A. M. MORRISON.

RIVETING MACHINE.

APPLICATION FILED JUNE 6, 1910.

988,370. Patented Apr. 4, 1911.

2 SHEETS—SHEET 1.

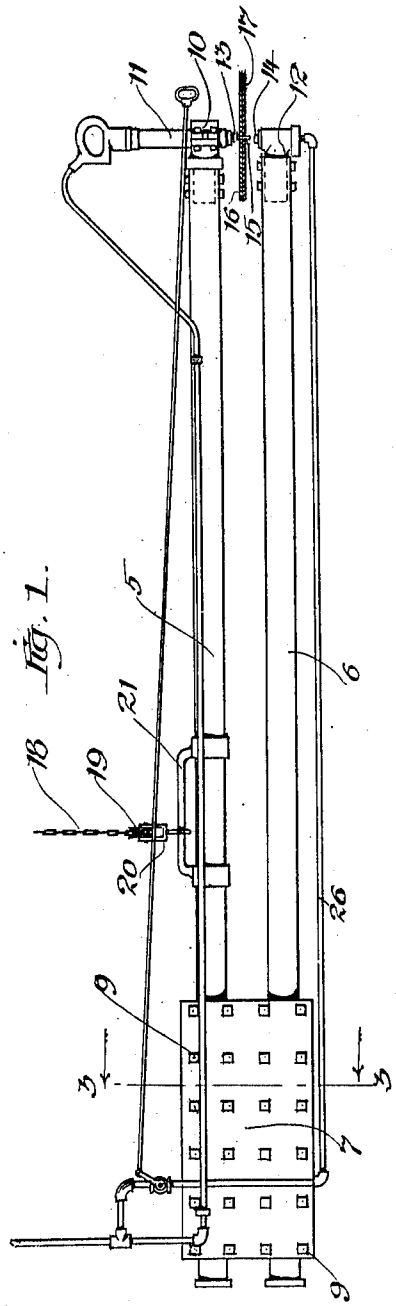

Fig. 1.

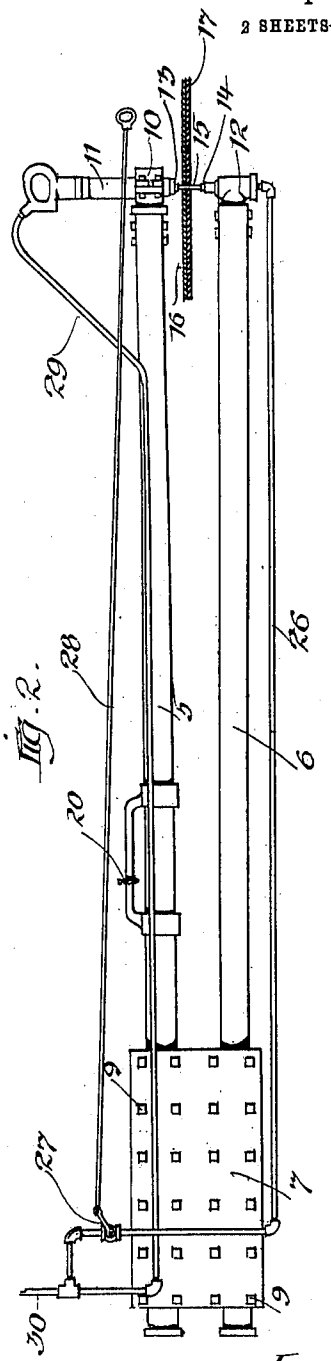

Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 3.

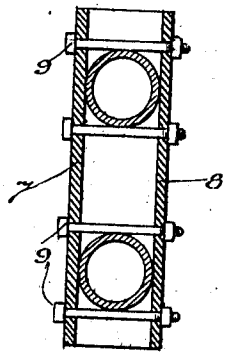


Fig. 5.

