

a generating station for developing alternating three-phase current, together with transmission-lines and substations equipped with motors. The alternators, which are directly coupled to three engines of the horizontal cross compound condensing side-crank type, are of 750-horse power each, and include three 400-kilowatt machines and 30-kilowatt exciters. The large generators are of the revolving-field type, having 48 poles, and are run at a speed of 150 revolutions per minute, and generate a three-phase 60-cycle current at a potential of 6,600 volts. The high-pressure voltage is transformed down to 440 volts at the substation for motor use at the hoists, pumps, puddling-pans, Root's blowers, &c., and to 220 volts for locomotives of the Ganz type*, two of which are employed. The pumping plant for this mine consists of a three-throw plunger pump capable of raising 2,000 gallons per minute to a height of 360 ft.; formerly a Mather and Platt two-stage centrifugal pump of similar capacity was employed; but I was informed by the manager, Mr. G. F. Bryant, that his company found that the plunger pumps were cheaper to work and more efficient, consequently the centrifugal pump was replaced by them. The electric winding plant consists of a 75-horse-power induction-motor connected by spur gearing to the coupled drums, which are controlled by a friction brake, the motor being started, reversed, or stopped by a starting-switch as used on electric cars. A great defect in this hoist has been the spur gearing (of $2\frac{1}{2}$ to 1), the teeth and other parts of the wheels constantly breaking, and it is considered by the electrical and mechanical staff that a chain gearing would be preferable. With this exception the plant works satisfactorily. Ventilation is produced by a Root's blower† of the largest size (No. 9), and conveyed through pipes 16 in. in diameter for a distance of about one mile for the use of the fifty-four men employed in the mine. The underground haulage in the main drives is operated by Ganz electric locomotives, which, it is stated, are capable of developing a draw-bar pull of 650 lb. at a speed of five miles per hour. The trollies are connected to the motors by flexible cables; the wires are carried by insulators held by safety brackets in a top corner of the haulage-road. The weight of the locomotive is $1\frac{1}{2}$ tons, and the gauge of the road 16 in.

The auriferous lead at this mine averages about 1,200 ft. wide, and is worked from a main shaft 344 ft. deep. The average depth of the wash from the surfaces is 247 ft., the lead having an inclination of about 1 in 100. I was informed by the manager that the working-costs absorb 11 dwt. of gold per fathom, and that miners' wages vary between 7s. 6d. and 9s. 2d. per shift.

The Duke and Main Lead Consols Mine (Captain Glover, manager), which was also inspected, is worked under somewhat similar conditions to the Charlotte Plains and other deep-lead mines in the Maryborough district. At this mine electricity is not so extensively employed; at the present time the puddling plant, plunger, and other pumps, and Root's blower are the only equipment at which this power is used, but it is proposed to introduce electric traction by Ganz locomotives, as previously described. The mine is drained by Cornish pumps in the shaft, and by two horizontal plunger pumps in an underground chamber. Originally three-throw centrifugal pumps of Worthington type were employed, and I was informed that they successfully dealt with two-thirds of the quantity of water which they were estimated to lift—viz., 700 gallons per minute against a head of 284 ft.; but the plunger pumps were found to be more efficient, and are now in use. Boring upwards to drain the gravels prior to working has been extensively carried out at this mine, the average cost per foot being about 2s. 6d. for labour alone. A hand plant operated by rocking-lever is used, the holes being of sufficient dimensions to admit of 3 in. casing being introduced; the greatest height thus bored upwards is 72 ft. In the event of the borehole coming in contact with a large hard boulder, the hole is "bulled" with gelignite, or else abandoned.

At the Victorian Deep Leads alluvial mine a successful instance exists of electrically driven double-action Cornish pumps producing, I was informed by the Consulting Engineer, an output of 1,910 gallons per minute against a head of 360 ft. Three-phase alternating current is employed, the induction-motor having 400 R.P.M., while the pump works with 8·3 strokes of 8 ft. per minute, the motor being connected to the pump by rope-driven pulleys and reduction gear. The diameter of the pumps is 20 in., and of the columns 22 in. I was informed that the efficiency of this pump was exceedingly high. Mr. Wilkinson, M.E., the representative of Messrs. Bewick, Moreing, and Co., in Victoria, who control the mine, also informed me that these pumps had been employed constantly for four years, and gave every satisfaction. The evidence is most important in view of the misapprehensive statements that Cornish pumps cannot be successfully driven by electricity, and it will be satisfactory information to the many mining engineers who prefer the Cornish pump to all others for reliability.

NEWCASTLE COALFIELD.

The coalfields of New South Wales of Palæozoic age probably constitute the most valuable mineral asset in Australasia. The total contents of these coalfields in exploitable seams not less than $2\frac{1}{2}$ ft. in thickness have been estimated to be 78,000,000,000 tons by the late Mr. C. S. Wilkinson, Government Geologist, and by Mr. E. F. Pittman, A.R.S.M., F.G.S., the present occupant of that position, to be 115,000,000,000 tons. In the former estimate a deduction of one-fifth was made for waste in getting, and in the latter a deduction of one-third. The area of the Newcastle Coalfield, the most important coalfield in the State, has been estimated by Professor T. W. E. David, B.A., F.G.S., of Sydney University, to cover an area exceeding 212 square miles.

The principal seam worked at Wallarah, about sixty miles north of Sydney, is supposed to be identical with that at Bulli, nearly the same distance south of Sydney.

* These electric locomotives are employed at the Great Southern Consols, Berry Consols Extended, Charlotte Plains, and New Havilah alluvial mines. They give satisfaction on long-haulage roads of flat gradient if carefully handled and kept clean. They cost only £252 each. † This blower, owing to leakage of the pipes, has not been a great success, the quantity of air admitted being 4,620 cubic feet per minute, at a water gauge of 28·5 in., of which only 1,136 ft. was delivered (*vide* Chief Inspector Merrin's annual report, 1907).