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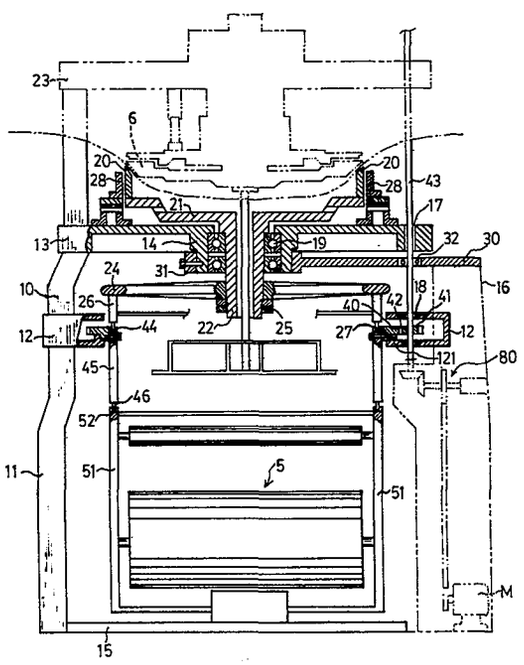
## (54) Circular knitting machine.

(57) In circular knitting machines one source of imperfection in the finished fabric is vibration arising at the point of meshing between a ring gear for the needle cylinder and a driving pinion. In accordance with the invention, this is overcome or mitigated by lengthening the transmission path between the ring gear and the needle cylinder and also by inclusion, where appropriate, of a vibration damping device. As shown in Fig. 1, a needle cylinder (20) is mounted on a disc (21) on a hollow shaft (22) driven by a wheel (24). Drive to the wheel (24) is from a ring gear (40), mounted on a support ring (12), via transmission arms (26). A vibration disperser or damping device has a ring shaped end (31) clamping a hub portion of a support table (13) in which a shaft (22) is mounted. The opposite end (30) of the damping device is solid with a separate supporting frame (16) which also mounts a drive (M and 80) for a pinion (41) in mesh with the ring gear (40).

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# CIRCULAR KNITTING MACHINE

The present invention relates to circular knitting machines and more particularly to circular knitting machines of a novel type wherein the needle cylinder is not directly driven by a driving pinion and the distance of power transmission between the driving pinion and the needle cylinder is comparatively lengthened, and in which a vibration or oscillation damping means is provided whereby unbalanced vibration or oscillation occurring on each needle cylinder, which would bring about undesirable horizontal lines upon the knitted fabric during the operation of the knitting machine, is compensated and attenuated.

Generally, a conventional circular knitting machine employs a driving pinion to engage with a large ring gear provided on the needle cylinder. There is no provision at the central portion of the ring gear, for any centre shaft or any other centre supporting means, and the gear is directly driven by the pinion to rotate supported by an annular guide or bearing groove provided on the machine frame. Since no centre shaft provided for either the gear or the guide groove and because of the clearance between the teeth of the pinion and the ring gear, vibrations occur and because of the difference of the distance from each needle to the mesh point or the power input point of the driving pinion and the driven ring gear, the vibrations or oscillations have a differential effect. During each revolution, when a given one of the cylinder needles rotates to the position where it is nearest the vibration source (i.e. the mesh point), the vibration or oscillation is strongest, and where it is furthest from the vibration source, the vibration or oscillation is weakest.

Because of the great differences in the magnitudes

of vibration occurred on needles, undesirable, irregular horizontal lines tend to appear on the knitted fabrics, degrading the quality of the fabrics.

Of course, undesirable horizontal lines are also caused by reasons other than the above mentioned vibration or oscillation, such as the uneven tension of yarns, the unadequate adjustment of cams, the uneven tension of fabric roll, and so forth. Nevertheless, these causes may easily be eliminated and controlled by adjusting the tension of yarns and fabric, and the correct positioning of cams. And the elimination of these causes cannot totally eliminate the undesirable horizontal lines; there are still lines appearing once on the knitted fabric for each rotation of the needle cylinder.

To prove that the undesirable horizontal lines occur from the uneven vibration, the inventor has taken a conventional double knit circular knitting machine of 30 gauge to make an experiment therewith. The inventor smeared some coloured ink on a yarn feed corresponding to the cam which is closest to the mesh point between the pinion and the ring gear so as to have the yarn through that feed dyed with colour ink. As a result, the knitted fabric reveals that there is the dyed track on the thick horizontal lines thereof. A similar experiment was also made on a conventional circular knitting machine which consists of a driving gear and two balance gears all in mesh with the ring gear at three equiangularly spaced positions. The inventor also found that the same number of dyed tracks appeared in the form of the undesirable horizontal lines on the knitted fabric at the positions corresponding the three mesh points, and that the lines appear more noticeable on the side of the driving pinion and less noticeable on the side of the balancing gears. To obtain a further proof thereof, the inventor removed the balancing gears

and found that the horizontal lines on the knitted fabric in the sides of the balancing gears disappeared. This appears to verify that the undesirable result on knitted fabric is brought about by the vibration originated at the gear mesh points, and the farther the distance from the mesh point is, the weaker the undesirable horizontal lines.

From the above discoveries, it is evident that the adjustments of the tension of yarns, fabric and the accuracy of the cam position, and so forth cannot thoroughly solve the problem; and only the improvements in the driving and the transmission mechanism of the machine can solve the problem. Due to the machine structure and the motion of driving mechanism in the conventional circular knitting machine, it is impossible to thoroughly exclude all the vibration or oscillation caused by the movement of the machine, but the vibration can be greatly diminished, if the distance between the power input point (i.e. mesh point) and the needle cylinder is lengthened or the vibration is evenly distributed on all over the needles, whereby the undesirable horizontal lines can be diminished.

A principal object of the invention is to provide an improved circular knitting machine with a new arrangement of driving mechanism for driving the needle cylinder so as to eliminate the undesirable horizontal lines appeared on the knitted fabric caused by the uneven vibrations of the needles point during the machine operation.

Another object of the invention is to provide an improved circular knitting machine having centre shafts provided with the cylinder and dial to maintain an accurate centre whereby an even rotation of cylinder and dial can be obtained so as to diminish the undesirable horizontal lines on the fabric.

Still another object of the invention is to provide an improved circular knitting machine having the distance between the direct power input point or the mesh point of driving gear and needle cylinder comparatively lengthened and a vibration dispersing means further provided whereby the undesirable horizontal lines on the knitted fabric is greatly decreased.

