United States Patent

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[54] SWAGING MACHINE FOR SWAGING TUBULAR WORKPIECES

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[52] U.S. Cl. 72/76, 72/208, 72/402

[51] Int. Cl. B21b 25/02

[58] Field of Search 72/76, 208, 209, 402

[56] References Cited

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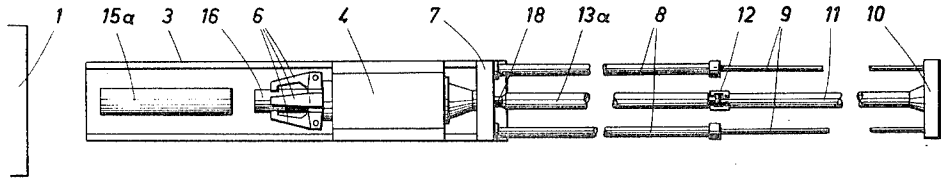
[57] ABSTRACT

A swaging box has receiving and discharge ends and contains swaging tool means. First and second gripping head beds are respectively disposed at said receiving and discharge ends of said swaging box outside thereof. First and second gripping heads are respectively mounted on said first and second gripping head beds. Each of said gripping heads is provided with a horizontal, rotatable, tubular spindle having an inner end which is nearer to the other gripping head, and with gripping jaws hinged to said spindle at said inner end thereof. Said spindles are axially aligned and each of said gripping heads is movable on the respective bed in the axial direction of its spindle. The machine comprises also an attachment for use in processing tubular workpieces. This attachment comprises a bridge secured to said first bed adjacent to that end of said first gripping head which is remote from said second gripping head; two cylinder-piston motors, which are flanged to said bridge and extend parallel to said spindles and away from said first gripping head, each of said motors having a displaceable member; a yoke which connects said displaceable members and comprises a center rod, which is coaxial with said spindle of said first gripping head and has a free end adjacent to said bridge; a swaging mandrel having an actuating rod which extends through said spindle of said first gripping head; and a connector carried by said free end of said center rod and releasably connected to said free end of said center rod and releasably connected to said actuating rod, whereby said motors are operable to extend and retract said mandrel relative to said spindle of said first gripping head.

7 Claims, 10 Drawing Figures



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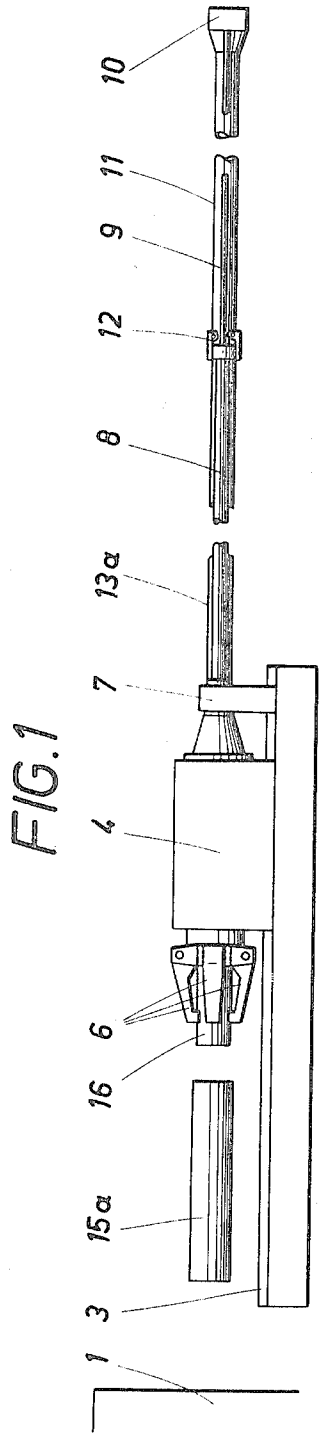

