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Miyamoto

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[54] **HAND RIVETER**

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[73] Assignee: **Vessel Tool Company, Ltd.**, Osaka, Japan

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[52] **U.S. Cl.** **72/391**

[51] **Int. Cl.** **B21j 15/34**

[58] **Field of Search** 72/391, 114, 453; 29/243.53, 243.54

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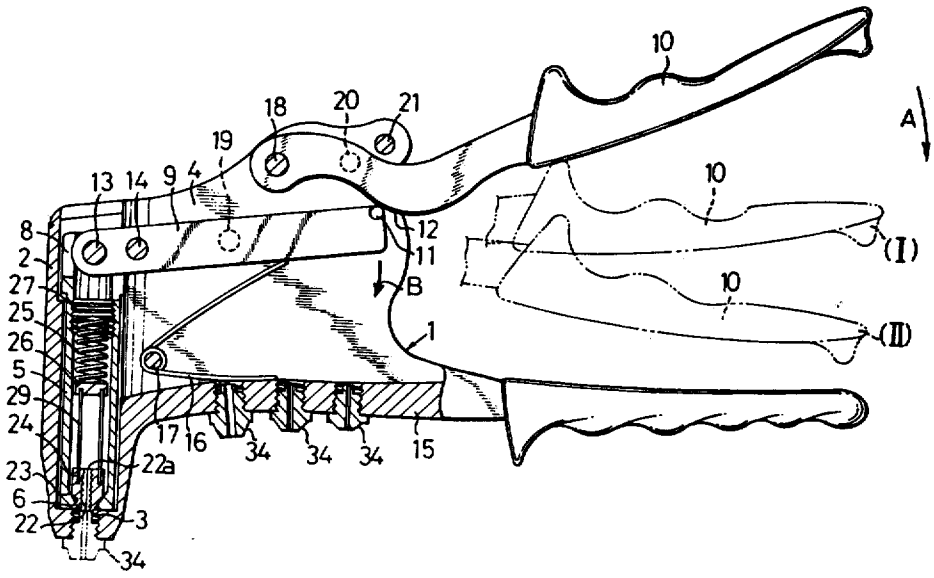
Primary Examiner—Milton S. Mehr
Assistant Examiner—Gene P. Crosby
Attorney, Agent, or Firm—Armstrong, Nikaido & Wegner

[57] **ABSTRACT**

A hand riverter is disclosed having a body with a fixed handle, and a movable handle mounted to lift a jaw case which houses the jaws, a jaw pusher, and a spring. The movable handle is composed of a first movable handle having a rolling member at its one end and a separate second movable handle having a curved cam surface substantially in elastic contact with the rolling member. The first and second movable handles are pivoted individually to constitute a double lever mechanism to assure smooth and reliable riveting operation with a small force. The jaw pusher includes spring rods engaged in the jaws to permit them to move away from and toward each other in elastic contact with the inner peripheral surface of a tapered bored end of the jaw case while maintaining their chucking surfaces in parallel to assure proper chucking action.

