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MINE SURVEYING.

BY WILLIAM HIBBS.

This is a very common subject to many people, but the fact of its being common is like many other things that are conducted in old and narrow channels and for years and years make no change in their form or usefulness, until necessity or common sense, the Mother of all invention leads them out in a new way under improvement. Ninety-two years ago the surveyor laid out this part of our grand state into sections and quarter sections. They followed the magnetic needle through the dense forests from sun-rise to sun-set. Since that time the county surveyors have hunted for those lines and divided those quarters while the magnet varied from hour to hour, sometimes knowing they were right but frequently allowing a very wild guess.

With the mining engineer the case is different. He has long since departed from the guidance of the needle. He has a different *modus operandi* in a different place; a different work for a different purpose. And let me say just here, that, it is not the desire to write of other states, but as to Ohio, a great amount of its mine surveys are not creditable to the profession. County surveyors and railroad engineers have no love for the miners and little affinity for the mines. This accounts for the fact that so much mine work is done in a careless and indifferent way, and when the work is platted upon the paper in map form, it is inelegant, inconvenient and of little practical benefit except to fulfill the law and to avoid law-suits. Mine inspectors pay little attention to surveys, and of course many operators regard them as an unnecessary expense. And true, many are such.

The writer has seen a number of mine maps of this class. One in my recollection was drawn with a lead pencil upon manilla paper. All that could be seen was the entries, or rather the stations taken with straight lines drawn from one to the other. The work cost the operator \$45.00, and he said it was not even correct. You need not go outside Jackson County to find this map and the man who made it. Another was platted upon vellum cloth. The work was correct, but several entry lines, which were the only ones shown, extended beyond the

edges of the paper. These and a part of the boundary lines and buildings connected were the only things mapped. It cost the owner \$230.00, and if viewed by a stranger, it could not be told from a part of the Jungles of Africa. This chart was the work of one of the profession in Guernsey County. Many others could be mentioned, but these are sufficient. They belong to the class which may be regarded as an expense, but, that expense should yield a profit if the work were rightly done. The value of a good map can hardly be estimated.

A mine map should contain among many other features the following points of interest:

1. The property lines of the territory and parts of the adjoining lands.
2. The approximate crop lines of the property and that of the lands adjoining.
3. The location of all roads, railroads and buildings.
4. The meanderings of all water courses and ravines.
5. The forms of relief of the surface by contours and the elevation of important points inside the mine.
6. The correct form and size of the underground workings.

The surface lines are first to demand the engineers attention, and upon them depends not only the shape of the property but in many cases a division of royalties must be made according to their position. The location of each corner must be done accurately according to the best evidence, the records of the public surveys and the rulings of the Commissioners of the General Land Office.

Each surveyor has his own particular way of doing things, and indeed the state of an engineers ability lies in his being ready with a plan for anything at any time, and his having the stemana to carry it out. Probably the best way to locate the property lines is to first find one corner. Then from the records take the bearing to the next as nearly as can be calculated by known movements of the needle, being sure there is no magnetic disturbance, and if there is, to turn it off.

After deciding upon this approximate bearing, lift the needle from its pivot and range the line by use of the transit telescope, setting stakes, with tops flush with the ground, at important and especially at places where a wide view of the surroundings can be taken in the future. No stake should be hid from view from the nearest two. Measure the horizontal distance from the beginning to each stake and also the full length of the required line, setting a stake at the end. From this the second corner can be located. Then take its bearing and distance to it. This new survey can be platted and the two corners located upon the

map when a straight line can be drawn from one to the other, thus making the first true line of the survey. In a similar way other lines may be ranged out and the corners located, and when put upon the map, will constitute the property lines, while the different stakes upon them will serve in the future as reference in obtaining the location of any point in the true lines.

The crop lines are of much importance, because when rightly traced they show the shape and size and the possible extent of the underground workings, besides they serve as a guide in laying out plans of mining. In surveying them it is well to use a combined transit and leveling instrument. (There are none better than those made by Heller & Brightley of Philadelphia, Pa.) The start should be at a well known spot where the seam comes to the surface, or at the pit mouth of a drift mine at or above water level. After taking the height of the instrument upon the rod, let it be carried forward to a spot exactly on a level with the point of beginning when the bearing can be taken from the needle and the distance read from the rod by the stadia wires. Thus will follow one course after another, checking up or down as the case may require at any and all points where the seam can be seen or found conveniently. After following out the cropings through the entire tract and as much more as would be of benefit, and after platting the survey a number of points will be found on the paper by which the line may be drawn practically correct.

