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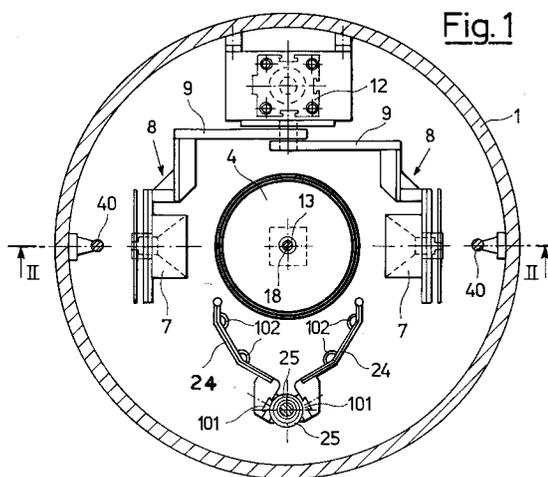
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54 **Automatic device for loading and unloading stacks of reels of yarn.**

57 An automatic device for loading and unloading stacks of reels of yarn comprises a centering mechanism (8, 10-13, 17, 18, 20, 21, 100) of a vertical reel-holding rod (3) on which the reels (4) are, or are about to be, stacked; the centering mechanism (8, 10-13, 17, 18, 20, 21, 100) comprises a vertical stem (13) on which a stack of reels to be moved is transferred so as to move it from a rod (3) to be unloaded to a rod (3) to be loaded, and a mechanism (24-29, 32, 35, 40) for removing and positioning the stack of reels that comprises an element (24) for removing the stack of reels (4) that is made to slide vertically to accomplish the removal or the positioning of the stack itself; the centering mechanism (8, 10-13, 17, 18, 20, 21, 100) comprises sensor means (18, 20, 21, 100) suitable for detecting the vertical alignment of the stem (13) with the reel-holding rod (3) and to operate the activation of the removal and positioning mechanism (24-29, 32, 35, 40); the removal element of the removal and positioning mechanism (24-29, 32, 35, 40) is constituted by a pair of jaws (24) suitable for grasping a reel (4) at the base of the stack.



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The present invention relates to an automatic device for loading and unloading stacks of reels of yarn, particularly for loading and unloading material holders suitable for dyeing and centrifuging.

The process for the treatment of reels of yarn generally provides for a step of dyeing the same; the dyed reels are soaked, and they must subsequently be subjected to drying, typically by means of centrifuges.

Generally a drying centrifuge for reels of yarn comprises a rotating basket on the bottom of which vertical rods are fastened and arranged along concentric circumferences; each rod acts as the central supporting axis of a stack of reels that has been slipped over it. The reels to be centrifuged are removed from a material holding carriage, or directly from a basket immersed in the dyeing bath, where in a similar manner they are stacked on vertical reel-holding rods, and are transferred to the centrifuge.

An automatic device is known for unloading drying centrifuges that comprises a mechanism for centering the reel-holding rod, comprising in turn a first stem to which the stack of reels is transferred while it is being removed, and a mechanism for removing the stack of reels whose removal organ is inserted under the reel at the base of the stack; the removal organ, integral with a second vertically sliding stem, is then raised together with the stack of reels, that is transferred to the first stem and is inserted on the latter. The same device can be used for loading the stack of reels, here transferred from the first stem to the corresponding holding rod of the centrifuge.

A device of this type has two main drawbacks: the first derives from the fact that, in order to allow the removal organ to be inserted under the reel at the base of a stack, it is necessary to provide suitable spacers at the base of each reel-holding rod that keep the stack of reels raised by an amount sufficient to allow the passage of the removal organ; this implies that the baskets of the centrifuges, as well as the various material holding carriages, be altered to adapt themselves to the use of the automatic loading and unloading device. The second drawback is linked with the centering mechanism that, not being provided with an automatic device for checking that centering has actually taken place, can cause the incorrect positioning of the stem on which the reels are transferred at removal, typically a slight misalignment of the stem with respect to the reel-holding rod that can cause damage to the yarn product during the reel transfer step.

In view of the described state of the art, the object of the present invention is to provide a device that allows the automation of the operation of loading and unloading the reels from the cen-

trifuge, or from material holding carriages in general, without being affected by the abovementioned drawbacks.

