tion of electric power for mining and milling purposes, the most notable installations being in the properties of the War Eagle Mining and Development Company, the British Columbia Bullion Extracting Company, the British American Corporation, and the Gertrude, Big Three and Iron Mask mines. These six properties alone consume about seventeen hundred horse power in the operation of hoists, compressors, crushers, conveyors, ventilating blowers and in electrolytic work. The bulk of this power is delivered by induction motors, for, as a general rule, synchronous motors have been applied only to the driving of compressors.

Fig. 7 gives a general view of the controller of the War Eagle hoist, which will be seen to be a standard General Electric induction motor. It is a three-phase equipment operated at 2,300 volts, has twenty-four poles and delivers three hundred horse-power at three hundred revolutions per minute. Its technical designation is, therefore, "I 24-300-300 form A." The rotor shaft is geared to a Ledgerwood type double drum hoist through double reduction gearing, having a ratio of reduction of 300 to 40. The War Eagle shaft is at present down a little beyond the 600-foot level and the maximum load raised amounts to eight tons, including the load, cage and rope, the speed being 720 feet per minute for this load.

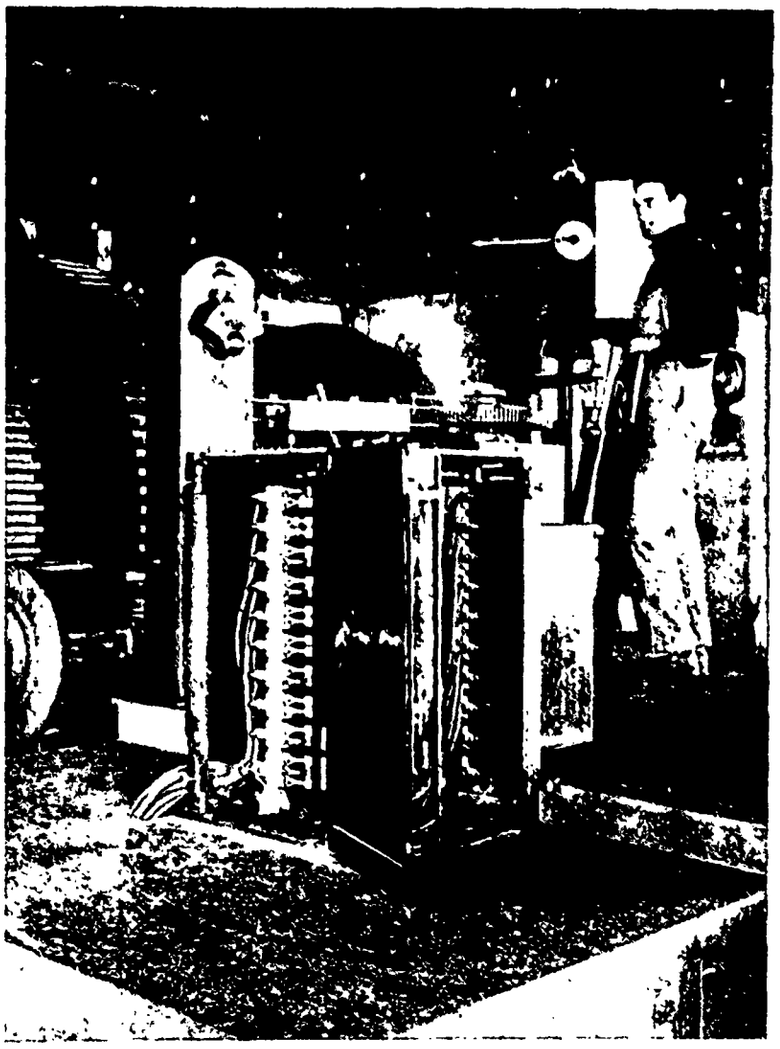

FIG. 7.—VIEW OF CONTROLLER FOR INDUCTION MOTOR FOR WAR EAGLE MINE.

Interest, of course, centres in the method of speed control, each technical detail of which is fully shown in the accompanying illustrations. Secondary control is used exclusively; that is, no effort whatever is made to control the primary current, while the secondary current, or that induced in the rotor circuit, is varied by the introduction of external resistance. The controller proper, shown in Fig. 7, is a duplex one, inasmuch as the movement of the controller handle manipulates both the primary and secondary circuits of the motor, the former for making, breaking and reversing, and the latter for the control of the variable external resistance. The controller on the high tension or stator side operates in a bath of mineral oil. The secondary windings are led to three collector rings placed on the shaft with the rotor, and upon these rings bear carbon brushes which cover about 90 degrees of the surface of the rings, this being a necessary procedure because of the heavy ampereage to be taken off. The maximum secondary electromotive force obtained is in the neighborhood of seventy volts. From the rotor brushes the current is carried to the low tension side of the controller, through which resistance may be cut in or out of the rotor windings in ten steps. The resistance consists of cast iron grids arranged upon a large slate resistance board as shown in Figs. 8 and 9. With the maximum load of eight tons gross at a speed of 720 feet per minute the current reaches a maximum of 110 amperes per phase, dropping back to 90 amperes as the load decreases by reason of the cage nearing the surface. With a load of men the maximum current is 70 amperes per phase.

FIG. 8.—FRONT VIEW OF EXTERNAL RESISTANCE BOARD.

The principle under which variable speed is attained in the operation of this induction motor is found in the fact that while in the synchronous motor exact synchronism between the motor and the generator must always be maintained, yet the induction motor is so constituted as to be nearly independent of any magnetic slippage that may exist between its stator and rotor. When under full speed the motor is practically in synchronism with the generator, but with the generator speed constant a variable speed in the motor is best