2 Claims, 7 Drawing Figures



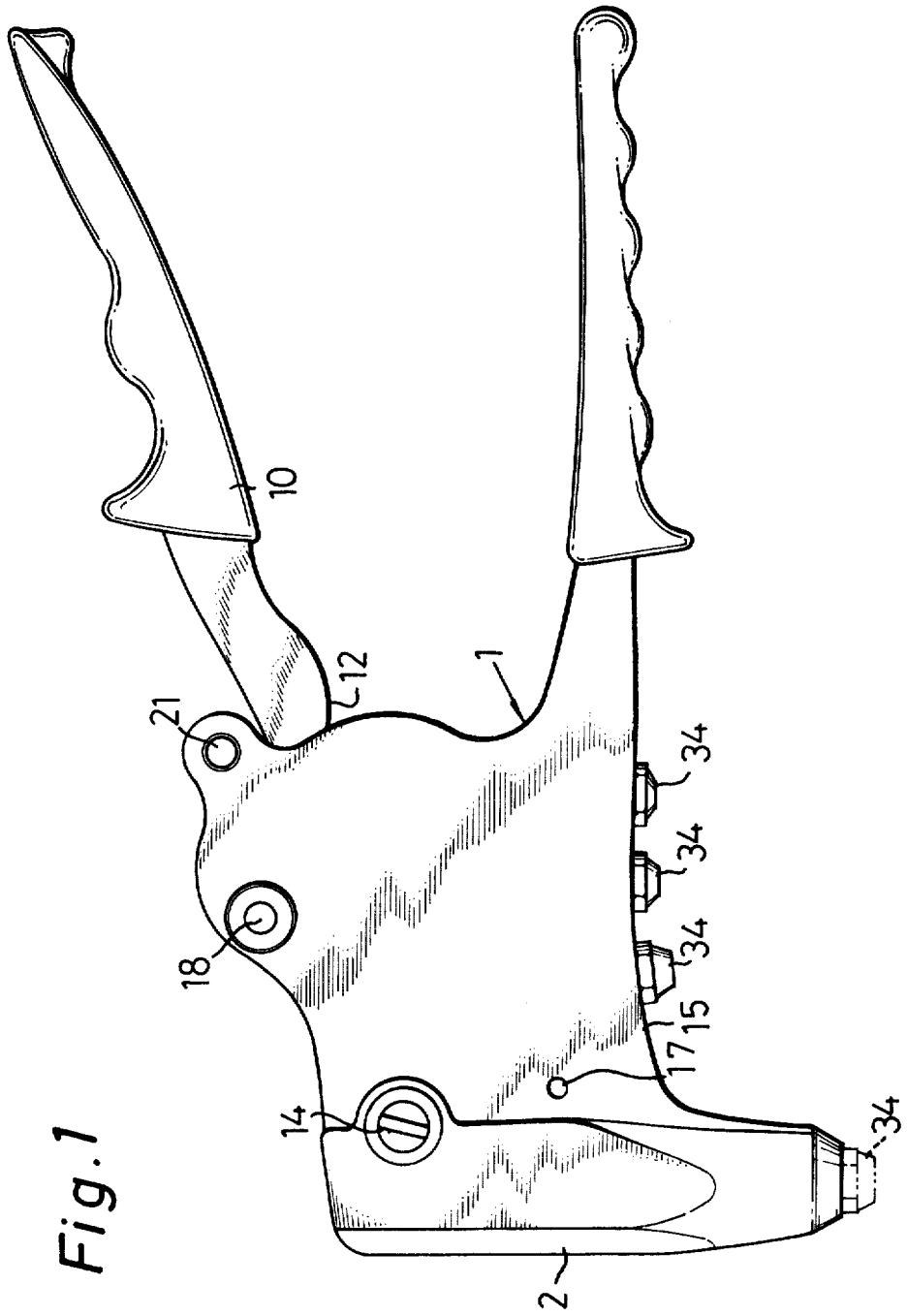


Fig. 1

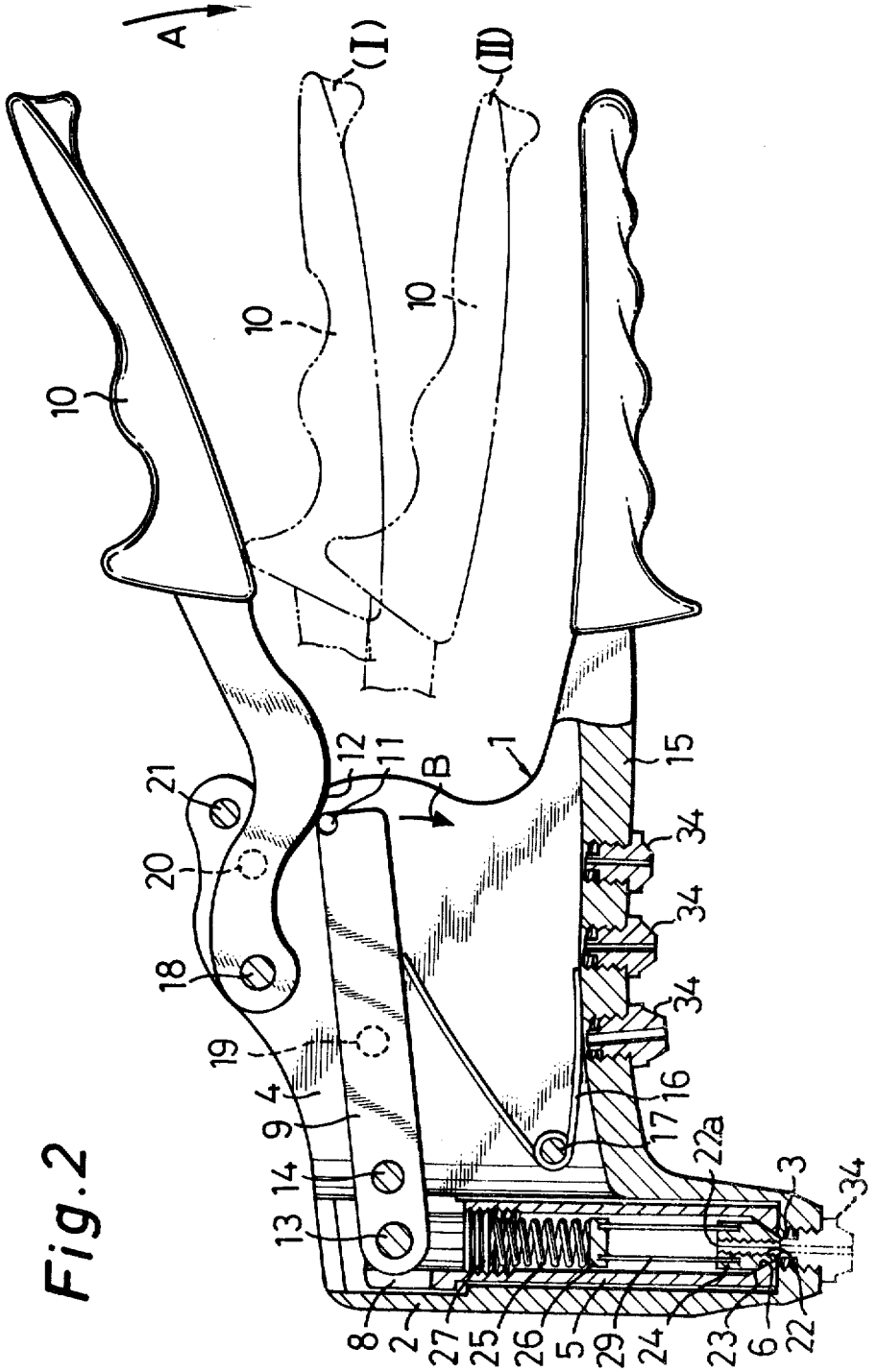

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Fig.2

Fig.5

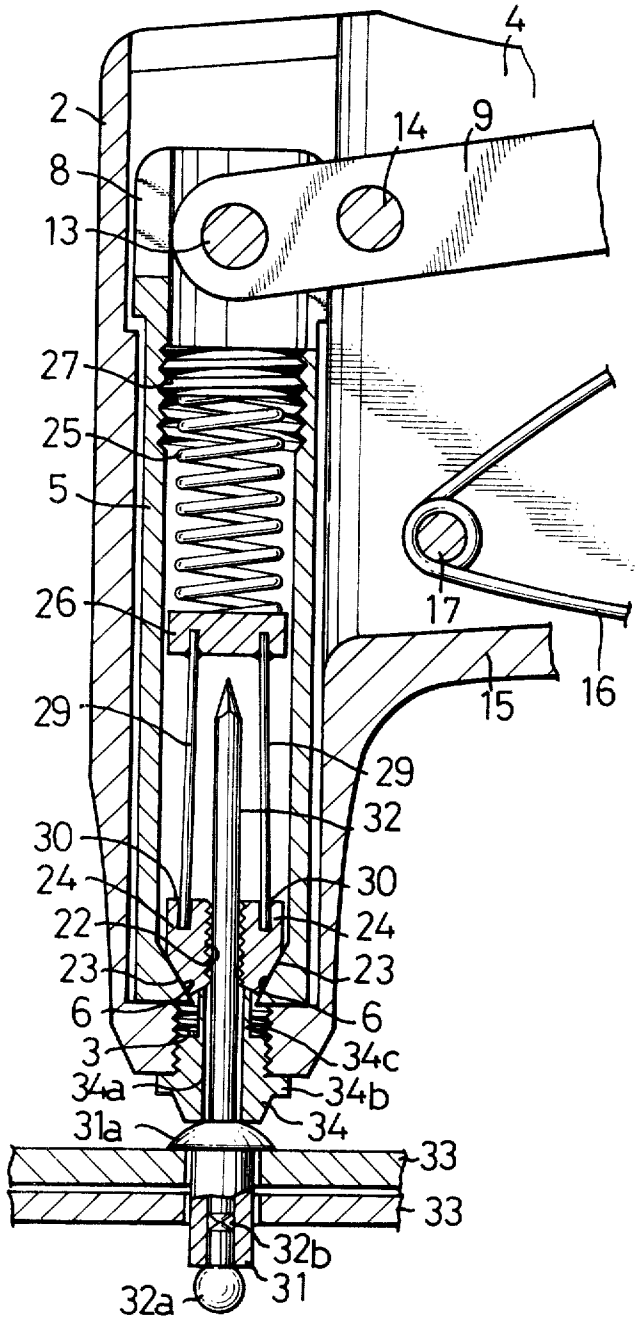
