# DESCRIPTION OF A HYDRAULIC SHEARS AND PUNCH.

By Mr. JAMES TANGYE, of Birmingham.

The object of this Hydraulic Shears is to afford the means of readily cutting large sections of bar iron or railway rails, with the power of one man only, and with a machine of simple and compact construction.

This shears is shown in Figs. 1 and 2, Plate 93, and consists of a strong vertical cast iron frame A A, divided in the centre horizontally, in the upper half of which the upper shear blade B is fixed; and a short hydraulic press C is cast in the lower half of the frame, having the lower shear blade D fixed upon the top of the ram of the press, which is 10 inches diameter with 3 inches length of stroke. The upper and lower castings of the frame are secured together by two bolts E E, 3 inches diameter. The box F bolted upon the side of the cylinder contains the force pump G, and serves as the reservoir for the water of the pump. The pump is worked by the lever H, and consists of a single brass casting, shown enlarged to half full size in Fig. 5, Plate 94. This pump is screwed into its place in the side of the hydraulic press C, and contains a small conical suction valve I and delivery valve K, ¼ inch diameter, held down to their seats by spiral springs. A small wire gauze guard is fixed over the outside of the inlet and outlet openings of the pump, to prevent any dirt from getting into the press cylinder. The plunger L, ⅝ inch diameter and 1½ inch stroke, is continued backwards to work in a guide socket in the end of the reservoir F, and a tongue M on the shaft of the hand lever H works in a square slot in the plunger rod.

The shear blade D, Figs. 1 and 2, Plate 93, is lowered after the cut by means of a self-acting motion connected with the force pump lever. The length of stroke of the lever is limited in ordinary working by a stop pin fixed on the side of the cistern, which catches the lever at the bottom of its stroke; but by shifting the lever $\frac{3}{8}$ inch outwards upon the squared end of the shaft, it is made to clear this stop pin, and is pushed down into a lower position. The tongue working the plunger then advances to the position M, Fig. 5, Plate 94, its ordinary working limits being the two dotted positions O O. The prolonged end of the plunger then reaches the delivery valve K of the pump and presses it open, allowing the water to flow back from the press cylinder into the pump; and at the same time the water is allowed to flow through the centre of the plunger by a hole drilled through the entire length of the plunger. This hole is closed at the outer end by a conical escape valve P opening outwards, which is kept shut in ordinary working by the tongue M of the hand lever; but when the lever is depressed below the stop for lowering the shears, a recess in the tongue is brought over the head of the escape valve P, allowing the valve to be forced back from its seat by the water pressure, and leaving a passage open for the water to escape through the hole in the plunger back into the cistern. The act of raising the hand lever again into its working position closes the escape valve P and keeps it shut during the working of the pump. A second force pump of larger size, with 2 inches diameter of ram, is used to bring up the shears quickly to the work to be cut.

With this shears a bar of wrought iron 3 inches square is readily cut by one man, the time required being about $2\frac{1}{4}$ minutes. Different sizes of the shears are made for cutting bars up to $3\frac{1}{2}$ inches square; the smaller sizes of bars being cut off several at a time.

This hydraulic shears is found very useful in iron warehouses for cutting large bars, where the power of only one or two men is available; and also on railways for cutting the rails, for which purpose the shears can be readily carried on an ordinary platelayer's lorry, no other foundation being required, and the whole weight being only 14 cwts. In the case of cutting rails, the shear blades are made of the same shape as the outline of the two sides of the rail, as shown in Figs. 1 and 2, Plate 93, so as to cut the whole section at once and make a clean square cut.

The Hydraulic Punch, shown in Figs. 3 and 4, Plate 94, is of similar construction to the shears already described, only inverted in arrangement, having the fixed die A at the bottom, and the punch B fixed on the end of the inverted ram C of the hydraulic press, which is 6 inches diameter with 2 inches length of stroke. The box F containing the force pump G and reservoir of water is fixed on the side of the press cylinder at the top. The punch is withdrawn quickly after the stroke by means of the spiral spring E pulling up the ram; the water being allowed to escape back from the press cylinder to the cistern through the centre of the plunger by the same means as in the shears already described.

With this punch a hole 1 inch diameter is punched in a $\frac{7}{8}$ inch iron plate, with the power of one man in about half a minute. The machine is very portable, the total weight being only $4\frac{1}{2}$ cwts.; and it has been applied with advantage to punching the holes for fish bolts in railway rails, as shown in Figs. 3 and 4, Plate 94. A successful application of this machine has also been made to the manufacture of horse shoes, by punching them out cold, with the holes and countersink complete at one operation.

