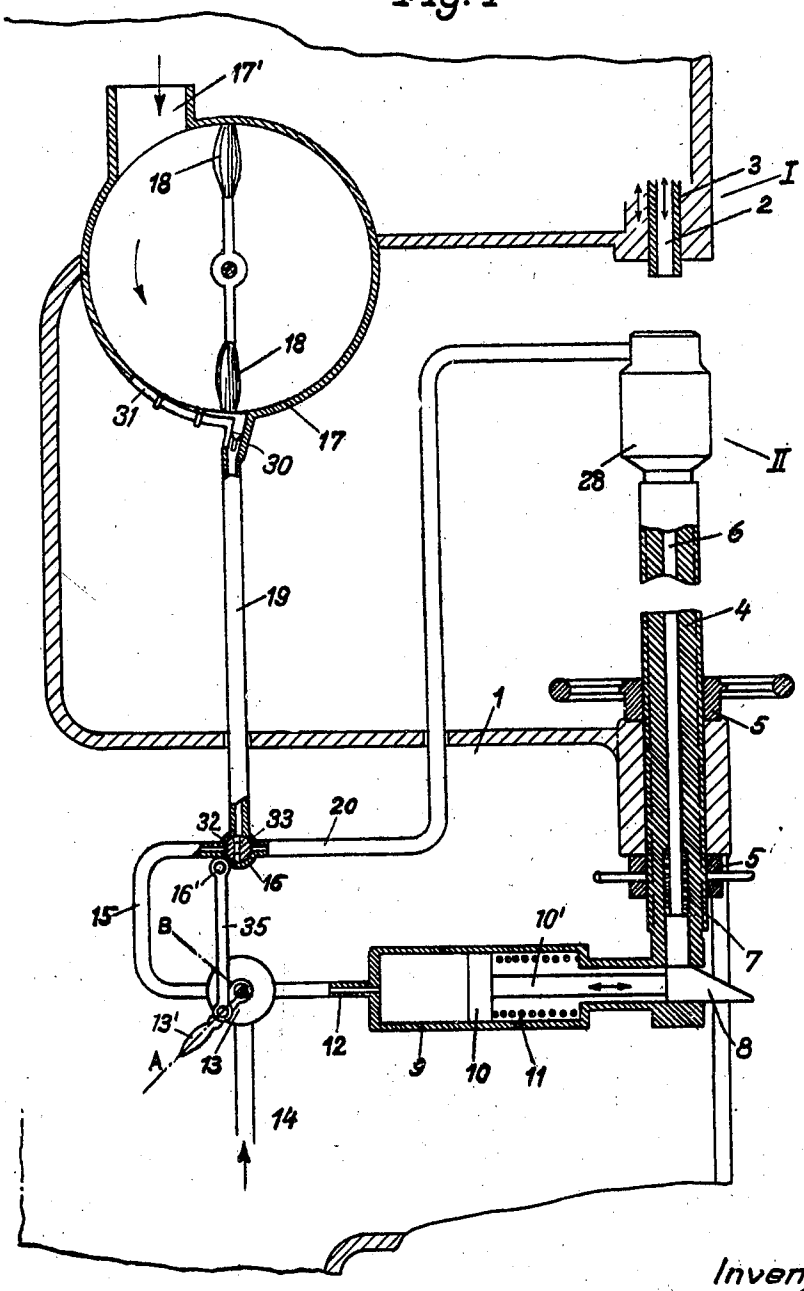
Feb. 1, 1944. H. MÖRTL 2,340,552

RIVETING APPARATUS

Filed Jan. 28, 1941 5 Sheets-Sheet 1

Fig. 1



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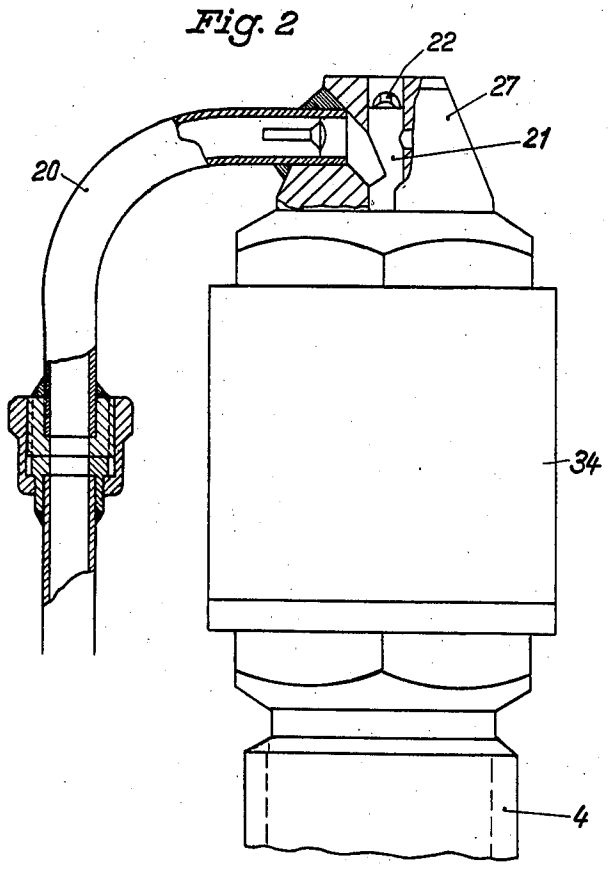
