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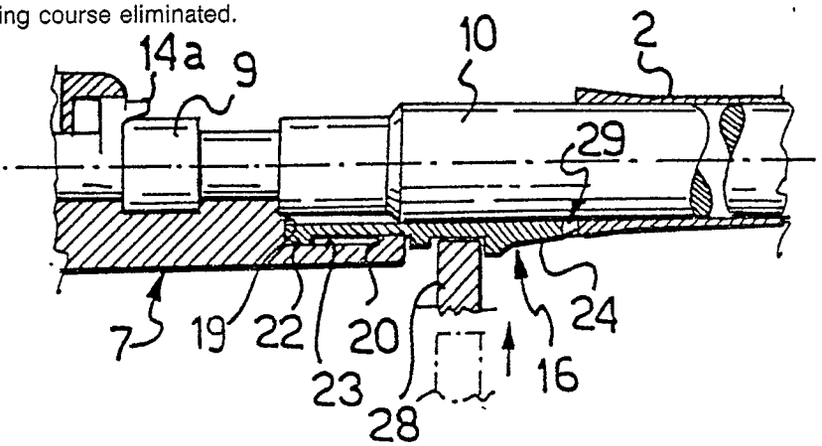
(54) A pilgrim-process rolling mill for hot rolling pipes.

(57) In a pilgrim-process rolling mill, the mandrel-breaker bush (16) is mounted to the spindle (7) on which it is guided for movement between two stop ledges (19,20) in axial alignment relationship with the mandrel (10) accommodating seat (16). Thus, the rolling mill reliability can be improved and replacement of the bush at each rolling course eliminated.

FIG.6



EP 0 348 596 A2

This invention relates to a pilgrim-process rolling mill for hot rolling pipes of a type which comprises a spindle formed with a seat which extends along the rolling axis and is adapted to accommodate a mandrel.

As is known, on completion of a pipe hot rolling operation on a pilgrim-process rolling mill, the rolled pipe fits snugly around the mandrel due to the deformations it underwent.

To enable the mandrel to be slipped off the pipe, a so-called mandrel-breaker bush is generally used which fits slidably over the mandrel and abuts against one end of the rolled pipe. With the bush tightened down and by applying a sharp pull to the mandrel in the axial direction, the mandrel can be released from the pipe.

After it has been freed from the pipe, the mandrel is removed from the spindle and sent to a cooling station, and a new mandrel is set up.

The mandrel change involves of necessity the handling of the mandrel-breaker bushes, which is currently performed by means of specially provided devices. This, additionally to making the rolling mill still more complex, contributes toward longer downtime in a rolling course.

The technical problem that underlies this invention is to provide a pilgrim-process rolling mill which has such constructional and performance characteristics as to overcome the cited shortcomings of the prior art.

This problem is solved according to the invention by a pilgrim-process rolling mill being characterized in that it comprises a mandrel-breaker bush of substantially cradle-like shape mounted to the spindle in alignment relationship with said seat and being open thereinto, said bush being movable in a guided fashion along the rolling axis between two ledges formed on the spindle.

Advantageously in accordance with a further aspect of the invention, the rolling mill comprises a locking means mounted on the spindle for locking the bush angularly.

The features and advantages of a rolling mill according to the invention will be more clearly understood from the following detailed description of a preferred embodiment thereof, to be taken by way of illustration and not of limitation in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a fragmentary view showing schematically in side elevation and in section a pilgrim-process rolling mill according to the invention;

Figure 2 is a sectional detail view of the rolling mill shown in Figure 1 taken along the line II-II;

Figure 3 is a perspective view showing in longitudinal section a detail of the rolling mill of Figure 1;

Figures 4 and 5 are cross-sectional views, corresponding to Figure 2, which show the rolling mill of this invention at different stages of a mandrel-breaker bush assembling to the spindle; and

Figures 6 to 10 are sectional views showing schematically the rolling mill of Figure 1 at successive stages of its operation.

With reference to the drawing views, the numeral 1 comprehensively designates a pilgrim-process rolling mill for hot rolling seamless pipes 2.

The rolling mill 1 comprises a hydropneumatic box 3, known per se, which has a piston 4 movable in the direction of the rolling axis along guides 5 and rotatable about its own axis by a drive means, not shown, associated with the hydropneumatic box 3.

