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(72) Inventors:
 • Shimizu, Daisuke
 Daito-shi
 Osaka 574-0013 (JP)
 • Takasaka, Daisuke
 Daito-shi
 Osaka 574-0013 (JP)

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(71) Applicant: **Funai Electric Co., Ltd.**
 Daito-shi,
 Osaka 574-0013 (JP)

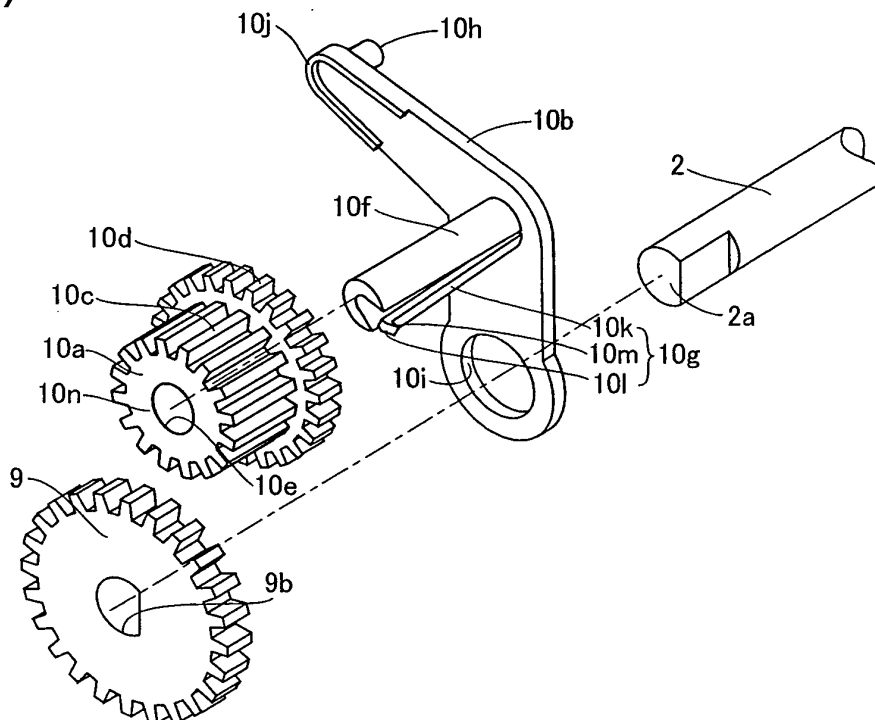
(74) Representative: **Calderbank, Thomas Roger et al**
MEWBURN ELLIS
 York House
 23 Kingsway
 London WC2B 6HP (GB)

(54) **Image generating apparatus**

(57) An image generating apparatus capable of rotating and rotatably supporting a gear while reducing the number of components is obtained. This image generating apparatus comprises a normally and reversely rotatable drive gear (9), a driven gear (10a) meshing with the

drive gear and a rotating arm (10b) of resin integrally provided with a rotation fulcrum portion (10i) rotatably mounted on the drive gear, a support shaft (10f) rotatably supporting the driven gear and a spring portion (10g) outwardly inclined by a prescribed angle with respect to the extensional direction of the support shaft.

FIG.7



Description

[0001] The present invention relates to an image generating apparatus, and more particularly, it relates to an image generating apparatus comprising a rotating arm capable of rotating a gear while rotatably (swingably) supporting the same.

[0002] A drive transmission device provided with a swing member (rotating arm) capable of rotating a gear while rotatably (swingably) supporting the same is known in general, as disclosed in Japanese Patent Laying-Open Nos. 2004-225761 and 9-60705 (1997), for example.

[0003] The aforementioned Japanese Patent Laying-Open No. 2004-225761 describes a drive transmission device capable of transmitting driving force of a driving gear (drive gear) to a driven gear (take-up gear) through a swing gear (driven gear). In this drive transmission device, a swing member (rotating arm) rotatably supports the swing gear meshing with the driven gear. This swing member swings through a spring and a wire provided independently thereof. More specifically, the spring so urges the swing member that the swing gear meshes with the driving gear, while the wire so pulls the swing member that the swing gear separates from the driving gear. When the swing member is released from the pulling force of the wire, the spring urges the swing member so that the swing gear swings to mesh with the driving gear. Thus, the driving force of the driving gear is transmitted to the driven gear.

[0004] The aforementioned Japanese Patent Laying-Open No. 9-60705 describes a drive transmission device capable of transmitting driving force of a driving gear (drive gear) to a driven gear (take-up gear) through a planetary gear (driven gear), similarly to the aforementioned Japanese Patent Laying-Open No. 2004-225761. In the drive transmission device described in Japanese Patent Laying-Open No. 9-60705, a magnetizing material is added to the planetary gear while a swing member (rotating arm) rotatably supporting the planetary gear is constituted of a magnetizable material, thereby increasing frictional force between the planetary gear and the swing member. Thus, the swing member swings in the direction of rotation of the driving gear, so that the planetary gear meshes with the driving gear for transmitting the driving force of the driving gear to the driven gear.

[0005] A thermal transfer printer is generally known as an exemplary image generating apparatus comprising a rotating arm capable of rotating a gear while rotatably (swingably) supporting the same. Fig. 16 is a perspective view showing the overall structure of an exemplary conventional thermal transfer printer. Fig. 17 is a front elevational view showing respective motors and respective gears of the conventional thermal transfer printer shown in Fig. 16. Figs. 18 to 21 are diagrams for illustrating the structure of the conventional thermal transfer printer shown in Fig. 16 in detail. The structure of the conventional thermal transfer printer is described with reference to Figs. 16 to 21.

[0006] As shown in Figs. 16 and 17, the conventional thermal transfer printer comprises a chassis 101 of metal, a feed roller 102 of metal for feeding a paper, a press roller 103 of metal coming into contact with the feed roller 102 with prescribed pressing force, a feed roller bearing 104 rotatably supporting the feed roller 102, a press roller bearing 105 rotatably supporting the press roller 103, a bearing support plate 106 of metal supporting the press roller bearing 105, a print head 107 for printing, a take-up reel 108 for taking up an ink sheet, a feed roller gear 109, a swing gear portion 110 mounted with a swing gear 110a, a motor bracket 111, a motor 112 for driving the feed roller 102 and the take-up reel 108, a motor 113 for driving the print head 107, and intermediate gears 114 and 115 (see Fig. 17).

[0007] As shown in Fig. 16, the chassis 101 has first and second side surfaces 101a and 101b. The motor bracket 111 is mounted on the first side surface 101a of the chassis 101. As shown in Fig. 17, a slot-shaped inhibiting portion 101c is provided on the first side surface 101a of the chassis 101 for inhibiting the swing gear portion 110 from rotating beyond a constant quantity. As shown in Fig. 16, a cartridge receiving hole 101d is provided on the second side surface 101b of the chassis 101 for receiving an ink sheet cartridge (not shown).

[0008] As shown in Figs. 18 and 20, a D-shaped gear insert portion 102a is provided on the feed roller 102. This gear insert portion 102a of the feed roller 102 is fitted into the feed roller gear 109 not to idle, as shown in Figs. 17 and 20. The press roller bearing 105 mounted on the bearing support plate 106 rotatably supports the press roller 103, as shown in Fig. 16. The print head 107 is mounted inside the first and second side surfaces 101a and 101b of the chassis 101, to be rotatable about a support shaft 107a.

[0009] As shown in Fig. 17, a gear portion 108a of the take-up reel 108 is so arranged as to mesh with the swing gear 110a of the swing gear portion 110, regularly meshing with the feed roller gear 109, upon swinging of the swing gear 110a. As shown in Figs. 18, 19 and 21, a shaft portion 109a (see Fig. 21) of the feed roller gear 109 is provided with a D-shaped mounting hole 109b, into which the gear insert portion 102a of the feed roller 102 is press-fitted.

[0010] As shown in Figs. 18 and 21, the swing gear portion 110 has the swing gear 110a of resin, a rotating arm 110b rotatably supporting the swing gear 110a, a helical compression spring 110c pressing the rotating arm 110b with prescribed pressing force and an E-ring 110d. As shown in Figs. 17 to 20, the swing gear 110a is provided with a small-diametral gear portion 110e meshing with the feed roller gear 109 (see Figs. 19 and 20), a large-diametral gear portion 110f meshing with the gear portion 108a (see Fig. 17) of the take-up reel 108 and a receiving hole 110h (see Fig. 18) receiving a support shaft 110g of the rotating arm 110b. As shown in Fig. 18, the rotating arm 110b is provided with the support shaft 110g for rotatably supporting the swing gear 110a,

a boss 110i fitted into the slot-shaped inhibiting portion 101c (see Fig. 17) provided on the first side surface 101a of the chassis 101 and a feed roller receiving hole 110j rotatably receiving the feed roller 102. The support shaft 110g of the rotating arm 110b is provided with a groove 110k to be mounted with the E-ring 110d.

[0011] As shown in Fig. 21, the helical compression spring 110c presses the rotating arm 110b and the swing gear 110a in a thrust direction (axial direction), so that the swing gear 110a is hard to rotate. Upon rotation of the feed roller gear 109, therefore, the swing gear 110a moves in the direction of this rotation, thereby rotating the rotating arm 110b mounted on the swing gear 110a. As shown in Figs. 19 and 21, the E-ring 110d is mounted on the groove 110k (see Figs. 18 and 21) provided on the support shaft 110g of the rotating arm 110b, in order to prevent the swing gear 110a from falling resulting from the pressing force of the helical compression spring 110c.

[0012] As shown in Fig. 17, the driving force of the motor 112 for driving the feed roller 102 and the take-up reel 108 is transmitted to the feed roller gear 109 and the gear portion 108a of the take-up reel 108 through the intermediate gears 114 and 115.

