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(54) **REELING DEVICE FOR INTERLEAVED BAGS, CORRESPONDING METHOD FOR REELING INTERLEAVED BAGS, AND MACHINE FOR THE PRODUCTION OF ROLLS OF INTERLEAVED BAGS COMPRISING SUCH A REELING DEVICE**

(57) Reeling device (10) of interleaved bags (7) in plastic material, in particular waste collection bags, comprising a rotating drum (20) carrying a number of mandrels (11) apt to receive said interleaved bags (7) for forming rolls, passing through a plurality of stations (S1-S4), wherein said drum (20) comprises two opposing flanges (21), mounted in a fixed position on a central shaft (22), between which are arranged said mandrels (11), each consisting of two half-mandrels (30) carried by respective carriages (31) sliding on guides (32), to be brought from a closed position, in which they protrude from the respective flanges (21) to come into contact one with the other, forming a single mandrel, to an open position, wherein they re-enter the flanges (21), freeing the space between them.

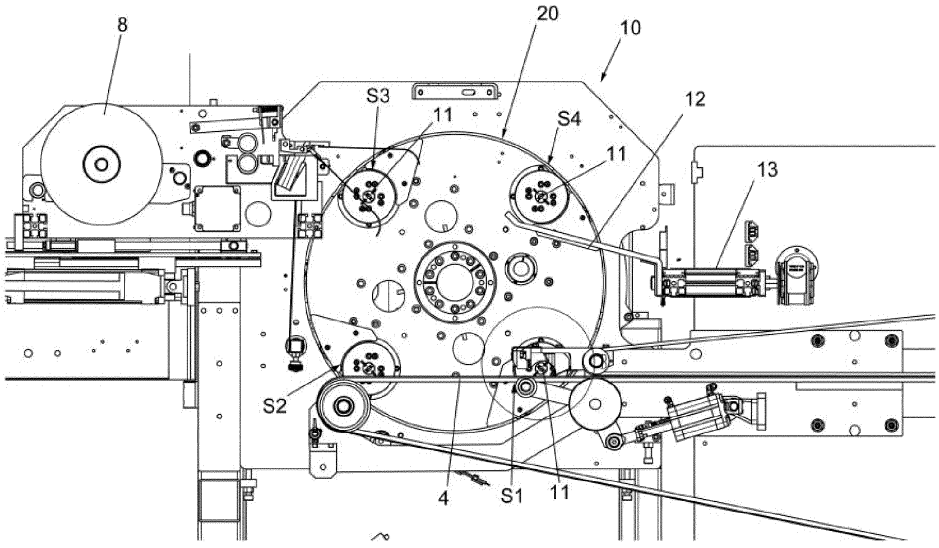

FIG.2

EP 4 273 080 A1

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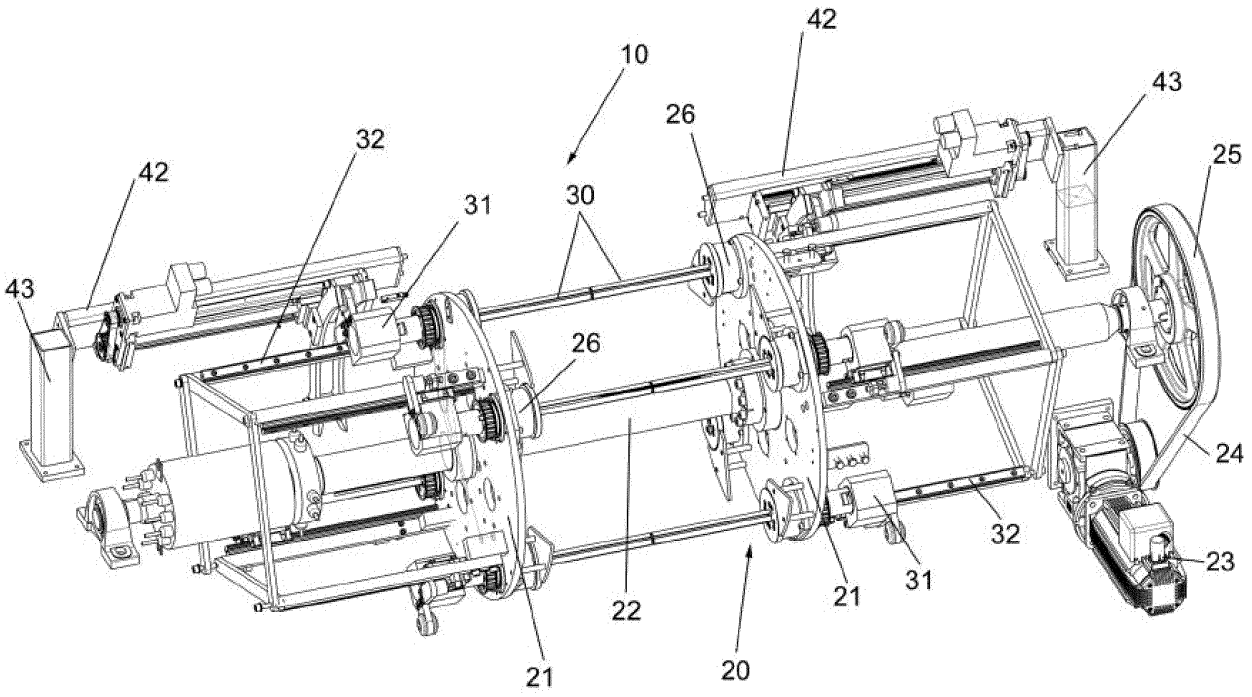
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FIG. 3

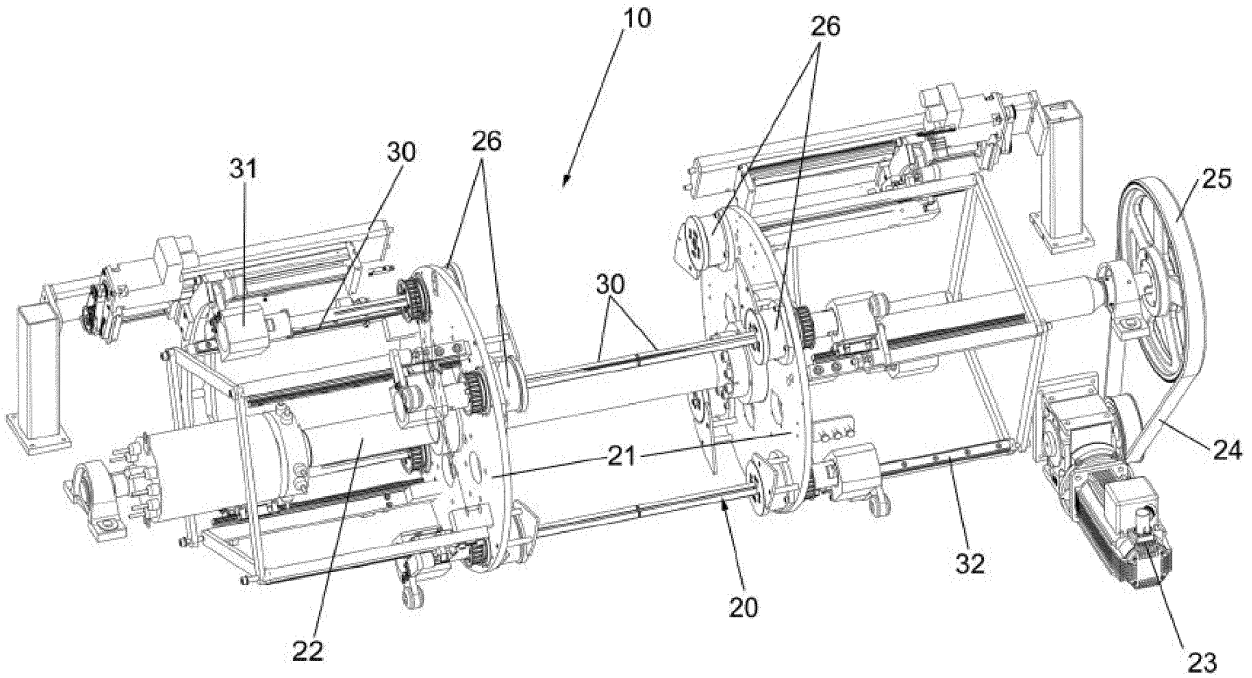
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FIG.4

Description

[0001] The present invention relates to a device for reeling interleaved bags in plastic material, in particular bags for the collection of waste (but also open-mouth bags, shopper-type bags and the like), a relative method of reeling and a machine for producing interleaved bags comprising such a reeling device.

