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Ohio Mining Journal

Title: Practical Mining

Creators: [Love, Thomas H.](#)

Issue Date: 1895

Citation: Ohio Mining Journal, no. 24 (1895), 85-100.

URI: <http://hdl.handle.net/1811/32695>

Appears in Collections: [Ohio Mining Journal: Whole no. 24 \(1895\)](#)

E. D. HASELTINE



THOMAS H. LOVE.

PRACTICAL MINING.

THOS. H. LOVE, DIST. MINE INSPECTOR, LEESVILLE, OHIO.

Mr. President and Gentlemen of the Institute :

It is not my intention to worry you with a lengthy article on Practical Mining, for upon this subject volumes have been written and perhaps the half has never been told. This subject should be presented and discussed with the sole object in view of giving to the operator the greatest possible profit on his capital invested, giving to the miner an equal premium on his labor, and at the same time throwing around him equal security to his life and health.

Yesterday you listened to the views of a gentleman who has been practically trained in the mines of fourteen counties in England. This experience would no doubt require volumes within itself to fully relate and my subject being closely in touch with his paper on long wall, I will confine my remarks to the operating of three seams of coal known as Nos. 6, 7 and 8 in the geological columns of Ohio, without giving a detailed description of these valuable coal measures. I desire to say that these seams have many natural advantages and are largely developed in the fifth mining district, where my duties have been for the last five years.

These mines are invariably worked on the double entry system, with a continuous air current for ventilation, which is by no means perfect, and I think I am safe in saying will not be, so long as the system is in use, regardless of the amount of air in circulation. The miner is compelled to break two tights in driving his room up and can only have good ventilation while he is near the break-throughs and after picking, drilling and shoveling all day he finds that forty per cent. of the labor has gone through a one and one-fourth inch space; and in all probability if the screen was abolished entirely he would be compelled to throw a large portion of the fine coal in the gob, it being of little value in the market.

I have prepared a pencil sketch on a large scale, practically showing four systems of working the seam referred to. No. 1 shows the double entry system with defective ventilation, loss of

coal and unnecessary yardage. There are twenty-nine rooms, thirty feet apart, making eight hundred and seventy-three yards of room neck. Supposing the pillars between the rooms to be two yards thick, there would be one hundred and twelve yards of break-throughs, making a total of one hundred and ninety-nine yards; and in many cases short rooms are met with and the yardage is paid for with little or no profit. The break-throughs are made irregular when the roof is bad in order to keep the rooms from falling in before they are driven to the required distance.

Plan No. 2 shows that all the coal may be taken out by leaving entry pillars and carrying the track close to the rib, making the rooms say eighteen feet wide, and bringing the pillars of a like thickness back within a safe distance from the entry.

Plan No. 3 shows a long wall advancing system with pack-walls, gateways, etc. This system having been discussed, I will leave it and go to plan No. 4, where entries can be driven any distance apart desirable, bringing the section back on a long wall retreating plan, thus avoiding the yardage, timber and loss of coal and carrying the track and air current always along the face. I do not hesitate in saying that any of the seams referred to can safely be worked on this system unless it is under streams of water or near abandoned workings containing water or gas which is confined at high pressure.