[0013] A paper feed operation of the conventional thermal transfer printer is now described with reference to Figs. 16 and 17. In paper feeding, the thermal transfer printer drives the motor 112 for driving the feed roller 102 and the take-up reel 108 to rotate a motor gear 112a (see Fig. 17) mounted on the motor 112 along arrow A2 in Fig. 17 thereby rotating the feed roller gear 109 along arrow B2 in Fig. 17 through the intermediate gears 114 and 115, as shown in Figs. 16 and 17. Thus, the feed roller gear 102 carries the paper (not shown) along arrow C2 in Fig. 16, as shown in Fig. 16. At this time, the rotating arm 110b rotates along arrow D2 in Fig. 17, so that the swing gear 110a mounted on the support shaft 110g of the rotating arm 110b does not mesh with the gear portion 108a of the take-up reel 108. Therefore, the take-up reel 108 remains unrotational, not to take up the ink sheet (not shown). At this time, the motor 113 for driving the print head 107 rotates the print head 107 in a direction for separating from the paper (along arrow E2 in Fig. 16), as shown in Fig. 16.

[0014] In paper discharge (printing), on the other hand, the thermal transfer printer drives the motor 112 for driving the feed roller 102 and the take-up reel 108 to rotate the motor gear 112a (see Fig. 17) mounted on the motor 112 along arrow F2 in Fig. 17 thereby rotating the feed roller gear 109 along arrow G2 in Fig. 17 through the intermediate gears 114 and 115, as shown in Figs. 16 and 17. Thus, the feed roller 102 carries the paper (not shown) along arrow H2 in Fig. 16, as shown in Fig. 16. At this time, the rotating arm 110b rotates along arrow I2 in Fig. 17, so that the large-diameter gear portion 110f of the swing gear 110a meshes with the gear portion 108a of the take-up reel 108 and rotates along arrow J2 in Fig. 17. Thus, the take-up reel 108 rotates along arrow K2 in Fig. 16, thereby taking up the ink sheet (not shown).

Further, the motor 113 for driving the print head 107 rotates the print head 107 in a direction (along arrow L2 in Fig. 16) for pressing the ink sheet and the paper, as shown in Fig. 16. Consequently, the thermal transfer printer prints an image on the paper.

[0015] However, the conventional thermal transfer printer shown in Figs. 16 to 21 must be provided with the helical compression spring 110c, in order to rotate the rotating arm 110b while rendering the driven gear 110a hard to rotate through resistance (frictional force) resulting from the load applied by the helical compression spring 110c in the axial direction (thrust direction). Therefore, the number of components is disadvantageously increased.

[0016] On the other hand, the drive transmission device described in the aforementioned Japanese Patent Laying-Open No. 2004-225761 must be provided with the spring and the wire independently of the swing member in order to swing the swing member, and hence the number of components is disadvantageously increased.

[0017] Further, the drive transmission device described in the aforementioned Japanese Patent Laying-Open No. 9-60705 increases the frictional force between the planetary gear and the swing member by constituting the swing member (rotating arm) of the magnetizable material while separately adding the magnetizing material to the planetary gear (driven gear). Thus, the number of components is disadvantageously increased since the magnetizing material must be separately added to the planetary gear.

[0018] The present invention has been proposed in order to solve the aforementioned problems, and an object of the present invention is to provide an image generating apparatus capable of rotating and rotatably (swingably) supporting a gear while reducing the number of components.

[0019] In order to attain the aforementioned object, an image generating apparatus according to a first aspect of the present invention comprises a normally and reversely rotatable drive gear, a driven gear meshing with the drive gear and a rotating arm of resin integrally provided with a rotation fulcrum portion rotatably mounted on the drive gear, a support shaft rotatably supporting the driven gear and a spring portion outwardly inclined by a prescribed angle with respect to the extensional direction of the support shaft.

[0020] In the image generating apparatus according to the first aspect, as hereinabove described, the rotating arm of resin is integrally provided with the spring portion outwardly inclined by the prescribed angle with respect to the extensional direction of the support shaft so that the integrally provided spring portion urges the driven gear rotatably mounted on the support shaft, thereby causing frictional force between the driven gear and the support shaft. Upon rotation of the driven gear, therefore, the rotating arm mounted with the driven gear can rotate in the direction of rotation of the drive gear due to the frictional force. Thus, the rotating arm is rotatable through

the frictional force resulting from the urging force of the integrally provided spring portion, whereby no helical compression spring or the like may be separately provided for rotating the rotating arm. Consequently, the number of components can be reduced.

[0021] The aforementioned image generating apparatus according to the first aspect preferably further comprises an ink sheet for printing an image on a paper and a take-up gear for taking up the ink sheet, while the support shaft of the rotating arm is preferably formed with an arcuate outer peripheral portion at least by half on a region other than that formed with the spring portion, the rotating arm preferably rotates in the direction of rotation of the drive gear due to frictional force between the driven gear and the support shaft caused by the spring portion urging the driven gear, and the driven gear preferably meshes with or separates from the take-up gear due to rotation of the rotating arm. According to this structure, the driven gear can stably rotate about the support shaft as compared with a support shaft formed with an outer peripheral portion less than half. Thus, the support shaft of the rotating arm can stably rotatably support the driven gear despite the spring portion integrally provided thereon.

[0022] In the aforementioned image generating apparatus according to the first aspect, the spring portion of the rotating arm is preferably integrally provided with a stop portion for inhibiting the driven gear from slipping off the support shaft. According to this structure, the stop portion integrally provided on the spring portion can inhibit the driven gear from axial slippage, whereby no E-ring is necessary for inhibiting the driven gear from axial slippage, and the support shaft of the rotating arm may not be grooved for receiving such an E-ring. Consequently, the number of components can be further reduced, and the number of assembling steps can also be reduced.

[0023] In the aforementioned image generating apparatus provided with the stop portion, the driven gear preferably further includes a receiving hole receiving the support shaft and the spring portion of the rotating arm, and the stop portion is preferably provided with a hook engaging with an edge of the driven gear after the spring portion is inserted into the receiving hole of the driven gear. According to this structure, the stop portion provided on the spring portion can easily engage with the driven gear for easily inhibiting the driven gear from axial slippage due to the engagement therebetween.

[0024] In the aforementioned image generating apparatus provided with the stop portion, the driven gear preferably further includes a receiving hole receiving the support shaft and the spring portion of the rotating arm, the spring portion preferably further includes a shaft portion arranged along the axial direction of the receiving hole of the driven gear and provided with the stop portion on an end thereof, and the axial length of the shaft portion of the spring portion is preferably substantially identical to the axial length of the receiving hole of the driven gear. According to this structure, the image generating apparatus

can inhibit the driven gear from moving along the axial direction of the shaft portion of the spring portion.

[0025] In the aforementioned image generating apparatus according to the first aspect, the driven gear preferably further includes a receiving hole receiving the support shaft and the spring portion of the rotating arm, and the spring portion is preferably so provided on the rotating arm that the shaft portion of the spring portion comes into surface contact with the inner surface of the receiving hole of the driven gear and urges the inner surface of the receiving hole of the driven gear when the spring portion is inserted into the receiving hole of the driven gear. According to this structure, the spring portion can stably supply urging force to the inner surface of the receiving hole of the driven gear, thereby easily causing frictional force between the driven gear and the support shaft. Consequently, the rotating arm can easily rotate in the direction of rotation of the drive gear.

[0026] In the aforementioned image generating apparatus having the spring portion so provided on the rotating arm that the shaft portion of the spring portion comes into surface contact with the inner surface of the receiving hole of the driven gear and urges the inner surface of the receiving hole of the driven gear when the spring portion is inserted into the receiving hole of the driven gear, the spring portion is preferably rendered substantially parallel to the axial direction of the receiving hole of the driven gear when the support shaft and the spring portion of the rotating arm are inserted into the receiving hole of the driven gear. According to this structure, an axially extending portion of the outer peripheral surface of the shaft portion of the spring portion can entirely come into contact with and urge the inner surface of the receiving hole of the driven gear while the spring force is inserted into the receiving hole of the driven gear.

[0027] In this case, the support shaft and the spring portion of the rotating arm preferably have arcuate outer peripheral portions respectively, and the arcuate outer peripheral portions of the bottoms of the spring portion and the support shaft are preferably substantially arranged on the circumference of a circle. According to this structure, the arcuate outer peripheral portion of the spring portion, capable of coming into contact with the inner surface of the receiving hole of the driven gear from the bottom, can be easily substantially arranged parallelly to the axial direction of the receiving hole of the driven gear when the support shaft and the spring portion of the rotating arm are inserted into the receiving hole of the driven gear.

[0028] In the aforementioned image generating apparatus according to the first aspect, the driven gear preferably further includes a receiving hole receiving the support shaft and the spring portion of the rotating arm, and the spring portion preferably urges the inner surface of the receiving hole in a direction intersecting with the axial direction of the support shaft. According to this structure, the spring portion can easily urge the inner surface of the driven gear when the support shaft and the spring portion

of the rotating arm are inserted into the receiving hole of the driven gear, thereby easily causing frictional force between the driven gear and the support shaft.

[0029] In the aforementioned image generating apparatus according to the first aspect, the support shaft of the rotating arm preferably has an arcuate outer peripheral portion, and the spring portion is preferably arranged at a prescribed interval from the arcuate outer peripheral portion of the support shaft. According to this structure, the image generating apparatus can inhibit the spring portion from coming into contact with the arcuate outer peripheral portion of the support shaft, so that the spring portion is not hard to move. Thus, the image generating apparatus can suppress reduction of the urging force of the spring portion on the driven gear.

[0030] In the aforementioned image generating apparatus according to the first aspect, the rotating arm preferably further includes a regulating portion for regulating the quantity of rotation of the rotating arm, and a reinforcing rib is preferably formed on a peripheral portion of the regulating portion of the rotating arm for suppressing deformation of the rotating arm. According to this structure, the image generating apparatus can suppress deformation of the rotating arm also when large force is applied to the regulating portion thereof.

