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(54) Angular positioning of magnets in a developer roller used in electrophotographic apparatus or the like.

(57) An extended portion of an axle (9) supporting magnets (10a) in a developer roller (4) is provided with a gear (27) and a lever plate (28). A magnetic sensor (91), such as a Hall element, is arranged in place of a photosensitive drum (1) where there is the narrowest gap between the developer roller (4) and the photosensitive drum (1). The sensor (91) detects the magnetic field of the magnets (10a) while the magnets are rotated by an external drive (93, 94) via the gear (27). At an angular position of the magnets (10a) where a peak of magnetic field of a particular magnet pole (N_1) facing the drum (1) is detected, the lever plate (28) is fixed to a frame (25), which rotatably supports the axle (9), of a developer unit including the developer roller (4) by, for example, fastening a screw (30) on the frame. Accordingly, the angular position of the magnets (10a) can be adjusted easily and accurately enough to achieve quality printing.

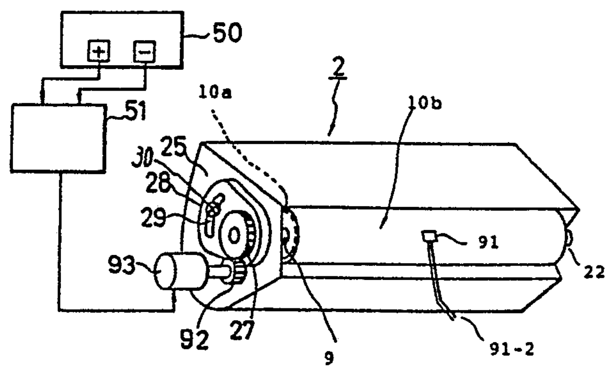

FIG.8

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Angular positioning of magnets in a developer roller used in electrophotographic apparatus or the like.

This invention relates to electrophotographic printing or copying apparatus or the like, and more particularly to the adjustment of angular position of stationary magnetic poles in a rotating developer roller which serves for carrying toner particles and magnetic carrier particles.

In electrophotographic printing or copying apparatuses using two-component dry developer composed of toner powder and magnetic carrier powder, many types of developing mechanism have been employed. One mechanism involves the use of a developer roller where a non-magnetic cylinder sleeve rotates around stationary magnets, and dry developer powder is conveyed onto an electrostatic latent image produced on a photosensitive drum while the carrier in the developer powder is attracted by the magnets onto the outer surface of the rotating cylinder sleeve. The magnets have typioally two N poles and three S pole angularly arranged around the axis of the cylinder sleeve. The magnets are generally made of a solid ferrite cylinder, installed on an axle, electromagnetically magnetized to provide the above-mentioned pole arrangement with the poles extending uniformly in the axial direction of the cylinder. Accordingly, the cylinder is called a magnet roll. The angular positions of the magnetic poles can be determined in relation to a flat face provided on the side of the axle. The magnet roll is assembled into the cylinder sleeve, which rotates coaxially around the magnet roll. This developer roller assembly is mounted in a developer unit, which is further mounted in the electrophotographic apparatus. The developer roller is arranged parallel to the photosensitive drum with an approximately 1 mm gap between them where they are closest, and a peak of the magnetic field intensity of a particular pole must be precisely aligned to face the photosensitive drum. When mounting the developer roller, the angular disposition of the magnets with respect to the drum is determined by the use of the flat face provided on the axle. However, the optimum angular disposition of the magnetic field is not always achieved with this mounting process. This is because the desired angular disposition of the magnetic field is required to be achieved with an accuracy of typically $\pm 1^{\circ}$, which is a much higher accuracy than the $\pm 2^{\circ}$ accuracy achievable with the conventional mounting process relying upon the flat face on the axle. If the peak of the magnetic field deviates from its optimum position in the direction of rotation of the drum and the developing roller, magnetic carrier powder is apt to undesirably stick to the photosensitive drum, resulting in a weak or missed print. If the peak deviates from optimum in the opposite direction (opposite to the direction of rotation of the drum and the developing roller) toner for forming the lower end of a character to be printed is apt to fail to be transferred to the photosensitive drum, resulting in non-uniformity at the lower edge of printed images.

Aspects of the present invention provide a structure and a method enabling more precise adjustment of angular position of stationary magnetic poles in a developer roller of an electrophotographic apparatus. Embodiments of the invention can provide for quick adjustment of angular position.

In accordance with the present invention an extended portion of a rotatable stationary axle supporting magnets is provided with a lever plate and a gear and a magnetic sensor is tentatively arranged in place of a photosensitive drum at a position where a peak of magnetic field strength of a specific one of the magnets is to be generated; the gear is driven by an external drive to rotate the magnets; and the peak of the magnetic field is searched while the magnets are rotated. When the peak is located, the lever plate is fixed to a frame supporting the axle, and the external drive is disengaged from the gear. Thus, the angular position of the magnets in relation to the photosensitive drum can be determined with sufficient precision to achieve a uniform print quality.

Reference is made, by way of example, to the accompanying drawings, in which:-

Fig. 1 is a schematic vertical sectional view illustrating the general constitution of an electrophotographic printer in which an embodiment of the present invention can be employed;

Fig. 2(a) is a schematic vertical sectional view illustrating operation of a developer unit used in the apparatus of Fig. 1;

Fig. 2(b) is an axial sectional view of a developer roller of Fig. 2(a);

Fig. 3(a) is a perspective view of a developer unit showing a screwed roller and regulating blades;

Fig. 3(b) schematically illustrates the function of the regulating blades of Fig. 3(a);

Fig. 4 is a perspective view of a developer roller with a structure in accordance with an embodiment of the present invention;

Fig. 5 illustrates angular positions of magnetic poles, and a magnetic sensor used in accordance with an exemplary embodiment of the present invention;

Fig. 6 illustrates variation of magnetic field strength as detected by the magnetic sensor when the magnets are rotated;

Fig. 7 is a perspective view of a jig employed in accordance with one method in accordance with an exemplary embodiment of the present invention;

Fig. 8 is a perspective view of a developer unit in which structure in accordance with an exemplary embodiment of the present invention is provided;

Fig. 9 shows a modification of a gear of the structure of Fig. 8;

Fig. 10 shows a modification of the structure of Fig. 8 in which a single piece part provides a lever plate and a gear;

Fig. 11 schematically illustrates a developer unit dumping developer powder;

Fig. 12 illustrates lever plate position for dumping developer powder; and

Fig. 13 illustrates lever plate position for a developing operation.

