$r = 53^\circ 45'$
$130^\circ 2'$	$49^\circ 58'$	$76^\circ 17'$	$53^\circ 45'$	<hr/>
				$180^\circ 00'$

$$\text{Area} = K = \frac{1}{2} \left(\frac{(125.07)^2 \times \sin 76^\circ 17' \times \sin 49^\circ 58'}{\sin 53^\circ 45'} \right)$$

log 125.07	=	2.097164
log to square	=	2.097164
log sin 76° 17'	=	9.987434
log sin 49° 58'	=	9.884042
colog sin 53° 45'	=	0.093425
colog 87120	=	<u>-5.059882</u>
log 0.1656	=	-1.219111

log 125.07	=	2.097164
log to square	=	2.097164
log sin 76° 17'	=	9.987434
log sin 49° 58'	=	9.884042
		<hr/>
		4.065804
log sin 53° 45'	=	<u>9.906575</u>
		<hr/>
		4.159229
log 43560	=	<u>4.639088</u>
		<hr/>
log 0.3313	=	-1.52014

2)0.3313
0.1656 acres
<u>0.0739 acres</u>

Total area *jkhr* = 0.2395 acres.

Another way of calculating the quadrilateral *jkhr* is as follows: We first figure the triangle *kk'h* in which, as we have seen above, we have $kh = 81.94$.

$k = \begin{array}{r} 75^\circ \\ 26^\circ \\ \hline 101^\circ \end{array}$	$\begin{array}{r} 180^\circ \\ 101^\circ \\ \hline 79^\circ \end{array}$	$k' = \begin{array}{r} 10^\circ 15' \\ 26^\circ \\ \hline 36^\circ 15' \end{array}$	$h = \begin{array}{r} 75^\circ \\ 10^\circ 15' \\ \hline 64^\circ 45' \end{array}$	$\begin{array}{r} k' = 79^\circ \\ k' = 36^\circ 15' \\ h' = 64^\circ 45' \\ \hline 180^\circ 00' \end{array}$
---	--	---	--	--

$\sin 36^\circ 15' : 81.94 = \sin 64^\circ 45' : ?$

$\text{Area} = K = \frac{1}{2} \left(\frac{(81.94)^2 \times \sin 79^\circ \times \sin 64^\circ 45'}{\sin 36^\circ 15'} \right)$

$\log 81.94 = 1.913496$
 $\log \text{ to square} = 1.913496$
 $\log \sin 79^\circ = 9.991947$
 $\log \sin 64^\circ 45' = 9.956387$
 $\text{colog } \sin 36^\circ 15' = 0.228185$
 $\text{colog } 87120 = -5.059882$

$\log 0.115 = -1.063393$

$0.115 = \text{area } kk'h$

$\log 81.94 = 1.913496$
 $\log \sin 64^\circ 45' = 9.956387$
 $\text{colog } \sin 36^\circ 15' = 0.228185$

$\log 125.35 = 2.098068$

$jk = 80.13$

$kk' = 125.35$

$jk' = 205.48$

For the triangle $jk'r$ we thus have the base from which we figure the area.

$\log 205.48 = 2.312769$
 $\log \tan 36^\circ 15' = 9.865240$
 $\log 205.48 = 2.312769$
 $\text{colog } 87120 = -5.059882$

$\text{area } jk'r = 0.355 \text{ acre}$

$\text{area } kk'h = 0.115 \text{ acre}$

$\text{area } jkhr = 0.240 \text{ acre}$

$\log 0.355 = -1.550660$

This result checks the first method and gives another method which frequently has to be used.

Conflict With Sur. No. 12716

Taking next our conflict with Sur. No. 12716, we figure the missing course from Cor. No. 4, Sur. No. 17846, to

Cor. No. 2, Sur. No. 12716, using our tie made on the ground from No. 8. We assume that we have found the boundaries of Sur. No. 12716 to be correct.

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
4-17846 — No. 9.....	S. 15° E.	150.00	.....	144.88	38.82	.....
No. 9 — No. 8.....	S. 75° W.	458.00	.....	118.54	.....	442.39
No. 8 — 2-12716.....	N. 40° 32' W.	62.3	47.35	.....	.....	40.48
			47.35	263.42	38.82	482.87
				47.35		38.82
				216.07		444.05

$$\log 216.07 = 2.334595$$

$$\log 444.05 = 2.647432$$

$$\log \cot 64^\circ 03' = 9.687163$$

$$\log 444.05 = 2.647432$$

$$\log \sin 64^\circ 03' = 9.953845$$

$$\log 493.84 = 2.693587$$

Course S. 64° 03' W. 493.84 feet.

$$64^\circ 03'$$

$$400.0 = 175.04 \quad 359.67$$

$$93.0 = 40.69 \quad 83.62$$

$$0.84 = 0.36 \quad 0.75$$

$$\text{To check} \quad 216.09 \quad 444.04$$

The triangles wxz and wxy may be worked at the same time, and the triangle yzx afterwards calculated as a check and for area.