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RIVETING APPARATUS

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Fig. 2



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RIVETING APPARATUS

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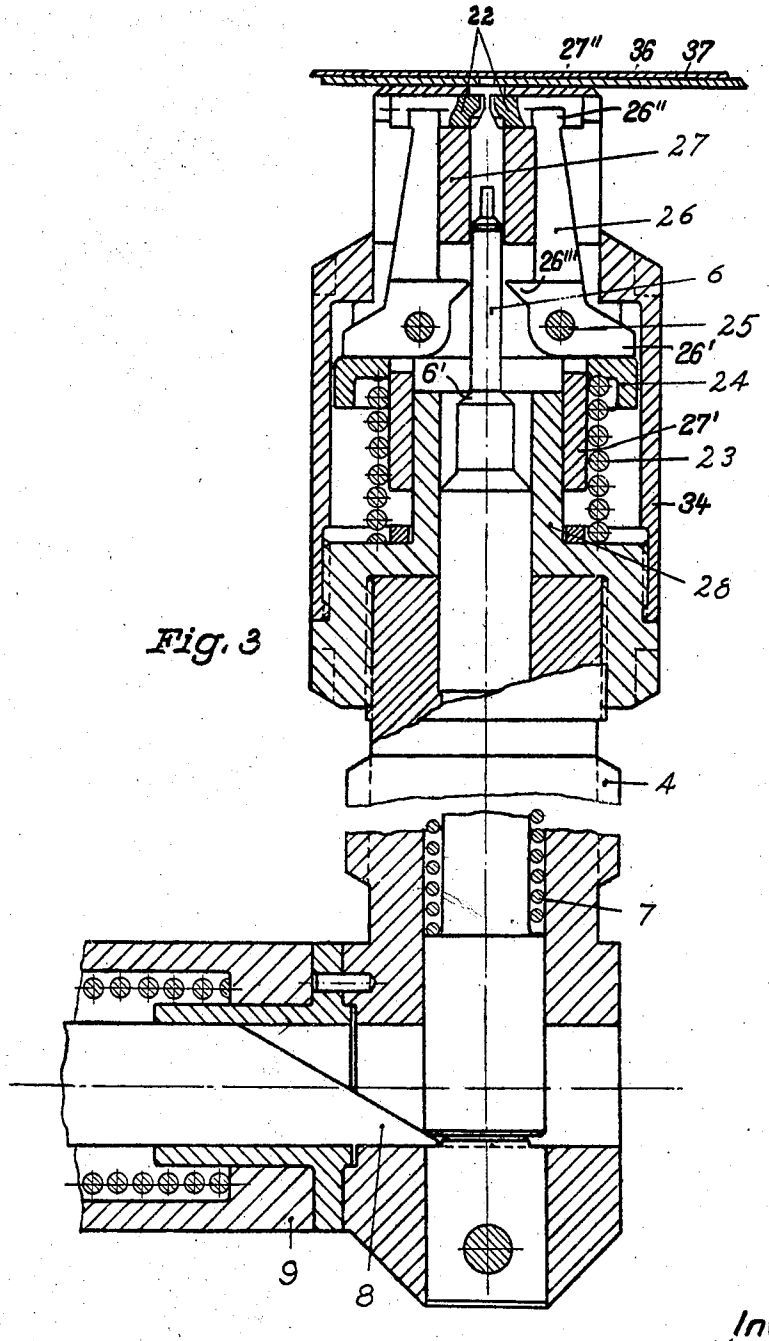