[0002] These types of bags, widely available on the market, are normally wound into rolls, from which they are individually removed for use.

[0003] Traditionally, these bags are wound continuously, joined together and separated one from the other by a pre-score or pre-cut line, which is torn off for the removal of the individual bags. This operation requires the user to hold the roll still with one hand and exert forceful traction with the other hand on the free flap of the film web, which at times produces an unwanted tearing of the same.

[0004] Currently, bags separated previously and reeled in an interleaved fashion are becoming increasingly widespread, such that the user simply has to take them off the roll, rather than tear them off the pre-cut line.

[0005] The cycle of production of these bags involves starting from a strip of plastic film normally open on one side (single-fold film).

[0006] If the final bag is to have a 'tie' closure, more commonly referred to as NASTROSAC, the closure tape is inserted in the open side of the film, followed by sealing of the pocket containing it, by longitudinal welding of the film.

[0007] The film enters a welding device where double transverse welds are produced with a pre-cut knurling in the space between the two welds. Two adjacent pre-cut lines determine the sides of a bag.

[0008] Subsequently, the strip of bags is folded into several parts in the longitudinal direction to reduce the bulk of the final roll.

[0009] The film then enters the tearing station, composed of an infeed conveyor belt, an outfeed conveyor belt and in the middle a drum carrying two rods between which the film passes. The 180-degree rotation of the drum causes one of the two rods (which alternate) to interfere with the film, putting it under tension until the pre-cut area breaks.

[0010] The outfeed conveyor belt has a lower speed with respect to the infeed one, thus causing each bag to overlap with the next by approximately 150 mm.

[0011] At the exit, a row of bags already cut and overlapping 'wallet-like' will then have been created, which is accompanied towards the reeling device by the conveyor belt.

[0012] The reeling device, normally with several stations, reels a predetermined number of bags on a mandrel and at the end the roll is bundled by means of the application of a moistened paper band.

[0013] One of the critical points of these machines which, in order to be profitable, must reach a considerable speed (over 120 metres per minute) is represented by the extraction of the roll from the reeling mandrel.

[0014] In fact, the new materials currently used, coming from post-consumer recovery or are biodegradable, are very elastic and difficult to extract from the mandrel once the roll is finished.

[0015] On traditional machines for bags in a roll that reel bags joined by pre-cutting, the reeling normally takes place by hooking the film to be reeled with two pairs of grippers (one on each side), which are then easily removed from the roll, which is in this way unhooked.

[0016] To be able to reel the interleaved (and therefore already torn) bags, it is indispensable to wind them on a perfectly cylindrical mandrel that rotates in contact with the belt that moves forwards the strip of pre-cut and overlapped bags.

[0017] When the film is to be hooked onto the new mandrel, the latter is set to rotate at the same peripheral speed as the conveyor belt and a suction created by an air blade causes the film to be wound on the mandrel.

[0018] The prior art provides for the mandrel to be a cylindrical tube, cantilevered on a drum carrying two or four mandrels that alternate in winding.

[0019] The conveyor belt that carries the strip of interleaved bags at the time of entry rises until coming into contact with the mandrel previously set to rotate at the same peripheral speed as the conveyor belt.

[0020] A sort of hood with a concave interior then descends onto the mandrel, which wraps around the mandrel creating a chamber which, traversed by a blade of air, creates a suction that forces the first incoming bag to rise up inside the chamber and then to wrap onto the mandrel.

[0021] Once the roll is finished, it is extracted by sliding an extraction flange (usually composed of anti-friction plastic) that pushes the roll outside of the mandrel.

[0022] If the film grips very tightly on the mandrel during reeling, the extraction operation becomes improbable. If the plastic film being processed is elastic or slippery, the inner layers of the film, which are pushed sideways for extraction, will curl in on themselves, creating a bead that blocks the roll on the mandrel.

[0023] Some manufacturers provide for the blowing of compressed air from inside the mandrel, air that comes out of small holes formed in the mandrel. However, if the roll is too tight on the mandrel, the pressure of the air is not in any case sufficient for making the roll widen to the point where it can be pulled off. Another solution provides for making the mandrel with two half-moons held slightly distanced by a shim that retracts during the extraction phase, allowing the two half-moons to close slightly. This solution makes extraction slightly easier than the previous ones but does not solve the problem completely in the case of very elastic films, such as biodegradable ones, since if the inner layers of the film slide one in relation to the other (because pushed on one side only), they form the abovementioned bead which blocks extraction thereof.

[0024] WO2016150946A1 relates to a roll making apparatus comprising spindles optionally having apertures for pressurized air and/or for applying a vacuum, the spindles being movable between a retracted position and an extended position, a roll engaging face configured to engage a roll carried by a spindle, upon the spindle carrying said roll moving to said retracted position, to move the roll relative to the spindle.

[0025] WO2009048407A1 discloses a method and device in order to simplify loading and unloading and shaft spindle handling, respectively, in a machine for the reeling of a web-formed material, which machine comprises at least one shaft spindle for the carrying of a reel as well as at least two reel holding arms in order to between each such pair mount the shaft spindle having means expandable against the reel having web-formed material for locking, with or without internal core, the reeled material at the shaft spindle.

[0026] The object of the invention is to eliminate the disadvantages of the known reeling devices described above.

[0027] More particularly, an object of the invention is to provide a device for reeling interleaved bags that allows easy and safe discharge of the rolls formed from the relative mandrels.

[0028] Another object of the invention is to provide such a reeling device that allows a high speed of the machine for production of interleaved bags.

[0029] A further object of the invention is to provide such a reeling device which is simple and inexpensive to manufacture.

[0030] These and other objects are achieved by the device for reeling interleaved bags according to the invention which has the features of the appended independent claim 1.

[0031] Advantageous embodiments of the invention are disclosed in the dependent claims.

[0032] Substantially, the device for reeling interleaved bags in plastic material, in particular bags for the collection of waste according to the invention, comprises a rotating drum carrying a plurality of mandrels suitable for accommodating said interleaved bags for the formation of rolls, passing through a plurality of stations, wherein said drum comprises two opposing flanges mounted in a fixed position on a central shaft, between which said mandrels are arranged, each made up of two half-mandrels carried by respective carriages, sliding on guides, to be carried from a position of closure, in which they protrude from their respective flanges to come into contact one with the other, forming a single mandrel, to a position of opening, in which they re-enter the flanges, freeing the space between them.

[0033] Further features of the invention will be made clearer by the following detailed description, referring to one of its embodiments purely by way of non-limiting example, illustrated in the accompanying drawings, in which:

Figure 1 is a schematic view in longitudinal section of the end part of a machine for the production of interleaved bags, provided with a reeling device according to the invention;

Figure 2 is an enlargement of the front part of Figure 1, showing in particular the reeling device;

Figures 3 and 4 are schematic axonometric views of the reeling device in two different configurations;

Figures 3a and 4a are enlargements of the left side of the reeling device of Figures 3 and 4, respectively;

Figures 5 and 6 are schematic axonometric views showing a mandrel with its respective actuation means in closed and open condition, respectively;

Figures 5a and 6a are enlargements of the right-hand part of Figures 5 and 6, respectively;

Figures 7, 8 and 9 are sectioned views schematically showing a half-mandrel in the transition from the position of closure (Figure 7) to the position of opening (Figure 9);

Figures 7a and 8a are enlarged views of the circled parts of Figures 7 and 8, respectively.

[0034] Before describing more or less in detail the reeling device for interleaved bags according to the invention, the production cycle of these bags is again briefly described with reference to the partial diagram of Figure 1.