$$\begin{array}{r} w = 75^\circ \\ 64^\circ 03' \\ \hline 10^\circ 57' \end{array}$$

$$\begin{array}{r} x = 64^\circ 03' \\ 51^\circ \\ \hline 13^\circ 03' \end{array}$$

$$\begin{array}{r} y = 51^\circ \\ 90^\circ \\ 15^\circ (90^\circ - 75^\circ) \\ \hline 156^\circ \end{array}$$

$$\begin{array}{r} w = 10^\circ 57' \\ x = 13^\circ 03' \\ y = 156^\circ \\ \hline 180^\circ 00' \end{array}$$

$$\begin{array}{r} z = 75^\circ \quad 180^\circ \\ 39^\circ \quad 114^\circ \\ \hline 114^\circ \quad 66^\circ \end{array}$$

$$\begin{array}{r} x = 64^\circ 03' \\ 39^\circ \\ \hline 103^\circ 03' \end{array}$$

$$\begin{array}{r} w = 10^\circ 57' \\ z = 66^\circ \\ x = 103^\circ 03' \\ \hline 180^\circ 00' \end{array}$$

$$\sin 156^\circ : 493.84 = \sin 10^\circ 57' : ?$$

$$\sin 156^\circ : 493.84 = \sin 13^\circ 03' : ?$$

$$\sin 66^\circ : 493.84 = \sin 10^\circ 57' : ?$$

$$\sin 66^\circ : 493.84 = \sin 103^\circ 03' : ?$$

$$\log 493.84 = 2.693587$$

$$\log \sin 10^\circ 57' = 9.278644$$

$$\text{colog} \sin 156^\circ = 0.390687$$

$$\log 230.63 = 2.362918$$

$$\log 493.84 = 2.693587$$

$$\log \sin 10^\circ 57' = 9.278644$$

$$\text{colog} \sin 66^\circ = 0.039270$$

$$\log 102.68 = 2.011501$$

$$\log 493.84 = 2.693587$$

$$\log \sin 13^\circ 03' = 9.353726$$

$$\text{colog} \sin 156^\circ = 0.390687$$

$$\log 274.16 = 2.438000$$

$$\log 493.84 = 2.693587$$

$$\log \sin 103^\circ 03' = 9.988636$$

$$\text{colog} \sin 66^\circ = 0.039270$$

$$\log 526.61 = 2.721493$$

In the right triangle yzx we have from above $zx = 102.68$.

$$\log 102.68 = 2.011501$$

$$\log \tan 66^\circ = 10.351417$$

$$\log 230.63 = 2.362918$$

$$\log 102.68 = 2.011501$$

$$\log 230.63 = 2.362918$$

$$\text{colog} 87120 = -5.059882$$

$$\log 0.2718 = -1.434301$$

$$0.2718 = \text{area } yzx$$

$$\log 102.68 = 2.011501$$

$$\log \cos 66^\circ = 9.609313$$

$$\log 252.47 = 2.402188$$

To check

$$274.16$$

$$252.47$$

$$526.63$$

Conflict With Sur. No. 1462

In the case of the conflict with Sur. No. 1462, no corners, bearing trees, or bearing rocks could be found, neither could the discovery shaft be identified. The conflict, therefore, must be figured according to its patented or descriptive position and from its section tie. This patented position of Sur. No. 1462 may or may not be its true position, depending on the accuracy of the section tie. In this case a traverse is made from Cor. No. 1, Sur. No. 1462, to section corner (by means of its section tie), thence by section tie to Cor. No. 1, Sur. No. 17846, thence along lines 1-4 and

4-3, Sur. No. 17846, thence by missing course to Cor. No. 1, Sur. No. 1462.

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
1-1462 — Sec. Cor.....	N. 87° 14' W.	2006.4	96.85	.....	.....	2004.06
Sec. Cor. — 1-17846....	S. 77 58 W.	618.49	.....	128.89	604.90	.....
1 — 2-17846.....	N. 75 E.	1500.00	388.23	.....	1448.85	.....
2 — 3-17846.....	S. 15 E.	300.00	.....	289.78	77.64	.....
			485.08	418.67	2131.39	2004.06
			418.67		2004.06	
			66.41		127.33	

$$\begin{aligned} \log 66.41 &= 1.822233 & \log 127.33 &= 2.104928 \\ \log 127.33 &= 2.104928 & \log \sin 62^\circ 27' &= 9.947731 \\ \log \cot 62^\circ 27' &= 9.717305 & \log 143.61 &= 2.157197 \end{aligned}$$

Course S. 62° 27' W. 143.61 feet.

$$\begin{array}{r} 62^\circ 27' \\ 100.0 = 46.25 \quad 88.66 \\ 43.0 = 19.89 \quad 38.12 \\ 0.61 = 0.28 \quad 0.54 \\ \hline \text{To check} \quad 66.42 \quad 127.32 \end{array}$$

From this the triangles *ust* and *vst* are figured.

$$\begin{array}{cccc} v = 32^\circ & s = 62^\circ 27' & t = 15^\circ & 180^\circ \\ 15^\circ & 32^\circ 00' & 62^\circ 27' & 77^\circ 27' \\ \hline 47^\circ & 30^\circ 27' & 77^\circ 27' & 102^\circ 33' \\ & & & 180^\circ 00' \end{array}$$

$$\begin{array}{cccc} u = 75^\circ & 180^\circ & t = 75^\circ & u = 137^\circ \\ 32^\circ & 43^\circ & 62^\circ 27' & t = 12^\circ 33' \\ \hline 43^\circ & 137^\circ & 12^\circ 33' & s = 30^\circ 27' \\ & & & 180^\circ 00' \end{array}$$

$$\begin{aligned} \sin 137^\circ : 143.61 &= \sin 30^\circ 27' : ? \\ \sin 137^\circ : 143.61 &= \sin 12^\circ 33' : ? \\ \sin 47^\circ : 143.61 &= \sin 102^\circ 33' : ? \\ \sin 47^\circ : 143.61 &= \sin 30^\circ 27' : ? \end{aligned}$$

$$\begin{aligned} \log 143.61 &= 2.157197 \\ \log \sin 30^\circ 27' &= 9.704825 \\ \text{colog } \sin 137^\circ &= 0.166217 \end{aligned}$$