Fig. 3

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RIVETING APPARATUS

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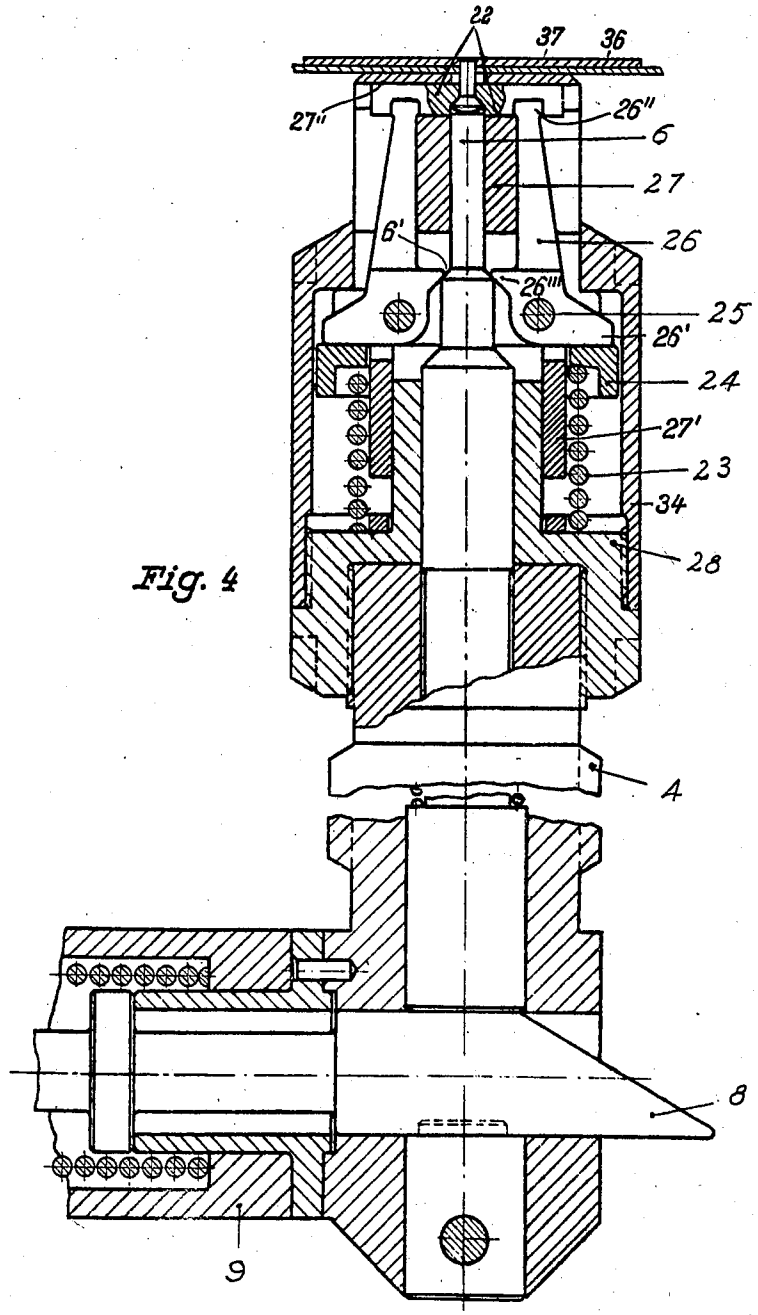