The Hydraulic Lifting Jack, shown in Figs. 6, 7, and 8, Plate 95, is constructed on the same plan as the shears and punch before described, as regards the force pump G, shown enlarged to half full size in Fig. 9. The jack consists of an inverted hydraulic press A, the ram of which C forms the foot upon which the jack stands, and the pump G and reservoir of water F are fixed on the opposite end of the press cylinder, and form the head of the jack. The ram C is of wrought iron, $3\frac{1}{2}$ inches diameter and 12 inches length of stroke, with the foot forged upon it; and the press cylinder A is formed of a hammered wrought iron bar, bored out of the solid, leaving $\frac{5}{8}$ inch thickness of metal for the sides of the cylinder. A claw B is forged on one side of the cylinder at the bottom, for the purpose of using the jack to lift from the bottom when required. The head F forming the reservoir of water is of malleable cast iron, fixed upon the top end of the cylinder by being bored out a tight fit and pressed on up to a shoulder.

The jack is lowered by similar means to that previously described for the shears and punch; except that instead of the water escaping through the plunger L, Fig. 9, Plate 95, the suction valve I is forced open by the same movement that presses open the delivery valve K by means of a small inclined plane upon the prolonged end of the plunger L, which passes through an eye in the stalk of the suction valve I, and draws back the valve from its seat directly after the delivery valve K has been pressed open, allowing the water to flow back into the reservoir in the contrary direction to the ordinary working.

The ram of the jack is packed with a cupped leather D, shown black in Fig. 6, Plate 95, resting in a hollow $\frac{3}{16}$ inch deep turned in the top of the ram. These leathers have been found thoroughly successful in standing the pressure and wear, the same leathers having been in regular work for several years without requiring renewal. The force pump plunger L in the lifting jack and also in the shears and punch is packed with a narrow strip of leather $\frac{3}{16}$ inch wide, coiled round spirally in a groove turned near the bottom of the plunger, as shown in Figs. 5 and 9, with the ends of the strip bevilled off to fill up the groove close.

The hydraulic jack shown in Plate 95 is for lifting 30 tons, and several different sizes are made for weights from 4 to 60 tons. The head of the jack is prevented from turning round by a sliding block working in a longitudinal groove E in the ram; but by withdrawing the screw that fixes the block the head is allowed to turn freely with the load upon it. The hydraulic jack is convenient for use with heavy weights, from the great power obtained, one man being able to lift readily 30 tons and upwards; and from the lightness of construction, the 30 ton jack weighing only about $1\frac{1}{2}$ cwts. At the same time the loss of power from friction is comparatively small; and the small extent of wear to which the working parts are subjected gives great durability and freedom from risk of derangement.

Mr. Tangye exhibited a specimen of the hydraulic lifting jack and of the force pump used in the hydraulic shears and punch, together with specimens of bars and rails sheared and punched by them. He explained that the shearing machine was a modification of the hydraulic shearing press described at a former meeting of the Institution in 1858, the present shears and punch being made much smaller and lighter, so as to be easily portable and to give the means of readily shearing or punching bars or rails by the power of one man.

The Chairman enquired whether any of the hydraulic shears were in use on railways for cutting rails.

Mr. Tangye replied that two or three hydraulic shears were at work on railways for that purpose, the first having been applied about two years ago; and some were employed in iron warehouses for cutting the bars of iron, one having been in use now for five years.

Mr. G. M. Miller thought the shears would be a useful and convenient machine for use on a railway, particularly on curves where the joints of the inner rail overtook those of the outer, so that every third or fourth rail on the inner side had to be cut shorter, in order to bring the joints opposite each other and keep the sleepers square across the line; but he thought it would be desirable to get a smoother cut than was shown in the rails exhibited. He enquired whether the rails were sheared cold, and how the cutters were found to stand the work.

Mr. Tangye said the rails were sheared cold, and the cutters stood well when of proper quality of steel. Several thousands of cuts had been made with the machine first constructed, without the cutters requiring renewal yet; and a machine of the size shown in the drawings was strong enough for cutting bars of iron 3 inches square. The sheared rails exhibited were not favourable specimens of the cut made by the machine, the cutters not having been good in this case; but the machine generally sheared tolerably smooth, leaving the ends of the rails quite ready to go together without any labour of dressing them off for the purpose.