FIG. 1

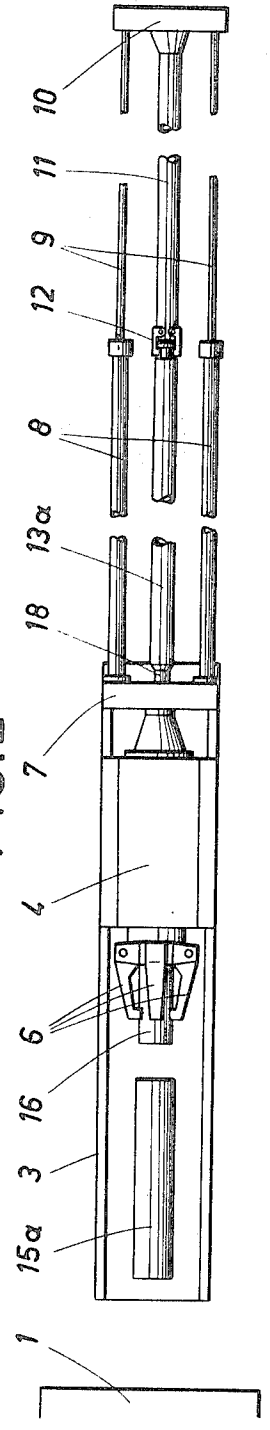

FIG. 2

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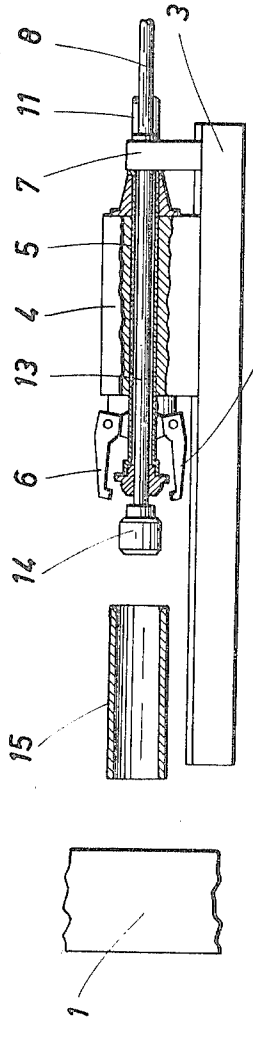