The piston 4 has a piston rod 6 to which a spindle 7 is fitted to rotate as a unit therewith.

The spindle 7 is formed with a cradle-shaped seat 8 which extends along the rolling axis and is accessible from the spindle outside axially through an axial opening provided at a forward end 7a of the spindle 7, as well radially through a longitudinal opening bordered laterally by two longitudinal edges 7b and 7c.

The seat 8 receives a tang 9 of a mandrel 10 over which fits the pipe 2 being rolled.

The rolling mill 1 comprises, in order to hold the mandrel 10 axially into the seat 8, retainer means 11 consisting of a groove 12 formed circumferentially around the tang 9 and having a cylindrical cross-section shape, for engagement by a raised portion 13 concentrical with the rolling axis and formed in the shape of a half-ring integrally with the cradle seat 8 and having the same length os the groove 12 in the axial direction.

Collectively indicated at 14 are sprung means mounted on the spindle 7 and adapted to lock the tang 9 radially within the cradle seat 8. In particular, the sprung means 14 include an eave 14a adapted to overlap the tang 9 and hold it radially within the seat 8.

Mounted on the hydropneumatic box 3 are pusher means 15 arranged to act on the sprung means 14 to move the eave 14a from a position where it interferes with the cradle seat 8 to a position where it does not interfere with it, thereby the tang 9 is released and can be removed from the spindle 7.

The rolling mill 1 comprises a so-called mandrel-breaker bush 16 mounted to the spindle 7 and effective to pull the mandrel 10 off the pipe 2 on completion of the rolling operation.

The bush 16 is configured substantially cradle-like concentrically with the rolling axis and accessible from the outside both axially, and radially

through a longitudinal opening bordered laterally by two parallel longitudinal edges 17 and 18 set at a distance apart, thereby the mandrel 10 can be inserted and withdrawn in the radial direction. Further, the bush 16 extends aligned to the cradle seat 8 in the spindle 7 and opens thereinto.

Advantageously, the bush 16 can be driven in a guided fashion along the rolling axis between two edges 19 and 20 formed on the spindle 7, as explained in detail hereinafter.

On the bush 16, there is defined a rearward section 21 having, formed integrally on a free end thereof a radially raised collar 22 which fits slidably into a substantially half-ring-shaped groove 23 whose angular extension exceeds 180°, being formed in the cradle seat 8 between the raised portion 13 and the forward end 7a of the spindle 7.

The groove 23 defines two walls, facing each other and lying perpendicularly to the rolling axis, which constitute said rearward 19 and forward 20 ledges for the collar 22. Furthermore, the axial length of the groove 23 represents, less the thickness of the collar 22, the stroke length of the bush 16 relatively to the spindle 7.

The bush 16 also comprises, outside the spindle 7, a forward section 24 which also extends over a predetermined distance in the direction of the rolling axis and tapers toward it.

Between the forward section 24 and the rearward section 21, there are formed circumferentially around the bush 16 two parallel substantially half-ring-shaped elevations 25 and 26, also having a wider angular extension than 180°, which define a groove 27 therebetween adapted to engage with a mandrel-breaker rest 28, known per se.

The rolling mill 1 further comprises face interfit means 29 formed on one end of the forward section 24 of the bush 16 and adapted to engage one end of a pipe 2 being rolled.

Advantageously according to the invention, the interfit means 29 comprise a plurality of teeth 30 arranged annularly around the rolling axis and extending along it; furthermore, each tooth 30 has a back 30a tapering toward its free end.

To lock the bush 16 angularly on the spindle 7, locking means, collectively indicated at 31 are used and comprise a detent 32 affixed to the spindle 7, preferably in interfit relationship, at the edge 7b, and an insert 33 mounted removably by means of screws 34 on the opposed edge 7c. Both the detent 32 and the insert 33 jut out of their respective edges 7b and 7c of the spindle 7 over the cradle seat 8.

The bush 16 is mounted to the spindle 7 in the manner described herein below with reference to Figures 4, 5 and 2. In particular, Figure 4 depicts a start condition with the insert 33 removed from the edge 7c.

