

is a rising of the floor; a "thrust" is the cutting up of the roof by the remaining pillars of coal, while a "crush" is the general breaking up of the coal. As a creep or thrust tends to shorten a pillar by filling the space about it, they support, and to a certain extent, strengthen the pillars; for other things being equal, high pillars are weaker than shorter pillars. A seam of coal is not homogeneous, but is made up of several bands, both of different qualities of coal, and dirt. Like a chain, its strength depends on that of its weakest member, for that reason one cannot calculate the crushing strength of coal, as if it were a column of some more uniform substance, e.g., steel; yet coal pillars are called upon to uphold the overlying strata which is generally assumed to weigh 11b. per square inch for every foot in height, so it would be useful to have some approximate idea of a seam's strength. When a portion of a seam is extracted, the remaining coal has to support the weight previously borne by the whole seam. At first the total weight of the superincumbent strata does not rest on the pillars, for there is a certain amount of side support; so that for a time, it may appear as if the pillars left were sufficient for their purpose, but as the undermined area increases, a greater weight comes on the pillars which may eventually crush them. The proper proportioning of the pillars is therefor a very important matter. A certain amount of relief may be obtained by arch action in the overhead strata if there is sufficient depth of cover, but the value of this is reduced by the presence of faults or other breaks in the strata. Coal becomes more tender with depth, so it is simply a matter of depth with a horizontal seam, when the quantity of coal available for extraction, where pillars are left, limits coal mining as a commercial venture. As all rocks are more or less elastic, pillars may be compressed almost to the point of fracture without showing signs of failure. When rock is broken up into small pieces, it occupies about one-third more space than it did *in situ*. When a crush takes place, only a small portion of the roof above the bords breaks up, and that generally in large slabs, the bulk of the superincumbent strata coming down bodily, and consequently the effect is far reaching. A slight movement in the goaf of a lower seam, may be sufficient to start the pillars left in an upper seam, and so cause a crush and subsidence above the upper seam. Where the surface has to be kept intact, the pillars must be left, with the consequent loss of coal.

Barrier pillars may have to be left in, when seams liable to spontaneous combustion have to be worked on the pannel system. Then, again, it is usual to leave barrier pillars between adjoining mines, so as to prevent any encroachment and interference with ventilation. Such barriers are especially

advisable between properties, one of which is worked under a large body of water, for should the water burst through, and the properties to the dip be connected together, they would be bound to become flooded.

Incorrect surveys from which a new manager cannot obtain definite knowledge of old workings which may be full of water or gas, might oblige him to leave a thicker barrier of coal than he otherwise would. Also he might find it impossible to ascertain the position and quantity of coal that had been temporarily left.

It is only natural that the best available coal should be worked at the present day, for no colliery owner wishes to lose trade by putting an inferior article on the market, which would cost him just as much to win as the better article. As many seams are made up of bands of coal that vary in freedom from dirt and pyrites, and have bands of rock interbedded with them, it is frequently found necessary, for commercial reasons, to mine only the top, bottom or middle coal as the case may be, leaving the inferior coal intact. Later on when this inferior coal may be of marketable value, it will be found to be so broken up or covered with fallen debris as to be too costly to extract. It thus becomes a total loss. The present system of paying for bands makes some seams unprofitable to work, while with others only a portion can be mined.

When a seam is worked in close proximity to an upper one which is left for a time, the latter becomes broken up, and more or less spoilt for future working, thus reducing the possible yield per acre. It would not pay to fill the space formerly occupied by the lower seam by means of flushing, then either the two seams might be worked simultaneously, or the upper seam might be worked first. If, however, the upper seam was composed of inferior coal, it might not be considered wise to work it for a time, in which case it would probably be rendered useless for future working; or if the lower seam was left till the upper seam became of commercial value, its potential worth would be lying idle.

Nature has also caused a waste of coal; sometimes by coking or sintering it, at others by causing it to be so deep down that it is unsuitable for mining, at least by present-day methods. As an example, I may quote an instance given by Prof. T. W. E. David, in his monograph on the "Geology of the Hunter River Coal Measures, New South Wales," p. 73, where he mentions that the Greta Coal Measures under Newcastle would lie at a depth of probably 9000ft., where the temperature and engineering difficulties would make it impossible to work. In the Upper Greta seam, the brassy tops, which consist largely of the chemically unstable mineral marcasite has caused spontaneous combustion, the heat from which has

actually fused the sedimentary rocks above and below during prehistoric times, as can be seen in the neighbourhood of Cessnock, where they may readily be mistaken for igneous rocks. At Mount Wingen, the Greta coal is still burning.

Our coke trade has increased considerably during recent years, and the North Bulli colliery, the youngest colliery on the South Coast, is leading the way in the production of this valuable substance, not only in quantity, but in the method of production. Ever since the initiation of the coke trade in New South Wales, first made in beehive ovens, but now mostly in those of the McLanahan type, the bye-products have been allowed to go to waste. Only in two plants do they make use of any of the waste heat in the side flues for heating the oven, and in one case the waste heat is used for boiler purposes. The North Bulli Company has ordered a gas engine to be worked by the waste gases, from the ovens, and they are about to instal a gas producing plant for generating electricity in which they will utilize the black ends and coke dust. They are also arranging for a plant to save the tar and for the manufacture of sulphate of ammonia. The South Coast coal should yield about two or three per cent. of tar, and one per cent. of sulphate of ammonia.

