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(54) Automatic bobbin-exchanging device for webs of wrapping material.

(57) A device for automatically changing reels for feeding webs of wrapping material, especially for cigarette packaging machines, which comprises: a magazine for a row of coaxial full replacement reels (1), with means (2, 3) for successively feeding said reels (1) to a collecting station; an unwinding mandrel (20) whose axis is parallel with the axis of the row of reels (1), on which mandrel it is possible removably to lock an unwinding reel (1''); a transfer mandrel (16) parallel with the unwinding mandrel (20), on which it is possible removably to lock a full replacement reel (1') and which is mounted on a transfer arm (7), by which the full replacement reel (1') is moved from the collecting station (1') to a station (1''') for joining the head end of its web of wrapping material to the tail end of the web of the finished unwinding reel (1'') and then from the joining statioin (1''') to the unwinding station (1''''), where the replacement reel (1'''') is passed to the unwinding mandrel (20).

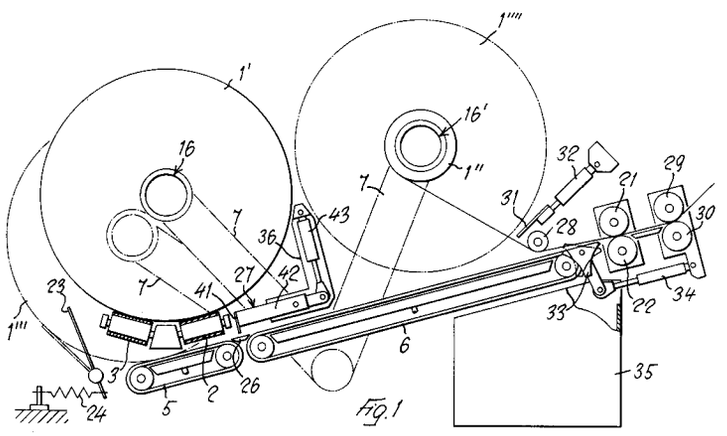

FIG. 1

EP 0 618 161 A2

The invention relates to a device for automatically changing reels for feeding webs of wrapping material, especially for cigarette packaging machines.

The object of the invention is to provide a reel-changing device of the type described above of inexpensive and relatively simple construction, capable in a functionally reliable way of automatically replacing finished reels of wrapping material with full reels even if these are very heavy, with no interruption in the web of wrapping material fed to the machine and without requiring that the machine be stopped.

The invention achieves the above objects with a device for changing reels for feeding webs of wrapping material, especially for cigarette packaging machines, which comprises:

- a magazine for a row of full replacement reels which stand coaxially with each other on feed means for successively feeding replacement reels from said row to a collecting station which collects the frontmost reel of said row;
- a first unwinding mandrel which is driven about an axis parallel with the common axis of the row of full reels in the magazine, on which mandrel it is possible removably to lock the core of an unwinding reel, which unwinding mandrel is movable in both axial directions;
- a second transfer mandrel which is also driven about an axis parallel with the first unwinding mandrel, is also movable in both axial directions and on which transfer mandrel it is possible removably to lock the core of the frontmost reel of the row of full replacement reels, said transfer mandrel being mounted on a transfer arm by which said frontmost full replacement reel, locked on the transfer mandrel, is transferred from the collecting station to a joining station in which the head end of its web is joined to the tail end of the web of the nearly finished unwinding reel, and then from the joining station to the unwinding station where, after the core of the finished unwinding reel has been removed from the unwinding mandrel, said full replacement reel is passed from the transfer mandrel to the unwinding mandrel.

In a preferred embodiment, the transfer arm is located in front of the row of full replacement reels and in front of the unwinding reel and is able to pivot about an axis parallel with the common axis of the row of full reels and able to move along said axis in both directions away from and towards the row of full replacement reels, while the transfer mandrel is carried in a stationary manner on the transfer arm and points towards the row of full reels in the opposite direction to the unwinding mandrel, which unwinding mandrel engages the reels on the rear side away from the transfer arm and the transfer mandrel on the front side nearest the transfer arm, the centres of the cores of the reels in the corresponding collecting, joining and unwinding stations being situated on the circular path of the axis of the transfer mandrel in the angular movement of the transfer arm.

In the collecting station the frontmost reel of the row of full reels is set back in the axial direction and parallel with that, with respect to the unwinding reel and with respect to the transfer arm, while when the head end of the replacement reel is being joined to the tail end of the finished unwinding reel, the full replacement reel in the joining station and the unwinding reel are situated such that their axes are parallel with each other and are lined up basically next to each other.

The transfer mandrel and unwinding mandrel are provided with an expandable head that engages the cores of the reels only half way into their axial lengths. After the core of the finished reel has been removed, the transfer of the full replacement reel from the joining station to the unwinding station and in that unwinding station from the transfer mandrel to the unwinding mandrel takes place by means of an axial movement of the unwinding mandrel in the direction of a laterally staggered position away from the full replacement reel on the transfer mandrel, to a position of mutual non-interference, followed by an angular movement of the transfer arm until the transfer mandrel is coaxial with the unwinding mandrel and a reverse axial movement of the unwinding mandrel towards the transfer mandrel, so that the first unwinding mandrel enters the core of the replacement reel on the opposite side from the transfer mandrel, while the two mandrels are rotating and brought to an identical speed of rotation and the unwinding mandrel is locked in the core of the full replacement reel by expanding and the transfer mandrel is disengaged from said core by the retraction of the expandable head and withdrawn from the core in an axial movement of the transfer arm away from the unwinding mandrel.

By this means the correct lateral alignment of the web is maintained at all times while being unwound.

Advantageously, the joining station comprises at least one endless suction-action conveyor belt which collects the head end of the full replacement reel and feeds it, towards the unwinding reel, to a subsequent joining device located downstream of the outlet end of the suction-action collecting/feeding belt, which belt extends in line with these reels underneath the replacement reel in the joining station and underneath the unwinding reel,

while the suction-action collecting/feeding belt is accompanied by a knife which detaches the head end of the web of the full replacement reel and a knife which cuts the tail end of the web unwound from the nearly finished unwinding reel at a point upstream of the joining device.

Advantageously, between the full replacement reel, in the joining station and the nearly finished unwinding reel, there is another knife which cuts off the unwanted front part of the head end of the web of wrapping material of the replacement reel in the joining station, while between the outlet end of the suction-action collecting/feeding belt and the joining device is a two-position deflector which deflects the web of wrapping material on the collecting/feeding belt either towards the joining device or towards a receptacle which collects the unwanted front part of the head end of the web of wrapping material.

In an improvement, the cutting knife is positioned above the suction-action collecting/feeding belt which consists of two independent suction-action conveyor belts arranged one after the other in line with each other in the direction of travel, while between these is a stationary part linking their conveying sides together and acting as a supporting surface on which the cutting knife can cut.