[0035] Upstream of what is shown in Figure 1, the cycle starts with a strip of single-fold plastic film 1 open on one side, into which a closure tape is optionally inserted, which is sealed in the pocket that contains it by longitudinal welding of the film. In the subsequent welding station, double transverse welds are made on the film with a pre-cut knurling in the space between the two welds, which will form one side of the bag that is to be formed.

[0036] After being folded into several parts in the longitudinal direction to reduce the bulk of the final roll, the film 1 enters the tearing station, shown schematically in Figure 1 and denoted by reference numeral 2, comprising an infeed conveyor belt 3 and an outfeed conveyor belt 4, between which is arranged a drum 5 carrying two opposing rods 6 between which the film 1 passes. The rotation of the drum causes the two rods 6 to interfere alternately with the film 1, putting it under tension until the pre-cut area is broken, forming the bags 7 shown in Figure 1.

[0037] Since the outfeed conveyor belt 4 has a lower speed than the infeed conveyor belt 3, on the belt 4 there is a partial overlap, for example of about 150 mm, of each bag 7 with the next one, thus creating a row of already cut and overlapped bags "in wallet form" which is accompanied by the conveyor belt 4 towards the reeling device 10 according to the invention, schematically shown more clearly in the enlargement of Figure 2, and in greater detail in the subsequent drawings.

[0038] Referring initially to Figure 2, the method of reeling of the bags 7 is briefly described.

[0039] The reeling device 10 comprises a drum 20 carrying a plurality of mandrels 11, four in this case, arranged

at 90° one from the other, which can be moved, in operation, between four workstations, denoted respectively by the initials S1, S2, S3, S4, proceeding clockwise, from the lowest to the right in the drawing.

[0040] As is the case in the prior art, in station S1 a respective mandrel 11, rotating at the same peripheral speed as the conveyor belt 4, makes contact therewith, initiating the reeling of the bags 7, thanks to the sending of an air blade.

[0041] Once the film has been fed onto the mandrel, the drum 20 rotates through 90°, bringing the mandrel into reeling, still in contact with the conveyor belt 4, in station S2, where the reeling is completed, until the roll of the established dimensions is formed.

[0042] A subsequent rotation of the drum brings the mandrel with the finished roll into station S3 where a moistened paper band, detached from a roll 8, is applied to seal the roll of bags.

[0043] A further rotation of the drum 20 translates the roll produced into station S4, where it is freed from the mandrel 11, as will be explained in detail here below, falling onto a chute 12 which makes it roll as far as a conveyor belt 13, by means of which it is evacuated in a transverse direction to the machine.

[0044] The mandrel 11 emptied of the roll is finally returned to the initial station S1.

[0045] What has just been described is the cycle of formation of a roll. It is clear that, during operation, all stations S1-S4 are occupied. Thus, for example, while in station S2 the reeling of a roll is being completed, in station S1 the reeling of a new roll has begun, just as in station S3 the application of the band takes place and in station S4 the unloading of the respective rolls takes place.

[0046] The structure of the reeling device 10 is shown schematically, as a whole, in Figures 3 and 4.

[0047] According to the invention, the drum 20 comprises two opposing flanges 21 mounted in a fixed position on a central shaft 22 that can be driven in rotation by an electric motor 23 by means of a belt 24 and a pulley 25 mounted at one end of the shaft. Naturally, other means for rotating the drum 20 are possible.

[0048] The mandrels 11 are arranged between the two flanges 21 and are each made up of two half-mandrels 30, which will also be referred to as grippers here below, carried by respective carriages 31, sliding on guides 32, to be brought from a position of closure, in which they protrude from the respective flanges 21 to come into contact one with the other, to a position of opening, in which they return into the flanges 21. More particularly, the half-mandrels 30 are slidably housed in corresponding guide sleeves 26 present in the flanges 21.

[0049] The positions of closure and opening of the half-mandrels 30 of a mandrel 11 are shown in Figures 5 and 6, respectively.

[0050] During functioning of the reeling device, the half-mandrels 30 are closed in the stations S1, S2 and S3 and open in station S4 to allow ejection of the formed roll.

[0051] The movement of opening and closure of the half-mandrels 30 can be controlled in any way, for example by a cam, by one or two motors or by pneumatic cylinders.

[0052] Figures 3, 4 show, merely by way of example, a mode of actuation in translation of the carriages 31, and thus of opening and closure of the half-mandrels 30.

[0053] It should be noted that the half-mandrels 30, in the stations S1, S2, S3, are normally held in closure by a magnet 33 integral with the respective guide 32, with which a fin 34 integral with the carriage 31 engages (see also Figures 5 and 6).

[0054] When a half-mandrel 30, following the rotation of the drum 20, arrives in the unloading station S4, a lever 35, protruding from the respective carriage 31, enters a channel 36 determined by two arched rods side by side 37 carried by a slide 40, sliding on a guide bar 41 attached to the fixed structure of the machine, shown in the drawings, more particularly by a beam 42 supported by an upright 43. In the slide 40 a nut 44 is formed, schematically shown in Figures 3a and 4a, which engages a screw 45 driven in rotation by a motor 46 by means of a pinion transmission 47 and belt 48.

[0055] Starting from the position of closed half-mandrels of Figure 3a, the translation to the left of the slide 40 initially causes the detachment of the fin 34 from the magnet 33, overcoming the force of attraction thereof, and then the backward movement in opening of the corresponding half-mandrel, up to the position of Figure 4a, thus freeing the roll of bags formed, considering that the same takes place for the other half-mandrel.

[0056] Subsequently, the slide 31 returns into the position of Figure 3a, bringing the corresponding half-mandrel 30 into closure, to form the complete mandrel 11 ready for a new reeling following the rotation of the drum 20, and therefore the exit of the lever 35 from the channel 36.

[0057] The structure of the half-mandrels or grippers 30 is seen more clearly in Figures 5 onwards.

[0058] Each half-mandrel 30 is internally hollow and has a median transverse slot 50, which extends for a large part of its length, starting from the free end, determining a pair of half-rounds 51 held open by an internal spacer 52.

[0059] In the work position, the spacer 52 is interposed between the two half-rounds 51, forcing the same outwards through interference with the respective support surfaces 53 (Figures 7, 7a). During the extraction phase, the spacer 52 retracts slightly (Figures 8, 8a), freeing the support surfaces 53 and consequently the two half-rounds 51 can move close one to the other through the effect of the constraining force of the roll that has just been reeled, reducing the external diameter that the two half-rounds 51 formed, consequently favouring the extraction of the roll once the half-mandrel is completely retracted, as shown in Figure 9.

[0060] The two half-mandrels or grippers 30, in the

phase of extraction, pull out one from one side and the other from the opposite side, applying an opposing force to the inner layers of the roll which cancels the crumpling effect. This, combined with the slight reduction in the outer diameter of the half-mandrels described above, allows any type of film to be reeled.

[0061] In order to prevent a flap of the roll from getting caught between one half-mandrel and the corresponding guide sleeve 26, the two half-rounds 51 have a respective longitudinal groove 54, extending longitudinally for part of their length, starting from the free end, with which corresponding scrapers 55 are engaged, made integral with the sleeves 26, which move the film away from them.

[0062] From what has been disclosed the advantages of the reeling device according to the invention appear clear, which, thanks to the particular conformation of the mandrels 11, allows even very elastic films, such as biodegradable films, to be processed.

[0063] Naturally the invention is not limited to the particular embodiment previously described and illustrated in the accompanying drawings, but numerous detailed changes may be made thereto within the reach of the person skilled in the art, without thereby departing from the scope of the invention itself, as defined in the following claims.

Claims

1. Reeling device (10) of interleaved bags (7) in plastic material, in particular waste collection bags, comprising a rotating drum (20) carrying a number of mandrels (11) apt to receive said interleaved bags (7) for forming rolls, passing through a plurality of stations (S1-S4), **characterised in that** said drum (20) comprises two opposing flanges (21), mounted in a fixed position on a central shaft (22), between which are arranged said mandrels (11), each consisting of two half-mandrels (30) carried by respective carriages (31) sliding on guides (32), to be brought from a closed position, in which they protrude from the respective flanges (21) to come into contact one with the other, forming a single mandrel, to an open position, wherein they re-enter the flanges (21), freeing the space between them.