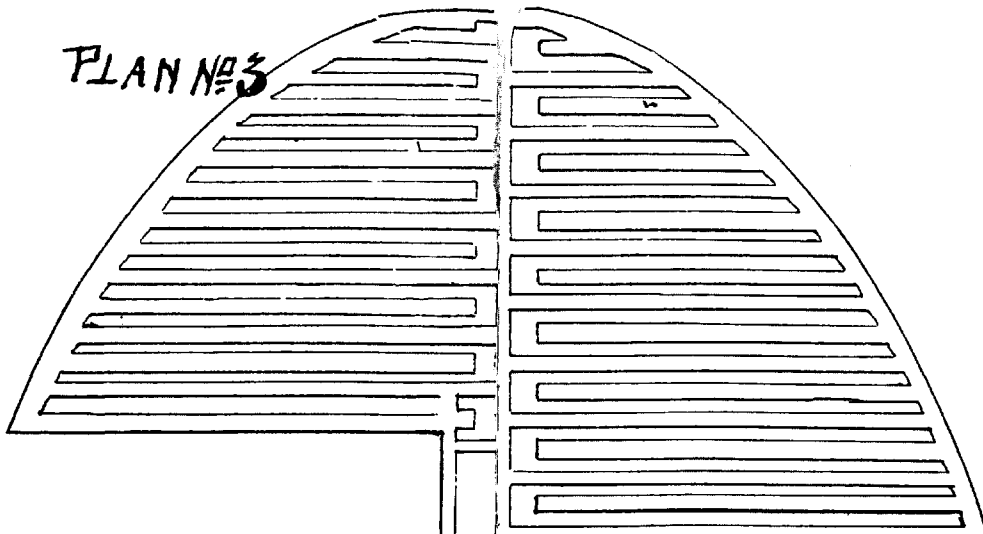
Prudence dictates that narrow work is really essential under these circumstances. The double entry, or post and stall system, are both extravagant and impractical when it is desired to obtain the best returns for the capital invested. The loss of coal by the present system has been estimated to be thirty per cent.; but taking into consideration the amount of coal mined that is of no value, I am of the opinion that the loss in some of the veins will reach fully forty per cent. When we take into consideration that we are getting but two-thirds of our birthright through the lack of skill in reclaiming it, it is high time that the attention of the commonwealth is called to the matter with the hope that our mineral treasures may be preserved for the use of future generations.

After completing the reading of his paper, Mr. Love explained in detail the several plans outlined on his map.

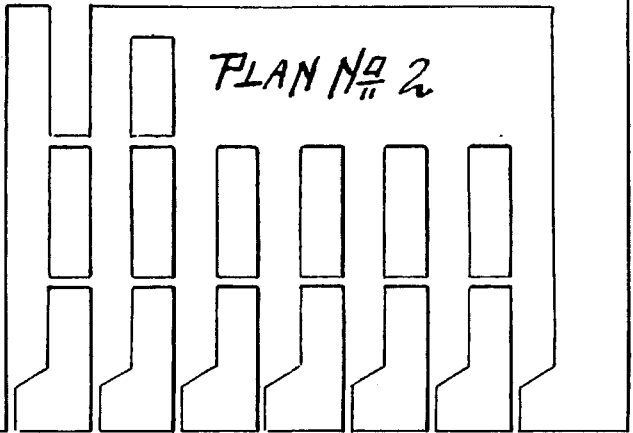
THE CHAIR: You have all heard Mr. Love's paper and his explanation of his map. Are there any remarks in regard to it?

MR. DOE: I would like to ask Mr. Love if he considers the system of long wall retreating applicable to any coal field in Ohio,