In accordance with a first aspect of the invention there is provided a circular knitting machine comprising: a machine frame having a plurality of legs, a supporting ring provided at an intermediate portion of the frame, a supporting table above said supporting ring and a base plate in the bottom thereof; a needle cylinder secured onto a rotating disc having a downward extending hollow shaft rotatably mounted within a hub portion of the said supporting table; a vibration dispersing member provided beneath the said supporting table, with one end fixed onto a supporting frame separated from said machine frame and a ring shape free end fixed onto the outer periphery of the hub portion of said supporting table; a rotating wheel disposed at the lower end of said hollow shaft of the rotating disc and provided with a transmission member extending downward therefrom; a ring gear slidably and rotatably mounted on a rail portion of said supporting ring; a driving pinion rotatably supported in the groove of said supporting ring by a driving shaft and in mesh with said ring gear so as to drive the gear to rotate within said supporting ring; a transmission device disposed on said ring gear and engaged with said transmission member of the rotating wheel to transmit the rotation of said ring gear to the rotating wheel; a fabric takeup roller device rotatably mounted on the bottom of the machine frame and driven by said transmission device.

In accordance with a second aspect of the invention, there is provided a circular knitting machine comprising: a machine frame having a plurality of legs, a supporting

ring provided at an intermediate portion of the machine frame, at least one ring-shaped supporting table above the supporting ring and a base plate at the bottom of the frame; a needle cylinder secured onto a rotating cylinder which is slidably mounted on said supporting ring; lower cam means fixed onto a ring-shaped cam seat secured on said supporting ring so as to surround the needle cylinder; a ring gear slidably rotatably mounted on the supporting ring; a transmission device connected to said ring gear so as to transmit the rotation of said ring gear to said rotating cylinder above it and for a fabric take-up device below it through upper and lower transmission arms; and a driving pinion rotatably mounted within the groove of said supporting ring by a driving shaft and in mesh with said ring gear so as to drive the ring gear in rotation.

In accordance with a third aspect of the invention, there is provided a circular knitting machine, comprising: a machine frame having a plurality of legs, a supporting ring provided at an intermediate zone of the frame, at least one ring-shaped supporting table above the supporting ring and a base plate in the bottom thereof; a needle cylinder secured onto a rotating cylinder which is slidably mounted on said supporting table; lower cam means fixed onto the ring-shaped cam seat secured on said supporting table; a dial means rotatably suspended on an upper supporting table of the machine frame and located in juxtaposition to said needle cylinder; an upper cam means attached on the lower end of the hub portion of said upper supporting table; a driven gear rotatably mounted on the upper supporting table; a driving pinion rotatably supported on the upper supporting table and in mesh with said driven gear; a driving means provided on a top bracket above the upper supporting table; and roller transmission means provided between the dial means and needle cylinder so as to transmit the rotation of the

dial means to the needle cylinder; and a transmission device provided on the rotating cylinder so as to transmit the rotation of said cylinder to the fabric take-up roller means below the cylinder.

The invention will be further described in various specific embodiments which are illustrated in the accompanying drawings, wherein:

Figure 1 is a longitudinal cross-sectional view of the main portion of a first embodiment of the invention;

Figure 2 is a plan view showing a vibration dispersing means in the embodiment of Figure 1;

Figure 3 is a longitudinal cross-sectional view of the main portion of a second embodiment of the invention;

Figure 4 is a plan view showing the distance adjusting steel rings in the embodiment of Figure 3;

Figure 5 is a longitudinal cross-sectional view of the main portion of a third embodiment of the invention;

Figure 6 is a longitudinal cross-sectional view of the main portion of a fourth embodiment of the invention;

Figure 7 is a longitudinal cross-sectional view of the main portion of a fifth embodiment of the invention;

Figure 8 is a plan view of a roller transmission device of the fifth embodiment of the invention; and

Figure 9 is a front view of the roller transmission device of Figure 8.

As shown in Figure 1, a machine frame 10 comprises, as in conventional three supporting legs 11 and a supporting ring 12 provided in the middle portion of the frame 10. It also comprises a supporting table 13 having a hub portion 14 with bearings 19 mounted in the centre thereof and a base plate 15 provided in the bottom of the frame 10.

A needle cylinder 20 is fixed onto a rotating disc 21 which has a downwardly extending hollow shaft 22 rotatably inserted in the bearings 19 housed within the hub 14. A rotating wheel 24 is fixed at the lower end

of said shaft 22 by nuts 25 and a key. A vibration dispersing device 30 is provided below the supporting table 13 as shown in Figure 1 and Figure 2, in such a manner that one end is fixed on a supporting frame 16, which is separated from said machine frame 10 and provided for installing the motor M and driving means 80 therein. The other end of the device 30 is a ring shape free end 31 fixed to the outer periphery of said hub portion 14 by bolts.

A ring gear 40 for driving said rotating wheel 24 through a transmission means is slidably, rotatably mounted on a rail portion 121 of said supporting ring 12. The gear 40 meshes with a driving pinion 41 rotatably supported on a driving shaft 43 at the mesh point 42 and is driven by the driving pinion 41 which is driven by the motor M mounted on said frame 16 through a suitable transmission means 80.

At opposed locations on the inner side of said gear 40, there are provided a pair of transmission arms 45 having a pair of radial grooves 44 on their upper surface and a pair of pin-shaped free ends 46 on their lower ends. A pair of upper transmission arms 26 is provided on opposite sides of the lower face of the rotating wheel 24 and have their pin-shaped free ends 27 radially slidably inserted into said grooves 44 but always contacting with the one side of wall of said grooves 44 in the rotating direction of the gear 40 so as to transmit the rotation of said gear 40 to the rotating wheel 24 as well as to accomplish a self centering alignment with respect to the centre of said gear 40.

Beneath the transmission arms 45 there is a knitted fabric take-up device 5 provided for winding the knitted fabric into a roll. Said take-up device 5 consists of a pair of brackets 51 having a pair of radial grooves 52 on their upper ends corresponding said transmission arms

45 for engaging with said pin ends 46. The downward pin-shaped free ends 46 of said transmission arms 45 are radial slidably inserted into the grooves 52 in the like manner as said pin ends 27 of the transmission arms 26 so as to rotate said roller means 5.

The driving shaft 43 extends upwardly and passes through said vibration dispersing member 30 and supporting tables 13, 23 so as to drive an automatic yarn feeding device (not shown) and the dial means 6 (shown in dot lines) through suitable transmission gears (not shown). Said shaft 43 is driven by the motor M (not shown) mounted on the bottom of said frame 16 via a suitable transmission gears 80.

In order to prevent the vibration of the driving shaft 43 affecting said supporting table 13 provided with a cam set 28 thereon, the hole 17 on the supporting table 13, through which said shaft 43 passes, is a little larger in diameter than the shaft 43 to provide a clearance. Only the holes provided on the supporting ring 12 and vibration dispersing member 30 have bearings 18,32 secured within them respectively so as to rotatably support said shaft 43.