$$\log 106.74 = 2.028239$$

$$\begin{aligned} \log 143.61 &= 2.157197 \\ \log \sin 102^\circ 33' &= 9.989497 \\ \text{colog } \sin 47^\circ &= 0.135873 \end{aligned}$$

$$\log 191.67 = 2.282567$$

$$\begin{aligned} \log 143.61 &= 2.157197 \\ \log \sin 12^\circ 33' &= 9.337043 \\ \text{colog } \sin 137^\circ &= 0.166217 \end{aligned}$$

$$\log 45.76 = 1.660457$$

$$\begin{aligned} \log 143.61 &= 2.157197 \\ \log \sin 30^\circ 27' &= 9.704825 \\ \text{colog } \sin 47^\circ &= 0.135873 \end{aligned}$$

$$\log 99.52 = 1.997895$$

In triangle *uvw* we have:

$$\log 106.74 = 2.028239$$

$$\log \tan 43^\circ = 9.969656$$

$$\log 99.52 = 1.997895$$

$$\log 106.74 = 2.028239$$

$$\log 99.52 = 1.997895$$

$$\text{colog } 87120 = -5.059882$$

$$\log 0.1219 = -1.086016$$

0.1219 acre = area triangle *uvw*.

$$\log 106.74 = 2.028239$$

$$\log \cos 43^\circ = 9.864127$$

$$\log 145.92 = 2.164112$$

To check $145.92 = uv$

$$45.76 = wu$$

$$191.68 = vw$$

Conflict With Sur. No. 17560

For Sur. No. 17560 we first find the course and distance from Cor. No. 3, Sur. No. 17846, to Cor. No. 4, Sur. No. 17560, as follows:

Station.	Course.	Dist.	N. lat.	S. lat.	E. d'p.	W. d'p.
4-17650 — No. 8.....	N. 45° 10' W.	149.5	105.40	.....	.....	106.02
No. 8 — No. 9.....	N. 75 E.	458.00	118.55	.....	442.39	.....
No. 9 — 3-17560.....	S. 15 E.	150.00	.....	144.88	38.82	.....
			223.95	144.88	481.21	106.02
			144.88		106.02	
			79.07		375.19	

$$\log 79.07 = 1.898012$$

$$\log 375.19 = 2.574251$$

$$\log \cot 78^\circ 06' = 9.323761$$

$$S. 78^\circ 6' W. \quad 383.43 = \text{course}$$

$$78^\circ 6'$$

$$300.0 = 61.86$$

$$83.0 = 17.11$$

$$0.43 = 0.08$$

$$79.05$$

$$293.55$$

$$81.21$$

$$0.42$$

$$375.18$$

$$\log 375.19 = 2.574251$$

$$\log \sin 78^\circ 06' = 9.990565$$

$$\log 383.43 = 2.583686$$

For the triangle ABt :

$$A = 75^\circ 00'$$

$$34^\circ 08'$$

$$40^\circ 52'$$

$$B = 180^\circ 00'$$

$$78^\circ 06'$$

$$101^\circ 54'$$

$$34^\circ 08'$$

$$136^\circ 02'$$

$$t = 78^\circ 06'$$

$$75^\circ 00'$$

$$3^\circ 06'$$

$$A = 40^\circ 52'$$

$$B = 136^\circ 02'$$

$$t = 3^\circ 06'$$

$$180^\circ 00'$$

$$\sin 40^\circ 52' : 383.43 = \sin 136^\circ 02' : ?$$

$$\sin 40^\circ 52' : 383.43 = \sin 3^\circ 06' : ?$$

$$\log 383.43 = 2.583686$$

$$\log \sin 136^\circ 02' = 9.841509$$

$$\text{colog} \sin 40^\circ 52' = 0.184222$$

$$\log 406.83 = 2.609417$$

$$\log 383.43 = 2.583686$$

$$\log \sin 3^\circ 06' = 8.733027$$

$$\text{colog} \sin 40^\circ 52' = 0.184222$$

$$\log 31.69 = 1.500935$$

For the triangle DAE :

$$D = 75^\circ 00'$$

$$75^\circ 45'$$

$$150^\circ 45'$$

$$318.98 = EB$$

$$31.69 = BA$$

$$287.29 = EA$$

$$180^\circ 00'$$

$$150^\circ 45'$$

$$29^\circ 15'$$

$$A = 75^\circ 00'$$

$$34^\circ 08'$$

$$40^\circ 52'$$

$$D = 29^\circ 15'$$

$$A = 40^\circ 52'$$

$$E = 109^\circ 53'$$

$$180^\circ 00'$$

$$E = 34^\circ 08'$$

$$75^\circ 45'$$

$$109^\circ 53'$$

$$\sin 29^\circ 15' : 287.29 = \sin 109^\circ 53' : ?$$

$$\sin 29^\circ 15' : 287.29 = \sin 40^\circ 52' : ?$$

$$\log 287.29 = 2.458320$$

$$\log \sin 109^\circ 53' = 9.973307$$

$$\text{colog} \sin 29^\circ 15' = 0.311028$$

$$\log 552.91 = 2.742655$$

$$\log 287.29 = 2.458320$$

$$\log \sin 40^\circ 52' = 9.815778$$

$$\text{colog} \sin 29^\circ 15' = 0.311028$$

$$\log 384.70 = 2.585126$$

In order to ascertain the intersection of line 6-1, Sur. No. 17560, and line 4-1, Sur. No. 17846, prolong line 6-1, Sur. No. 17560, with dotted lines, until it touches line 2-3, Sur. No. 17846. Thus we have the triangle *GDF*, of which we have the side *GD*, as follows:

