MACHINE FOR PRESSING RINGS HAVING PROFILED INNER SURFACES

Fig. 1

Fig. 2

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3 SHEETS—SHEET 1.
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3 SHEETS—SHEET 3.

Fig. 5

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[Signature]

[Date]
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UNITED STATES PATENT OFFICE.

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1,350,568.


To all whom it may concern:

Be it known that I, PATRICK SAMUEL RYDBECK, of Gotteborg, in the Kingdom of Sweden, have invented and useful improved Machines for Pressing Rings Having Profiled Inner Surfaces, of which the following is a specification.

This invention relates to a machine for manufacturing rings having a profiled inner surface, particularly outer track rings for ball bearings, by upsetting tubular blanks in the longitudinal direction while the blanks are held in place around a mandrel.

The primary object of the invention is to provide a suitable construction of said mandrel in order to facilitate the insertion of the tubular blanks in the machine as well as the removing of the blanks from the machine after the completion of the upsetting operation.

Another object of the invention is to effect in a simple manner and in a continued operation an upsetting of the tubular blanks from both ends thereof so as to secure a uniform compression of the material in the whole length of the blanks.

The invention consists, chiefly, in this that the mandrel, around which the blank is held during the upsetting operation, is composed of pairs of gripping jaws the jaws of each pair being movable toward and from each other and the two pairs being movable in longitudinal direction with respect to each other, one of said pairs serving to lock the other pair when both pairs are at the same level but releasing it when the pairs are displaced longitudinally with relation to each other.

The invention will be better understood from a description with reference to the accompanying drawings in which, Figure 1 shows a vertical section through the upper portion of the machine while Figure 2 shows a vertical section through the lower portion of the same machine in its position of rest. Figure 3 shows a vertical section of the machine in position of operation. Figure 4 is a detail section showing the mandrel after the completion of an upsetting operation. Figure 5 shows a cross section of the mandrel and the parts of the machine surrounding same.

The preferred embodiment of the machine illustrated in the drawings is adapted for manufacturing outer track rings for ball bearings having a spherical track, by longitudinal upsetting of tubular blanks cut to the desired length. The machine includes two main parts, viz., a lower stationary part (Figure 2), and an upper, vertically reciprocating part (Figure 1). The lower part includes a central mandrel, consisting of two pairs of gripping jaws 1 and 2, a counter die 3 surrounding said jaws and serving to support the work, a die 4 surrounding the counter die and in which the counter die together with the mandrel is movably mounted, and a die holder 5 adapted to be mounted on the stationary upsetting table.

The central mandrel 1, 2 consists, as stated, of two pairs of jaws. One of said pairs 1, is situated between the other pair (as shown in Figure 5) and the two jaws of the said first-mentioned pair are movable toward and from each other. The said jaws are mounted on horizontal stud-pins 6 carried by the fork-shaped upper portion of a rod 7 the lower end of which is attached to a screw plug 8 screwed into a sleeve 9 depending from the die-holder 5. The sleeve 9 is formed at its upper end with a flange 10, resting on a ring 11 which is carried by means of a number of springs 12 (one of which only is shown in the drawing) in turn supported by a cup-shaped carrier 13 secured to the die-holder 5 by means of screws. A certain relative movement of the die-holder 5 and the sleeve 9 with the jaws 1 is thus secured.

The jaws 2 are also mounted on horizontal pins 14. Said pins, however, are directed at right angles to the pins 6. The pins 14 are carried by a sleeve 15 surrounding the rod 7 and movable longitudinally with respect thereto, said sleeve 15 being supported by means of a spring 16 inserted in the...
sleeve 9 between the plug 8 and the sleeve 15. Also inserted in the sleeve 9 is a sleeve 17 surrounding the spring 16 and serving to limit the compression of the spring 16. The sleeve 17 is connected by means of rods 31, extending through holes in the plug 8, to a slide-plate 22 mounted in the sleeve 9 and having an outwardly projecting extension 33. The spring 16 normally maintains the sleeve 15 in a position in which the jaws 2 are at a higher level than that of the jaws 1, as shown in Fig. 2. The jaws 2 are formed on their sides facing each other with notches 18 whereby the jaws 2 are able in this position to be turned inwardly through a small angle toward each other around the pins 14. The jaws 1 and 2 are formed at their upper ends with inner bevels forming parts of a conical surface for the purpose of being set forth in the following. The counter die 3 rests on a shoulder 19 of the sleeve 15.

The die 4 is not rigidly secured to the die-holder 5, but rests on a number of supports 20 (only one of which is shown in the drawing) mounted on the said ring 11 and extending through openings in the bottom of the die-holder 5 and further extending a short distance above the bottom 21 of the recess 30 in the die-holder 5 which receives the die. Formed at the upper end of the die is a shoulder 22 which normally engages with a thrust-plate 23 attached to the upper surface of the die-holder by means of screws.