FIG. 3

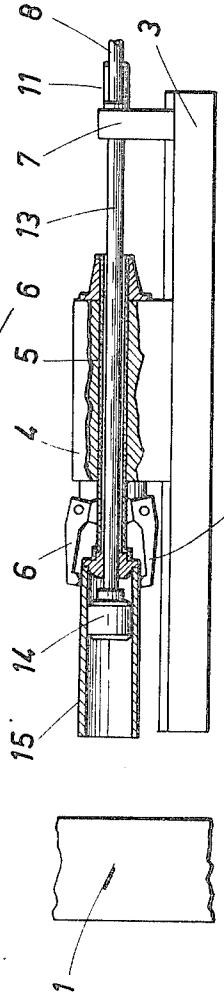

FIG. 4

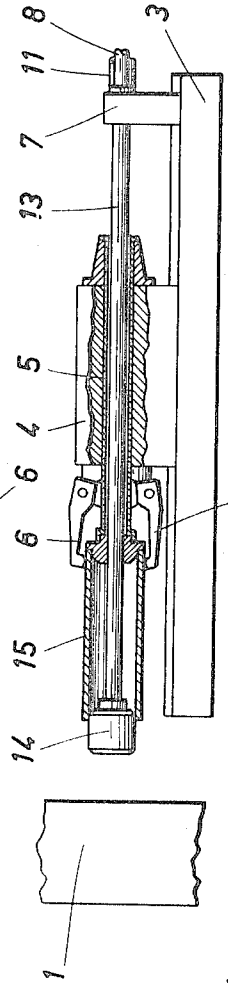

FIG. 5

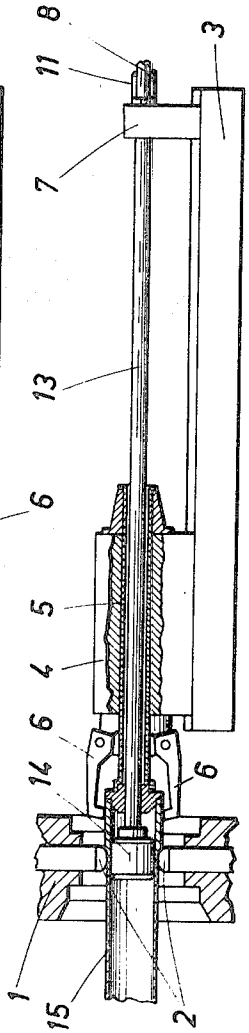

FIG. 6

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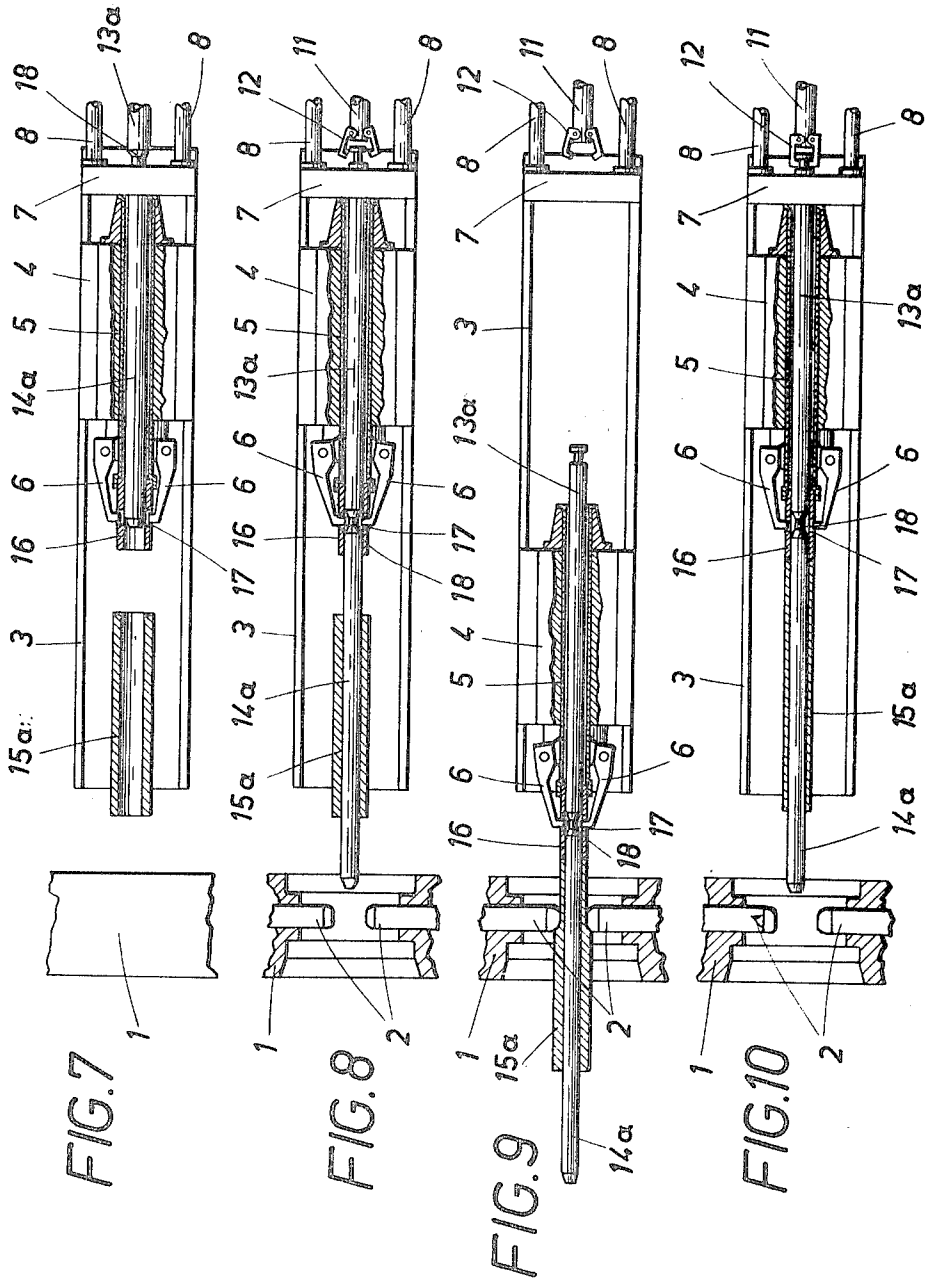

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SWAGING MACHINE FOR SWAGING TUBULAR WORKPIECES

This invention relates to an attachment for use in processing tubular workpieces in swaging machines, which comprise gripping heads, which are disposed at opposite ends of the swaging box outside thereof and horizontally movable on a bed and comprise each a rotatable tubular spindle extending in the feeding direction, and gripping jaws hinged to said spindle at that end thereof which faces the swaging box.