$$500.00 = 5-6-17560$$

$$384.70 = DE$$

$$115.30 = GD$$

$G = \begin{array}{r} 75^\circ 45' \\ 36^\circ 00' \\ \hline 39^\circ 45' \end{array}$	$D = \begin{array}{r} 75^\circ 45' \\ 75^\circ 00' \\ \hline 150^\circ 45' \end{array}$	$180^\circ 00' \\ 150^\circ 45' \\ \hline 29^\circ 15'$	$F = \begin{array}{r} 75^\circ 00' \\ 36^\circ 00' \\ \hline 111^\circ 00' \end{array}$	$G = \begin{array}{r} 39^\circ 45' \\ D = 29^\circ 15' \\ F = 111^\circ 00' \\ \hline 180^\circ 00' \end{array}$
--	---	---	---	--

$$\sin 111^\circ : 115.30 = \sin 39^\circ 45' : ?$$

$$\sin 111^\circ : 115.30 = \sin 29^\circ 15' : ?$$

$$\log 115.30 = 2.061829$$

$$\log \sin 39^\circ 45' = 9.805799$$

$$\text{colog } \sin 111^\circ = 0.029848$$

$$\log 78.97 = 1.897476$$

$$\log 115.30 = 2.061829$$

$$\log \sin 29^\circ 15' = 9.688972$$

$$\text{colog } \sin 111^\circ = 0.029848$$

$$\log 60.35 = 1.780649$$

In the right triangle *JFH* $36^\circ - 15' = 21^\circ$, *JH* = 300 ft.,

$$\text{nat tan } 21^\circ = 0.38386$$

$$\begin{array}{r} 300 \\ \hline 115.158 \end{array}$$

$$\text{nat secant } 21^\circ = 1.071145$$

$$\begin{array}{r} 300 \\ \hline 321.3435 \end{array}$$

$$321.34 = JF$$

$$60.35 = GF$$

$$260.99 = JG = \text{Cor. No. 6-17560 to line 4-1-17846.}$$

In figuring the triangle *ABt* we find Cor. No. 2-17846 to

$$A = 1,500$$

$$406.83 = At$$

$$1093.17 = 2-17846-A$$

From Cor. No. 2-17846 to *D* we have:

$$1093.17 = 2-17846-A$$

$$552.91 = DA$$

$$540.26 = 2-17846-D$$

In the triangle GDF we find FD , and in the triangle JHF we find HF :

$$FD = 78.97$$

$$HF = \underline{115.15}$$

$$HD = 194.12$$

$$\text{Cor. No. 2-17846 to } D = 540.26$$

$$HD = \underline{194.12}$$

$$\text{Cor. No. 2-17846-H} = 346.14 =$$

$$\text{Cor. No. 1-17846 to line 6-1-17560.}$$

In the triangle JKL , line JK is drawn parallel to line 1-2-17560.

$J = 75^\circ 00'$	$K = 34^\circ 08'$	$L = 36^\circ 00'$	180°	$J = 40^\circ 52'$
$34^\circ 08'$	$36^\circ 00'$	$75^\circ 00'$	111°	$K = 70^\circ 08'$
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
$40^\circ 52'$	$70^\circ 08'$	$111^\circ 00'$	69°	$L = 69^\circ 00'$
				<hr/>
				$180^\circ 00'$

$$\sin 69^\circ : 318.98 = \sin 40^\circ 52' : ?$$

$$\sin 69^\circ : 318.98 = \sin 70^\circ 08' : ?$$

$$\log 318.98 = 2.503764$$

$$\log \sin 40^\circ 52' = 9.815778$$

$$\text{colog } \sin 69^\circ = \underline{0.029848}$$

$$\log 223.55 = 2.349390$$

$$\log 318.98 = 2.503764$$

$$\log \sin 70^\circ 08' = 9.973352$$

$$\text{colog } \sin 69^\circ = \underline{0.029848}$$

$$\log 321.34 = 2.506964$$

$$1000.00 = 6-1-\text{Sur. No. 17560.}$$

$$260.99 = JG$$

$$739.01 = 1-\text{Sur. No. 17560 to 1-4-Sur. No. 17846.}$$

$$223.55 = KL$$

$$962.56 = 2-\text{Sur. No. 17560 to 1-4-Sur. No. 17846}$$

$$346.14 = 1-\text{Sur. No. 17846 to line 6-1-Sur. No. 17560.}$$

$$321.34 = JL$$

$$667.48 = 1-\text{Sur. No. 17486 to line 2-3-Sur. No. 17560.}$$

$$1000.0$$

$$962.56$$

$$37.44 = 3-\text{Sur. No. 17560 to line 4-1-Sur. No. 17846.}$$

Areas of Sur. No. 17560.

We first figure the area of the trapezoid JL 3 6 and the

parallelogram represented by Cors. Nos. 3, 4, 5 and 6 of Sur. No. 17560.

$$\begin{array}{r} 260.99 = J\ 6 \\ 37.44 = L\ 3 \\ \hline 2)298.43 \\ 149.21 \end{array}$$

$$\begin{array}{r} \log 149.21 = 2.173798 \\ \log 300 = 2.477121 \\ \text{colog } 43560 = -5.360912 \\ \hline \log 1.027 = 0.011831 \end{array}$$

$$\begin{array}{r} 500 \\ 300 \\ \hline 150000 = 5.176091 \\ \text{colog } 43560 = -5.360912 \\ \hline \log 3.443 = 0.537003 \end{array}$$

Area for the triangle *DAE*

$$\begin{array}{r} \log 552.91 = 2.742655 \\ \log 287.29 = 2.458320 \\ \log \sin 40^\circ 52' = 9.815778 \\ \text{colog } 87120 = -5.059882 \\ \hline \log 1.193 = 0.076635 \end{array} \quad \begin{array}{r} 1.027 \\ 3.443 \\ \hline 4.470 \\ 1.193 \\ \hline 3.277 \end{array}$$

3.277 = Total area in conflict between Surs. Nos. 17846 and 17560.