The upper vertically reciprocating part (Figs. 1 and 3) of the machine includes a sleeve-shaped carrier 24, an upsetting ring 25 attached therein, and a plunger 26 slidably mounted in the upsetting ring as well as in the sleeve 24, said plunger having a conical extension 27. The plunger 26 is operated by a spring 28 inserted in the sleeve 24 and surrounding the shank 29 of the plunger. The said shank 29 extends through the sleeve 24 and is formed with a head 30. The said conical extension 27 fits the conical inner surfaces of the jaws 1 and 2.

The operation of the machine is as follows: When the machine is at rest, the parts thereof are in the position shown in Figs. 1 and 2. In this position the upper part of the machine is in its raised position, and in the lower machine part the spring 16 maintains the two jaws 2 in a raised position with respect to the jaws 1. In this position not only the jaws 1 but also the jaws 2 may be swung inwardly toward each other. A tube piece cut to proper length to form an outer track ring of a ball-bearing is placed around the jaws 2 so that it comes to rest on the counter die 3. The placing of the tube piece is effected without any difficulty as the jaws 2 may swing inwardly sufficiently to permit the said placing of the blank.

After the ring blank has been placed around the jaws 2 the upper portion of the machine is lowered. In this movement the conical extension 27 of the plunger 26 engages between the jaws 2 and moves them apart. When the plunger 26 in its descent comes in contact with the upper surface of the jaws 2 the latter and also the sleeve 15 are caused to move with the plunger 26 thereby compressing the spring 16. At the same time, the upsetting ring 25 engages the upper edge of the ring blank and moves the same downwardly thereby causing the ring blank to enter the die 4 the counter die 3 being pressed downwardly according as the sleeve 15 moves and provides room for the ring blank. When the sleeve 15 in its descent engages the stop ring 17, the downward movement of the sleeve and thus also that of the jaws 2 ceases, the total tension of the springs 12 supporting the sleeve 9 and the sleeve 17 being greater than that of the spring 28 which will thus be compressed while the carrier 24 with the upsetting ring 25 continues its downward movement. At the same time that the sleeve 15 strikes the stop sleeve 17 the counter die 3 abuts against the bottom surface 21 in the die-holder 5. The jaws 1 and 2 are at the same time moved into the same vertical position in which the jaws 1 by standing between the jaws 2 lock the latter in their outermost position, while the jaws 1 are locked by the conical extension 27 entered between them, as will appear from Fig. 5.

During the said continued movement of the upsetting ring the upsetting operation proper commences, the upsetting ring 25 moving relatively to the jaws 1, 2, the counter die 3 and the die 4 while all of said last-mentioned parts are prevented from moving. During this upsetting operation, particularly the upper portion of the ring blank is compressed the contraction at the middle portion of the ring blank preventing substantially any displacement of the material of the lower part of the blank. Said upsetting action will continue until the lower surface of the carrier 24 comes into contact with the upper surface of the die 4. When this takes place the die will partake of the downward movement. In this movement the die moves the supports 20 with the ring 11 while compressing the springs 12. The sleeve 9 is thus moved downwardly, and by means of the compressed spring 28 the plunger 26 with the jaws 1 and 2 is caused to move with the sleeve 9. It will thus be seen, that the upsetting ring 25, the die 4 and the mandrel 1, 2 are now moving downward with the same speed, while the counter die 3 is held stationary, as it rests, as stated above, on the bottom 21 of the recess in the stationary die-holder 5. The effect will thus be the same as if
the counter die were moved upwardly and the other parts were stationary, that is there is effected an upsetting of the lower portion of the blank. When the die reaches the bottom 21 in the die holder the movement will cease and the ring is now completely upset, the upsetting action having been effected to the same extent from both ends of the ring whereby a uniform displacement of material has been secured.

The upper part of the machine then commences to move upwardly, the parts of the lower machine portion being at the same time restored to the position shown in Figs. 1 and 2. In this movement the spring 16 becomes free to move the sleeve 15 with the jaws 2 and the counter die 3 upwardly. The newly pressed ring is then removed from the die 4 and may be stripped off from the jaws 2 without difficulty as the latter may swing inwardly sufficiently to release the ring.

If the ring were to be held firmly in the die so that the spring 16 cannot move the sleeve 15 with the jaws 2 and the counter die upwardly, the sleeve 15 may be displaced by striking upwardly upon the extension 33 so as to remove the ring from the die.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. A machine for producing rings having a profiled inner surface, as for instance outer track rings of ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a mandrel, having outside the shape of the desired inner surface of the rings, said mandrel consisting of pairs of jaws movable with respect to each other to permit the placing of a tubular blank around the mandrel, means for supporting the blank during the upsetting operation, means for upsetting the blank placed on said supporting means and means for moving the said jaws to operative position.

