

Adverting to the direct cutting of coal-faces mechanically, it has been known and admitted for many years past that the mechanical engineering of collieries has attained a modern and therefore a high standard of efficiency in the application of machinery designed and utilised in various ways conformable with local conditions, both for underground haulage, surface haulage, drainage of mines, artificial ventilation, winding from depths, and the sorting, grading, &c., of the mineral at the surface; but, strange to say, such application has appeared to cease at the coal-face, the very place where the resulting benefits should be of a marked character. The reason of this anomaly can probably be ascribed to the strongly exhibited prejudices of the coal-hewer against the introduction of coal-cutting machinery, coupled with a lengthy period of apathy on the part of mining engineers adverse to grappling earnestly with the subject in detail—that is, compared with the skill and determination which has characterized the latter in mechanically surmounting various other abnormal difficulties connected with coal-winning. However, amends are being made for apparent delays in connection with this important matter, for the mining records of the day show that the British engineer has determinedly taken the matter in hand. This being so, he will ultimately achieve his object, and thereby in the near future completely revolutionise the present stereotyped methods of coal-extraction.

It is desired in this article to avoid technicalities; likewise it is not attempted to render detailed descriptions of the various types of machines, but rather to give an abridged reference to their principles and forms of construction, with general reference to their application.

The types of machines now in use for coal-cutting may be classed as follows: (1) Disc machines, (2) chain breast machines, (3) bar machines, (4) circular heading machines, (5) pick machines. The types 1, 2, 3, and 4 are distinguished as rotary machines from the fact that they are constructed to perform their work by rotary motion applied in various ways. The No. 5 type operates by impactation; that is, the blow of the pick is delivered direct at the coal-face, and, practically speaking, embodies the principle of attack as made by the coal-hewer's pick.

Of the disc machines, which are claimed to be giving satisfactory results at longwall faces, may be mentioned the Diamond, the Yorkshire Engine Company, the Clarke and Steavenson, the Gillott and Copley, and the Jeffrey machines. Chain machines also in noticeable operation are the Jeffrey, the Morgan-Gardner, and the Mather and Platt. Of the bar type the Hurd, also the Goolden, may be mentioned. The Stanley Header is a machine which as it advances cuts out a circular area of coal. The "header" and cutters can be arranged to excavate diameters varying 5 ft. to 7 ft. When greater width of heading is required than can be cut by the single machine, a double header may be employed. This takes the form of two machines combined, working side by side, which excavate two annular and parallel grooves. From this it can be readily inferred that with sets of cutters having radii of 3 ft. the width of heading will not be less than 12 ft. The percussive pick machines which are so much used in America are known as the Ingersoll-Sergeant, the Harrison, the Yoch, the Leyner, and the Sullivan.

The motive power actuating all the aforementioned types of machines is either electricity or compressed air. The application of electricity to the driving of the percussive type has not hitherto proved successful. Doubtless this is due to the intermittent action of the machine. The blow of the pick is resultant from a direct thrust, and after delivery the piston has to return to a given point preparatory to a repetition of the blow. With machines embodying this reciprocating motion the motive power yielding the most satisfactory results is compressed air. The principle of the other forms of machines is that of continuous action, and they are manufactured to be driven by either power referred to, each motive power having its adherents relative to adoption under certain conditions whereby it may be considered the greater useful effect will be obtained. Electricity has, however, been successfully applied to the driving of the continuous-action machines, and the time is not far distant when its use in that respect will be practically universal. Naturally, mines already equipped with costly and up-to-date air-compressing plants will continue to use the latter with fair efficiency.

In any colliery adopting coal-cutting machinery, when the power to be used is determined upon, it is true economy to instal only modern and thoroughly effective plant, with a good margin of excess power to meet contingencies. By this means maximum benefits will obtain at the machines. In all cases it is a fair deduction to say that where machines are introduced, which from their special construction renders them properly adaptable to whatever local conditions exist, the results will prove satisfactory in comparison with hand-labour. If the comparative results are not as stated, then the right type of machine is not in operation.

The disc machine is rectangular in form, with the cutting-disc set horizontally and at right angles to the framework which carries the driving gear. With some makers the disc is placed at a right angle to the end of the machine; other designers have the disc at right angles to the centre of the machine, with the driving-power equally disposed at each end. The principal mechanical parts are the framework, upon which is placed the motors if electrically driven, or cylinders if actuated by compressed air; also the necessary shafting and gearing for reducing the disc to the second or third motion as desired. There is, further, a small rope drum, which is operated automatically, whereby the machine is moved along the coal-face during the process of undercutting. The disc is strongly bracketed to the side of the machine, and is a bevelled toothed wheel with the spaces between the teeth open right through. By this means the lodgment of coal-cuttings between the teeth is prevented, and clogging of them which would otherwise take place is obviated. This gear is operated by a pinion-wheel vertically arranged in framework. The said bevel wheel has a specially designed periphery, into which the cutters or pick-points are fixed at required distances. These machines are calculated to undercut to depths varying from 3 ft. to 6 ft. One particular aim in their design is that the vertical space occupied shall be such as to admit of application to the winning of extra-thin seams. In this the designers have been very successful. The heights will range from 18 in. to 24 in., with a width, exclusive of disc, approximating 3 ft. 9 in., and a length from 8 ft. to 9 ft. The weights average from 22 cwt. to 2 tons 5 cwt.