Fig. 1 is a cross-sectional side view schematically illustrating general constitution of a laser printer, as a typical example of an electrophotographic apparatus. A paper feeder unit 101 stocks sheets of paper and supplies the paper to a printer unit 102 where the paper is electrophotographically printed; a stacker 104 stocks the printed paper which is transported from the printer unit 102 via a paper transport unit 103. Sheets of paper for printing are loaded from an external source into a paper cassette 110 and kept stacked therein (this is not shown in the Figure), and picked up by a pick roller 111, sheet-by-sheet, therefrom. The paper picked up by roller 111 is fed into a paper path 115 by a feed roller pair 112 and transported by a feed roller pair 113 to the printer unit 102. Paper to be printed may also be manually fed through a manual inlet 116, driven by a feed roller pair 114, into the paper path 115.

In an optical unit 122, a laser light beam LB is generated, modulated according to data to be printed, deflected and focused to scan over a photosensitive drum 1 along an axial direction of the drum. The photosensitive drum 1, typically composed of an Organic Photosensitive Conductor layer of typically 17 μm thickness coated on an aluminum drum, rotates as indicated by an arrow in the Figure, and is electrically charged, to typically -600 V, by a corona discharge at a charger 121 before the light LB is projected thereon.

The light beam LB projected onto the photosensitive drum 1 discharges electric charge on the photosensitive drum 1 so that a latent image is produced thereon. Developer powder, which is triboelectrically charged to about -350 V (by friction between powder particles while the powder is being mixed), is conveyed by a developer roller 4 in a developer unit 2 to the photosensitive drum 1 and then toner in the developer powder is electrostatically attracted to deposit on the latent image produced on the drum, and thus the image to be printed is developed on the drum 1. Structure and function of the developer unit 2 will be described below in more detail. Paper (not shown in the Figure) fed through the feed roll pair 113 is contacted with the drum 1 having the developed image, i.e. the toner, thereon. The toner is then electrostatically transferred to the paper at an image transfer unit 124. Thereafter, paper separated from the drum 1 but carrying toner thereon is fed into a fixer unit 127, where the paper is pressed by a heat roller 127a and a backup roller 127b and the toner is melted so that it adheres to the paper. Thus, the printing operation is completed.

Electric charges remaining on the drum 1 after the toner is transferred to the paper are removed by a discharger 125, typically composed of a lamp. A cleaner unit 126 located after the discharger 125 includes:- a fur brush 260, which rotates in the same direction as the drum 1, for brushing off toner remaining on the drum 1, and scrapers 261 for removing toner sticking to the brush 260. Thereafter, the cleaned portion of the drum 1 arrives at the charger 121 again.

Printed paper is transported from unit 127 by roller pairs 130, 131 and 132 through an outlet path 133 into the stacker 104 where printed sheets are stacked with their printed faces down. Accordingly, the S-shaped paper path allows the apparatus to be compact in size, and provides that the first printed sheet is first, with its printed face down, at the bottom of the stacked papers in the stacker 104.

Structure and function of the developer unit 2 are further illustrated in Figs. 2 and Figs. 3, and embodiments of the present invention are then described with reference to Figs. 4 to 10.

A reservoir 234 (Fig. 1) stores and supplies the toner powder to a screwed roller 5. The developer powder is a mixture of toner and carrier made of a soft magnetic material, such as soft iron powder. The proportion of magnetic carrier in the developer powder is typically 4.5% by weight. The toner powder (not shown in Fig. 1) falling from the reservoir 234 is stirred by rotation of the screwed roller 5 in the direction indicated by an arrow in Fig. 2(a), as shown by particles in Fig. 2(a), and at the same time is delivered to developer roller 4.

The developer powder fed from the screwed roller 5 is magnetically attracted by poles S_2 and N_2 in the developer roller 4, depositing on the surface of the developer roller 4, and is then conveyed by continuous rotation of the developer roller 4 as denoted by an arrow in Fig. 2(a) and held by the successive magnetic fields from the poles N_2 and S_3. Thickly deposited developer powder on the developer roller 4 is sliced at a predetermined height (depth), typically 1.0 mm, by a doctor blade 6 while passing through a gap defined by the doctor blade 6. Developer powder deposited with a depth less than the height of the gap is further conveyed to the narrowest gap, typically 1.0 mm, between the photosensitive drum 1 and the developer roller 4 by rotation of the developer roller 4 and successive magnetic fields of poles S_3 and N_1. At this narrowest gap the toner in the developer powder conveyed thereto is electrostatically attracted by the latent image on the drum 1; however, the magnetic carrier in the developer powder remains on the developer roller 4, being attracted thereto by the magnetic pole N_1 which is aligned with the narrowest gap. The location of the magnetic pole N_1 in relation to the narrowest gap is important, and details of this matter, with which embodiments of the present invention are concerned, are described below in more detail. Toner and carrier remaining on the developer roller 4 are further conveyed to the magnetic poles S_1 and S_3, where the developer powder is removed from the developer roller 4 due to repulsive force between the magnetic poles S_1 and S_3, and accordingly falls down to the screwed roller 5. Excessive developer powder sliced by the doctor blade 6 is returned, passing over a partition blade 7, to the screwed roller 5. On the other hand, the screw 5′ of the screwed roller 5 conveys the developer powder in a direction M (Fig. 3) axially of the roller 5 as a result of rotation of the roller 5 as indicated by the arrow in Fig. 2(a). The partition blade 7 is provided with regulator blades 7-1 to 7-6 which are so tilted as to smoothly guide falling powder in the direction opposite to the direction M in which powder is transported by the screwed roller. Accordingly, the developer powder is continually mixed by these two opposite movements of powder, in opposite axial directions. A sensor 8 is provided on the bottom of a case 3 of the developer unit 2 in order to monitor the condition of the developer powder (toner density).