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Fig.3

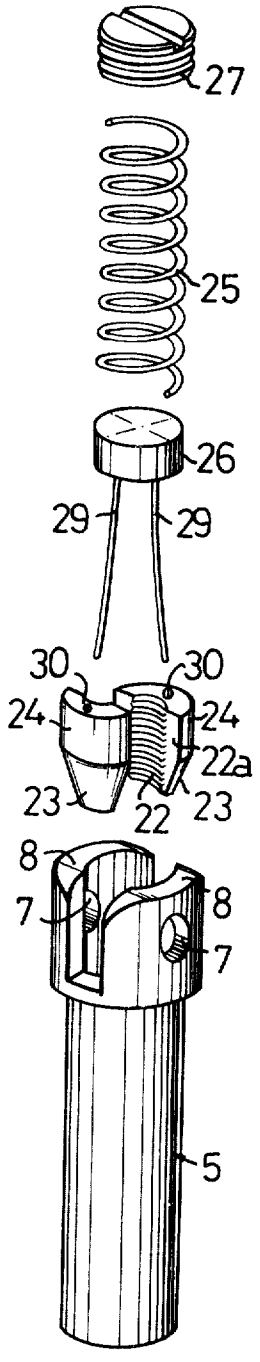
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Fig. 6

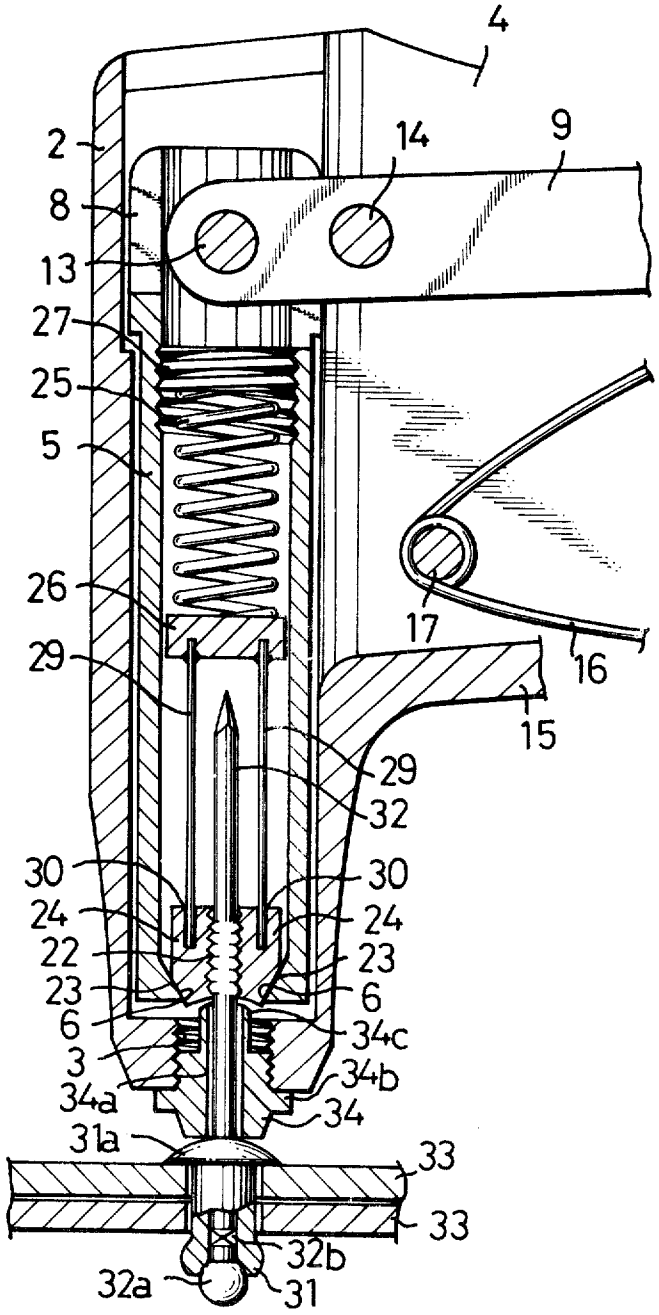
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Fig. 4