Fig. 4

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RIVETING APPARATUS

Filed Jan. 28, 1941 5 Sheets-Sheet 5

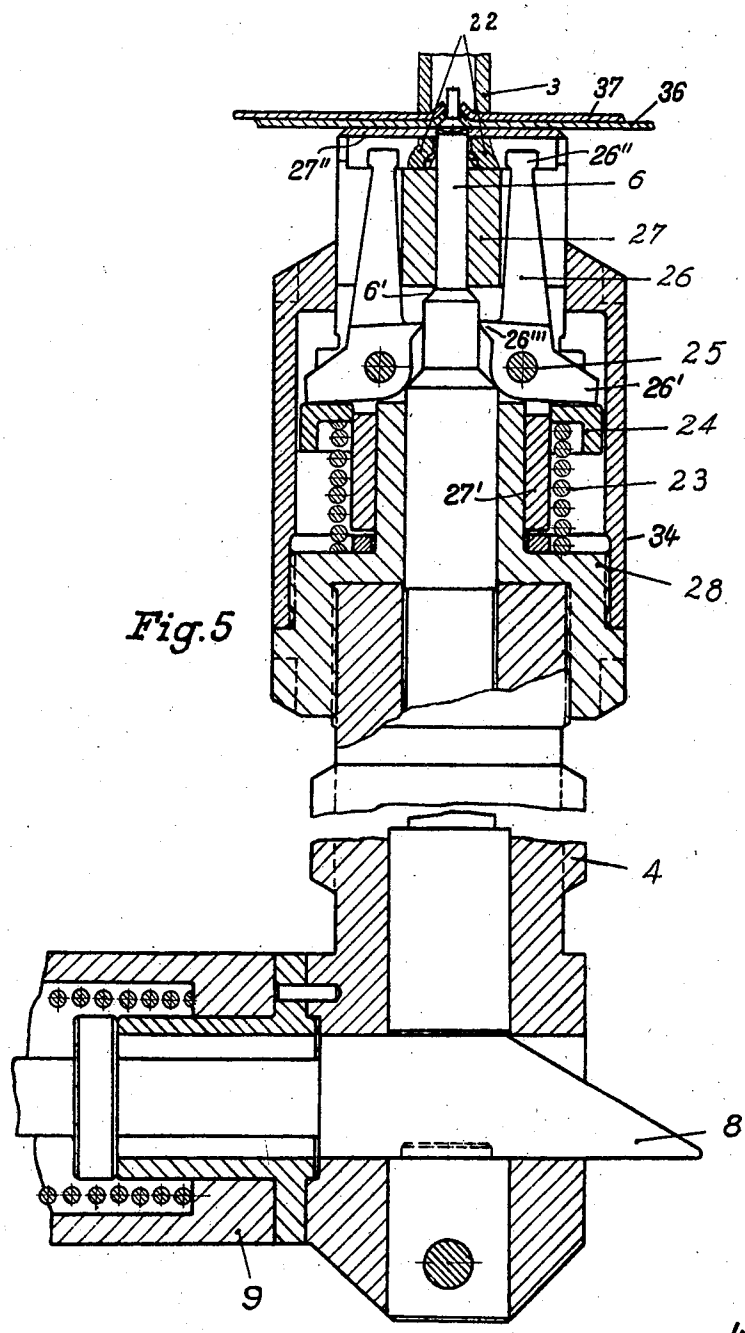


Fig. 5

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Patented Feb. 1, 1944 2,340,552

UNITED STATES PATENT OFFICE

2,340,552

RIVETING APPARATUS

Hubert Mörtl, Regensburg, Germany; vested in the Alien Property Custodian

Application January 28, 1941, Serial No. 376,385
In Germany October 21, 1939

7 Claims. (Cl. 78—48)

This invention relates to a riveting apparatus of the type comprising means for automatic feeding of the rivets to the riveting place and gripping members, such as, tongs or the like arranged in the holding-up hammer or head cup portion, for holding the rivets in position before the riveting operation.

In one known apparatus of this type, the rivets coming from the rivet supply are fed to the gripping members through a pipe terminating on that side of the work pieces to be riveted where the rivet stamp is arranged, i. e., on the side facing away from the holding-up hammer. In this case, the space between the stamp and the holding-up hammer has to be cleared by the work pieces each time for transferring a rivet from the feed pipe to the gripping members. It follows that the work pieces to be riveted have to be withdrawn each time a rivet has been closed, for introduction of the next rivet into the gripping members. This operation, while being time-wasting already with small work pieces, is unpracticable for large work pieces, such as those, for instance, occurring in aircraft construction.

