

EQUIPMENT OF COLLIERIES.

Coal-mining operations in New Zealand have been considerably facilitated by the hilly character of the country and the comparative shallowness of the coal-seams, which conditions have permitted the majority of the mines to be worked from the outcrop by means of adits or inclined planes, usually level-free, thus avoiding the use of winding and pumping machinery, and in many instances of hauling-engines also, and permitting small mines, with a comparatively insignificant output, to be profitably worked. At only four mines is the coal raised by steam-power from shafts—viz., at Taupiri and Taupiri West, and at two small pits in Otago; at the remaining 160 mines haulage-planes and adits are adopted.

The haulage systems at the chief collieries on the Buller and Grey Coalfields are of considerable magnitude, even when compared with those in Europe and America, and are therefore of more than passing interest. These mines being situated on the coastal ranges at considerable altitudes above sea-level it is necessary to lower the coal by means of surface tramways worked by various systems of haulage. The following summary of the principal features of the most important inclines connecting the mines with the Government railways will serve to show the magnitude of the outside haulage-systems:—

Name of Colliery.	Section of Incline.	Horizontal Length.	Maximum Gradient.	Vertical Height.	General.
Denniston	Upper	M. ch. 0 33	1 in 3·3	Ft. 834	Single railway-wagons of 6½ tons capacity are lowered on a 3 ft. 6 in. gauge at the rate of 15 wagons per hour.
"	Lower	0 50	1 in 1·2	864	
Millerton	Upper	0 70	...	1,660	Tubs of 22 cub. ft. capacity are lowered by self-acting endless-rope tramway of 24 in. gauge at a speed of 2½ miles per hour.
"	Lower	0 51	...		
Westport-Stockton	Top	2 20	1 in 21·2	2,376	Electric traction by 20-ton locomotives on top section. From thence tubs of 30 cwt. capacity are lowered on endless-rope tramway of 3 ft. gauge. Maximum gradient for rope haulage, 1 in 3. The lower section is worked by the "main and tail rope" system.
"	Intermediate	0 39	1 in 6·7		
"	"	0 33	1 in 4		
"	Lower	0 28	1 in 63		
Paparoa	Upper	0 52	1 in 12	255	Coal-tubs lowered by endless-rope self-acting tramway.
"	Lower	0 44	1 in 3	850	

Hydraulic brakes are in general use for the purpose of regulating the speed on all the self-acting rope-haulage inclines. The pulleys or drums at the top of each haulage section are fitted with cranks keyed on to the ends of the shafts, which are attached by connecting-rods to the pistons of three water-cylinders fitted with cataract governors, the water in the cylinders checking or arresting the motion of the pistons at the will of the brakeman. These brakes, which were introduced by the late Mr. R. B. Denniston early in the eighties, are far more effective and reliable, and are less destructive to the haulage-ropes, than ordinary friction-brakes.

Great improvements have recently been effected in the mechanical ventilation of the mines, for, whereas in 1891 only three ventilating fans were employed, during 1908 twenty-two had been installed, the fans most favoured being of the "Sirocco," Waddle, and Hayes types.

Multivane turbine fans of the "Sirocco" type having recently been installed at the collieries of the Westport, Paparoa, and Taupiri Companies and at the State collieries in this Dominion, a reference to the special features of this type of ventilator may be of interest. Until recent years it was the general opinion of mining engineers that the fans required for ventilation must necessarily be of large diameters. When, however, the turbine or multivane mine-fan was invented, it became very evident that this opinion needed considerable modification, and it became still more obvious when the results obtained with these fans under actual working-conditions were made public.

The very first installation where the "Sirocco" multivane fan (see drawings) was used bore out the makers' claims, a 75-in.-diameter fan of the double-inlet type not only doing the work of two other fans whose aggregate diameters amounted to 10½ times that of the "Sirocco," but even delivering a 12-per-cent. larger volume of air. This was only the first of many similar instances. At another mine in Great Britain a 77-in.-diameter "Sirocco" is replacing a fan measuring 44 ft. in diameter, while many others of less than 100 in. are being installed in place of fans of the old type measuring 30 ft. to 40 ft.

Interesting though this question of reduced diameter undoubtedly is from the mechanical standpoint, it would be of little value if it could not show some advantageous features when considered also from a commercial aspect. The chief advantage of fans of small diameter lies in the fact that they can be run at comparatively high speeds, making it possible to couple them directly to motors or engines which develop the required power at a high speed of rotation.

The first cost of the motor or engine is consequently very much lower than is the case of a slow-running fan, which often could not be direct-coupled, owing to slow speed necessitating the use of a large-size motor or engine with the proportionate increase of cost.

The reduced dimensions of the high-speed fans lead to a very marked economy in the cost of erection, owing to the small amount of brickwork and masonry necessary to provide their housing, and this fact is clearly evidenced when taking the actual space occupied by the fan-wheels into con-