Structure and function of the developer roller 4 and the magnets therein will be described in more detail below. The developer roller 4 is composed of a typically 1 mm thick non-magnetic stainless steel cylinder sleeve 10b (Figs. 2) rotating with an axle 22 provided on one end of the cylinder sleeve 10b, and the magnet roll 10a made of a solid ferrite rod mounted on an axle 9 extending in the opposite direction to the axle 22, rotatable in the cylinder sleeve 10b. The magnet roll 10a is magnetized to have typically two N poles N_1, N_2, and three S poles S_1 to S_3 whose angular positions are specifically given as shown in Fig. 2(a) and Fig. 5. The magnetization is uniform in axial directions of the magnet roll. Magnetic fields produced by the magnetic poles S_2, N_2, S_3 and N_1 attract developer powder onto the surface of the cylinder sleeve 10b. The peak of magnetic field intensity of the magnetic pole N_1, generating 850 gauss (which is higher than the 600 gauss of the other poles), is to be aligned with the narrowest gap between the drum 1 and the cylinder sleeve 10b. The axles 9 and 22 are coaxial with each other as shown in Fig. 2(b) and are rotatably mounted respectively on a frame 25 of the developer unit 2 (Fig. 8).

In accordance with an embodiment of the invention, fixed to an extended portion of the axle 9, there are provided a lever plate 28 and a gear 27, which are accordingly rotatable with the axle 9. A flat face provided on the side of the axle 9 and a screw (not shown in the Figures) to press the flat surface through the gear or the lever plate 28 are effective for fixing the lever plate 28 and the gear 27 to the axle 9. One side of the lever plate 28 faces a side of the frame 25. The lever plate 28 is generally fan-shaped and is provided with an arc slot 29 which is coaxial with the axle 9. On the frame 25, there is provided a tapped hole (not shown in the Figure) and the lever plate can be fixed to the frame 25 by fastening a screw 30 through the arc slot 29 with the tapped hole.

Referring to Fig. 7, one method of adjusting magnet location as employed in relation to an embodiment of the present invention will be hereinafter described. The developer unit 2, designed to be detachable from the remainder of the electrophotographic apparatus, is axially pulled out of the apparatus, and is mounted on an adjusting jig 40 by fastening screws 41 to fix a part 25′ of the frame 25 of the developer unit 2 to the jig 40. Thus, the developer unit 2 is positioned to the jig 40 exactly as it is in the apparatus, when it is in place in the apparatus. A supporting member 42 of the jig 40 imitates the shape of the drum 1, but in the jig it simply supports a magnetic sensor holder 91-1. At the head of the holder 91-1 a magnetic sensor 91 is installed (in place of the drum 1) at a particular angular position in relation to the frame 25 of the developer unit 2, where the peak of the strongest magnetic pole N_1 is to be located, i.e. facing the narrowest gap between the drum 1 and the developer roller 4. The magnetic sensor 91 typically uses a Hall element having an approximately 1.0 mm diameter, and is spaced approximately 1 mm apart from the surface of the cylinder sleeve 10b on the jig 40. A lead 91-2 delivers a signal detected by the magnetic sensor 91 to an indication device such as a meter or an oscilloscope (which are not shown in the Figures).

When the developer unit 2 is mounted on the jig 40, the gear 27 on the axle 9 is engaged with a driving gear 92 (Fig. 8), which is installed on the jig 40 and driven by a step motor 93 through step-down gears 94 and a belt 95 (which are shown in Fig. 7 but not shown in Fig. 8 where they are included in the motor 93). Switches 50 instruct a driver circuit 51 with regard to the direction in which the step motor 93 is to be driven. When the magnet roll 10a is rotated by the step motor 93 via the gear 27 and the axle 9, the magnetic field intensity detected by the magnetic sensor 91, and indicated by the meter, etc., varies as shown in Fig. 6. Thus, the optimum angular position of the magnetic pole N_1 generating the peak of the magnetic field intensity 850 gauss is easily determined by observing the output of the magnetic sensor 91 while the magnet roll 10a is rotated. When the optimum angular position of the magnet roll 10a is determined, the lever plate 28 is fixed to the frame 25 by fastening the screw 30 through the arc slot 29. Then, the developer unit 2 is removed from the jig 40, and mounted into the electrophotographic apparatus again. Using a gear 27 of 0.5 module having 38 teeth and a step motor 93 of five-phase drive, having 0.35° resolution and including 1/10 step-down gears, provides for alignment of the magnet with an accuracy of ± 0.75°, fully satisfying requirements for the electrophotographic apparatus. The gears 94 used to deliver the rotation of the motor 93 to the gear 27 are preferably scissors gears, which generate no backlash. The belt 95 is of non-slip type.

Though in the above description the magnetic sensor 91 is placed at the narrowest gap between the drum 1 and the developer roller 4, the magnetic sensor may be shifted from the position of the narrowest gap by an arbitrary angle, if required.

The magnetic field intensity detected by the magnet sensor 91 at each angular position of the magnetic pole N_1 may be stored in a memory device of a microprocessor (not shown in the Figure), and the angular position at which the magnetic roll is to be fixed may be instructed by the microprocessor according to the stored data. Furthermore, the angular position at which the magnet roll is to be fixed may be shifted from the very peak position by any arbitrary angle according to a preprogrammed instruction in the microprocessor. In other words, the microprocessor, already knowing the relationship of detected magnetic field intensity to angular position (as in Fig. 6), can easily determine the amount of angular adjustment necessary, and can easily determine the number of pulses by which the step motor 93 should be driven to provide the angular adjustment. Accordingly, the procedure for adjusting the angular position of the magnetic pole N_1 is simply completed by transmitting the exact number of the pulses from the microprocessor to the step motor 93.

Although, in the procedure described above the developer unit 2 is detached from the apparatus and then mounted on the jig, alternatively the drum 1 may be detached from the apparatus and the magnetic detector inserted into the vacant space left by removal of the drum 1 so that the magnetic detector is placed at the very position where the drum 1 makes the narrowest gap with the developer roller while the developer unit 2 is kept installed in the apparatus.

