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(54) A device for fine adjustment of the vertical movement of rollers in a skinpass rolling mill.

(57) There is disclosed a skinpass rolling mill which comprises a pair of rollers (12a, 12b), a respective shaft assembly for each roller which includes a supporting shaft (1a) on which the roller is mounted and an eccentric shaft (10a) projecting from the supporting shaft, a housing (32) in which each shaft assembly is axially movably mounted, and adjusting means for axially adjusting each shaft assembly relative to the housing in order to adjust the alignment of the centre lines (38a, 38b) of the profiles of the rollers (12a, 12b). In order to provide fine adjustment of the vertical movement of the rollers, an individual adjusting means is provided for the fine adjustment of each roller and which comprises an input worm drive (17a, 17b; 18a, 18b) and a worm wheel (15, 15b) coupled therewith, and a threaded member (29a) secured to the worm wheel for rotation therewith and threadedly coupled with the respective supporting shaft via a screw gear (5a, 5b) secured thereto, in order to impart axial movement to the roller upon rotation of the threaded member.

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A DEVICE FOR FINE ADJUSTMENT OF THE VERTICAL MOVEMENT OF ROLLERS IN A SKINPASS ROLLING MILL

This invention relates to a device for fine adjustment of the vertical movement of rollers in a skinpass rolling mill which is capable, in the final stage of finishing in rolling bar steels, of preventing improper meshing of the rollers and of improving the roundness of wire rods and steel bars formed in the mill.

Since precision rolling is used, for slight screw-down and for forming the shape of product bar steels, it is most essential, for enhancing the degree of precision, to employ a roller profile (depressed type) with a precision shape and to ensure the mutual exactness in centering of a pair of the rollers. As illustrated in Figure 5 of the accompanying drawings, in most cases there is some deviation between the centre lines 38a and 38b of the profiles (depressed type) of the pair of rollers 12a, 12b.

The primary cause of improper centering or alignment of the roller profiles comes from errors in machining to provide the roller profiles, making it almost inevitable that machining errors of about 5/100 be sustained. The second cause of such improper centering may be sustained in mounting the rollers on the usual eccentric shafts and eccentric pieces, namely accumulated dimensional errors resulting from combining the rollers with other component pieces.

If improper centering is left uncorrected, it is possible that the flanges 12a1 and 12b1 of the roller profile may damage the rolled steel bar products with the possibility of leaving flaws on the products and of causing improper cross-sectional accuracy of the product.

As a means of correcting improper centering or alignment of the roller profiles, push bolts have been used. In other words, it is a method of adjusting the centering by setting a push bolt in the upper and lower

parts of each roller supporting shaft, by moving the push bolts in the axial direction of the roller support shafts, as well as by moving the roller installed on the supporting shaft up and down. This method, however, is incapable of effecting very fine adjustment movement of the roller in the vertical direction, making it impossible to accomplish the adjustment with high accuracy. Further, in order to turn the lower push bolt, the roller guide needs to be removed once from the rolling line, making it even more troublesome to perform the adjustment. What is more, since the upper and lower roller supporting shafts need to be regulated while rendering the push pressure balanced, many separate steps have to be undergone, thus calling for operator skills for obtaining the necessary accuracy.

The present invention has therefore been developed primarily with a view to permit fine adjustment of the movement of the rollers in the vertical direction both simply and easily, and also to enable this fine adjustment to be carried out accurately without having to use special skills.

According to the invention there is provided a skinpass rolling mill comprising a pair of rollers, a respective shaft assembly for each roller which includes a supporting shaft on which the roller is mounted and an eccentric shaft projecting from the supporting shaft, a housing in which each shaft assembly is axially movably mounted, and adjusting means for axially adjusting each shaft assembly relative to the housing in order to adjust the alignment of the centre lines of the profiles of the rollers:

characterised in that an individual adjusting means is provided for fine adjustment of each roller and comprises an input worm drive and a worm wheel coupled therewith, and a threaded member secured to the worm wheel for rotation therewith and threadedly coupled with

the respective supporting shaft in order to impart axial movement thereto upon rotation of the threaded member.

One embodiment of skinpass rolling mill according to the invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side view of an adjustment device for fine adjustment of the vertical movement of rollers in a skinpass rolling mill;

Figure 2 is a plan view of the device;

Figure 3 is a rear view of the device;

Figure 4 is a front view of a correctly adjusted pair of rollers of the rolling mill; and

Figure 5 is a front view of a pair of rollers which are out of alignment.