The advantages of the reel-changing device according to the invention are obvious from the above description. It is of a relatively simple construction comprising a limited number of constructional parts. Moreover, said parts can easily be made with the strength required to move even relatively heavy reels. The special arrangement of the collecting, joining and unwinding stations requires a very small number of displacements which can easily be controlled with the necessary precision even if the masses to be displaced are considerable. The fast that the joining means are made in the form of a suction-action belt to collect and feed the head end of the web of wrapping material from the replacement reel under which it runs, means that it is possible to grasp, guide and feed to the joining device the head end of the web of wrapping material with the necessary reliability and accuracy. These means too are easy to construct.

The invention also covers other characteristics which further improve the above-described device for changing reels of wrapping material, and these are the subject of the dependent claims.

The special characteristics of the invention and the advantages procured thereby will be described in greater detail in the description of a preferred embodiment which is illustrated by way of a non-restrictive example in the accompanying drawings, in which:

Fig. 1 is a schematic front view of one embodiment of the device according to the invention.

Fig. 2 is an enlarged lateral view showing the side of the magazine of full replacement reels for the devise shown in Fig. 1.

Fig. 3 is a partial top view of the device shown in Fig. 1.

Fig. 4 is an enlarged view in axial section of an expandable-head mandrel, in particular the transfer mandrel.

Fig. 5 is an enlarged detail of the rollers used to join the head end of the web of wrapping material from the replacement reel to the tail end of the nearly finished unwinding reel.

Fig. 6 is a transverse section of the two joining rollers shown in Fig. 5.

With reference to the figures, a device for changing reels for feeding webs of wrapping material, especially for cigarette packaging machines, is composed of a magazine for a row of full replacement reels 1. The replacement reels 1 stand coaxially side by side and are supported on underlying conveying means which advance them in the direction of their common axis. Said means consist of at least two endless conveyor belts 2 and 3 driven by a motor 4 in the direction of the common axis of the row of replacement reels 1. The two conveyor belts 2 and 3 run parallel with the common axis of the row of replacement reels 1 and are inclined to form a conveying cradle transversely to their length in symmetrically opposite directions at the external radius of the replacement reels 1.

In front of the outlet end of the conveying cradle of the row of replacement reels 1, with reference to its direction of advance, is a transfer arm 7 which pivots about an axis parallel with the common axis of the row of replacement reels 1. In particular, as can be seen in Fig. 2, the arm 7 is mounted on a shaft 8 parallel with the common axis of the row of replacement reels 1 and is rotated by a motor 9. The motor 9 is carried by a slide 10 in which the shaft 8 is supported rotatably on bearings 11. The slide 10 is engaged so as to be able to slide in both directions of the shaft 8, which is parallel with the common axis of the row of replacement reels 1, on a guide 12 and is caused to slide by a motor 13 via a transmission which may be of any type. In the example illustrated, the transmission is a screw and nut, the screw 15 being turned by the motor 13 and the nut 14 being fixed non-rotatably to the slide 10. At its free end, the transfer arm 7 carries without relative movement a transfer mandrel 16 with an expandable head. The axis of rotation of the transfer mandrel 16 is parallel with the common axis of the row of replacement bobbins 1 and extends towards the frontmost replacement reel 1' of the row immediately in front of it. The relative position of the

transfer mandrel 16 and of the row of replacement reels on the conveyor belts 2, 3 are such that the axis of the replacement reels 1 on the conveyor belts 2, 3 coincides with the circular path followed by the transfer mandrel 16 as the transfer arm 7 pivots. The transfer mandrel 16 can therefore be moved angularly to a position coaxial with the core 101 of the frontmost replacement reel 1' of the row, while because of the slide 10 it can be moved axially away from and towards it and its expandable head 17 inserted into the core 101. Advantageously, behind the expandable head 17, the transfer mandrel 16 has radial stops to limit its insertion into the core 101 of a replacement reel 1. These means may take the form of a disc 18 against which the opposite front side of the replacement reel 1 is pushed. Preferably, the insertion-limiting disc 18 carries sensors 19 to sense the presence of the replacement reel 1 on the transfer mandrel 16: these sensors may be of any type suitable for the purpose.

The conveyor belts 2 and 3 of the magazine are driven in advancing steps so as one by one to bring the first frontmost replacement reel 1' of the row to the collecting station at their outlet end.

Next to the magazine of the row of replacement reels 1 is an unwinding station with an unwinding mandrel 20 (Figs. 1 and 3) for an unwinding reel 1''. The axis of the unwinding mandrel 20 is parallel with the common axis of the row of replacement reels 1 and extends in the opposite direction to that of the transfer mandrel 16, so that it engages the unwinding reel 1'' from the opposite side to that from which the transfer mandrel 16 engages the corresponding replacement reel 1'. The unwinding mandrel 20 is mounted in a stationary manner in a position in which its axis coincides with the circular path of the transfer mandrel 16 on the transfer arm 1, so that said transfer mandrel 16 can be carried in opposition to the unwinding mandrel 20, coaxially therewith, as indicated by the numeral 16' in Fig. 1.

The unwinding mandrel 20 is also supported in such a way that it can move axially in both directions in the same way as can the transfer arm 7, on a slide 10 mounted on guides 12 and moved by means of a motor 13 via a screw and nut transmission 14, 15.

Similarly, the unwinding mandrel 20 has an expandable head 17, behind which is an insertion-limiting disc 18 which also carries a sensor 19 to sense the presence of the unwinding reel 1'' on the mandrel 20.

A further characteristic which is clear particularly from Fig. 3 is that the expandable heads 17 of the transfer mandrel 16 and unwinding mandrel 20 are of such dimensions, and are so positioned with respect to the insertion-limiting disc 18, that when the core 101 of a reel 1 is engaged, these heads do not project beyond the halfway line of the axial length of the cores 101. Consequently a single reel 1 can accommodate in its core 101, simultaneously and on opposite sides, the expandable heads 17 of both the opposing mandrels, namely the transfer mandrel 16 and the unwinding mandrel 20.

With reference to Figs. 2 and 3, it is clear that the first replacement reel 1' in the station where they are collected from the magazine, which is located at the outlet end of the conveyor belts 2 and 3, is set back axially and parallel with respect to the unwinding reel 1'' in the unwinding station, on the unwinding mandrel 20, to an extent that is approximately equal to, and preferably slightly greater than, the thickness of the reels 1.

