(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 348 588 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 89100772.6

(51) Int. Cl.4: **B21B 21/04**

(22) Date of filing: **18.01.89**

(30) Priority: **30.06.88 IT 2117988**

(43) Date of publication of application:
03.01.90 Bulletin 90/01

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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(54) A pilgrim-process rolling mill.

(57) In a pilgrim-process rolling mill the mounting of a spindle (7) to the piston (4) from the hydropneumatic box (3) is made faster and more reliable by a ramp-type bayonet joint (14) provided between the rod (6) of said piston (4) and the spindle (7).

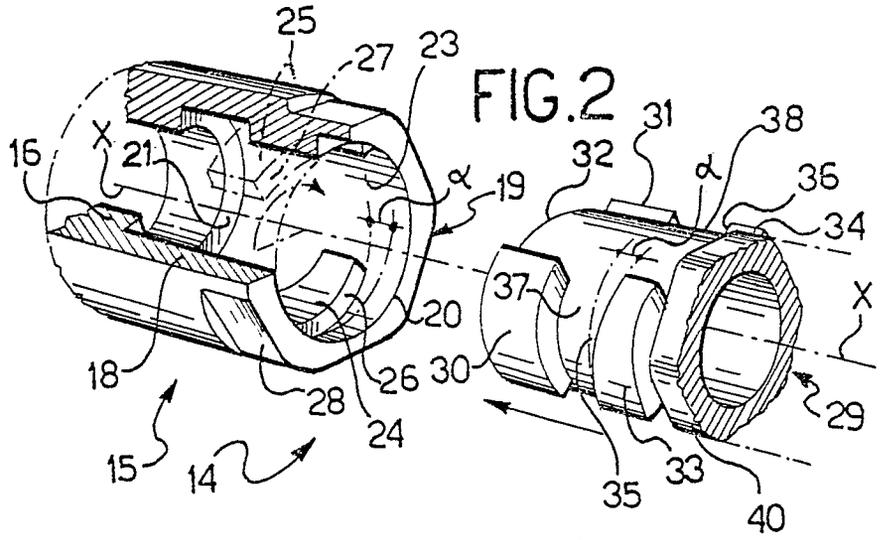

FIG.2

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This invention relates to a pilgrim-process rolling mill of a type comprising a spindle coaxially fitted to a piston rod of a piston from a hydropneumatic box

As is known, a pilgrim-process rolling mill basically comprises, in addition to two work rolls having peculiar eccentric profiles, a mandrel, a mandrel-breaker bush associated with the mandrel, a spindle fitted to a piston from a hydropneumatic box, and a drive means for rotating the mandrel.

Pilgrim-process rolling mills are usually employed for hot rolling seamless pipes; in particular, a current trend in the application of such mills favors the production of large size pipes in small but neatly differentiated batches, which leads to the need for frequent exchange of the mill tooling and particularly of the mandrels and spindles.

Of special concern is in this respect the way the spindle is coupled to the piston rod from the hydropneumatic box. On conventional design pilgrim-process rolling mills, this connection is generally accomplished by means of slanted keys; however, while being satisfactory for the purpose of providing a strong connection, such keys involved lengthy recourse to the crane and maul, and especially with large size mandrels, the mandrel mounting and removing operations are exceedingly laborious.

It is known to use, as an alternative to keys, threaded half-bushes which have, however, the drawback of providing a less than fully reliable connection and requiring continued attendance and reiterate intervention to take up the play which develops between the half-bushes during the rolling process.

Another connection conventionally employed between the spindle and the hydropneumatic box is the so-called oil pressure type, which consists basically of inducing a temporary expansion of the spindle in a radial direction by means of pressurized oil, thereby enabling the spindle to fit over the piston rod. Such an oil pressure connection is quite a reliable one, especially when compared to the threaded half-bush, but requires skilled labor, and the spindle mounting and removing times still are too long with it.

The problem underlying this invention is to provide a pilgrim-process rolling mill wherein the connection of the spindle to the piston rod from the hydropneumatic box is a secure and reliable one, and makes for quick replaceability of the spindle.