The Germans, benefiting by the bye-products from their coke ovens, are, with the help of cheap freights, able to successfully compete with locally-made coke, and have dumped their surplus coke into Australia where it has been used at the Mount Morgan, Broken Hill Proprietary and Wallaroo and Moonta smelting works. However, the Germans have somewhat spoilt their trade by sending out too large a percentage of breeze or coke dust, which is not wanted out here any more than in Europe.

Matters that affect our coal trade naturally affect the working of our collieries. Some of these matters are under the control of those in Australia, or at least may be regulated if not prevented by them; others are outside our influence altogether. Amongst the latter is the question of deep-sea freights. These are always high during the wool and grain season, with the result that at that time of year the coal trade is slack. Interstate trade is always dull during the summer months. So dependent is one industry on another that in those years when Australia suffers from a drought, the coal trade is brisker owing to cheaper available freight. Again, some fifty to sixty million superficial feet of timber are sent to Australia every year from New Zealand, and the ships that bring it look to coal for back loading; if they have to return in ballast, then the freight of timber must go up. Yet another instance of the influence other trades have on the coal industry, is to be seen in the recent trouble at Broken Hill, the

Broken Hill Proprietary Company being a large consumer of coal and coke. The largest proportion of our oversea trade is with the Western Coast of America, and here it may be interesting to note that the first shipment of Australian coal to South America was made by the A.A. Co., in 1850. Vessels leaving Great Britain to load Australian wool and grain are glad to secure a cargo of British coal for American Pacific ports, rather than come out in ballast, and this gives British coal an advantage of about four shillings per ton in freight over that from Australia. It is not that we are unable to find a market for our coal all the year round, but we cannot compete with outside sources when increased freight is against us, consequently inferior but cheaper British Columbian and Japanese coal is substituted. The duty placed on coal imported into the United States of America favors the Pennsylvanian coal fields, but on the other hand this coal has to travel all the way round Cape Horn to reach San Francisco. War in any of those countries washed by the Pacific is likely to work beneficially towards the New South Wales coal trade, so long as we are not involved in the trouble.

The first coal strike in New South Wales took place at Newcastle in 1861, since when, there have been several others. Strikes, and a high rate of wages tend to decrease our output; the latter by limiting our competition with other countries; the former by making the output so uncertain that contractors cannot depend on regular supplies. As an instance, in 1906 Australian shipments to the Straits Settlements were 218,931 tons, and that of Japan, 85,209 tons. In the following year the Australian shipments were reduced to 91,049 tons, while those from Japan had risen to 251,527 tons. Here not only did we fail to obtain our fair share of the increased trade, but lost considerably on that of the previous year. Although labour troubles have undoubtedly materially affected the Australian coal trade with the Straits Settlements, cheaper freight from Japan has also had a marked influence on it. On looking over figures in other cases, we may at first congratulate ourselves that our export of coal has increased, but the real question is, has it increased as much as it should in proportion to that of competing countries?

Coal being bulky and of comparatively low value, the available means of transport are most important. But besides the advantages of low freights, the handling and transport effect our coal, as losses are increased by rough handling breaking up the coal, and waste also occurs in transit from various causes.

For any business to be satisfactory, all parties concerned must make a fair profit out of it. It is no use closing our eyes

to the signs of the times. If we admit that a man must be paid a living wage (according to the judgment of Mr. Justice Higgins), and that he has a right to share in profits (as others contend), then many concerns that are struggling along under present conditions must close down, temporarily at least, thus throwing many men out of work. It is easy to speak generally of a living wage and share in profits, but there are many details to be decided before the giving of workmen a pecuniary interest in their industry can be used for putting a stop to disastrous strikes. Strikes are not always initiated on account of dissatisfaction with the remuneration received. A living wage varies, not only in different districts, but at different periods in the history of that district; besides, what is a living wage for a bachelor would be starvation wages for a man and wife with a large family. A man who has saved money for his old age, and wishes to invest it, if prudent, is not likely to risk it in an industry where there is little chance of obtaining a fair interest for the risk he runs. Whether the investor, who has to stand any loss, shall have a first call on the profit, and if so up to what amount, is another point to be decided. However, such matters will doubtless be settled in each instance by arbitration. If there was any guarantee that no more strikes would take place, investors could afford to make concessions, and would be satisfied with a lower rate of interest than they now consider necessary, for there would be less risk in loss of trade and damage to property. Another effect that a compulsory living wage would have, would be to conserve our products for higher prices, as it would never do to over-produce and let foreigners benefit by our over-production, as the United States did when they dumped their iron and steel into Europe at a less price than it was sold for in the country where it was produced. On the other hand, if people were thrown out of work periodically because the trade at which they worked could not pay a living wage, someone would have to keep them from starving in the meanwhile, and presumably that support would come from their friends who were earning a living wage; but such a drag on the purses of those in work would reduce their available cash, and anyhow those out of work would scarcely receive an equivalent to a living wage. The other alternative would be for the Government to support those out of work, either by keeping them in idleness, or by subsidizing the languishing industries, the means for which would have to come out of the pockets of tax payers. To nationalise our collieries would not help the labouring class; on the contrary, if the Government honestly carried out the work entrusted to it, and worked our coal-fields on the most economic principles, there would be less hands employed, and we know only too well that those who

work for the State get just as dissatisfied as those who are employed by private individuals or corporations, and that even government employees strike sometimes.

What is plentiful to-day, may be scarce to-morrow, and we are very apt to be careless with substances that are cheap and plentiful. It is only begging the question when the improvident man remarks that posterity has done nothing for us, so let posterity look after itself. We have a legacy handed down to us by our forefathers, and it is our duty to mankind to make the most of it, and not waste it.