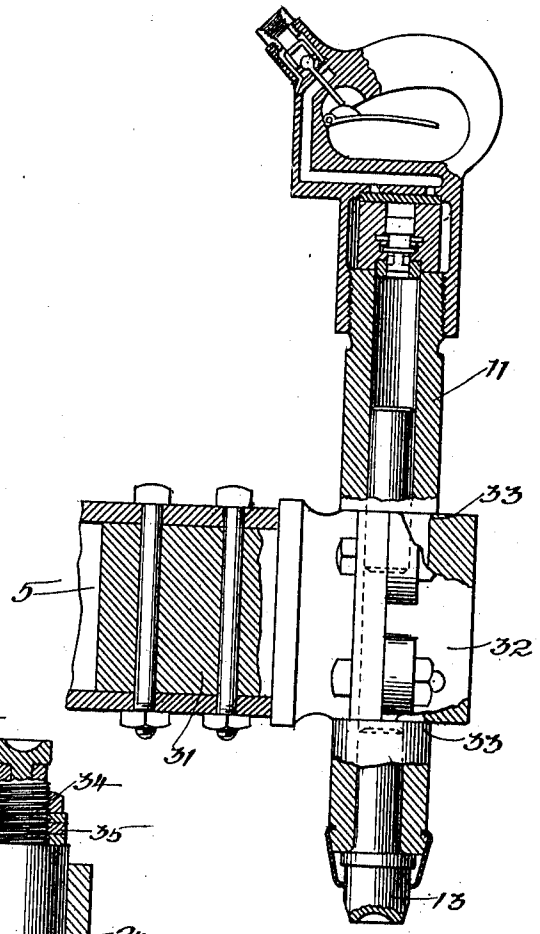
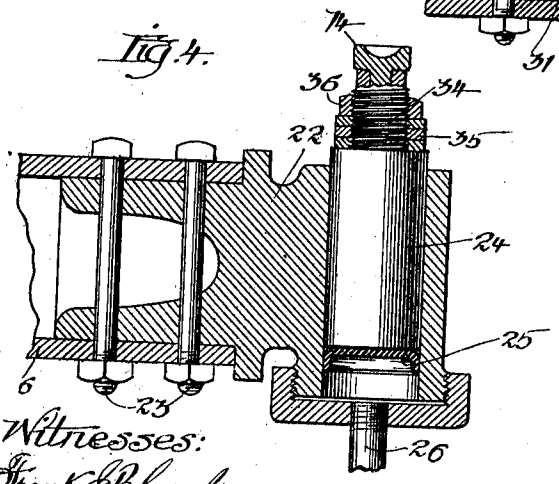


Fig. 4.



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UNITED STATES PATENT OFFICE.

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RIVETING-MACHINE.

988,370. Specification of Letters Patent. Patented Apr. 4, 1911.

Application filed June 6, 1910. Serial No. 565,213.

To all whom it may concern:

Be it known that I, ANDREW M. MORRISON, a citizen of the United States, residing at Dubuque, in the county of Dubuque and State of Iowa, have invented certain new and useful Improvements in Riveting-Machines, of which the following is a specification.

At the present time it is customary in carrying on riveting operations, where a number of plates are to be joined together, to pass the rivets through the holes in the plates from the reverse side, and then to form the head on the protruding shank of the rivet while the latter is held in position by means of a retaining die held against the original head of the rivet. This necessitates the labors of an additional workman, who must enter the boiler or tank and shove the shanks of the rivets through, and then hold them in position while workmen on the outside complete the riveting operation by heading down the shank. There are a number of serious objections to this process, among which are, that the labors of additional workmen are needed; that the rivets must be tossed into the boiler and caught by the workman therein, who must then shove them through the holes; that it is sometimes difficult for all the workmen to known which hole is to be riveted up, and therefore delays occur and hot rivets frequently become unduly cooled; and, furthermore, it is often difficult to form the rivets straight—that is, they become twisted so that when finally headed up they do not hold with the greatest efficiency. Any riveting operation which necessitates the presence of a man on the inside of the shell is especially objectionable where the shell is of small size, for then a man cannot conveniently work in it.

Objects of my invention are, to provide a riveting machine in the use of which the rivets may all be placed in from the outside of the shell and then headed up, not by striking them on the shanks, but by striking them from the side of the shell opposite to that from which the shanks protrude; to provide a machine which can be operated with the fewest possible number of men; to provide a machine which will insure that the rivets always come straight, so that each one will hold with the greatest efficiency; to provide a machine which shall always head the rivets up tight against the plates; to provide a machine which shall always be under the complete control of the chief riveter; to provide a machine which may head up rivets at large distances from the edge of the plates; and to provide a machine of the simplest possible construction and one of the greatest mechanical strength.

Other objects and uses will appear from a detailed description of my invention, which consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings—Figure 1 shows a side elevation of my improved machine properly suspended and adjusted preparatory to commencing the riveting operation, the lower die being in released position previous to applying the air pressure; Fig. 2 is a view similar to Fig. 1, the lower die being forced into working position by the application of air pressure; Fig. 3 is a detail cross-section through the clamping plates and arms, taken on the line 3—3 of Fig. 1 looking in the direction of the arrows; Fig. 4 is a detail cross-section of the lower die member and piston for throwing the die into working position, the die member being attached to one of the arms; and Fig. 5 is a detail cross-section of the upper hammer gripping box and pneumatic hammer, showing the former attached to the end of the upper arm.