The location of roads, railroads, buildings and water courses may generally be made by taking notes by the use of the stadia wires and as the other work proceeds, but when the streams and ravines lay above the underlying strata a careful survey of them must be made, which may be done by starting from a well known datum and by the needle, stadia rod and wires, read the bearing, distance and elevation of every station along their courses and at all points where the tops and bottoms of all strata occur readings should be made, that the elevation and position of the overlying rocks, when platted upon the map, will show to the mine manager where to locate his works in the future. By this he can see at a glance where or in what direction to look for dips and rises, and by the position of the ravines to avoid deluging the mine by letting in some stream of water. Location of faults in some cases may be made when no knowledge of them otherwise exists.

Last but not least, the forms of relief may be considered. This part of the survey can be accomplished in the following manner: By stadia measurement starting upon the former datum and from this and the points whose elevations are known

from the former work, take readings for distance, bearings and elevations to all points that may serve in getting the height at different places on the surface. Then extend this work to new points until a net work extends over the entire territory. When this is platted, showing position and elevation of all the points, contours may be drawn among them, thus showing the thickness of the overlying strata and the shapes of the hills and valleys.

Much more could be said, but not in this short paper, and the author will cease by saying that the underground works should be traced correctly and extended at convenient periods and mapped in a separate color each time. The levels should also be taken for all inside points, with reference to the surface datum, and marked upon the map in a different color from surface figures.

Thus a mine map may be made that would be of some use to its owner. It would serve him in making his calculations, and if the chart be constructed before he commences his work it might save him a great unnecessary outlay of capital and labor, for it is always best to know previous to any work, all that is possible to know.

Let an exact copy of this plan be made, divided into convenient sections and numbered and then cut apart. This sectional map can be carried, entire or in parts, into the mine or about the works, where reference to it can be had without the trouble of going to the office and unrolling the large one.

Regretting that I can not be present at this meeting, and wishing the Institute unbounded success, I am,

Yours truly,

WILLIAM HIBBS.

Scio, O., Jan. 16, 1893.

MR. E. D. HASELTINE: Mr. President, I read that paper over once before reading here, and as I went along in my reading it seemed to me there were two or three points I would wish to sit down upon. In running my outcrop line I have endeavored to follow as nearly as I could the practicable line of minable coal and not the outcrop mine of the coal, and in doing that we must be governed very largely by judgment rather than by taking the elevation—the known height of the coal, because it will depend upon the contour of the ground as to whether they could mine out the crop line or not.

Now as to his making a duplicate map and cutting it into sections; I think I have a much preferable plan to that. In the last

few years of my surveying, I have discarded entirely the making of maps on heavy paper. I make simply a tracing, and I put all I desire to have appear in the map on the tracing, and then I put that in a blue print frame and I send one to the superintendent, and one to the pit boss and keep one myself. Then by a simple inspection of the tracing I had the last time, the tracing I sent the last time, will show the difference or the extent of the mining. When I used to send a good map, when it came back it would be all covered with oil and marked up with lead pencil. By this other plan they are always in my office so that I know where they are. In regard to contour lines, it don't seem to me there is any necessity to run contour lines. I never have bothered with that. I have endeavored to make the mine according to the wishes of the people or the operators rather than of any set rule as to what I would do or not do.

SECRETARY HASELTINE: Mr. President, this paper was in line with my occupation for about twenty years, and it is a very excellent paper and has a great deal in it that gives a great deal of valuable advice. The writer has evidently confined his practice exclusively to the coal that is above drainage, while my practice was for a great many years almost exclusively in the coal fields that were below drainage. In speaking of maps and what they should contain, I have been annoyed greatly in my present position in attempting to secure maps for filing in the office of the chief inspector of mines of the state, which would be a matter of absolute record and one that future generations could take in their hands and go upon the ground and locate the position and the extent of territory excavated in old mines at any time. I have never, with the exception of a few maps that came from a portion of the state which modesty will prevent me from locating—never have received a map with the exception of those from any part of the state that I did not have to return one to three times to have them corrected and extended and details put in, so that a person could tell even what county they were in. There is a lot of maps up in my office numbering several hundred, that I will venture there is not a gentleman in this audience or a gentleman in the State of Ohio, civil or mining engineer, that can take that