This problem is solved according to the invention by a rolling mill as specified above being characterized in that it includes a bayonet joint between said piston rod and the spindle.

The features and advantages of a pilgrim-process rolling mill will be apparent from the following detailed description of a preferred embodiment thereof, to be taken by way of example 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 an exploded perspective view, drawn to an enlarged scale, of a detail of Figure 1;

Figures 3A, 3B are enlarged scale sectional views showing schematically a detail of Figure 1 and taken along the line III-III at successive mounting stages; and

Figures 4A, 4B are schematical perspective views, respectively corresponding to Figures 3A and 3B, showing a detail of Figure 1.

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

The rolling mill 1 comprises a conventional hydropneumatic box 3 having a piston 4 movable along a horizontal rolling axis X-X on guides 5 and driven to rotate about its own axis by a drive means, not shown, associated with said hydropneumatic box 3.

The piston 4 has a piston rod 6 wherewith a spindle 7 is associated axially. A substantially cradle-like portion 8 of the spindle 7 accommodates a tang 9 of a mandrel 10 extending along the axis X-X, with the pipe 2 to be rolled partway fitted over it.

Collectively indicated at 11 are sprung means mounted to the spindle 7 and operative to lock the tang 9 radially in the cradle seat 8.

Mounted on the hydropneumatic box 3 is a pusher means 12 acting on the sprung means 11 to release the tang 9 and enable it to be removed from the cradle seat 8 in the spindle 7.

The reference numeral 13 designates a mandrel-breaker bush associated with the mandrel 10 and adapted to release the pipe 2 from the mandrel 10 on completion of the rolling process.

In accordance with this invention, the pilgrim-process rolling mill 1 is provided with a bayonet joint 14 between the spindle 7 and the rod 6

The bayonet joint 14 comprises a sleeve 15 which extends in the direction of the axis X-X and has a first section 16 of a smaller diameter next to the box 3, being fitted under oil pressure over a portion 17 of the rod 6 having a matching diameter dimension, and a second section 18 of larger diameter next to the spindle 7.

More specifically, in the second section 18, there is defined a substantially cup-shaped seat 19 having a circular inlet 20 facing toward the spindle 7, a bottom 21 remote from the inlet 20 and from which an end portion 22 of the rod 6 juts out into

the seat 19, and a circumferential inner wall 23.

On the circumferential inner wall 23, close to the inlet 20, there are formed integrally with the sleeve 15 two identical diametrically opposed dogs 24, 25 which extend along a circumference of the wall 23.

Advantageously, for each of the dogs 24, 25, a respective side wall 26, 27 facing the inlet 20 is set at predetermined angle alpha which would be selected in relation to the material used to manufacture the sleeve 8, the type of the lubricant employed, and the dimensions of the rolling mill. In the example shown, the angle alpha is approximately 5°.

Thus, the dogs 24, 25 will have, in plan view, a profile tapering in a common direction that, in the example shown, is counterclockwise as the inlet 20 sees the dogs 24, 25 .

Indicated at 28 is a polygonal contour formed peripherally on the exterior of the sleeve 15 close to the inlet 20 and adapted to be engaged by a spanner or the like tightening means.

The bayonet joint 14 further comprises a tang 29 formed integrally with the spindle 7 in line with the cradle seat 8.

The tang 29 has a substantially cylindrical shape and a suitable diameter to allow it to fit in between the dogs 24 and 25 on the sleeve 15. That tang 29 is provided on its exterior with a pair of first dogs 30, 31 located diametrically opposite each other in the proximity of an end 32 of the tang facing the sleeve 15 and extending a predetermined distance around the circumference of the tang, and a pair of second dogs 33, 34, also arranged diametrically opposite each other, which are aligned to the first dogs 30, 31 along generatrix lines of the cylindrical tang 29 and set apart therefrom. In addition, the spacing of the first dogs 30, 31, which spacing is equal to the spacing of the second dogs 33, 34, should be larger than the length of the dogs 24, 25 on the sleeve 15 in the circumferential direction.

