signed that they can be examined at any time with the least possible trouble.

The main frame of the pumps is made in two halves, and bolted together. The frame is built of the inverted U section, thoroughly ribbed and stayed; the crosshead guides or bearings are of liberal dimensions, truly planed and finished, having pockets at either end for the reception of oil or grease to lubricate crossheads; the bearings of the crank and lying shaft are of the type peculiar to the Corliss engine, built up entirely of brass, and provided with wedges to take up wear or loose motion. Some idea of the massiveness of the frames can be formed when it is known that their weight alone is over 18,000 pounds each.

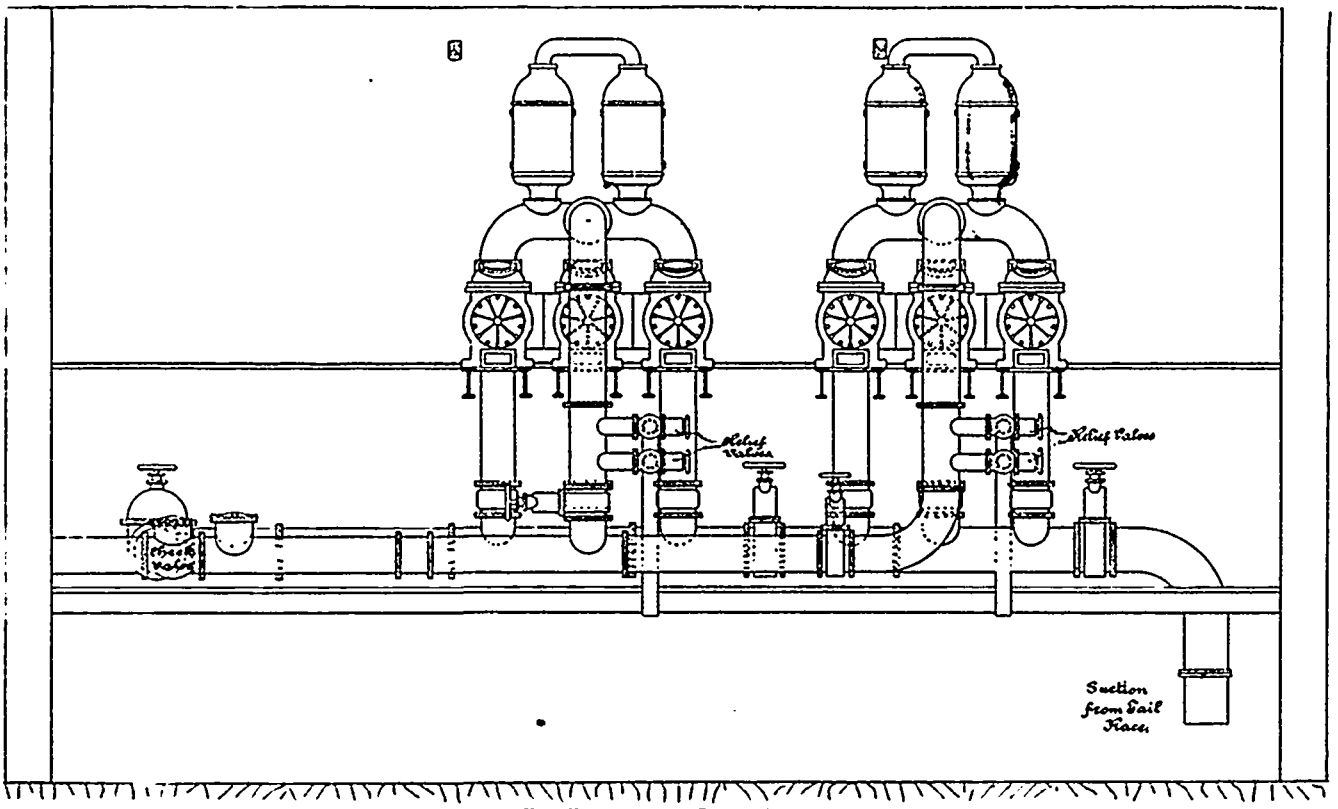
The plungers are made of cast iron working in a brass-lined cast iron stuffing gland, which can be readily packed from the outside, and are carried in the stuffing box, which is securely bolted to front end of cylinder.

The plungers are cast hollow with spherical ends, and are made as light as possible, so as to "float," and thus reduce their weight on their horizontal bearings; they are secured directly to the crossheads.

internal circular flange and securely bolted to the cast iron crank disc, in which the crank pins for the outside cylinders are placed. The crank pins on discs are ground in and fitted in a taper hole, and securely held by key on inside of disc.

The discs were pressed on to the crank shaft and provided with steel keys. The crank shaft is 10 inches in diameter, of hammered steel made by the Nova Scotia Steel Company; the centre crank pin is formed upon the crank shaft, of the same diameter as the crank shaft; the outer crank pins are 7 inches diameter and 7 inches long. The entire weight of the crank shaft, with discs and spur wheels, is about 13,700 lbs., the heaviest single piece to be handled. The connecting rods are of forged steel of rectangular section, with a ratio of 6 to 1 of the crank; they are all provided with brass boxes, wedges for taking up loose motion, and are finished bright all over.

The crossheads are of cast iron of massive design, and in keeping with the rest of the pumps, they are provided with adjustable slippers for taking up any wear. The bearing part of slipper against guide is




End Elevation of Power Pumps.

The crossheads have a bearing only on underside, as the plungers do no work upon their forward motion, there being no thrust upward; all the thrust takes place upon the backward motion of the pumps.

The cylinders are securely bolted by the back end of main frame, at the front end of which is the lying shaft operated by the water wheel shaft, as seen by the illustrations; between the lying shaft and the cylinders is placed the crank shaft, from which motion is imparted to the plungers. The lying shaft is driven from water wheel shaft by bevel gearing, and motion is imparted to the crank shaft through the spur pinions on lying shafts in gear with large spur wheels on crank shaft.

The spur gears are 2 to 1, the pinions are 33 inches diameter, 11-inch fall, and 4-inch pitch; the spur wheels are 64 inches diameter, 11 inches faces, and 4-inch pitch. The spur gearing teeth are all machine cut, thus insuring accuracy of motion.

The large spur wheels are simply a rim with an

formed of babbitt metal run up into the recess made for same in slipper; the babbitt is then well hammered when cold, and afterwards neatly planed off, thus forming an excellent rubbing surface with the cast iron guide on frame. The crosshead pins are of steel, 5 inches diameter by 5½ inches long.

Each set of pumps is provided with two air chambers of large capacity made of cast iron, weighing over 2,000 lbs. each, of neat external design; the air chambers are connected to each other by a 4 inch pipe, thus ensuring an equal volume of air in each. The air chambers are wholly supplied by the "snifting valves" placed on top of pump barrels, and having the necessary glass gauges. The usual piping for priming and draining off the cylinders is provided, and so placed between the cylinders as to be easily operated when required. The delivery pipe from each set of pumps to the pumping main is 16 inches diameter, and is supplied with a 16-inch gate valve so that each set of pumps can be entirely shut off from the mains. The