map and tell where it belongs. It will fit just as well in Mr. Haseltine's district in Mahoning County or in Jackson or in any county in the state, and no man living can tell where it does belong. Still they are preserved there among the archives of the State of Ohio and are of no earthly use. I have maps that after returning three times for the purpose of having the certificate of the surveyor or the bank boss as to their correctness, to have the land lines put on, section, township or some monument and to have it connected by a line to some important point in the mine, so that in the future that portion could be located and the rest of the mine traced, and after having it sent back three times, it came back in its original form, no better, if not worse. Now this subject of making mine maps is not one that can be stereotyped; that is, no single rule will do under all circumstances. Mines that are above water drainage should be made and can be made very differently from those in which the coal is at great depth. Maps made of those veins of coal which lie substantially level can be made very much different from those that lie in the block coal regions, in which the basins are deposited in large troughs planed out of the conglomerate rock and the basins are surrounded on all sides by immense hills in which the coal runs up to a feather edge. Mr. Hibbs paper I desire should be read by the mining engineers of the state and that they will follow it as long as I am inspector of mines, because then we will have no trouble in tracing the mines if they follow out the directions in the Massillon or Mahoning fields, Summit and Portage and Jackson County, and above all, Jackson County. These mines are below drainage, and as fast as they are worked out and abandoned, they are filled with water. and two or three times during my term of office people found basins of coal in their vicinity and the question of the proximity of these old abandoned mines became one of vital importance. Then we looked up the maps and found they were made probably years before the mine was exhausted and the extent of territory mined out was entirely unknown. The location of the old works was hard to determine. We had to take into account the accuracies and inaccuracies of the persons who made the maps, and as a matter of fact we have never approached a mine in any instance in which we had any certainty from maps

on file in the office as to the extent of the excavation, and we always had to approach these mines with search holes. Last Summer we had a very serious time in Guernsey County, where Mr. Turner had a very serious time with that matter. If the old mines had been correctly mapped it would have saved a great deal of trouble. I desire to extend to Mr. Hibbs and Captain Morris a vote of thanks for their very able papers.

MR. W. B. HANLON: I think Mr. Hibb's paper is full of information. While he does not go into the details of mapping as far as this gentleman that read it has gone into it, I will give you somewhat of my history of some of my practice. I have never had very good satisfaction from using stadia wires as a means of measurement. That is, I have never depended upon it. As to these crop lines, it has been my practice to run them out 25 feet above the coal vertical height. And where we buy coal land by the acre we buy it at that line that would give solid coal, that would work out without danger of water getting in or caves. Of course the privilege should be granted of driving out to the surface for air or water. As to the map, I make these maps on mounted paper. I find that a map I made in 1884 on paper has been used continually since that and it is now in a very much dilapidated condition. It requires the very best paper to stand the handling. The mine is now measured up every six months. That map is gone over every six months. I have found that after making a map of a territory on mounted paper and making a tracing of it, that on coming to fit that on the map again you will find that it won't fit, and especially where you use colors on the tracing, the dampness of the colors causes shrinkage and you will have trouble fitting it on. So I would not advise depending upon a tracing alone. Make your map on just as heavy paper as you can get and then make a tracing from that, and from that tracing I blue print. In some mines I have charge of I make blue prints for the working parts of it and carry with me when I measure up. At another mine where I have charge I use a map 5 by 9 feet wide, and I take that every six months and have it photographed on an 8 by 10 negative and make blue print off that negative and carry that with me in measuring up. The

print is plain enough so that you can see every room in there and break through and cut through, and it is very convenient to carry in cases of that kind. It makes a very convenient copy to give to the manager or superintendent of the mine or to the bank boss. The inspector there is very familiar with this mine in Belmont County. It has been opened for about 13 years. I expect it is one of the largest mines where every room in the mine is shown in the state.

SECRETARY HASELTINE: That is the Wheeling Creek mine in Belmont County.