2. Reeling device according to claim 1, **characterised in that** each half-mandrel (30) is internally hollow and has a median transverse slit (50), which extends for part of its length, starting from the free end, determining a pair of half-rounds (51) held open by an internal spacer (52).

3. Reeling device according to claim 2, **characterised in that** said spacer (52) is interposed between the two half-rounds (51) forcing the same outwards through interference with respective support surfaces (53), a slight retraction of the spacer freeing the support surfaces (53) and consequently causing the two half-rounds to come closer (51).

4. Reeling device according to any one of the preceding claims, **characterised in that** each half-mandrel (30) has at least one longitudinal groove (54), extending longitudinally for part of its length, from the free end, with which a corresponding scraper (55) on a respective guide sleeve (26) carried by a corresponding flange (21) engages.

5. Reeling device according to any one of the preceding claims, **characterised in that** each half-mandrel (30) is normally held in the closed position by a magnet (33) integral with the respective guide (32), with which a fin (34) integral with the carriage (31) engages, the movement into the open position being determined by a cam, an electric motor or a pneumatic cylinder.

6. Method of reeling interleaved bags (7) by means of a reeling device according to any one of the preceding claims, comprising a rotating drum (20) carrying four mandrels (11), each consisting of two half-mandrels (30), arranged at 90° one from the other, which can be moved, in operation, between four successive workstations (S1), (S2), (S3), (S4), said method comprising the following steps:

   - feeding with a conveyor belt (4) of a row of interleaved bags (7) to the station (S1), where a respective mandrel (11), rotating at the same peripheral speed of the conveyor belt (4), comes into contact therewith, starting the reeling of the bags (7), by sending an air blade;
   - rotation of the drum (20) through 90° to bring the mandrel during reeling, always in contact with the belt (4), into the station (S2), where the reeling is completed, until the roll of the established dimensions is formed;
   - subsequent rotation of the drum to bring the mandrel with the finished roll into the station (S3) where a band of moistened paper, detached from a roll (8), is applied to seal the roll of bags;
   - further rotation of the drum (20) to translate the roll produced into the station (S4), where it is released from the mandrel (11), falling onto a chute (12) which makes it roll as far as a conveyor belt (13), by means of which it is evacuated from the machine;
   - further rotation of the drum (20) to return the mandrel (11) emptied of the roll to the initial station (S1).

7. Method according to claim 6, wherein the unloading of the roll from the mandrel (11) takes place by retracting the two half-mandrels (30) into the respective flanges (21) of the drum (20).

8. Machine for the production of rolls of interleaved bags (7), comprising:

- an unwinding station for a single-fold film strip (1) open on one side, or closed on both sides;
- a welding station able to carry out at least one transverse weld on the film with a pre-cut knurling;
- an optional station of folding in several parts in the longitudinal direction of the film (1) in order to reduce the bulk of the final roll;
- a tearing station (2), comprising an infeed conveyor belt (3) and an outfeed conveyor belt (4), between which a rotating drum (5) is arranged, able to tension the film until the pre-cut area is broken, forming a row of bags (7) partially overlapped on the outfeed conveyor belt (4) advancing at a lower speed with respect to the infeed conveyor belt (3);
- a reeling station for said bags (7);

characterised in that said reeling station comprises a reeling device according to any one of claims 1 to 5.