Figures 3 and 4 show a second embodiment of the invention. In this embodiment, the machine frame 10A consists of a plurality of legs 11A, a supporting ring 12A and supporting tables 13A,23A similar to those in the first embodiment. Both the rotating disc 21A having a needle cylinder 20A disposed thereon and the rotating plate 67A having a dial 60A disposed thereon are fixed on a common hollow shaft 22A which is rotatably supported between the centre hubs 14A of the upper supporting table 23A (shown in dot line) and the lower supporting table 13A by means of bearings 19A. When said hollow shaft 22A rotates, both the rotating disc 21A and plate 67A rotate together with said shaft 22A. Upon the plate 67A, a cam device 68A with its lower surface

against said dial 60A is mounted on a cam seat 69A which is secured onto the lower end of the downward extending central hub of the upper supporting table 23A. Surrounding said needle cylinder 20A there is a cam device 28A mounted on a lower cam seat which is fixed onto said lower supporting table 13A. Between said plate 67A and said duct 21A, there are an upper and a lower distance adjusting rings 63A and 64A each having a plurality of supporting bars 61A and 62A fixed onto said disc 21A and onto said hollow shaft 22A respectively so as to support said rings 61A,64A in horizontal planes as shown in Figure 4. The upper adjusting ring 63A is a circular ring and concentric with said hollow shaft 22A, while said lower adjusting ring 64A is a heart-shaped ring. A cutting knife 66A is provided between said plate 67A and said disc 21A and extends vertically downward whereby the knitted cylindrical fabric is longitudinally cut into a flat one so as to be collected in a bundle form and led into the fabric inlet 65A opened on the side of said hollow shaft 22A at the position opposite to said knife 66A and above said disc 21A. A vibration dispersing member 30A is provided below the table 13A with its free end 31A and root end fixed onto said hub 14A and the frame 16A respectively as in the first embodiment.

To further clarify, as the arrows shown in Figure 3 and 4, the cylindrical knitted fabric is vertically cut at a position corresponding to the knife to become a flat one by said cutting knife 66A, and then collected at the cut end to form a bundle, and the bundle of fabric is led downward through said distance adjusting rings 63A,64A to obtain an equal distance from any point on circumference of said adjusting ring 63A to said fabric inlet 65A, finally the bundle-like fabric is led out from the lower opening of said hollow shaft 22A and is spread to become

a sheet-like fabric so as to be wound up by take-up device 5A.

The gear driving means and transmission means below said hollow shaft 22A are the same with the former embodiment, i.e. the shaft 22A is rotatably supported in the bearings 19A disposed in the hub portion 14A of the table 13A; affixed onto the lower end of said shaft 22A is the rotating wheel 24A, on the opposite sides of the periphery of which is a pair of transmission arms 26A diametrically disposed. A ring gear 40A is also provided below said rotating wheel 24A and meshes with a driving pinion 41A rotatably mounted inside the groove of said supporting ring 12A via a driving shaft 43A. A pair of transmission arms 45A are disposed on the inside periphery of said ring gear 40A and consist of a pair of radial grooves 44A on their upper ends for engaging with the pin ends 27A of said arms 26A and a pair of pin shape free ends 46A at their lower ends. Below the transmission member 45A, there is the fabric take-up device 5A provided with a pair of brackets 51A having a pair of grooves 52A on the upper ends for engaging with the pin ends 46A of said arms 45A. The gear driving and the transmission means is so constructed, when the ring gear 40A is driven to rotate along said supporting ring 12A by said pinion 41A, the rotating disc 21A with provision of the needle cylinder 20A thereon and the rotating plate 67A with provision of said dial 60A thereon rotates steadily through the transmission arms 45A and 26A, rotating wheel 24A and said hollow shaft 22A.

In this embodiment, except that both of the rotating disc 21A and rotating plate 67A are fixed onto a central shaft 22A instead of the two corresponding members 21 and 67 being fixed on two separate shafts as in the first embodiment, and that in order to enable

the fabric to pass through the space between said disc 21A and plate 67A and to be led into the centre hole of said shaft 22A, there are the provision of the cutting knife 66A, the distance adjusting rings 63A,64A and the fabric inlet 65A, all other elements are the same as the first embodiment.

Figure 5 shows a third embodiment of the invention, which is an application of the driving and transmission means of the first embodiment to a conventional single or double side type circular knitting machine. In this kind of machine, there is no provision of a central shaft 22 and a vibration dispersing device 30 like the first embodiment described above, but the application of the driving and transmission mechanism of this invention to said machine can also obtain a stable and even motion. Therefore the vibration or oscillation can be relatively reduced.

In the conventional circular knitting machine, the cylinder member 21B is integrally connected to the ring gear 40B, but in this embodiment, the ring gear 40B is separated from said cylinder 21B. Said gear 40B is rotatably disposed on the supporting ring 12B of the frame 10B like the manner of the first embodiment and is driven by the driving pinion 41B provided in the supporting ring 12B. The cylinder member 21B is provided with a pair of transmission arms 26B extending downward and having a pair of pins 27B formed at their lower end. A transmission ring 47B, which has a pair of radial grooves 44B provided on its upper surface for engaging with said pins 27B and a pair of transmission arms 45B extending downward therefrom with a pair of pins 46B provided on the free ends for inserting into the grooves 52B of the transmission brackets 51B, is attached to the ring gear 40B rotatably mounted on the supporting ring 12B. A

driving pinion 41B is fixed on the driving shaft 43B to rotate together with it and meshes with the ring gear 40B at the mesh point 42B. When the driving pinion 41B rotates with the shaft 43B, the ring gear 40B is driven to rotate on the supporting ring 12B by the pinion 41B. Thus the rotation of the ring gear 40B is transmitted to the cylinder 21B and the fabric take-up device 5B. The difference between this embodiment and the first embodiment is that the cylinder 21B also functions as a rotating wheel, therefore, there is no separate rotating wheel 24 such as in the first embodiment. As regard to other parts and portions, they are structurally same as in a conventional machine, so they are omitted from the drawings and the description.

Figure 6 shows a fourth embodiment of this invention. In this embodiment, instead of the ring gear 40 being mounted on the supporting ring as in the first embodiment, a gear wheel 40C with a bearing 46C in its centre is used and rotatably supported in the centre of the base plate 15C at the bottom of the machine frame 10C. The gear wheel 40C meshes with the driving pinion 41C at the mesh point 42C and is driven by the driving pinion 41C. A rotating wheel 24C fixed to the lower end of the hollow shaft 22C is driven by the gear wheel 40C through a transmission member which consists of a pair of upper transmission arms 26C fixed on the rotating wheel 24C and a pair of lower transmission arms 51C fixed on the gear wheel 40C. These arms are connected to each other by pins 27C and grooves 52C at their connecting ends. Because the driving means consisting of a motor M, driving pinion 41C and gear 40C are located on the bottom frame 15C, if the power is to be directly transmitted to the upper gear provided for driving the dial device and the automatic yarn feeding device, the transmission distance will be too long and the driving shaft also must be extended upward

from the bottom of the frame and become ineffective from the point of dynamics. Therefore, the rotating wheel 24C is formed as a gear wheel and meshes with a pinion 70 fixed on the shaft 43C. The shaft 43C functions as the extension of the driving shaft 43 in the first embodiment to drive the dial device and yarn feeding device provided on the upper supporting table 23C of the frame 10C.