The Chairman asked whether the hydraulic lifting jack had been in use for any length of time.

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Mr. Tangye replied that in its present form, with the force pump and reservoir of water contained inside the head of the jack, it had been in use about eight months; but a previous make, similar in construction but having the pump outside the jack, had been in use for five years. About 200 of the jacks had already been made of various sizes.

Mr. D. Joy observed that some delicacy of adjustment appeared to be necessary in the stud at the bottom of the force pump plunger, if it were required to open both the valves simultaneously for lowering the jack; and he enquired whether those parts of the pump had proved durable in working.

Mr. Tangye explained that the two valves were not required to be opened at the same instant, but it was only necessary to ensure that the lower or delivery valve was opened by the stud before the suction valve. The valves and working parts, though small in size, were made very durable: their durability had been severely tested by three days' constant work, raising and lowering a weight of 3 tons three or four times in a minute continuously, which gave the jack as much work as it was likely to have to do in twelve months; and at the end of the trial all the working parts were found in as good condition as at first.

The Chairman enquired what was the weight of the small sized jack exhibited, and what load it would lift.

Mr. Tangye said the small jack exhibited weighed 60 lbs. and was intended for lifting 4 tons load; the jack shown in the drawings weighed 150 lbs. and would lift 30 tons.

Mr. G. M. Miller asked whether the reservoir ever wanted filling with water again, and what means there was of replenishing it.

Mr. Tangye said that sometimes a little leakage took place if the cupped leather had been allowed to get dry by the jack standing unused for a length of time without a full supply of water; but after the leather had been soaked for a few minutes it became quite water-tight again. The reservoir was easily filled at any time through a plug hole in the jack head, or by turning the jack upside down and drawing out the ram; and when the jack was kept fully charged with water, the leather was always moist and in working order. There was no difficulty in keeping the jacks always full of water, and they were usually supplied ready filled with water; but some jacks sent to St. Petersburg had been sent empty, to prevent any risk of the water freezing and bursting them.

Mr. G. M. Miller enquired whether the jacks were ever worked with oil instead of water, and whether the water had to be let out of the jacks in frosty weather in this country.

Mr. Tangye said the jacks were usually worked with water made soft with soap and oil; sometimes in winter they were filled with oil, to avoid risk of freezing in the most severe weather, but he had not heard of any instance of a jack being burst by the frost.

The Chairman proposed a vote of thanks to Mr. Tangye for his paper, which was passed.

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The Meeting then terminated.

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# HYDRAULIC SHEARS.

*Plate 93.*

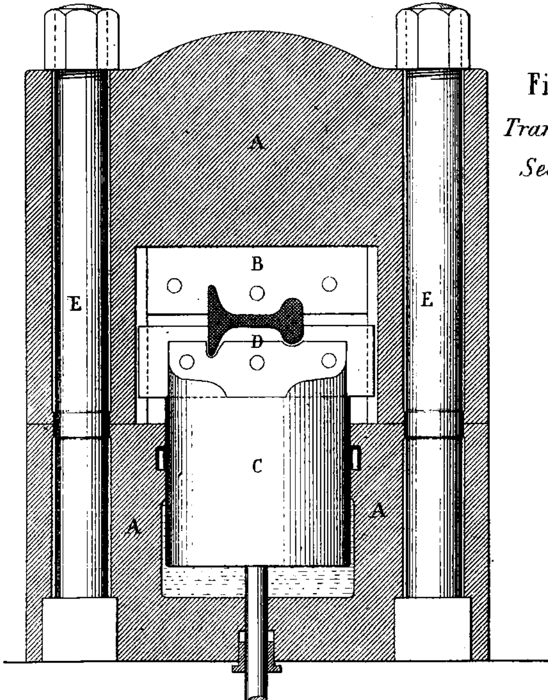



Fig. 1.