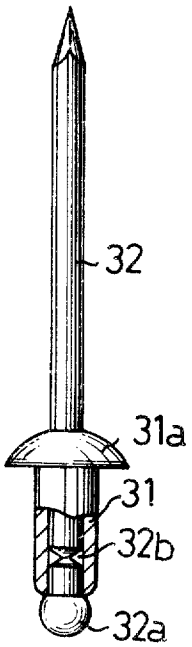
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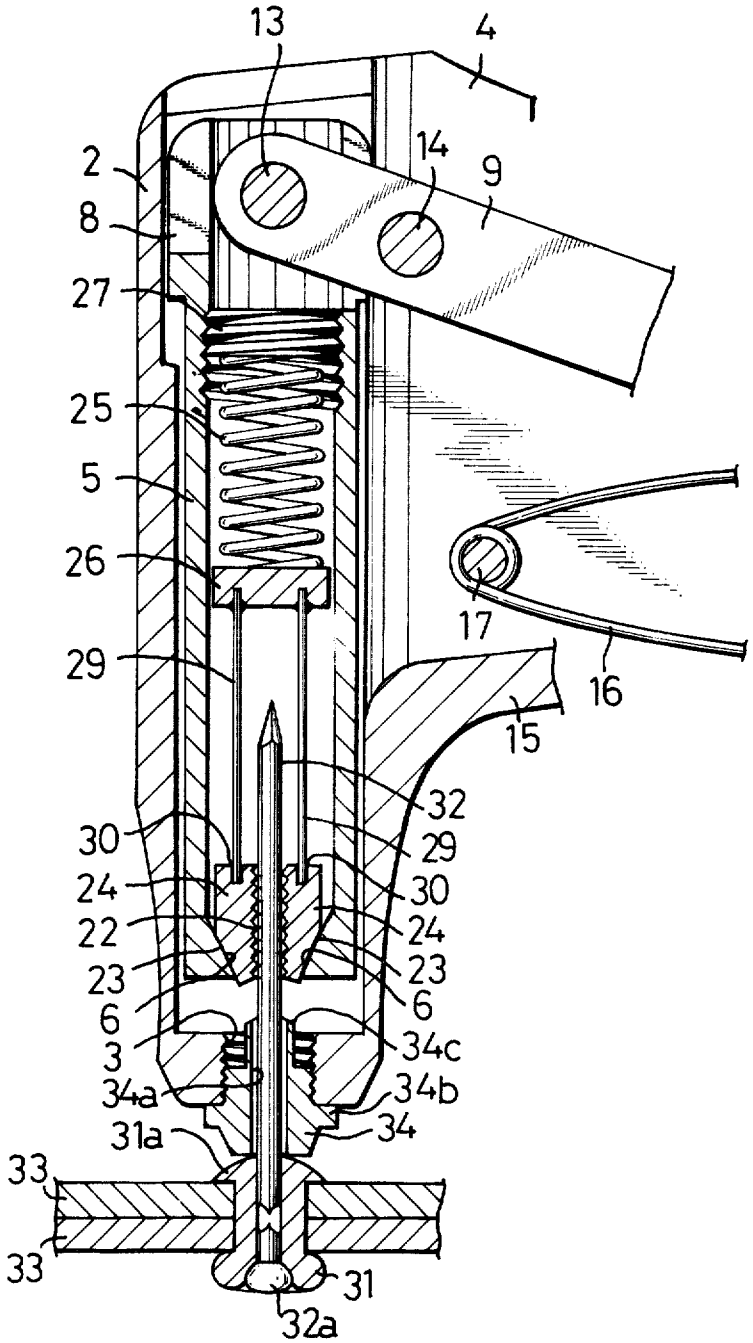
Fig. 7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HAND RIVETER

BACKGROUND OF THE INVENTION

The present invention relates to improvements in riveters for fastening plate-like members together with rivets composed of a rivet tube having a flange at one end and a nail-like mandrel serving as a core of the rivet and inserted into the rivet tube from the other end thereof, with the head of the mandrel supported by the other end of the rivet tube. More particularly, the invention relates to improvements in hand riveters for conducting riveting operation with rivets of the type described.

Riveters have already been known by which plate-like members are joined together with the above-mentioned rivets as disclosed in Japanese Utility Model Publications Nos. 23,918/1970; 18,957/1971; 18,958/1971 and 18,959/1971, U.S. Pat. Nos. 3,082,898 and 3,100,578. These riveters are divided into two types: hand riveters for manual riveting operation and power-operated riveters employing air, oil or like pressure medium as a power source for riveting operation.

With riveters of either type, a plurality of members are fastened together by passing a flanged rivet tube through the members, inserting a headed mandrel into the rivet tube, subjecting one end of the rivet tube to plastic deformation to diametrically expand the end with the head of the mandrel by drawing the mandrel in an axial direction and snapping off the mandrel at its neck portion to leave the head in the expanded deformed end as a core so that the members will be held together by the flanged end and the deformed end of the rivet tube.