In the embodiment of my invention I make use of a framework comprising two arms rigidly held together at one end so that they may not vibrate sidewise with respect to each other, but so that they may vibrate up and down in the same plane with respect to each other. One of these arms carries on its end the hammer and upper die and the other arm carries on its end a lower die member in position to coact with the upper die. Means are provided for forcing the lower die into contact with the rivet so that the latter will be firmly gripped between the upper and lower dies previous to commencing the heading operation. The parts are also so arranged that during the heading operation the rivet will always have its original head held down in contact with the plates, so that the new head will be properly formed and so that there will exist no tendency for the original head to rise away from the plates.

It will be understood that when the hammer is operated blows will be delivered

against the hammer die, which blows will then be transmitted through the rivet and plates to the lower die. This die will then commence to vibrate in such a way as to deliver blows against the end of the shank of the rivet, thereby forming the new head while the original head remains in contact with the plates. It will be understood that the concussions of the shank of the rivet against the lower die will also aid to form the new head, and that the vibration of the lower die to deliver blows will therefore not be the sole force acting to head the rivet.

Referring now to the drawings, the mechanism comprises upper and lower arms 5 and 6 rigidly held near one end between side plates 7 and 8 by means of rivets or bolts 9. It will be understood that the construction is one in which the two arms 5 and 6 will always be kept horizontally in line, although they may vibrate vertically by bending. That is, any relative vibration of the arms will be such that the arms always lie in the same plane. The upper arm 5 is provided on its outer end with a box 10 of suitable size and shape to securely hold a pneumatic or other hammer 11. The lower arm 6 carries a lower die member 12, whose construction will be more particularly described hereafter. The hammer 11 carries an upper die 13 and the member 12 carries a lower die 14, which dies properly aline so that a rivet 15 passing through plates 16 and 17 may be properly gripped and headed. The lower die member 12 is of a construction such that the die 14 may be forced firmly into contact with the protruding shank of the rivet 15 in the manner shown in Fig. 2, whereby both dies will be brought solidly into contact with their respective ends of the rivet previous to the heading operation.

The mechanism as a whole is suspended in any suitable manner, as by a chain 18 passed under a pulley 19, the latter being attached to the upper arm 5 in such a way that the exact point of suspension of the mechanism as a whole may be adjusted. The preferred construction is one in which the pulley 19 is carried by a yoke 20, which in turn may be shifted back and forth to any position along a rail 21 suitably attached to the arm 5.

When it is desired to form a head on the shank of the rivet protruding through the plates away from the hammer—that is to say, when it is desired to form a head on the end of the rivet farthest from the hammer—the process is as follows: The rivet is placed through the holes in the sheets and then the arms are swung into position so that the die 13 may rest against the original head of the rivet. It will be understood that the mechanism should then be suspended in such a way that the die 13 will be naturally held in contact with the original head of the rivet by reason of the weight of the mechanism. Thereafter the die 14 may be forced up against the protruding shank of the rivet, which, however, will still remain with its original head against the upper plate. When the heading operation commences, the hammer blows will transmit concussions through the rivet and metal sheets to the opposite or responsive die 14 in such a way that a head will be formed on the protruding shank, the original head of the rivet always remaining in contact with the sheet next to the hammer die and the rivet always being solidly gripped between the active die and the responsive die, so that the responsive die will follow up as the shank is headed and becomes a rivet.

In order to properly carry on the heading process, the responsive die must be solidly held against the lower end of the rivet. The preferred embodiment of my invention is one in which the responsive die member is in the form of a pneumatic cylinder, whose piston carries the responsive die 14. This construction is illustrated in Fig. 4, where the member 12 comprises a casting 22 having on one side a lug adapted to be rigidly held in the end of the arm 6, as by means of bolts 23. The casting 22 is bored so that it forms a cylinder in which a piston 24 may operate. This piston is provided at its upper end with a recess which carries the die 14 and at its lower end with a leather cup washer 25. An air pipe 26 serves to supply air against the lower face of the piston when a valve 27 is opened by means of a rod 28 (see Fig. 2).

The preferred type of hammer is a pneumatic hammer of such construction that the die 13 will not move appreciably with respect to the body of the hammer while the blows are being delivered. The pneumatic hammer may be supplied with air through a pipe 29, and a pipe 30 serves to supply air to both the hammer and the cylinder.

The preferred form of box 10, for carrying the hammer 11, is shown in Fig. 5. It comprises two castings, 31 and 32, the former provided on one side with a lug which may be bolted into the end of the arm 5 and the latter of a suitable construction to solidly grip the body of the hammer against the former casting. Ordinarily pneumatic hammers of the preferred construction are formed with recesses, such as 33, formed in their exterior surfaces. The box 10 should preferably grip the body of the hammer in such a recess, so that any possibility of longitudinal movement of the hammer will be done away with.

