and one without diffusion guides, and both rated 2,500 gal. per min., 880 r.p.m., and 180 ft. head.

The efficiency curves show a higher efficiency in the pump having diffusion guides, due to the better hydraulic conditions prevailing on account of having definite passages for the guidance of the water from the impeller and to the smaller losses in the smaller impeller required. On account of the smaller power required at no load and at full load by the pump with diffusion guides, it is evident that

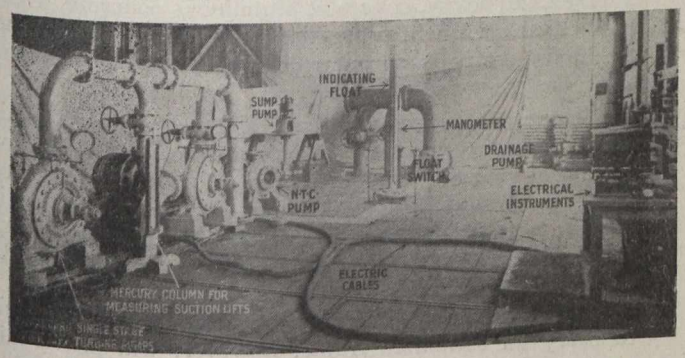

Fig. 3.—Arrangement of Equipment, Pump-testing Plant.

its efficiency curve must be higher over the full range of the pump since the b.h.p. curves are nearly straight lines.

It will be noted that, with the pump not having diffusion guides, the point of maximum capacity is not very far beyond the point of maximum efficiency which is at rated capacity of the pump. The pump having diffusion guides, however, gives considerably greater capacity than that at which maximum efficiency occurs. So, by taking advantage of the overload guarantee of electric motors (25% for 2 hours) it can be seen that approximately 30% extra capacity can be obtained for two hours. This is valuable for heavy fire service and all the more valuable since the pressure only drops approximately 15 per cent. With a pump not having diffusion guides the pressure falls to zero on small overload demands, which would be serious if firemen coupled on a few extra lines of hose and opened them out too much. Furthermore, with this latter type, no advantage can be taken of the overload capacity of the electric motor.

The characteristics of the diffusion guide pump were fully demonstrated at Bracebridge. The nozzles were removed and the discharge regulated by a valve. The discharge was increased above the rated capacity and the pressure held up as shown on the curve in Fig. 4. The equipment was intended for 4 fire streams and it was shown that nearly 7 could be obtained without a serious falling off in pressure, or overloading of the motor.

The overload relay on the motor was set for between 35 and 40% overload. On opening up the discharge wide the motors automatically tripped out. These conditions correspond to a break in the water mains and showed how the pressure was automatically removed which would prevent a big washout around the break in the water main. The overload relay can be arranged either to operate an alarm or trip the motor out or both.

Mr. W. C. Simmons, superintendent of the municipal systems at Bracebridge, laid out the equipment and put in the installation. The convenience with which his

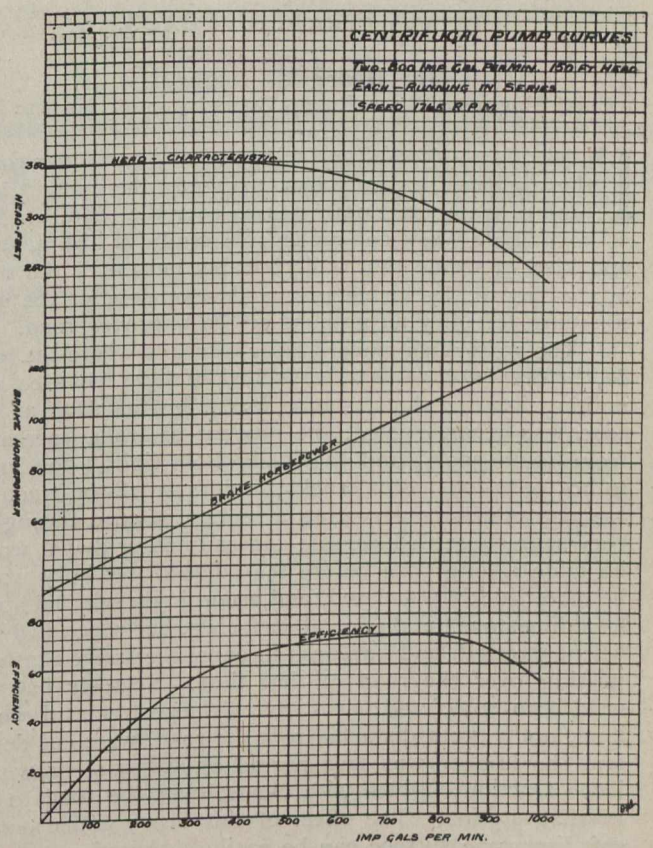

Fig. 4.—Characteristics of Two 800-gal. per min. Pumps Running in Series, 150 ft. Head, 1,765 r.p.m.

equipment may be operated is worthy of notice. The operator, standing in front of the switchboard, can start up both motors from that position and is able to watch his instruments while doing so. After the motors are started, by facing about, he has all the valves within reach and the gauges are mounted in front of him, so that he is able to see just exactly what is happening when opening the valves. It is easily possible to start everything from rest and have fire pressure on the mains within 30 seconds from the time the alarm is sent in.

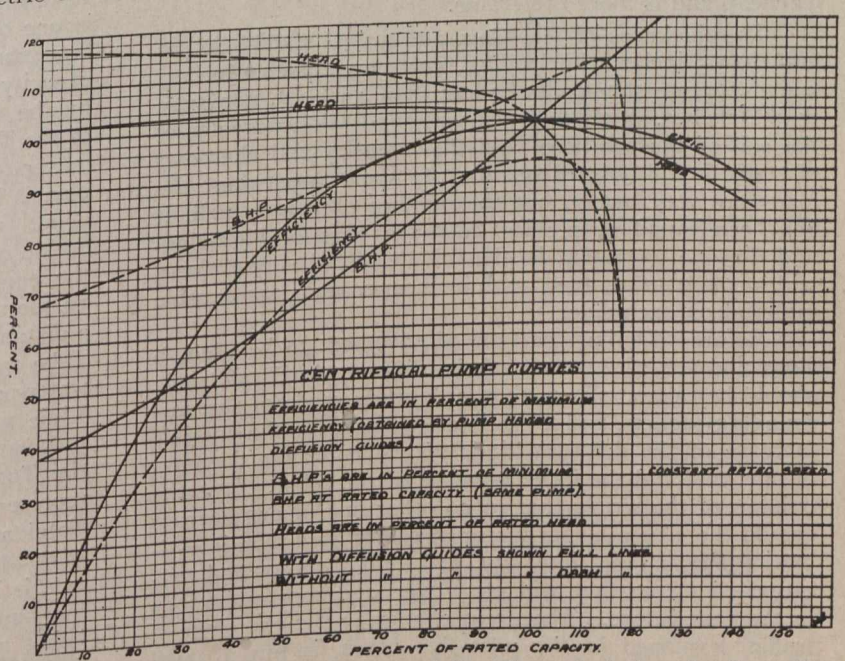

Fig. 5.—Effect of Diffusion Guides on the Characteristics of a Centrifugal Pump, as Shown by Actual Test.