To perform the operation described above, the riveter generally includes divided jaws which are adapted to chuck the mandrel and spring-loaded to elastically engage in the tapered bore of a jaw case. Further to render the riveter serviceable for versatile uses, a plurality of nosepieces are prepared for the riveter in conformity with various sizes of rivet assemblies. The nosepiece is detachably mounted in the rivet and, when set in position, the nosepiece pushes the jaws open so that the mandrel can be chucked by the jaws.

When the jaws are brought to position for chucking the mandrel, a movable handle is pushed toward a fixed handle by grasping if the riveter is of the manual type, thereby pulling the mandrel in the axial direction while the mandrel is being chucked firmly by the jaws. If the riveter is power-operable, the same operation is effected with compressed air or pressure medium which substitutes the manipulation of handle. The power-operated riveter is advantageous in that the air or pressure medium serving as the power source is very effective in drawing the mandrel in the axial direction, but it is inferior in portablility, complex in overall construction and very costly. Moreover, it has the drawback that when in condition for chucking the mandrel, the slightest displacement of the chucking element would affect adversely on the subsequent operation of drawing the mandrel in the axial direction.

Such drawback has been experienced with the power-operated riveter disclosed in U.S. Pat. No. 3,082,898 which is the typical of its kind. With the riveter disclosed, the action of a jaw spring is delivered through a jaw pusher to jaws, which are in turn engaged elastically into the tapered bore of a jaw case, the jaws being adapted to be pushed apart by the inner end of a nozzle screwed in to receive the mandrel for chucking action. If in this case the nozzle and the jaws are not uniformly smooth-surfaced for contact with each other and the contact surfaces of the jaw pusher and jaws lack uniform smoothness, for example, due to abrasion caused by years of service, the opposing divided jaws will be pushed open in uneven fashion, with the result that the mandrel will not longer be chucked properly. According to U.S. Pat. No. 3,100,578, the nozzle is not designed to push open the jaws and, accordingly, there will be no objectionable contact between the nozzle and the jaws which would displace one jaw from the other. However, if the chucking surfaces of the jaws should involve an uneven portion, the mandrel will not be chucked properly as in the above-mentioned case. Likewise, the riveters disclosed in Japanese Utility Model Publications No. 23,918/1970, No. 18,957/1971, etc., have the same drawback. Such drawback is attributable to the construction in which the divided jaws are simply pressed on by the jaw spring via the jaw pusher. With these known riveters, it is difficult to correct displacement or improper chucking action once such objection occurs and irregular break of mandrel or damage to the jaws therefore results.

Thus, despite its usefulness, the riveter of the power-operated type has found only limited applications because of the foregoing disadvantages involving poor economy. In fact, many of the riveters presently used are of the manual type.

As compared with the power-operated riveter, the hand riveter which is manually operable is inferior with respect to its ability to draw the mandrel axially in gripping engagement therewith, but it is easy to handle and inexpensive and will become more useful than the power-operated riveter, if it has a greater ability to draw the mandrel and that in parallel to the axial direction. For example, Japanese Utility Model Publication No. 18,957/1971 discloses a hand riveter including a sector gear provided at the end of a movable handle and meshing with a lever-like sector gear mounted on the jaw case so as to impart a greater ability to the movable handle. However, the construction fails to assure accurate and reliable meshing engagement between the sector gears, which are therefore liable to damage. Moreover, the riveter lacks smoothness in its operation and is expensive to make. Furthermore according to U.S. Pat. No. 3,100,578, the movable handle is formed at its end with a cam surface which proves useful in improving the smoothness of operation. However, the riveter has not been improved sufficiently in exhibiting a great ability to draw the mandrel in the axial direction, since the lever mechanism merely employs a single lever.

SUMMARY OF THE INVENTION

An object of this invention is to overcome the problems and drawbacks of conventional riveters described above and to provide a hand riveter which is simple, smoothly operable, durable, efficient and relatively inexpensive.

Another object of this invention is to provide a hand riveter having movable handle means incorporating therein a double lever mechanism to make it sure that riveting operation will be conducted with a small force.

Another object of this invention is to provide a hand riveter incorporating therein the above-mentioned double lever mechanism comprising a first movable

handle and a second movable handle formed, at a portion thereof where it applies a force to the first handle, with a cam surface so shaped as to permit a small constant force to effect riveting operation smoothly all the time.

Still another object of this invention is to provide a hand riveter wherein divided jaws can be so positioned as to chuck the mandrel uniformly all the time regardless of the type of mandrel, such that even if the jaws are brought out of position the chucking surfaces of the jaws will come into face-to-face contact with the mandrel when chucking the same, the hand riveter thus having a high ability to chuck the mandrel.

The foregoing object of this invention to impart a great ability to the hand riveter and to render the same operable smoothly can be achieved by the construction of this invention in which the above-mentioned movable handle means comprises separate first movable handle and second movable handle to provide a double lever mechanism, the movable handle means including a cam surface of a special shape in combination with a rolling member in contact with the cam surface.

The hand riveter of this invention comprises a fixed handle having a hollow body at its head portion; a jaw case housed in the hollow body in axially movable manner and accommodating jaws, a jaw pusher and a jaw spring, the jaw spring acting on the jaws by way of the jaw pusher to elastically bring the jaws into contact with the inner peripheral surface of a tapered bore at one end of the jaw case; movable handle means opposing the fixed handle and mounted on the jaw case; a spring interposed between the fixed handle and the movable handle means to elastically bring the bored end of the jaw case into contact with the bottom of the hollow body; and a nosepiece having a flange and a piecing bore for passing a mandrel serving as a core of a rivet, the nosepiece being mountable from outside into the hollow body through the bottom thereof with the flange abutting against the bottom so as to cause the inner end of the nosepiece to act on the jaws and to thereby push the jaws outward away from each other. The movable handle means comprises a first movable handle carrying a rolling member at its one end and a second movable handle having a cam surface at its base portion, the separate first and second movable handles constituting a double lever machanism. The first movable handle is mounted, at the other end thereof, on the upper portion of the jaw case and is pivoted to the head portion at an intermediate portion thereof that is as close as possible to the mounted position. The first handle extends rearward and terminates at the end where it carries the rolling member.

