

The deepest coal-measures are supposed to be in the neighbourhood of Sydney, where the shaft of the Sydney Harbour Colliery has been sunk to a depth of 3,000 ft. to a 6 ft. seam of superior coal. This shaft is situated within one mile of Sydney, and the mining operations will be carried out under the harbour. Owing to the favourable situation of this mine the mine-trucks will practically be tipped direct into the ship's hold. This colliery is only exceeded in depth by three others in the world, all of which are situated in Belgium.

The output from the New South Wales collieries during 1907 amounted to 8,657,924 tons, being third in magnitude of production of the British dependencies overseas.

Mining operations on the bord-and-pillar system are conducted according to the most modern practice, and the equipment of the more recently established collieries is of a high order.

Among the collieries visited by me the two most important as regards equipment and output were the Hebburn and South Bulli, and as these mines contain respectively large electrical installations of D.C. low and A.C. high pressure, I will endeavour to describe the most important features I observed at them.

The Hebburn Colliery (Mr. R. A. Harle, manager), the property of the Australian Agricultural Company (Limited), situated thirty-one miles by rail from Newcastle, is a recently opened mine, having a daily output of about 2,000 tons, and will operate over a total area of 3,131 acres, 1,329 acres of which is freehold. Two seams of 7½ ft. and 6 ft. in thickness, inclined at 1 in 19·5 are worked. These seams are separated by 17 ft. The coal is hauled up dip haulage-roads to the surface, no winding being required. The surface arrangements are laid out on the most modern labour-saving principles, and electric power at low pressure and by direct current is extensively employed. The generating plant consists of a Roby compound engine of 370 brake horse-power, which drives two 6-pole Scott and Mountain generators providing 365 amperes each, also a similar machine supplying 360 amperes, all generators being connected by flexible couplings on one shaft. The power thus produced is used principally for coal-cutting by the Jeffrey's chain breast machines, driven by enclosed flame-proof motors of about 21-horse power, the mine in places being gaseous, in which places the New South Wales Electrical Special Rules require many important conditions to be observed to prevent the ignition of gas by sparking or flashing, among which precautions are the aforesaid flame-proof motors; also switches which are submerged in oil, and the electrical pressure employed shall not exceed 650 volts. Each coal-cutting machine employs two men; and 4½ bords, each 18 ft. wide, are holed or undercut to a depth of 5 ft. or 6 ft. by one machine per shift, thereby producing about 100 tons of coal, at a cutting-price of 4½d. per ton, in safety-lamp sections, the price where open lights are used being 1d. less. Each machine requires a current of from 35 to 45 amperes at a pressure of 230 volts. At the Northern Extended Colliery, which I also visited, the cost of cutting by a Sullivan chain breast machine was about 3d. per ton; the above figures were supplied to me by the managers of the mines referred to. At Hebburn the trailing cables which conduct the current from the junctions are protected by plaited green hide to effectively protect the insulation from abrasions, other forms of covering having been found unsatisfactory. The trailing cables are securely clamped to the motors. The cutting-machines, owing to the gradients, are "fitted" or transported by their own electric power. These machines are extensively employed throughout the State where the conditions are favourable—viz., upon hard seams not too highly inclined; but they would not be so successful or economical in the free-working and often highly-inclined bituminous coalfields on the west coast of this Dominion. The mine is unwatered by a four-stage centrifugal pump lifting 200 gallons per minute against a head of about 200 ft., requiring a current of about 65 amperes at a pressure of 240 volts. The ventilation of the Hebburn Colliery is effected by a 9 ft. 6 in. by 12 ft. Cappell double-inlet fan, which at present is run at 42 R.P.M., and produces 200,000 cubic feet of air per minute at a water gauge of 1·6 in. The maximum output of this fan is estimated to be half a million cubic feet per minute. This machine is also driven by a Robey compound engine.

The South Bulli Colliery (Mr. A. E. O. Sellars, manager), was also inspected, and being the only colliery in Australasia employing alternating-current electricity at high pressure, the following details may be of interest. The power-station contains one G.E. Company's generator of 146-horse power, also one Siemen's generator of 467-horse power, the former machine being preferred by the management. These generators supply a voltage of 2,300, which, being transformed down to 220 volts at the motors, is utilised for all the power required in the mine—viz., one motor of 100-horse power for driving an air-compressor for "Little Hardy" coal-cutters used in gaseous places; one of 75-horse power for driving-rope haulage (120 amperes); three of from 5- to 30-horse power for pumps (25 to 55 amperes); one of 70-horse power for conversion to direct current for working "Goodman" chain breast coal-cutters. The output of this mine, which is worked from an adit in the hillside, is about 2,000 tons per day, and when the mine is fully opened up the underground haulage will extend seven miles in one continuous main haulage-road in coal. The ventilation is produced by a fan of the Walker type, 26 ft. in diameter and 8 ft. wide, now producing 230,000 cubic feet per minute, at a water gauge of 3 in., but when running at 140 R.P.M. it is estimated that 450,000 cubic feet per minute will be produced at a water gauge of 4·5 in. I was informed by the manager that a centrifugal pump was installed at this colliery, but proved a failure owing to the gritty water. This pump was guaranteed to lift 250 gallons per minute against a head of 400 ft., but it was only tested against a head of 250 ft., and after working for three months for eight hours per day the efficiency declined from 65 per cent. to 40 per cent. The gritty water wearing away the impellers, causing them to bend at the tips, the suction failed, and the pump ran hot. The makers removed the pump without payment for the same, the guarantee having failed.

During my visits of inspection to the Australian goldfields and coalfields I made close investigation into the results obtained from centrifugal pumps, and the consensus of opinion of the mine-managers and engineers using them was that with bronze impellers and under favourable conditions