



Tech Talk: Controlling the Roof - More on Longwall Coal Technology

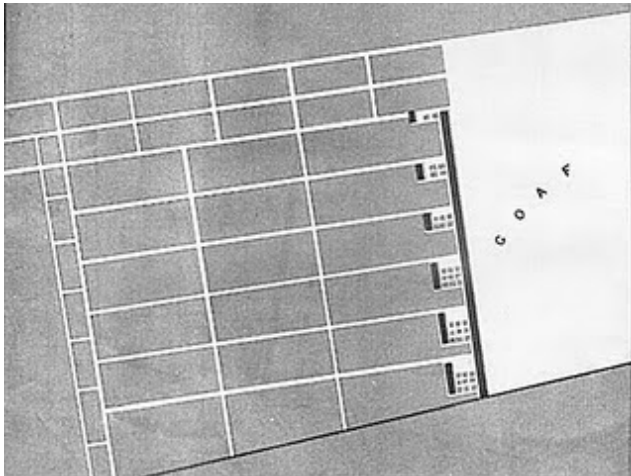
Posted by [Heading Out](#) on August 8, 2010 - 9:01am

Topic: [Supply/Production](#)

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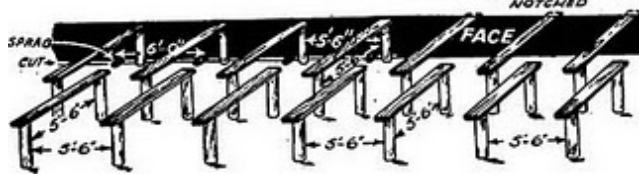
This is another post in [Heading Out's tech talk series](#).

In describing the [earliest types of longwall](#) I mentioned that the evolution came from initially putting different mining sections into a line as a way of simplifying the ventilation and the haulage of supplies to the miner, and coal that he had filled into tubs. This is a layout showing one of those early operations, and the roof is temporarily held up either by pit props, typically around 4 – 6 inches in diameter, and cut to length as needed, or small packs. Because the miner was penalized if there was too much stone in the tub (the entire tub would not be counted) he could stack the stone he found in small packs, with the larger stone on the outside and small stuff shoveled within to provide the roof some support, as needed.

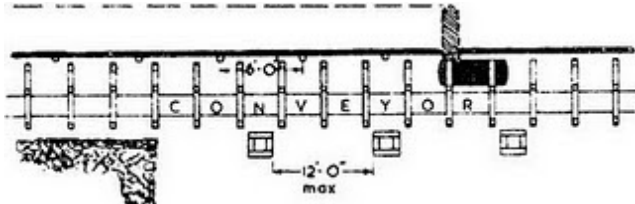


Mining occurs in the open spaces, the small squares are the roof supports and the dark line is where the putter would bring the tubs and supplies or leave with the coal.

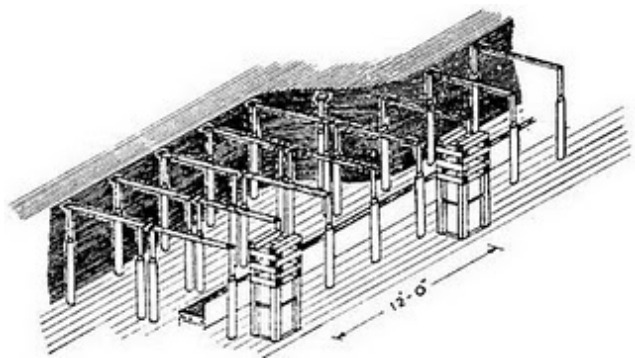
The first transition was to change the direction of mining so that it wasn't perpendicular to the goaf (or collapsed waste) but parallel to it, and then to join all the individual stints into a single face. At this point the supports became more organized and regular plans were developed to ensure that the roof was supported. (These were assembled in a book that the mine manager had to certify, with the conditions for each face specified, and any special support locations laid out.) An early version of such a plan showed the plan and spacing of the props.