Referring now to Figures 1 to 3, there is shown a fine adjustment device for the rollers 12a, 12b of a skinpass rolling mill. The fine adjustment device is intended to permit adjustment of the alignment of the centre lines 38a, 38b (see Figure 5) of the profiles of the rollers 12a, 12b, by adjusting each roller along its axis.

A respective shaft assembly is provided for each roller, which comprises a supporting shaft 1a (only one supporting shaft 1a is shown in the drawings) on which the roller is mounted and an eccentric shaft 10a integrally projecting from the supporting shaft with its axis parallel to the axis of the supporting shaft (only one eccentric shaft 10a is shown). A housing 32 is provided in which each shaft assembly is axially movably mounted, and adjusting means is provided for axially adjusting each shaft assembly relative to the housing 32 in order to adjust the alignment of the centre line 38a, 38b of the profiles of the rollers.

The axis of each eccentric shaft 10a is radially spaced (to the right in Figure 1) from the axis of each

supporting shaft 1a. The eccentric shafts 10a are movable in the axial direction inside the housing 32, and are provided with the rollers 12a and 12b mounted thereon, in each of which there is arranged a respective tapered roller bearing set 13, enabling it to freely rotate with reference to each eccentric shaft. On the upper and lower sides of each bearing 13 there are arranged a slinger 28 and a dust seal 36. Further, around the lower part of each eccentric shaft 10a, there is fitted an eccentric piece 11a (only the eccentric piece 11a on the side of the eccentric shaft 10a is shown). A seal 14 is installed around the upper part of each piece 11a. Furthermore, in the axial centre of the bottom of each eccentric shaft 10 there is provided an upwardly extending threaded hole 31, and into this hole there is screwed from below an adjusting bolt 27. By tightening each bolt, the bearing 13 can be prevented from becoming loose from its roller.

The upper part of each supporting shaft is positioned inside a gear wheel cover 26, and this upper part is composed of a screw gear 5a and a spacer 37, and screw gear 5b and a spacer 37 respectively. In the axial centre of the screw gears and the spacer are bored threaded holes (only the threaded hole 25a is shown in the screw gear 5a). On the upper part of the gear wheel cover there are provided a pair of gear cases 19a and 19b, and in each case are mounted worm wheels 15a and 15b. In the lower part of each worm wheel there is mounted a projecting screw (only screw 29a of worm wheel 15a is shown), and this is screwed into the respective threaded hole 25a. On the upper part of the worm wheels 15a and 15b there are mounted, with pushing pressure, fixing screws 16a and 16b which are placed on the gear cases 19a and 19b, and the bottom of each screw is made to contact the upper surface of the respective worm wheel. 24a and 24b are washers for adjusting purposes

and 30 is a washer.

In the gear cases 19a and 19b, there are arranged respective input worm drives in the form of worms 18a and 18b which are firmly fastened to worm shafts 17a and 17b respectively, and each worm is arranged to mesh with a respective one of the worm wheels 15a and 15b. One end of each of the worm shafts 17a and 17b projects from the respective gear case 19a and 19b.

A bracket 8 is fastened to the gear wheel cover 26 by means of bolt 7, and the bracket is provided with an adjuster shaft 2. The purpose of the shaft 2, as will become apparent from more detailed description below, is to provide a common input to a common lateral adjustment device which is coupled with the rollers 12a and 12b and which is operable to move the rollers laterally relative to each other in order radially to vary the gap therebetween (see Figure 4) in which rolled product M can be received.

On the inner end of shaft 2 there is a pinion 3 for centre-to-centre adjustment, and this pinion meshes with a gear (not shown) which is fastened firmly to worm spindles 4a and 4b. Worms 6a and 6b are mounted on the worm spindles 4a and 4b, and each worm meshes with a respective one of the screw gears 5a and 5b. Shaft 2 is prevented from turning by tightening a butterfly nut 9 which is mounted on the bracket 8.

The skinpass rolling mill illustrated herein has a housing 20 which is fixed in position on a rest bar 23 by a fastener 21 and a clamp bolt 22. The housing 20 is provided with a delivery guide 34, and this guide is made to extend towards the gap between a pair of rolls 33. 35 is a fastening bolt for an entry guide.

The adjusting procedure for aligning the centre lines 38a and 38b of the roller profiles will now be explained below.

