Cylinder, valve, chest, slides, and frame of the engine are all cast in a single block, in which the necessary apertures are bored. No cores are used in the moulding. Steam goes to a simple slide valve operated by an eccentric, and is admitted during one-third, and exhausted during five-sixths, of the stroke. The shaft, crank, and eccentric are cast in one piece. All rubbing surfaces are of steel. The piston is made in segments, of cast iron, on the Ramsbottom system, and all the ports are circular.

The object of the device is to do any light work now performed by hand, such as driving sewing or washing machines, turning wringers, operating pumps, etc. Its height from floor to top of fly wheel is about 43 inches, and exterior diameter, 14 inches. *Scientific American.*

HYDRAULIC RIVETING MACHINE.

The use of high pressure steam, especially in marine engines, which has become so universal during the last few years, has required a stronger construction and form of boiler than hitherto employed

In order to retain the large diameter so convenient in marine boilers very strong plates are necessary, and it is now no unusual thing to have boilers in use at sea with plates of 1in. and even upwards in thickness. Such boilers require to be constructed with rivets of sizes that cannot be satisfactorily set up by mere manual labour, and of late years, after many applications of steam and gearing for this purpose, hydraulic power has been employed with the best results.

The first thing that strikes an observer of this new process is the entire absence of that most defening noise, the usual accompaniment of ordinary riveting, and a little further attention will show that this absence of noise is its least merit By the quiet, steady pressure rivets are enlarged throughout their length and fill up all roughness or irregularities inside the punched holes they enter, so that they remain firmly fixed, even when one or both of the heads are cut off, and must be drilled out altogether should it ever be necessary to remove them. The pressure not only forms heads on the rivets, and effects the above named compression, but it holds them up, and the plates also, close together, until the former are sufficiently cooled to bear the strain, and even draws the plates closer together by subsequent contraction.

The illustration on page 379 shows Messrs. McKay and McGregor's patent hydraulic riveter, which has been for some time in use at the Millwall Docks Engineering Works, London. This machine is one of the most powerful of its class, and gives a pressure of 60 tons upon the rivet, an amount abundantly sufficient for the largest class of boiler work hitherto required for marine engines. Above the machine stands a powerful travelling crane, from which boilers are suspended over it, their (ordinary) horizontal axis of course then being in a vertical position. Circular seams of rivets are brought to the machine by the simple process of turning the boiler round on a swivel and vertical seams by raising or lowering it in the usual manner with mechanical arrangements of this class.

The pressure is derived from an accumulator, and it amounts to 700 lb. per square inch in the present case. This pressure is only admitted into the large cylinder when the dies come in contact with the hot rivet, the "slack" being taken up by the action of a smaller cylinder. By this arrrangement a considerable saving of power is effected: for if the large cylinder took its supply and moved the levers their entire distance by accumulator pressure, it is evident that great waste of power would ensue thereby, and in all direct acting steam riveting machines this waste must come from the nature of their construction.

The hydraulic cylinder, and all valves, levers, weights, &c., are placed in a pit below ground, clear out of the way of men working, and safe from frost or accidental injury. Of course the pit is covered over, and in winter carefully protected from cold, and where, as is sometimes the case, these machines stand practically out of doors, a precaution of this kind should never be neglected

The upper end of the powerful cast iron levers which form the most conspicuous part of this machine are perfectly free from all surroundings, except only a conveniently placed handle for starting or reversing; this handle stands behind one of the levers, and therefore does not appear in the present illustration These levers are so strong that any accidental blow given to them can do no harm; and the readiest access is obtained to every part of the machine. Steel dies are simply placed in bored holes, and naturally hold themselves there.

When all is prepared, and a heated rivet in position, a movement of the handle admits high-pressure water to the smaller cylinder, the dies rapidly close upon the rivet, the self-acting valves admit water to the larger cylinder, and without noise or vibration the work is done The dull, heavy pressure crushes together the thick plates, and after holding them and the rivet together for a moment that the latter may cool, the pressure is released, the dies recede, another rivet is soon completed, and a boiler is finished with astonishing ease and rapidity

The distance from the centre shaft on which both levers work to the dies or centre hydraulic cylinder is 6ft. in the present case, so that after deducting the centre bearing, and wrought iron straps to carry the tensile strain, there remains a clear space of 5ft. for boiler plates, and this is found to be ample for the several classes of work for which this particular machine is used.

To all those interested in the development of high-pressure at sea, such a machine as this we have described cannot fail to be most interesting; and still it is only one element in those most numerous facilities we owe to the inventive powers of our mechanical engineers. Such machines as this compensate in some measure for the enhanced value of labour and materials, and no one who has read the pages of this journal can have failed to notice this encouraging fact. No sooner do workshop requirements outstrip existing means of production, than forthwith tools are invented, or new processes discovered and we still retain our control over the inert resistances of material things.—*The Engineer.*

IMPROVED WIND WHEEL AND WATER ELEVATOR.

Irregularity of motion, oscillation of turning table and vane, unavoidable use of small wheels on the main shaft preventing the transmission of quick motion when the same is needed, liability to get out of repair, and excessive cost, are objections to the employment of wind power, which the inventor of the device illustrated on page 379 claims to have overcome. The fans are centrally pivoted to two circles, which constitute portions of the frame of the wheel, and the bearings for the main axle rest upon stationary posts. A is a weight attached to a rod which traverses the shaft and is pivoted in a sleeve which slides back and forth between the arms. To the sleeve are attached jointed rods which are connected with guides, at B. so that, as the sleeve passes back and forth, the rods are given an inward and outward motion. Near the outer extremity of the latter are pivoted systems of small rods, C, jointed together to form parallelograms, operating on the principle of lazy tongs. From each of these extend three arms, one passing through the outer circle and carrying a ball, D, the second pivoted to the inside corner of one fan, at E, and the third similarly secured to the outer corner of the other adjacent fan, at F. The rods, G, connect these fans with those next to them, so that one shifting rod, with its lazy tongs, governs a set of four fans, which move through the same space at the same time.

In order to stop the windmill, the weight, A, is removed, when the balls tend to bring the portions of the lazy tongs to a position at right angles with the shifting rods, and hence the fans, to a right angle with the wheel. The fans, it is stated, move with equal facility in strong or light winds, no greater force being required to operate them than is necessary to overcome the friction of the different bearings. The power is, besides, through its application diagonally across from the inside corner of one fan to the outside corner of the other, transmitted to the best advantage. For large wheels, we are informed, hydraulic pressure is used to equalize the motion

The water elevator consists of a series of buckets, H, which are pivoted, a little above their centres, between every two links of an endless chain or band which passes over two palleys, one at the bottom and the other above the well. The bottom of the bucket swings in, and a projection thereon takes against the upper shaft as the vessel is carried over. This causes the latter to empty, with little splash, into the conduit provided, in which the water is conducted to any desired point.

It will be seen that the construction of the apparatus denotes considerable strength, as it is built on the plan of a wagon wheel, the fans serving as spokes. The inventor states that it is almost impossible to blow it to pieces.—*Scientific American.*