A provision of two gripping heads at opposite ends of the swaging box may be particularly desirable in conjunction with heavy swaging machines and has the advantage that the workpiece can be fed by one gripping head to the hammers provided in the swaging box and can then be received by the other gripping head so that the workpiece is swaged throughout his length in one operation and there is no unswaged portion left between the jaws. Besides, the workpiece may be clamped in its axial direction between the two gripping heads. The gripping head spindle carries the gripping jaws for the workpiece and during the swaging of a workpiece to a circular cross section imparts to the workpiece the required rotation about the workpiece axis. So far, the fact that this spindle is tubular has only been utilized to introduce the workpiece through the gripping head spindle from that end thereof which is remote from the swaging box. In the known swaging machines of this kind, difficulties arise when it is desired to swage tubular workpieces because the same must be swaged on or onto a mandrel and no means are provided to hold, guide and move a swaging mandrel.

Another known swaging machine comprises a gripping head which has a tubular sleeve, through which the actuating rod of a swaging mandrel extends, and said actuating rod is connected to the piston rod of a hydraulic cylinder-piston motor, which comprises a cylinder that is mounted in a bracket of the bed of the gripping head. This swaging machine is relatively light and serves to swage rifle barrels. The machine comprises only one gripping head, which has no gripping jaws, and the workpiece is supported in said machine by a holder-up, which is disposed at that end of the swaging box which is remote from the gripping box. Hydraulic pressure is applied to the holder-up. In view of its function, the swaging mandrel is short and thin. Because it is moved relative to the workpiece opposite to the feeding direction during the swaging operation and at the end of the swaging operation extends only in the trailing end portion of the workpiece, the mandrel can be withdrawn from the workpiece without difficulty. For heavy swaging machines intended to swage large workpieces that design would not be suitable, particularly if the workpiece would have to be swaged onto the mandrel throughout the length of the workpiece because the swaged workpiece could not be removed from the mandrel. Besides, the machine cannot be used selectively with swaging mandrels differing in length and/or diameter.

It is an object of the invention to provide an attachment for swaging machines of the kind defined first hereinbefore, which attachment enables a swaging of tubular workpieces and the use of different mandrels and avoids difficulties in the removal of the swaged workpiece from the mandrel.

The invention accomplishes the above-mentioned object in that the attachment comprises a bridge, which is adapted to be secured to one of the gripping head beds adjacent to that end of the gripping head which is remote from the swaging box, two cylinder-piston motors, which are flanged to said bridge and extend parallel to the gripping head spindle and away from the gripping head, and a yoke, which connects the displaceable members of these cylinder-piston motors and comprises a center rod, which is directed toward the bridge and coaxial with the gripping head spindle and at its free end is provided with a releasable connector adapted to be selectively connected to an actuating rod of any of several swaging mandrels which differ in length and/or diameter, said actuating rod extending in known manner through the gripping head spindle, which serves in known manner to indirectly or directly support the workpiece in the axial direction of the latter. Hence, the attachment constitutes a unit which is independent of the remainder of the swaging machine and can be applied to or removed from the machine as may be required. Because the mandrel is connected to the displaceable members of the cylinder-piston motors by the center rod and the yoke and can be displaced by means of the cylinder-piston motors, and the respective gripping head is also separately displaceable, the gripping head and mandrel have the required freedom of relative movement. Different mandrels may be used and the releasable connector between the mandrel rod and the center rod permits of a disconnection of the mandrel from the center rod and a movement of the mandrel alone by means of the gripping head; said disconnection is possible even during the operation of the machine. To remove the workpiece from the mandrel, it is sufficient to move the gripping head toward the bridge so that the spindle of the gripping head bears directly on the bridge. When the mandrel is now retracted from the swaging box by means of the cylinder-piston units, force will be transmitted from the workpiece, which bears on the gripping head spindle, to the bridge by means of the spindle so that the cylinder-piston motors can apply their full force without need for a special fixation of the gripping head and without a stressing of other parts of the structure. When the mandrel is short and has an outside diameter that is larger than the inside diameter of the gripping head spindle, the workpiece is gripped and the mandrel is then advanced until it is adjacent to that end of the workpiece which is remote from the gripping head, whereafter the gripping head and mandrel are advanced to move the workpiece and mandrel between the hammers. Thereafter, the advance is continued only by the gripping head whereas the mandrel is held in position. The swaged workpiece is then received by the second gripping head at the other end of the swaging box and the workpiece may be clamped between the two gripping heads if this is desired. When the mandrel is long and has an outside diameter which is smaller than the inside diameter of the gripping head spindle, the workpiece is fitted directly on the advanced mandrel, which is then disconnected from the center rod and together with the workpiece is moved between the hammers only by means with the gripping head, which together with the mandrel is then retracted as far as to the bridge, whereafter the actuating rod is reconnected to the center rod and the retraction of the mandrel is continued to remove the workpiece from the mandrel.