Although in the description above the gear 27 is provided with its teeth all around the circumference, the teeth may be provided, as denoted at 27′ in Fig. 9, only over the angle needed for rotating the magnet roll 10a.

Although in the description above transmission means are formed using gear 27 (or 27′), the transmission means may be formed on a belt, such as V-belt, a timing belt or a flat belt.

Although in the description above, the lever plate 28 and the gear 27 are referred to as separate parts, they may be formed as a single piece, an example of which is illustrated at 28′ in Fig. 10. This single piece can be produced for instance by a molding or sintering method.

When the life of the carrier powder in the developer unit 2 is completed and it is to be removed therefrom, the developer unit 2 is detached from the apparatus. Next, the screw 30 is loosened and the magnet roll 10a is rotated until the magnetic poles S_1 and S_2 face an opening of the unit 2 as shown in Fig. 11, and the cylinder sleeve 10b as well as the screwed roller 5 is rotated in the direction indicated by an arrow in Fig. 11 (where the cylinder sleeve 10b is not separately shown, for the purpose of simplifying the Figure). Accordingly, the developer powder attracted onto the cylinder sleeve 10b by the magnetic poles N_1 and S_1, as well as the developer powder contained in the developer unit 2, is conveyed to the portion between the poles S_1 and S_2 by a continuous rotation of the cylinder sleeve 10b in the direction shown by the arrow. Due to the repulsive magnetic field between the poles S_1 and S_2, the developer powder attracted onto the cylinder sleeve 10b leaves the sleeve to fall down through the opening of the frame. There may be tentatively placed a bucket 11 to receive the falling developer powder. In order to easily determine the angular position of the magnet roll 10a for dumping the developer powder, there may be provided an extended part 28-1 on the lever plate 28 and a stopper pin 31 installed on the wall of the frame 25 as shown in Fig. 12. The extended part 28-1 is shaped and located so that, when the lever plate is rotated in the direction indicated by an arrow in Fig. 12, until the extended part 28-1 is blocked by the stopper pin 31, the magnet roll is in the position to dump the developer powder. When the magnet roll 10a is to be adjusted back to its developing position, the lever plate 28 is rotated in the direction opposite to that of the arrow in Fig. 12 so that the N_1 pole comes to the peak position of the magnetic sensor (Fig. 13), and finely adjusted and then fixed with the screw 30, as described above. Furthermore, a mark made with paint or the like on the frame so as to indicate the position of the lever plate 28 on completion of adjustment of the magnet's angular position allows its easy readjustment after the developer powder is dumped. The gear 27 and the cylinder sleeve 10b are not shown in Figs. 12 and 13 to simplify the Figures.

Although in the above description the lever plate 28 is fan-shaped, this is merely exemplary. The shape can be arbitrarily chosen as long as the function of the lever plate is fulfilled.

Although in the above description magnetic poles N and S are particularly specified, it will be apparent N and S poles are interchangable with each other in embodiments of the present invention.

Although a laser printer has been referred to as apparatus in respect of which an embodiment of the present invention can be employed, it will be apparent that embodiments of the present invention are applicable also to facsimile or copying machines, for example.

An extended portion of an axle supporting magnets in a developer roller is provided with a gear and a lever plate. A magnetic sensor, such as a Hall element, is arranged in place of a photosensitive drum where there is the narrowest gap between the developer roller and the photosensitive drum. The sensor detects the magnetic field of the magnets while the magnets are rotated by an external drive via the gear. At an angular position of the magnets where a peak of magnetic field of a particular magnet pole facing the drum is detected, the lever plate is fixed to a frame, which rotatably supports the axle, of a developer unit including the developer roller by, for example, fastening a screw on the frame. According to the structures and methods embodying the present invention, the angular position of the magnets can be adjusted easily and accurately enough to achieve quality printing.

Claims

1. A developer unit for supplying developer powder including magnetic carrier powder to an image-bearing member, for use in an electrophotographic printing apparatus or the like, comprising:-
a developer roller, rotatable for conveying developer powder to the image-bearing member, the developer roller being arranged parallel to the image-bearing member;
magnetic poles provided in the developer roller, installed on an axle coaxial of the developer roller, the magnetic poles being arranged with specific angular positions around the axle;
frame means for rotatably supporting the axle;
transmission means fixed to the axle, for rotating the axle, capable of being driven by an external drive; and
lever means fixed to the axle, capable of being fixed to the frame means.

2. A developer unit for supplying developer powder including magnetic carrier powder to an image-bearing member, for use in an electrophotographic printing apparatus or the like, comprising:-
a developer roller, rotatable for conveying developer powder to the image-bearing member, the developer roller being arranged parallel to the image-bearing member;
magnetic poles provided in the developer roller, installed on an axle coaxial of the developer roller, said magnetic poles being arranged with specific angular positions around the axle;
frame means for rotatably supporting the axle;
transmission means fixed to the axle, capable of being driven by an external drive, for rotating the axle, whereby angular position of the magnetic poles can be adjusted and fixed relative to the frame means; and
lever means fixed to the axle, capable of being fixed to the frame means.

3. A developer unit as claimed in claim 1 or 2, wherein the transmission means is provided by a gear.

4. A developer unit as claimed in claim 1, 2 or 3, wherein the transmission means and the lever means are unified to be a single piece.

5. A developer unit as claimed in claim 1, 2, 3 or 4, wherein the lever means is formed of a plate having an arc slot coaxial with the axle, and the lever means is capable of being fixed to the frame means by a fixing means through the arc slot.

6. A developer unit as claimed in any preceding claim, wherein the transmission means is disengaged from said external drive after the lever means is fixed to the frame means.

7. A method of adjusting angular position of magnetic poles of a developer unit, which unit serves for conveying developer powder including magnetic carrier powder to an image-bearing member, for use in an electrophotographic printing apparatus and the like, the developer unit including:-
a developer roller, rotatable for conveying developer powder to the image-bearing member, the developer roller being arranged parallel to the image-bearing member;
magnetic poles provided in the developer roller,

installed on an axle coaxial of the developer roller, the magnetic poles being arranged with specific angular positions around the axle;
a frame means for rotatably supporting the axle;
transmission means fixed to the axle, for rotating the axle, capable of being driven by an external drive; and
a lever means fixed to the axle, capable of being fixed to the frame means,
the method comprising the steps of:-
placing a magnetic sensor in a predetermined position where a peak of magnetic field intensity of a specific one of the magnetic poles is to be generated;
rotating the transmission means, driven by the external drive;
finding an angular position of the transmission means where said peak of said magnetic field intensity of said specific magnetic pole is detected by the magnetic sensor while said transmission means is rotated;
fixing the lever member to the frame member; and
disengaging said external drive from the transmission means.

