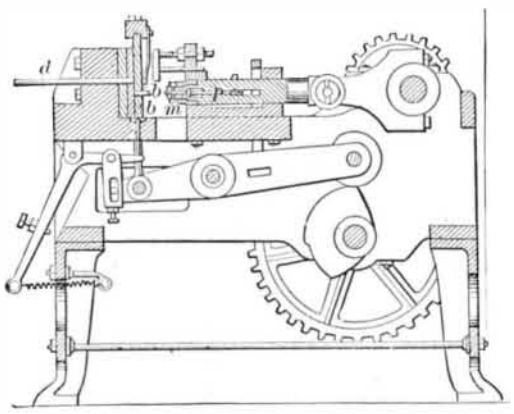
RIVETS AND RIVETING.

Rivets are made, usually, by special machinery, such as we shall describe further on, from the most tough and ductile iron, having an ultimate tenacity of at least 60,000 lbs. per square inch. In practice, their ordinary dimensions are estimated by the following rules: Diameter of a rivet for plates less than half an inch thick, about double the thickness of the plate; for plates of half an inch thick and upwards, about once and a half the thickness of the plate. The length of a rivet before clinching, measuring from the head, should equal the sum of the thicknesses of the plates to be connected added to 2½ times the diameter of the rivet.

Fig. 1.

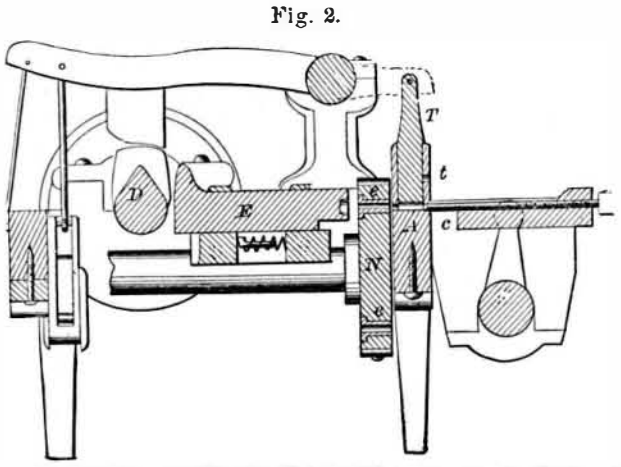


The longitudinal compression to which a rivet is subjected during the operation of clinching, whether by hand or machinery, tends to make it fit the hole tightly, and thus to produce uniform distribution of the stress; but as such uniformity cannot be expected always to be realized, it is usual to assume, in practice, that there is a deviation from uniformity of shearing stress sufficient to neutralize the difference of the toughness of the metal in the rivets and that in the plates which they connect; and therefore, the distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.

STRENGTH OF RIVETED JOINTS.

The tenacity of good wrought iron boiler plates is about 50,000 lbs. per square inch. Professor Rankine states that that of a double riveted joint per square inch of the iron left between the rivet holes (if drilled, and not punched) is the same; that of a single riveted joint somewhat less, as the

Fig. 2.



tension is not uniformly distributed. In practice, it is convenient to state the tenacity of riveted joints in lbs. per square inch of the entire plate, and it is so stated in the following formula: The joints of plate iron boilers are single riveted; but from the manner in which the plates break joint, the ultimate tenacity of such boilers is considered to approach more nearly to that of a double riveted joint than to that of a single riveted joint.

The forces required to burst asunder iron plates, riveted and other, are as follows:

Wrought iron plate joints, double riveted, the diameter of each hole being $\frac{8}{10}$ of the pitch or distance from center to

Fig. 4.

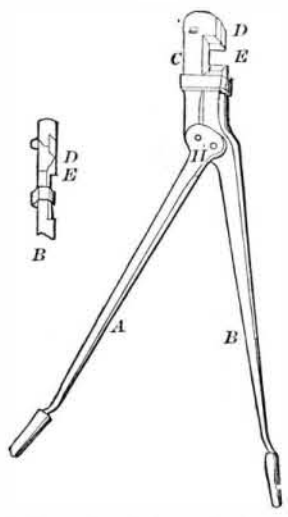
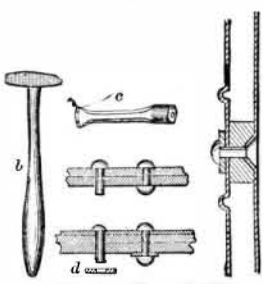


Fig. 3.



center of holes, 35,000; wrought iron plate joints, single riveted, 28,000; wrought iron boiler shells, with single riveted joints properly crossed, 34,000; wrought iron retort, with welded joint, 30,750; cast iron boilers, cylinders, and pipes (average), 16,500; malleable cast iron cylinders, 48,000: all in lbs. per square inch.

