

## LONGWALL MACHINE MINING\*

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The greatest modern advance in coal mining of late years has been the introduction of machinery to undertake the work formerly performed by the miner underground. This applies to both longwall and the pillar and room systems; but, as continuance of operation is a large factor in the economical working of machines, longwall systems present the best field for their use. In room and pillar methods, a regular succession of varied operations takes place within a short time and the tonnage in each place is relatively small, whereas in longwall working many tons are handled. This gives the machines a continuous work period and so provides the best conditions under which they could be operated. Machine mining too offers the only antidote to the ever increasing wages cost. There is also the advantage of more systematic working methods, with a consequent increase in safety and efficiency. For these reasons alone it is probable that longwall operation will be the more largely utilized system in the future even under conditions which otherwise might be said to favor the pillar method.

### Fundamental Problems

To such an extent has machine mining altered mining conditions that there appears now no special problems limiting its possibilities. But there are two factors that have a very large influence on its success, viz,—the roof and a question of organization. By the roof is meant not the few feet of stone immediately overlying the coal; but the succession of strata within 50 feet or more above.

As an illustration, imagine the conditions in any old hand mined longwall working, set out without regard to the roof. Naturally through various causes certain places fall behind others, some stone pillars are built solid, timber is left standing in the waste. From all these causes troubles arise. One miner says his coal is hard and demands extra rates, another fills nothing but small coal, falls are numerous and seem to occur regularly at one or two points, more timbering is wanted at each road head, at various points the pavement requires to be lifted. In other words, due to the overriding weight of the strata above, lines of force are produced which run anyway, and local pressures come into existence at certain points whose position is determinable by the relationship between the line of the coal face, the distance apart of the roads, and the areas open supported and unsupported. The man in charge of such a section usually blames the roof—quite correctly too. But he should realize that it was his method of working that caused the roof to act in such a manner.

The introduction of machine walls and conveyor operation demands straight lines in the coal face, and that the needed supports be placed at stated intervals running in both directions. Regularity becomes the fashion, with the result that equal pressures, lines—unknown under former conditions—develop parallel or at right angles to the line of the coal, and can be taken advantage of in operation. The power that is in the roof becomes a help instead of a hindrance. Safety is increased: if you know what a roof will do you can within limits prepare for it. No two roofs are alike in the weight exerted, the type and direction of break or the swing of the loosened strata; but once regularity

of working is established they may each be expected to exert their several powers in the same way. And to gain the best advantage of this regularity in roof pressure a knowledge of all the underlying principles that cause these phenomena becomes a matter of first importance.

Next to a proper understanding of the roof comes the organization of the underground operations. System in every part of the work is much needed and it must be almost military in its exactitude. Let a man or a machine fall behind in his time for the task allotted and the whole routine becomes disjointed. Should a coal cutter be three hours overdue in finishing its run men have to wait before they are able to turn over their coal. When the end of the shift appears, this coal has still to be loaded, extra men have to be procured and finally the machine starts the next shift again behind time, one loss accumulating on the other.

### Coal Cutters

Undercutting by machine has advanced so far as to now allow the mine manager a varied choice of machines, although they can all be related to one of three accepted types, viz,—disc, bar and chain. Details of construction cause variations in the appearance of the machines of different factories, but the essential features are the same. Each type can be air driven, or electric, and neither on skids or wheels. Haulage along the face is accomplished by a rope and gear passing in most cases under the machines.

Certain special advantages are attached to each machine, which are worth considering. The disc machine is the heaviest and fastest worker. The disc generally makes a better cutting arrangement, and its shape and action produce dross in the cut which is cleaned out by the machine itself.

Against this there is the disadvantage in a soft coal or fireclay of the disc becoming jammed by the coal falling down upon it or the cutter wheel being clogged. In many cases this has caused great delay, as the getting out of blocks of coal hidden behind the machine in a thin 18 in. seam is an awkward task. Many troubles of this character limit the cutting time of a disc. Neither is it adapted to working into the coal by itself at the commencement of either end of the cut, and places have to be specially prepared for it by hand labor.

When using a bar machine, the bar being only 4 in. in diameter, the coal even should it fall on the cutter does not stop the progress of the undercutting. The design of the mechanism places the cutter bar at one end of the machine, and as it has a swivel action through about 180° it is possible for this machine to cut its own way into the coal at the beginning of the cut, and, if turned, at the commencement of the return journey. In working, the bar produces "gum," a very fine powdered coal. Generally bar machines seem to be more dusty than disc cutters although this would depend on the class of coal. The noise of a disc cutting is much the greater and by comparison a bar running often appears quite an "abode of silence," but the claim sometimes made for the bar that it enables the working of the roof to be heard can hardly be considered.

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