In another embodiment, the gear 40C used in the fourth embodiment is omitted. To drive the rotating disc 21C, the rotating gear wheel 24C, which is originally a driving gear now becomes a driven gear, and is directly driven by the pinion 70 which is originally a driven pinion and now becomes a driving pinion and is driven by the motor M through a suitable transmission device 80C. Thus both of the rotating disc 21C provided the needle cylinder 20C thereon and the transmission arms 26C,51C for supporting the fabric take-up device 5C are driven by the gear 24C.

Figure 7 shows the fifth embodiment of this invention. In this embodiment, the gear 40B and the driving means for drive the gear 40B originally located on the intermediate supporting frame 13B are removed onto the upper supporting frame 23D where they are shown as gear 40D and pinion 41D; other parts or portions are the same with the third embodiment as shown in Figure 5. The gear 40D is rotatably mounted on the upper end of a centre shaft 601 of the rotating disc 21D and the motor M is mounted on the supporting bracket 13E fixed upon the upper supporting table 23D. The gear 40D is driven by the motor M through a transmission means such as belt and pulley transmission 80D and a pinion 41D. When the gear 40D rotates, the rotating plate 67D provided with dial device 60D thereon follows the rotation through the shaft 601, and the

cylinder 20D is driven by the rotating plate 67D through one or more roller transmission devices 29 shown in more detail in Figures 8 and 9.

As shown in Figure 8 and Figure 9, the or each roller transmission device 29 comprises two rollers 29A and 29B pivoted upon two stationary eccentric shafts 294 which are integrally formed and are fixed onto an upper supporting plate 291 secured onto the bottom surface of said dial plate 60D, a driving roller 29C and a braking roller 29D respectively disposed at opposite sides of said two rollers 29A,29B, said rollers 29C and 29D being respectively pivoted on two shafts 295,296 which are fixed onto two lower supporting plates 292,293 respectively. Said two plates 292,293 are adjustably mounted on the upper surface of said cylinder 20D. There is a small clearance provided between the transmission roller 29A and the driving roller 29C and likewise a small clearance is provided between the transmission roller 29B and the braking roller 29D. Since said two rollers 29A,29B are respectively provided on said eccentric shafts 294, the knitting fabric, flowing down from the clearance formed between the dial 60D and needle cylinder 20D, may pass through said clearance between the rollers and flow thereunder. During the rotation of the rotating plate 67D, said two rollers 29A,29B are rotated as shown by arrows in Figure 8 and 9. Therefore, in addition to a function for said dial plate 67D to have a synchronous rotation, said roller transmission device 29 has another function for knitting fabric to pass therethrough. Since the conventional roller transmission device thereof comprises four sets of driving rollers and one set of braking roller. It is found that five undesired vertical lines will be brought about on the knitted fabric, due to the friction contact between the rollers.

However, only two vertical lines will occur on the fabric if only a single roller transmission device 29 is used. In order to ensure the good appearance and quality of the knitted fabric, one simple way can be adopted and so obtain a good result by longitudinally cutting the circular knitted fabric along the central line between said undesirable vertical lines by a vertical knife to make the fabric become a flat one, thus the position of the undesirable vertical lines are on two longitudinal edges of the knitted fabric and do not affect the fabric.

The above description of various embodiments are most for the doubt knit type circular knitting machines. However the only difference between single knit type and double knit type is that the former comprises a needle cylinder and a dial device, while the later comprises only a needle cylinder and no dial device and the related mechanism provided thereon. Therefore, this invention can be applied to both of single knit type and double knit type circular knitting machines.

In this invention, because of the mesh point of the gears is removed from near the needle cylinder to a much farther location, and the rotation of needle cylinder is stabilized by the rotating wheel and the self-centre-alignable transmission device, especially in the first and second embodiments, the rotating plate and disc supporting needle cylinders thereon have a central shaft supported in the centre of supporting tables, so that they are provided with steady supporting and also aligned on the same axis, enabling the knitting machine to diminish vibrations caused by the imbalance at the power input point, at the same time to disperse the vibration evenly to the needle points. The combined effects prevent the undesirable horizontal lines on the knitted fabrics, and upgrade quality and the value of

the products.

Claims:-

1. A circular knitting machine comprising: a machine frame having a plurality of legs, a supporting ring provided at an intermediate portion of the frame, a supporting table above said supporting ring and a base plate in the bottom thereof; a needle cylinder secured onto a rotating disc having a downward extending hollow shaft rotatably mounted within a hub portion of the said supporting table; a vibration dispersing member provided beneath the said supporting table, with one end fixed onto a supporting frame separated from said machine frame and a ring shape free end fixed onto the outer periphery of the hub portion of said supporting table; a rotating wheel disposed at the lower end of said hollow shaft of the rotating disc and provided with a transmission member extending downward therefrom; a ring gear slidably and rotatably mounted on a rail portion of said supporting ring; a driving pinion rotatably supported in the groove of said supporting ring by a driving shaft and in mesh with said ring gear so as to drive the gear to rotate within said supporting ring; a transmission device disposed on said ring gear and engaged with said transmission member of the rotating wheel to transmit the rotation of said ring gear to the rotating wheel; a fabric takeup roller device rotatably mounted on the bottom of the machine frame and driven by said transmission device.

2. A circular knitting machine according to claim 1, in which a driving means for the driving shaft is installed on the said supporting frame separated from the machine frame.

3. A circular knitting machine according to claim 1 or 2, further comprising: a diam means rotatably disposed on an upper supporting table of the machine frame and upper cam means fixed on the lower end of the hub portion of said supporting table.

4. A circular knitting machine according to claim 1, modified in that the ring gear is rotatably mounted on a bearing disposed on a centre portion of the base plate of said machine frame to drive the rotating wheel fixed on said hollow shaft by transmission means which include a pair of upper transmission arms and a pair of lower transmission arms connected to the rotating wheel and the ring gear respectively and self-alignably connected to each other by pins and grooves.

5. A circular knitting machine according to any of claims 1 to 4, wherein the central hollow shaft also carries a rotating plate having a needle dial thereon, the rotating plate and rotating disc being rotatably supported between an upper supporting table and a lower supporting table by said hollow shaft which is vertically supported on central bearings mounted in the said supporting tables.

6. A circular knitting machine according to claim 1 to 5, wherein the rotating wheel is a circular rotating wheel.

7. A circular knitting machine according to claim 1 to 6, wherein the rotating wheel is a gear wheel.

8. A circular knitting machine according to claim 6, wherein the rotating wheel is driven by a transmission member which is driven by a motor and gear driving means provided below said wheel.

9. A circular knitting machine according to claim 7, wherein the rotating gear wheel is directly driven by a driving pinion which is driven by a motor through a transmission means.