Advantageously, a respective side wall 35, 36 of the second dogs 33, 34, which walls face the first dogs 30, 31, respectively, is set at the same angle alpha as the dogs 24 and 25.

Accordingly, between each first dog 30, 31 and its corresponding second dog 33, 34, there is defined a tapering seat 37, 38 adapted to receive in press fit relationship a dog, 24, 25, of the sleeve 15. The length of the tapering seats 37 and 38 along the circumferential direction is equal to the corresponding length of the dogs 24 and 25.

The first dogs 30, 31 and second dogs 33, 34 are advantageously formed integrally with the tang 29.

A cylindrical notch 39 is formed in the end 32 of the tang 29 to receive the end portion 22 of the rod 6 therein.

The reference numeral 40 designates a polygonal contour formed peripherally around the tang 29 of the spindle 7 and also intended, like the similar contour 28 on the sleeve 15, for engagement by a spanner or the like tool, not shown.

The mounting procedure according to the invention, will be now described for fitting the spindle 7 to the rod 6 of the piston 4 with the intermediary of the bayonet joint 14.

The spindle 7 is first aligned, using a conventional crane not shown, to the sleeve 15 so that it coincides with the horizontal rolling axis X-X, the tang 29 being so oriented as to prevent the first dogs 30, 31, and hence the second dogs 33, 34, from interfering with the dogs 24, 25 on the sleeve 15 on insertion of the tang 29 into the sleeve.

The tang 29 of the spindle 7 is then driven to bottom out in the cup-shaped seat 19 of the sleeve 15, and a preliminary rotary motion is next imparted on the spindle to engage the dogs 24 and 25 in the tapering seats 37 and 38 in the tang 29.

At this stage, the spindle 7 will be supported on the sleeve 15, in turn rigid with the hydropneumatic box 3, and can therefore be released from the crane.

Thereafter, the spindle 7 is released for rotation by applying a spanner to the polygonal contour 40 of the tang 29, and by operating the hydraulic motor conventionally provided in the hydropneumatic box 3 for adjusting the angular setting of the piston 4, the dogs 24, 25 are driven into their respective tapering seats 37 and 38 to thus complete the spindle 7 mounting to the piston rod 6.

To remove the spindle 7 from the sleeve 15, a spanner is applied to the polygonal contour 40 of the spindle 7, and after that the bayonet joint 14 is shaken loose by a maul blow on the spanner, possibly while holding the sleeve 15 with another spanner applied to the polygonal contour 28.

In the event that the hydropneumatic box includes no hydraulic motor, the spindle may be mounted by suitably acting with appropriate spanners on the polygonal contours 28 and 40.

With the pilgrim-process rolling mill of this invention, by virtue of the bayonet joint described hereinabove, the spindle mounting/removal to/from the piston rod from the hydropneumatic box is rapidly and easily carried out, thus making for comfortable replacement of the spindle each time that this becomes necessary to set up the mill anew for a different production.

The coupling of the spindle to the hydropneumatic box is, moreover, quite reliable. It has been beneficial in this respect to provide the slleve dogs with sloping walls and the respective seats with matching shapes in that, while this fur-

ther facilitates the spindle mounting and removing operations, it also enables any play developed from the dog wear to be taken up by driving the sleeve dogs deeper into the tapering seats to ensure that a press fit is maintained.

Understandably, the pilgrim-process rolling mill described hereinabove may be altered and modified in many ways without departing from the true scope of this invention as set forth in the appended claims.

Claims

1. A pilgrim-process rolling mill of a type comprising a spindle (7) coaxially fitted to a piston rod (6) of a piston (4) from a hydropneumatic box (3), characterized in that it includes a bayonet joint (14) between said piston rod (6) and the spindle (7).

2. A rolling mill according to Claim 1, characterized in that said bayonet joint (14) comprises at least one dog (24,25) formed on a sleeve (15) mounted to said piston rod (6) for releasable engagement with at least one seat (37,38) formed in the spindle (7) at a tang (29) adapted to fit inside the sleeve (15).