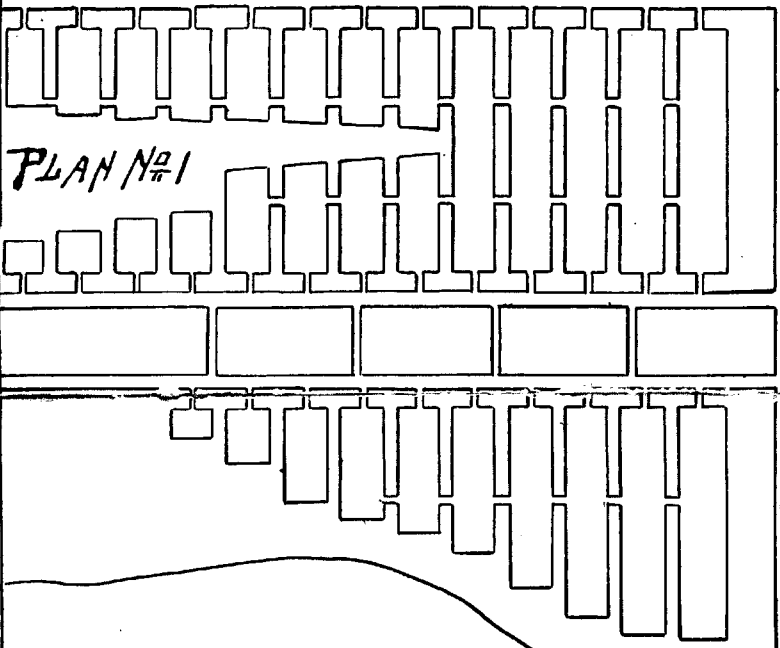
PLAN №3



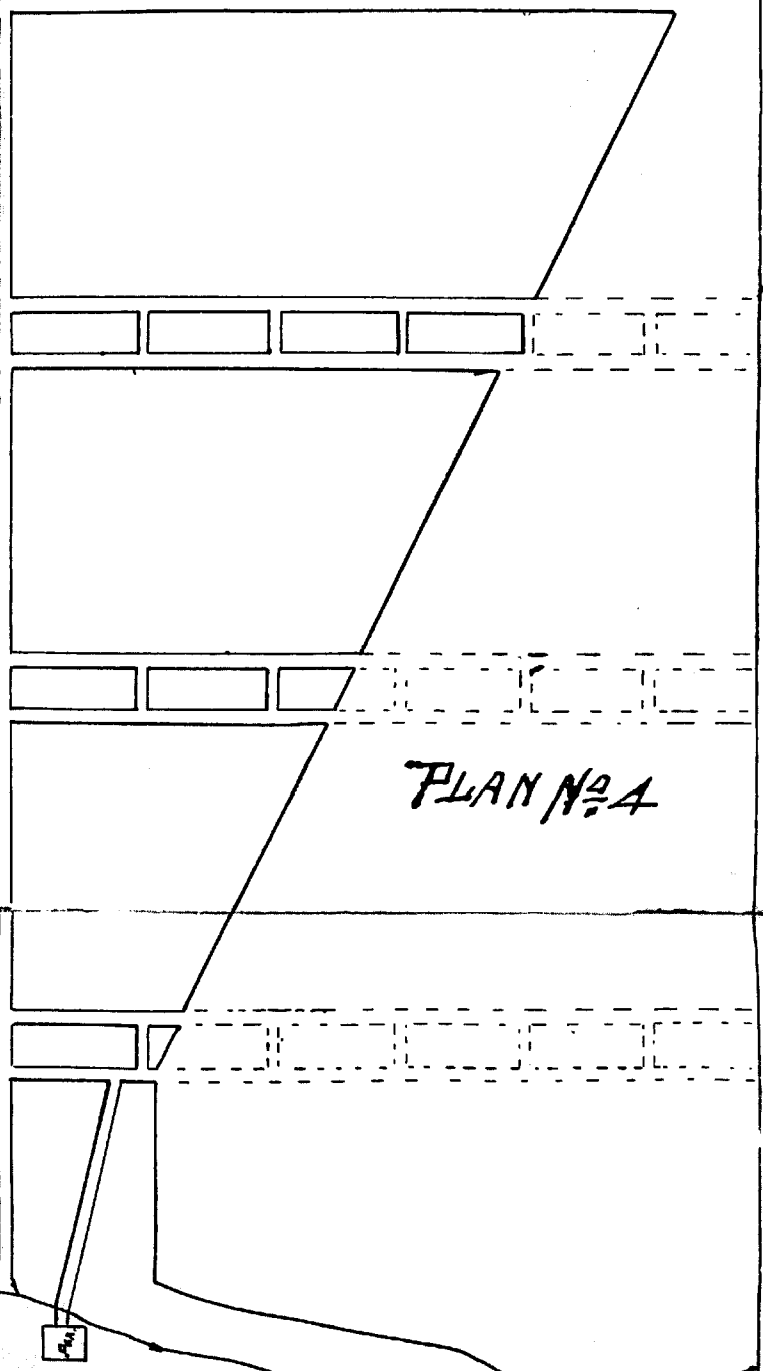
PLAN №2



PLAN №1



PLAN №4



PLAN №1

—for instance, in the Hocking valley or in the Guernsey county field where shafts range from fifty to a hundred feet deep.