The face is shown after it has been undercut, but before it has been fired, and the coal blasted down. In addition the back set of supports would be removed, and the conveyor advanced, before the shot went off. After the back row of supports were removed, it would look more like this, and more typically undercutting and inserting the powder would take place after the move.

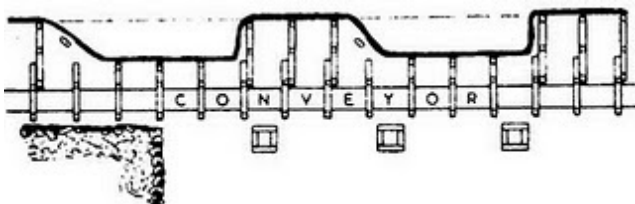


The path of the coal cutter can be seen, and thus use of square sets of timber that were used in bad ground to help support the roof long enough to remove the coal. These replaced the stone piles that had been used earlier. Personally I did not work on faces that used them, except when we had a major face collapse, and we had to mine through it – but that’s another story.

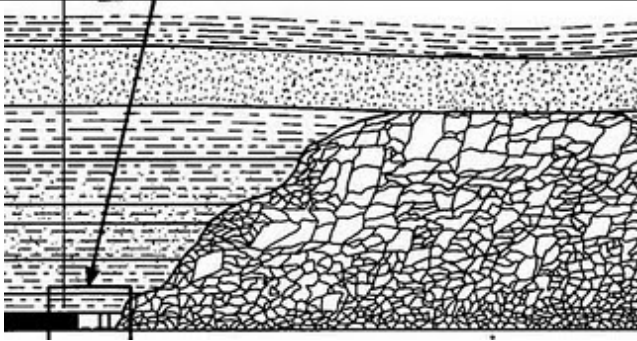


Chock location and construction.

Once the back set of props was removed and the conveyor split, moved forward and remade, then the coal was blasted down and then, as each man loaded out his fifteen yards of coal, the new set of supports was installed.



The reason we could get by with using wood was that the process was relatively slow, and we would mine only one cut a day. This gave time for the roof stresses to redistribute, and the collapsed roof to build up and support the overlying strata.

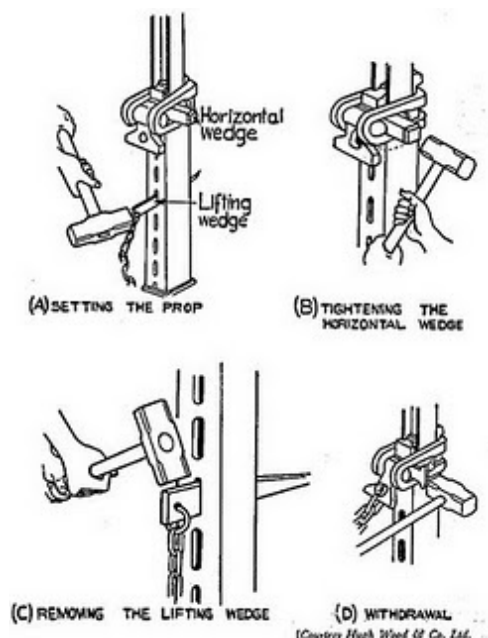


Section through the face (lower left) showing how the roof breaks, bends and ultimately resupports itself.

As mining began to mechanize, one of the first things that changed was the material of the roof supports. The first step was to change the wooden bars on top of the props for steel ones. Sounds like a good idea, right?

Well imagine that you are kneeling on the floor and you have to erect one of these supports. You put the long bar on your shoulder, pick up the axe and a wedge in one hand, the prop in another, and raise your body until the bar is pressed against the roof. Then you put the prop in the middle, and slide the wedge on top, and tap it tight with the axe. With the bar then stabilized, temporarily, you get a second prop and put it at one end and tighten it into place, and then do the other. Then you remove the central prop. With a wooden bar it was relatively easy in heights from 2.5 ft to 5 ft. With the greater weight of the steel it was harder to move, more critical that you be near the middle when you start, and more vital that the first prop was close to the middle. With a wooden bar there was also a little flexibility in driving in the wedge, absolutely none with the steel bar. Oh, and since we were re-using these (pulling them out of the waste as the last row was collapsed) they pretty soon got bent and so had to be straightened a bit before they could work.