Between the transfer arm 7 and the outlet end of the conveyor belts 2 and 3 of the magazine for the row of full replacement reels 1 is a joining station which joins the head end of the replacement reel 1''' (shown by the dot-and-dash lines in Figs. 1 and 2 and in solid lines in Fig. 3) in said station to the tail end of the nearly finished reel 1'' in the unwinding station. The joining station comprises a suction-action collecting/feeding belt 5 which runs transversely, especially perpendicularly, to the common axis of the row of replacement reels 1 and close to them. The suction-action collecting/feeding belt 5 is located at a lower level than the conveyor belts 2 and 3 of the magazine. It is driven along in the direction of the unwinding mandrel 20 and is inclined upwards relative to the horizontal plane towards this mandrel. The arrangement of the suction-action collecting/feeding belt 5 is such that it is in line with the unwinding reel 1'' on the unwinding mandrel 20. Therefore, as can be seen in Fig. 1, the frontmost replacement reel 1' is taken from the collecting station, from the magazine, by means of an angular movement of the transfer arm 7 whereby the transfer mandrel 16 is brought coaxial with the core 101 of said reel 1' followed by an axial movement of approach to said replacement reel 1', whereby its expandable head 17 is inserted into the core 101 until the reel 1' stops against the insertion-limiting disc 18. After the core has been grasped by the expansion of the head 17 of the transfer mandrel 16, the full replacement reel 1' is removed coaxially from the row of replacement reels 1 in a reverse axial movement of the transfer arm 7 and brought to the position marked 1''' in the joining station by an angular movement of the transfer arm 7 in the opposite direction to the unwinding station. Furthermore the conveyor belts 2 and 3 are so driven as to advance the row of replacement reels 1 towards their outlet end, bringing the next frontmost reel of the row to the collecting station. In the joining station, the replacement reel 1''' is aligned vertically above the collect-

ing/feeding belt 5 and with the unwinding reel 1'' on the unwinding mandrel 20, as shown in Figs. 1, 2 and 3.

At the inlet end of the suction-action collecting/feeding belt 5 is a knife 23 which detaches the head end of the web of wrapping material from the full replacement reel 1'''. The detaching knife 23 is aligned with said collecting/feeding belt 5, is supported so as to be able to pivot about an axis parallel with the axis of the full replacement reel 1''' and is loaded elastically by a spring 24 against this reel. The correct position of alignment of the full replacement reel in the joining station, as indicated by 1''', is verified by means of two position sensors 25 that are located above the reel in position 1''', are separated in the axial direction thereof by an amount equal to its thickness and are each associated with one of the front sides of the reel. The head end of the web of wrapping material detached by the detaching knife 23 is taken by the suction-action collecting/feeding belt 5 and fed by it towards the unwinding mandrel 20.

Another suction-action collecting/feeding belt 6 is provided as an extension of the first collecting/feeding belt 5 and is aligned with the latter, extending underneath the unwinding reel 1'' on the unwinding mandrel 20 and in vertical alignment with it. The second suction-action collecting/feeding belt 6 is driven along in the same direction as the first belt 5. Downstream of its outlet end is a pair of opposing joining rollers 21, 22 between which the web of wrapping material from the unwinding reel 1'' is also passed by means of a deflecting roller 28. Downstream of the joining rollers 21, 22 is a pair of drive rollers 29, 30 which drive the unwound web of wrapping material along. The two pairs of rollers 21, 22 and 29, 30 are parallel with each other. The rollers 21, 22 and 29, 30 of each pair are lined up perpendicularly to the surface on which the web of wrapping material is being conveyed and the areas of mutual contact between the rollers lie in the extension of said conveying plane.

In the unwinding station, between the unwinding reel 1'' and the deflecting roller 28 is a knife 31 which cuts off the tail end of the web of wrapping material unwound from that reel. The cutting knife is carried on the end of actuating means 32 which move it from the inactive withdrawn position to the active cutting position on the web of wrapping material. These actuating means 32 may be linear actuators, such as pneumatic or hydraulic cylinders or the like.

In an improvement, between the two suction-action collecting/feeding belts 5, 6, that is to say in an intermediate position between the replacement reel 1''' in the joining station and the unwinding reel 1'' in the unwinding station, is a linking part 26 which constitutes the cutting surface for another cutting knife 27. The cutting knife 27 is for cutting the head end of the web of wrapping material unwound from the full replacement reel in position 1'', whose end has been detached from the reel 1''' by the detaching knife 23. Also, between the outlet end of the suction-action collecting/feeding belt 6 and the pair of joining rollers 21, 22 is a deflecting part 33 which deflects the web or wrapping material unwound from the replacement reel 1''' which, by means of an actuator 34, can be moved alternately to a position of feeding the web of wrapping material to the joining rollers 21, 22 or to an underlying receptacle 35 for offcuts. Hence the head end of the web of wrapping material of the replacement reel 1''' in the joining station, whose front end has been detached from it by the detaching knife 23, can be cut from the next length of wrapping material by the knife 27 and deflected as required into the offcuts receptacle 35, so that any damage to the head end cannot have negative repercussions during later processing stages, leading to errors in joining or faulty packets.

Following the cutting off and discarding of the head end unwound from the replacement reel 1''', whose end was detached by the detaching knife 23, the next head end of the web of wrapping material of said reel is guided by the suction-action collecting/feeding belts 5, 6 to the joining rollers 21, 22, to which it is fed together with the tail end of the web of wrapping material unwound from the nearly finished unwinding reel 1'', underneath it in a position of perfect alignment and superimposition of the two lengths of wrapping material one upon the other.

The process of making the join involves activating the joining knife 31 which separates that part of the web of the finished unwinding reel 1'' which is joined to the head end of the web of the replacement reel 1''', from the final end of the web which is possibly still wound on the core 101 of the finished unwinding reel 1''. Next, after the core 101 of the finished reel 1'' has been taken off the unwinding mandrel 20, the transfer arm 7 is made to transfer the replacement reel 1''' to the same unwinding mandrel 20. As Figs. 1 and 3 clearly show, this transfer is performed by an axial movement of the unwinding mandrel 20 laterally away from the belt or belts 5 and 6 and away from the full replacement reel 1''' into a position where there can be no interference between said replacement reel 1''' and the head 17 of the unwinding mandrel 20. The transfer arm 7 is then moved angularly to bring the replacement reel on the transfer mandrel 16 into a coaxial position in front of the unwinding mandrel 20, as indicated by the dot-and-dash lines and by 1'''' in Fig. 1. The unwinding mandrel 20 which is turning at the same speed as the transfer mandrel 16 is moved axially in the reverse direc-

tion towards the transfer mandrel 16 until its expandable head 17 enters the core 101 of the replacement reel. The expandable head 17 of the unwinding mandrel 20 is locked into the core 101, while that of the transfer mandrel 16 is made inactive and withdrawn and the transfer mandrel 16 can be retracted and returned to the collecting station in front of the replacement reel 1' of the row of reels 1, by means of an axial movement away of the transfer arm 7 and a subsequent angular movement towards the magazine of replacement reels 1. The axial movement of the mandrels 16 and 20 means that the replacement reel 20 has maintained its correct lateral alignment throughout the transfer.