MR. LOVE: I will answer that it can be applied to any seam of coal I know in Ohio, and it does not make any difference as to the thickness of the coal, nor very much as to the nature of the roof. And I think it can be worked better than room and pillar or long wall advancing.

MR. WEST: I have worked in that system you speak of.

MR. DALRYMPLE: In the fourth plan you have there, how would you handle four hundred miners? If you were going to work four hundred miners on that system, how much territory would have to be opened up?

MR. LOVE: I would open up on this side and on this (indicating on map).

MR. DALRYMPLE: How many miners could work between each pair of entries?

MR. LOVE: That would be owing to the number of feet you give him,—same as long wall mining.

MR. DALRYMPLE: Can you work more than three or four miners?

MR. LOVE: Certainly. This is intended to show one hundred yards (indicating on map). I think you could work twenty to thirty miners in one section.

MR. DALRYMPLE: Wouldn't that plan require too much narrow work and too much excavation to employ that many miners.

MR. LOVE: You can calculate that—the narrow work.

MR. DALRYMPLE: What I want to get at is, would you not have to drive narrow work in that lump of coal in order to get that number of miners in there to bring it back. It seems not possible to work over four or five miners on either side of that entry

(indicating on map) in order to run across there (indicating) and connect with the other miners driving to the center of that solid coal.

MR. LOVE: This is the crop here (indicating on map). We drive across here (indicating) a room say twenty-four feet wide, and carry a brattice up there to ventilate. There is no other means to ventilate. You are not paying for any yardage and it is a saving to carry a brattice and put in the number of miners you have room for. And it is the same with this section, and this, and this (indicating).

MR. DALRYMPLE: Very well; I wanted to understand this. I have seen it worked and I don't believe any company in Ohio has territory sufficient to work a force of four hundred miners by that plan. You see there is one pair of entries for ten men, for you can't work more than five miners in any one place and make any headway, practically speaking; and where five miners are working together they don't get along very fast. In order to work that many miners there must be some other plan or system, and the way to do it is to drive narrow work between those entries, up to the boundary and commence and bring the coal all back. Then if the miners at the head of the entry haven't got the coal back close enough so there is coal enough left to protect the entries, they must stop and let the other men bring it back.

THE CHAIR: I would like to ask why there could not as many men work in there as if there were rooms?

MR. DALRYMPLE: Because there is no company in Ohio that I know of that has territory sufficient to employ four hundred miners, working by that plan, making the entries one hundred yards apart.

THE CHAIR: How much frontage would you give a man in long wall advancing.

MR. DALRYMPLE: As much as you please.

THE CHAIR: I suppose, when working long wall mining, you are supposed to get it worked out as fast as possible.

MR. DALRYMPLE: I want to show that this plan is not successful, because you cannot work enough miners to get the coal out in Ohio. I have no objection to that system, but I believe more narrow work is needed, although most of the operators prefer bringing in their tonnage as they proceed. Where I saw it done was where there was a very bad roof and they could not work any other way. They drove too much narrow work and had to abandon it. They drove too much narrow work to get enough miners to work it.

THE CHAIR: As I understand Mr. Love, he has here just marked out a block and is not showing the whole mine.

A MEMBER: Mr. President, it occurs to me that it would take a longer time to open a mine up on that system, but after it was done there is no reason why as many men should not be worked as in any other system. Taking a section a hundred feet long and giving each man twenty feet to work on, you could work fifteen men on a section and increase the sections, and I think it would be cheaper.

MR. WEST: It is seldom the case that the maximum output can be reached until twelve or eighteen months. In that time I think any of the mines in this State could reach the extremes of the coal field.