But that was the easy step (in retrospect) because the next thing to replace was the wooden prop. Both the wooden prop and bar were easy to move. But to replace the prop the first idea was to use a friction prop. Here's how it worked:

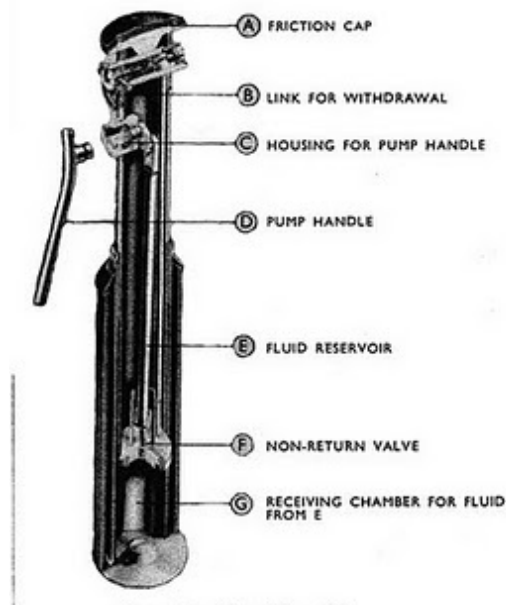


The prop was made up of a sliding central square section (above the horizontal wedge in the first picture) that slid within a lower section (where the lifting wedge is inserted).

You lifted the central section until it was about right, then tapped the lifting wedge until the prop was tight against the bar. Now you could move to one side and tighten the horizontal wedge that gripped the sliding section and held it in place. Then you removed the lifting wedge. And when you wanted to remove it, all you had to do was tap the horizontal wedge.

It had the advantage that as the roof stress changed so the prop was intended to yield, with the inner section sliding within the friction band, rather than failing as the wooden prop would if the stress got too high. However, you might want to remember that here we were doing this individually in relatively low coal (at least we didn't have to saw them to length) with a 6-ft steel bar resting on your shoulder while you try and drive these wedges in. It was a learned art, one of the first things to learn was not to hold the prop above the wedge while you tap it out. The prop drops when released and will hit your hand – usually the thumb – and it has the weight of that steel strap on top of it. Funny how you still remember!

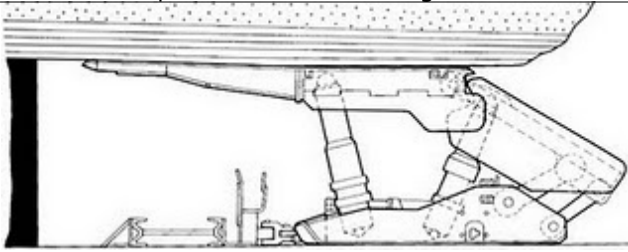
They didn't last long, for a variety of reasons, but were replaced with the forerunner of today's roof support, the hydraulic prop. The first ones were relatively simple, and heavy, but much easier to use.



Country Dooty Mining Equipment Ltd.

Simply you put the pump handle in the socket, and started pumping. This moves fluid from the upper reservoir to the lower, pushing the central cylinder and the top cap up, and against the prop. To release it you put the handle in the link, and pull, and slowly the prop sinks. Much easier to work with.

But that was only the start, and moving these by hand was still slow, and so the transition to full mechanization began. And before long instead of the simple hydraulic prop, the roof was supported by massive, and powerful hydraulic chocks, but this also required other changes to mining practice. For, as it was said at the time, “We cut the coal by machine, we transport the coal by machine, isn't it stupid to still load it by hand?”



Schematic view along a face showing a more modern roof support.



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