In a development of the invention, a backing sleeve is provided, which is adapted to be slidably fitted on a long swaging mandrel, which has an outside diameter that is smaller than the inside diameter of the gripping head spindle, and said backing sleeve is formed in its periphery with apertures through which the gripping jaws can extend to enter an annular groove or the like formed in the mandrel, said groove or the like being adapted to receive said gripping jaws when the mandrel is advanced as far as possible. Hence, the backing sleeve is disposed between the workpiece, which has been fitted on the mandrel, and the gripping head spindle, so that the workpiece can be swaged throughout its length because that end portion of the workpiece which is disposed near the gripping head is not gripped by the gripping jaws. In this condition, the backing sleeve serves to transmit an axially directed force from the gripping head spindle to the workpiece and in the opposite direction. The swaging mandrel can be disconnected from the center rod because the gripping jaws extend through the backing sleeve into the annular groove in the swaging mandrel and hold the latter in position.

The subject matter of the invention is illustrated by way of example in the accompanying drawings, in which

FIGS. 1 and 2 are diagrammatic views showing in a side elevation and a top plan view, respectively, a portion of a swaging machine provided with the attachment.

FIGS. 3 to 6 illustrate the operation of the machine provided with a short mandrel in four different operating positions.

FIGS. 7 to 10 are diagrammatic views showing the machine provided with a long mandrel in four swaging positions.

Hammers 2 which strike radially against the workpiece are accommodated in a swaging box 1 (FIGS. 6 to 10). Two beds 3 are disposed at opposite ends of the swaging box 1 outside thereof. A gripping head 4 is horizontally movable on each bed 3. Only one gripping head bed and one gripping head are shown in each Figure of the drawing. Each gripping head comprises a tubular spindle 5, which is rotatably mounted and extends in the feeding direction. Gripping jaws 6 are hinged to that end of the spindle which is adjacent to the swaging box 1.

The attachment comprises a bridge 7, which is adapted to be secured to the gripping head bed 3 at that end of the gripping head which is remote from the swaging box, and two hydraulic cylinder-piston motors 8, which extend parallel to and away from the gripping head spindle 5. Displaceable piston rods 9 of the motors 8 are connected by a yoke 10. The yoke 10 carries a center rod 11, which is coaxial with the gripping head spindle 5 and at its free end is provided with a releasable connector 12. By means of the connector 12, the center rod 11 may be connected to an actuating rod 13 of a short swaging mandrel 14 or an actuating rod 13*a* of a long swaging mandrel 14*a*. The actuating rod 13 extends through the gripping head spindle 5. The outside diameter of the short mandrel 14 is larger and that of the long mandrel 14*a* is smaller than the inside diameter of the gripping head spindle 5.

FIG. 5 shows the position of the machine before the introduction of a workpiece 15 for work with the short mandrel 14. The gripping head 4 is retracted and the gripping jaws 6 are open. The gripping head 4 and the mandrel 14 are then advanced so that the mandrel enters the workpiece and the latter moves to a position between the gripping jaws. The latter are now closed so that the workpiece 15 is held in position and is supported by the gripping head spindle 5 (FIG. 4). The cylinder-piston motors 8 are subsequently operated to advance the mandrel 14 to a position adjacent to that end of the workpiece which is remote from the gripping head (FIG. 5). The gripping head and mandrel are then advanced until the mandrel 14 is disposed between the hammers. Now the gripping head alone advances the workpiece between the hammers over the mandrel and the swaging operation is performed (FIG. 6). The swaged workpiece is received on the other side of the swaging box by the second gripping head (not shown). The gripping jaws are then opened and the gripping head and the mandrel retracted to their initial position.