MR. W. B. HANLON: Yes sir, it has been eighteen years in operation, and I don't think there is a room in that mine but is on that map, and on there in its proper position. I measure that up every six months. The superintendent keeps a tracing of it. After I have finished my measurement he sends me the tracing and I enter it up on my original and make a tracing off it and return the tracing to him, and I also return to him probably a half dozen copies of this negative for his own use; and in that way it goes on from year to year. I find that mine bosses become addicted to the use of a map. The mine boss at Wheeling Creek can take that map up and block out work ahead just as well as any one can, because he has become used to it and knows just how many rooms he can get out to a certain crop line or how long the entry is. He has learned the use of the scale and can measure on a map. I think this matter of mine maps ought to be presented more and more to the managers of coal companies throughout the state. I am sure that the chief inspector has done his part in that line, because it would aid him a great deal to have a correct map of every mine in the state. Now I believe the state law requires that whenever the inspector calls for it a measuring up must be made. That period I think depends upon the vein of coal a great deal. In some mines the rooms will stand up for a year. In other places we have trouble to hold them up for six months. I have charge of one mine where the order now is to measure up every four months. Still I measured rooms there a few months ago that had been mined out two years I think.

That is in No. 6 coal. But in No. 8 coal, when a room is worked out it is a very few days until it is caved in. I believe that is all.

THE CHAIR: There is a vote of thanks proposed to Mr. Hibbs and Captain Morris by Mr. Haseltine.

Motion prevailed.

THE CHAIR: I understand that Mr. Houston, of The Thompson-Houston Electric Co. is with us to-night. We will be glad to hear him.

MR. HOUSTON: I am a stranger and really did not know that you were expecting me to say anything here, or else I would be better prepared to say a few words. But, not coming closely to the subject of electricity, allow me to diverge a little. I heard your remarks about maps of the State of Ohio in the mining department, and it is certainly a surprise to me that they are not accurate. A gentleman over there spoke about blue prints. I would state that by electricity in the mines you can take your blue prints on white grounds in black lines by means of electric current. You may make a tracing and put it under the glass and get your blue print from that any time in the night or day. In speaking of electrical mining, the Thompson-Houston people are now paying special attention to doing away with horses and mules in the mines. We have a special electrical locomotive that will go into any room and take the coal from the rooms and put it into the entries and fit it up for the general make-up of the track. I did not come here to make a solicitation of trade to you but I only want to explain what we are doing. We also have first class electrical drills, etc., and when the Thompson-Houston people take hold of a mining plant, they do not turn it over to the operators until it is perfect in every particular. Electrical mining has come to stay. The coal operators of the Hocking Valley or any region in these United States cannot do without it and you gentleman will take it, you will accept it just as you do your cup of coffee. Electrical mining has come and it is bound to stay. I was down in the Hocking Valley nearly all summer and I must give credit to the Hocking Valley as being the most scientific miners in the United States. I must give you credit for

being the most scientific operators that there are in these United States anywhere. I don't wish to flatter you, but such is the truth.

SECRETARY HASELTINE: You spoke about your having a mine locomotive that will run into the rooms. Do you mean you have a locomotive that you can run in over the ordinary track and run in on a wooden rail, Mr. Houston.

MR. HOUSTON: Yes sir. If I had known I would be called upon, I should have brought you people prints, etc.

SECRETARY HASELTINE: You have to have a trolley run into every room?

MR. HOUSTON: Yes sir. We have a locomotive that will do the same work as horses or mules. Now in the Hocking Valley it costs to remove your coal about a cent and a half per ton. The locomotive will do it for seven-tenths of one cent per ton and the Thompson-Houston Co. is able to back that up.

A MEMBER: Did I understand you to say that was a portable electric lamp?

MR. HOUSTON: Oh yes, you can move it anywhere. All you have to have is the regular blue print frame and put your light at the back of the glass. Of course you have to have a 32 candle power lamp, and after you make your drawing or tracing you can put it under the ordinary blue print glass and you can easily get a blue print. You can also use a white print on black ground.

FORMER SPEAKER: I don't know whether you understood my question or not. Does the lamp I am speaking of, the electric lamp, is it to be carried in the hand by the workers?

MR. HOUSTON: Oh, no.

A MEMBER: The electricity is sent into the mine by a wire?