According to the invention, such object is attained thanks to an automatic device for loading and unloading stacks of reels of yarn, comprising a centering mechanism of a vertical reel-holding rod on which the reels are, or are about to be, stacked, said centering mechanism comprising a vertical stem on which a stack of reels to be moved is transferred so as to move it from a rod to be unloaded to a rod to be loaded, and a mechanism for removing and positioning the stack of reels that comprises an element for removing the stack of reels that is made to slide vertically to accomplish the removal or the positioning of the stack itself, characterized in that said centering mechanism comprises sensor means suitable for detecting the vertical alignment of said stem with said reel-holding rod and to operate the activation of the removal and positioning mechanism, and said removal element of the removal and positioning mechanism is constituted by a pair of jaws suitable for grasping a base reel of the stack on one side.

Thanks to the device according to the invention, it is possible to automate the operation of loading and unloading the reels from the drying centrifuge, or from a generic material holding carriage, without it being necessary to modify the same to adapt it to the functional needs of the loading and unloading device, while at the same time ensuring a greater degree of safety of the operation itself.

The features of the present invention will be made more evident by the following detailed description of an embodiment thereof, described as a non-limiting example in the enclosed drawings, wherein:

Fig. 1 shows a device according to the invention in a cross-sectional view taken along the transversal horizontal plane I-I of Fig. 2;

Fig. 2 is a cross-sectional view of said device taken along the line II-II of Fig. 1;

Fig. 3 shows a detail of said device in a cross-sectional view similar to that of Fig. 2, and a stack of reels to be moved;

Fig. 4 shows said device in a cross-sectional view taken along a different transversal horizontal plane, indicated with IV-IV in the subsequent Fig. 6;

Fig. 5 is similar to Fig. 4, but in it some components of the device have been omitted;

Fig. 6 is a cross-sectional view of said device taken along the line VI-VI of Fig. 4;

Figs. 7, 8 and 9 show a detail of the device according to the invention, in three different operational conditions;

Fig. 10 shows the detail of a removal element of said device in the removal position.

With reference to the drawings, a device according to the invention consists of a cylindrical shell 1, destined to contain a centering mechanism (visible in Figs. 2, 3 and 7-9) of a reel-holding rod 3, for example of a drying centrifuge, and a removal mechanism (visible in Figs. 4-6) of a stack of reels 4 slipped over said rod 3. The reel-holding rods 3 are tapered in their upper section, and terminate with an end 5 having a diameter that is smaller than that of the casing 6 of the rod 3. The shell 1 is fastened to a bridge (not shown) that can move on wheels.

The centering mechanism comprises a pair of cheeks 7 of a clamp 8, whose clamping action is operated, by means of levers 9, by the rotation of respective gears 10 along two toothed racks 11; the clamp 8 is operated by an oleodynamic cylinder 12 that, by determining the downward stroke of the clamp 8 itself, causes the gears 10 to move along the two toothed racks 11, so that the cheeks 7, as they move downward, rotate at the same time through 90° with respect to their open position, so as to clamp themselves over the tapered end 5 of the reel-holding rod 3 to facilitate the centering operation.

Said centering mechanism also comprises a vertical stem 13, in a section of whose surface there is a toothed rack 14 (Figs. 7-9) that, engaging with a gear 15 keyed on a shaft 16 of an electric motor 17, allows the upward and downward translatable stroke of the stem 13 itself, for the reasons that will be made clear later. The stem 13 is hollow, the internal diameter being sufficient to receive the upper end 5 of the reel-holding rod 3, and inside it there is a rod 18 with a diameter that is slightly less than the internal diameter of the stem 13 and with a length that almost corresponds to that of the latter; the rod 18 slides freely inside the stem 13, but there is a clamping key (not shown) to prevent the rod 18 from slipping out of the stem 13.

Above the shell 1, a supporting bracket 19 to the side of the stem 13 has, at different heights, three sensors 20, 21 and 22 (Figs. 7-9), suitable for detecting the axial position of the stem 13; a further bracket 103, also to the side of the stem 13, supports a sensor 100 suitable for detecting, when the stem 13 is in the position of Fig. 8, the fact that the upper end of the rod 18 protrudes from the stem 13, for the reasons that will be made clear later.

The cheeks 7 of the clamp 8 have a conformation such as, when they are clamped over the end 5 of the reel-holding rod 3, to determine a conical guide 23 to facilitate the centering of the reel-holding rod 3 on the part of the stem 13.