10. A circular knitting machine comprising: a machine frame having a plurality of legs, a supporting ring provided at an intermediate portion of the machine frame, at least one ring-shaped supporting table above the supporting ring and a base plate at the bottom of

the frame; a needle cylinder secured onto a rotating cylinder which is slidably mounted on said supporting ring; lower cam means fixed onto a ring-shaped cam seat secured on said supporting ring so as to surround the needle cylinder; a ring gear slidably rotatably mounted on the supporting ring; a transmission device connected to said ring gear so as to transmit the rotation of said ring gear to said rotating cylinder above it and for a fabric take-up device below it through upper and the lower transmission arms; and a driving pinion rotatably mounted within the groove of said supporting ring by a driving shaft and in mesh with said ring gear so as to drive the ring gear in rotation.

11. A circular knitting machine according to claim 10, comprising a dial means rotatably suspended on an upper supporting table of the machine frame and located in juxtaposition to said needle cylinder; and an upper cam means disposed on the lower end of the hub portion of said upper supporting table.

12. A circular knitting machine according to claim 1, 4 or 10, wherein the upper portion of the driving shaft passing through the hole provided on the supporting table does not contact with the supporting table.

13. A circular knitting machine, comprising: a machine frame having a plurality of legs, a supporting ring provided at an intermediate zone of the frame, at least one ring-shaped supporting table above the supporting ring and a base plate in the bottom thereof; a needle cylinder secured onto a rotating cylinder which is slidably mounted on said supporting table; lower cam means fixed onto the ring-shaped cam seat secured on said supporting table; a dial means rotatably suspended on an upper supporting table of the machine frame and located in juxtaposition to said needle cylinder; an upper cam means attached on the lower end of the hub

portion of said upper supporting table; a driven gear rotatably mounted on the upper supporting table; a driving pinion rotatably supported on the upper supporting table and in mesh with said driven gear; a driving means provided on a top bracket above the upper supporting table; and roller transmission means provided between the dial means and needle cylinder so as to transmit the rotation of the dial means to the needle cylinder; and a transmission device provided on the rotating cylinder so as to transmit the rotation of said cylinder to the fabric take-up roller means below the cylinder.

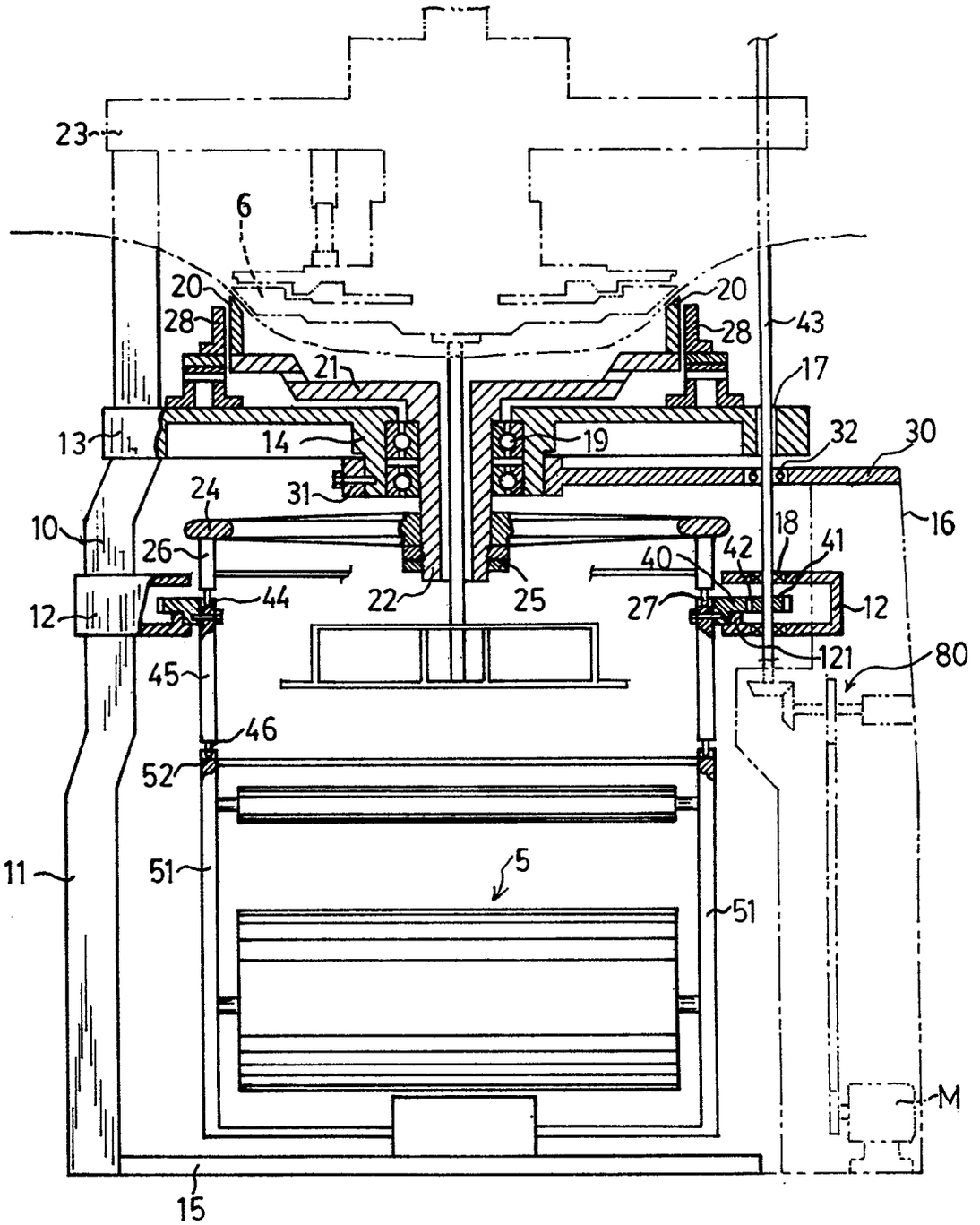
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FIG. 1