MR. HOUSTON: Oh yes, sir, by the electric current. Excuse me. I would say that there is a company starting to estab-

lish an electric general power company in the Hocking Valley to supply an electric current to all mines within a radius of eleven miles; so this electrical company, that is, the Thompson-Houston Company, will put a current in the mouth of each mine within that radius. It works on the same principle as the power plant down here supplies current to the railroads. We propose to put a current at the mouth of each mine at so much per ton that passes over the tipple.

SECRETARY HASELTINE: That is, a central power plant?

MR. HOUSTON: Yes sir, that is the idea. From the center of that circle to the mouth of each mine we will have to carry a current of 650 volts, but when we touch the mouth of the mine we put a step down transformer there which gives the mine a power of 220 volts, which is safe to life or limb. You can use the current to cut your coal, run your locomotives, run your fans and pumps, all by the same current, and light up your mines and take your blue prints right there. It will revolutionize the mining industry, but it has to come and it will come. It is only a question of time. But we hope to have this plant there and in working order by the 1st of October.

A MEMBER: Did I understand you to say that the Thompson-Houston Company have coal cutters?

MR. HOUSTON: Yes sir.

A MEMBER: Are there any at work?

MR. HOUSTON: Yes sir, and I have received orders within the past few days from Mr. Turney and from the Knoxville Coal Co. of Tennessee.

A MEMBER: Perhaps you misunderstood my question. I asked if there were any coal cutters now in operation.

MR. HOUSTON: Yes sir, we have them in operation in the anthracite region in Pennsylvania.

A MEMBER: Are those the same cutters that are adapted to bituminous coal?

MR. HOUSTON: No sir, a cutter that will work in anthracite coal will not work in bituminous coal.

THE CHAIR: I think we are all under obligation to Mr. Houston for his courtesy in giving us this information.

SECRETARY HASELTINE: I move that the association extend a vote of thanks to Mr. Houston for his interesting talk on electricity.

The motion being seconded, prevailed.

THE CHAIR: Before we go to any other business, I would like to call attention to a matter which has been brought to my attention. Messrs. Veit & Perfler of this city have an exhibit of instruments here to which I have been requested to call the attention of the members of the institute. They have brought a number of their instruments here and they invite your attention to them.

SECRETARY HASELTINE: Mr. President, it is getting late and I move you we suspend the meeting here for the evening and take up whatever was left over at a convenient time tomorrow or to-morrow evening. I move we adjourn until nine o'clock standard time.

The motion being seconded, prevailed, and the institute adjourned until Friday morning, January 20, at 9 o'clock A. M.

FRIDAY, JANUARY 20, 9 O'CLOCK A. M.

The Institute was called to order by Secretary Haseltine, who said:

Gentlemen: Prof. Lord will not be here this morning, as he is at the Ohio State University preparing his plans for our entertainment this afternoon. Will some one suggest a suitable person to act as President this morning.

A MEMBER: I would suggest Captain J. L. Morris to act as President pro tem.

The motion being seconded prevailed and Captain Morris took the chair.

SECRETARY HASELTINE: Now Mr. President and gentlemen of the Institute: As we are going along, there are several things we want to attend to that can be progressing while the Institute is in session; and one that I wish particularly to call your attention to is the revision of the by-laws, as I alluded to it in my report last evening. The original anticipation of the Institute was that it was to be exclusively an Ohio affair. We thought then that was taking in an immense scope. We have grown now until our membership extends all over the state and to other states. We have applications from men of other states who will be of great aid to us. I desire now to make a motion that a committee of three be appointed to revise the constitution and report the revision at the evening session, so that these gentlemen may be legally elected members of the institute. I make that in the form of a motion, that the chair appoint a committee of three to revise the constitution and report this evening.

The motion being seconded, prevailed.

THE CHAIR: I will appoint on that committee William B. Hanlon, T. H. Love and Edwin D. Haseltine. You may now retire, gentlemen, and report to us.

THE CHAIR: In the absence of Mr. Rennie, who is not here in time, we will call upon Prof. F. W. Sperr, of the Ohio State University, to read his paper on "Sewerage, Drainage and Water Supply," and I see he has lots of pictures here.

PROF. SPERR: Mr. President, when one has to announce his subject before he has written his paper, he has to make it very general, and "Sewerage, Drainage and Water Supply" of course is very broad in its scope and I felt sure that if I announced that as the subject I could bring my paper within the subject as announced by the secretary. But it would perhaps better be named something about the sewerage of Columbus and a certain water supply on the State University grounds.