NEW COMPOUND PUMPING ENGINE.

The attention of town and city authorities is especially desired to the consideration of the peculiarities and merits of the compound pumping engine described below, which embodies in its construction and operation certain new features which are affirmed to be highly advantageous. The requirements of towns and cities of moderate size, which have been studied with much care by the makers of pumping engines, have originated many of the recent improvements in this class of machinery, inasmuch as they demanded the production of an engine which should combine with high duty a very moderate first cost, and economy in operation and maintenance. The last named conditions are imperative, and must be estimated by the relation which they sustain to the desired capacity of the works. These requirements have called out the best efforts of our engine builders, and the fruits of their labors will compare very favorably with the best achievements in other branches of the mechanic arts.

The improvements that have been made in this department of mechanical engineering have long ago displaced the old type of direct-acting pumping engines, in which the steam was used at constant pressure the full length of the stroke, and then exhausted at that pressure into the atmosphere without doing any further duty ; and in place of these have come the compound engines using steam expansively, experience having demonstrated that engines of this type are vastly superior in duty to the old and no more expensive in operation and maintenance.

The compound pumping engine illustrated and described herewith is one of the best representatives of its class and embodies certain specially advantageous features in its construction.

The most desirable plan for moving water is by the direct action of a steam piston upon the plunger of the pump ; and the labors of the makers of pumping machinery have been expended in the task of effecting a combination of the pump with an engine that would yield the highest duty—in other words, with an engine that would work the steam in the most economical manner. In the compound engine herewith illustrated we have a machine eminently adapted to meet this requirement. In this we have the steam doing a portion of its work in one cylinder, operating one plunger of the pump, then exhausting into a large receiver beneath the floor, and expanding into a second cylinder, whose piston operates another pump plunger. To render the equalization of force between the two cylinders as nearly perfect as possible, a notable advantage is derived from placing the receiver between the cylinders, which, by the addition which it makes to the volume of steam effected by influx and effiux, materially assists in maintaining uniformity of pressure. The two steam pistons moving coincidently, the degree of expansion is governed by the relations of the areas of the two steam pistons and their stroke. The relation of these areas is determined by the steam pressure, the grade of expansion determined on, and by the measure of work to be done.

The engraving shown illustrates an engine of the type above described. They are in use at the water works of Milwaukee, Wis. ; Cincinnati and East Liverpool, O ; and Trinidad, Colo., and have been constructed up to the capacity of eight million gallons for twenty-four hours.

As above described, these machines consists substantially of two direct-acting pumping engines. They deliver into one main, but there is no further connection between them. save by the steam and water pipes. They have entirely independent motions, and their pipes and valves are so designed and constructed that either one or the other may be operated independently. The low-pressure is made at least equal in power to the high-pressure engine. An isochronal device is attached to the low-pressure engine, which insures a perfect regulation of the speed. The motion of the two engines being entirely independent of each other, the grade of expansion is varied by an increase or decrease in the speed of the low-pressure piston, which practically effects a change in the comparative volumes of the cylinders. The engine being self-adjusting, the low-pressure piston adapts its motion to the work required of it, thus maintaining the needful pressure in the receiver from which it draws its steam supply. In practice the engines are carefully proportioned for the work required of them, so that no excessive variations in the number of strokes of the engine shall occur.

From the foregoing description it will be perceived that we have in this machine a self adjusting, variable expansion, direct-acting pumping engine, which possesses special advantages on the score of simplicity of arrangement and extended adaptability.

These engines are manufactured by the Cope & Maxwell Manufacturing Co., of Hamilton, Ohio.

Mechanics.

NEW MECHANICAL MOVEMENT.

The engraving shows a new mechanical movement for changing a reciprocating motion into a continuous rotary motion at every point in the revolution of the crank.

Fig. 1 is a plan view, and Fig. 2 is a side elevation, partly in section, showing the relation of the various parts. The device is represented as connecting the crosshead and crank shaft of a reciprocating steam engine, but it is capable of application to any kind of machinery in which reciprocating is converted into rotary motion. The ways, A, support the crosshead, which is attached to the piston rod of the engine and reciprocated in the usual way. The crosshead carries a lever C, having at its ends connecting rods connected with the cranks D E, the latter being connected together by the tie rod F, so that they stand at right angles to each other. Pawls G H, jointed to opposite sides of the upper end of the lever C, are fitted to engage notches in the ends of the auxiliary crosshead B, and are arrranged so that during the stroke one of them may be engaged by an arm attached to one of the ways A, and the other will be engaged by an arm projecting from the other way.

With this device arranged in this way the engine will turn only in one direction, but by attaching a set of pawls G H, to the lower end of the lever, C, the engine may be made to turn in either direction, depending of course upon which set of pawls is allowed to operate.

The auxiliary crosshead is of such length relative to the length of the main crosshead that has an independent long stroke—that is, a longitudinal movement at the ends of the stroke which is independent of the movement of the main crosshead, and the ends of the auxiliary crosshead are provided with the grooves with which the notched end of the pawls G H, alternately engage while the crosshead is traveling the space of its independent movement. By this means the force during the independent movement of the auxiliary crosshead is transferred through the pawls, G H, to a point above the plane of reciprocation, and applied to the cranks of the shaft through the oscillating lever C, and the connecting rods at a point above the line of dead center. It will be understood that during this time the main crosshead remains at rest, and that the motion of the oscillating bar is only upon its pivot.

When the main crosshead and oscillating bar begins to move, the pawls G H, are thrown out of engagement with the notches by coming in contact with the arms or projections, which are secured in proper position for that purpose upon the ways A, as shown in the plan view.

After sufficient motion has been obtained to carry past the dead-center, the auxiliary crosshead is brought to its short stroke by placing blocks between the crossheads or by the employment of a device actuated by a lever which locks the two crossheads together, when they act as a single crosshead.

SOME INTERESTING PARTS OF MACHINES.

BY G. W.

None of all our countless and wonderful practical scientific attainments will be found to involve so great an amount of ingenuity and practical application of theoretical principles as the designing of the working parts of machinery. Our great engineering works, such as the railway and the canal, vast as they are in their actual size, when compared with the contents of the average machine-shop, sink far out of sight below them, as regards ready application of inventive power, or minuteness in the mathematical calculation of details. Every part of a well working machine must be designed in its size and form, not only with a view to the force it has to bear and transmit to other parts, but also with a view to the rate of motion required ; and, what is almost more important still, to the effective working of the whole, with a view to the uniformity of that motion, and the reduction to a minimum of the friction between the parts in contact, by so adapting them to one another that they shall work together with all the nicety and accuracy possible.

Still giving the first place to practical knowledge, it will naturally follow from the above that more really useful theoretical knowledge is to be obtained from books and magazines in this branch of engineering than in any other ; and bearing the same in mind, it is intended in this series of articles, which at present are designed to extend not beyond three or four numbers of this magazine, to gather together some interesting ex-