8. A method as claimed in claim 7, wherein the transmission means is formed of a gear and is driven by a gear or a gear chain.

9. A method as claimed in claim 7 or 8, wherein the transmission means is driven by an external drive comprising a step motor.

10. A method as claimed in claim 7, 8 or 9, wherein the said steps are carried out while the developer unit is detached from the electrophotographic apparatus and is mounted on a jig on which said magnetic sensor is installed.

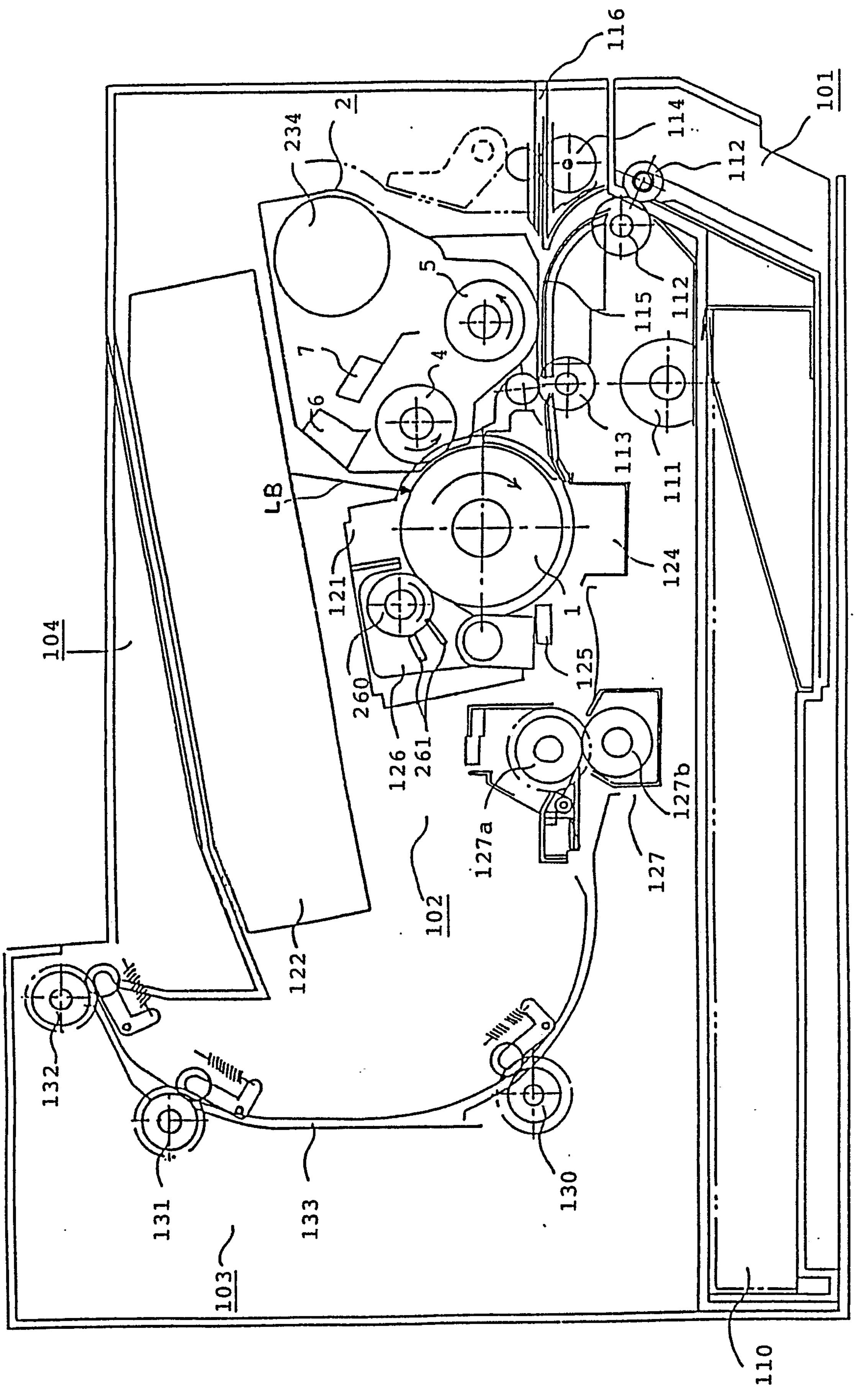
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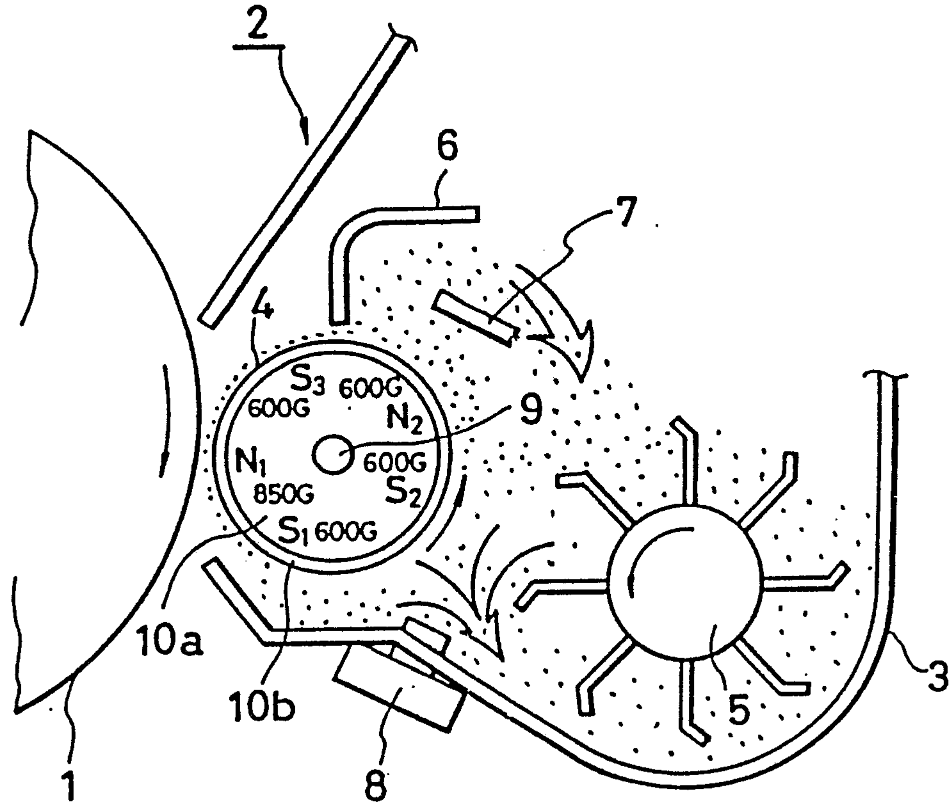
FIG. 1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8