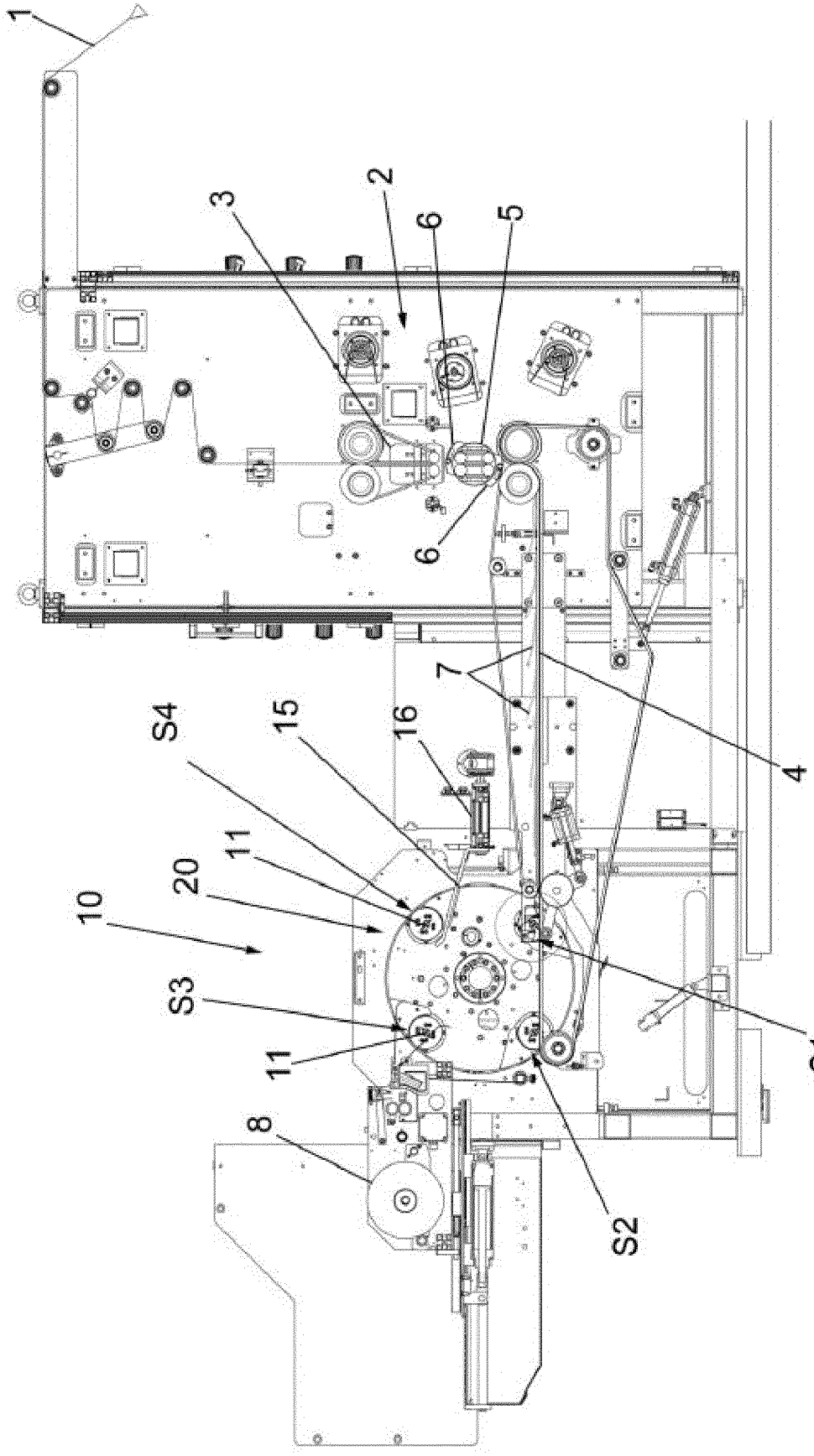

FIG. 1

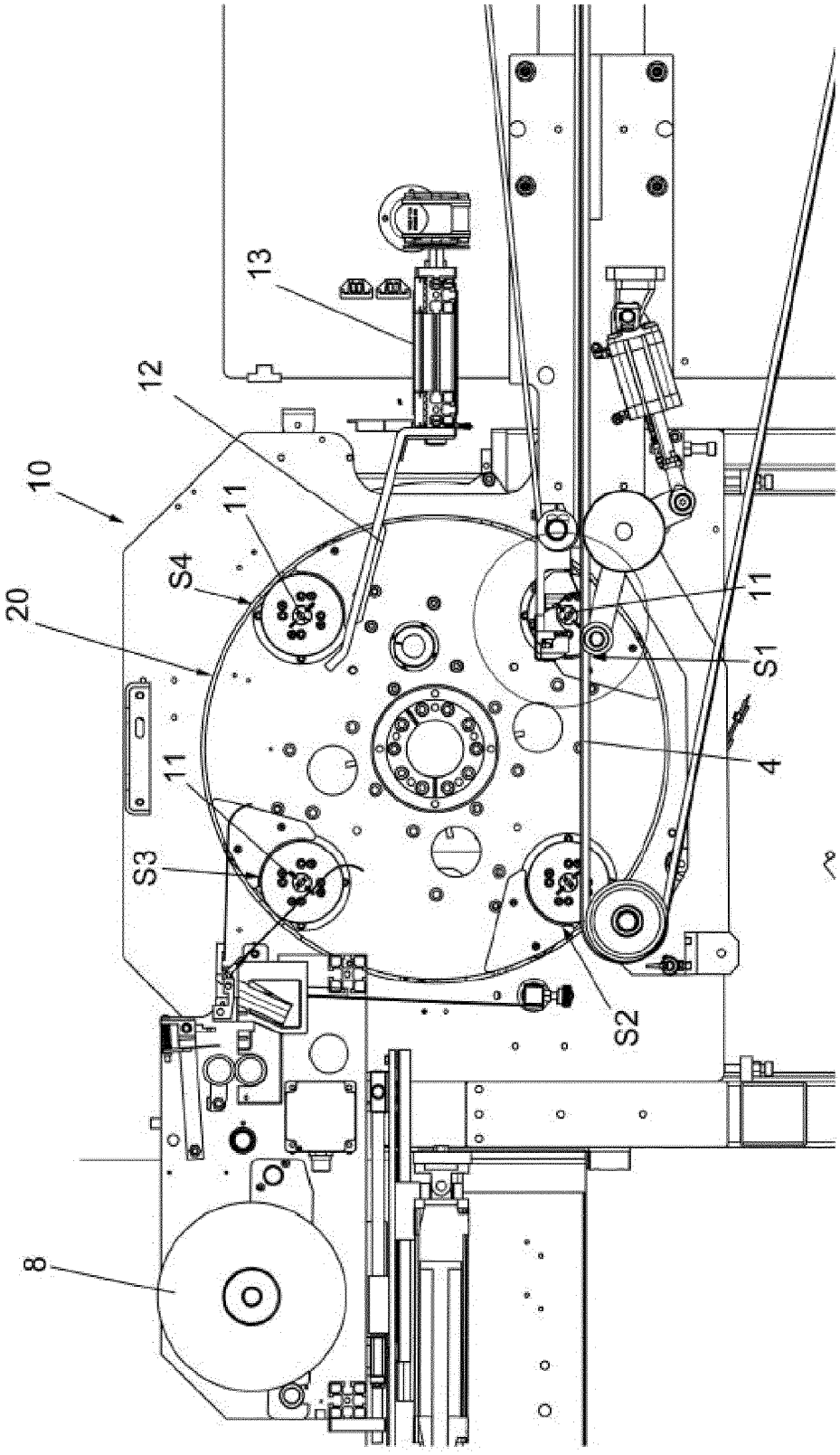

FIG.2

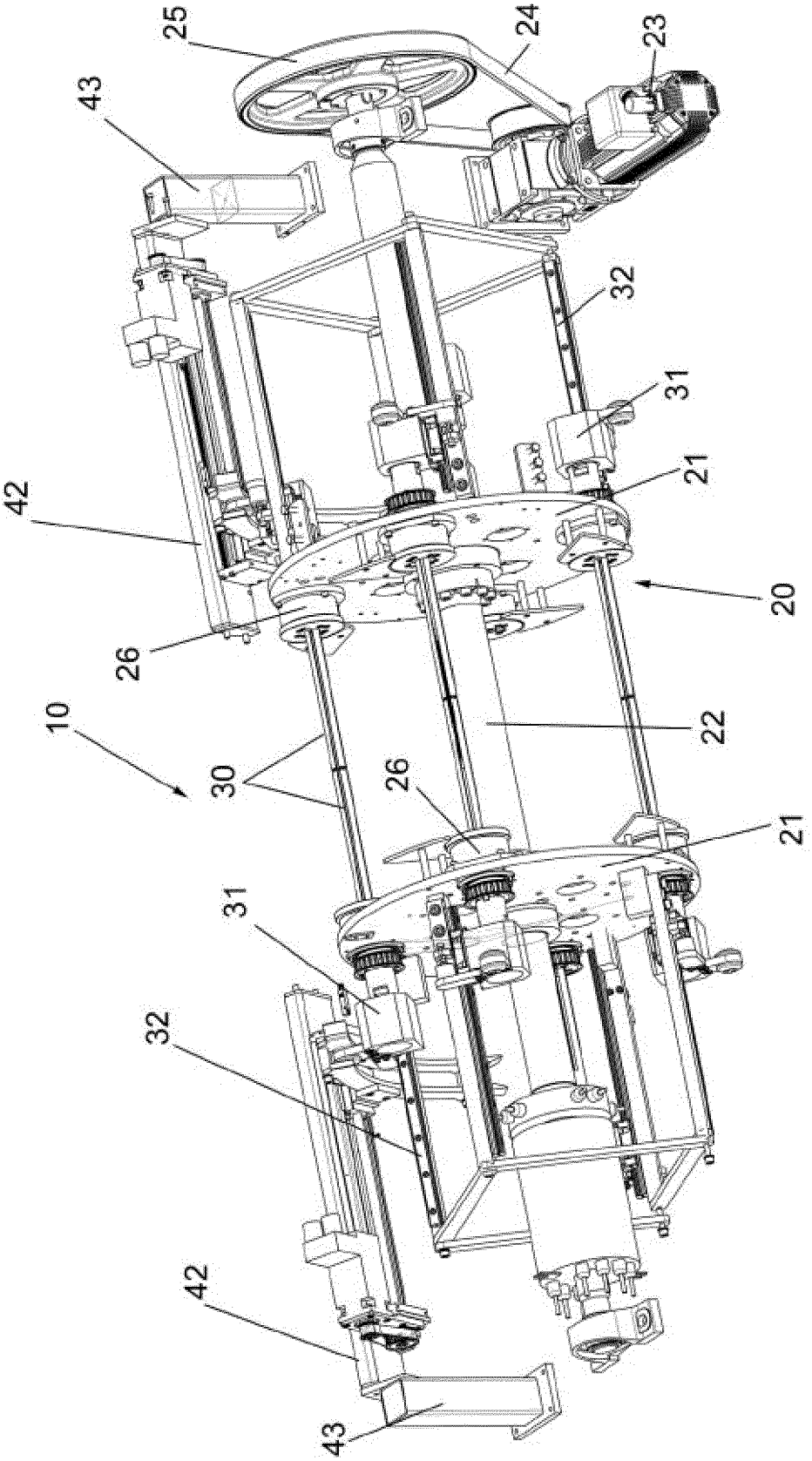

FIG. 3