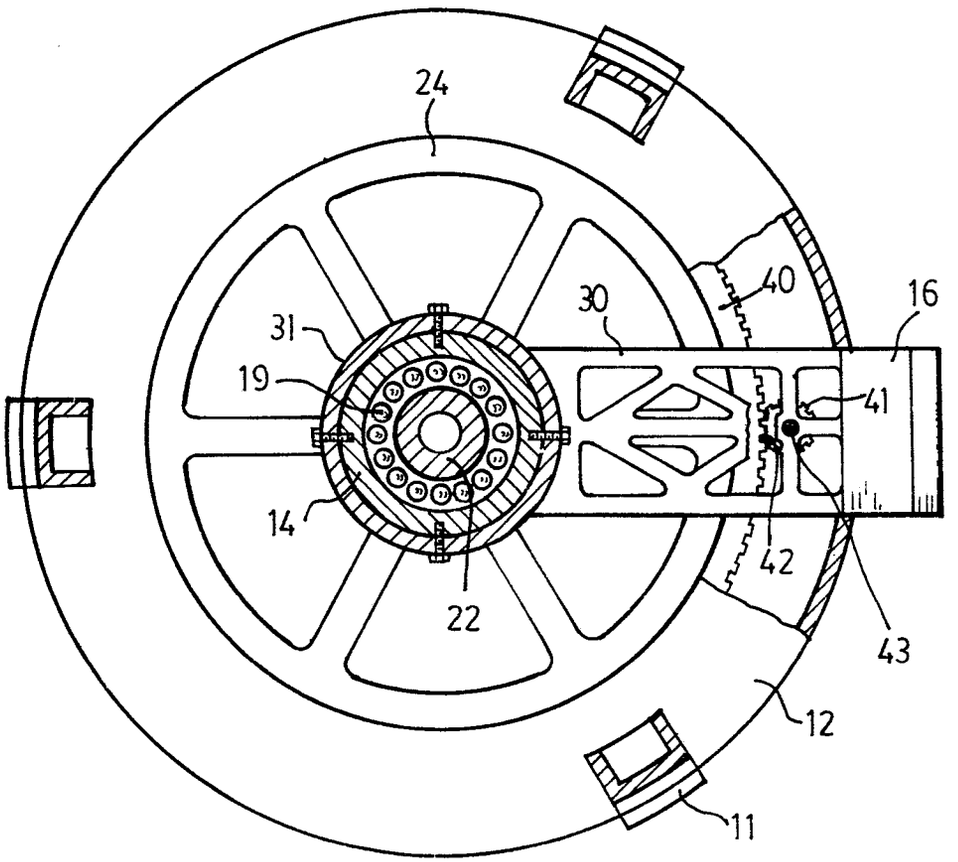
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FIG. 2

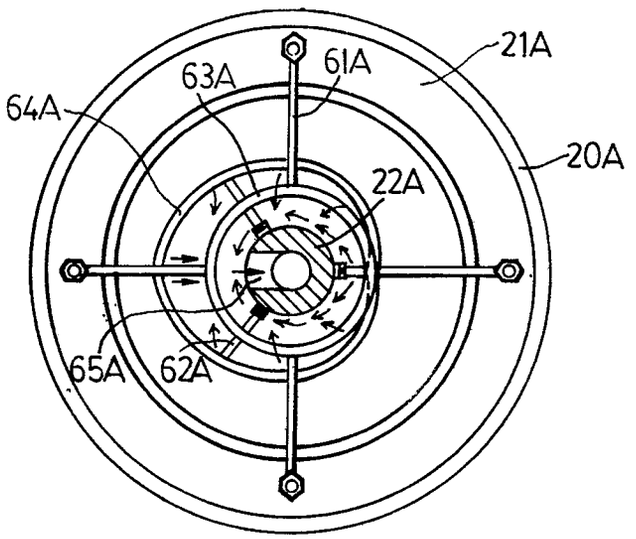
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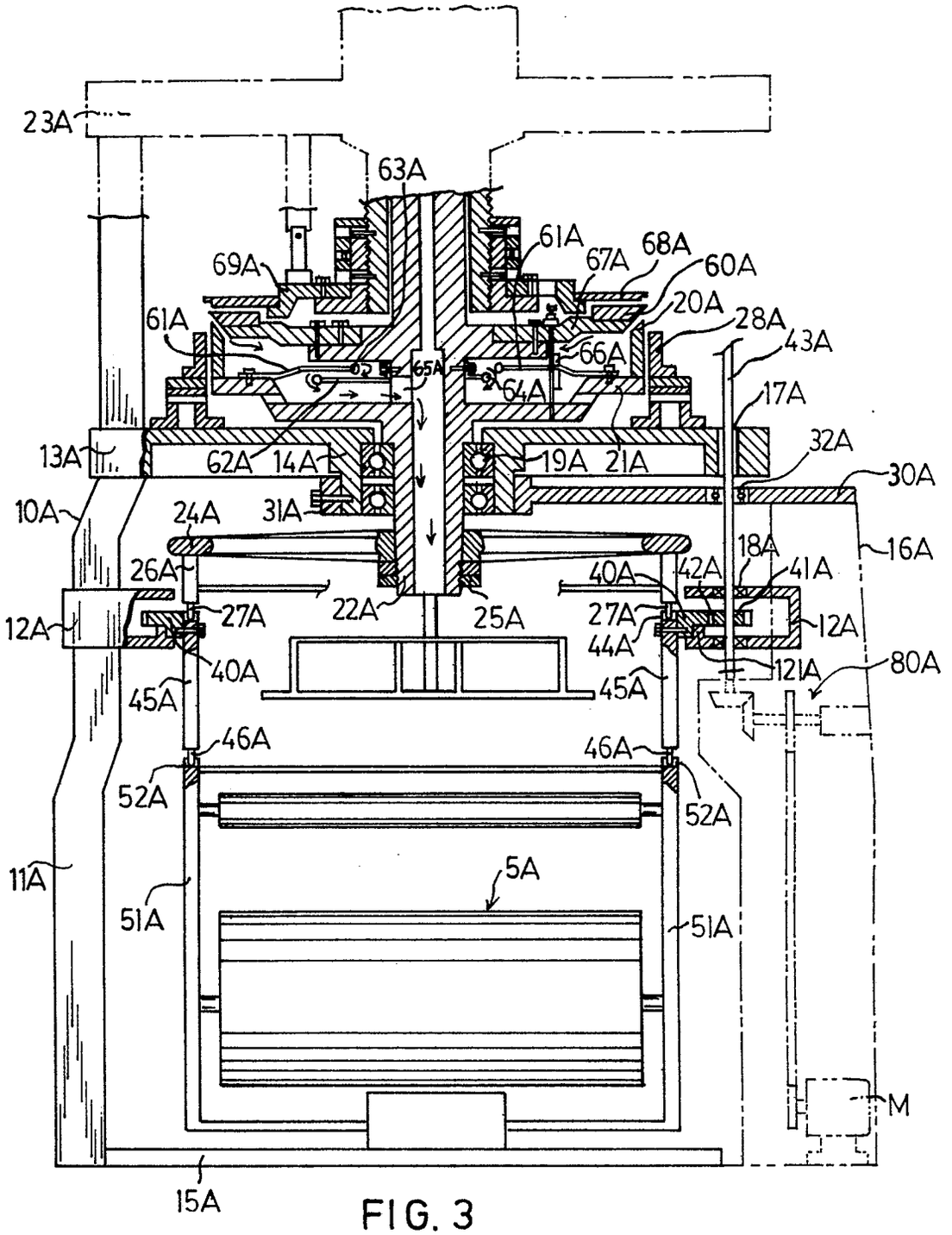
FIG. 4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63A
61A
67A
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60A
69A
20A
28A
61A
43A
66A
65A
64A
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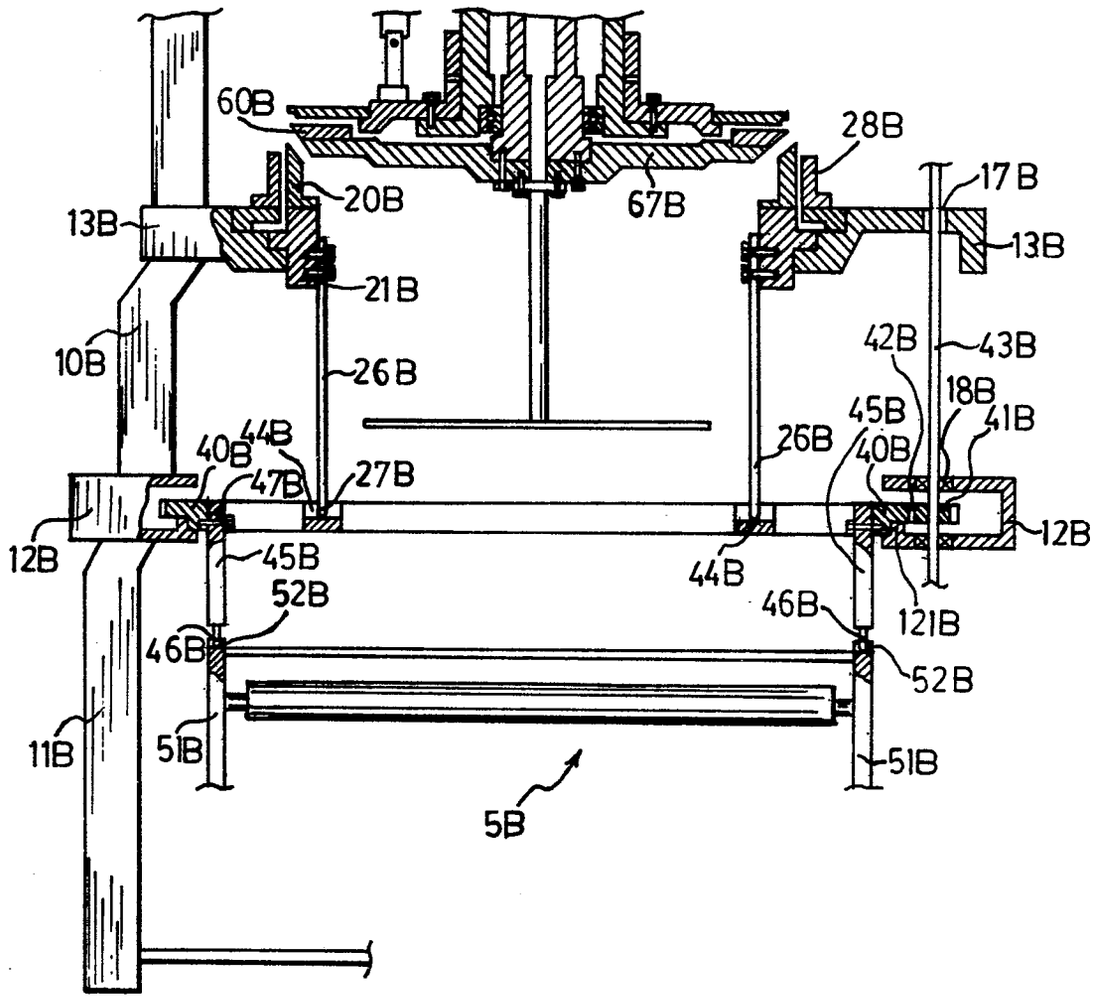
62A
14A
19A
21A
32A
30A
10A
24A
31A
16A
18A
26A
40A
42A
41A
27A
22A
25A
27A
12A
12A
44A
121A
80A
40A
45A
45A
46A
46A
52A
52A
11A
5A
51A
51A
M
15A