With reference to Fig. 3, the cutting knife 27 is so supported that it can move from a position of operational readiness in which it is above the web of wrapping material on the suction belts 5 and 6 and a rest position in which it is withdrawn laterally to the side of the suction belts 5 and 6. In the example illustrated, the cutting knife 27 consists of a supporting bracket 36 that is supported movably on a pair of extensible arms. In particular, the bracket 36 is carried by two parallel horizontal arms 37 which are parallel with the axes of the reels 1, 1', 1'', 1''' and slide longitudinally in coinciding tubular guides 38 in the supporting frame. The slide 36 is moved by a linear actuator 39 which is parallel with the two arms 37 in an intermediate position between them and is hinged at one end to the frame 40 and at the other to the bracket 36. The blade 41 of the knife is supported in a position of approximate perpendicularity to the web of wrapping material and can pivot towards the latter on a knife holder 42 which pivots about a horizontal axis running transversely to the web of wrapping material as it is guided along the suction belts 5 and 6. In particular, the axis of pivoting is situated at an intermediate point on the knife holder 42, while one of its ends carries the blade 41 and the other end is hinged to the rod of a linear actuator 43 which is perpendicular to the surface of the wrapping material and is fixed at its opposite end to a corresponding extension of the bracket 36.

Fig. 4 illustrates in detail the construction of the expandable-head mandrels with reference to the transfer mandrel 16 only, said mandrels being basically identical. Inside a tubular cylindrical casing 50 is a first tubular cylindrical shaft 53 supported rotatably about its axis on bearings 51 with sealing rings 52 at the ends of the casing 50. The forward end of the tubular cylindrical shaft 53 projects out of the end of the tubular casing 50, with which the insertion-limiting disc 18 is integrally formed. The other end projects into an extension of the tubular casing 50 and has a thread on which is screwed a nut 54 pressing axially against an external annular shoulder 153 of the tubular shaft 53, against bearings 51 and against cylindrical tubular distance pieces 55 that are located between these and the nut and rotate with the tubular shaft 53. The bearings 51 are furthermore housed in internal annular grooves in the tubular casing 50 which are defined axially by annular widenings 150 of the casing 50 and also by radial internal shoulders 156 on removable end pieces 56 of the casing 50.

Housed inside the tubular shaft 53 is another shaft 57 which transmits the rotary drive motion of a motor 58 to the expandable head 17. The transmission shaft 57 is coupled in rotation to the tubular cylindrical shaft 53 by a key 58 in an axial groove 253 thereon and can slide coaxially axially in the tubular shaft 53 in both directions. The key 58 is located at the forward end of the transmission shaft 57 and the groove 253 is greater in axial length than the key 58 in order to permit the mutual axial sliding of the shafts 53 and 57 and is opened appropriately at the end of the cylindrical shaft 53 for easy fitting. The expandable head 17 is carried by the limiting disc 18 and comprises a cup part 117 inside which there are mounted for radial sliding a plurality of angularly equidistant jaws 217. Mounted on the expandable-head 17 end of the transmission shaft 57 is a frustoconical expander part 59 which projects coaxially into the cup body 117 and is so oriented as to be divergent towards its free end. The jaws 217 press against the surface of the expander part 59 with the ability to slide axially over it, their internal axial side being inclined in conformity with the frustoconical surface of the expander part 59, and they are loaded radially inwards against the expander part 59 by springs 60. Therefore, the axial sliding of the transmission shaft 57 through the tubular shaft 53 in one direction causes the jaws 217 to move out and in the other direction to retract radially.

At the opposite end, the transmission shaft 57 is coupled in rotation to, and able to slide axially relative to, the shaft 61 of a motor 62. The corresponding end of the transmission shaft 57 is tubular and has internal axial splines in which the splined end 161 of the motor 62 shaft 61 engages.

The axial movement of the transmission shaft 57 is controlled by a forked lever 63 whose fulcrum is at 64 and which pivots to cause the transmission shaft 57 to slide. The forked lever 63 projects from the tubular casing 50 and is hinged at its outer end to the rod 165 of a linear actuator 65 which is fixed to the tubular casing 50 and is oriented such that the rod 165 slides parallel with the transmission shaft 57. The forked lever 63 engages at an intermediate point via rollers 66 in an external annular groove 67 provided externally on that end of the transmission shaft 57 where the motor 62 is coupled. Pivoting of the lever therefore causes the transmission shaft 57 to move axially to expand or

retract the head 17, and enables the same to rotate.

With reference to Figs. 5 and 6, the joining of the tail end of the web from the finished reel 1'' to the head end of the web from the replacement reel 1''' is done by simultaneously deforming the two webs laid one upon the other. This deformation can be of any design. The parallel contrarotating joining rollers 21, 22 consist of a deforming roller with impression reliefs 122 on at least part of its outer surface, and a roller covered externally in a layer of an elastically deformable material or a metal roller comprising the negative form of the above reliefs.

An advantageous characteristic is that the impression reliefs 122 are so arranged as to form deformations of circular design. This ensures that the two layers of wrapping material hold fast to each other in any direction of relative movement. They are preferably arranged so as to form one or more parallel rows of areas of deformation 222 of circular design. In particular, the impression reliefs 122 are so shaped as to present at least two arms at an angle, e.g. forming an L, which are arranged on one or more concentric circles in each area of deformation 222.

Claims

1. Device for automatically changing reels for feeding webs of wrapping material, especially for cigarette packaging machines, which comprises:
   - a magazine for a row of full replacement reels (1) which stand coaxially with each other on feed means (2, 3) for successively feeding replacement reels (1) from said row to a collecting station which collects the frontmost reel (1') of the row of replacement reels (1);
   - a first unwinding mandrel (20) which is driven about an axis parallel with the common axis of the row of full reels (1) in the magazine (2, 3), on which mandrel it is possible removably to lock the core (101) of an unwinding reel (1''), which unwinding mandrel (20) is movable in both axial directions;
   - a second transfer mandrel (16) which is also driven about an axis parallel with the first unwinding mandrel (20), is movable in both axial directions and on which transfer mandrel (16) it is possible removably to lock the core (101) of the frontmost reel (1') of the row of full replacement reels (1), said transfer mandrel (16) being mounted on a transfer arm (7) by which said frontmost full replacement reel (1'), locked on the transfer mandrel (16), is transferred from the collecting station (1') to a joining station (1''') in which the head end of its web of wrapping material is joined to the tail end of the web of the nearly finished unwinding reel (20), and then from the joining station (1''') to the unwinding station (1'') where, after the core (101) of the finished unwinding reel (1'') has been removed from the unwinding mandrel (20), said full replacement reel (1'''') is passed from the transfer mandrel (16) to the unwinding mandrel (20), while the transfer mandrel (16) is then disengaged from the reel (1'''') and returned from the unwinding station to the magazine.