FIG. 2 (a)

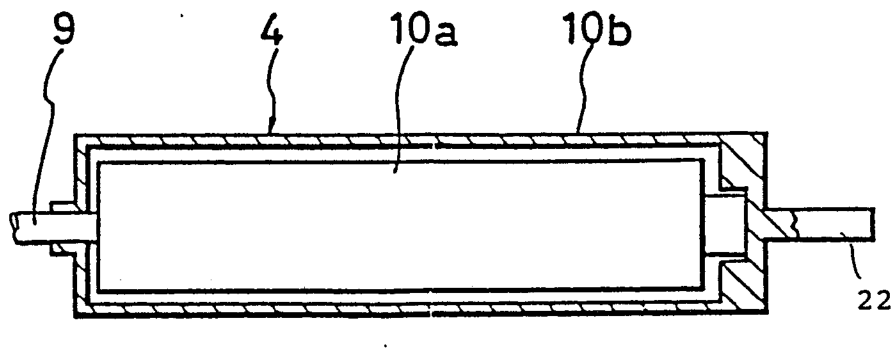
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FIG. 2 (b)

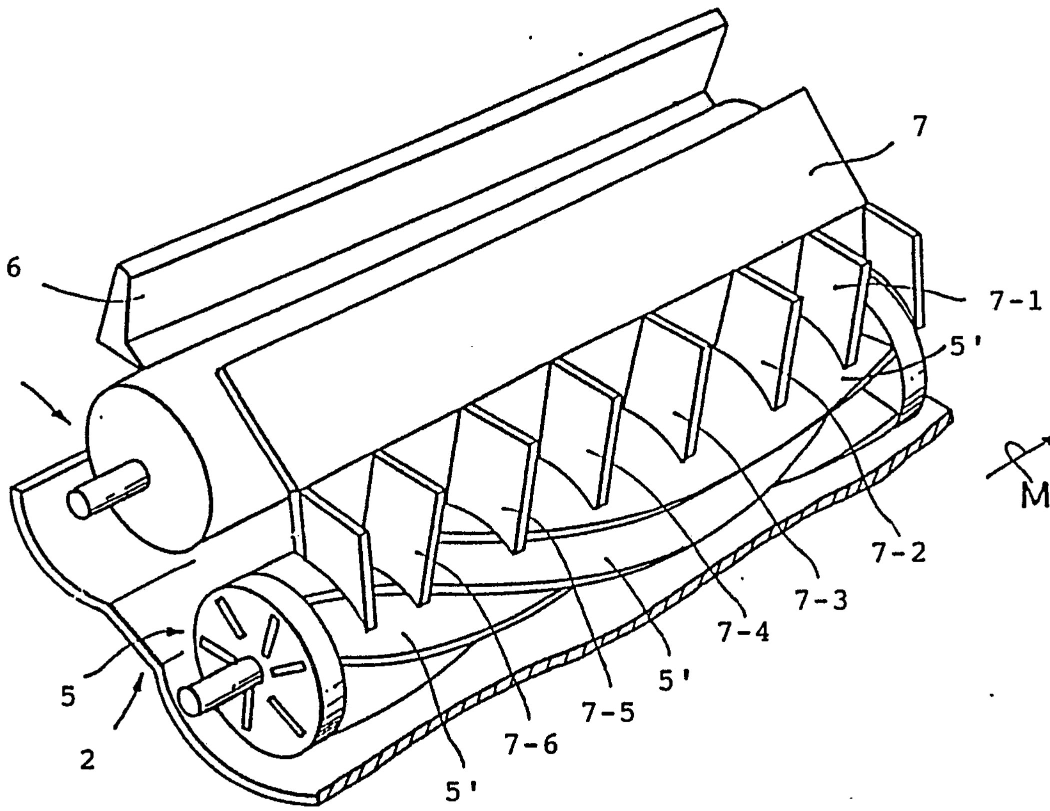

FIG. 3 (a)

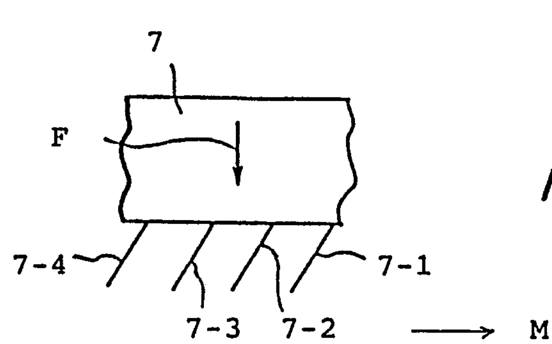

FIG. 3 (b)