To find the area in conflict between Sur. No. 16591 and Sur. No. 17560 within Sur. No. 17846, we figure the area of the triangle *JeN*.

$$\begin{array}{r} J = 75^\circ \quad 180^\circ \quad e = 75^\circ 00' \quad N = 36^\circ 00' \quad J = 69^\circ \\ \quad 36^\circ \quad 111^\circ \quad \quad 10^\circ 15' \quad \quad 10^\circ 15' \quad e = 64^\circ 45' \\ \hline \quad 111^\circ \quad 69^\circ \quad \quad 64^\circ 45' \quad \quad 46^\circ 15' \quad N = 46^\circ 15' \\ \hline \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 180^\circ 00' \end{array}$$

$$\begin{array}{l} 624.77 = 1\text{-Sur. No. } 17846 - 2\text{-}3\text{-}16591. \\ 346.14 = 1\text{-Sur. No. } 17846 - 6\text{-}1\text{-}17560. \end{array}$$

$$\begin{array}{r} 278.63 = Je \\ \sin 46^\circ 15' : 278.63 = \sin 64^\circ 45' : ? \\ \log 278.63 = 2.445028 \\ \log \sin 64^\circ 45' = 9.956387 \\ \text{colog } \sin 46^\circ 15' = 0.141244 \\ \hline \log 348.87 = 2.542659 \end{array}$$

$$\begin{array}{r} \log 278.63 = 2.445028 \\ \log \sin 69^\circ = 9.970151 \\ \log 348.87 = 2.542659 \\ \text{colog } 87120 = 5.059882 \\ \hline \log 1.041 = 0.017720 \end{array}$$

In the triangle *GNM*

348.87 = <i>JN</i>	G = 75° 45'	N = 36° 00'	M = 75° 45'	180°
260.99 = <i>JG</i>	36° 00'	10° 15'	10° 15'	86°
87.88 = <i>GN</i>	39° 45'	46° 15'	86° 00'	94°

G = 39° 45'
N = 46° 15'
M = 94° 00'
180° 00'

$$\text{Area} = \frac{1}{2} \left(\frac{(87.88)^2 \times \sin 39^\circ 45' \times \sin 46^\circ 15'}{\sin 94^\circ} \right)$$

log 87.88 = 1.943890	
log to square = 1.943890	1.041 = area <i>JeN</i> .
log sin 39° 45' = 9.805799	0.041 = area <i>GMN</i> .
log sin 46° 15' = 9.858756	
colog sin 94° = 0.001059	1.000 = net area in conflict of Surs.
colog 87120 = -5.059882	Nos. 17560 and 16591 within Sur. No.
log 0.0410 = -2.613276	17846.

We now figure the area in conflict of Sur. No. 17560 and Sur. No. 17541 within Sur. No. 17846 which is *QopDG*.

By previous work we have found the total conflict of Sur. No. 17541 and Sur. No. 17846 to be .752 acres. We have also found the area of the quadrilateral *jrhk* to be .240 acres. We must now find the area of *QrMG*. In order to figure the area of the triangle *QrN* it is necessary to find the length of one side, which we will take to be *rN*. In previous figuring the area of the triangle *jr h* was obtained and from the data used in that work we find the side *rh* as follows:

j = 64° 00'	180° 00'	r = 64° 00'	h = 10° 15'
66° 02'	130° 02'	10° 15'	66° 02'
130° 02'	49° 58'	53° 45'	76° 17'
sin 53° 45' : 125.07 = sin 49° 58' : ?			

log 125.07	= 2.097164	$j = 49^\circ 58'$
log sin 49° 58'	= 9.884042	$r = 53^\circ 45'$
colog sin 53° 45'	= 0.093425	$h = 76^\circ 17'$
log 118.75	= 2.074631	<hr/> 180° 00'

In the small triangle FhN we must obtain the side hN .
We have the side Fh , as follows:

483.29 = 2-Sur. No. 17846 to line 2-3, Sur. No. 16591.

461.29 = 2-Sur. No. 17846 to F .

$22.00 = Fh$.

$F = 75^\circ$	180°	$h = 75^\circ 00'$	$N = 36^\circ 00'$	$F = 69^\circ 00'$
36°	111°	$10^\circ 15'$	$10^\circ 15'$	$h = 64^\circ 45'$
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
111°	69°	$64^\circ 45'$	$46^\circ 15'$	$N = 46^\circ 15'$
				<hr/>
				$180^\circ 00'$

$\sin 46^\circ 15' : 22.00 = \sin 69^\circ : ?$

log 22.00	= 1.342423	$Nh = 28.44$
log sin 69°	= 9.970152	$hr = 118.75$
colog sin 46° 15'	= 0.141244	<hr/>
		$rN = 147.19$

log 28.44	= 1.453819	$Q = 64^\circ$	180°	$r = 53^\circ 45'$
$r = 64^\circ 00'$	$N = 10^\circ 15'$	36°	100°	$N = 46^\circ 15'$
$10^\circ 15'$	$36^\circ 00'$	<hr/>	<hr/>	$Q = 80^\circ 00'$
<hr/>	<hr/>	100°	80°	<hr/>
$53^\circ 45'$	$46^\circ 15'$			$180^\circ 00'$

Area triangle $QrN = \frac{1}{2} \left(\frac{(147.19)^2 \times \sin 53^\circ 45' \times \sin 46^\circ 15'}{\sin 80^\circ 00'} \right)$

log 147.19	= 2.167878
log to square	= 2.167878
log sin 53° 45'	= 9.906575
log sin 46° 15'	= 9.858756
colog sin 80°	= -0.006649
colog 87120	= -5.059882
<hr/>	
log 0.1471	= -1.167618

Subtracting from this the area of triangle GMN , found in previous work to be .0410 acre, we have:

0.1471
<hr/> 0.0410
<hr/> 0.1061 acre = $QrMG$.