The rearward section 21 of the bush 16 is inserted into the cradle seat 8 with a substantially pivotal movement (see Figure 5) by inserting the edge 17 of the bush 16 in between the edges 7b and 7c of the spindle 7, turning the bush 16, and sliding it into the seat 8 until the edge 17 abuts the detent 32.

The insert 33 is then mounted on the edge 7c so as to retain the edge 18 and lock the bush 6 angularly (see Figure 2), with the collar 22 fitted in the groove 23.

To mount the mandrel 10 to the spindle 7, the pusher means 15 is first operated to move the eave 14a of the sprung means 14 to the position of no interference with the cradle seat 8, and the tang 9 of the mandrel 10 is then introduced radially into the seat 8 and the bush 16, with the groove 12 of the tang located at the raised portion 13. Thus, the mandrel 10 is retained axially by the fit of the raised portion 13 in the groove 12.

At this stage, the sprung means 14 are released to allow the eave 14a to locate at the interfering position so as to overlie the end of the tang 9 and hold the mandrel 10 radially.

The hot rolling of the pipe 2 on the pilgrim-process rolling mill 1 is carried out in a conventional manner not described herein. It matters to remark, however, that during the initial rolling steps, referred to as the tacking, the bush 10 locates at a partway retracted position inside the spindle 7, with the collar 22 abutting the rearward ledge 19 of the groove 23 and the face teeth 30 of the bush 16 in engagement with the rearward end of the pipe 2 and locking the pipe angularly to the bush. Thus, initial slip or play is advantageously prevented as may occur while the pipe 2 is yet to fit closely over the mandrel 10 and, accordingly, not yet unitized therewith, whereas as the rolling process progresses, the pipe 2 would tighten around the mandrel 10 by deformation.

According to the invention, moreover, the mandrel 10 can be easile uncoupled angularly from the spindle 7, and the rotary motion required to roll the pipe 2 is imparted by the cited drive means of the hydropneumatic box 3 on the spindle 7, then on the bush 16 rigid rotatively with the spindle 7, and finally on the pipe 2 through the teeth 30.

To break the mandrel 10 axially off the pipe 2 at the end of the rolling process, and enable the mandrel to be withdrawn, the mandrel-breaker rest 28 is first positioned in the groove 27 of the bush 16 (see Figure 6). Then, a first pull is applied in the axial direction, using conventional means and causing the spindle 7 and mandrel 10 to move back by a distance equal to the stroke length of the bush 16 as locked by the rest 28 relatively to the spindle 7, until the collar 22 abuts against the forward ledge 20 (see Figure 7), thereby the mandrel 10 is dis-

engaged partway from the pipe 2.

Subsequently, the spindle 7 with the mandrel 10 is again advanced while still holding the bush 16 locked with the rest 28, by a distance equal to the bush stroke, to disengage the teeth 30 from the end of the pipe 2, which end is substantially bell-shaped on completion of the rolling process (see Figure 8).

At this stage, the rest 28 is released from the groove 27, the spindle 7 with the mandrel 10 is again moved backward, with the bush 16 also no longer retained by the rest 28, and said rest is positioned between the bush 16 and the pipe 2 (see Figure 9).

Lastly, the spindle 7 is moved farther back until the mandrel 10 is drawn fully out of the pipe 2 as held back by the mandrel-breaker rest 28 (see Figure 10).

On the pilgrim-process rolling mill according to this invention, the mandrel-breaker bush is mounted directly to the spindle and does not require, therefore, to be manipulated and replaced on the occasion of a change of a mandrel at the end of a rolling course. As a result, additionally to the advantage of eliminatin bush handling devices, with a rolling mill according to the invention, tool handling, and specifically mandrel changes, is made much easier, which reflects in improved reliability of the rolling mill.

In addition, it has proved particularly advantageous to provide a forward section of the bush with an elongate shape that tapers toward the rolling axis to enable rolling of a longer section of the pipe bell-shaped end and reduce scrap.

A further advantage afforded by a pilgrim-process rolling mill according to the invention is that by providing face interfit means between the mandrel-breaker bush and the pipe to be rolled, the rolling operations can be performed in an optimum manner even at the tacking stage, by eliminating any play or slip of the pipe.

Furthermore, due to the teeth engaging in the pipe being rolled, the pipe itself is made to cooperate mechanically with the bush, thereby the latter may have reduced size and weight to bring about lower costs.

