BERNAY'S STEAM PUMP.

Mr. Joseph Bernays, of Newgate street, London, is exhibiting in the West Annexe of the International Inventions Exhibition, Group XI., two steam pumps of novel design, one of which will be shown under steam. The novelty consists in the use of a connecting-rod of a length equal only to the radius of the crank) so arranged that it passes from above the crank at one end of the stroke to below the crank at the other end, whilst maintaining at every point its proper relative position to the crank. The rod thereby turns completely over for each revolution of the shaft, and, adding its own length to that of the crank at each end of the stroke, causes the piston travel to be four times the radius of the crank, instead of twice only. All side strain is avoided, and the use of crosshead guides is dispensed with, while at the same time the glands are protected from wear. The smaller of the two pumps at the exhibition is a ram pump (No. 1), having a steam cylinder 2⅝ in. in diameter, ram 1½ in. in diameter, with a stroke of 3 in., and delivering at 160 revolutions per minute about 180 gallons per hour. The other is a double-acting pump with a steam cylinder 6 in. in diameter, a water cylinder 4½ in. in diameter, and a stroke of 9 in. The cylinder is lined with gun-metal, and the glands are bushed with the same metal; this pump will deliver at an average speed 4800 gallons per hour. Mr. Bernays has granted an exclusive license for the making of his patent pump to Messrs. T. Larmuth & C., engineers, of Salford, Manchester, and the various details of construction have been very carefully considered. Every working part of the pump is in view and easy of access.

A general perspective view of the second pump is given, accompanied by four detail views explanatory of the arrangement of the crank and connecting-rod. Figs. 1 and 2 illustrate the arrangement shown in the large engraving, and Figs. 3 and 4 another arrangement which is slightly easier to comprehend. In Fig. 3 the pump ram is shown at the end of its stroke, and the crank and connecting-rod stand in a line with one another. In Fig. 4 the piston has made one quarter of its stroke, and a tail-piece formed on the connecting-rod, has come into gear with a pair of toggles on the framing. This tail-piece and the toggles run together like wheel gearing until the stroke is nearly accomplished, when the connecting-rod attains the position of Fig. 3, and then goes into gear with the opposite toggles.

In Figs. 1 and 2 the connected rod is formed in one with an eccentric block. The block is made in halves, and is fitted in to a strap, to which the piston and pump rods are connected. There are two tail pieces, one at each side, and these gear into toggles as already described, and cause the eccentric block to rotate in the strap and around the crank-pin at the same time. The piston moves accurately in accordance with the true law of the "versed sine," both on the in and out stroke; it therefore reaches the cylinder ends at greatly reduced speed, and the slide valve can be set alike for both ends.

The pumps take up very little space, and can be fixed in places where other flywheel pumps would be impossible. They are made in all sizes, and can be adapted for any purpose.—*Eng.*

DUNCAN'S COMPOUND LAUNCH ENGINE.

Messrs. Duncan Brothers, of Queen Victoria Street, E.C., exhibit a couple of launch engines the one fitted with the Bremme valve gear, and the other a compound engine fitted with the arrangement of reversing valve designed and patented by Mr. Robert Duncan, of the firm of Messrs. Ross & Duncan Whitefield Works, Glasgow. Of these latter engines we give detail views showing the arrangement of the reversing valve to which we have referred. In our illustrations, Fig. 1 is a vertical section through both cylinders and distributing valves, Fig. 2 a horizontal section showing both the distributing and the reversing valves, Fig. 3 a vertical section through both valves, Fig. 3 a vertical section through both valves of one cylinder, and Fig. 4 a similar view through both reversing valves. The steam is distributed by piston valves S_1 S_2 working in casings with ports all round them, so that the valves are in equilibrium and there is no unnecessary strain thrown upon the eccentric, of which there is but one. The eccentric rod has a crosshead which is connected to both valve rods, and imparts equal and similar motions to each. To render this possible it is necessary that the cranks of the two cylinders should be either together or separated by 180 deg., as steam will be admitted to both cylinders simultaneously. The latter arrangement is the one adopted, as it provides for the easy balancing of the parts, the motion of one crank and piston being contrary to that of the other, and thus tending to reduce vibration. There is no lap on the valves, only a little cover, the steam entering until the termination of the stroke in both cylinders, and flowing direct from the smaller to the larger without the intervention of a receiver. The reversing valves are exactly alike, and but for constructive reasons might equally as well be in one. They are stationary except at the moment when the engine is being reversed, when they are moved simultaneously by a lever and a rock shaft. The steam enters first one of the reversing valves, then flows past or through it into the distributing valve of the high-pressure cylinder. After doing its work there it returns through the distributing valve to the second reversing valve, and thence to the low-pressure cylinder. When the valves are in the positions shown, steam entering at the branch D has access to the centre of the valve R_1, Fig. 2, and thence by the passage M_1 to the centre of the valve S_1 by which it is alternately delivered to either end of the high-pressure cylinder. The exhaust from the cylinder escapes past the end of the valve into the casing, and gains access to the valve casing of the other cylinder through the passage L (Figs. 2 and 4). It is delivered to the cylinder by the valve S_2, acting like an ordinary slide valve, and when exhausted it passes from the cavity of that valve, through the passage M into the cavity of the reversing valve and thence by the branch E into the air or the condenser, as the case may be. Under these conditions the eccentric follows the crank, but if the reversing valve be moved downward until the steam entering at the branch D blows into the casing instead of into the cavity of the valve, then the direction of motion is changed and the eccentric goes in advance of the crank as usual. The high-pressure valve then distributes the steam by its ends and receives the exhaust in its cavity, while the low-pressure valve operates in the opposite manner. For work in which it is necessary that the cranks should be at right angles, Mr. Duncan proposes to employ two tandem engines, each controlled in the manner we have been describing.

Thom's Slide Valve.

Mr. John Thom, of 8, Storey-square, Barrow-in-Furness, is the exhibitor of his "economical" slide valve, which we had occasion to notice a few months ago in connection with the engines of the s.s. County of Salop, and engravings of which we reproduce 199. From the views there given, which show the valve in six successive positions during one stroke of the piston, it will be seen that the valve is of the Trick, or Allen type, having a passage through its back for affording a double admission of the steam, the openings of this passage, however, being so placed that during a certain part of the stroke of the valve the passage through its back form a communication from one end of the cylinder to the other, thus enabling a certain amount of steam to pass from the pressure side to the exhaust side of the piston. Thus, if the various views be examined, it will be seen that in the fourth position shown—the piston being then approaching the bottom of its stroke—the valve is so situated that steam from the upper end of the cylinder can pass along the valve passage to the underside of the piston, thus filling the lower steam ports with steam of the pressure then existing at the upper end of the cylinder, and increasing the cushioning at the lower end. This action is particularly useful in the case of the low-pressure cylinder where, when working with a good vacuum, the pressure of the steam ordinarily available for cushioning is but about 2½ lb. absolute per square inch, and when in consequence it is sometimes necessary to give great lead to the low pressure valve in order to get sufficient counter-pressure against the piston at the end of the stroke to secure smooth working. In Mr. Thom's arrangement, on the other hand, this necessary cushioning is obtained by the transference of steam which would otherwise be passed into the condenser, and a material saving is thus effected. In will be seen from the views, that the face on the cylinder is double-ported, the ports next the exhaust opening being used for exhausting only, and being smaller than the outer ports, which are enlarged to give the full advantage of the steam entering through the passage on the back of the valve. Mr. Thom's slide valve has now been applied to a number of steamers, in some cases to both high and low-pressure cylinders and we are informed with very satisfactory results, both as regards saving steam and producing smooth running.