Since worms 18a and 18b will rotate when the

respective worm shafts 17a and 17b are turned, the worm wheel 15a and 15b will also rotate, thereby causing the supporting shaft (1a) connected to the screw 29a of each worm wheel to move slightly up or down, and also making rollers 12a and 12b move up or down a little for fine vertical adjustment of the rollers, thereby causing relative movement of the profile centre lines 38a, 38b from the position shown in Figure 5, to the aligned position shown in Figure 4. Either one, or both of the input worm shafts 17a and 17b can be operated, in order to carry out necessary axial adjustment of the rollers for alignment purposes.

Moreover, in case there is excessive play between the rollers 12a and 12b, and bearing 13, bolt 27 may be tightened so as to push up eccentric piece 11a and slinger 28. By removing such excessive play, the accuracy of the cross-sectional dimensions of the rolled product M can be improved.

The above description has been in relation to fine axial adjustment of the rollers 12a and 12b, in order to align the centre lines 38a and 38b. However, in order to adjust the rollers radially, to vary the gap therebetween, the common lateral adjustment device is operated, which is formed by common input shaft 2, pinion 3, the transversely extending worm drives 4a, 6a and 4b, 6b, and the screw gears 5a and 5b secured to the upper ends of the supporting shaft 1a. Rotation of the supporting shaft will cause rotation also of the integral eccentric shaft 10a in the housing 32, which will thereby cause lateral (radial) movement of the roller axis in order to vary the clearance gap between the rollers.

During the axial adjustment of the rollers, and after adjustment of the centering of the roller profiles, the reduction system provided by pinion 3 and worms 6a and 6b will have the function of preventing the screw gears 5a and 5b from turning.

During the lateral adjustment of the rollers 12a and 12b, by operation of the common lateral adjustment device (input shaft 2 etc), the rollers can be moved radially relative to each other in order to vary the gap defined between them, in which the ~~old~~ product M is received. The rotation of either of the screw gears 5a or 5b causes vertical movement of the respective supporting shaft 1a, so that it will usually be necessary for vertical alignment adjustment to be carried out, via the input worm drives 17a, 17b, after any lateral adjustment of the rollers has been completed.

Claims:

1. A skinpass rolling mill comprising a pair of rollers (12a, 12b), a respective shaft assembly for each roller which includes a supporting shaft (1a) on which the roller is mounted and an eccentric shaft (10a) projecting from the supporting shaft, a housing (32) in which each shaft assembly is axially movably mounted, and adjusting means for axially adjusting each shaft assembly relative to the housing in order to adjust the alignment of the centre lines (38a, 38b) of the profiles of the rollers (12a, 12b):