Claims

1. A pilgrim-process rolling mill for hot rolling pipes of a type comprising a spindle (7) formed with a seat (8) which extends in the direction of the rolling axis and is adapted to accommodate a mandrel (10), characterized in that it comprises a mandrel-breaker bush (16) of substantially cradle-like shape mounted to the spindle (7) in alignment relationship with said seat (8) and being open thereinto, said bush (16) being movable in a guided fashion along the rolling axis between two ledges (19,20) formed on the spindle (7).

2. A rolling mill according to Claim 1, characterized in that it comprises locking means (31) mounted to the spindle (7) to lock the bush (16) angularly.

3. A rolling mill according to Claim 1, characterized in that said bush (16) comprises a rearward section (21) fitted slidably in said seat (8) on the spindle (7).

4. A rolling mill according to Claim 3, characterized in that said rearward section (21) of the bush (16) is provided with a raised collar (22) fitting into a groove (23) formed in said seat (8) and defining two facing walls which constitute said edges (19,20).

5. A rolling mill according to Claim 4, characterized in that said bush (16) includes outside the spindle (7) a forward section (24) extending along the rolling axis and tapering toward it.

6. A rolling mill according to Claim 5, characterized in that it includes a groove (27) formed circumferentially around the bush (16) outside the spindle (7) between said rearward section (21) and said forward section (24).

7. A rolling mill according to Claim 4, characterized in that it comprises face interfit means (29) formed on one end of the forward section (24) of the bush (16) and adapted to engage a pipe (2) being rolled.

8. A rolling mill according to Claim 7, characterized in that said interfit means (29) comprise a plurality of teeth (30) arranged into an annulus and extending along the rolling axis.

9. A rolling mill according to Claim 8, characterized in that said teeth (30) have tapering backs (30a).

10. A rolling mill according to Claim 2 characterized in that said locking means (31) comprise a detent (32) attached to the spindle (7) on one side of said seat (8) and an insert (33) removably mounted on the other side of said seat (8).