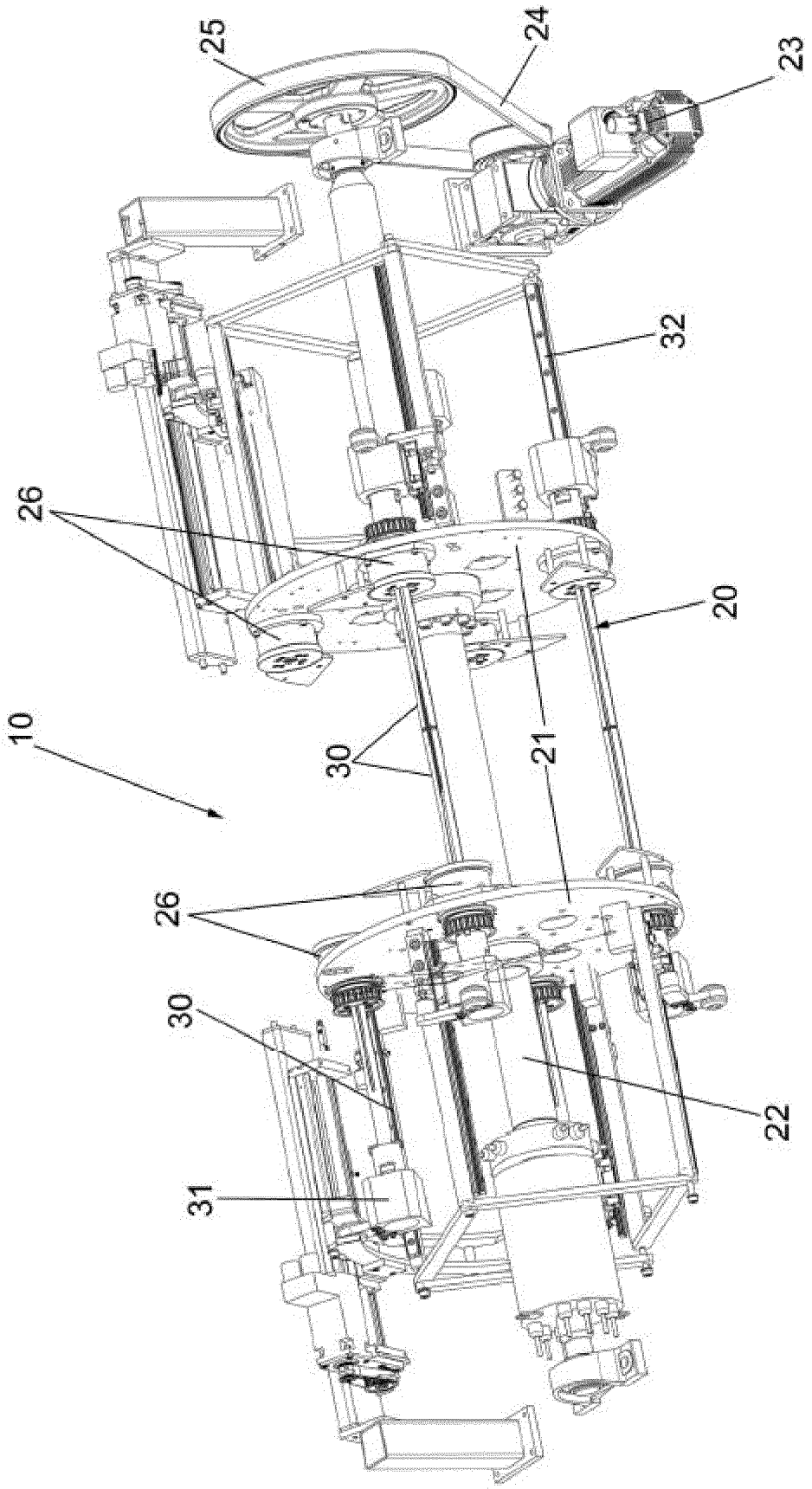

FIG.4

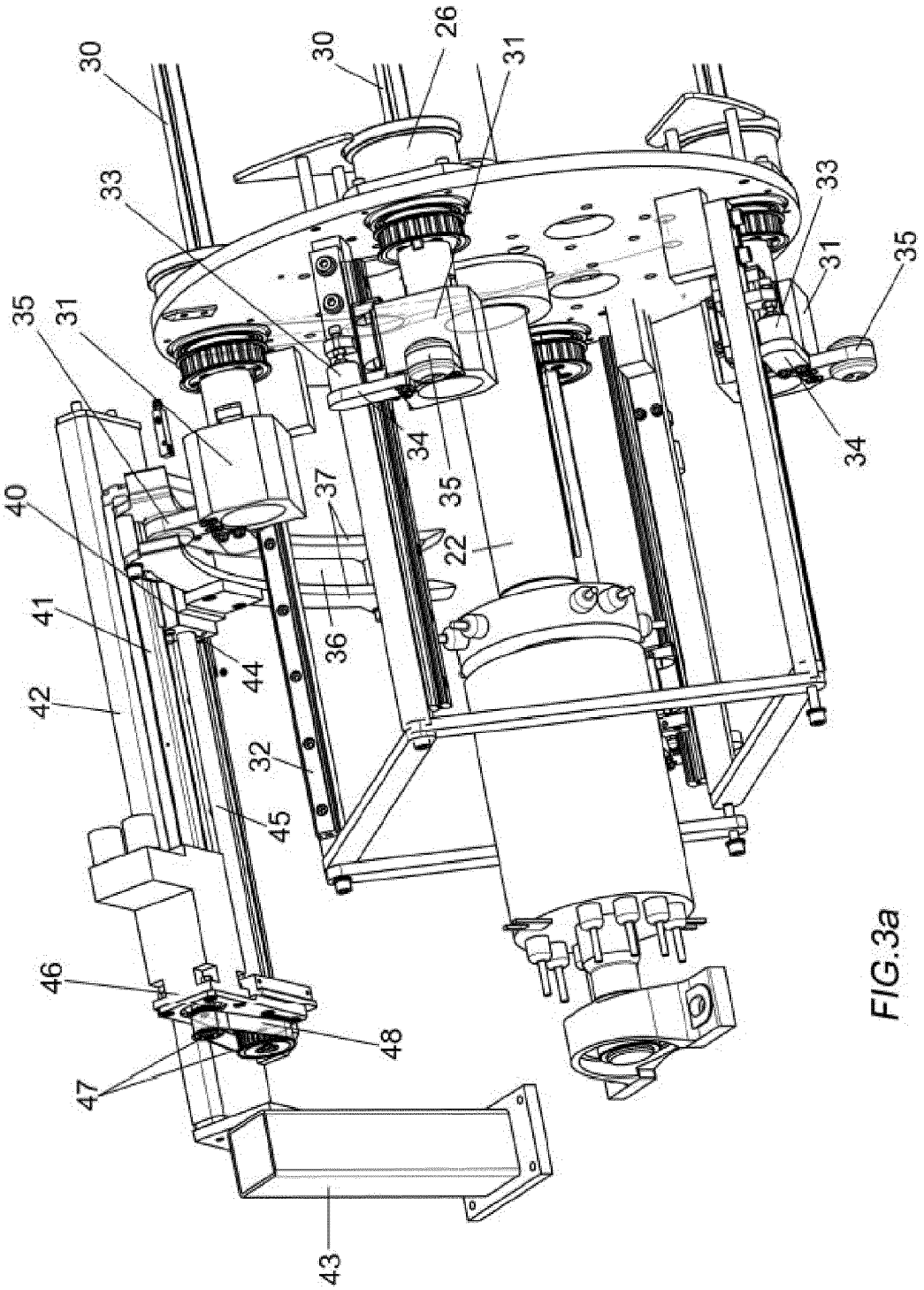
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FIG.3a