[0031] An image generating apparatus according to a second aspect of the present invention comprises an ink sheet for printing an image on a paper, a take-up gear for taking up the ink sheet, a normally and reversely rotatable drive gear driving the take-up gear, a driven gear meshing with the drive gear and a rotating arm of resin including a rotation fulcrum portion rotatably mounted on the drive gear and a support shaft rotatably supporting the driven gear, the rotating arm is integrally provided with a spring portion outwardly inclined by a prescribed angle with respect to the extensional direction of the support shaft of the rotating arm, the driven gear further includes a receiving hole receiving the support shaft and the spring portion of the rotating arm while the spring portion is so provided on the rotating arm that the shaft portion of the spring portion comes into surface contact with the inner surface of the receiving hole of the driven gear and urges the inner surface of the receiving hole of the driven gear when the spring portion is inserted into the receiving hole of the driven gear, the spring portion of the rotating arm is integrally provided with a stop portion for inhibiting the driven gear from slipping off the support shaft while the stop portion is provided with a hook engaging with an edge of the driven gear after the spring portion is inserted into the receiving hole of the driven gear, the support shaft of the rotating arm is formed with an arcuate outer peripheral portion at least by half on a region other than that formed with the spring portion, the rotating arm rotates in the direction of rotation of the drive gear due to frictional force between the driven gear and the support shaft caused by the spring portion urging the driven gear, and the driven gear meshes with or separates from the take-up gear due to rotation of the rotating

arm.

[0032] In the image generating apparatus according to the second aspect, as hereinabove described, the rotating arm of resin is integrally provided with the spring portion outwardly inclined by the prescribed angle with respect to the extensional direction of the support shaft so that the integrally provided spring portion urges the driven gear rotatably mounted on the support shaft, thereby causing frictional force between the driven gear and the support shaft. Upon rotation of the driven gear, therefore, the rotating arm mounted with the driven gear can rotate in the direction of rotation of the drive gear due to the frictional force. Thus, the rotating arm is rotatable through the frictional force resulting from the urging force of the integrally provided spring portion, whereby no helical compression spring or the like may be separately provided for rotating the rotating arm. Consequently, the number of components can be reduced. Further, the support shaft of the rotating arm is formed with the arcuate outer peripheral portion at least by half on the region other than that formed with the spring portion, whereby the driven gear can stably rotate about the support shaft as compared with a support shaft formed with an outer peripheral portion less than by half. Thus, the support shaft of the rotating arm can stably rotatably support the driven gear despite the spring portion integrally provided thereon. In addition, the spring portion of the rotating arm is so integrally provided with the stop portion for inhibiting the driven gear from slipping off the support shaft that the stop portion can inhibit the driven gear from axial slippage, whereby no E-ring is necessary for inhibiting the driven gear from axial slippage, and the support shaft of the rotating arm may not be grooved for receiving such an E-ring. Consequently, the number of components can be further reduced, and the number of assembling steps can also be reduced. Further, the driven gear further includes the receiving hole receiving the support shaft and the spring portion of the rotating arm while the stop portion is provided with the hook engaging with the edge of the driven gear after the spring portion is inserted into the receiving hole of the driven gear, whereby the stop portion provided on the spring portion can easily engage with the driven gear for easily inhibiting the driven gear from axial slippage due to the engagement therebetween. Further, the spring portion is so provided on the rotating arm that the shaft portion of the spring portion comes into surface contact with the inner surface of the receiving hole of the driven gear and urges the inner surface of the receiving hole of the driven gear when the spring portion is inserted into the receiving hole of the driven gear, whereby the spring portion can stably supply urging force to the inner surface of the receiving hole of the driven gear for easily causing frictional force between the driven gear and the support shaft. Consequently, the rotating arm can easily rotate in the direction of rotation of the drive gear.

[0033] In the aforementioned image generating apparatus according to the second aspect, the spring portion

preferably further includes a shaft portion arranged along the axial direction of the receiving hole of the driven gear and provided with the stop portion on an end thereof, and the axial length of the shaft portion of the spring portion is preferably substantially identical to the axial length of the receiving hole of the driven gear. According to this structure, the image generating apparatus can inhibit the driven gear from moving along the axial direction of the shaft portion of the spring portion.

[0034] In the aforementioned image generating apparatus according to the second aspect, the spring portion is preferably rendered substantially parallel to the axial direction of the receiving hole of the driven gear when the support shaft and the spring portion of the rotating arm are inserted into the receiving hole of the driven gear. According to this structure, an axially extending portion of the outer peripheral surface of the shaft portion of the spring portion can entirely come into contact with and urge the inner surface of the receiving hole of the driven gear while the spring force is inserted into the receiving hole of the driven gear.

[0035] In this case, the spring portion preferably has an arcuate outer peripheral portion, and the arcuate outer peripheral portions of the bottoms of the spring portion and the support shaft are preferably substantially arranged on the circumference of a circle. According to this structure, the arcuate outer peripheral portion of the spring portion, capable of coming into contact with the inner surface of the receiving hole of the driven gear from the bottom, can be easily substantially arranged parallel to the axial direction of the receiving hole of the driven gear when the support shaft and the spring portion of the rotating arm are inserted into the receiving hole of the driven gear.

[0036] In the aforementioned image generating apparatus according to the second aspect, the spring portion preferably urges the inner surface of the receiving hole in a direction intersecting with the axial direction of the support shaft. According to this structure, the spring portion can easily urge the inner surface of the driven gear when the support shaft and the spring portion of the rotating arm are inserted into the receiving hole of the driven gear, thereby easily causing frictional force between the driven gear and the support shaft.

[0037] In the aforementioned image generating apparatus according to the second aspect, the spring portion is preferably arranged at a prescribed interval from the arcuate outer peripheral portion of the support shaft. According to this structure, the image generating apparatus can inhibit the spring portion from coming into contact with the arcuate outer peripheral portion of the support shaft, so that the spring portion is not hard to move. Thus, the image generating apparatus can suppress reduction of the urging force of the spring portion on the driven gear.

[0038] In the aforementioned image generating apparatus according to the second aspect, the rotating arm preferably further includes a regulating portion for regulating the quantity of rotation of the rotating arm, and a

reinforcing rib is preferably formed on a peripheral portion of the regulating portion of the rotating arm for suppressing deformation of the rotating arm. According to this structure, the image generating apparatus can suppress deformation of the rotating arm also when large force is applied to the regulating portion thereof.

[0039] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

[0040] IN THE DRAWINGS:

Fig. 1 is a perspective view showing the overall structure of a thermal transfer printer according to an embodiment of the present invention;

Fig. 2 is a front elevational view showing respective motors and respective gears of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Figs. 3 and 4 are perspective views of a swing gear portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 5 is a front elevational view showing a rotating arm of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 6 is a front elevational view showing a feed roller gear of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Figs. 7 and 8 are perspective views showing a mounting structure of the swing gear portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 9 is a front elevational view of the swing gear portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 10 is a sectional view of the swing gear portion taken along the line 100-100 in Fig. 9;

Fig. 11 is a sectional view of the swing gear portion taken along the line 200-200 in Fig. 9;

Fig. 12 is a sectional view of the rotation arm taken along the line 200-200 in Fig. 9;

Fig. 13 is an enlarged plan view of a spring portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 14 is a perspective view of a stop portion of the spring portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 15 is an enlarged plan view of a modification of the spring portion of the thermal transfer printer according to the embodiment of the present invention shown in Fig. 1;

Fig. 16 is a perspective view showing the overall structure of an exemplary conventional thermal transfer printer;

Fig. 17 is a front elevational view showing respective motors and respective gears of the exemplary conventional thermal transfer printer shown in Fig. 16; Fig. 18 is an exploded perspective view showing a mounting structure of a swing gear portion of the exemplary conventional thermal transfer printer shown in Fig. 16;

Fig. 19 is a perspective view of the swing gear portion of the exemplary conventional thermal transfer printer shown in Fig. 16;

Fig. 20 is a front elevational view of the swing gear portion of the exemplary conventional thermal transfer printer shown in Fig. 16; and

Fig. 21 is a sectional view of the swing gear portion taken along the line 300-300 in Fig. 20.

[0041] An embodiment of the present invention is now described with reference to the drawings.

[0042] The structure of a thermal transfer printer according to the embodiment of the present invention is described with reference to Figs. 1 to 15. According to this embodiment, the present invention is applied to the thermal transfer printer, which is an exemplary image generating apparatus.

[0043] As shown in Figs. 1 and 2, the thermal transfer printer according to the embodiment of the present invention comprises a chassis 1 of metal, a feed roller 2 of metal for feeding a paper, a press roller 3 of metal coming into contact with the feed roller 2 with prescribed pressing force, a feed roller bearing 4 rotatably supporting the feed roller 2, a press roller bearing 5 rotatably supporting the press roller 3, a bearing support plate 6 of metal supporting the press roller bearing 5, a print head 7 for printing, a take-up reel 8 for taking up an ink sheet 16a, a swing gear portion 10 mounted with a swing gear 10a, a motor bracket 11, a motor 12 for driving the feed roller 2 and the take-up reel 8, a motor 13 for driving the print head 7, and intermediate gears 14 and 15 (see Fig. 2). The feed roller gear 9 is an example of the "drive gear" in the present invention, and the swing gear 10a of the swing gear portion 10 is an example of the "driven gear" in the present invention.

[0044] As shown in Fig. 1, the chassis 1 has first and second side surfaces 1a and 1b. The motor bracket 11 is mounted on the first side surface 1a of the chassis 1. As shown in Fig. 2, a slot-shaped inhibiting portion 1c is provided on the first side surface 1a of the chassis 1 for inhibiting the swing gear portion 10 from rotating beyond a constant quantity. As shown in Fig. 1, a cartridge receiving hole 1d is provided on the second side surface 1b of the chassis 1 for receiving an ink sheet cartridge 16.

[0045] As shown in Figs. 7 and 8, a D-shaped gear insert portion 2a is provided on the feed roller 2. This gear insert portion 2a of the feed roller 2 is fitted into the feed roller gear 9 not to idle, as shown in Figs. 2 and 3. The press roller bearing 5 mounted on the bearing support plate 6 rotatably supports the press roller 3, as shown in Fig. 1. The print head 7 is mounted inside the first and

second side surfaces 1a and 1b of the chassis 1, to be rotatable about a support shaft 7a.