The side plates 7 and 8 grip the ends of the arms 5 and 6 in such a way that lateral or sidewise vibration of the arms is entirely prevented. In fact, I find that by properly proportioning the parts the construction may be made extremely stiff without being unduly heavy. Owing to the stiffness of the

parts, any rivets which do not seat through the holes exactly square will be straightened up as soon as air pressure is applied against the piston 24, and any tendency of the rivets to form unevenly will be overcome by reason of the tendency of the metal to seat within the pockets of the dies. It will be understood that in any case, when carrying on the riveting operation, the riveting machine must be so balanced that the original head of the rivet shall be kept in contact with the plates during the heading operation.

It will be understood that when performing the riveting operation with the rivets inserted with the original head in contact with the hammer die, the new head is formed by concussions transmitted through the rivet against the responsive die and by vibrations of the responsive die against the shank of the rivet. By holding the responsive die against the shank with considerable force, the concussions will largely act to form the head; but in any case a certain amount of vibration of the responsive die will occur. This vibration may be in the nature of movements of the piston 24 and die 14 up and down in the air cylinder, and also movements of the arm 6 and cylinder vertically with respect to the arm 5 and hammer. The greater the pressure used, the greater will be the vibrations of the arm and cylinder. In any event, the die 14 should vibrate as nearly as may be in synchronism with the strokes of the hammer, in order to obtain the best results. The frequency of such vibration will depend largely upon the weight of the moving part; therefore, in order to permit of a certain amount of adjustment, the piston 24 may be provided with a threaded shank 34 adapted to receive one or more weight washers 35 and a lock nut 36.

Although my riveting machine makes it possible to carry on the riveting operations when the rivets are hit not on the shank but on the original head, still it is evident that the operation may be carried on with rivets inserted through the plates in the ordinary manner. However, in this case it would be necessary to employ the services of an additional workman inside of the boiler or shell, to insert the rivets, as is now customary.

In practice, the riveting machine may be built up from ordinary heavy wrought iron pipe, and the plates 7 and 8 may be of suitable steel gage. I have found in practice that the construction shown and described is well adapted for use in machines having very large spans—that is, large clearances between the dies and the edges of the plates 7 and 8. In fact, owing to the box construction disclosed, spans as large as 12 to 15 feet have been successfully used, in which the dies are so rigidly held that the rivets are perfectly formed; but, of course, much larger spans than these may be used when the parts are properly proportioned.

Owing to the manner in which the machine may be balanced on the rail 21, and the manner in which the air pressure may be thrown against the piston 24, the machine may be easily and quickly adjusted to head up each rivet. In fact, it is found that the rapidity with which the rivets can be headed up is limited only by the speed of the hammer, for the new rivets may be inserted in the holes by an assistant while a previous rivet is being headed, and then the hammer and dies may be swung over so as to embrace the next rivet, air pressure may be applied, and the process may be completed.

Although I have shown and described my machine as used in a location where the hammer is placed directly over or vertical with respect to the responsive die, still it is evident that the mechanism can be used either in an inverted manner or tilted sidewise, the action in all cases being the same.

I claim:

1. In a riveting machine, the combination of two resilient arms rigidly secured together at one end in a manner to permit relative vibration between them in the same plane, a movable die carried by one of the arms at its end, a hammer die carried by the other arm at its end and in line with the movable die and in a manner to prevent axial movement thereof with respect to the arm to which it is secured during the riveting operation, means for forcing the movable die toward the hammer die to grip a rivet between the dies, and a hammer for striking the hammer die to transmit a concussion into the rivet and movable die, whereby the movable die is caused to vibrate and the rivet is headed, substantially as described.

2. In a riveting machine, the combination of two resilient arms rigidly secured together at one end in a manner to permit relative vibration between them in the same plane, a movable die carried by one of the arms at its end, a hammer die carried by the other arm at its end in a manner to prevent the vibration thereof with respect to the arm and in line with the movable die, means for forcing the movable die toward the hammer die to grip a rivet between the dies, and a pneumatic hammer for striking the hammer die to transmit concussions through the rivet to the movable die, when the latter is gripped between the dies, to cause the movable die and the arm which carries it to vibrate to deliver blows on the rivets for heading the same, substantially as described.

3. In a riveting machine, the combination of two resilient arms rigidly secured together at one end, a movable die carried by

one of the arms at its end, a hammer die carried by the other arm at its end in line with the movable die and in a manner to resist axial movement away from the movable die, means for forcing the movable die toward the hammer die to grip a rivet between the dies, means for suspending the arms in a manner to hold a rivet head always in contact with the face of a plate being acted on, and a hammer for striking the hammer die to deliver a concussion through the rivet to the movable die and the arm which carries the same, whereby the rivet head is always maintained in contact with the face of a plate, and whereby the rivet is headed up, substantially as described.

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