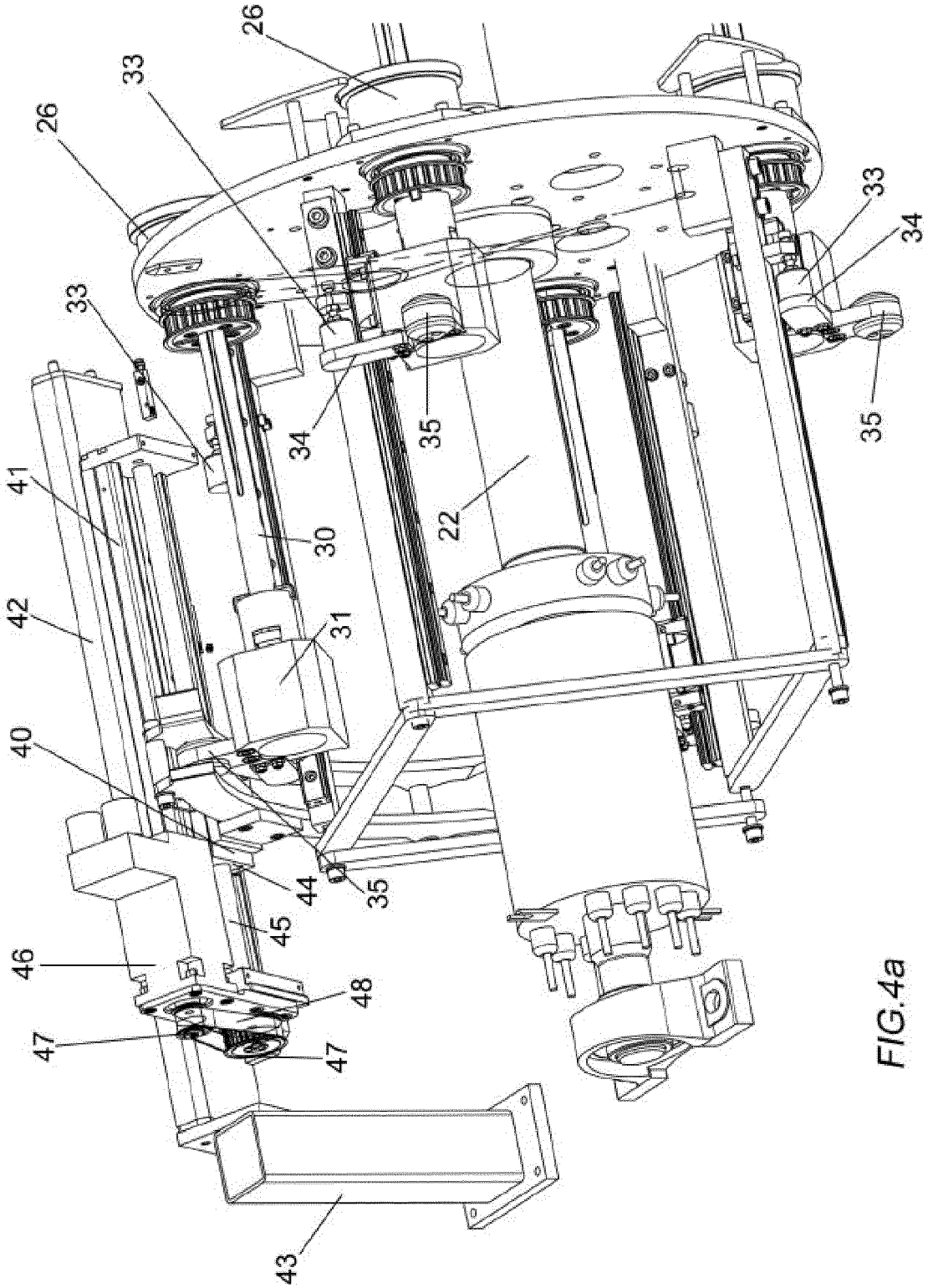

FIG.4a

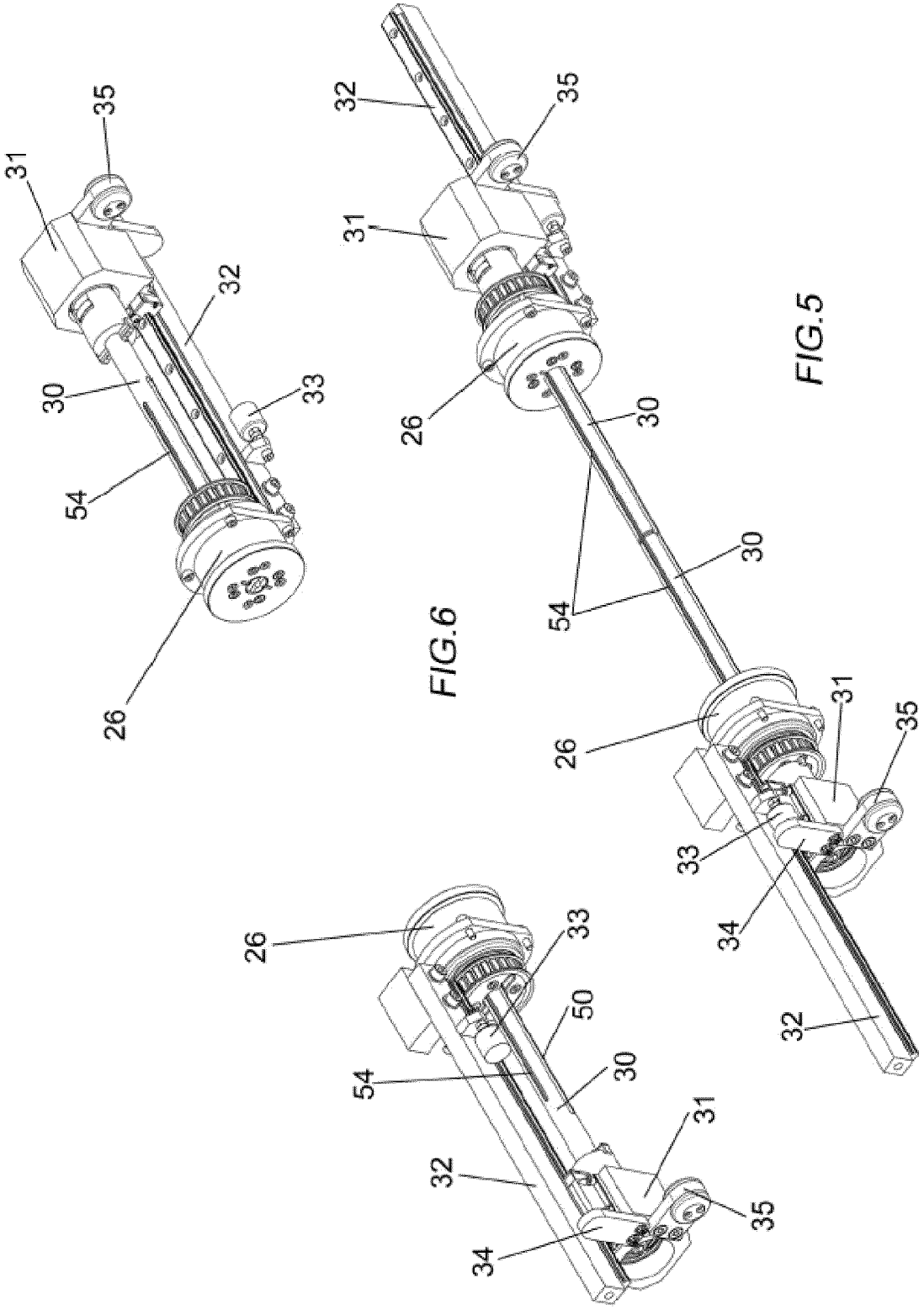
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FIG.5
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FIG.6