THE MANUFACTURE OF RIVETS

is accomplished by special machines, such as are exhibited in Figs. 1 and 2 (which, with the other engravings here given, we select from Knight's *Mechanical Dictionary*).* In the apparatus shown in Fig. 1, the rod, *d*, is fed through a guide plate into movable dies, *b b*, the length of the blank being regulated by a stop. The movable dies have reciprocating motion, and they cut off the rod fed into the machine, carry the blank in front of the heading die, and finally serve as the die in which the head of the bolt is formed. As they descend, they cut off the length of rod against the face of the guide plate, and carry it in front of a hollow die, *m*, that has a horizontal motion, the interior of the die corresponding to the intended form of the shank of the rivet. The stub end of the rivet is formed against the plunger, B, which also serves to eject it when finished.

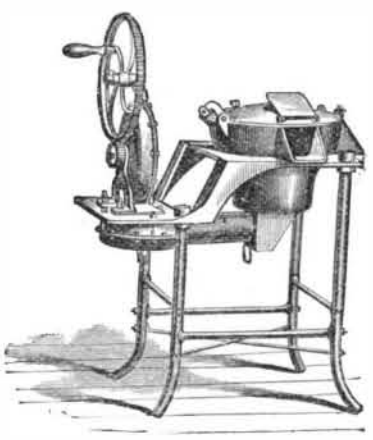
In Fig. 2, the rod is fed into the feed plate, A, through an aperture, *t*. A blank is cut off by the downward motion of the plunger, T, which holds and guides it while being forced into one of the openings, *e*, in the die wheel, N, by the reciprocating rod, *c*, where it is subjected to the action of the header, E, operated by the same compound cam, D, that actuates the lever carrying the plunger, T.

RIVETING TOOLS.

Riveted joints are shown in Fig. 3.

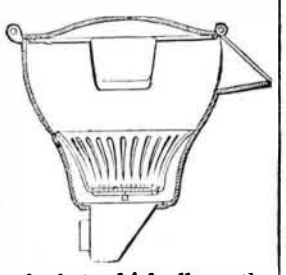
In riveting the plates composing the skin of iron ships, it is necessary that the outer end of the rivet should be flush with the plate. A countersink is, accordingly, formed in this side. The operation of riveting is performed by three

Fig. 5.



men and a boy. The latter brings it from the furnace with a pair of tongs and passes it to the holder up, who receives it in a short pair of tongs and inserts it into the rivet hole from the inside. He then presses against it with a hammer or with a tool called a dolly, *c*, Fig. 3, having its end indented to receive the head of the rivet, while the two men, on the outside, hammer the other end down so as to fill the countersink

Fig. 6.



For cutting off flush the stub ends of rivets or bolts, the tool shown in Fig. 4 is used. The handle, A H, is pivoted to the handle, B, and piece, C, so that the jaws, D E, are brought together as the handles are compressed.

The portable riveting forge, Fig. 5, has a pot, Fig. 6, rotatable by gearing and having three doors, so as to employ three operatives. It contains a grate-like basket, which allows the blast from the tuyere to pass through. At the bottom of the basket is a grate and a comb raker, operated from the outside. Beneath the grate is the tuyere box. A fan is provided for creating a blast.

The first application of steam to

RIVETING MACHINERY

is due to Sir Willam Fairbairn. He states that it was contrived when he had a large number of orders on hand for his double flued boilers, and the men struck. "In this dilemma I was driven to the necessity of supplying the place of the riveters by a passive and unerring workman, which, from that day to this, has never complained, and did as much work in one day as was formerly accomplished by twelve of our best riveters and assistants in the same time. I desired the foreman to reverse the action of the punching machine, and with proper dies to rivet the plates instead of punching them. In six weeks from that date we had the riveting machines at work, making tighter joints and executing the work with greater perfection than could possibly be done by the hammer."

The machine, illustrated in Fig. 6, is set in motion by a band on the pulley, *a*, on the axis of the latter is a pinion gearing into a large spur wheel, *b*, on whose axis is a cam, *c* operating the riveting lever, *d*, the face of the cam being steeled, and the end of the lever having a roller to diminish the friction. The riveting lever has a fulcrum in the frame, and acts by its face upon the riveting rod, *e*, when punching, and by a link connection with the tool when retracting, the tool sliding in a socket fixed in the side frames.

