and heavy concrete walls. The timber work of the roof is of the slow-burning type, consisting of 3 inch plank with 16 inch purlines 10 feet apart. A 20 ton Shaw electric travelling crane traverses the entire length of the shop, passing also under the riveting tower at the extreme south end. This tower is to be 55 feet 4 inches high to the runway rail of the hydraulic riveting crane, and is to contain two hydraulic riveters, with necessary accumulators and pumps.

The erection of boilers is done in the northern half of the building, and the rest of the building, up to the riveting tower, is to be used for punches, shears, planers, plate rolls, and other machinery.

Power Requirements.

The power, previous to the improvements, was supplied by three separate steam engines, and distributed to the tools by shafting and belting. The lighting system, mainly of incandescent lamps, was incomplete. The shops were heated in part by exhaust steam, but live steam was also used to a considerable extent, especially in very cold weather. It was decided to substitute a central power station large enough to supply the power, light, and heat now required, and arranged so as to permit of ready enlargement in the future.

The desirability of installing gas engines operated by producer gas was made the subject of some little study. Where the question of heating need not be considered it is believed that a plant of this kind will produce power more cheaply than steam engines and boilers. This will be the case even with much higher coal consumption than that claimed by interested parties, and taking into account also increased fixed charges on first cost of plant.

In case, however, the exhaust steam can be utilized for heating purposes, a steam plant will not only be simpler but generally more economical in operation as well as first cost.

In a climate like Canada, with long and severe winters, this will be the case except in rare instances. A steam plant with electrical generation and transmission of power was therefore adopted.

In view of the compactness of the plant and the nature of the work to be done, it was decided to use a continuous current throughout, generating it at 250 volts, and using this voltage in all motors with a two-wire distribution. All lamps are for 125 volts, with a three-wire distribution, a 10-kilowatt balancer set being used.

An analysis of the probable requirements was made on the basis of the actual indicated horse power of the engines in use, with proper allowance for the existing shortage of power which had not permitted all tools to run at their full capacity. The figures so obtained were checked by comparison with the requirements and load factors for similar machine shops elsewhere, especially at the Angus shops of the Canadian Pacific at Montreal, the figures for which were kindly placed at the writer's disposal.

Apart from the crane loads, which are intermittent, the present requirements for power and lighting were computed at 240 kilowatts at the switchboard. This estimate has been confirmed by the actual average 10 hour load for December last, which was 228 kilowatts, as taken from the switchboard readings.

The size of the power plant, and the several parts of its equipment, were based on the above power requirements, as well as on the steam required for operating the necessary air compressors and for heating.

A reasonable provision for spares was made, and the building is of ample size to allow for future increase in equipment. The building and equipment are briefly described in the following sections of this paper.

Power House.

The general arrangement of the power house is shown in Figs. 2 and 3.

The base of the entire building consists of a concrete slab about 3 feet thick, which rests on piles spaced 3 to 4 feet apart and driven to bed rock. The slab supports the walls, floors, and boiler and engine foundations. The space between the top of the slab and the finished floor level, where not occupied by foundations, is utilized for pipe trenches, all remaining voids being filled in with earth.

The building has a steel frame, of columns, and roof beams, 20 inch concrete walls, and a hollow tile and reinforced concrete roof on the Kahn system. Practically all the steel work is protected by concrete.

The engine room has a tiled floor, an enameled tiled dado, and painted concrete walls.

The entire building is fire proof except as to the doors and windows, and the interior is attractive and easily kept clean.

The engine and boiler rooms are 83 feet long and 32 feet and 38 feet wide, respectively, the latter being of somewhat greater height to accommodate the vertical boilers.

The north end of the boiler room is divided off by permanent fire proof partition to form a separate pump room free from the dust incident to stoking. The ceiling of this pump room is of reinforced concrete, resting on a steel frame, which supports the induced draft plant.

Equipment of Power House.

A view of the interior of the power house and the engine and generator equipment is shown in Fig. 1.

The equipment for any given power plant should be such as will produce the required power, light, and heat at a minimum cost. The type of apparatus by which this result can in each case be best secured will depend on local conditions. These should, therefore, be carefully taken into account. This is a point which is often overlooked, and the equipment is in many cases not suited to the special work which the plant is called upon to do. The most important elements involved, besides the amount of power required, are the length of the working day, the cost of coal and water, the amount of steam required for heating and other purposes, and the length of the winter season.

In the Kingston works there is little night work, a considerable amount of exhaust steam is required for heating, and the winters are long and severe. The cost of coal is not excessive, and there is plenty of river water available for boiler feed and condensing purposes.

Under these conditions, the lowest cost for fixed charges and operation will be obtained by apparatus, simpler and less expensive than that which would be proper in a large city central power plant.

The efficiency will, of course, be somewhat less than that obtained in the large plants with 24-hour service, which have no use for the exhaust steam.

It is believed that both the boilers and engines and auxiliaries, as well as the general layout, are in accordance with the above principles. The engines especially combine moderate first cost with a very low steam consumption, while the boiler efficiency is excellent without excessive first cost.

The equipment may be summarized as follows:

The boiler plant consists of three Wickes boilers, with Foster superheaters and Murphy stokers, and a Buffalo Forge Co. induced draft plant.

The pump room contains the Webster feed water heater, separate pumps (in duplicate) for boiler service and general shop supply, and a large fire pump.