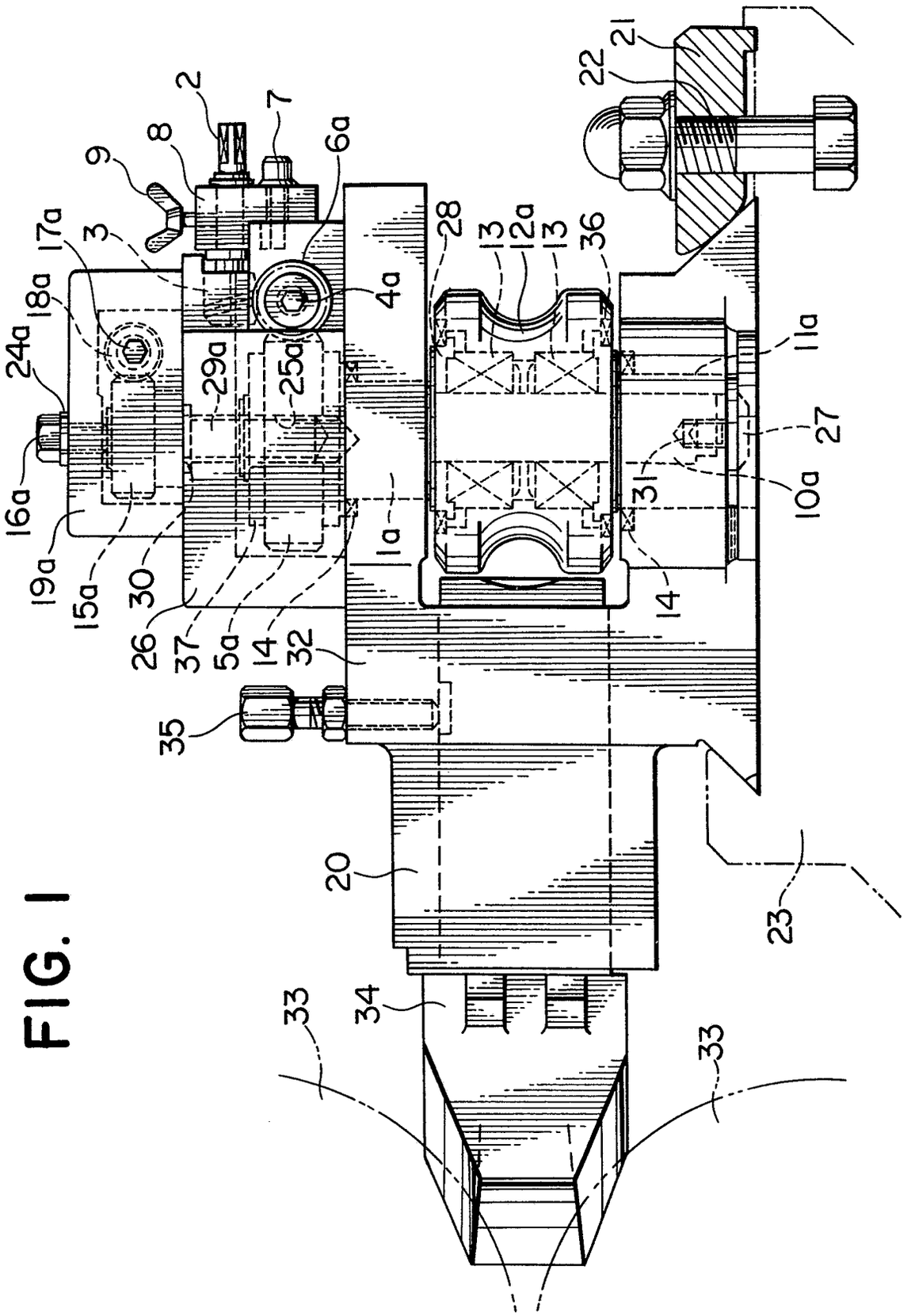
characterised in that an individual adjusting means is provided for fine adjustment of each roller and comprises an input worm drive (17a, 17b; 18a, 18b) and a worm wheel (15a, 15b) coupled therewith, and a threaded member (29a) secured to the worm wheel for rotation therewith and threadedly coupled with the respective supporting shaft in order to impart axial movement thereto upon rotation of the threaded member.

2. A skinpass rolling mill according to claim 1, characterised in that each threaded member (29a) engages in a threaded hole (25a) in a screw gear (5a, 5b) which is secured to a respective supporting shaft (1a).

3. A skinpass rolling mill according to claim 2, characterised in that a common lateral adjustment device is coupled with the rollers (12a, 12b) and is operable to move the rollers laterally relative to each other in order radially to vary the gap therebetween in which rolled product (M) can be received, said adjustment device comprising a common input shaft (2), and a pair or transversely extending worm drives (4a, 6a; 4b, 6b) coupled at one end with the input shaft (2) and at the opposite end with a respective one of said screw gears (5a, 5b).

4. A skinpass rolling mill according to any one of the preceding claims, characterised in that each fine

adjusting means is mounted in a respective gear casing (19a, 19b) and a setting device for each roller comprises a threaded adjuster (16a, 16b) which is mounted on each gear casing and which presses against a respective worm gear (15a, 15b) therein.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12a
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FIG. 1