[0046] As shown in Fig. 2, a gear portion 8a of the take-up reel 8 is so arranged as to mesh with the swing gear 10a of the swing gear portion 10, regularly meshing with the feed roller gear 9, upon swinging of the swing gear 10a. The gear portion 8a of the take-up gear 8 is an example of the "take-up gear" in the present invention. As shown in Figs. 7 and 8, a shaft portion 9a (see Fig. 8) of the feed roller gear 9 is provided with a D-shaped mounting hole 9b, into which the gear insert portion 2a of the feed roller 2 is press-fitted. As shown in Figs. 6 and 8, the shaft portion 9a of the feed roller gear 9 is provided with an arm support portion 9c having an outer diameter smaller than that of the shaft portion 9a of the feed roller gear 9.

[0047] As shown in Figs. 3, 4, 7 and 8, the swing gear portion 10 has the swing gear 10a of resin and a rotating arm 10b of resin rotatably supporting the swing gear 10a. According to this embodiment, the resin is prepared from polyacetal resin (POM). As shown in Figs. 7 and 10, the swing gear 10a of the swing gear portion 10 is provided with a small-diametral gear portion 10c meshing with the feed roller gear 9, a large-diametral gear portion 10d meshing with the gear portion 8a (see Fig. 2) of the take-up reel 8 and a receiving hole 10e receiving a support shaft 10f of the rotating arm 10b.

[0048] As shown in Figs. 7, 12 and 13, the rotating arm 10b is provided with the support shaft 10f for rotatably supporting the swing gear 10a, a spring portion 10g urging the inner surface of the receiving hole 10e of the swing gear 10a, a boss 10h fitted into the slot-shaped inhibiting portion 1c (see Fig. 2) provided on the first side surface 1a of the chassis 1, a hole-shaped rotation fulcrum portion 10i mounted on the arm support portion 9c provided on the shaft portion 9a (see Fig. 8) of the feed roller gear 9 and a reinforcing rib 10j arranged on the peripheral portion of the boss 10h for suppressing deformation of the rotating arm 10b. The boss 10h is an example of the "regulating portion" in the present invention.

[0049] According to this embodiment, the support shaft 10f of the rotating arm 10b has an arcuate outer peripheral portion of about 300° as viewed from the axial direction of the support shaft 10f, as shown in Fig. 13. Further, the spring portion 10g is integrally provided on the rotating arm 10b on a region other than that formed with the support shaft 10f, as shown in Figs. 5, 7, 12 and 13. This spring portion 10g is outwardly inclined by a prescribed angle θ with respect to the extensional direction of the support shaft 10f, as shown in Fig. 12. When the spring portion 10g and the support shaft 10f of the rotating arm 10b are inserted into the receiving hole 10e of the swing gear 10a, therefore, the spring portion 10g urges the inner surface of the receiving hole 10e of the swing gear 10a in a direction intersecting with the axial direction of the support shaft 10f with a load of about 10 g, for causing frictional force between the swing gear 10a and the support shaft 10f. As shown in Fig. 12, the spring portion 10g

is constituted of a shaft portion 10k and a stop portion 101 provided on the forward end of the shaft portion 10k.

[0050] According to this embodiment, the spring portion 10g is substantially parallel to the axial direction of the receiving hole 10e of the swing gear 10a when the swing gear 10a of the rotating arm 10b is fitted with the support shaft 10f and the spring portion 10g, as shown in Fig. 11. Thus, an axially extending portion of the outer peripheral surface of the shaft portion 10k (see Fig. 12) of the spring portion 10g entirely comes into contact with and urges the inner surface of the receiving hole 10e of the swing gear 10a.

[0051] According to this embodiment, the axial length of the shaft portion 10k of the spring portion 10g is substantially identical to that of the receiving hole 10e of the swing gear 10a.

[0052] According to this embodiment, the shaft portion 10k of the spring portion 10g has an arcuate outer peripheral portion as viewed from the axial direction of the support shaft 10f, as shown in Figs. 7 and 13. The arcuate outer peripheral portions of the bottoms of the spring portion 10g and the support shaft 10f are substantially arranged on the circumference of a circle O1.

[0053] According to this embodiment, a hook 10m (see Fig. 14) is provided on the stop portion 101 of the spring portion 10g, as shown in Figs. 3, 9, 11, 12 and 14. As shown in Figs. 9 and 11, this hook 10m of the stop portion 101 engages with an edge 10n of the swing gear 10a when the support shaft 10f and the spring portion 10g of the rotating arm 10b are inserted into the receiving hole 10e of the swing gear 10a, thereby inhibiting the swing gear 10a from slipping off the support shaft 10f of the rotating arm 10b.

[0054] As shown in Fig. 2, the driving force of the motor 12 for driving the feed roller 2 and the take-up reel 8 is transmitted to the feed roller gear 9 and the gear portion 8a of the take-up reel 8 through the intermediate gears 14 and 15.

[0055] A paper feed operation of the thermal transfer printer is now described with reference to Figs. 1 and 2. In paper feeding, the thermal transfer printer drives the motor 12 for driving the feed roller 2 and the take-up reel 8 to rotate a motor gear 12a (see Fig. 2) mounted on the motor 12 along arrow A1 in Fig. 2 thereby rotating the feed roller gear 9 along arrow B1 in Fig. 2 through the intermediate gears 14 and 15, as shown in Figs. 1 and 2. Thus, the feed roller gear 2 carries the paper along arrow C1 in Fig. 1, as shown in Fig. 1. At this time, the spring portion 10g of the rotating arm 10b urges the inner surface of the receiving hole 10e of the swing gear 10a for causing frictional force between the swing gear 10a and the support shaft 10f of the rotating arm 10b, whereby the rotating arm 10b rotates in the direction of rotation of the feed roller gear 9 (along arrow B1 in Fig. 2). Thus, the rotating arm 10b rotates along arrow D1 in Fig. 2, so that the swing gear 10a mounted on the support shaft 10f of the rotating arm 10b does not mesh with the gear portion 8a of the take-up reel 8. Therefore, the take-up

reel 8 remains unrotational, not to take up the ink sheet 16a. At this time, the motor 13 for driving the print head 7 rotates the print head 7 in a direction for separating from the paper (along arrow E1 in Fig. 1), as shown in Fig. 1. When the rotating arm 10b rotates along arrow B1 so that the boss 10h thereof comes into contact with the slot-shaped inhibiting portion 1c provided on the first side surface 1a of the chassis 1, the inhibiting portion 1c inhibits the rotating arm 10b from rotating along arrow B1.

[0056] In paper discharge (printing), on the other hand, the thermal transfer printer drives the motor 12 for driving the feed roller 2 and the take-up reel 8 to rotate the motor gear 12a (see Fig. 2) mounted on the motor 12 along arrow F1 in Fig. 2 thereby rotating the feed roller gear 9 along arrow G1 in Fig. 2 through the intermediate gears 14 and 15, as shown in Figs. 1 and 2. Thus, the feed roller 2 carries the paper along arrow H1 in Fig. 1, as shown in Fig. 1. At this time, the spring portion 10g of the rotating arm 10b urges the inner surface of the receiving hole 10e of the swing gear 10a for causing frictional force between the swing gear 10a and the support shaft 10f of the rotating arm 10b, whereby the rotating arm 10b rotates in the direction of rotation of the feed roller gear 9 (along arrow G1 in Fig. 2). Thus, the rotating arm 10b rotates along arrow I1 in Fig. 2, whereby the large-diameter gear portion 10d of the swing gear 10a meshes with the gear portion 8a of the take-up reel 8, to rotate along arrow J1 in Fig. 2. Therefore, the take-up reel 8 rotates along arrow K1 in Fig. 2, to take up the ink sheet 16a.

[0057] The motor 13 for driving the print head 7 rotates the print head 7 in a direction (along arrow L1 in Fig. 1) for pressing the ink sheet 16a and the paper (not shown), thereby performing printing on the paper.

[0058] According to this embodiment, as hereinabove described, the spring portion 10g outwardly inclined by the prescribed angle with respect to the extensional direction of the support shaft 10f is so integrally provided on the rotating arm 10b of resin that the integrally provided spring portion 10g urges the swing gear 10a thereby causing frictional force between the swing gear 10a and the support shaft 10f when the swing gear 10a is rotatably mounted on the support shaft 10f. Upon rotation of the swing gear 10a, therefore, the rotating arm 10b mounted with the swing gear 10a can rotate in the direction of rotation of the feed roller gear 9 due to the frictional force. Thus, the rotating arm 10b is rotatable through the frictional force resulting from the urging force of the integrally provided spring portion 10g, whereby no helical compression spring or the like may be separately provided for rotating the rotating arm 10b. Consequently, the number of components can be reduced.

[0059] According to this embodiment, the support shaft 10f of the rotating arm 10b is formed with the arcuate outer peripheral portion at least by half on the region other than that formed with the spring portion 10g, whereby the swing gear 10a can stably rotate about the support shaft 10f as compared with a support shaft formed with an outer peripheral portion less than by half. Thus, the

support shaft 10f of the rotating arm 10b can stably rotatably support the swing gear 10a despite the spring portion 10g integrally provided thereon.

[0060] According to this embodiment, the spring portion 10g of the rotating arm 10b is so integrally provided with the stop portion 101 for inhibiting the swing gear 10a from slipping off the support shaft 10f that the stop portion 101 can inhibit the swing gear 10a from axial slippage, whereby no E-ring is necessary for inhibiting the swing gear 10a from axial slippage, and the support shaft 10f of the rotating arm 10b may not be grooved for receiving such an E-ring. Consequently, the number of components can be further reduced, and the number of assembling steps can also be reduced.

[0061] According to this embodiment, the swing gear 10a is provided with the receiving hole 10e receiving the support shaft 10f and the spring portion 10g of the rotating arm 10b while the stop portion 101 is provided with the hook 10m engaging with the edge 10b of the swing gear 10a after the spring portion 10g is inserted into the receiving hole 10e of the swing gear 10a, whereby the stop portion 101 provided on the spring portion 10g can easily engage with the swing gear 10a for easily inhibiting the swing gear 10a from axial slippage due to the engagement between the swing gear 10a and the stop portion 101.