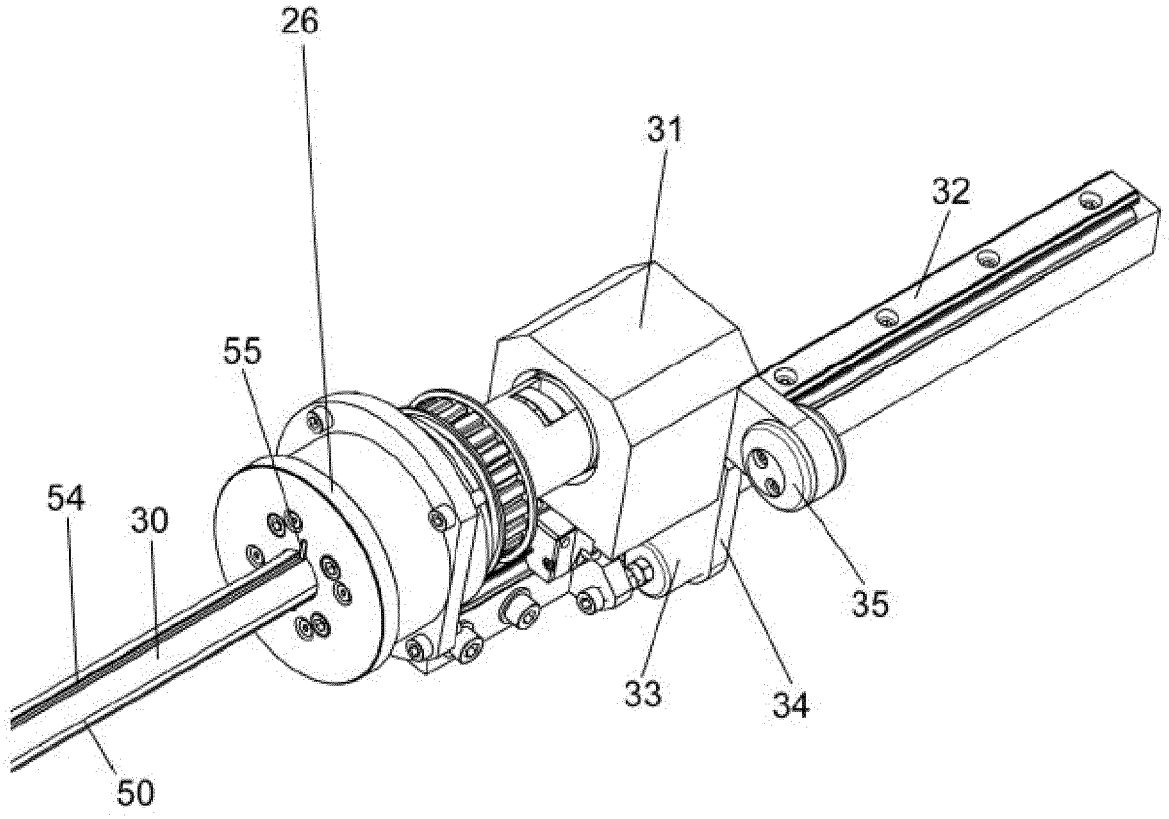

FIG.5a

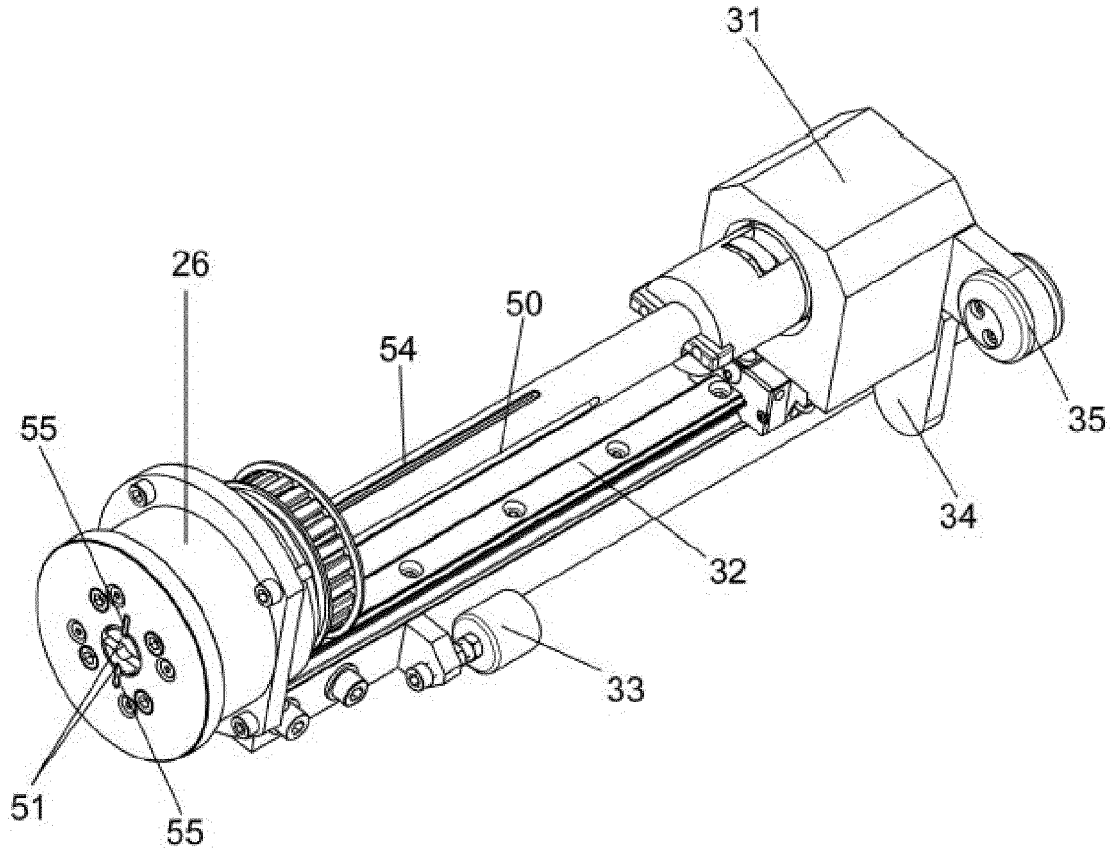

FIG.6a

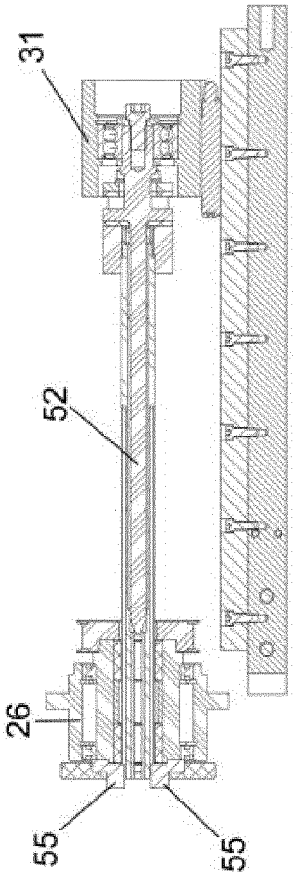

FIG.9

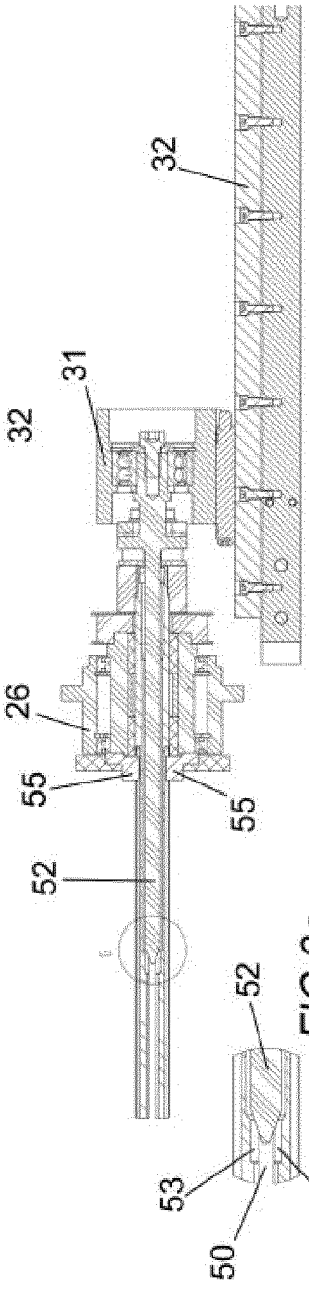

FIG.8a

FIG.8

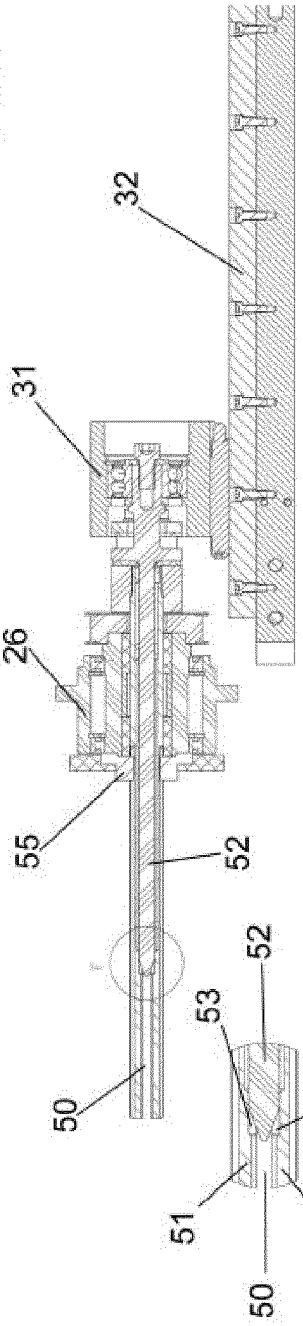

FIG.7a

FIG.7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 6447

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B31F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 August 2023	Ureta, Rolando

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