MR. LOVE: You can very near as soon open out for the same number of men by this system, as by the double entry system. You could reach one of the extremes of the field and put in the required number of men. I saw an account some time ago of a system similar to that. I don't know the exact number of men who could work between the entries, but I think somewhere about twenty. You could bring the cars in on one entry and take the full ones out on the others, and these men would be working between the entries.

A MEMBER: I desire to ask a question. You made the assertion that this is a good plan in any kind of slate roof that you know of,—I believe you made that assertion?

MR. LOVE: Yes, sir; I said that.

MR. BROPHY: I would just say that I have visited mines in the Appalachian coal field in four or five different veins, from a foot up to fourteen feet thick, and that system could not be worked in any of them. The possibility would be in every one of those seams, if you would drive a room up here (indicating on map) and make an excavation at the head of that room thirty feet square, you would have a cave-in and it would cave from eight to ten feet back, below solid coal. Suppose it was only eight feet wide—six or eight feet—the rock would jam tight against there and nothing on earth could stop it. All the cribbing you could do would not stop it.

MR. LOVE: Where is it?

MR. BROPHY: In West Virginia, in the Appalachian coal fields.

MR. WEST: Did they try that plan?

MR. BROPHY: No, sir; it would be impossible. They are working the double entry system. The trouble is caused by the nature of the rock. Where we are as soon as you make an excavation of thirty feet, it will run back as high as fifteen feet.

MR. LOVE: What is that rock?

MR. BROPHY: It is a slate and heavy sandstone. One vein there has this heavy wall,—it is as hard as iron.

MR. LOVE: There is some cause for that.

MR. BROPHY: It is the nature of the rock. It breaks right against the coal and nothing can help it.

MR. LOVE: Is it a gaseous mine?

MR. BROPHY: No, sir; no gas in it.

MR. WEST: Don't it carry the rooms up to the proper distance before it falls?

MR. BROPHY: Yes, sir.

MR. MOSS: Is there a surface anywhere in the United States where they could work that system? It would be natural that it would choke up and cause you to drive new entry work. Every time it fell it would cause you to make new openings to get started again. I also think it would be a failure for the reason that it would break the hill all around. I learned that the first principle of hill working was to keep the outcrops solid and not break all around. It is a certain thing if you get the weight on it, it is no longer safe or profitable. I also think it would be a failure because no company to my knowledge would take that plan and work to the extreme of their territory before they would get any return. Generally companies go into coal mining to make money and they must get returns to carry on the business.

MR. ———: I am sure it would be a failure in that field, because there are four seams through the Georgesville region, none of which would stand the work. You can drive up to the head of this room, same as this (indicating on map), and after getting out there, open out a space of thirty feet and it will make a fall every time, and if near the crop, before that time.

MR. LOVE: You drive room and pillar work now?

MR. ———: Rooms fourteen feet wide and leave a block of thirty feet between rooms. Leave a stump thirty by fifteen feet, and in drawing that about half way out—in many cases not half of it comes—and it throws the coal in every direction. It is a fourteen foot vein and it would be impossible to work it this way.

MR. LOVE: How deep is the mine?

MR. ———: They are generally drift mines.

MR. LOVE: That pencil sketch simply shows a hill of coal. I don't care with what system, whether it is above water level or below. Now the gentleman said it would bring the weight on the mine. We want to bring the weight on all the coal. We want to break it off on the edges to keep the weight off the

center. There is but the natural weight of the earth, which the coal has always held, and certainly if there is a weak spot it is likely to fall in at any time. If you have a good seam of coal you don't need to work to the extreme boundaries. I tried to explain that a while ago, but I was probably not understood. You can work in sections. For instance, there is a shaft here (indicating on map) and coal all around. You can start and bring sections back to there (indicating). You can take them any way because you have solid coal to protect you. Well, then, if you take the weight off there (indicating) there is as much weight on the coal as before. You have not another break until you get some distance. The weight is taken off, and if the weight is on the center, it is only the same as when you started the mine.