[0062] According to this embodiment, the spring portion 10g is so provided on the rotating arm 10b that the shaft portion 10k of the spring portion 10g comes into surface contact with the inner surface of the receiving hole 10e of the swing gear 10a and urges the inner surface of the receiving hole 10e of the swing gear 10a when the spring portion 10g is inserted into the receiving hole 10e of the swing gear 10a, whereby the spring portion 10g can stably supply urging force to the inner surface of the receiving hole 10e of the swing gear 10a, for easily causing frictional force between the swing gear 10a and the support shaft 10f. Consequently, the rotating arm 10b can easily rotate in the direction of rotation of the feed roller gear 9.

[0063] According to this embodiment, the axial length of the shaft portion 10k of the spring portion 10g is rendered substantially identical to that of the receiving hole 10e of the swing gear 10a, so that the thermal transfer printer can inhibit the swing gear 10a from moving along the axial direction of the shaft portion 10k of the spring portion 10g.

[0064] According to this embodiment, the arcuate outer peripheral portions of the bottoms of the spring portion 10g and the support shaft 10f are substantially arranged on the circumference of the circle O1 whereby the arcuate outer peripheral portion of the spring portion 10g, capable of coming into contact with the inner surface of the receiving hole 10e of the swing gear 10a from the bottom, can be easily substantially arranged parallelly to the axial direction of the receiving hole 10e of the swing gear 10e when the support shaft 10f and the spring portion 10g of the rotating arm 10b are inserted into the receiving hole

10e of the swing gear 10a.

[0065] According to this embodiment, the spring portion 10g is arranged at the prescribed interval from the arcuate outer peripheral portion of the support shaft 10f, whereby the thermal transfer printer can inhibit the spring portion 10g from coming into contact with the arcuate outer peripheral portion of the support shaft 10f, so that the spring portion 10g is not hard to move. Thus, the thermal transfer printer can suppress reduction of the urging force of the spring portion 10g on the swing gear 10a.

[0066] According to this embodiment, the reinforcing rib 10j is formed on the peripheral portion of the boss 10h of the rotating arm 10b for suppressing deformation of the rotating arm 10b, whereby the thermal transfer printer can suppress deformation of the rotating arm 10b also when large force is applied to the boss 10h thereof.

[0067] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims, as interpreted by the description and drawings.

[0068] For example, while the above embodiment has been described with reference to the thermal transfer printer employed as an exemplary image generating apparatus, the present invention is not restricted to this but is also applicable to an image generating apparatus other than the thermal transfer printer, so far as the apparatus comprises a structure capable of rotating a gear while rotatably (swingably) supporting the same.

[0069] While the support shaft provided on the rotating arm is formed with the arcuate outer peripheral portion of about 300° on the region other than that formed with the spring portion in the aforementioned embodiment, the present invention is not restricted to this but the support shaft provided on the rotating arm may simply be formed with an arcuate outer peripheral portion at least by half (180°).

[0070] While the spring portion is integrally provided with the stop portion for inhibiting the feed roller gear from slipping off the support shaft in the aforementioned embodiment, the present invention is not restricted to this but the stop portion may alternatively be provided on a member other than the spring member. For example, the stop portion may be integrally provided on the support shaft. Further alternatively, a separately formed stop member may be employed for inhibiting the feed roller gear from slipping off the support shaft.

[0071] While the spring portion is so provided on the rotating arm that the shaft portion thereof comes into surface contact with and urges the inner surface of the receiving hole of the swing gear when the spring portion is inserted into the receiving hole of the swing gear in the aforementioned embodiment, the present invention is not restricted to this but the spring portion may alternatively be provided on the rotating arm so that the shaft portion

thereof comes into line or point contact with and urges the inner surface of the receiving hole of the swing gear.

[0072] While the rotating arm is provided with the single spring portion in the aforementioned embodiment, the present invention is not restricted to this but the rotating arm may alternatively be provided with two spring portions, as shown in Fig. 15. In this case, the two spring members are preferably provided at regular intervals, as shown in Fig. 15. Further alternatively, the rotating arm may be provided with at least three spring portions at regular intervals.

Claims

1. An image generating apparatus comprising:

a normally and reversely rotatable drive gear (9);
a driven gear (10a) meshing with said drive gear;
and
a rotating arm (10b) of resin integrally provided with a rotation fulcrum portion (10i) rotatably mounted on said drive gear, a support shaft (10f) rotatably supporting said driven gear and a spring portion (10g) outwardly inclined by a prescribed angle with respect to the extensional direction of said support shaft.

2. The image generating apparatus according to claim 1, further comprising an ink sheet (16a) for printing an image on a paper and a take-up gear (8a) for taking up said ink sheet, wherein said support shaft of said rotating arm is formed with an arcuate outer peripheral portion at least by half on a region other than that formed with said spring portion, said rotating arm rotates in the direction of rotation of said drive gear due to frictional force between said driven gear and said support shaft caused by said spring portion urging said driven gear, and said driven gear meshes with or separates from said take-up gear due to rotation of said rotating arm.

3. The image generating apparatus according to claim 1, wherein said spring portion of said rotating arm is integrally provided with a stop portion (101) for inhibiting said driven gear from slipping off said support shaft.

4. The image generating apparatus according to claim 3, wherein said driven gear further includes a receiving hole (10e) receiving said support shaft and said spring portion of said rotating arm, and said stop portion is provided with a hook (10m) engaging with an edge (10n) of said driven gear after said spring portion is inserted into said receiving hole of said driven gear.

5. The image generating apparatus according to claim 3, wherein said driven gear further includes a receiving hole receiving said support shaft and said spring portion of said rotating arm, said spring portion further includes a shaft portion (9a) arranged along the axial direction of said receiving hole of said driven gear and provided with said stop portion on an end thereof, and the axial length of said shaft portion of said spring portion is substantially identical to the axial length of said receiving hole of said driven gear.

6. The image generating apparatus according to claim 1, wherein said driven gear further includes a receiving hole receiving said support shaft and said spring portion of said rotating arm, and said spring portion is so provided on said rotating arm that said shaft portion of said spring portion comes into surface contact with the inner surface of said receiving hole of said driven gear and urges the inner surface of said receiving hole of said driven gear when said spring portion is inserted into said receiving hole of said driven gear.

7. The image generating apparatus according to claim 6, wherein said spring portion is rendered substantially parallel to the axial direction of said receiving hole of said driven gear when said support shaft and said spring portion of said rotating arm are inserted into said receiving hole of said driven gear.

8. The image generating apparatus according to claim 7, wherein said support shaft and said spring portion of said rotating arm have arcuate outer peripheral portions respectively, and said arcuate outer peripheral portions of the bottoms of said spring portion and said support shaft are substantially arranged on the circumference of a circle.

9. The image generating apparatus according to claim 1, wherein said driven gear further includes a receiving hole receiving said support shaft and said spring portion of said rotating arm, and said spring portion urges the inner surface of said receiving hole in a direction intersecting with the axial direction of said support shaft.

10. The image generating apparatus according to claim 1, wherein said support shaft of said rotating arm has an arcuate outer peripheral portion, and said spring portion is arranged at a prescribed interval from said arcuate outer peripheral portion of said

support shaft.

- 11.** The image generating apparatus according to claim 1, wherein
 said rotating arm further includes a regulating portion (10h) for regulating the quantity of rotation of said rotating arm, and
 a reinforcing rib (10j) is formed on a peripheral portion of said regulating portion of said rotating arm for suppressing deformation of said rotating arm.

- 12.** An image generating apparatus comprising:

an ink sheet (16a) for printing an image on a paper;
 a take-up gear (8a) for taking up said ink sheet;
 a normally and reversely rotatable drive gear (9) driving said take-up gear;
 a driven gear (10a) meshing with said drive gear;
 and

a rotating arm (10b) of resin including a rotation fulcrum portion (10i) rotatably mounted on said drive gear and a support shaft (10f) rotatably supporting said driven gear, wherein

said rotating arm is integrally provided with a spring portion (10g) outwardly inclined by a prescribed angle with respect to the extensional direction of said support shaft of said rotating arm, said driven gear further includes a receiving hole (10e) receiving said support shaft and said spring portion of said rotating arm while said spring portion is so provided on said rotating arm that said shaft portion of said spring portion comes into surface contact with the inner surface of said receiving hole of said driven gear and urges the inner surface of said receiving hole of said driven gear when said spring portion is inserted into said receiving hole of said driven gear,

said spring portion of said rotating arm is integrally provided with a stop portion (101) for inhibiting said driven gear from slipping off said support shaft while said stop portion is provided with a hook (10m) engaging with an edge (10n) of said driven gear after said spring portion is inserted into said receiving hole of said driven gear,

said support shaft of said rotating arm is formed with an arcuate outer peripheral portion at least by half on a region other than that formed with said spring portion,

said rotating arm rotates in the direction of rotation of said drive gear due to frictional force between said driven gear and said support shaft caused by said spring portion urging said driven gear, and

said driven gear meshes with or separates from said take-up gear due to rotation of said rotating

arm.

- 13.** The image generating apparatus according to claim 12, wherein
 said spring portion further includes a shaft portion (9a) arranged along the axial direction of said receiving hole of said driven gear and provided with said stop portion on an end thereof, and
 the axial length of said shaft portion of said spring portion is substantially identical to the axial length of said receiving hole of said driven gear.

- 14.** The image generating apparatus according to claim 12, wherein
 said spring portion is rendered substantially parallel to the axial direction of said receiving hole of said driven gear when said support shaft and said spring portion of said rotating arm are inserted into said receiving hole of said driven gear.

- 15.** The image generating apparatus according to claim 14, wherein
 said spring portion has an arcuate outer peripheral portion, and
 said arcuate outer peripheral portions of the bottoms of said spring portion and said support shaft are substantially arranged on the circumference of a circle.