The second movable handle is in the form of a bell crank and is pivoted at its front end to the head portion. The cam surface at the base portion of the second handle opposes the rolling member. By virtue of spring action, the rolling member substantially bears against the cam surface elastically. The free end of the second movable handle extends rearward in opposing relation to the fixed handle, the extension being positioned substantially at an angle to the fixed handle. Accordingly, the second movable handle is spaced apart from the fixed handle by a progressively increasing distance toward the free end. When the free end of the second movable handle is moved toward the fixed handle, the first movable handle carrying the rolling member elastically in contact with the cam surface turns about its pivot, forcing the jaw case upward in the hollow body, whereby the divided jaws which have been elastically engaged in the tapered bore of the jaw case draw the mandrel in the axial direction in firm chucking engagement therewith.

The double lever mechanism comprising the first and second movable handles exhibits a great ability to draw the mandrel in the axial direction with a very small force applied on the second movable handle. To allow the double lever mechanism to operate smoothly and to eliminate the power loss in the lever mechanism, the cam surface is curved progressively gently rearward and the rolling contact of the rolling member with the cam surface renders the mechanism operable with improved smoothness. The progressively gently curving cam surface serves to minimize the distance between the pivot of the second movable handle and the position where the contact between the cam surface and rolling member takes place, this preventing the loss of operating force.

To make it sure that the mandrel will be chucked reliably, the jaws can be pushed apart by the nosepiece while the opposing chucking surfaces are being maintained in parallel relation. In this respect, the jaw pusher is made serviceable not only to deliver the action of the jaw spring to the jaws but also to permit the chucking surfaces to be pushed apart while being maintained in parallel relation to each other. More specifically, the jaw pusher interposed between the jaw spring and the jaws has the following construction. Spring rods equal in number to the number of the divided jaws and extending axially of the jaw case are fixed, each at its one end, to the jaw pusher serving as a seat for the spring, the free ends of the spring rods being progressively directed slightly outward. The free ends of the spring rods are engaged in the top surfaces of the jaws loosely, such that the spring rods and jaws are movable upward and downward relative to each other, the jaws being turnable with respect to the spring rods.

Accordingly, when the jaws are to be placed into the tapered bore of the jaw case, the spring rods are loosely fitted into the jaws respectively, with the distance between the opposing spring rods reduced to position the rods substantially in parallel to each other and to thereby bias the jaws outward away from each other all the time. Thus when the jaws are opened to the chucking position by the inner end of the nosepiece mounted from outside into the bottom of the hollow body, the jaws are subjected to the action of the spring rods which tends to force the jaws outward. Inasmuch as the spring rods are generally in parallel, the jaws will be pushed apart outward, with their chucking surfaces kept in parallel for face-to-face contact with the mandrel to be chucked.

Even if the jaws are displaced from each other and are not positioned properly for chucking action before the nosepiece is mounted, the jaws, being turnable relative to the spring rods, can be brought to correct position by the nosepiece when the nosepiece is set in place.

These and other objects, features and advantages of this invention will become more apparent from the following description with reference to the accompanying drawings showing an embodiment of the invention for illustrative purposes only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view showing an embodiment of the riveter of this invention in its entirety;

FIG. 2 is a view partly in section showing the same and also illustrating the steps of operating a movable handle;

FIG. 3 is a perspective view showing a mandrel chucking assembly as exploded;

FIG. 4 is a view partly broken away and showing an example of rivet assembly to be used according to this invention;

FIG. 5 is a fragmentary enlarged view in section illustrating riveting operation, the mandrel chucking assembly being shown as it is ready for operation;

FIG. 6 is a similar view showing the mandrel chucking assembly during riveting operation; and

FIG. 7 is a similar view showing the same upon completion of riveting operation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGS. 1 and 2, a fixed handle 1 has a hollow body 2 at its head portion. The hollow body 2, positioned generally at right angles to the fixed handle 1, has at its lower end threaded grooves 3 and 3 defining a bore for accommodating a nosepiece. The head portion adjacent the hollow body 2 is composed of side walls 4 and 4 opposing each other in parallel. Disposed in the hollow body 2 is a cylindrical jaw case 5 which is movable axially of the body 2. The inner peripheral wall of the jaw case 5 at is lower end is tapered to provided a bore 6. As seen in FIG. 3, the jaw case 5 includes at its upper end a forked portion 8 having pivot holes 7.

For the axial displacement of the jaw case 5, the fixed handle 1 is provided with movable handle means serving as a double lever mechanism and comprising separate first movable handle 9 and second movable handle 10. The first movable handle 9 is in the form of a flat plate and carries at its one end a rollable rolling member 11 made of a super-hard metal material and disposed transversely thereof.

The second movable handle 10 is approximately in the form of a bell crank and has a cam surface 12 at a bent base portion. The cam surface 12 is curved gently progressively rearward.

The first movable handle 9 is pivotally mounted, at its front end, in the forked portion 8 of the jaw case 5 by means of a pivot 13 inserted in the pivot holes 7. Another pivot 14 supported by the opposite side walls 4 and 4 extends through the first movable handle 9, the pivot 14 being positioned as close as possible to the pivot 13.

A spring 16 wound around a pin 17 is disposed between the first movable handle 9 and the fixed handle 1, more specifically between the first movable handle 9 and the bottom wall 15 of the head portion. The spring 16 acts elastically on the first movable handle 9 all the time, so that the first movable handle 9, fulcrumed by the pivot 14, presses the jaw case 5 into contact with the bottom of the hollow body 2 elastically.