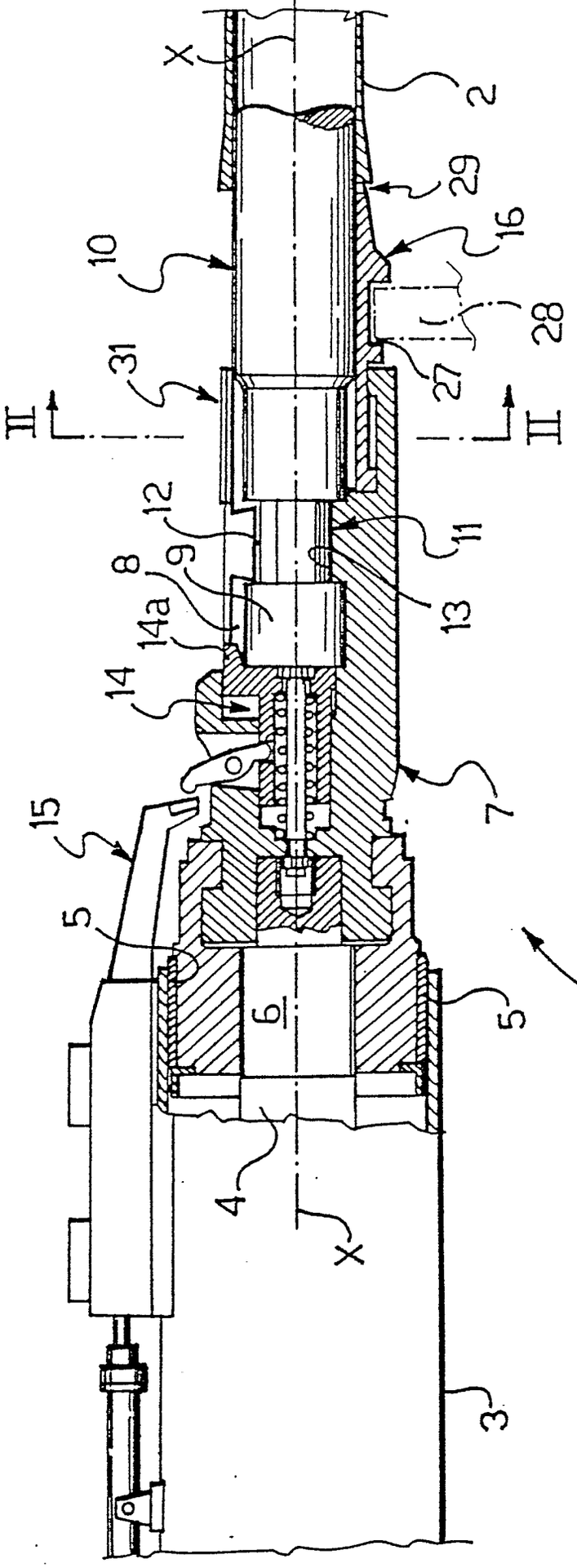


FIG.1

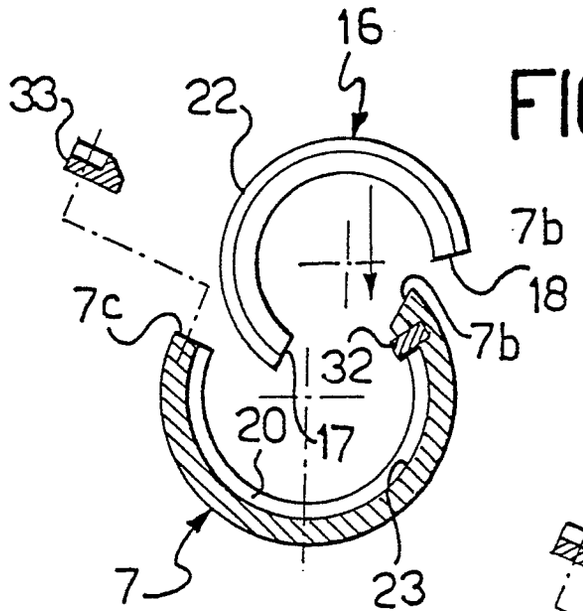


FIG.4

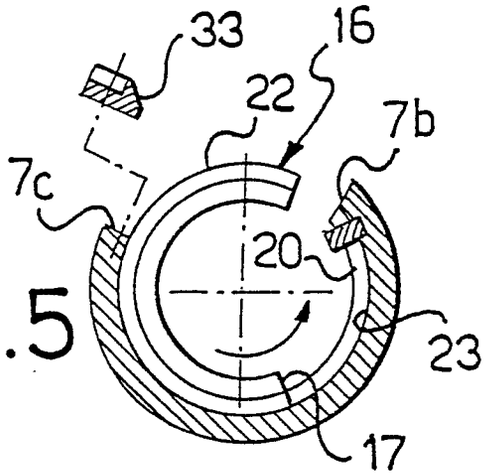


FIG.5

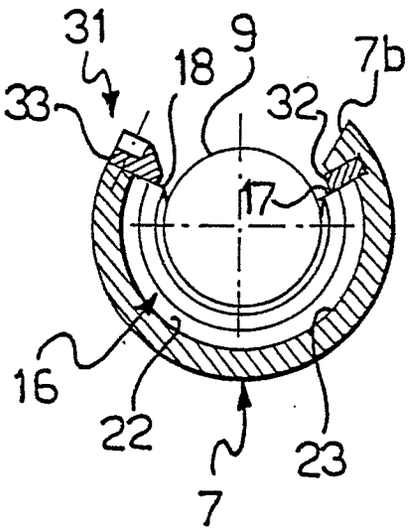