FIG. 3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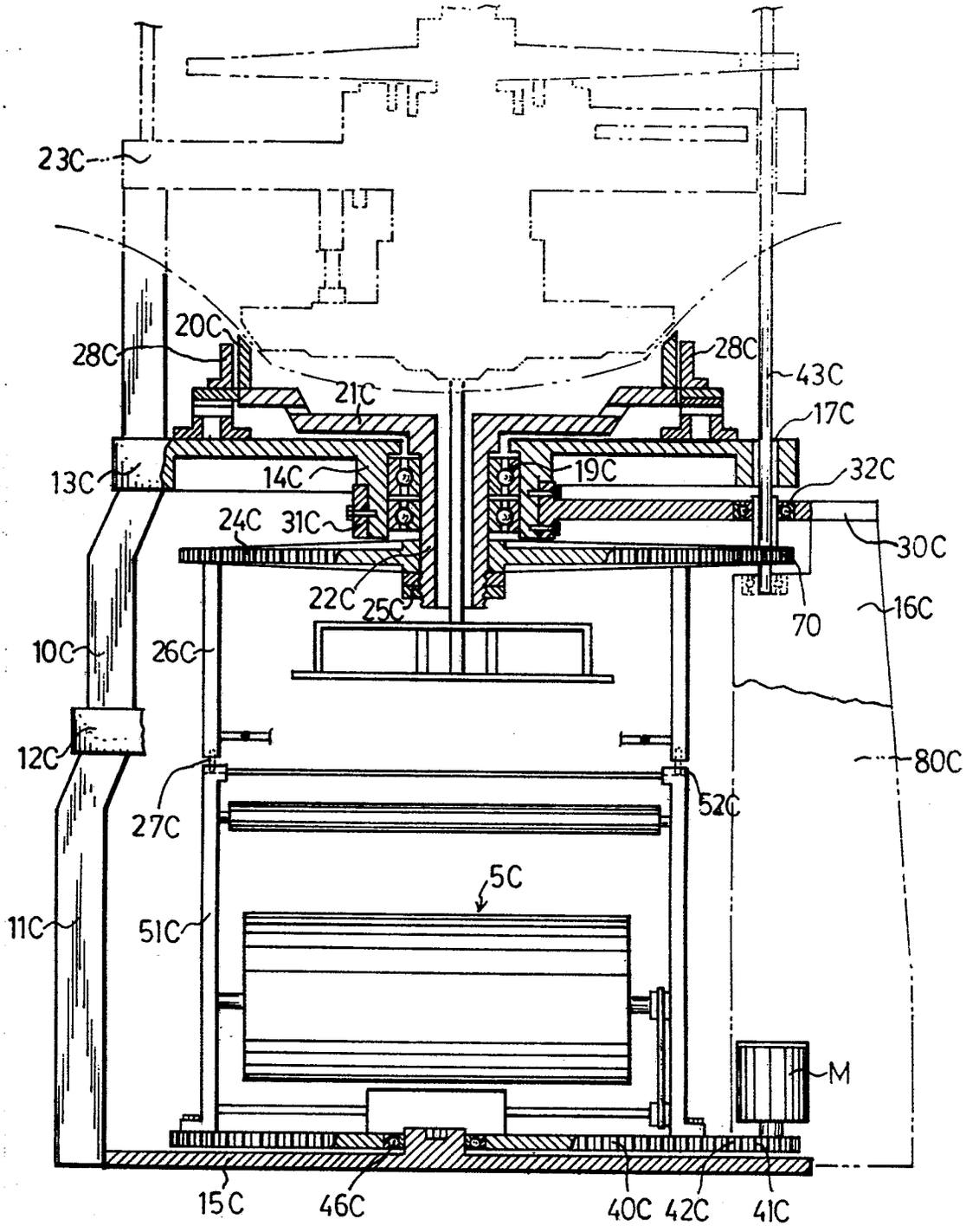
28B
17B
20B
67B
13B
13B
21B
10B
26B
42B
43B
18B
45B
41B
40B
44B
26B
40B
47B
27B
12B
12B
45B
44B
52B
46B
46B
121B
52B
11B
51B
51B
5B