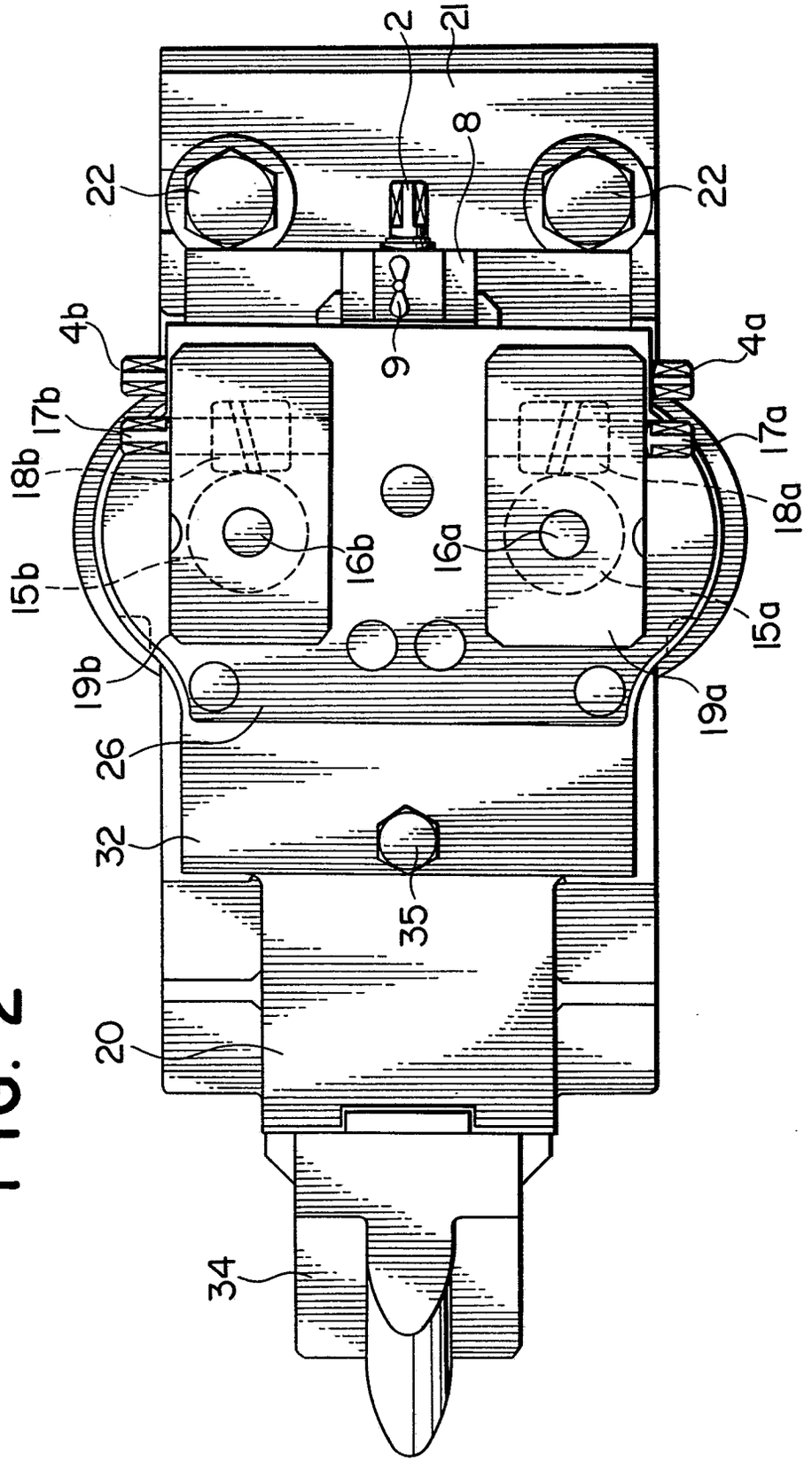
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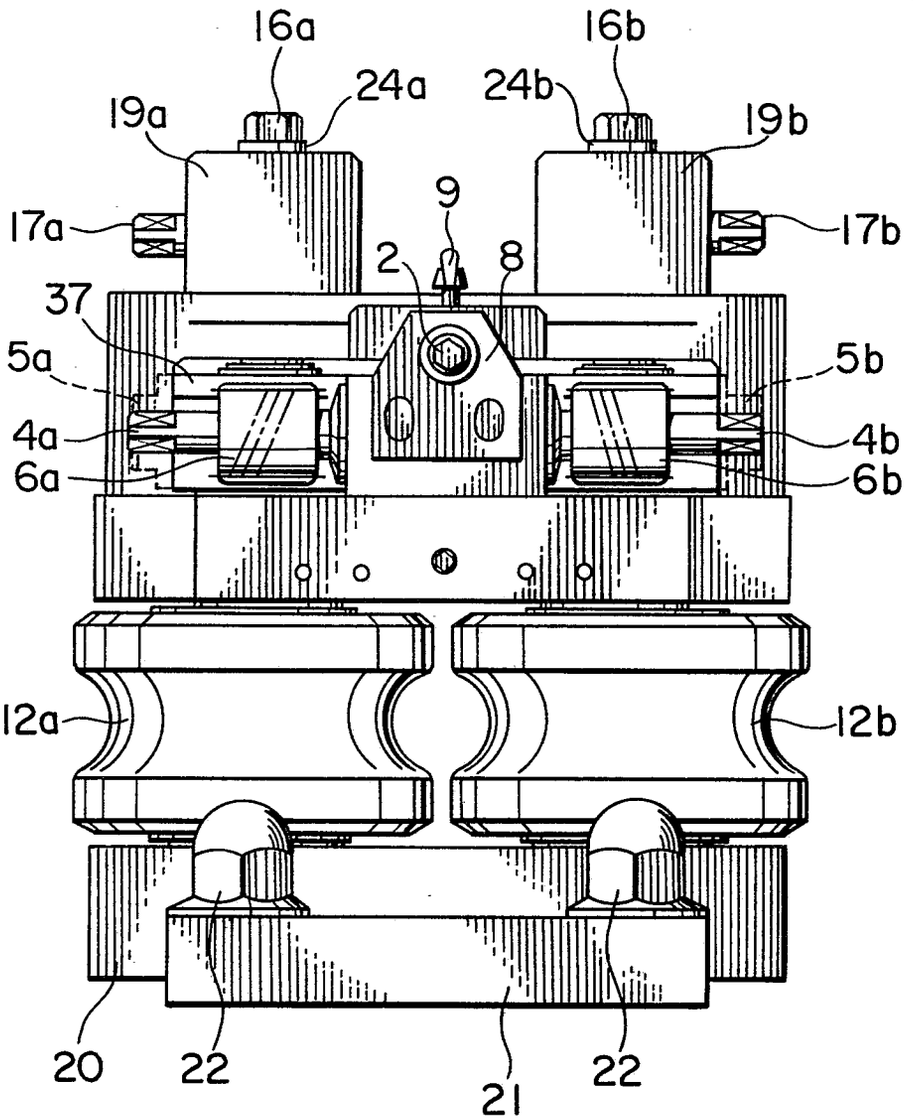
FIG. 2