*Transverse Section.*

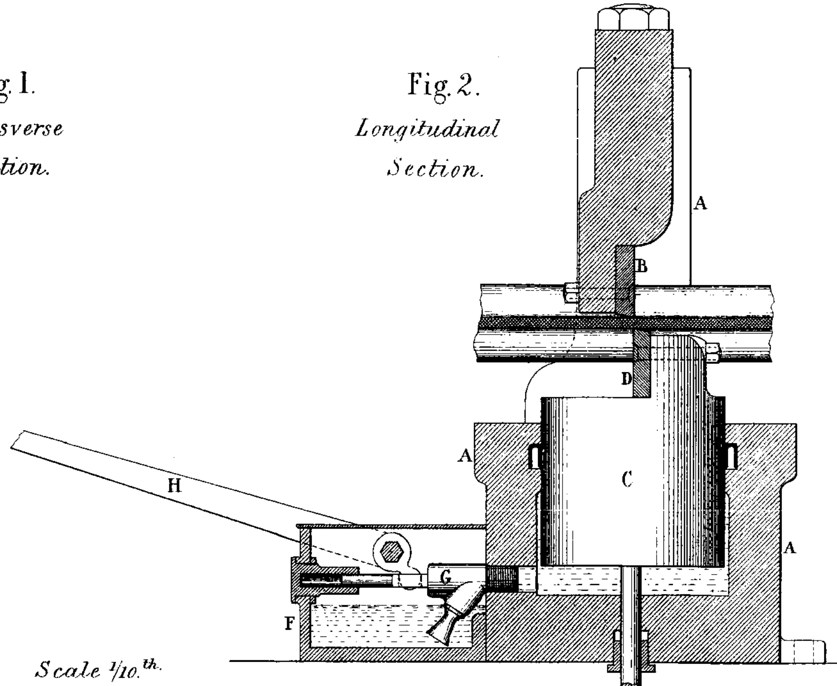



Fig. 2.

*Longitudinal Section.*

*Scale 1/10th.*

10 5 0 10 20 30 *Inches.*

*(Proceedings Inst. M.E. 1862. Page 341.)*

# HYDRAULIC PUNCH.

Fig. 3. *Transverse Section.*

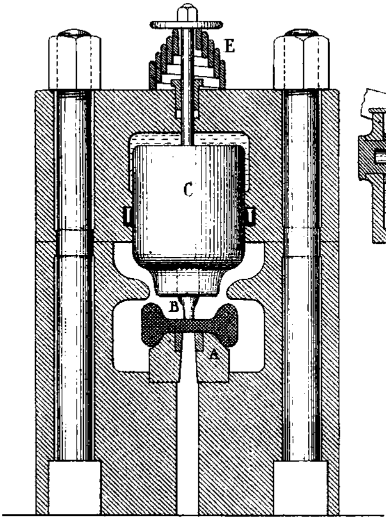
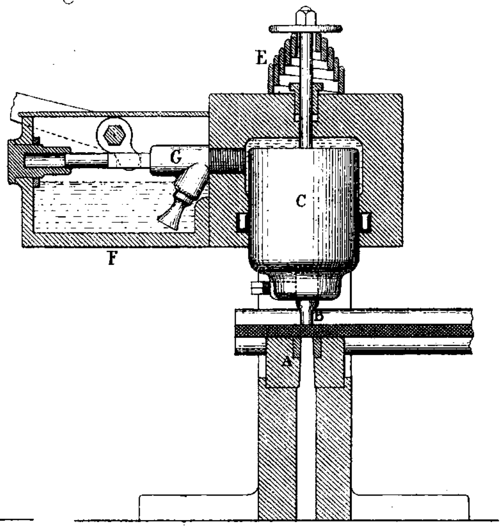
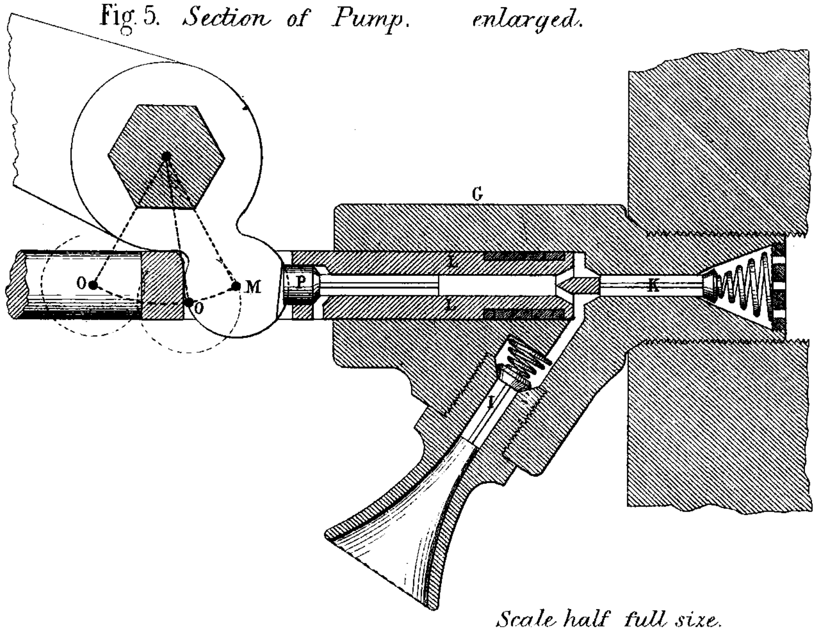



Fig. 4. *Longitudinal Section.*




*Scale 1/10th.* 10 5 0 10 20 Inches.