It is an important object of the present invention to provide means for avoiding this drawback of the known apparatus.

According to the invention, the rivet feeding pipe is connected to the holding-up hammer part of the riveting apparatus, in such a manner that the rivets in their travel to the gripping members need not be passed through the space between the stamp part and the holding-up hammer. Thus, the work pieces occupying this space need not be removed after each riveting operation, but have to be moved merely from the finished rivet to the next bore.

According to a further important feature of the invention, the rivet feeding pipe is connected to the casing for the holding-up hammer on that side of the rivet gripping members which faces away from the work pieces. This particular arrangement permits the remaining conveyance of the rivets into the rivet gripping members to be effected by the holding-up hammer which pushes the rivets between the gripping members or nippers. This affords a considerable simplification in the construction and operation of the apparatus, avoiding intricate positive control of the gripping members.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings showing by way of example and purely schematically a preferred embodiment of the invention and in which:

Fig. 1 is a fragmentary elevation, partly in section, of a riveting apparatus having the invention applied thereto.

Fig. 2 is an elevation, partly in section, of the upper portion of the holding-up hammer including the connection with the end of the rivet feeding pipe, on a larger scale.

Fig. 3 is a fragmentary axial section through the holding-up hammer part on a plane at right angles to the plane of Fig. 2, the head cup and a rivet shown in their positions taken up immediately after the rivet has been passed from the rivet feeding pipe into the casing for the head cup.

Fig. 4 is a section similar to Fig. 3, but with the head cup and rivet in their positions immediately after introduction of the rivet between the gripping members.

Fig. 5 is a section similar to Figs. 3 and 4, but showing the head cup and the rivet in their positions after the rivet has been pushed right through its bore.

Similar characters of reference denote similar parts in the different figures.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be seen that a frame 1 for the riveting apparatus, which is only roughly indicated, comprises two main parts, i. e., the stamp part I including the stamp 2 and the holding-down member 3, and the part II, including the holding-up hammer or head cup 6 which is slidably mounted in the bore of an exteriorly threaded spindle-shaped member 4. In its raised position the head cup 6 serves as a support for the rivet while the stamp 2 is producing the closing head thereof. This, of course, is the normal function of the head cup in riveting, but according to the present invention the head cup also performs various other functions which will be hereinafter described.

The head cup 6 is operated by means of a device consisting of a wedge member 8, a compressed air cylinder 9 and a piston 10 slidable in the cylinder and connected with the wedge member 8 through a rod 10', the head cup 6 being held in engagement with the wedge member 8 by means of a helical spring 7 accommodated in a bore of spindle 4 and bearing on a collar of the head cup 6. By admitting compressed air into the cylinder 9, through pipe 12, the piston 10 with the wedge member 8 can be moved to the right, against action of a helical spring 11 serving to return the piston 10 with the wedge mem-

ber 8 on decrease of the air pressure in cylinder 9. The pipe 12 communicates with a pipe 14 which is connected to a supply of compressed air (not shown), a change-over cock being connected between pipes 12 and 14 and establishing communication between the two pipes with position A of switching lever 13', as shown, while disconnecting the pipes with position B of lever 13', indicated in dot and dash lines, and establishing communication between pipe 14 and pipe 15 which moreover, through a second change-over cock 16, is adapted to communicate with the rivet feeding pipe 20. Further, a pipe 19 connects cock 16 with the branch 30 of a rivet supply or magazine 17 which receives the rivets through a branch 17', a pair of rotary brushes serving to assort the rivets by sweeping them into a suitable slot 31 in the cylindrical drum 17 and, from this slot, into branch 30, with their heads up.