MR. HAUGHEE: Mr. President, either system may be practical for certain seams of coal, but the system of Longwall re-treating is not practical for all seams of coal. I don't think either system of longwall would be practical in the Number Six seam in the Hocking Valley. For instance, take that plan of retreat there: you would drive entries to the boundary line and then drive across, then put men ten or fifteen feet apart. A strata of slate lies above this coal which is very brittle, and it parts from the rock when it gets a space not more than twenty feet wide. It has to be timbered to keep it up. They have to keep it full of timber all the time to keep up the slate. When they get a space a hundred feet wide, the sandrock above comes on and they have to abandon it and get back and wait until it falls and settles. While doing this they would probably start a few men on the breast or drive on another entry. I don't think it would be practical for the Number Six seam. I don't think the advance longwall system would have any advantage over the double entry and room system. I would always favor the double entry and room system for the Number Six coal. In many cases in the double entry system there is much coal lost. I know one mine where they calculated on leaving six feet of coal between the rooms. That was all wrong. I think in that mine, or any other mine to-day, ninety per cent. of the coal could be got out by leaving these pillars twelve or eighteen feet instead of

six, and then drawing the pillars. That would be the correct system for the Number Six coal. To do this the entries ought to be driven to the boundaries as in longwall, but I don't think that either system of longwall would be of any advantage in the Number Six seam.

MR. DOE: If I understand Mr. Love's theory correctly, he designs running the entries to a certain boundary. If your section of coal is four miles in extent, make that boundary at a point where it would be economical to haul the coal back. For instance, if you have a tract of four miles, you ought to put down a shaft and drive in four directions as far as it is economical to haul the coal—say a mile; that carries it two miles on either side. Then, as I understand it, you would drive three entries,—make one main entry and then drive three entries to that boundary. Then come across with a cross entry at the back side of those. That leaves the full extent of his breast to come back on. That being the case, as you retreat you take the weight off behind you. Now, wouldn't it be the right theory that as you take the weight off behind it swings the weight over on the solid coal? I had a case in Straitsville where we drove a butt entry and on one side it was good and on the other side faulty and poor. I worked it on one side single entry and abandoned the left hand side on account of poor coal. Just as soon as we drew the pillars, the weight was thrown from the pillars across the entry and filled the entry up, so we lost it. I think that is the correct principle for mining coal as far as economy is concerned. Whether it could be worked in the Hocking Valley is a matter of experiment. The greatest trouble would be in breaking into the hills and letting in water. If we had facilities for draining the water out freely I would have no hesitancy in trying it. We have there slate, scapstone and sandrock.

I asked in regard to Cambridge. I have made some investigations in that district in regard to mining operations and I think if it could be worked there it would be a great saving. There is the same question there in regard to water. The seam is shallow and it might break through and let the water in.

Now in regard to the number of men who could work on that breast. As I figure it out, breast work of three hundred feet would take fifteen men. I see no reason why they could not work along there and go together as well as three, four or five men in a room. You work two to three men in a room of thirty feet. If you have two hundred and twenty rooms, that figures six thousand six hundred feet face and have no difficulty in keeping that face for these men. I see no difficulty, if you lead out in blocks, in having all the face you want surrounding the shaft, or from the drift opening.

There was one idea advanced by one gentleman that no company in Ohio could stand it to drive to the boundary. I admit that. I hold the opinion that the proper way to mine our coal is to drive entries to the boundary and then come back. They would have the outlay in going in and the income as they came back. A company opening up a mine should have enough capital to open it up properly. If they can't do that they had better keep out of the business.

MR. HUGHES: I would like to ask whether in your opinion a coal operator who puts his capital in opening a mine on the long wall system alongside of a man who opens up a room as soon as he can and takes out the coal,—whether it is a saving on his investment? At the end of five years which would make the most money?

MR. DOE: Without stopping to figure it up, I would think the man who worked on the long wall system would be ahead. The experience of many of us is that we have a hole in the ground after the coal is dug out and no money left.