3. A rolling mill according to Claim 2, characterized in that a side wall (26,27) of said at least one dog (24,25) and a corresponding side wall (35,36) of said at least one seat (37,38) are set at a predetermined angle (alpha).

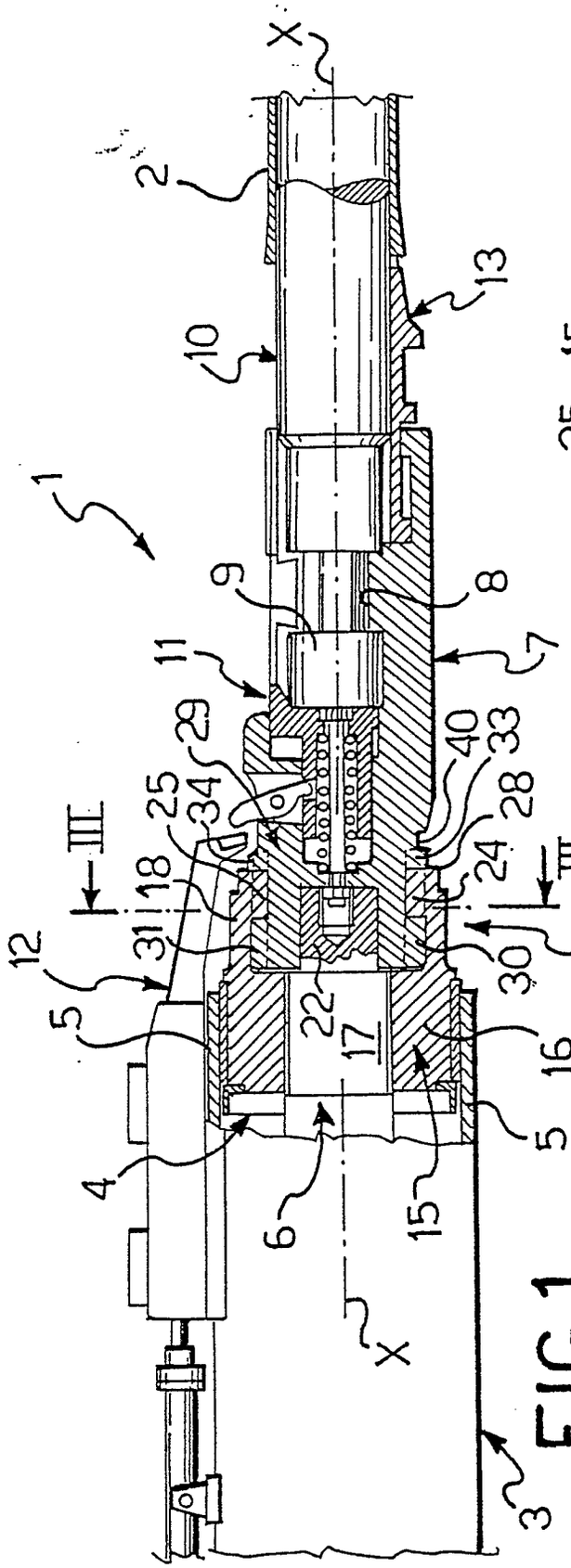

FIG.1

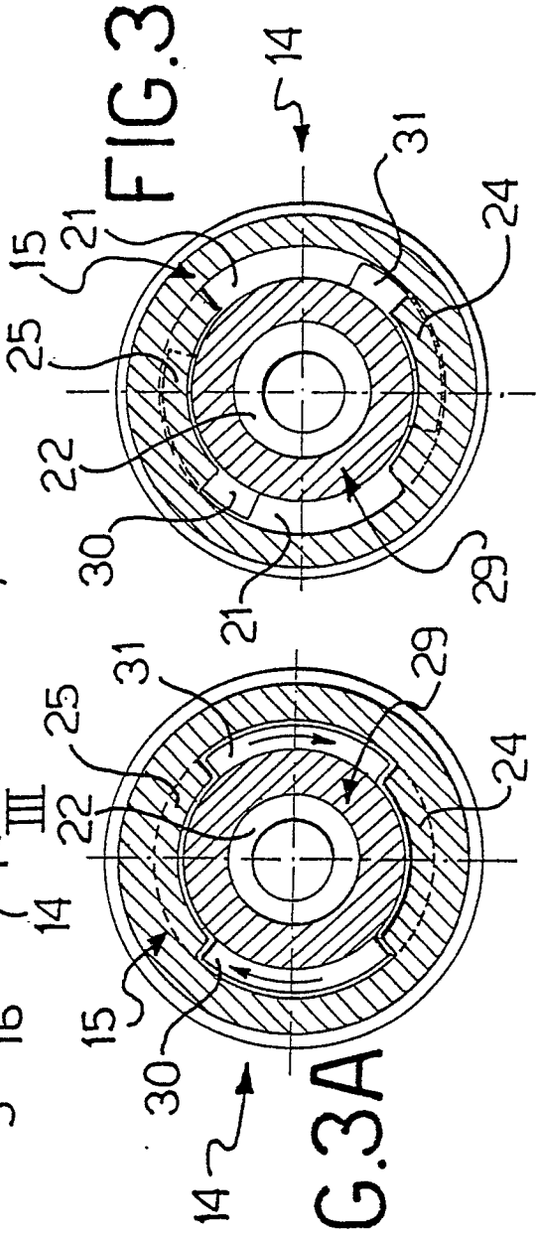