The plug 32 of the change-over cock 16 is provided with a cross channel 33 which conforms to the shape of the rivets. In one end position of the plug 32, shown in Fig. 1, this cross channel 33 is disposed vertical for reception of a rivet dropping through pipe 19, while in its position turned through 90°, corresponding to position B of lever 13', the cross channel 33 is horizontally disposed for establishing connection between pipes 15 and 20. As best seen from Fig. 2, showing the upper end of pipe 20 and its connection to the upper part of the part II, the rivets through pipe 20 reach the inner space 21 of the guide member 27 for the head cup 6.

The guide member 27 also serves for supporting the nipper device for the rivets, which includes two jaws or gripping members 22 acting like tongs and being controlled by three-armed levers 26 engaging the jaws 22 by their upper arms 26'' and fulcrumed in the member 27 by means of pivots 25. The member 27 with the levers 26 by means of its lower sleeve portion 27' is mounted to slide on a member 28 which is screwed to the top end of spindle 4 and in its central bore receives the lower thickened portion of head cup 6. Downward sliding of member 27 is caused by the stamp part 2, 3 of the riveting apparatus, against action of a helical return spring 23 supported on member 28 and leaning at its upper end against a flange spring plate 24 which in turn engages the lower arms 26' of lever 26. The whole mechanism is enclosed in a surrounding sleeve 34 screwed to an exterior thread of member 28.

The operation of the apparatus is as follows:

During the riveting operation, i. e., during formation of the closing head by means of the rivet stamp 2, the operating lever 13' of cock 13 is in position A, as shown in Fig. 1, and the operating lever 16' of cock 16, positively coupled to lever 13' by a coupling rod 35, is in a position aligning the cross bore 33 of the plug 32 with pipe 19, for reception of a rivet falling down therethrough. After the riveting operation has been finished, the rivet stamp 2 and the holding-down member 3 are raised and the lever 13' of cock 13 is moved into its position B, whereby the plug 32 of cock 16 is also moved into its other end position for interconnecting pipes 15 and 20 and shutting off the lower end of pipe 19. In position B of cock 13 the compressed air contained in cylinder 9 from the preceding operation is allowed to flow into pipe 15, through pipe 12, thereby conveying the rivet in plug 32 of cock 16, through pipe 20, into the space 21 within casing 27, Fig. 2. The rivet thereby comes to lie upon the upper end face of head cup 6, as shown in Fig. 3. Now, the operating lever 13' of cock 13 is again moved into position A, thereby establishing communication between cylinder 9 and the supply of compressed air connected to pipe 14. Under action of the compressed air brought to bear upon piston 10 through pipe 14, cock 13 and pipe 12, the piston is moved to the right, against action of spring 11, taking along the wedge member 8. The lower end of head cup 6 which at the beginning of this movement had been engaged on the front tip of the wedge, under action of helical spring 7, now slides upwards on the inclined face of the wedge, whereby the rivet lying on the upper end of the head cup is raised and pushed between the jaws 22 which by the rivet shaft are spread correspondingly, against the action of spring 23, this action being transmitted upon the jaws 22 through arms 26' and 26'' of three-armed levers 26. The rivet forced between the jaws 22 is thus safely held in its upright position, protruding from the upper surface 27'' of member 27 which serves as a support for the work pieces 36, 37 to be riveted. This permits the bores in the work pieces to be readily engaged over the rivet, so that the work pieces are secured in position for the riveting operation.

As best seen from Fig. 4, the lower end of head cup 6 in the upper position thereof has passed from the inclined surface of wedge 8 to its upper horizontal face. It follows that no reaction pressure is transmitted from head cup 6 to piston 10, the driving system thus being self-locking in this position and enabled to receive considerable forces acting upon the head cup in the riveting operation, without any yielding.

Continuing the riveting process, the holding-down member 3 engages the work pieces 36, 37 to be riveted, depressing them jointly with the member 27, the claws 22 and the three-armed lever 26, against action of the helical spring 23. In this phase of the operation, the head cup 6 is maintained in a static relation on the horizontal top face of wedge member 8, so that a relative motion of the three-armed levers 26 is caused with respect to the head cup. By this relative motion the inner arms 26''' of levers 26 are swung outwards by the conical collar 6' of head cup 6, against action of springs 23, which also causes outward swinging of the upwardly directed arms 26'' of levers 26. The jaws 22 therefore release the rivet clamped between them, so that the sheets 36, 37 under depressing action of the holding-down member 3 of the stamp part engage the countersunk head of the rivet which is countersunk into the sheets as shown in Fig. 5.

