THE EFFECT OF MINING OUT COAL NO. 6 BEFORE TAKING OUT THE SEAMS ABOVE IT.

BY THOMAS MIDDLETON.

This question is of great importance to quite a number of coal owners in the Hocking Valley coal fields, and one that should have the attention of all officials who have the care and management of mines in that region.

Why? Because, if the working out of No. 6 (Nelsonville seam) first is going to damage the seam of coal lying above it and prevent from winning and mining No. 7 (Bagley's Run coal) it will be a great loss and sacrifice on the part of the coal owners, the mining public, and quite a diminution of our States' wealth.

I will say here at the beginning that, my opinion is the working out of No. 6 seam first will not have any serious effect upon or prevent the future working of No. 7 seam.

However, the subject is a very interesting one, and discussion will not do any harm.

We read and hear of many serious cave-ins and subsidences of the surface in various places in the anthracite mining regions in eastern Pennsylvania. The coal mines in that part af Pennsylvania are peculiarly adapted to cause such subsidences to take place. The coal lies at all angles from horizontal to vertical, and from a thickness of 6 feet to 60 feet; and it is no unusual thing when the dip of the coal is steep that the beds of coal crop out at the surface on the hills and mountain tops. In the very steep and thick seams we have known the coal to "run" and keep coming down, independent of the miner, for days and days until it choked and wedged itself tight in the breast or room. If there was empty space enough in the breast, it would often keep running until it went to the surface. Another reason, and probably the greatest cause for the many cave-ins, in eastern Pennsylvania, is the opening out of old works and reworking of old breasts and pillars in the mammoth coal bed. These old workings are all comparatively shallow, and the coal lying near the surface, and since the first cost of sinking, and winning the coal, require large sums of money. wherever they can reopen the old shallow mines, they are doing it, regardless of the consequences to the surface surrounding.

It has been but a short time since we read of a subsidence which took place in Scotland, on the North British railraod near Preston Pans,

sinking down two feet. The damage done to the line was reported to have been caused by coal workings which were there—long before the railway was laid. The writer of the article says, "but if it was caused by them at all, it was on account of their being influenced by the workings of a seam of coal below them which was going on at the time of the subsidence." Now subsidences in the mining districts of Scotland are of rare occurrence, and the wonder is of the few, when we consider the long time that coal mining has been going on in that country.

Camden in his Britannia, published in the year 1607, mentions that in his time there existed in Scotland, old coal pits filled with water, and adds that many of the beds of coal have been on fire for centuries. These old coal works would appear to have been at least as old as the 15th century. Some of the good and workable coal seams lie very close to each other, separated only by a distance of from 6 to 24 feet.

If it were of a common occurrence for the superincumbent strata of the different coal beds to break away, and fall from coal bed to coal bed, whenever the coal has been extracted from the different coal seams underlying each other. It certainly would have shown long ago in fearful evidence by costly subsidences, both to life and property in England. For instance take the counties of Northumberland and Durham. We may liken them to one vast honey comb, caused by the many different coal seams being worked, from a few feet below the surface, down to a distance of 1800 feet.

In the year 1259, King Henry III, granted a charter to the freemen of Newcastle on Tyne for the liberty to dig coal, and its been going on, increasing with rapid strides, from that time up to the present time.

As a general thing the great shafts (pits) in England are sunk down to the lowest workable coal seam in the locality of the sinking operations going on, and when ready to draw coal, work is begun from two to four seams at the same time; beginning to hole around the bottom seam first.

At West Stanley, Durham county, the shaft is sunk down through four seams, and draws coal from all of them. There are only 24 feet of strata between two of the seams, one lying at a depth of 558 feet, and the other at 582 feet. The upper seam at a depth of 234 feet, and the lower one at a depth of 840 feet, from the surface. If time would permit I could refer to a hundred others similar to the one above, only differing in the depth of the shafts.

I will make a note of one more. At Blaydon Main on Tyne, they worked four seams with a distance between seams of 21 feet, between the first and second; 24 feet, between the second and third; and 54 feet, between the third and fourth. At times long intervals the transway for short distances (in the second seam) would sink down from 6 to 8 inches; and would have to be ballasted up. But there was no loss of coal by any displacement, sinking or crushing down of the seam, to cause any inconvenience to the miner at his work. If a displacement or letting down the seam in a room occurred, it was thought to be an advantage to the digger, because the coal was so loose he had no undermining to do.