The mechanism for removing a stack of reels comprises two jaws 24, provided with protruding reliefs 102; the two jaws 24 are fastened to two respective coaxial shafts 25 rotatable by means of indented couplings 101 that enable them to be interchangeable so as to adapt to reels of yarn of different diameters; the upper ends of the two shafts 25 are keyed on the head 26 of two respective connecting rods 27, that are operated by an oleodynamic cylinder 28 and by the corresponding piston 29, respectively (Figs. 4-6). The outer of the two coaxial shafts 25 is rotatably inserted in a sleeve 30, that is fastened to two shoes 31 of a saddle 32 that slides horizontally, under the action of a further oleodynamic cylinder 33, along horizontal guides 34 in a supporting structure 35; the sliding action of the saddle 32 allows the displacement of the jaws 24 from a distal position to a position close to the central axis of the shell 1. The rotation of the two coaxial shafts 25 does not determine the rotation of the sleeve 30, that remains fixed with respect to the supporting structure 35; to the sleeve 30 there is also fastened a bracket 36 on which there is hinged a conical gear 37 that, engaging two toothed half-moons 38 integral with the heads 26 of the two connecting rods 27, respectively, ensures that the two coaxial shafts 25 rotate, under the action of the oleodynamic cylinder 28 and of the piston 29, simultaneously and in opposite directions through the same angle so as to allow the simultaneous closing of the two jaws 24.

The supporting structure 35 is provided with four bushes 39 mounted in pairs on two vertical guides 40 that are in turn fastened to the shell 1, and that allow the upward and downward movement of the supporting structure 35 and as a consequence of the coaxial shafts 25 carrying the jaws 24, due to a winch not shown in the drawings, that acts on supporting chains 70 (Fig. 6).

At the start of each operation for the removal of a stack of reels, the cheeks 7 of the clamp 8 are raised and open (Fig. 2), the stem 13 is raised (Fig. 7), the supporting structure 35 of the removal jaws 24 is also raised and the jaws themselves are open (Fig. 6); moreover, the saddle 32 is in the distal position with respect to the central axis of the shell 1 (Fig. 4).

As already mentioned, the stacks of reels 4 are arranged inside a centrifugation basket 41 along concentric circumferences; the removal at first concerns the stacks of reels of the outermost circumference, and then gradually those of the innermost circumferences.

The shell 1 is positioned above the first reel-holding rod 3 to be unloaded, and is made to rotate so as to orient the jaws 24 in order that these will later grasp the stack of reels 4 along the centripetal

radial direction of the circumference to which the stack of reels belongs.

The oleodynamic cylinder 12 is then operated that, through the toothed racks 11 and the gears 10, cause the downward movement of the cheeks 7 of the clamp 8 and their simultaneous clamping action over the upper end 5 of the reel-holding rod 3. The motor 17 is subsequently operated to determine the downward stroke of the stem 13 and, at the same time, that of the rod 18; the stem 13, guided by the conical guide 23 offered by the cheeks 7 of the clamp 8, moves downward until it reaches the position shown in Fig. 8, where the sensor 21 causes it to stop; during the downward stroke of the stem 13 the upper end 5 of the reel-holding rod 3, by inserting itself in the lower cavity of the same stem 13, causes the downward stroke of the rod 18 to stop (Fig. 8). The sensor 100 detects the fact that the upper end of the rod 18 is now protruding from the stem 13. If this does not occur, that is if centering has not taken place and the downward stroke of the rod 18 is not brought to a stop by the upper end 5 of the reel-holding rod 3, the sensor 100 is not excited after the stem 13 has been brought to a stop in the position of Fig. 8, and the cheeks 7 of the clamp 8 are raised once again to make a new attempt later.

If the sensor 100 is excited thanks to the downward stroke of the rod 18 being brought to a stop, the same sensor 100 again determines the upward movement of the cheeks 7 of the clamp 8, and subsequently activates the motor 17 to allow the further downward stroke of the stem 13 over the upper end 5 of the reel-holding rod 3. The sensor 20 detects the further downward stroke of the stem 13, and the motor 17 is brought to a stop when the stem 13 is by now completely inserted over the upper end 5 of the reel-holding rod 3 (Fig. 9).