The anvil post, *f*, rises from the foundation, and has a riveting block of the shape of a frustum of a cone. The sections of boiler are lowered from above, by means of tackle, *g*, the point at which the rivet is to be placed being adjusted between the punch and the anvil block. The rivet is placed in the punched holes, the band slipped on to the fast pulley, and the upward motion of the cam raises the lever and swages the rivet.

Fig. 7.

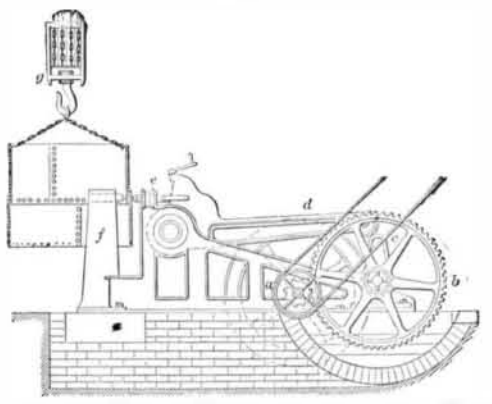
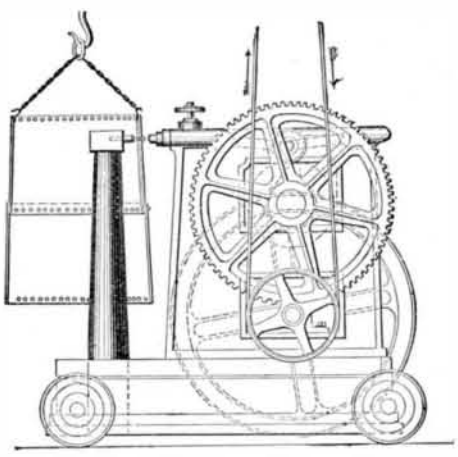


Fig. 8 is a portable machine on the same plan. Not being intended for such heavy work, its frame is less massive than that of the foregoing, and the construction and arrangement of its details are slightly different.

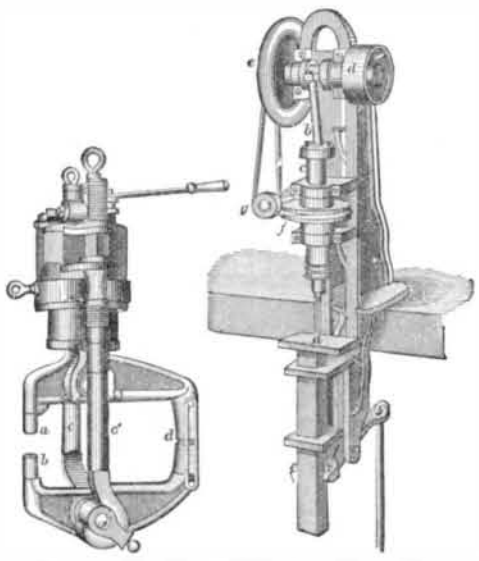
In Tweddel's machine (Fig. 9), the distance between the punch, *a*, and the anvil, *b*, is regulated, according to the thickness of the plate, etc., by screws, *c c'*, and links, *d*. The whole apparatus is mounted on a truck, and the pressure applied by a hydraulic accumulator operated by a portable engine.

Fig. 8.



In Adt's machine (Fig. 10), the work is supported on the table, *a*; the punch is reciprocated by a pitman, *b*, having a universal joint connection with the spindle, *c*, and actuated by an eccentric on the pulley shaft, *d*; the punch spindle is at the same time revolved by a belt on the shaft of the fly wheel, *e*, imparting motion to the pulley, *f*, through two small change pulleys, one of which is seen at *g*.

Fig. 9. Fig. 10.



In another machine intended for heading caster and hinge pintles, etc., the spring hammers strike the opposite ends of the pintles at once. The working parts are adjustable.

Fig. 11.

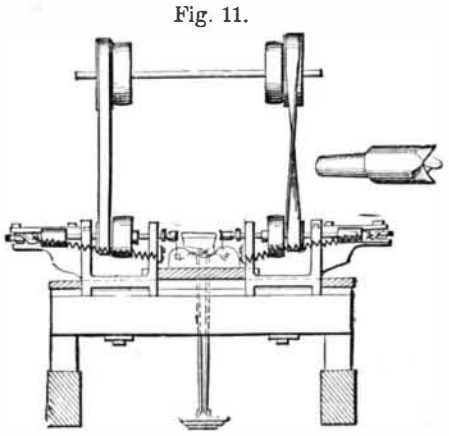


Fig. 11 is a machine for riveting hinges. Peculiarly shaped revolving milling tools spread the pintle when forced against it, and form the head

*Published by Hurd & Houghton, New York city.