I will briefly refer to the effect

the dreadful and terrible explosions of gas have on the overlying strata between the worked out coal seams. These fearful mine explosions shake the ground for miles around the point of explosion, and hundreds of feet above where the explosion takes place. with the usual scene of destruction, of loss of life, doors and air-crossings destroyed. bank cars broken to pieces and jammed or hurled one over another, posts and pillars of coal blown out, and heavy falls from the roof of hundreds of tons. But to my knowledge I have never known it to shatter the roof, sufficient to cause it to fall, a distance up of 40 feet.

It is surprising what an enormous pressure the falling of a small thickness of roof will take from the remaining pillar of coal and from the large excavated area. In drawing pillars back and making an excavation of 4 or 5 acres a heavy pressure is laid on the remaining pillars and whole coal, and before succeeding in getting the roof to break, and getting the first fall, the grinding and cracking of the roof is anything but pleasant to hear, even to the accustomed ear of the miner, listening to the terrible noise of the grinding roof above, and seeing the coal bursting off the pillars, one would think that the mountain of strata above was laboring to crash into the excavation. But a thickness of a very few feet of the roof falling, will stop all the cracking and grinding, and ease the crushing and terrible pressure from off the coal, allowing the remaining part of the pillar to be successfully mined.

The old system of working No. 6, in the Hocking Valley would certainly have no damaging effect on the seam lying above it. It has been estimated that, not less than 40 per cent. of the coal has been left in pillars or lost. That is certainly more than sufficient to keep up the superincumbent strata. The method of working away the pillars appears not to have been practiced at that time. The system of working being the single entry plan.

Lately, experience has made it evident to those who have the management of mines, that it is a great sacrifice to allow the pillars of coal to be left standing and lost. But even now at the present time, with rare exceptions, we are led to believe that, anything approaching to a regular system of taking out the pillars is obtained, and the loss of coal at a reasonable calculation will amount to 25 per cent. in pillars left standing This amount of standing coal distributed in various places in the mine, will prevent any damage by displacement to the upper seam.

Suppose, by better management, and a different system of working, we were enabled almost entirely to work away the pillars of coal. What then would be the effect to the upper seam?

I believe the effect then would not be damaging to the mining and working of it and my reason for it is this: There are many stumps of coal left standing and which cannot be taken out even by the very best of management and system of working on the pillar and room plan. These stumps will prevent many square feet of roof from falling, and the part of the surrounding roof breaking away and falling will ease off a large amount of pressure from the stumps, which stand as a supporting column to the unremoved roof. Besides the

stumps of coal a large amount of posts are standing in the excavations, and a great amount of slate, bone coal and other refuse thrown back in the gob, helps partly to fill up the excavation to a more or less extent, and when the heavy shale roof breaks away and falls on the then displaced posts and gob, it piles itself up in all shapes and angles, and soon fills the excavation, which chokes up and wedges tight, or forms an arch, before falling up to one-half the distance that separates Nos. 6 and 7 seams, the distance being from 60 to 100 feet.

In conclusion I would say that it is often an advantage to work out the bottom seam first as it makes a reservoir and the means of draining a large quantity of water from the upper seams.

DISCUSSION.

ROY.

I have listened with great pleasure to the paper just read. It contains a great deal of valuable information, yet I cannot agree with Mr. Middleton in his statement that by mining out No. 6 in the Hocking Valley No. 7 will not be injured thereby. A rule among practical men is that in a seam 4 feet thick and having 80 to 100 ft. of cover there will be a subsidence of the surface when the overlying strata gave away. In the Hocking Valley, where the coal is 9 to 10 feet thick there will be great chasms formed in the ground after the pillars of a mine are worked out, and the incumbent rock falls down, even if the overlying strata were 150 feet or more in thickness. This is true of every mining district. Any one who will visit an abandoned mine, in which the pillars have been taken out, will see this state of things. A seam of coal 70 feet above the great vein would be torn and rent in such a manner as to make it unminable. The roof would be all rent and torn. There would be less disturbance around Nelsonville where the vein is only 6 feet thick than there would be at points where it is 9 to 11 feet high. Even if part of the pillars were left in a mine and a crush should overrun the workings, the rocks above would break and crack for upwards of 100 feet. If the mining companies of the Hocking Valley wish to work No. 7, my idea would be for them to work both seams at once or work out the upper core first.