The sensor 20 also determines the activation of the removal mechanism, initially causing the downward movement of the supporting structure 35 that holds the pair of jaws 24, until the latter are at the level of the reel 4 at the base of the stack. When the downward stroke is completed, the saddle 32 is made to move forward toward the stack of reels, and the jaws 24 are thus brought into contact with said base reel (Fig. 10). At this point the jaws 24 are clamped round the reel at the base of the stack, the protruding reliefs 102 penetrate into the yarn product to prevent any possible slipping of the reel, and the supporting structure 35 is raised once again so that the stack of reels is transferred from the reel-holding rod 3 to the stem 13 above it and aligned thanks to the previous centering operations.

When the entire stack of reels has been transferred onto the stem 13, the latter is also raised again until it reaches the position illustrated in Fig.

7 and excites the sensor 22, and the mobile bridge then moves the shell 1 to the point where the stack of reels is to be positioned.

The positioning operation is identical with that of removal, providing for a centering step controlled by the sensors 20, 21 and 100, and then a step wherein the stack of reels is transferred from the stem 13 to a reel-holding rod to be loaded.

Once the first stack of reels has been unloaded, the operating cycle described is repeated for all the remaining stacks.

The loading operation of the drying centrifuge takes place in a manner altogether identical with that described, the only difference being that the stacks are first transferred onto the reel-holding rods of the innermost circumference of rods, and gradually to the outermost circumferences.

The device according to the present invention, whose operation has been described here in relation to the operation of unloading a drying centrifuge, can also be used for loading and unloading automatically, in different steps of reel processing, all material holding carriages on which the reels 4 are stacked on vertical rods.

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Claims

1. Automatic device for loading and unloading stacks of reels of yarn, comprising a centering mechanism (8, 10-13, 17, 18, 20, 21, 100) of a vertical reel-holding rod (3) on which the reels (4) are, or are about to be, stacked, said centering mechanism (8, 10-13, 17, 18, 20, 21, 100) comprising a vertical stem (13) on which a stack of reels (4) to be moved is transferred so as to move them from a rod (3) to be unloaded to a rod (3) to be loaded, and a mechanism (24-29, 32, 35, 40) for removing and positioning the stack of reels (4) that comprises an element (24) for removing the stack of reels (4) that is made to slide vertically to accomplish the removal or the positioning of the stack itself, characterized in that said centering mechanism (8, 10-13, 17, 18, 20, 21, 100) comprises sensor means (18, 20, 21, 100) suitable for detecting the vertical alignment of said stem (13) with said reel-holding rod (3) and to operate the activation of the removal and positioning mechanism (24-29, 32, 35, 40), and said removal element of the removal and positioning mechanism (24-29, 32, 35, 40) is constituted by a pair of jaws (24) suitable for grasping a base reel of the stack on one side.
2. Device according to claim 1, characterized in that said stem (13) is vertically slidable, is hollow and has a diameter suitable for receiving inside it an upper end (5) of said reel-

- holding rod (3), there being provided motor means (17) to execute the vertical sliding action of said stem (13).
3. Device according to claim 2, characterized in that said sensor means (18, 20, 21, 100) comprise a rod (18) inserted in said stem (13) and axially sliding with respect to the same stem (13) under the thrust of the upper end (5) of the reel-holding rod (3) when the latter, as a result of the downward stroke of the stem (13), penetrates inside the same stem (13), there being also provided sensor means (21, 100) suitable for detecting the position of the rod (18).
4. Device according to claim 1, characterized in that said centering mechanism (8, 10-13, 17, 18, 20, 21, 100) comprises a clamp (8) having a pair of cheeks (7) that are previously clamped over said upper end (5) of the reel-holding rod (3), said jaws defining at the upper end a conical guide suitable for facilitating the centering of the stem (13) over the reel-holding rod (3).
5. Device according to claim 1, characterized in that said jaws (24) are fastened to two respective rotatable coaxial shafts (25), whose rotation to allow the opening or closing of the jaws (24) is controlled by an oleodynamic cylinder (28, 29) and by two connecting rods (27).
6. Device according to claim 5, characterized in that said coaxial shafts (25) are mounted on a saddle (32) sliding, under the action of an oleodynamic cylinder (33), in a horizontal direction to impart to said jaws (24) a movement of getting closer to or moving away from the axis of the stack of reels to be removed from the rod (3) or positioned on the latter.
7. Device according to claim 6, characterized in that said saddle (32) slides along a pair of rails (34) with which a supporting structure (35) is provided, that is made to slide vertically by suspensions means (70) operated by a winch to allow the upward or downward movement of said pair of jaws (24).
8. Device according to claim 1, characterized in that said jaws are provided with a plurality of protruding reliefs (102) suitable for penetrating, following the closing of the jaws (24), inside the yarn product of the base reel to prevent the latter from sliding downward.
9. Device according to claim 5, characterized in that said jaws are fastened to said coaxial shafts (25) by indented couplings (101) to allow interchangeability between jaws (24) of variable diameter according to the diameter of the reels (4).