2. Device according to Claim 1, characterized in that the transfer arm (7) is located in front of the row of full replacement reels (1) and in front of the unwinding reel (1'') and is able to pivot about an axis parallel with the common axis of the row of full replacement reels (1) and able to move along said axis in both directions away from and towards them, while the transfer mandrel (16) is carried in a stationary manner on the transfer arm (7) and points towards the row of full replacement reels (1'), in the opposite direction to the unwinding mandrel (20), which unwinding mandrel (20) engages the reels on the rear side away from the transfer arm (7) and the transfer mandrel (16) on the front side nearest the transfer arm (7), the centres of the cores (101) of the reels (1, 1', 1'', 1''') in the corresponding collecting, joining and unwinding stations being situated at a point on the circular path of the axis of the transfer mandrel (16) in the angular movement of the transfer arm (7).

3. Device according to Claim 2, characterized in that in the collecting station the frontmost reel (1') of the row of full replacement reels (1) is set back in the axial direction and parallel with that, with respect to the unwinding reel (1'') on the unwinding mandrel (20), and with respect to the transfer arm (7), while the full replacement reel (1''') in the joining station and the unwinding reel (1'') are situated such that their axes are parallel with each other and are lined up basically next to each other.

4. Device according to Claim 3, characterized in that in the collecting station the full replacement reel (1''') is interposed between the next frontmost full replacement reel (1') of the row of replacement reels (1) fed to the collecting station and the transfer arm (7) and is located

at a lower level than the row of replacement reels (1), the transfer arm being moved initially to a position such that the transfer mandrel (101) is coaxial with the core (101) of the frontmost full replacement reel (1') in the collecting station and then moved axially towards it, while after it has been locked onto the transfer mandrel (16) the transfer arm (7) is moved axially away from the row of reels and then lowered angularly in the opposite direction to the unwinding mandrel (20).

5. Device according to Claim 3 or 4, characterized in that the transfer mandrel (16) and unwinding mandrel (20) are provided with an expandable head (17) that engages the cores (101) of the reels (1) only half way into their axial lengths, while the transfer of the full replacement reel (1''') from the joining station to the unwinding station (1'''') and in that unwinding station (1'''') from the transfer mandrel (16') to the unwinding mandrel (20) takes place by means of a first axial movement laterally away from the unwinding mandrel (20) from the plane containing the replacement reel (1''') to a position of mutual non-interference between the head (17) of said unwinding mandrel (20) and the replacement reel (1''') on the transfer mandrel (16), during a subsequent angular movement of the transfer arm (7) from the joining station in the coaxial position of the transfer mandrel (16) with the unwinding mandrel (20) and then by means of a reverse axial movement of the unwinding mandrel (20) towards the replacement reel (1'''') so that the head (17) of said unwinding mandrel (20) enters its core (101), the unwinding mandrel (20) being driven at the same speed of rotation as the transfer mandrel (16') and engaged by expanding the head (17) inside the core (101) of the replacement reel (1'''') and the transfer mandrel (16') being then disengaged from said core (101) by the retraction of the expandable head (17) and withdrawn from the core in an axial movement of the transfer arm (7) away from the unwinding mandrel (20).

6. Device according to one of more of the preceding claims, characterized in that the joining station comprises at least one endless suction-action conveyor belt (5) which collects the head end of the full replacement reel (1''') and feeds it, towards the unwinding reel (1''), to a subsequent joining device (21, 22) located downstream of the outlet end of the suction-action collecting/feeding belt (5), which belt extends in line with the replacement reels (1''', 1'') in the joining and unwinding station, while the suction-action collecting/feeding belt (5) is accompanied by a knife (23) which detaches the head end of the web of wrapping material from the full replacement reel (1''') and a knife (31) which cuts the tail end of the web of wrapping material unwound from the nearly finished unwinding reel (1'') at a point upstream of the joining device (21, 22).

7. Device according to Claim 6, characterized in that between the full replacement reel (1'''), in the joining station and the nearly finished unwinding reel (1''), there is another knife (27) which cuts off the unwanted front part of the head end of its web of wrapping material, while between the outlet end of the suction-action collecting/feeding belt (5, 6) and the joining device (21, 22) is a two-position deflector (33) which deflects the web of wrapping material on the collecting/feeding belt (5, 6) either towards the joining device (21, 22) or towards a receptacle (35) which collects the unwanted front part of the head end of the web of wrapping material.

8. Device according to Claim 7, characterized in that the cutting knife (27) is positioned above the suction-action collecting/feeding belt which consists of two independent suction-action conveyor belts (5, 6) arranged one after the other in line with each other in the direction of travel, while between these is a stationary part (26) linking their conveying sides together and acting as a supporting surface on which the cutting knife (27) can cut.

9. Device according to one or more of the preceding claims, characterized in that the means (2, 3) which feed the row of replacement reels (1) to the collecting station (1') consist of two mutually parallel conveyor belts running in the same direction towards the transfer arm (7), which conveyor belts (2, 3) run in the direction of the common axis of the row of reels (1) and are inclined to form a cradle transversely to their length with respect to the horizontal plane at the external diameter of the replacement reels (1) of the row.

10. Device according to one or more of the preceding claims, characterized in that the joining device consists of two parallel contrarotating rollers (21, 22) pressing against each other, there being fed between them, laid one upon the other and in line with each other, the head end of the web of wrapping material unwound from the replacement reel (1''') in the joining station and on top of it the tail end of the web

of wrapping material from the finished unwinding reel (1''), one roller (22) being provided with impression reliefs (122) and the other roller being provided with an elastically yielding covering (121) or being made of metal and provided with recesses complementary to the reliefs.

11. Device according to Claim 10, characterized in that the impression reliefs (122) are arranged on a circular area (222) or on several adjacent or successive areas (222) of circular shape.

12. Device according to Claim 11, characterized in that the impression reliefs (122) comprise a radial arm and a tangential arm and are arranged in each area (222) on one or more concentric circles.