In the small triangle hMD , we have $hD =$

$$540.26 = 2-17846 \text{ to } D$$

$$483.29 = 2-17846 \text{ to } h$$

$$56.97 = hD$$

$$\begin{array}{cccccc}
 h = 75^\circ 00' & M = 75^\circ 45' & D = 75^\circ 45' & 180^\circ 00' & h = 64^\circ 45' \\
 \quad 10^\circ 15' & \quad 10^\circ 15' & \quad 75^\circ 00' & 150^\circ 45' & M = 86^\circ 00' \\
 \hline
 64^\circ 45' & 86^\circ 00' & 150^\circ 45' & 29^\circ 15' & D = 29^\circ 15' \\
 & & & & \hline
 & & & & 180^\circ 00'
 \end{array}$$

$$\text{Area} = \frac{1}{2} \left(\frac{(56.97)^2 \times \sin 64^\circ 45' \times \sin 29^\circ 15'}{\sin 86^\circ} \right)$$

$$\log 56.97 = 1.755646$$

$$\log \text{ to square} = 1.755646$$

$$\sin 64^\circ 45' = 9.956387$$

$$\sin 29^\circ 15' = 9.688972$$

$$\text{colog } \sin 86^\circ = 0.001059$$

$$\text{colog } 87120 = -5.059882$$

$$\log 0.0165 = -2.217592$$

$$0.752 = \text{area } jkop$$

$$0.240 = \text{area } jrkh$$

$$0.512 = \text{area } rhop$$

$$0.016 = \text{area } hMD$$

$$0.496 = \text{area } ropDM$$

$$0.106 = \text{area } QrMG$$

$$0.602 = \text{area } QopDG$$

We therefore have found the total area in conflict of Sur. No. 17846 and Sur. No. 17560 to be 3.277 acres.

The net area in conflict of Surs. Nos. 17560 and 16591 within Sur. No. 17846 to be 1.000 acre.

The total conflict of Surs. Nos. 17560 and 17541 within Sur. No. 17846 to be .602 acre, and the net conflict of Surs. Nos. 17560 and 17541, within Sur. No. 17846 (that is, exclusive of $QrMG$, .106 acre) to be .496 acre.

Therefore, the net conflict of Surs. Nos. 17560 and 17846 is:

$$1.000 \text{ acre} = JeMG$$

$$0.496 \text{ acre} = ropDM$$

$$1.496 \text{ acres}$$

$$3.277 \text{ acres}$$

$$1.496 \text{ acres}$$

$$1.781 \text{ acres, net conflict.}$$

The result may be checked by double meridian distances as follows:

Station.	Course.	Distance.	Latitudes.		Departures.		Double M. D.	N. areas.	S. areas.
			N.	S.	E.	W.			
B-A.....	S. 34° 08' W.	31.69	.....	26.23	.....	17.78.	17.78	.....	466.37
A-P.....	S. 75 00 W.	386.22	.....	99.96	.....	373.06	408.62	.....	40845.65
P-O.....	N. 26 00 W.	138.44	124.43	.....	.....	60.68	842.36	104814.08	.....
O-T.....	S. 64 00 W.	149.33	.....	65.47	.....	134.23	1037.27	.....	67910.06
T-E.....	N. 10 15 E.	212.94	209.54	.....	37.89	.....	1133.01	237536.56	.....
E-L.....	N. 75 00 E.	42.71	11.05	.....	41.25	.....	1054.47	11651.90	.....
L-3.....	S. 36 00 E.	37.44	.....	30.29	22.00	.....	991.22	.....	30024.05
3-B.....	S. 75 45 E.	500.00	.....	123.07	484.61	.....	484.61	.....	59641.00
			345.02	345.02	585.75	585.75		354002.54 198887.13	198887.13
								2) 155115.41	
								77557.7	sq. ft.

log 77557.7 = 5.8896249

log 43560.0 = 4.6390879

log 1.780 = 1.2505370

The area statement for Sur. No. 17846 would be as follows:

	Acres
Total area Sur. No. 17846.....	10.330
Area in conflict with —	
Sur. No. 1462.....	0.122
Sur. No. 12716.....	0.272
Sur. No. 16591.....	2.284
Sur. No. 17541.....	0.752
Sur. No. 17541 (exclusive of its conflict with Sur. No. 16591)....	0.513
Sur. No. 17560.....	3.277
Sur. No. 17560 (exclusive of its conflict with Sur. No. 16591)....	2.277
Sur. No. 17560 (exclusive of its conflict with Sur. No. 17541)....	2.675
Sur. No. 17560 (exclusive of its conflict with Surs. Nos. 16591 and 17541).....	1.781

The following net area statement is not at present included in the field notes sent to the surveyor general, but is filed on separate sheet.

	Acres
Total area Sur. No. 17846.....	10.330
Less area in conflict with —	
Sur. No. 1462.....	0.122
Sur. No. 12716.....	0.272
Sur. No. 16591.....	2.284
Sur. No. 17541.....	0.513
Sur. No. 17560.....	1.781 = 4.972
Net area lode claim.....	<u>5.358</u>

In case of an irregular mill site or placer the calculations of the area by double meridian distances must be handed in with the field notes. The calculations have been taken up under mill sites and placers.