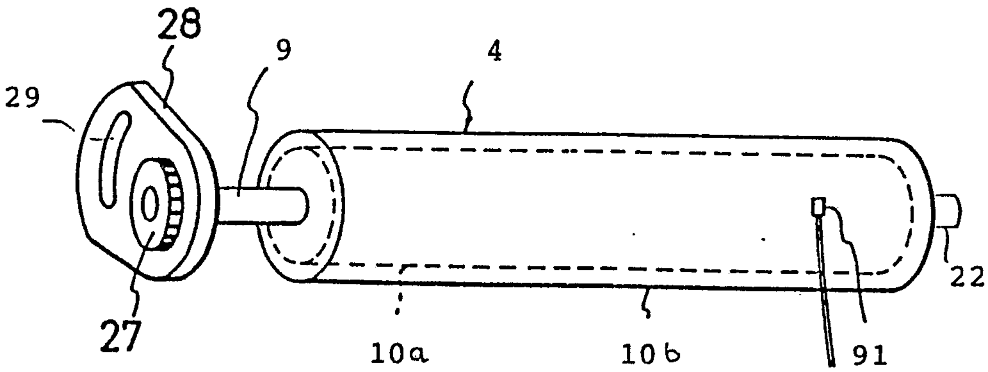

FIG. 4

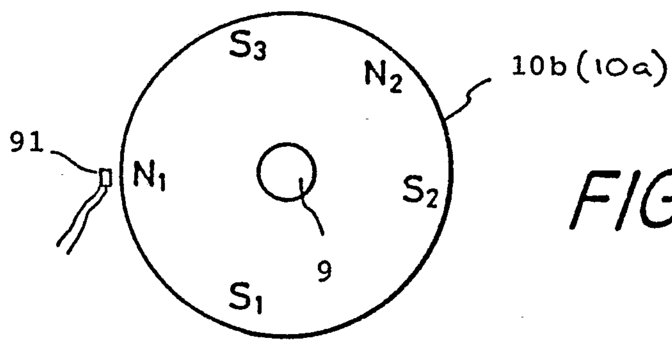

FIG. 5

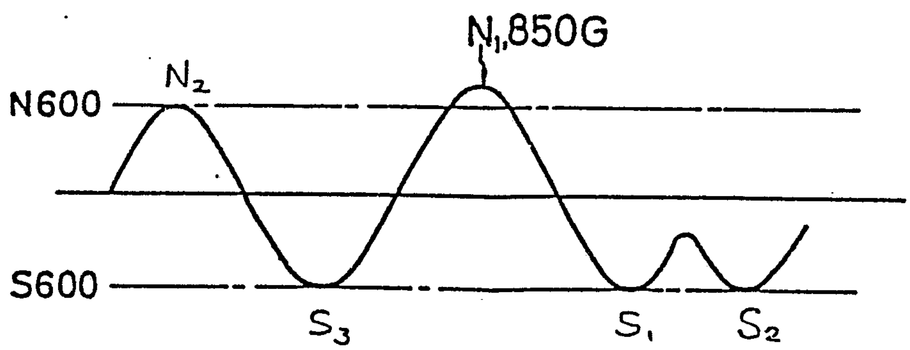

FIG. 6

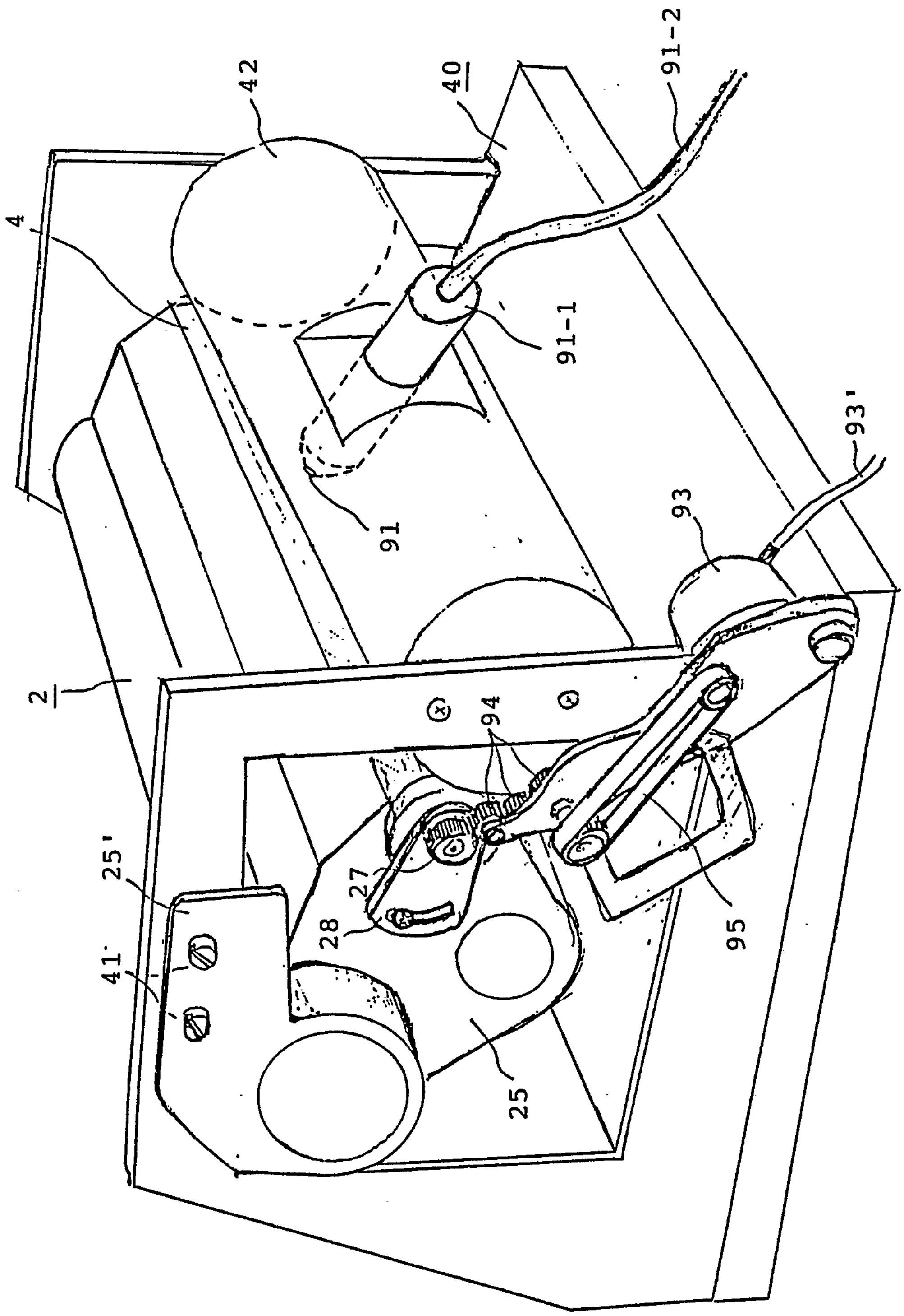

FIG.7

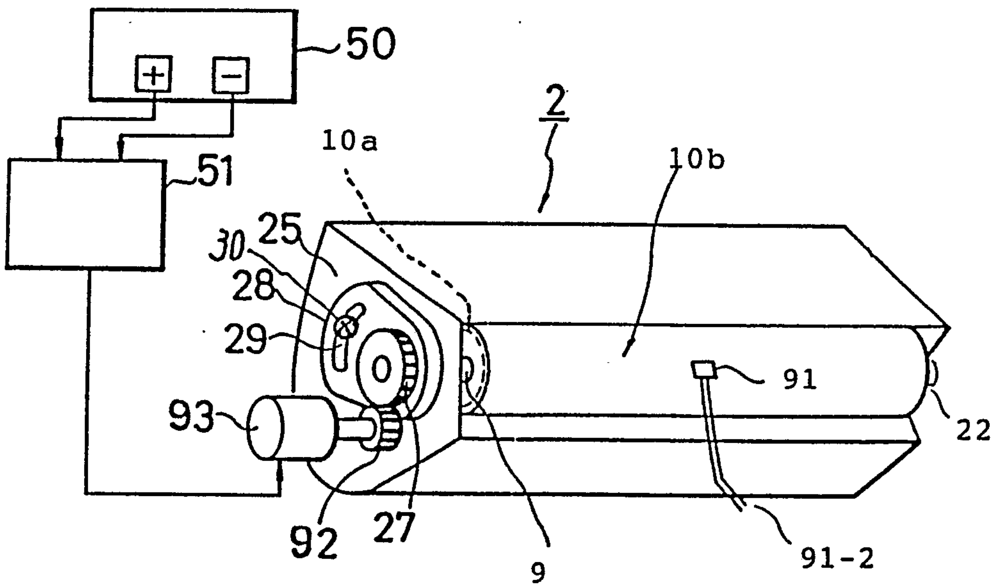

FIG.8