FIG. 3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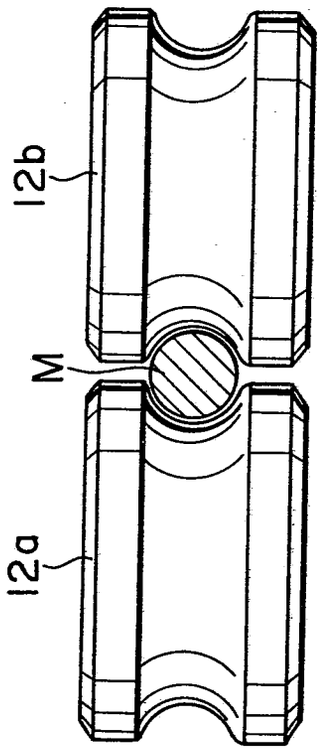

FIG. 4

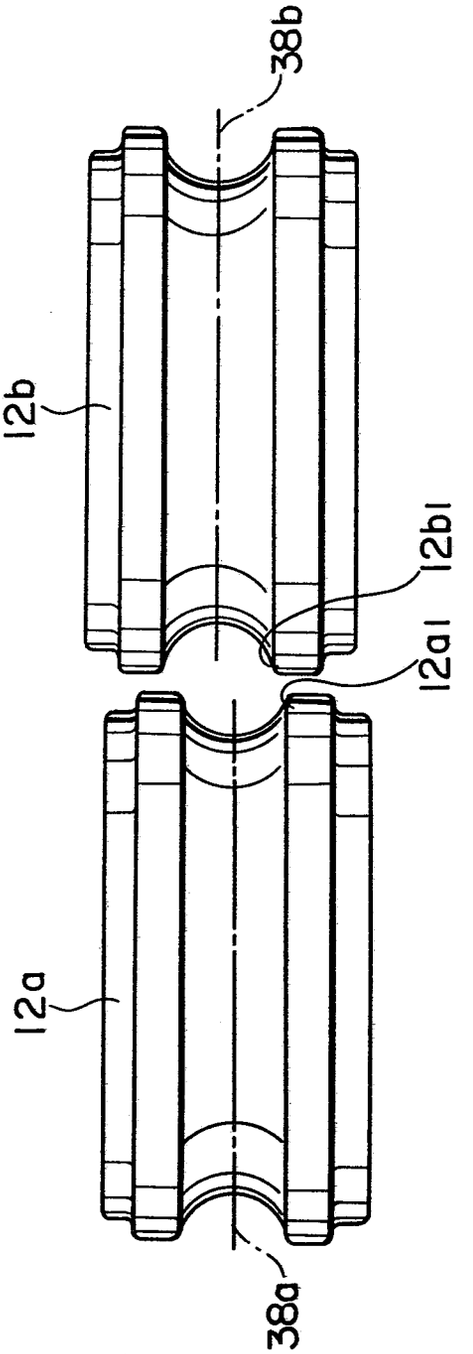

FIG. 5