MR. DALRYMPLE: These entries are three hundred yards apart. In order to work that breast of coal of three hundred yards, I know you can put fifteen men there in that space nicely. But how long can they work and extend the workings back here (indicating on map), before the weight cuts them off, from a practical standpoint? I know: I have done that work.

MR. LOVE: So have I.

MR. DALRYMPLE: In some cases they would be cut off in fifteen feet, and in that width of breast, ten feet.

MR. LOVE: Do you mean to say that in driving in solid coal, the weight would bring the top down?

MR. DALRYMPLE: The weight would come onto that breast so the miners would be afraid to enter into their places. I am satisfied you could not find a practical miner who would enter into that place. The only way it would be safe would be to cut up alongside of this excavation (indicating). The other is theory.

MR. LOVE: It is?

MR. DALRYMPLE: And it will not work in practice. It is not safe. I am speaking from practical experience.

MR. LOVE: So am I.

MR. DALRYMPLE: The only feature is there is too much narrow work to put in a force to get out the amount of coal required,—that is the only objectionable feature. In order to work it successfully, you would have to drive entries fifty feet apart to the boundary, or wherever is the place you want to stop—drive in narrow rooms and come back and bring the coal back. That is the only objectionable feature to this plan, and that costs.

After some further argument along this line, the discussion of the subject proceeded as follows:

MR. KANE: Mr. Chairman, I did not mean to say anything on this subject, but I was waiting for somebody who had worked in that system to speak, and apparently no one is going to.

MR. DALRYMPLE: I have seen it worked and know just what it will do.

MR. LOVE: So have I.

MR. KANE: I have worked on a modified plan of this system. Speaking about the lack of capital to work this system, and the necessity for extending your narrow work to the boundary, I would say that that does not hold good necessarily, because if

you want to, you can drive rooms at stated intervals while you are driving your narrow work to the boundary. And yet if you have a roof that is favorable to this system of working, you can still have the full advantage of the long wall retreating system. Or, in other words, instead of going ahead with your narrow work and not taking any wide work until you get to the rooms, you can drive rooms here and there as you go on, but not at the frequent intervals of room and pillar work; but leave large blocks of coal with rooms at certain intervals and that will help out some. Then when you get to the boundary you will have a full block of coal with the exception of those rooms driven as you went along. But as regards the system being safe, I want to give my personal experience in it in a modified way. At the place to which I refer, they had driven the mine in accordance with the room and pillar system for perhaps two miles and a half, and it afterwards went to the extent of four miles under ground. This was in the old country. On account of the depth to which it is necessary to sink the shaft, eighteen or nineteen hundred feet, they are obliged to go as far as they can. After they had reached two miles and a half they took a large block of coal and attempted this system and they thought it was going to be successful, but, in accordance with what Mr. Dalrymple says here, the weight and uncertainty of the roof was such that difficulty was encountered. (Here Mr. Kane illustrated by means of Mr. Love's map the manner in which it was attempted to work the mine and the difficulty encountered.)

They found that the weight of the roof was constantly breaking in on them at different stages, causing an irregularity of the face. The face ought to be straight when they get back to the entry here, to carry on the system economically. There are roofs, though, that can be depended upon. There are roofs that some men who have had experience in them know as well as they know when they are hungry,—they know what they will do when they fall, under what circumstances they will fall, how much timber is necessary to hold them. And in veins that are favorable, that are regular and break off straight, that haven't irregular strata and niggerheads in the roof,—under such conditions that system is

practical. But in a high, irregular roof it is impractical and very dangerous. If you have men working in the middle here (indicating), they have no means of escape or retreat. In ordinary cases men have a way of retreat, because the pillars of coal are behind them. In case of a warning here (indicating) where would they retreat to? There is just as much danger on either side.

MR. LOVE: The supposition is that the roof is protected by timbers.

MR. KANE: How many cases have you seen of a roof caving in, even with timber supporting it? I don't care what kind of timber you have, if the immediate strata is extremely thick and the pressure great, the shale will break down. Here you have an entry space taken out (indicating on map), and here you have an entry space taken out, as well as this (indicating), and if it would cave in here as is likely to occur, or here (indicating), and you have the men here (indicating), how are you going to get them out? You would have to dig them out—in case they were alive.