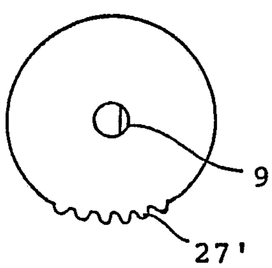

FIG.9

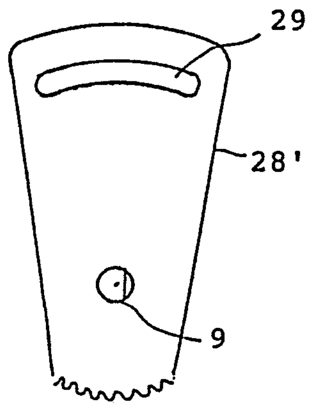

FIG.10

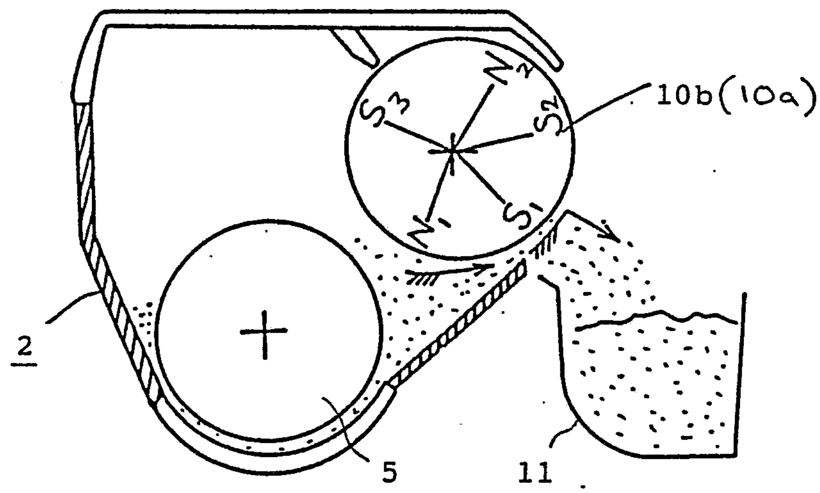

FIG.11

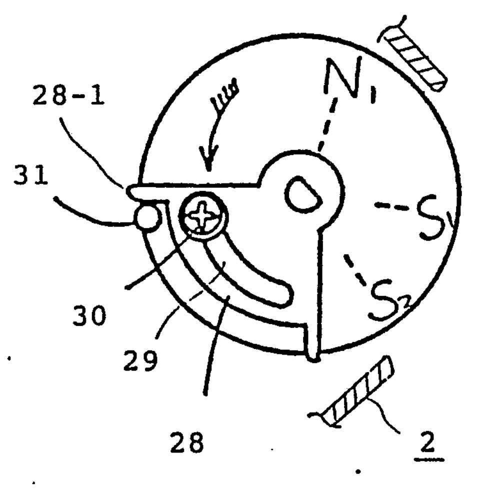

FIG.12

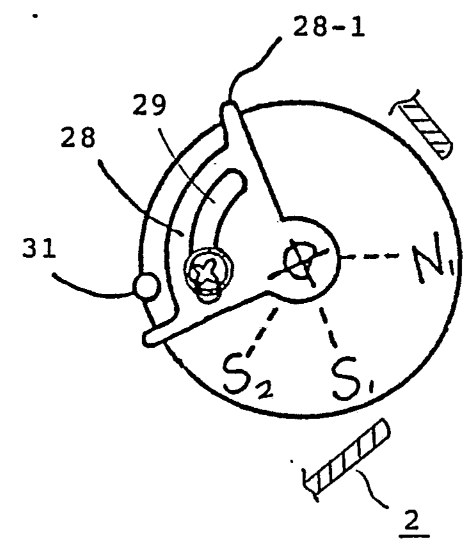

FIG.13