The rivet stamp 2 now makes the closing head of the rivet, opposed by the head cup which with its lower end is still bearing on the horizontal surface of wedge 8 in self-locking relation. The closing head being finished, lever 13' is again moved from position A to position B, for discharging the compressed air from cylinder 9. Piston 10 with its wedge member 8 therefore is moved leftward, under action of spring 11 and the head cup 6 is allowed to go down, sliding downwards on the incline of wedge member 8. The apparatus is now ready for another cycle of riveting operations.

In order to make the head-cap part II to conform to the shape of the work pieces to be riv-

eted, the same is provided for raising and lowering in the frame 1 by screwing the nuts 5 and 5' on spindle 4. To this end, the upper nut 5 is provided with a hand wheel while the lower nut 5' is provided with spokes. Further, the pipes 12 and 20 are made flexible or provided with flexible portions, for connection to a stationary rivet magazine 17; or the rivet magazine may be connected with the part II through rigid pipes, for vertical adjustment jointly with the head cup system.

The method and apparatus of the present invention have been described in detail with referenc to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawings.

I claim:

1. In a riveting apparatus, a rivet supply, a rivet stamp system including a holding-down member, a holding-up hammer system including means for tightly gripping each rivet in position before the riveting operation, and pipe means for automatically conveying the rivets to the holding-up hammer by compressed gas, said pipe means being connected to the holding-up hammer system at that side of the gripping means which faces away from the work pieces, the holding-up hammer system moreover including compressed gas-operated cylinder and piston means for imparting controlled axial motions to the holding-up hammer for forcing the rivets into the gripping means, and further means for supplying the rivet conveying means with the compressed gas discharged from said cylinder, said further means comprising a change-over cock provided in the rivet conveying pipe and connected by three separate branches with the rivet supply, with the compressed gas cylinder and with the holding-up hammer, respectively, said cock including a plug having a cross bore which in one end position communicates with the rivet supply for reception of a rivet therefrom while in its other end position it connects the compressed gas cylinder with the branch to the holding-up hammer, whereby the rivet in the cross bore by means of the compressed gas from the compressed gas cylinder is conveyed to the holding-up hammer.

2. In a riveting apparatus, a rivet supply, a rivet stamp system including a holding-down member, a holding-up hammer system including means for tightly gripping each rivet in position before the riveting operation, and pipe means for automatically conveying the rivets to the holding-up hammer by compressed gas, said pipe means being connected to the holding-up hammer system at that side of the gripping means which faces away from the work pieces, the holding-up hammer system moreover including compressed gas-operated cylinder and piston means for imparting controlled axial motions to the holding-up hammer for forcing the rivets into the gripping means, and further means for supplying the rivet conveying means with the compressed gas discharged from said cylinder, said further means comprising a change-over cock provided in the rivet conveying pipe and connected by three separate branches with the rivet supply, with the compressed gas cylinder and with the holding-up hammer, respectively, said cock including a plug having a cross bore which in one end position communicates with the rivet supply for reception of a rivet therefrom while in its other end position it connects the compressed gas cylinder with the branch to the holding-up hammer, whereby the rivet in the cross bore by means of the compressed gas from the compressed gas cylinder is conveyed to the holding-up hammer, and a second change-over cock mechanically coupled with said first cock and adapted to establish communication between the supply of compressed gas and the cylinder in its position corresponding to the rivet-receiving position of the first cock and further adapted to establish communication between the cylinder and the cylinder branch of the first cock in the other position of the second cock.

3. In an apparatus for riveting perforated work pieces, a rivet stamp system, a holding-up anvil system including an axially movable anvil and axially movable gripping means for tightly gripping and holding each rivet protruding from the upper surface of said anvil system and adapted to serve as a pilot pin for centering the corresponding hole of the work pieces, said gripping means including a set of grippers, a set of two-armed levers, one lever for each gripper, and moreover spring means acting parallelly with the riveting axis on one arm of each of said two-armed levers, the other arms of which engage the respective grippers, and tending to hold the set of grippers in the shut position, the center of the set of grippers remaining in the riveting axis during the whole cycle of operations, and means for feeding the rivets to said anvil system beneath said set of grippers, the anvil being adapted to force the rivets by axial movement into the set of grippers and being provided with a cam surface engaged by said two-armed levers when the gripping means move downward and causing the set of grippers to be opened.