- 16.** The image generating apparatus according to claim 12, wherein
 said spring portion urges the inner surface of said receiving hole in a direction intersecting with the axial direction of said support shaft.

- 17.** The image generating apparatus according to claim 12, wherein
 said spring portion is arranged at a prescribed interval from said arcuate outer peripheral portion of said support shaft.

- 18.** The image generating apparatus according to claim 12, wherein
 said rotating arm further includes a regulating portion (10h) for regulating the quantity of rotation of said rotating arm, and
 a reinforcing rib (10j) is formed on a peripheral portion of said regulating portion of said rotating arm for suppressing deformation of said rotating arm.

FIG. 1

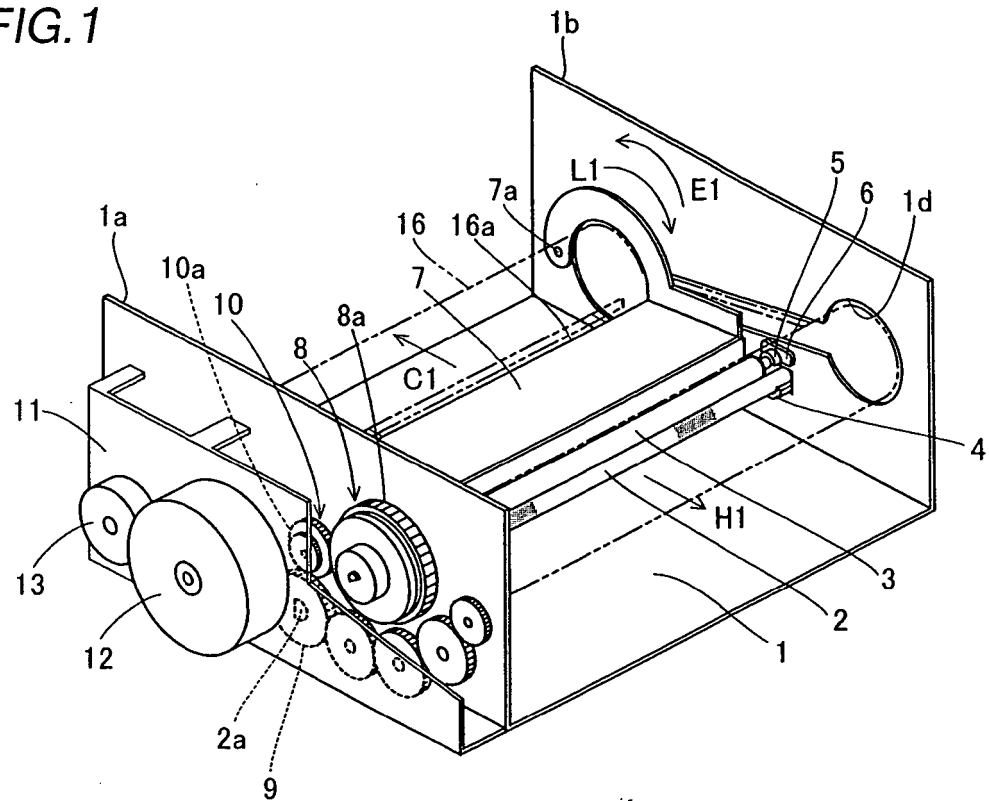


FIG.2

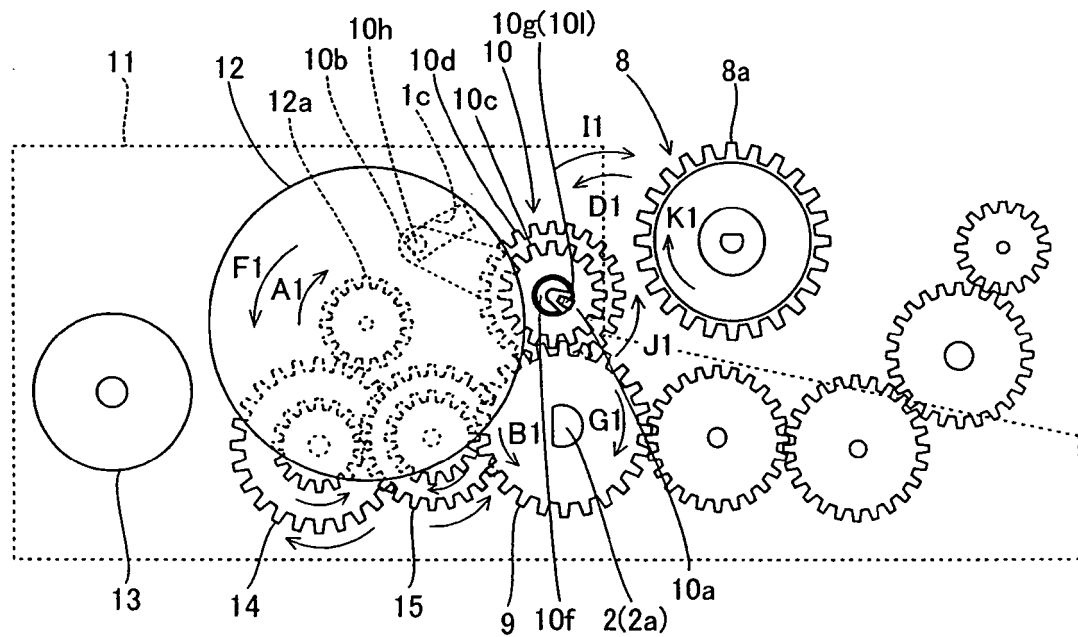


FIG.3

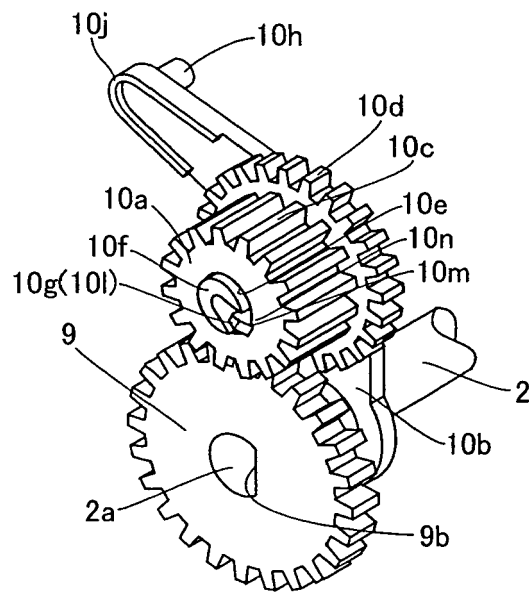


FIG.4

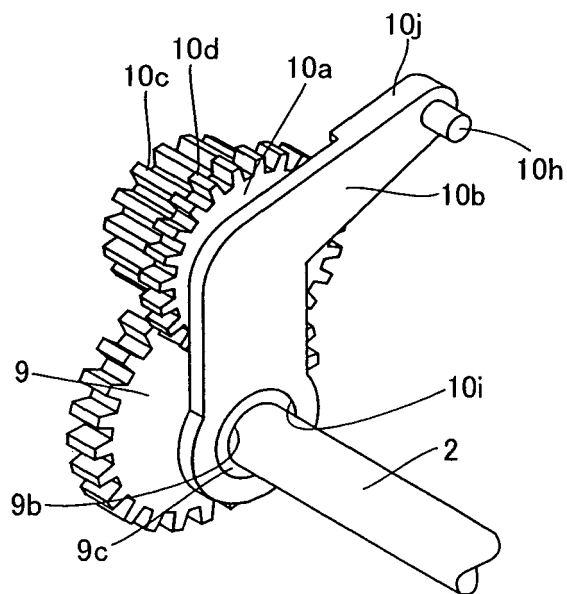


FIG.5

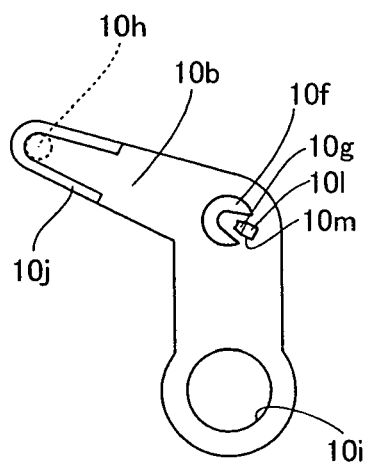


FIG.6

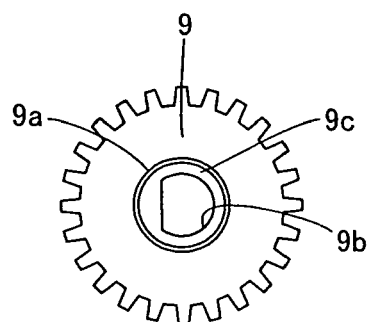


FIG. 7

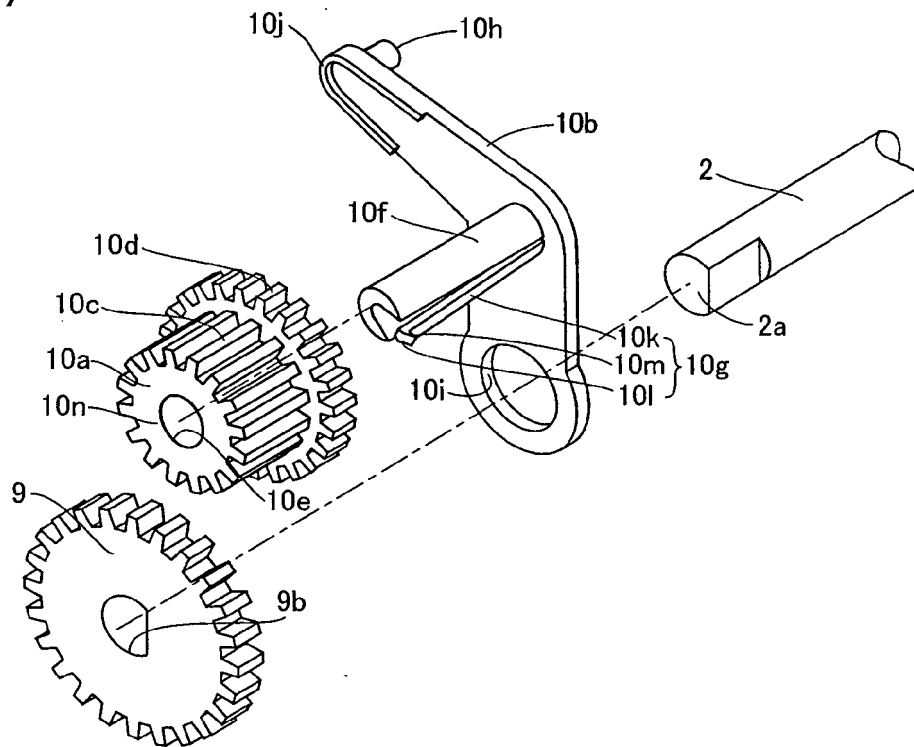


FIG. 8

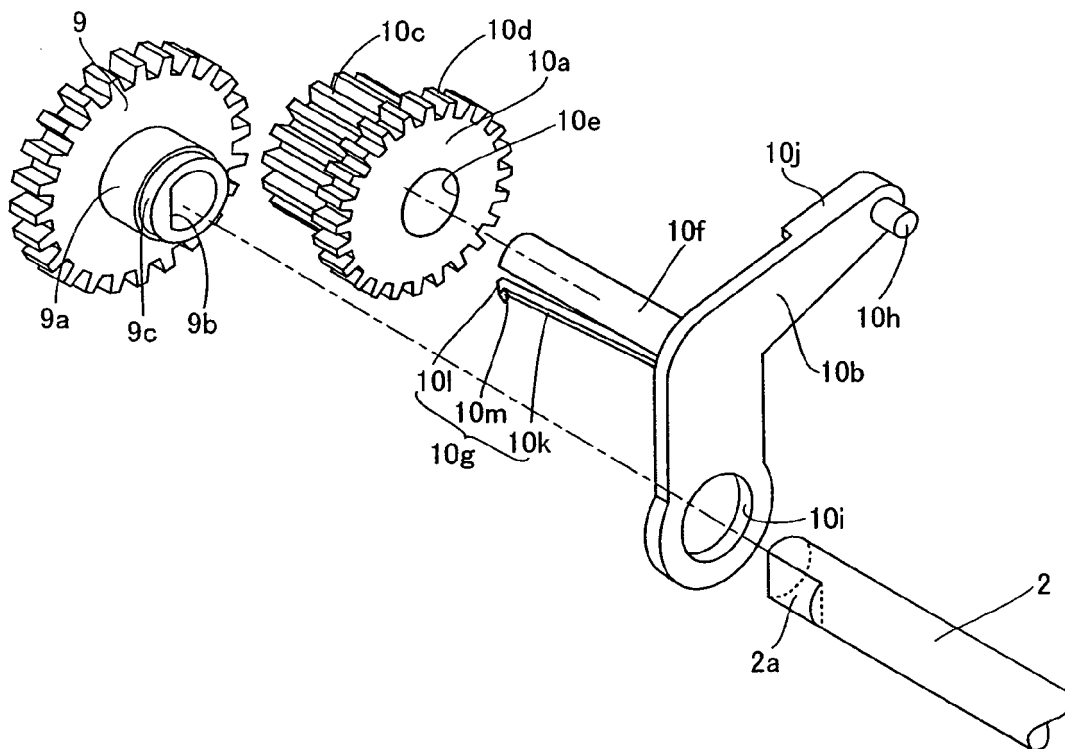


FIG.9

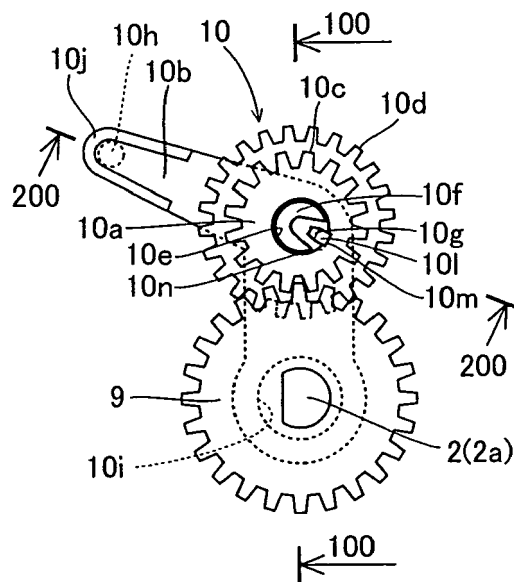


FIG.10

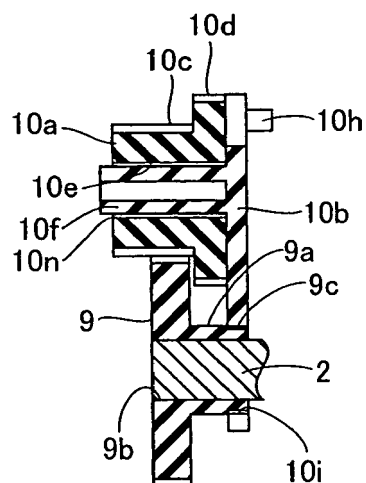


FIG. 11

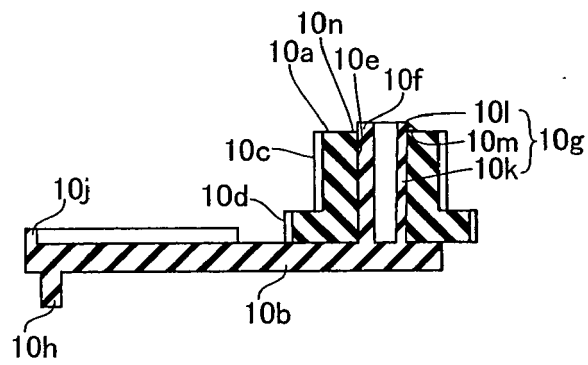


FIG. 12

