in. stroke, arranged two in tandem upon each side. The engine is direct-connected to a 2,500-k.m. d.c. Crocker-Wheeler generator, and operates at 85 r.p.m., or a piston speed of 1,020 ft. per min. The generator is designed for 25% overload capacity, and the engine is rated at approximately 6,000 I.H.P.

The magnitude of this engine may be realized from the following data: The 20-ft. flywheel weighs eighty tons, and the engine complete, without generator, weighs approximately 700 tons. The total length of the engine from rim of flywheel to the end of tail-rod guide measures 80 ft., and the overall width is 32 ft. The shaft in middle measures 32 in. in diam., and has an overall length of 26 ft., weighing, with crank discs, almost 100,000 lbs. Each complete connecting-rod weighs 10,300 lbs., and each bed or frame approximately 150,000 lbs.

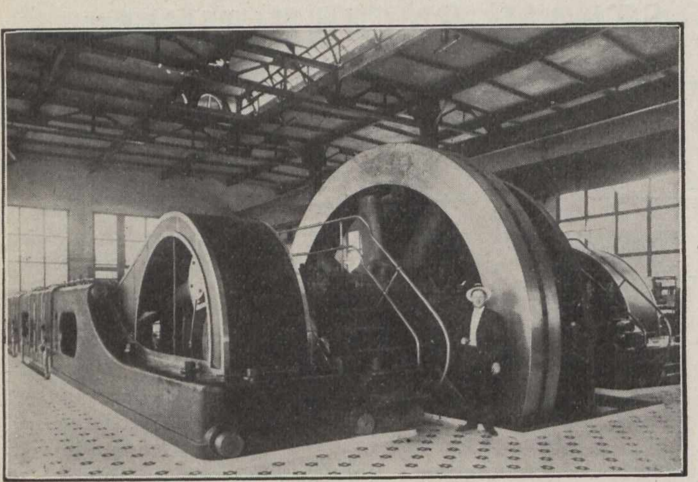

Fig. 2.—Front View of Engine in Fig. 1, Showing General Design and Massiveness.

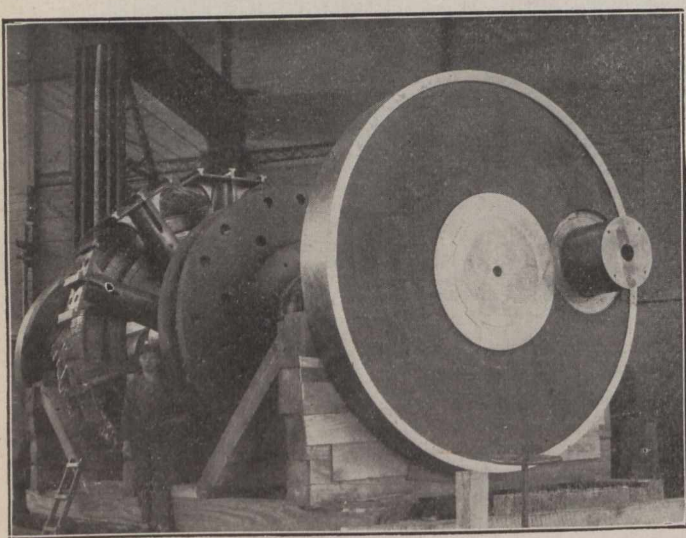

Fig. 3.—Crank Shaft with Armature Rotor, Ready for Transportation.

The engine is designed symmetrically around the centre line, and the massive bed-plate, common to nearly all large gas engines, is omitted, the object being to make the engine self-contained and securely anchored on its foundation, allowing the cylinders perfect freedom to adjust themselves according to stress or temperature changes. The massive frames are reinforced longitudinally by 6-in. steel tie-rods, shrunk into place. The cylinders and distance-housings are secured to their respective beds by a continuation of 6-in. steel tie-rods and nuts.

The total weight of the pistons and rods is supported by the main, intermediate and tail-rod crossheads, all riding on bored guides. The main crosshead body is made in two parts and of annealed steel casting. The two halves or sides are held together by turned steel bolts in reamed holes, and the bolts at the throat are arranged to produce a clamping effect on the piston-rod, where it is screwed into the neck. The shoes are independent of, and secured to the crosshead by the trunnion method.

The main bearing is of massive and unusual construction, the caps being set into the housing in such a manner as to form a strut and tie, and are secured in place by 6-in. steel tie-rods placed longitudinally. The lower shells are water-cooled by means of brass coils, which were bedded in recesses in the cast-iron shell, and the babbitt metal, poured on top, encasing each, thus avoiding the possibility of trouble from waterjacket due to defective casting. The crank discs are of the counter-balanced type, made of annealed steel casting, and the crank pins are cast integral with the discs.

The lay shafts are located above the floor line, and are driven by semi-steel spiral gears from the main shaft (bronze gears were used at first, but found impracticable). These lay shafts are in sections, secured to each other by pin couplings, so that each section remains with its particular cylinder, and perfect alignment between crank and the walking-beam, which it drives, is preserved. On each lay shaft there is secured a crank for each end of the two cylinders in the set, and each crank operates both inlet and exhaust valves through the medium of the walking-beam at the end of its respective cylinder. The walking-beam and lay shaft carrier brackets are made double in order that the pins may have double support instead of being overhung. The design throughout eliminates overhung pins or bearings.

The inlet, or admission valve at each end of the cylinder, is actuated by a cam, the operating bell-crank lever of which is located between the sides of the walking-beam and pivoted at the centre. One end of the bell-crank actuates a hook, steel-faced, which engages with another hook-plate lever, fulcrumed in the projections on top sides of the walking-beam. An eccentric upon the governor shaft operates a cam, which trips the valve mechanism at any point of the stroke determined by the governor, similar to the cut-off arrangement of a Corliss steam-engine. The valve is closed by a spring, and cushioning is effected by an air dashpot. The admission is of the quantitative method, and the governor performs no other work than adjusting the position of the tripping cams.

The exhaust valve is operated by a cam, which receives its motion through a link secured to the extreme inner end of the walking-beam. The leverages of the cam are so proportioned that a very slight movement of the walking-beam produces a considerable movement of the working surface of the cam in sliding contact with the lower end of the exhaust valve projection. The arrangement is such that at a certain position the movement of the valve is rapid, but when the outer end of walking-beam is at its lower range of travel there is a pause in the exhaust valve mechanism. The pistons and rods are hollow and water-cooled. The water enters the rods at the intermediate crosshead by means of a telescopic oscillating arrangement, the outer end of which is pivoted below the engine. The piston-rod contains an inner tube for the inlet water to the pistons, and the