It is well to be systematic in making and filing the above calculations. Many prefer books of uniform size, but it is very difficult for more than one person to work on the same case at the same time and keep the calculations together in the same book. It is also difficult to copy from

one page to another as is often necessary. The writer prefers to use traverse blanks printed and blocked. On these the traverse is first worked and the triangles and areas figured underneath on the same sheet. These sheets are then filed in Congress manila envelopes in document files. In this way any number of people may work on the same case without getting into each other's way. The papers of each survey are kept together in order, and all useless figuring and any calculations found to be in error are destroyed and do not encumber the record.

Miscellaneous Points on Patents

Various points may arise in figuring or writing up the notes that need attention. For example, it frequently happens that by excluding areas in the usual way a discovery shaft is excluded. To avoid this, a tract is made around the discovery shaft, and one corner of the tract is tied to a corner of the claim, and the tract described by metes and

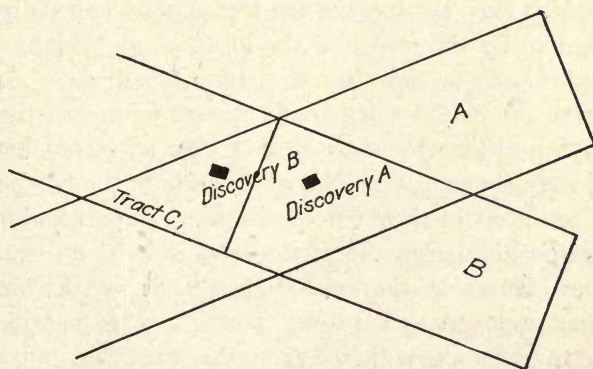


Fig. 39

bounds. In Fig. 39, if either *A* or *B* excludes the other, they respectively exclude their discovery shafts. To avoid this the conflict is described as follows:

	Acres
Total area <i>A</i> lode.....	5.165
Area in conflict with —	
Tract <i>C</i> (hereinafter described).....	0.310
<i>B</i> lode of this survey.....	0.840
<i>B</i> lode of this survey (exclusive of its conflict with tract <i>C</i>).....	0.530

The following net area statement is not at present included in the field notes sent to the surveyor general, but is filed on separate sheet.

	Acres
Total area <i>A</i> lode.....	5.165
Less area in conflict with tract <i>C</i>	<u>0.310</u>
Net area <i>A</i> lode.....	4.855

This tracting of the discovery is useful sometimes in conflict with a location survey. If *A* above is a location survey, a small tract, just large enough, may be made round the discovery shaft of *B* and not excluded with the remainder of the conflict of *A* with *B*. This small reservation, which may not be over ten feet square, is usually not objected to by the owner of the location, and might even be deeded back to him after the patent is issued.

During the period when conflicts were figured in the descriptive positions by their section ties, as stated before, tracts were frequently employed to exclude the conflicting claim or claims in their true positions. Thus, when figuring the position from the section ties showed no conflict, but the corners on the ground clearly showed a conflict, this was excluded as a tract. Tracts are frequently employed to exclude any desired area other than that embraced in an officially surveyed claim.

In case the discovery is unavoidably excluded the claim may still be patented according to the present rulings of the general land office by producing proofs that there is a

valid discovery of mineral at some other point on the center line not excluded.

Here it may be observed that for about five years between June, 1899, and August, 1904, the General Land Office required all claims to be figured according to their patented positions, as we have figured Sur. No. 1462, regardless of the existence or position of the monuments on the ground. As the section ties of many claims varied from a few feet to many thousand feet from the correct distance, the official plats issued during the period mentioned above often give a very erroneous idea of the conditions actually existing on the ground. The surveyor dealing with claims surveyed within the time mentioned must bear clearly in mind the conditions under which the surveys were made.

In case errors are found in the surveying and description of conflicts, the conflicting claim must be platted and figured as actually found on the ground, and a note added to the field notes filed with the surveyor general's office about as follows:

I find the following errors in the lines of former approved surveys:

Sur. No. 16162, Alice Lode:

Line 1-2, S. $16^{\circ} 10'$ W. 147.8 ft. instead of S. $16^{\circ} 50'$ W. 150 ft., as approved.

Line 2-3, S. $73^{\circ} 50'$ W. 1,406 ft. instead of S. $73^{\circ} 10'$ W. 1,500 ft., as approved, etc.

The mineral surveyor who made the conflicting survey which is found to be in error then files amended notes covering the errors in question. In case he does not admit that there is an error, a joint survey is called for at the expense of the one who is found to be wrong.

Mineral surveyors, however, rarely require an official

joint survey to settle their differences, and disagreements are, as a rule, arranged privately and the reports made in accordance with the facts. Here it must be remembered that an error of one in two thousand, or about two minutes in course is allowed by the surveyor general. Thus it is evident that two surveyors may differ from each other one in one thousand, or three minutes in course, and yet each be within the limit of allowable error.

All the intersections and areas having been figured for the claim, a plat is made on tracing cloth, on the dull side, and the notes are written up as in the example of field notes given later.

In case the claim has been narrowed on one side, so that the vein, and therefore the discovery, is not in the center of the claim, a tie must be given to it from some corner of the claim.

Claims are frequently cut short when, on account of conflicts, no acreage is obtained by patenting the full length. This of course often reduces the amount of figuring necessary, but it is sometimes objected to by the claimant, as he frequently thinks it desirable to be able to state that he has a claim 1,500 feet long, even if it gives him no more acreage than if the claim were only 800 feet in length and on clear ground. It must here be remembered that for many years the General Land Office required all claims either to cross a conflicting claim completely with the center line, or else cut off the claim at the point where the center line intersected the boundary lines of the conflicting claim. In fact, for a brief period no crossings at all were allowed by the General Land Office.