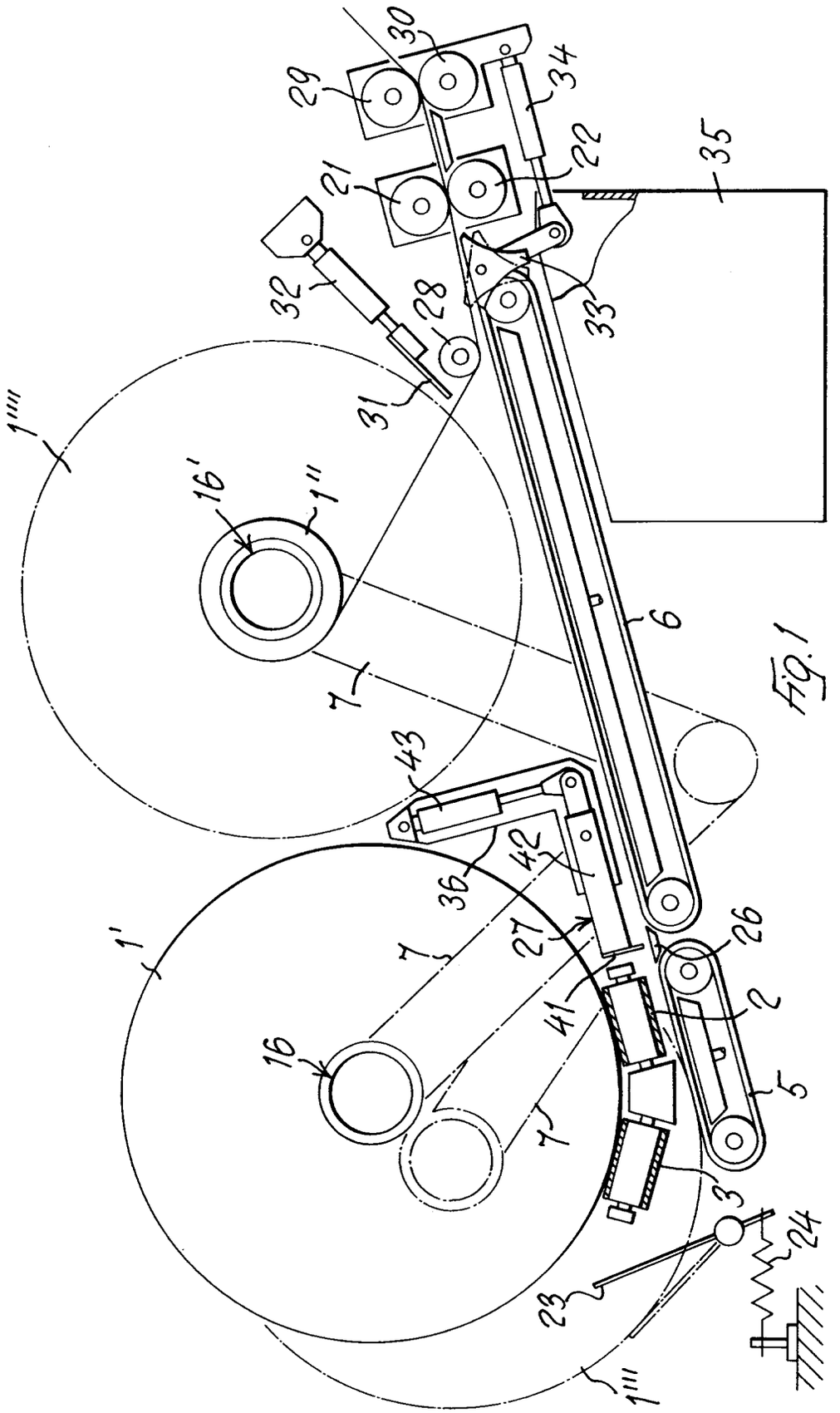

Fig. 1

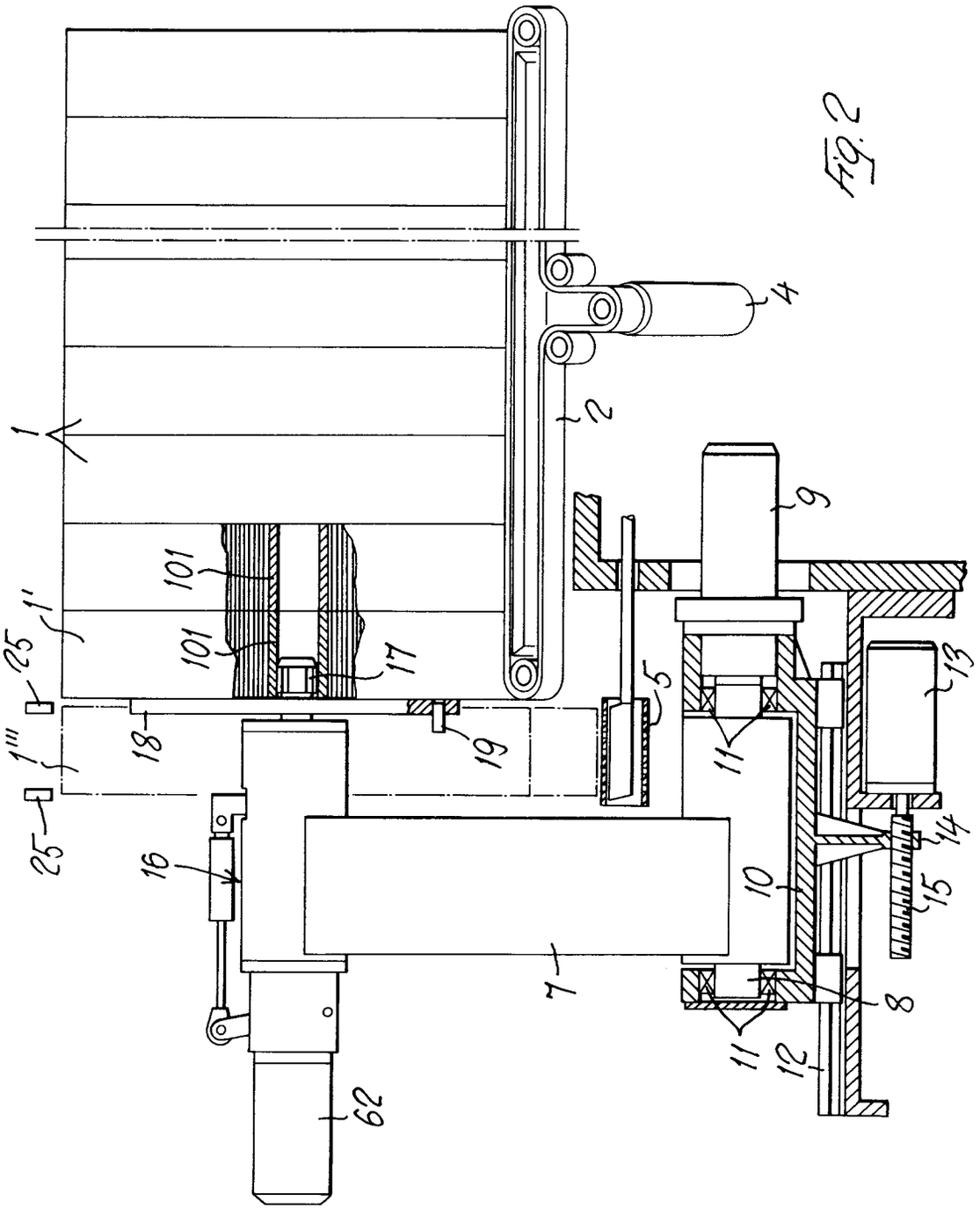

Fig. 2

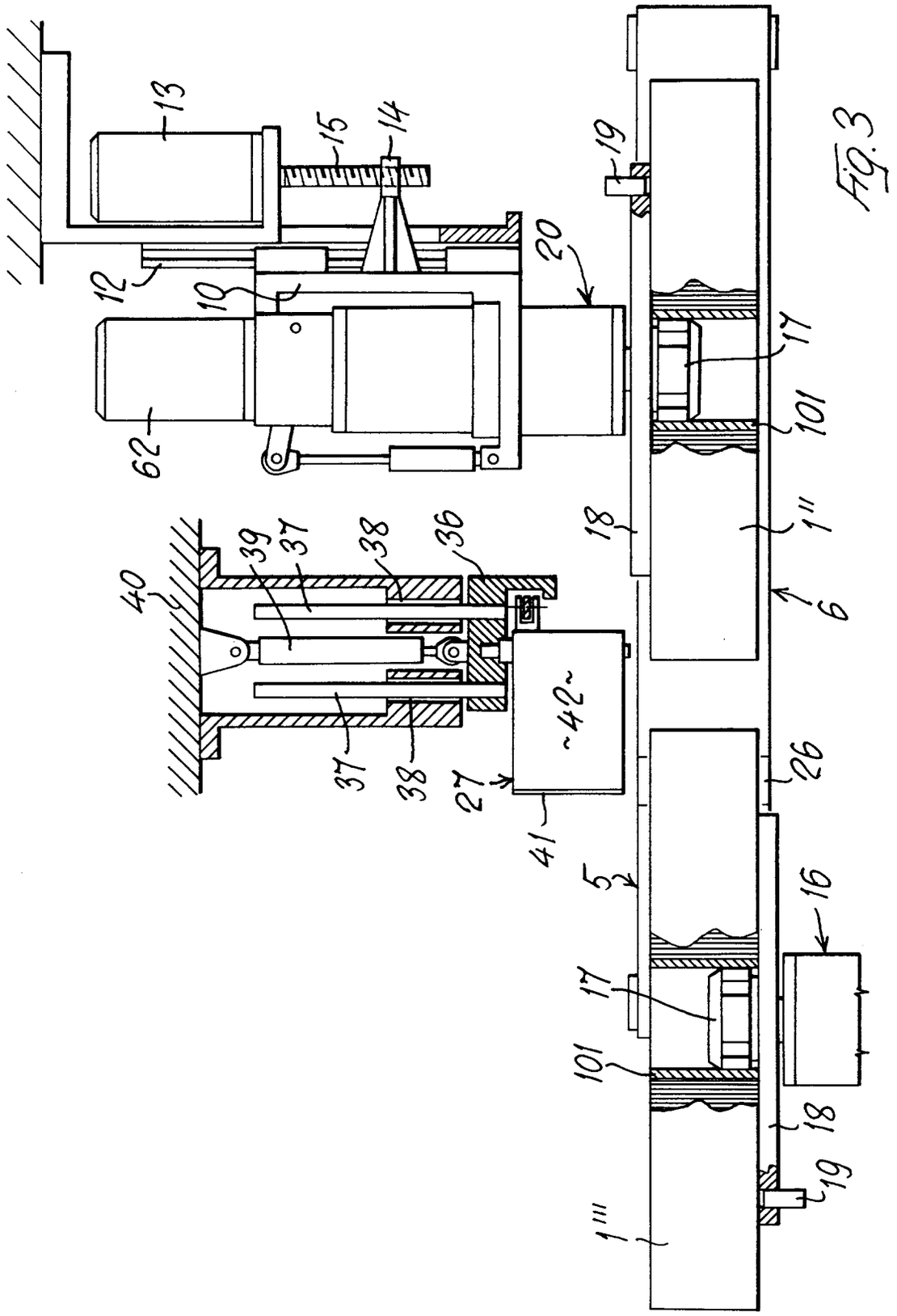