MORRIS.

In the Coshocton field we have at least about 175 to 225 feet of surface on No. 6. I have always found in that district that before anything could come down that roof and bottom would be so close together that you could not push your hand through them, consequently I don't see that that would hurt No. 7 in the least. In all my experience of 35 years, I have never seen No. 6 in this country, and it is 20 years I have been here,—affecting No. 7,—that is to an extent

where it would be necessary to lose the coal of No. 7.

In a mine in South Wales in the last shaft that I worked at we were working 7 veins in the shaft at the same time.

One vein in particular we had 2 feet of bottom coal, and 3 feet of iron ore over it that we worked right on as far as it was mined. Then there was 3½ feet of shale on top of this that would fall down after us when we were drawing the pillars back, and we worked 5 feet of ore and 2 feet of coal on top of that again. There was about 70 feet of a vein which was 7 feet thick and on the top of that 5 feet of slate which would come down we were pulling the pillars and on the top of that 6 feet of coal. Our pumps were in the bottom of the shaft, and there every pound of coal and iron ore was worked successfully though they were on top of each other, and I don't see by looking at it in that light that we could damage No. 7 by working No. 6.

BANCROFT.

I have no doubt there would be more or less subsidence from above in working out a lower vein, but I doubt that that would be sufficient in a vein running from five to ten feet thick with the pillars that may be left standing to very materially affect the working of a vein above. All through the anthracite region it can be seen where miners are working above each other, owned by the different companies. Our place used to fill in but we never had any toouble with the surface. I had a practical experience of 15 years in that country and I don't think that practically there is any effect unless it may be a beneficial effect.

HOWELLS.

I am much pleased to hear the discussion on that question. In some respects I agree with Mr. Middleton, in some respects with Mr. Roy. It seems to me that in working a vein of coal 10 feet thick that is 100 feet or 150 feet below an upper vein, that it is impossible to work the upper vein. It is true if you leave pillars enough you can do so, but without that I don't think you can. My experience is in working number one vein of coal that if you take the pillars out clean, as clean as can be taken out, that in 150 feet, yes 200 feet, you will find falls up to the top and especially large cracks will appear that you can put your arm in.

Now then, if that is the case and there is only 80 feet or 100 feet between the two veins, it strikes me that it would not be very profitable to try to work the upper vein.

M'MILLEN.

I think in a discussion of a paper of this kind I should be seen and not heard, but there is one point agreed upon between Mr. Howells and Mr. Roy, in which I want to suggest that they may be mistaken, and that is that a vein 6 to 10 feet the overlying material and the pillars would be more likely to crush than one five feet in thickness. It has occurred to me that it was in the self supporting tendency of the hill and not in the relief of the pillars. No one will assume that it does not make any difference whether it is 6 or 10 feet, is it not probable that the material itself simply bridges itself? The height of this bridge, or I should say arch will not depend upon the thickness

of this coal but upon the character of the overlying material. If it is a good solid rock it will arch much quicker, but the distance between the top and bottom of the entry or rooms, will make no difference.

DALRYMPLE.

I think Mr. Middleton's paper is a grand one, and from a practical standpoint don't believe I can criticise it in any respect. The Hocking Valley seam runs from 5½ to 6½ feet around Nelsonville. There is a great deal to be taken into consideration in the working of that seam. We have slate and slack, and from the amount of slate and slack and rubbish, it fills the places up pretty well, and when a fall does take place I don't think it will extend up through No. 7 to hurt it. When a fall takes place it extends up and runs together and chokes itself. Of course it makes a crack on the surface but that is very small. Now, I have known where they mined five seams at once in the same shaft varying in thickness from two feet up to four, and they worked right along without disturbance, and I might say that this seam of coal is entirely different from the No. 1 seam. There was no slate, scarcely anything, everything left clean; nothing but the posts to hold the roof up. When a fall takes place it would extend further up a 3½ foot seam probably than it would in a 6 foot seam, with the slate and rubbish. I think it would be an advantage to mine the lower vein first.

Mr. Chamberlain, I move that we extend a vote of thanks to Mr. Middleton for his very able paper.

Motion seconded and carried.