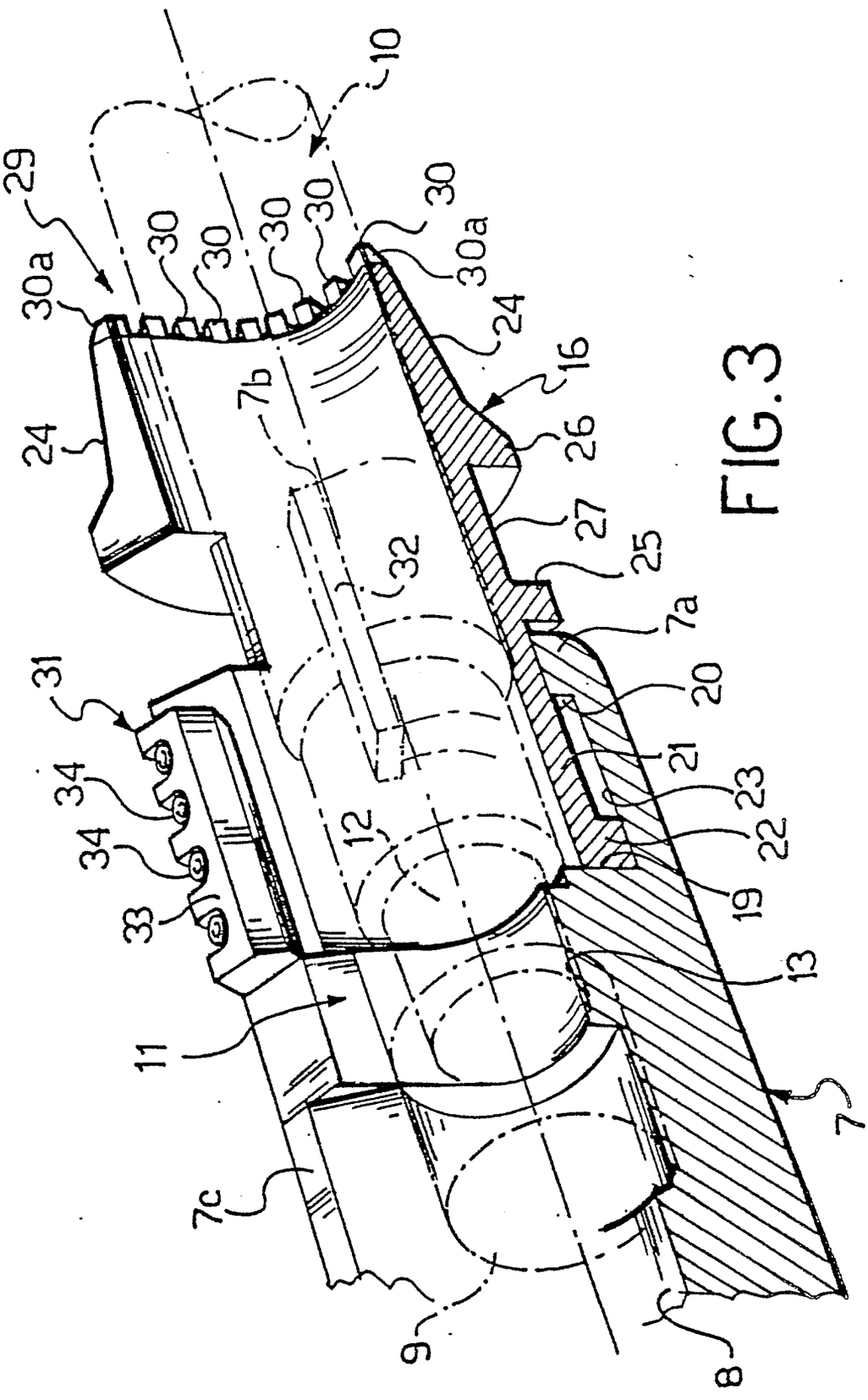


FIG.2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7b
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7c
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FIG.3