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Fig. 3

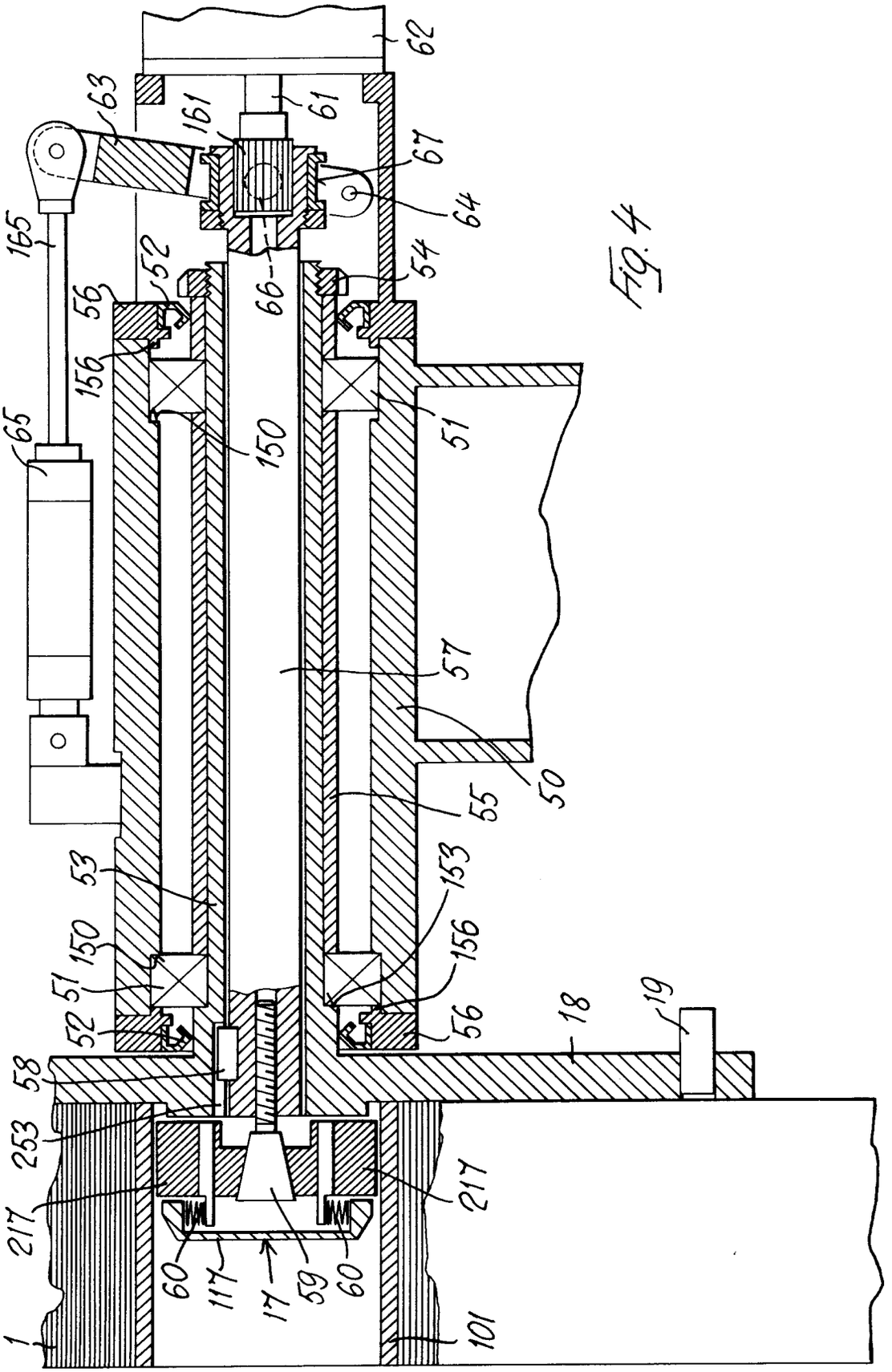
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Fig. 4