The second movable handle 10 is supported at its base end by a pivot 18 on the opposite side walls 4 and 4, with the cam surface 12 opposing the rolling member 11. Since the first movable handle 9 is spring-loaded as at 16, the rolling member 11 is substantially held in elastic contact with the cam surface 12. From the position of the cam surface 12, the second movable handle 10 extends further rearward, the extension opposing the fixed handle 1 and being spaced apart therefrom by a progressively increasing distance rearward. Thus the second movable handle 10 extends in slanting fashion.

When the free end of the second movable handle 10 is grasped and pushed toward the direction of arrow A in FIG. 2 against the action of the spring 16, the rolling member 11 rolls on the cam surface 12 smoothly, permitting the first movable handle 9 to be depressed in the direction of arrow B in FIG. 2 about the pivot 14. In this way, the double lever mechanism can lift the jaw case 5 with a very small force. Inasmuch as the first movable handle 9 is pivoted at the position as close as possible to the pivot 13 connecting the handle 9 to the jaw case 5, the mechanism works very effectively and makes it possible to force up the jaw case 5 approximately in linear fashion.

When the jaw case 5 is shifted upward as required to snap off the mandrel as will be described later, the first movable handle 9 almost comes into contact with the bottom wall 15. The bottom wall 15 therefore serves as a stopper by contact with the handle 9. As already apparent from the description above, the position of contact between the rolling member 11 and the cam surface 12 will become progressively remote from the pivot 18 of the second movable handle 10 as the operation proceeds, resulting in a loss of the applied force, but the cam surface 12 which is curved progressively gently serves to minimize the loss of the force. Despite the power loss involved, the present mechanism achieves an outstanding lever action as compared with conventional single lever mechanism. The curved cam surface 12 enables the rolling member 11 to roll along with improved smoothness.

To prevent shake of the first and second movable handles 9 and 10 as they turn about their fulcrums between the opposite side walls 4 and 4, guide pins 19 and 20 project from the side surfaces of the handles 9 and 10, respectively, in contact with the inner surfaces of the side walls 4 and 4. Further to limit the reverse turning of the second movable handle 10, a stopper pin 21 extends between the side walls 4 and 4 at an upper position close to the base end of the handle 10.

An assembly is housed in the jaw case 5 to chuck the mandrel during the operation stated above. The components of the chucking assembly are shown in FIG. 3. The chucking assembly comprises divided jaws 24 adapted to chuck the mandrel and having chucking surfaces 22 in opposing relation and tapered peripheral surfaces 23 at their lower ends respectively, a jaw spring 25 for bringing the tapered surfaces 23 into elastic contact with the inner peripheral wall of the tapered bore 6 of the jaw case 5, a jaw pusher 26 interposed between the jaws 24 and the spring 25 to deliver the action of the spring 25 to the jaws 24, a retaining nut 27 for adjusting the elastic action of the jaw spring 25, and the aforementioned jaw case 5.

The jaw pusher 26 not only serves to deliver the elastic force of the spring 25 to the jaws 24 but also permits the jaws 24 and 24 to move away from and toward each other with the chucking surfaces 22 and 22 maintained in parallel all the time.

To this end, slender spring rods 29 equal in number to the number of the jaws 24 and circular in cross sec-

tion are partially embedded in and spot-welded to the under surface of the jaw pusher **26** serving as a spring seat, the spring rods **29** being made of an elastic material such as metal. Before the spring rods **29** are placed into the assembly, the rods extend outward toward their lower ends as seen in FIG. **3**. Each of the jaws **24** is formed in its top surface with a bore **30** having a slightly greater diameter than the spring rod **29** and extending axially thereof.

To place the parts into the jaw case **5**, the spring rods **29** and **29** are inserted into the bores **29** and **29** to bring the jaws **24** and the pusher **26** together first, the jaws **24** are then placed into the jaw case **5** from above, the jaw spring **25** is thereafter inserted into the case **5**, and the retaining nut **27** is finally screwed into the case **5**. The action of the jaw spring **25** therefore acts through the jaw pusher **26** on the jaws **24** and **24** to elastically fit the tapered surfaces **23** of the jaws **24** in the tapered bore **6**. Consequently, the tips of the jaws **24** will be exposed slightly from the tapered bore **6** to position in the threaded bore **3** as shown in FIG. **2**, with the result that the spring rods **29** and **29** are spaced apart by a reduced distance substantially in parallel to each other, biasing the jaws **24** and **24** outward all the time. At this time, the divided surfaces **22***a* at the opposite sides of the chucking surfaces **22** are in intimate contact with each other (see FIG. **3**). Since the spring rods **29** and **29** are held generally in parallel to each other while rendering the jaws **24** and **24** turnable relative to the spring rods **29** and **29**, the possible displacement of the intimately fitted divided surfaces **22***a* can be corrected. Even when subjected to the action of the jaw spring **25**, the spring rods **29** will still remain in shape against buckling because they are positioned generally in parallel and are made of metal.

A plurality of members **33** and **33** are joined together using a rivet assembly consisting of a rivet tube **31** having a flange **31***a* at its one end and a nail-like mandrel **32** serving as a core of the rivet and having a head **32***a* and a notch **32***b* formed proximate to the head **32***a* as shown in FIG. **4**. Such rivets are available usually in about three sizes, so that nosepieces **34** are prepared for use with rivets of various sizes and are usually detachably mounted in the bottom wall **15** as seen in FIGS. **1** and **2**.