FIG.6

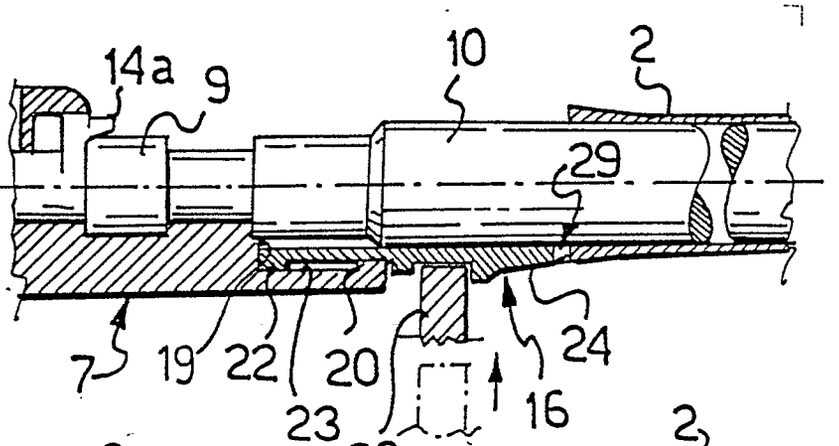

FIG.7

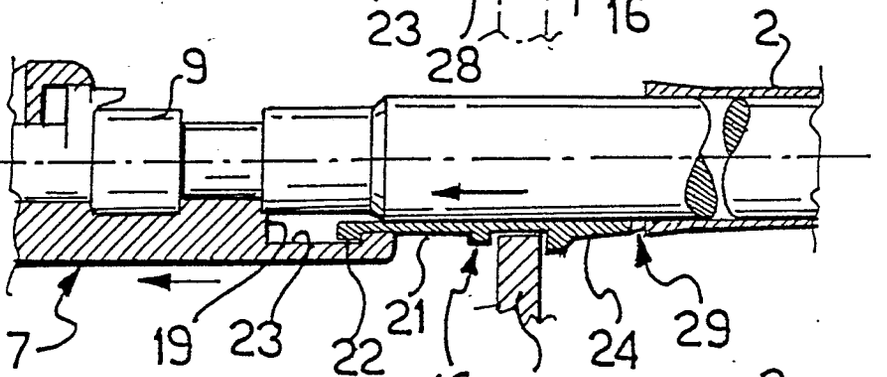

FIG.8

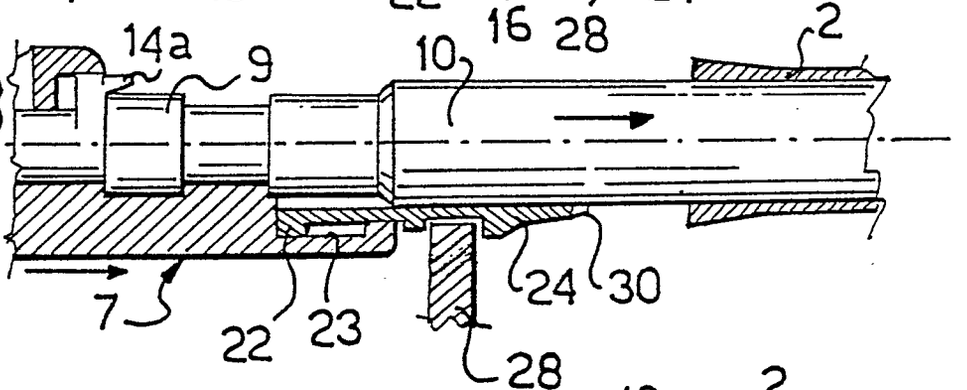

FIG.9

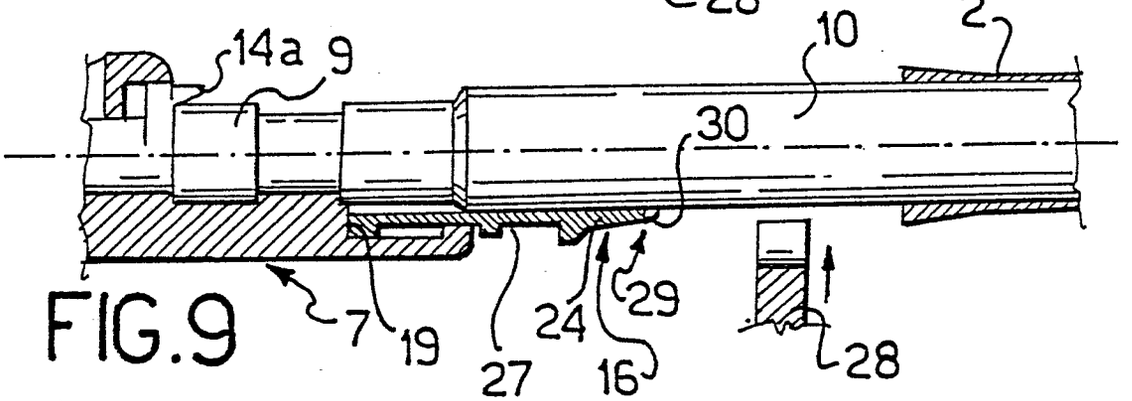

FIG.10