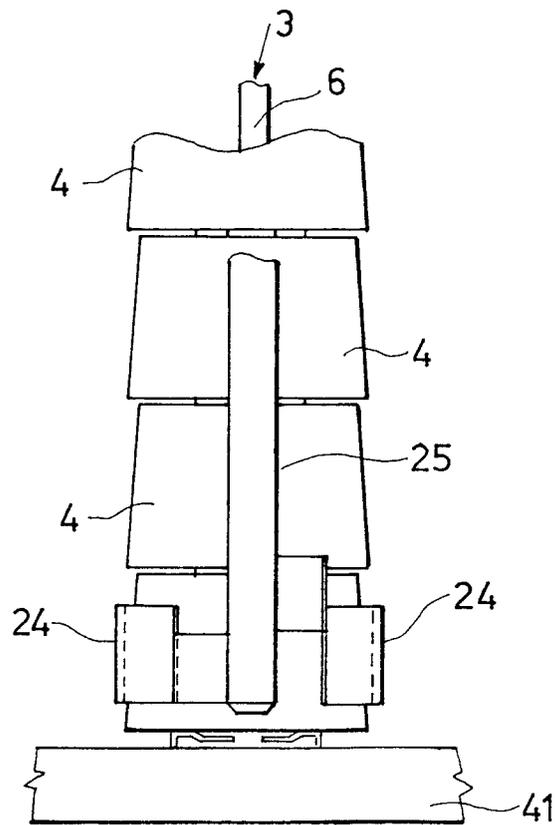
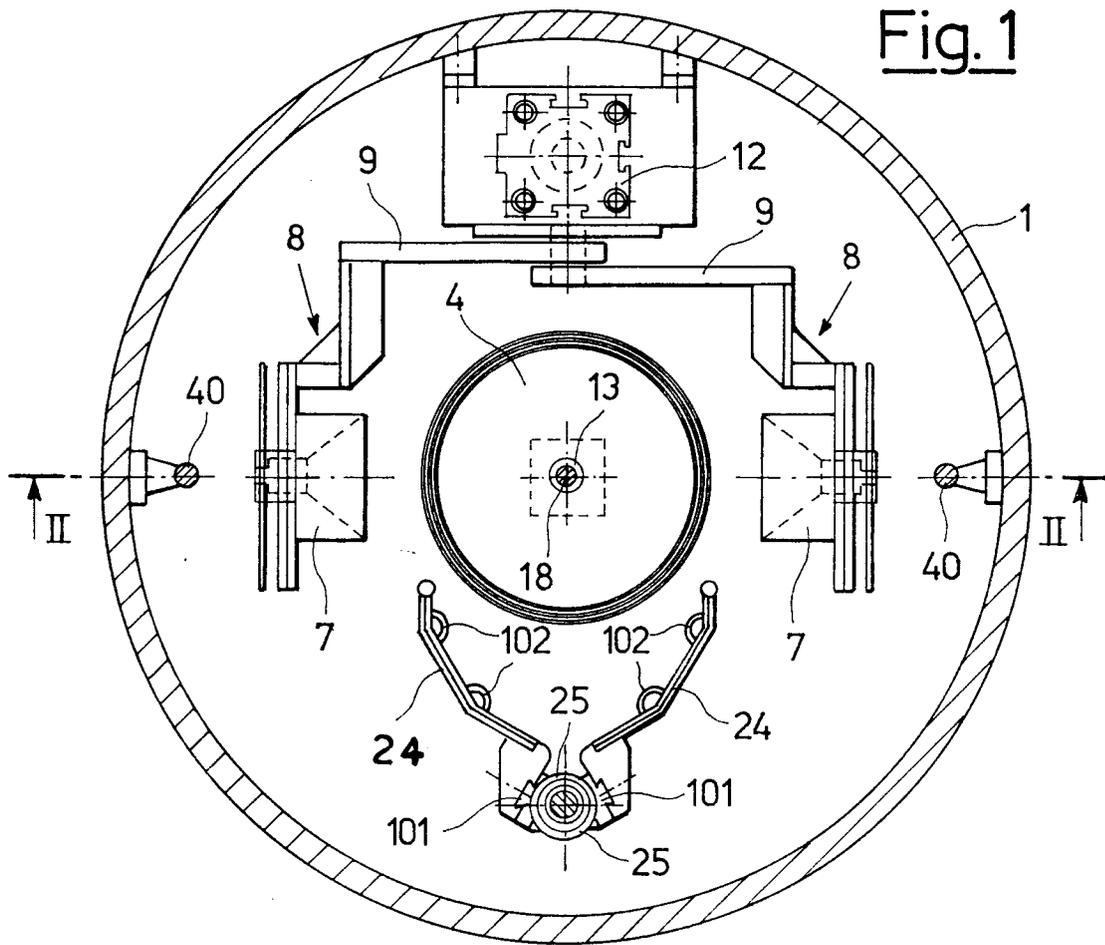