The nosepiece **34** has a center bore **34***a* for receiving the mandrel, an intermediate flange **34***b* and a jaw pushing portion **34***c* at its extreme upper end and is threaded in its upper peripheral wall. For use with a larger rivet, the mandrel receiving bore **34***a* will have a greater diameter, with an increased distance between the inner surface of the flange **34***b* and the upper or inner end of the pushing portion **34***c*.

For a better understanding of this invention, riveting operation by the present hand riveter will be described below in sequential order with reference to FIGS. **5** to **7**.

As in conventional manner, a rivet tube **31** is fitted into plate members **33** and **33**, and a nosepiece **34** in conformity therewith is screwed into the bore **3** against the action of the jaw spring **25**. When the nosepiece **34** is thus set in position, the inner surface of the flange **34***b* bears against the bottom of the hollow body **2**, with the inner end of the pushing portion **34***c* abutting against the jaws **24** and **24** to separate the divided jaws **24** and **24** to an extent suitable to chuck the particular mandrel **32**.

When the jaws **24** and **24** are to be brought to the position for chucking action, they are subjected to the outward biasing action of the spring rods **29** and **29** which are generally in parallel to each other, so that the jaws **24** and **24** are forced outward against the jaw spring **25** while their chucking surfaces **22** and **22** are being maintained in parallel. Accordingly, the jaws **24** and **24** can be brought into face-to-face contact with the mandrel **32** when chucking the mandrel by the subsequent manipulation of the second movable handle **10**. The mandrel receiving bore **34***a* and a chucking bore now defined by the outwardly displaced chucking surface **22** and **22** are coaxial with each other. The mandrel **32** is inserted into the rivet tube **31** and the distal end of the mandrel is passed through the nosepiece **34** and chucking bore.

Subsequently, the second movable handle **10** is grasped to lift the jaw case **5** axially of the hollow body **2**, permitting the jaw spring **25** to depress the jaws **24** and **24** with its spring force. Since the tapered surfaces **23** fit in the tapered bore **6** elastically, the jaws **24** and **24** are brought closer toward each other with progressive descrease in the distance between their chucking surfaces **22** and **22** and finally chuck the mandrel **32**. When chucking in this way, the jaws **24** and **24** are subjected to the action of the spring rods **29** which tends to restore them to the parallel position, namely to bring them diametrically inward, while the jaws **24** and **24** are turnable with respect to the spring rods **29** and **29**. Thus the jaws are brought to correct chucking position to achieve uniform face-to-face contact between the chucking surfaces **22**, **22** and the mandrel **32** and to thereby hold the mandrel firmly. The movable handle **10** is now in position (I) in FIG. **2**.

The second movable handle **10** is pushed further toward the fixed handle **1**, causing the head **32***a* of the mandrel **32** to progressively compress and collapse the rivet tube **31** (see FIG. **6**) while subjecting the mandrel **32** to high tension in axial direction until the mandrel **32** is snapped off at the notched portion **32***b*. Consequently, the head **32***a* of the mandrel **32** remains as a core in the portion **31** which has been expanded and deformed by compression, whereby the members **33** and **33** are completely fastened together. At this time, the movable handle **10** assumes position (II) in FIG. **2**. In the case where the largest rivet is used, the first movable handle **9** almost comes into contact with the bottom wall **15**.

Since the movable handle means comprises the separate first and second handles **9** and **10** to provide a double lever mechanism, the present riveter operates very effectively with a small force. When the riveter is freed from the operating force, the spring **16** acts to turn or move the parts in opposite directions to the foregoing, rendering the apparatus ready for the next riveting operation.

As will be apparent from the description given above, the hand riveter of this invention is operable with a very small force and is therefore easy and convenient to handle. In addition, the chucking assembly operates reliably to hold the mandrel firmly, making it sure that a plurality of members can be riveted together with high reliability. Thus the invention is of immense value for industrial uses.

What is claimed is:

1. A hand riveter comprising divided jaws, a jaw spring for elastically pressing the jaws, a jaw pusher in-

terposed between the jaws and the jaw spring to deliver the elastic force of the jaw spring to the jaws, a jaw case housing the jaws, the jaw spring and the jaw pusher and having a tapered bore for receiving the jaws in elastic contact wth the inner peripheral surface of the tapered bore, a fixed handle having at its head portion a hollow body acommodating the jaw case therein movably axially thereof, a nosepiece mountable from outside into the hollow body to open the jaws away from each other and movable handle means mounted on the jaw case to lift the jaw case and opposing the fixed handle, the movable handle means being composed of a first movable handle having a rolling member at its one end and a separate second movable handle in the form of a bell crank and formed at its base portion with a cam surface curved progressively gently rearward, the rolling member being substantially in elastic contact with the cam surface, the first and second movable handles being pivoted individually so as to serve as a double lever mechanism.

2. A hand riveter comprising divided jaws, a jaw spring for elastically pressing the jaws, a jaw pusher interposed between the jaws and the jaw spring to deliver the elastic force of the jaw spring to the jaws, a jaw case housing the jaws, the jaw spring and the jaw pusher and having a tapered bore for receiving the jaws in elastic contact with the inner peripheral surface of the tapered bore, a fixed handle having at its head portion a hollow body accommodating the jaw case therein movably axially thereof, a nosepiece mountable from outside into the hollow body to open the jaws away from each other and movable handle means mounted on the jaw case to lift the jaw case and opposing the fixed handle, the jaw pusher including a spring seat and spring rods equal in number to the number of the divided jaws and fixed to the spring seat each at its one end, the spring rods extending downward from the spring seat progressively outward but being positioned in parallel to each other when the jaws are turnably mounted thereon within the jaw case, the jaws being movable away from and toward each other in elastic contact with the inner peripheral surface of the tapered bore while maintaining their chucking surfaces in parallel to each other.

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