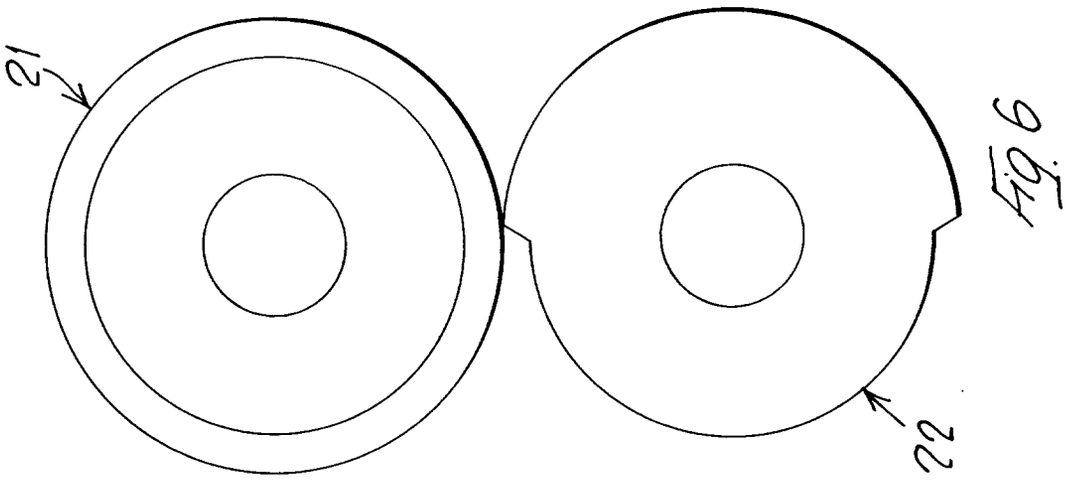

Fig.6

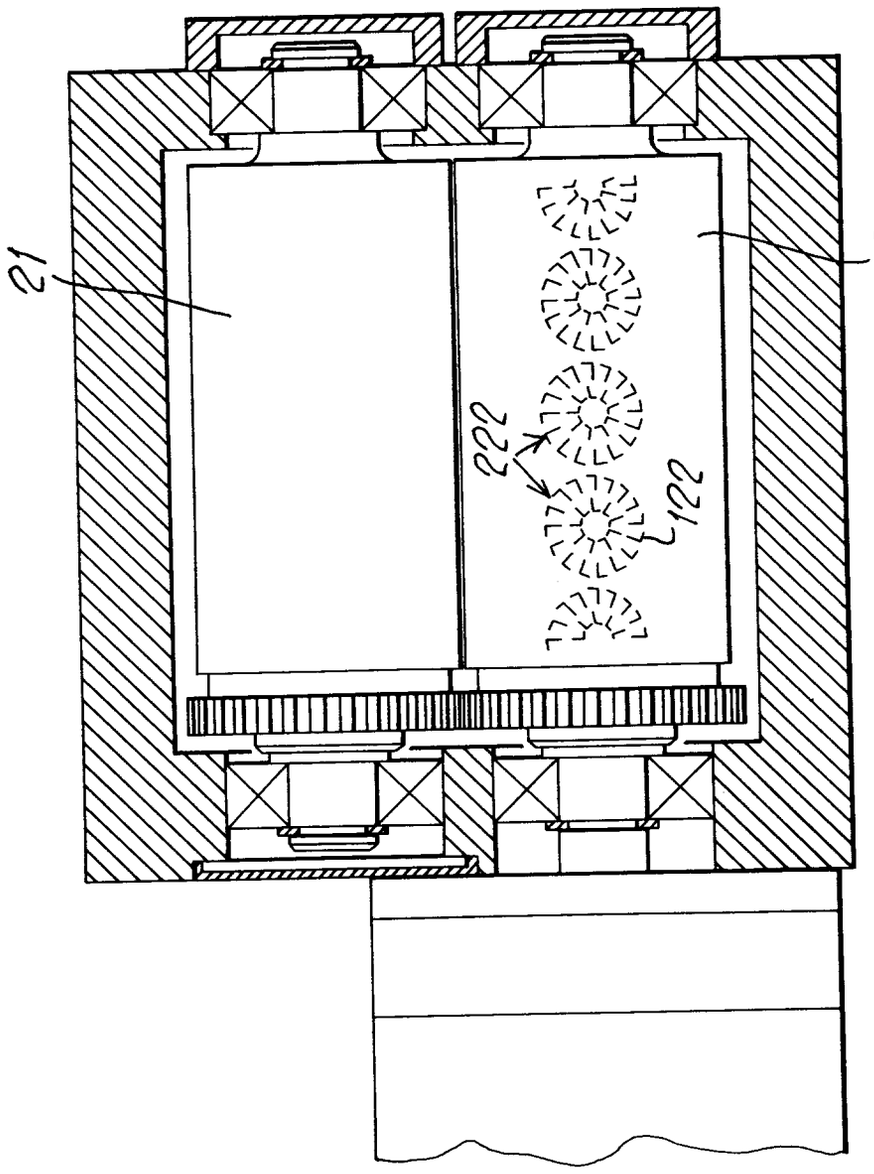

Fig.5