2. A machine for producing rings having a profiled inner surface, as for instance outer track rings of ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a mandrel, consisting of a pair of oppositely positioned jaws movable to and from each other, and another pair of oppositely positioned jaws movable longitudinally with respect to the said first-mentioned pair of jaws and further movable to and from each other in a direction at right angles to the direction of movement of the said first-mentioned jaws, when displaced longitudinally with respect to said first-mentioned pair of jaws, while being locked by said first-mentioned jaws when the two pairs are at the same level, a die for receiving the blank to be upset, means for moving the said jaws to operative position to form a mandrel, and means for upsetting the blank placed around said mandrel and engaging in said die.

3. A machine for producing rings having a profiled inner surface, as for instance outer track rings of ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a die adapted to receive the blank in the upsetting operation, two pairs of jaws placed within said die, one of said pairs of jaws being movable longitudinally with respect to the other jaws and to the said die, so as to extend beyond the upper surface of the die when displaced longitudinally, means for moving the said jaws to operative position to form a mandrel, and means for upsetting the blank placed around said mandrel and engaging in said die.

4. A machine for producing rings having a profiled inner surface, as for instance outer track rings of ball bearings, by upsetting a tubular blank in the longitudinal direction, comprising a die, a pair of jaws slidably mounted in said die, and movable to and from each other when displaced so as to extend beyond the said die, a spring for maintaining the said pair of jaws so movable, another pair of jaws placed between the jaws of said first-mentioned pair and movable to and from each other independently of said first-mentioned pair of jaws, means for displacing the said longitudinally movable jaws against the action of said spring, means for locking the jaws in operative position to form a mandrel, and means for upsetting the blank placed around said mandrel and engaging in said die.

5. A machine for producing rings having a profiled inner surface, as for instance outer track-rings of ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a die, a pair of jaws slidably mounted in said die and movable to and from each other when displaced so as to extend beyond the said die, a spring for maintaining the said pair of jaws so displaced, another pair of jaws placed between the jaws of said first-mentioned pair and movable to and from each other independently of said first-mentioned pair of jaws, a plunger movable longitudinally to and from the jaws and adapted to move the slidable jaws against the action of the said spring to the position at the same level as the other jaws, a conical extension on said plunger adapted to engage between the jaws and move same outwardly to operative position and to lock the jaws in said operative position to form a mandrel, and means for upsetting the blank placed around said mandrel and engaging in the said die.

6. A machine for producing rings having a profiled inner surface, as for instance outer track-rings of ball bearings, by up-
4. A machine for producing rings having a profiled inner surface, as for instance outer track-rings for ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a die, a pair of jaws slidably mounted in said die and movable to and from each other when displaced so as to extend beyond the said die, a spring for maintaining the said pair of jaws so displaced, another pair of jaws placed between the jaws of said first-mentioned pair and movable to and from each other independently of said first-mentioned pair of jaws, a plunger movable longitudinally to and from the jaws and adapted to move the said plunger against the action of the spring to the position at the same level as the other jaws, a conical extension on said plunger adapted to engage between the jaws and move same outwardly to operative position and to lock the jaws in said operative position to form a mandrel, an upsetting ring yieldingly connected with said plunger and adapted to act upon the blank in upsetting same in the longitudinal direction.

7. A machine for producing rings having a profiled inner surface, as for instance outer track rings for ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a die, a pair of jaws slidably mounted in said die at a certain distance from the inner surface of said die, a counter die for supporting the blank in the upsetting operation placed in the space formed between the said die and the said jaws to move longitudinally with said jaws, a stationary stop adapted to support the said counter die in the lowest position of the said jaws, another pair of jaws placed within said first-mentioned jaws, means for moving the jaws to operative position to form a mandrel, means for locking the jaws in said operative position, and means for upsetting the blank placed around said mandrel and engaging with said die as well as with said counter die.

8. A machine for producing rings having a profiled inner surface, as for instance outer track rings of ball bearings, by upsetting tubular blanks in the longitudinal direction, comprising a mandrel, consisting of a pair of oppositely proportioned jaws movable to and from each other, and another pair of oppositely positioned jaws movable longitudinally with respect to the said first-mentioned pair of jaws and further movable to and from each other in a direction at right angles to the direction of movement of the said first-mentioned jaws, when displaced longitudinally with respect to said first-mentioned pair of jaws, while being locked by said first-mentioned jaws, when the two pairs are at the same level, a die for receiving the blank to be upset, a yielding support for said jaws and said die, means for moving the jaws to operative position to form a mandrel and means for upsetting the blank.
and movable to and from each other independ-ently of said first-mentioned pair of jaws, means for displacing the said longitudinally movable jaws against the action of said spring, means for locking the jaws in operative position to form a mandrel, means for upsetting the blank in the longitudi-nal direction and means for positively mov-ing the slidable jaws to their position beyond the die.

In testimony whereof I have signed my name.

PATRIK SAMUEL RYDBECK.