FIG. 5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20C
28C
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21C
17C
13C
14C
19C
32C
24C
31C
30C
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25C
70
16C
10C
26C
12C
80C
27C
52C
5C
11C
51C
M
15C
46C
40C
42C
41C

FIG. 6

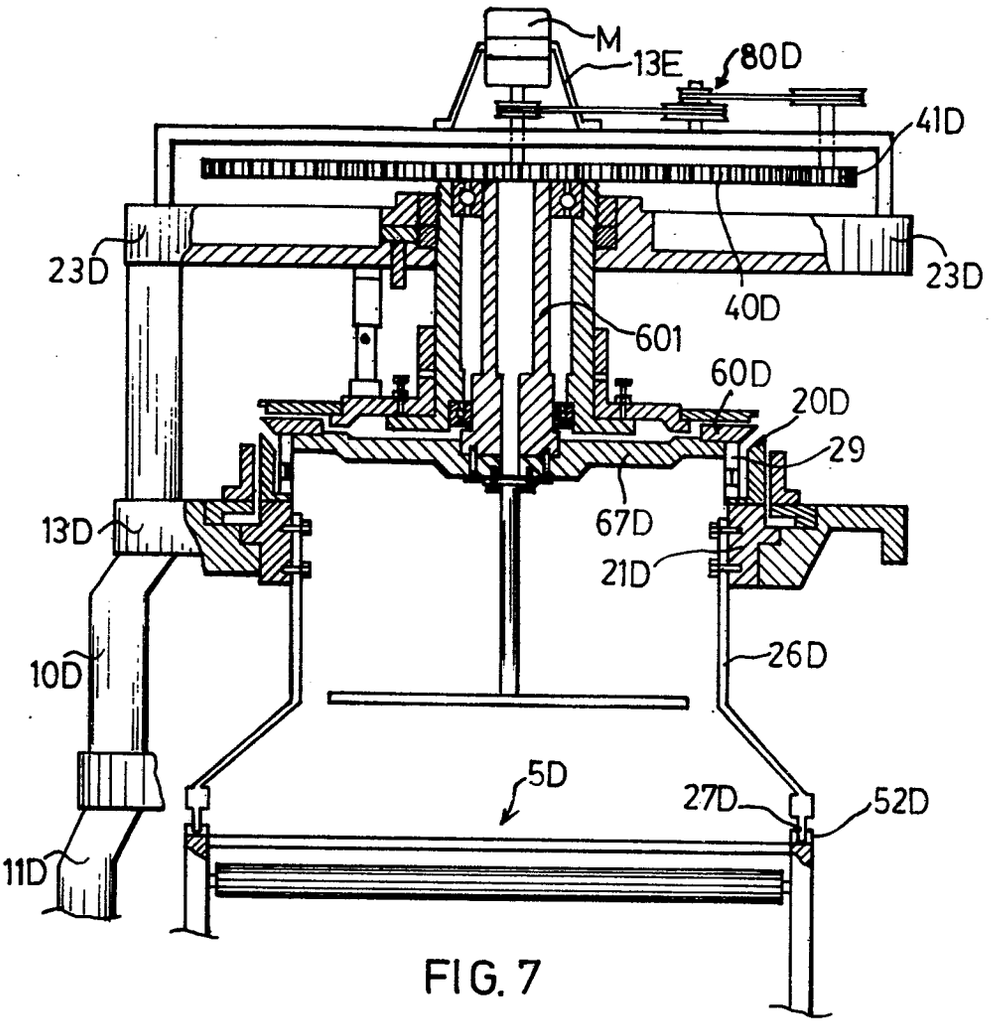


FIG. 7

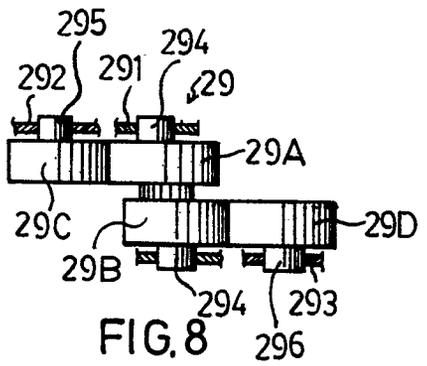


FIG. 8

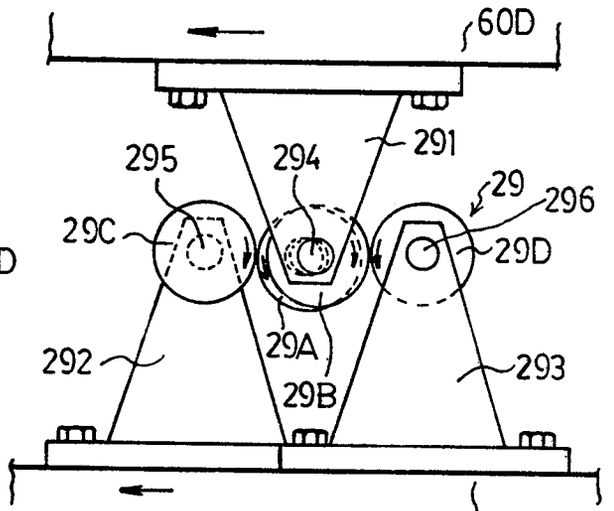


FIG. 9

European Patent Office

# EUROPEAN SEARCH REPORT

Application number EP 81 30 0764

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim |
|---|---|---|
| A | DE - A - 2 316 303 (MAYER)<br>* Page 4, line 26 - page 5, line 27; figures *<br>-- | 1 |
| A | US - A - 3 256 714 (WIESINGER)<br>* Column 1, lines 62-66; column 4, lines 52-73; figure 1 *<br>-- | 1 |
| A | GB - A - 1 287 645 (M.L.G.)<br>* Page 1, line 84 - page 2, line 14; figure 1 *<br>-- | 1 |
| A | FR - A - 1 394 455 (SINGER)<br>* Page 2, right-hand column, lines 7-28; figures 1-3 *<br>& GB - A - 994 299<br>----- | 1 |

CLASSIFICATION OF THE APPLICATION (Int Cl.³)

D 04 B 15/94

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

D 04 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
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T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family corresponding document

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

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 16-10-1981 | V. GELDER |

EPO Form 1503 1 06.78