4. In an apparatus for riveting perforated work pieces, a rivet stamp system, a holding-up anvil system including an axially movable anvil and axially movable gripping means for tightly gripping and holding each rivet protruding from the upper surface of said anvil system and adapted to serve as a pilot pin for centering the corresponding hole of the work pieces, said gripping means including a set of grippers, a set of two-armed levers, one lever for each gripper, and moveover spring means acting parallelly with the riveting axis on one arm of each of said two-armed levers, the other arms of which engage the respective grippers, and tending to hold the set of grippers in the shut position, the center of the set of grippers remaining in the riveting axis during the whole cycle of operations, and means for feeding the rivets to said anvil system beneath said set of grippers, the anvil system including moreover a wedge member adapted to advance the anvil towards the grippers and thereby causing the anvil to force the rivets into the set of grippers by cooperation of an incline on the wedge member with the rear end of the anvil and further adapted to maintain the anvil in its advanced position for the riveting operation by cooperation of a surface on the wedge member which is normal to the line of the anvil motion, with the rear end of the anvil and the anvil being provided with a cam surface engaged by said two-armed levers when the gripping means move downward and causing the set of grippers to be opened.

5. In an apparatus for riveting perforated work pieces, a rivet stamp system, a holding-up anvil system including an axially movable anvil and axially movable gripping means for tightly

gripping and holding each rivet protruding from the upper surface of said anvil system and adapted to serve as a pilot pin for centering the corresponding hole of the work pieces, said gripping means including a set of grippers, a set of two-armed levers, one lever for each gripper, and moreover spring means acting parallelly with the riveting axis on one arm of each of said two-armed levers, the other arms of which engage the respective grippers, and tending to hold the set of grippers in the shut position, the center of the set of grippers remaining in the riveting axis during the whole cycle of operations, and means for feeding the rivets to said anvil system beneath said set of grippers, the anvil system including moreover a wedge member adapted to advance the anvil towards the grippers and thereby causing the anvil to force the rivets into the set of grippers by cooperation of an incline on the wedge member with the rear end of the anvil and further adapted to maintain the anvil in its advanced position for the riveting operation by cooperation of a surface on the wedge member which is normal to the line of the anvil motion, with the rear end of the anvil, the anvil system also including compressed gas-operated cylinder and piston means for driving said wedge member, and the anvil being provided with a cam surface engaged by said two-armed levers when the gripping means move downward and causing the set of grippers to be opened.

6. In an apparatus for riveting perforated work pieces, a rivet stamp system, a holding-up anvil system arranged beneath said stamp system and including an axially movable anvil and means for tightly gripping and holding each rivet protruding from the upper surface of said anvil system and adapted to serve as a pilot pin for centering the corresponding hole of the work pieces and pipe means for automatically conveying the rivets from the rivet supply to the anvil system by compressed gas, the pipe means including sluice means for carrying the rivets from that part of the pipe means which is connected with the rivet supply to the part carrying the compressed gas.

7. In an apparatus for riveting perforated work pieces, a rivet stamp system, a holding-up anvil system arranged beneath said stamp system and including an axially movable anvil and means for tightly gripping and holding each rivet protruding from the upper surface of said anvil system and adapted to serve as a pilot pin for centering the corresponding hole of the work pieces, and including an anvil adapted to force the rivets into the gripping means, actuating means for imparting controlled axial motions to the anvil for forcing the rivets into said gripping means, said actuating means including compressed gas-operated cylinder and piston means, a rivet supply, pipe means for automatically conveying the rivets from the rivet supply to the anvil system by compressed gas, the pipe means including sluice means for carrying the rivets from that part of the pipe means which is connected with the rivet supply to the part leading the compressed gas, and further means for supplying the rivet-conveying pipe means with the compressed gas discharged from said cylinder.

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