FIG.3B

FIG.3A

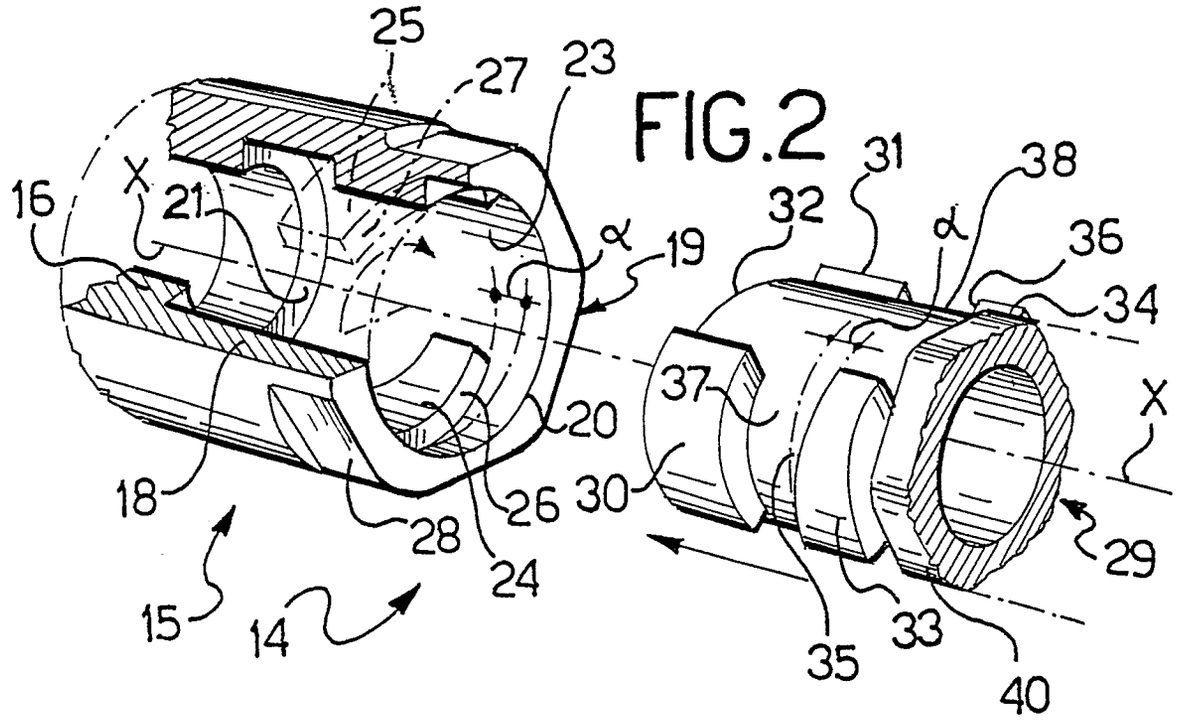

FIG.2

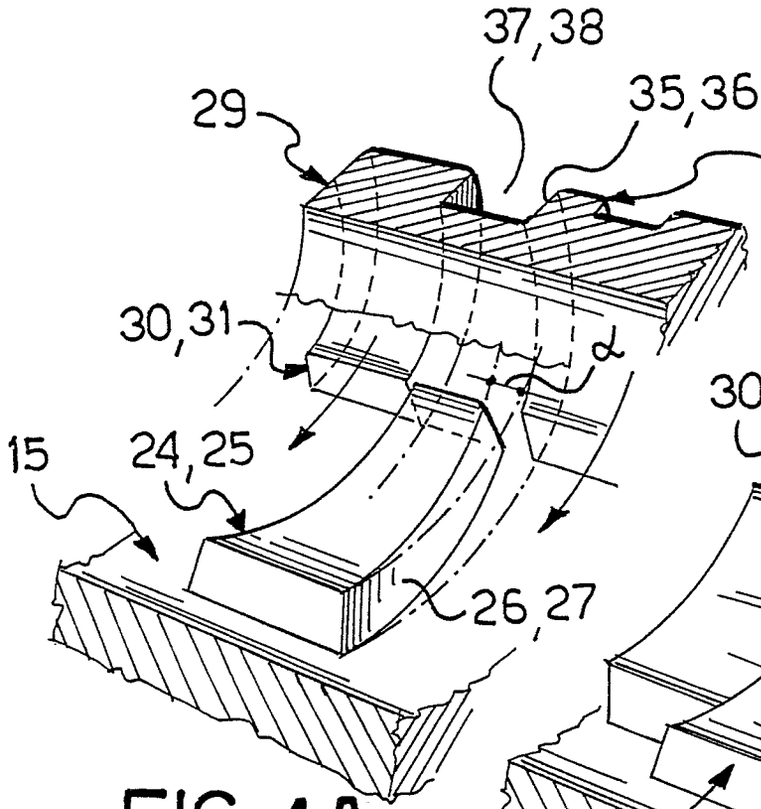

FIG.4A

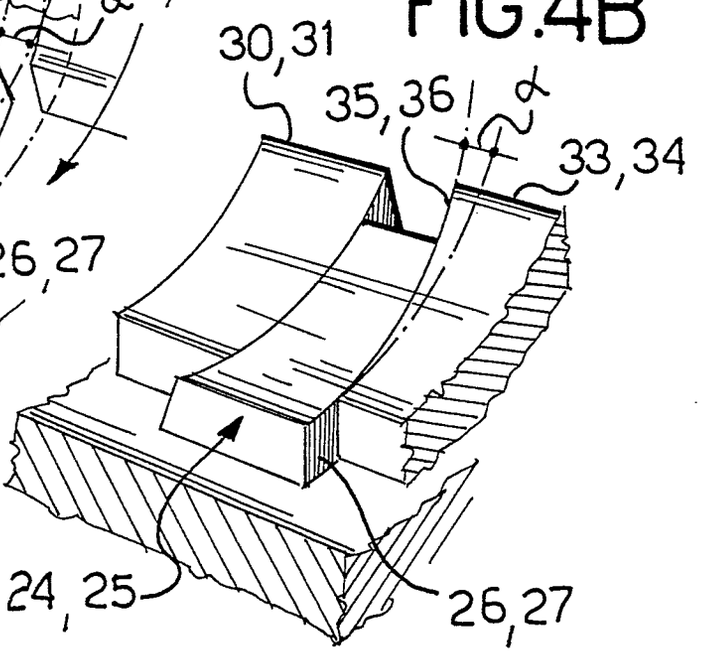

FIG.4B