In case the claim has been cut off for any reason, a tie must be given in every case from the corner set to the original corner of the location.

It is sometimes advisable in very complicated cases to write up the notes in advance of the actual figuring, leaving blank spaces, which are filled systematically as the calculations proceed. In this way repetitions and omissions are avoided.

In the matter of improvements, the so-called "\$500 worth of work," the Land Office is constantly changing its opinion. For many years \$500 worth of work sufficed for a whole group of locations, no matter how many, provided that the work was done for their common benefit. This was in accordance with a decision of the Supreme Court of the United States, which regarded a group of locations as one claim. At present \$500 worth of work is required for each claim, though it need not necessarily be on each claim. A tunnel can thus be used to patent a whole group, provided there is \$500 worth of work which can be shown to be for the benefit of each location, or a total of as many dollars as there are locations in the group multiplied by \$500. In case this mutual benefit cannot be shown for certain locations, other work must be in evidence. It cannot be too strongly stated that the utmost care must be taken by the mineral surveyor in preparing his mutual benefit statement to bring out strongly the fact of the mutual benefit of the improvements in the event that there is not actually \$500 worth of work on each claim. Neglect of this has caused a great deal of trouble in the subsequent dealings with the General Land Office. When the claim being patented is contiguous to a patented claim belonging to the same claimant, work done on the patented claim may apply towards the \$500 worth of improvements, provided the work has never been used in patenting any other claim, and also provided that it can be shown to be of benefit for the claim in question, and both these facts must be stated in the field

notes. This can be done only when the claims are contiguous, and under the same ownership or, when not contiguous, in the case of a tunnel, when the work is actually under the claims being patented.

All of the improvements need not be used in patenting if there is a possibility of their being used later on for other claims as \$500 expenditure. Where there is a chance of this in the future it is well to claim only enough improvements necessary to patent the claim in question. But it must be remembered that all improvements must be subsequent to the date of location of the claims which are thus benefited. (See 39 of the manual.)

At the time the survey is approved the required \$500 for each location may not have been completed, or it may happen that more improvements are required at a later date by the General Land Office. In this case, the surveyor makes a supplementary affidavit of labor. This is made on a form furnished by the surveyor general's office, and the surveyor repeats or revises all the data given in the approved field notes, and then adds the description of the new work. He also states, as is required, that the work was completed before the period of advertising expired. For this affidavit the surveyor general requires an additional fee.

Should it be desired to take the whole or any portion of a piece of ground that has been surveyed and advertised for patent, though no patent has actually issued, it is usually necessary to have the application for this claim cancelled before the ground or any portion of it can be included in a later application.

The surveyor must be careful, in the case of mill sites, to see that it is clearly shown that they are used for mining purposes and not merely to take up land or water.

They may legitimately contain mills and reduction works, dumps, necessary roads, cabins, storehouses, etc., actually used in connection with mining operations, and the fact must in each case be clearly shown.

It will be well, in the case of a survey of any claims or group of claims that are at all out of the ordinary, to find out, from the surveyor general having jurisdiction, just what is the proper procedure in the particular case in question. In this way future troubles may often be avoided.

Adverses and Protests

In surveys for adverse, the claim adverting is tied to the official survey adversed exactly as described in previous sections, and the area in conflict figured in the same way. Improvements should be also noted as in patent surveys. The net area in conflict is then described by metes and bounds and this description had best be traversed carefully to make sure of a closure. An adverse plat is finally prepared, usually on a scale of 200 feet to the inch, on tracing cloth and the area in conflict colored. The mineral surveyor signs a statement as follows:

I hereby certify that the above diagram correctly represents the conflict claimed to exist between the Little Annie lode and the Belle lode as actually surveyed by me. And I further certify that the value of the labor and improvements on the Little Annie lode made by the adverse claimant (and his grantors) is not less than one hundred dollars.

**JOHN SMITH,
United States Mineral Surveyor.**

When there is not time to figure the conflict completely, the adverse plat may be filed with the ties and boundaries

of the conflicting claims, and the improvements of the claim adverting, and the complete description may be sent in later. In case it is impossible to make the adverse survey, as, for example, on account of deep snow, the best statement possible of the facts should be made at once and a proper survey made later. The attorney for the claimant prepares all the papers in an adverse suit, as well as in a protest suit, which latter, from the standpoint of the surveyor, is practically the same as an adverse suit. The surveyor simply supplies the attorney with the plat and the description of the conflict.

The mineral surveyor who is surveying claims for patent should avoid all possible cause for adverse or protest proceedings by leaving out all ground clearly belonging to others. In spite of his best efforts, his claims will occasionally be adversely and his advice may be called for in connection with the settlement of the case, or he may be cited as a witness. Should the case be fought to a finish in the courts, he has no influence. In case of a compromise, by which the claimant patenting loses the area in conflict or any portion of it, the simplest solution is usually to deed this area to the contestant after the receiver's receipt is issued. In case the area is simply left out in the final application to purchase, the Land Office will call for an amended plat at some later date, with attendant delay and expense. The amended plat will be called for in any case where any area is excluded in the final application to purchase, and is not shown in the field notes approved by the surveyor general. While this is all part of the attorney's work, and really has nothing to do with the actual surveying, it is well for the surveyor to keep in mind the probable subsequent actions of the General Land Office, in order to provide for the best interests of his clients,

TRIANGULATION SURVEY IN CLEAR CREEK COUNTY, COLORADO.