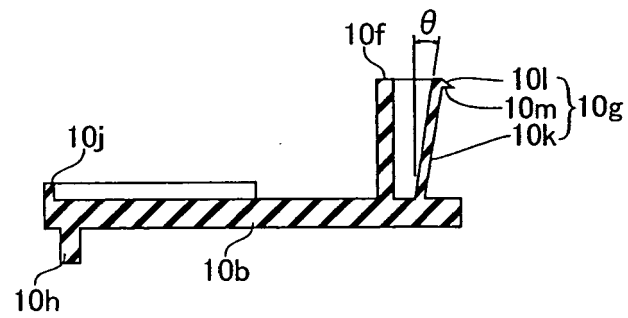


FIG.13

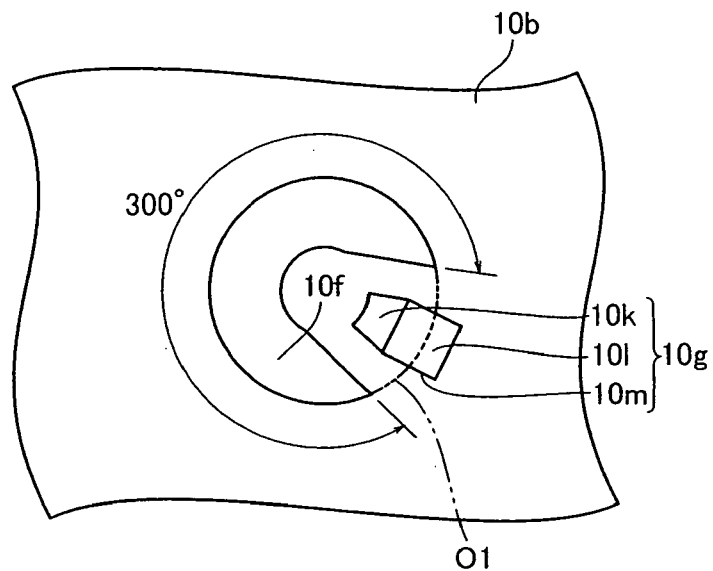


FIG.14

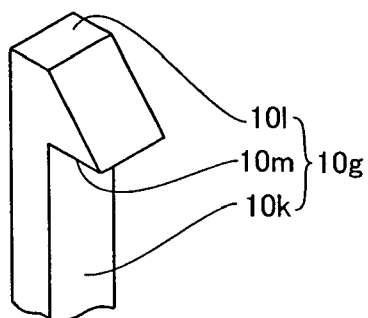


FIG. 15

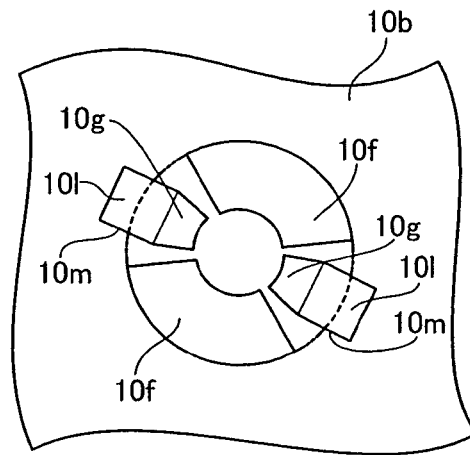


FIG. 16

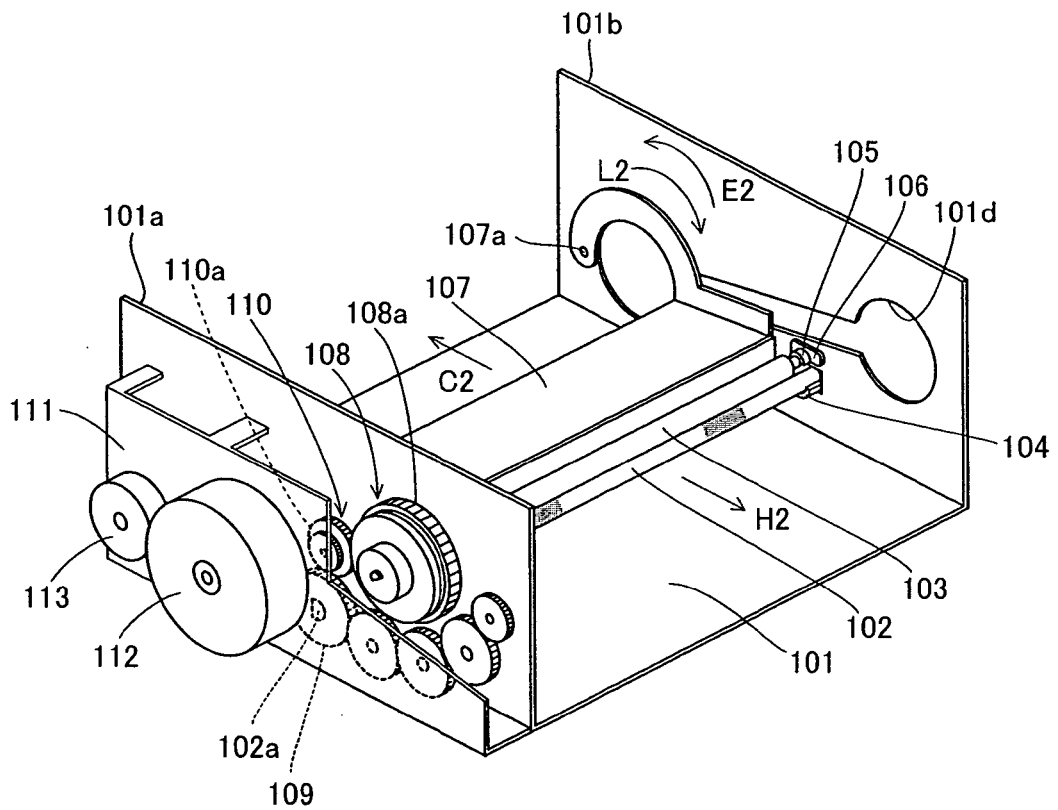


FIG. 17

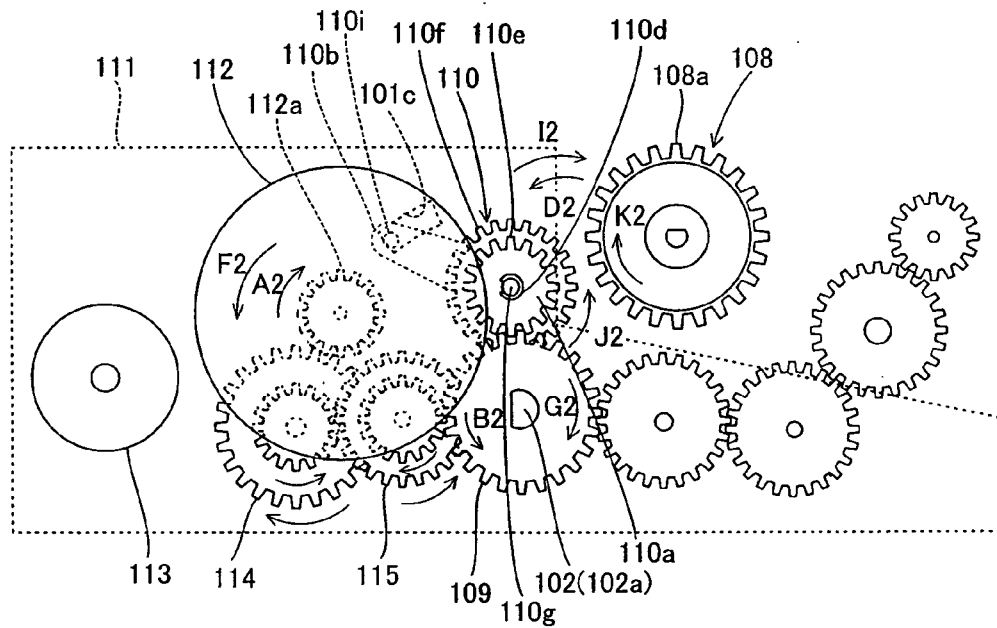


FIG. 18

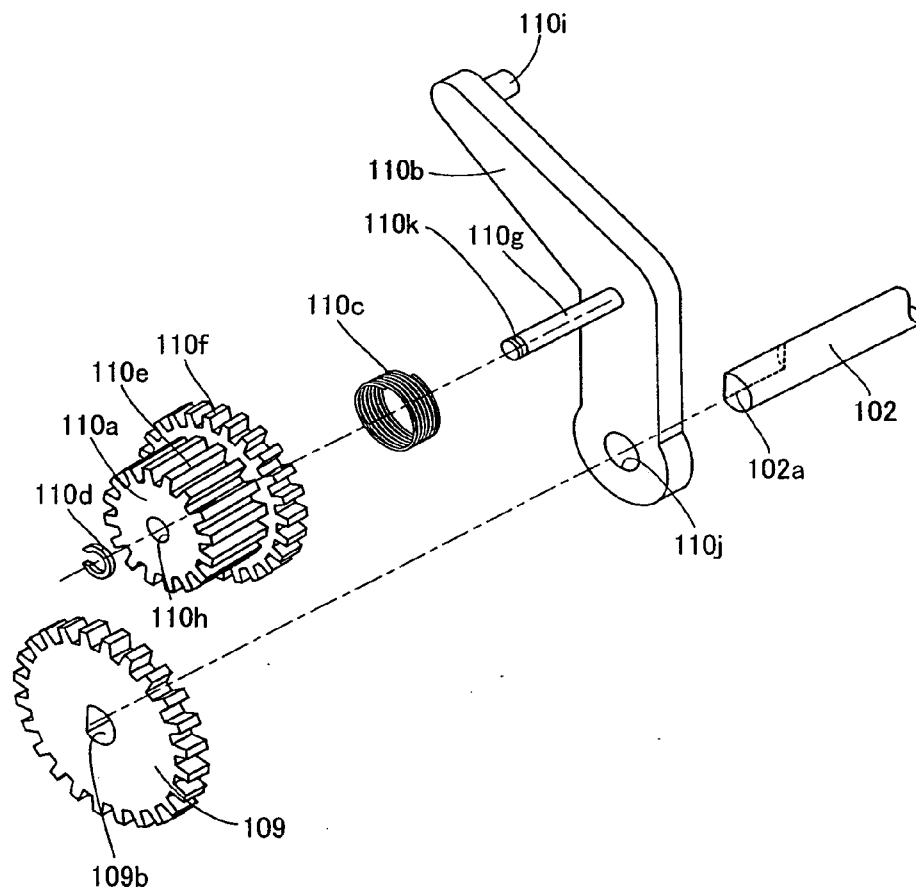


FIG.19

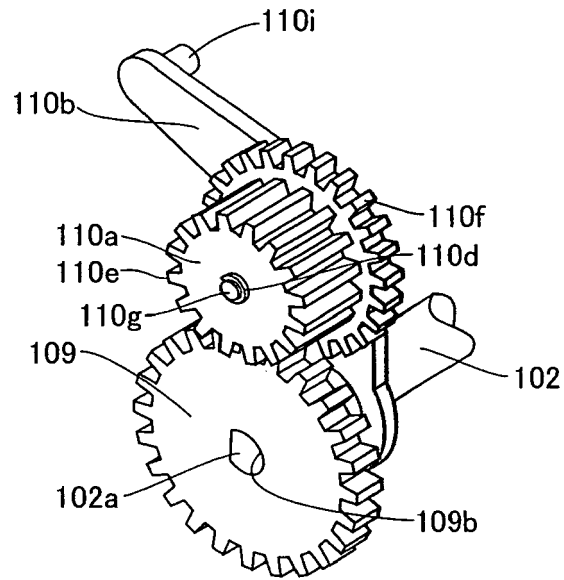


FIG.20

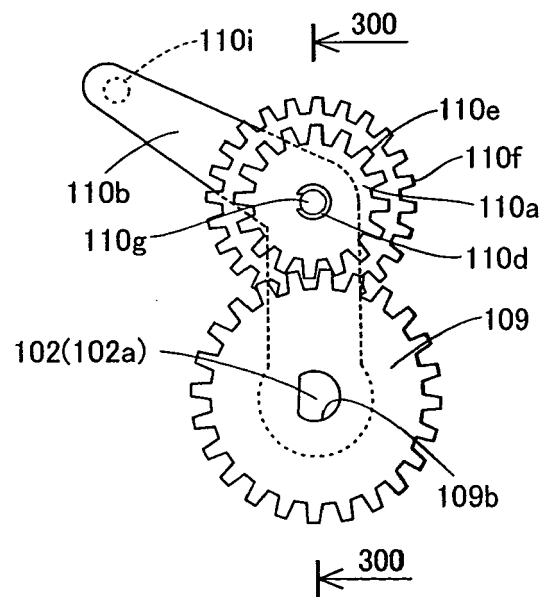
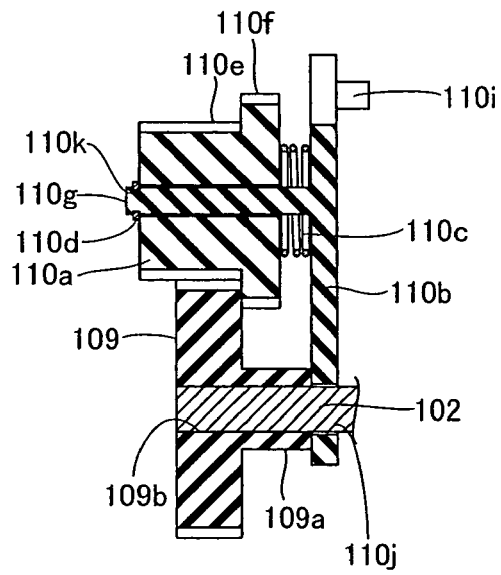


FIG. 21



REFERENCES CITED IN THE DESCRIPTION

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- JP 9960705 A [0002]
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