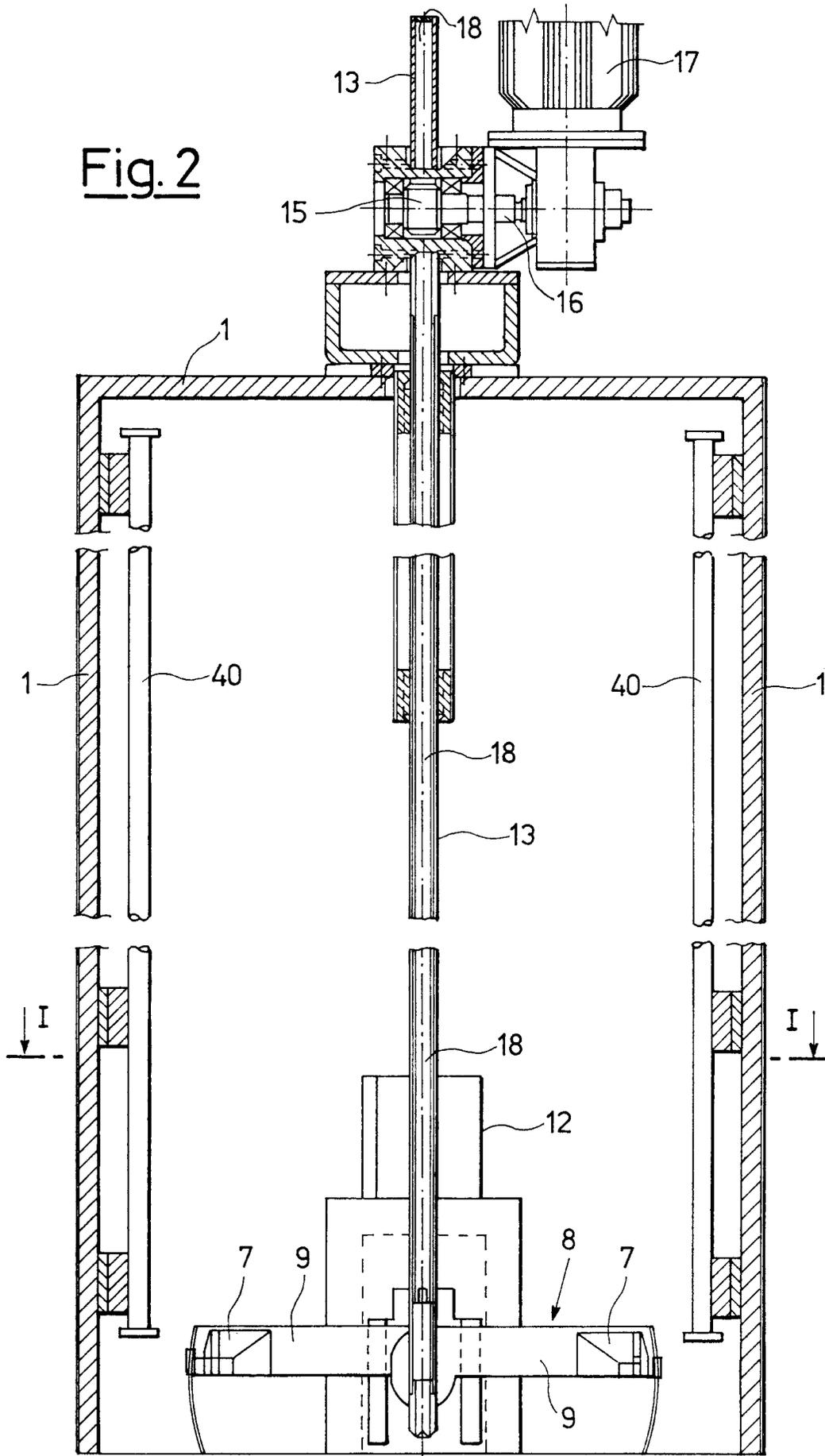


