safety rope will hold the cars. Furthermore, the safety rope, if called upon to take the load, will be controlled by all the automatic brake features in exactly the same manner as when the load is being handled by the main ropes. In actual operation the length of the safety ropes will be slightly more than that of the main hoist ropes, thereby relieving the safety ropes of any hoist stresses other than those required to keep the ropes themselves in motion.

Operation and Safety Appliances.—The operator's cabin is fitted with one electric control and two hand-brake levers. The levers will not be used ordinarily as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand-brakes, therefore, need only be used for the locking of the cars at the top and bottom positions or for cases of emergency. In starting a run, the operator releases the drum post brakes by the hand-levers, puts his foot on the small foot pedal located at bottom of master controller, and by moving the handle of the controller to either the right or the left, as the case may be, the cars will start and will automatically accelerate to the normal

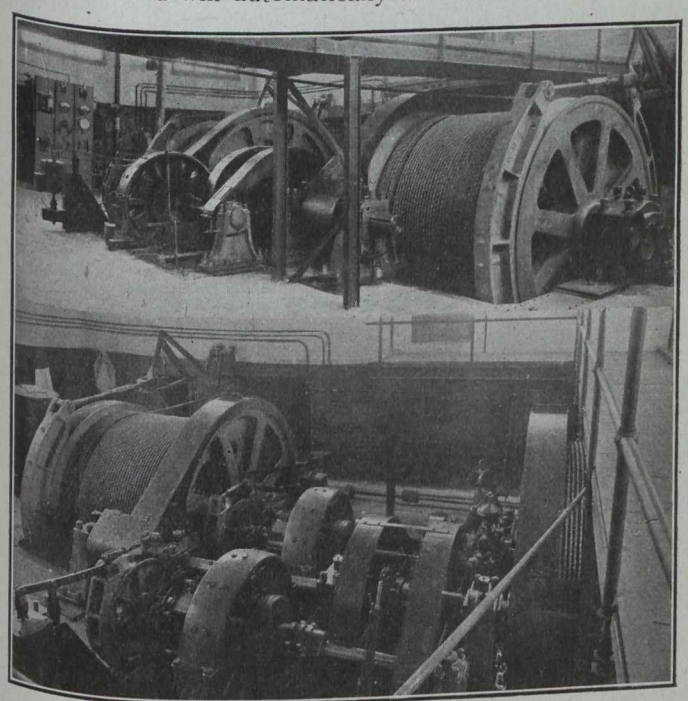

Fig. 2.—Interior of Power House. Top View Shows Geared Overwinding Safety Device on Drum Shaft and Solenoid Brake. Bottom View Shows Both Motors, Fly Ball, Speed Limit Device, Etc.

rope speed. At a predetermined point on the incline, the controller handle will be automatically turned to such a position that the speed will be cut down to 1/10 of the normal and finally be turned to the off position, thus setting the solenoid brakes and bringing the cars to rest. Should the operator become disabled during a run, he will of necessity remove his foot from the foot pedal, thereby cutting off the current, bringing the cars to rest. In order for the cars to move, the operator's foot must be on this pedal. In case the cars should stop short of their landing positions, due to the automatic overwinding mechanism, there are available two or three points on the controller so that the operator can bring them to their proper positions. Should the cars fail to stop, due to the fault of controller, an overwinding device is attached which will shut off the current and set the solenoid brakes. Should the speed of the cars exceed the normal by a predetermined amount an overspeeding device is so arranged that it will trip a weight of 570 lbs., which will set the drum post brakes. This overspeeding device or governor is of the fly ball type, and it will be caused to operate by an excessive speed, whether due to motor or a breakage of the hoist parts. The emergency weight may also be tripped manually from the cabin.

Shafts and Drums.—The drum shaft is a steel forging in two pieces, 12 in. in diam. Including the two sections, it is 32 ft. long and weighs 13,300 lbs. The intermediate shaft has been machined from a single steel forging and is 7 in. in diam. its entire length. It is 20 ft. long and weighs about 3,000 lbs.

There are two cast iron drums 96 in. in diam., 70-in. face and coil 800 ft. of 1⅝-in. rope, plus 3 holding coils at each end of one layer. These drums are made up in two sections, of barrel construction, and are bolted at one end to the post brake ring, and at the other end to the drum gear. The two sections composing each drum weigh each 8,350 lbs., which means a total weight of drum barrel for each drum of 16,700 lbs. Each of the drum gears is made of cast steel with cut involute teeth, and is of the double-arm wheel type, having eight arms reinforced by ribs forming an "H" section. The gear has 122 teeth of 1 D.P. and a face 12 in. in width, the pitch diameter being 122 in.

The intermediate gears are of cast steel with Herringbone teeth, cut. They have 113 teeth of 3 D.P. and a face 8 in. in width, being 56½ in. in pitch diameter. The intermediate pinions are of forged steel and have 22 teeth of 2 D.P., cut in the Herringbone type. They have a face of 8 in. in width and are 11 in. in pitch diameter.

Electrical Equipment.—Power is supplied in the form of 3-phase, 25-cycle, a.c., and for transforming this to d.c. a C.G.E. motor generator set has been installed of sufficient capacity to supply the average demand of the hoist, plus some surplus for charging the battery described below. The d.c. end of this machine is rated at 165 amp. continuously at 550 volts, the latter being the floating voltage of the battery. This generator is driven by a 2,200-volt induction motor. The generator end is designed with a special drooping characteristic by means of a reversed series field for the purpose of throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is, therefore, inherent in the design of the machine, and is entirely automatic.

The hoist is driven through two gear reductions, the total ratio of which is 29.84 to 1 by a General Electric 180-h.p., 500-volt, 475/585 r.p.m., d.c. motor, which is especially designed to stand such voltage variations as come from a storage battery when it is frequently charging and discharging. The motor is controlled by a magnetic contactor panel so that the motor may be controlled remotely from the operator. This system of control admits of the various protective devices to ensure against the cage operating at greater than a predetermined speed. To ensure a greater degree of continuity of service a reserve 180-h.p. motor and solenoid brake are provided. The machinery of the hoist is so constructed that in a very few moments one motor can be disconnected from the hoist and the other clutched in ready for service. The master controller is situated in the operator's cabin at the top of the incline.

Storage Battery.—The power plant has been supplemented by a storage battery built by the Electric Storage Battery Co., of Philadelphia. One of the objects of installing this was to reduce the maximum peaks due to the