Fig. 5. *Section of Pump. enlarged.*




*Scale half full size.*

Fig. 7. *Sectional Plan at* XX.

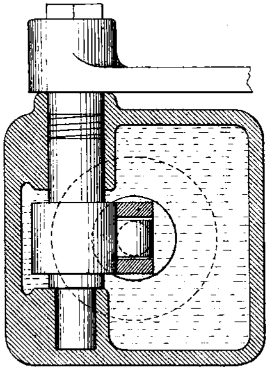


Fig. 6. *Vertical Section.*

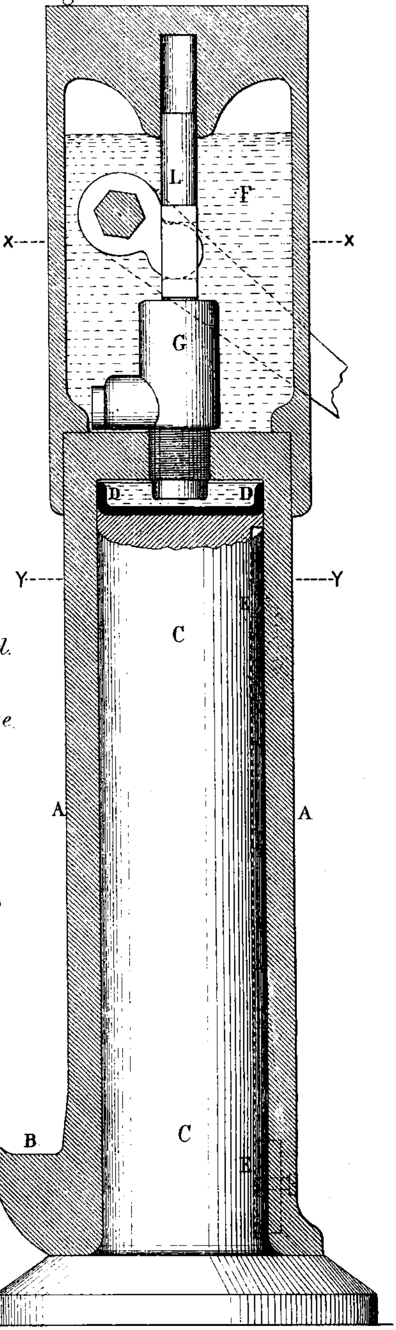



Fig. 8. *Sectional Plan at* YY.

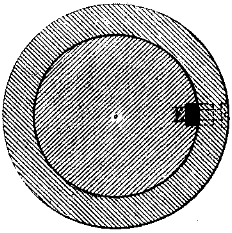
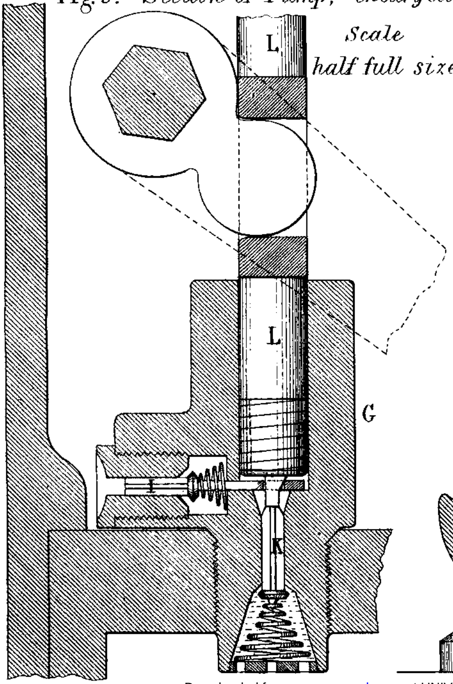


Fig. 9. *Section of Pump, enlarged.*

*Scale half full size.*






*Scale one quarter full size.*