Fig. 2



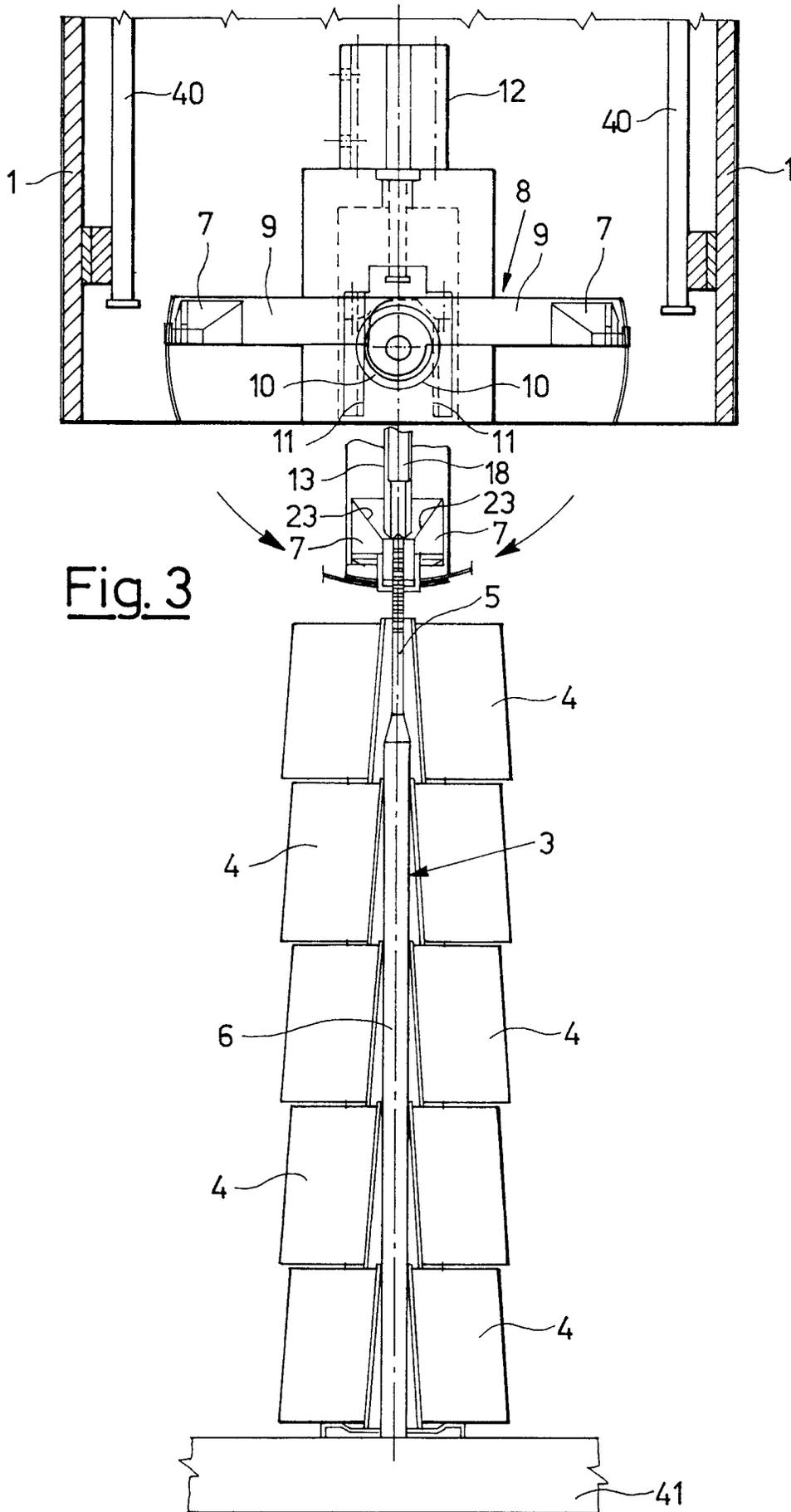


Fig. 3