In the arrangement shown in FIG. 7 before the charging of a workpiece 15*a*, the long mandrel 14*a* is entirely retracted and the spindle 5 of the gripping head 4 engages the bridge 7. A backing sleeve 16 is fitted on the mandrel 14*a* and provided in its periphery with apertures 17, through which the gripping jaws 6 can extend. The cylinder-piston motors are now operated to advance the mandrel 14*a* as far as possible so that the workpiece 15*a* is threaded onto the mandrel. The gripping jaws 6 extend through the apertures in the backing sleeve 16 into an annular groove 18 formed between the mandrel proper and its actuating rod and thus hold the mandrel in position so that the connector 12 can be released. When the mandrel has thus been disconnected from the center rod of the attachment, the gripping head now moves together with the mandrel and the workpiece 15*a* fitted thereon between the hammers and swaging is performed at the same time (FIG. 9). In this operation, the gripping head on the other side of the swaging box may be used as a holder-up to clamp the workpiece in an axial direction. When the swaging operation has been completed (FIG. 10), the gripping head 4 and the mandrel 14*a* are retracted until the gripping head spindle 5 has reengaged the bridge 7. The actuating rod 13*a* is then connected to the center rod 11 and the cylinder-piston motors 8 are operated to retract the mandrel 14*a*. During that operation, the workpiece 15*a* bears by means of the backing sleeve 16 and the gripping head spindle 5 on the bridge 7, which backs also the cylinder-piston motors 8 so that force is transmitted directly and the entire force of the cylinder-piston motors can be utilized to pull the swaged workpiece 15*a* from the mandrel. It will be understood that the gripping jaws 6 must be opened to such an extent that they no longer extend into the annular groove 18 before the mandrel can be retracted.

What is claimed is:

1. A swaging machine which comprises
a swaging box having receiving and discharge ends,
swaging tool means disposed in said swaging box,
first and second gripping head beds respectively disposed at said receiving and discharge ends of said swaging box outside thereof, and
first and second gripping heads respectively mounted on said first and second gripping head beds,
each of said gripping heads being provided with a horizontal, rotatable, tubular spindle having an inner end which is nearer to the other gripping head, and with gripping jaws hinged to said spindle at said inner end thereof,
said spindles being axially aligned and each of said gripping heads being movable on the respective bed in the axial direction of its spindle,
said machine also comprising an attachment for use in processing tubular workpieces, which attachment comprises
a bridge secured to said first bed adjacent to that end of said first gripping head which is remote from said second gripping head,
two cylinder-piston motors, which are flanged to said bridge and extend parallel to said spindles and away from said first gripping head, each of said motors having a displaceable member,
a yoke which connects said displaceable members and comprises a center rod, which is coaxial with said spindle of said first gripping head and has a free end adjacent to said bridge,
a swaging mandrel having an actuating rod which extends through said spindle of said first gripping head, and
a connector carried by said free end of said center rod and releasably connected to said actuating rod, whereby said motors are operable to extend and retract said mandrel relative to said spindle of said first gripping head.

2. A swaging machine as set forth in claim 1, in which said connector is adapted to be connected to any one of several swaging mandrels differing in diameter.

3. A swaging machine as set forth in claim 1, in which said connector is adapted to be connected to any one of several swaging mandrels differing in length.

4. A swaging machine as set forth in claim 1, in which said connector is adapted to be connected to any one of several swaging mandrels differing in length and diameter.

5. A swaging machine as set forth in claim 1, in which said spindle of said first gripping head is adapted directly to support said workpiece in its axial direction.

6. A swaging machine as set forth in claim 1, in which said spindle of said first gripping head is provided with means adapted to support the workpiece in its axial direction.

7. A swaging machine as set forth in claim 1, in which
said mandrel has an outside diameter which is smaller than the inside diameter of said spindle of said first gripping head,
a backing sleeve is slidably fitted on said mandrel and engages said inner end of said spindle of said first gripping head and in its periphery is formed with apertures,
said mandrel is formed with an annular groove arranged to be in register with said apertures when said mandrel has been extended out of said spindle of said first gripping head as far as possible, and
said gripping jaws are adapted to extend through said apertures into said recess when the latter is in register with said apertures.

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