MR. LOVE: In that case you have more protection than in the room and pillar system, for you have more coal to retreat to.

MR. KANE: You can't retreat through the coal.

MR. LOVE: It is just the same distance as in an entry or room.

MR. KANE: You never see an entry cave in for a very extensive space.

MR. LOVE: Four hundred feet have caved in.

MR. KANE: Even in that time the men can run out of the entry.

MR. WEST: Having had some little experience in that method of working, I would like to express an opinion. I consider it a mistaken idea as to the cost of narrow work, because by using a double row of pillars, in tessellated system, there will be no breaking in of the cover to five hundred feet. I could refer you to a place where that system is used advantageously with an

immediate cover of sixty feet of hard sandstone. There the method was adopted and by using a double row of checks in a checkered kind of way, there was no breaking in of the roof and it never overrides the men.

A MEMBER: I have worked in Yorkshire, England, where there was three to five hundred feet of face, and in neither case have I seen that stand.

MR. WEST: I have.

MR. ROY: I have been much interested in the discussion and Mr. Love has done good in bringing out such a discussion. I believe in many parts of England and in more than half the coal fields of Scotland and South Wales the work is done on the long wall system. They work to the boundary when they can. But they find it costs more to get the coal by the long wall than by the room and pillar system. They get more coal, however, and that is the reason the system is used, on account of the deep shafts which must be sunk.

A MEMBER: There is one or two things I would like to call attention to. My understanding is that the miner in the old country works nearly every day in the year?

MR. WEST: That is one advantage.

A MEMBER: We know what the coal fields are doing here at the present time,—some lying idle for six months and some for a year. In some of the mines which I look after, I know this system could not be worked. I have been around mines long enough, and have read enough to know that they cannot be worked that way. In some places there they cannot take the coal out at all. They have driven narrow places six feet wide, go out at night and in the morning there would be a fall of thirty feet and not a chunk of slate as large as your hand. I don't see how any timber can hold that six feet back to work in.

Another thing, about driving work to the boundary line. I will ask Mr. Dalrymple if he thinks it could be worked in five hundred or three hundred acres as well as in a thousand?

MR. LOVE: Just the same

A MEMBER: With the close margin at which they are selling coal at the present day, one company could not take up this system—unless, as was mentioned, it was very strong—on a five hundred acre tract of land, pierce it with entries, and compete with other companies. They could not do it, because we all know that to drive a lot of entry works runs up the expense of the coal. That is one reason why this system could not be adopted, because it would give the others the advantage of the man who undertook it.

THE CHAIR: How would it be with the others when this man was bringing his coal back?

MEMBER: If he did not get the coal out of his entries, he would not get it out at all.

A MEMBER: The probability is in five years hence he would not get any margin at all. They must look to the present, and the coal operator is not to be blamed altogether.

MR. WEST: Our friend's statement is correct in one sense. That is, where the top is soft and friable and will submit to atmospheric influences, then the face is likely to cave in when the mine stops for two or three months. But these cases are exceptional. They had to stop work at Dell Roy for two or three months. Ten or twelve men going through all the long wall faces prepared it in five minutes for these men to return to work.

A MEMBER: We have one mine where the men work one day and it takes the full force the next day to clean up so they can work again.

MR. LOVE: I would like to say one word more. I am glad the paper has brought out this discussion, for it has thrown a good deal of light on the subject. This gentleman here (indicating Mr. ———) has made the best argument of any, when he says that by this system we can furnish steady work for the miners. That is what we want.

In my small map I could not change it to show all the systems of long wall retreating that might be worked according to the top.

On motion of Mr. Dalrymple, seconded, a vote of thanks was extended to Mr. Love for his ambition and energy displayed in preparing his paper and map.

As the author of the next paper, "Explosive Character of Blanchester Mines," was not present, the paper was read by Secretary Haseltine, as follows: