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(54) PAPER SUPPLY DEVICE OF IMAGE FORMING APPARATUS AND METHOD

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(57) ABSTRACT

A paper supply device and method for an image forming apparatus. The paper supply device comprises a driving unit, a first idle gear rotated by the driving unit, a first idle gear rotational shaft which is installed to pass through the first idle gear and rotates with the first idle gear, a paper conveying unit which is installed to be rotated by the first idle gear and conveying paper inward along the paper conveying path, and a multiple-feed preventing unit which is installed to be rotated by the first idle gear and preventing multiple-feed of the paper.

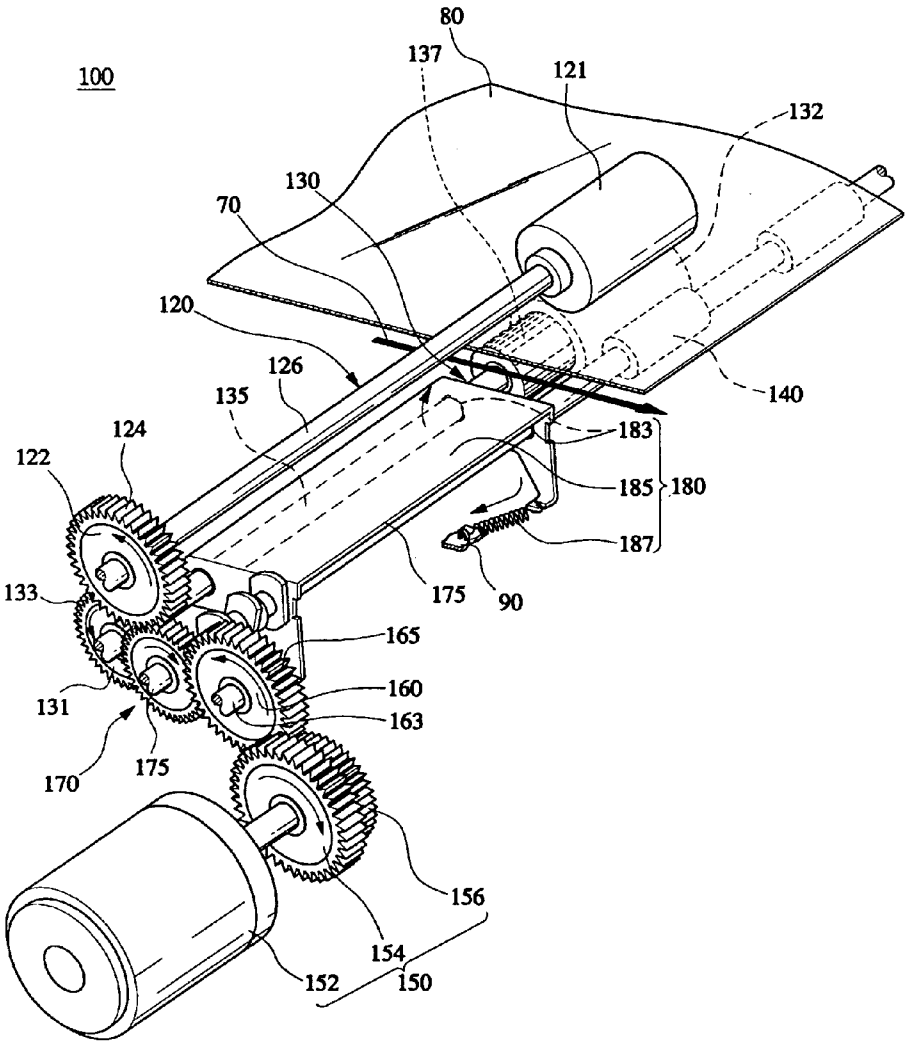

FIG. 1

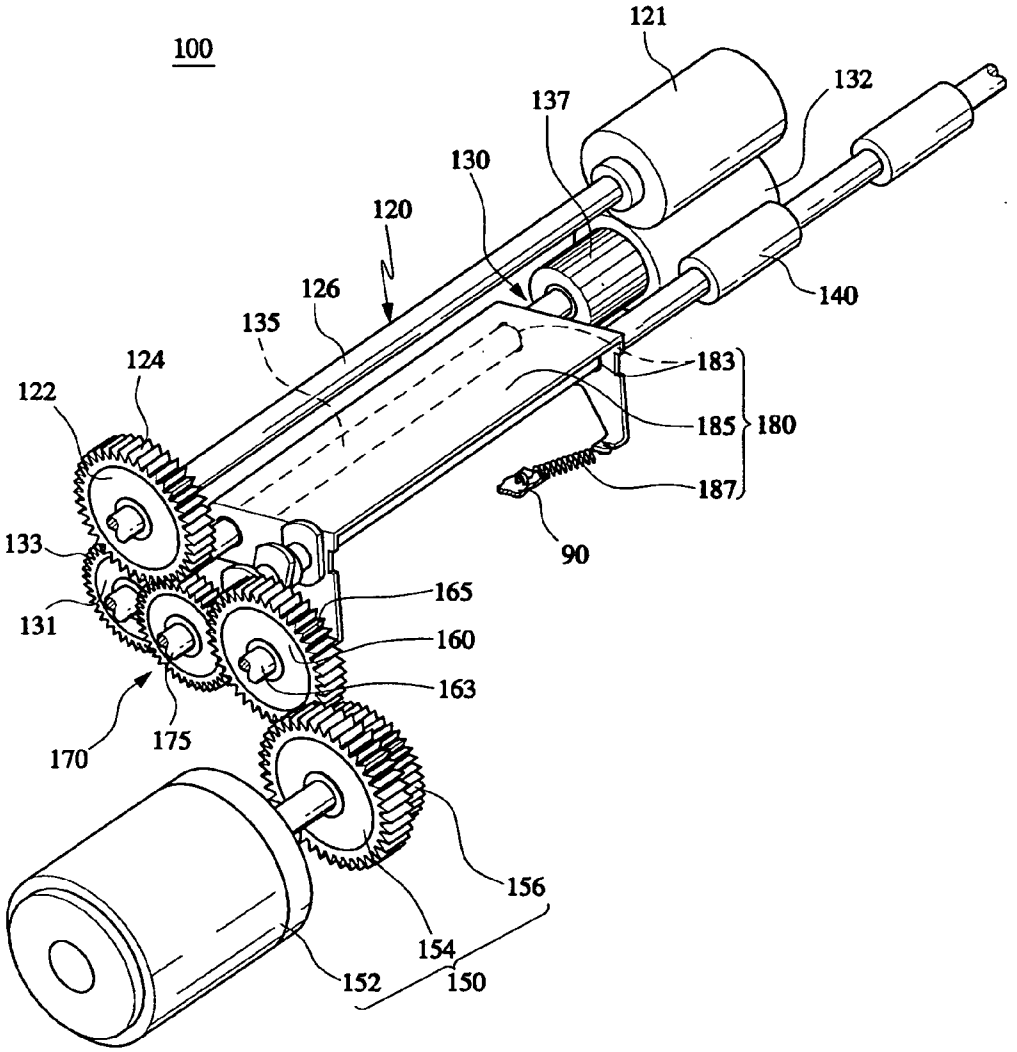
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FIG. 2

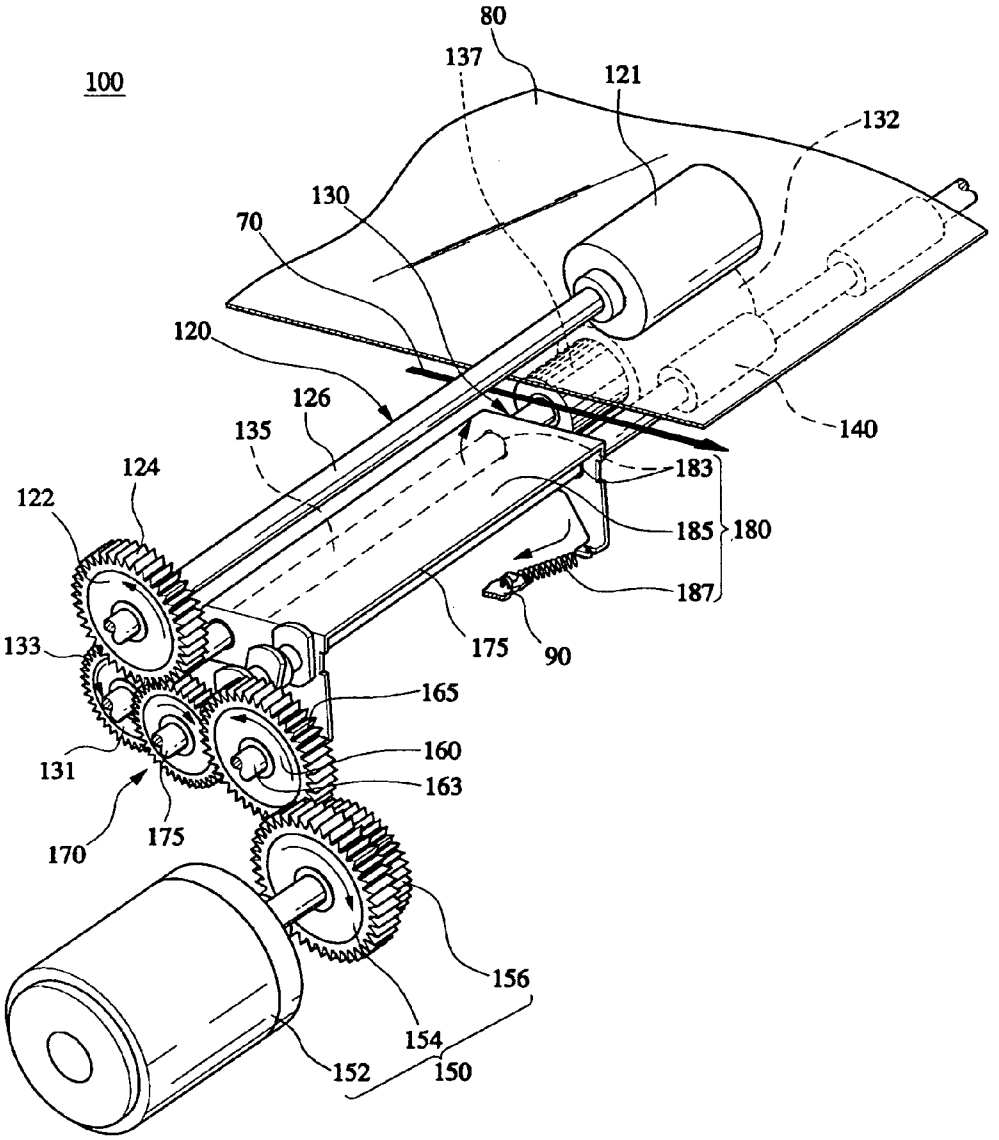
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FIG. 3

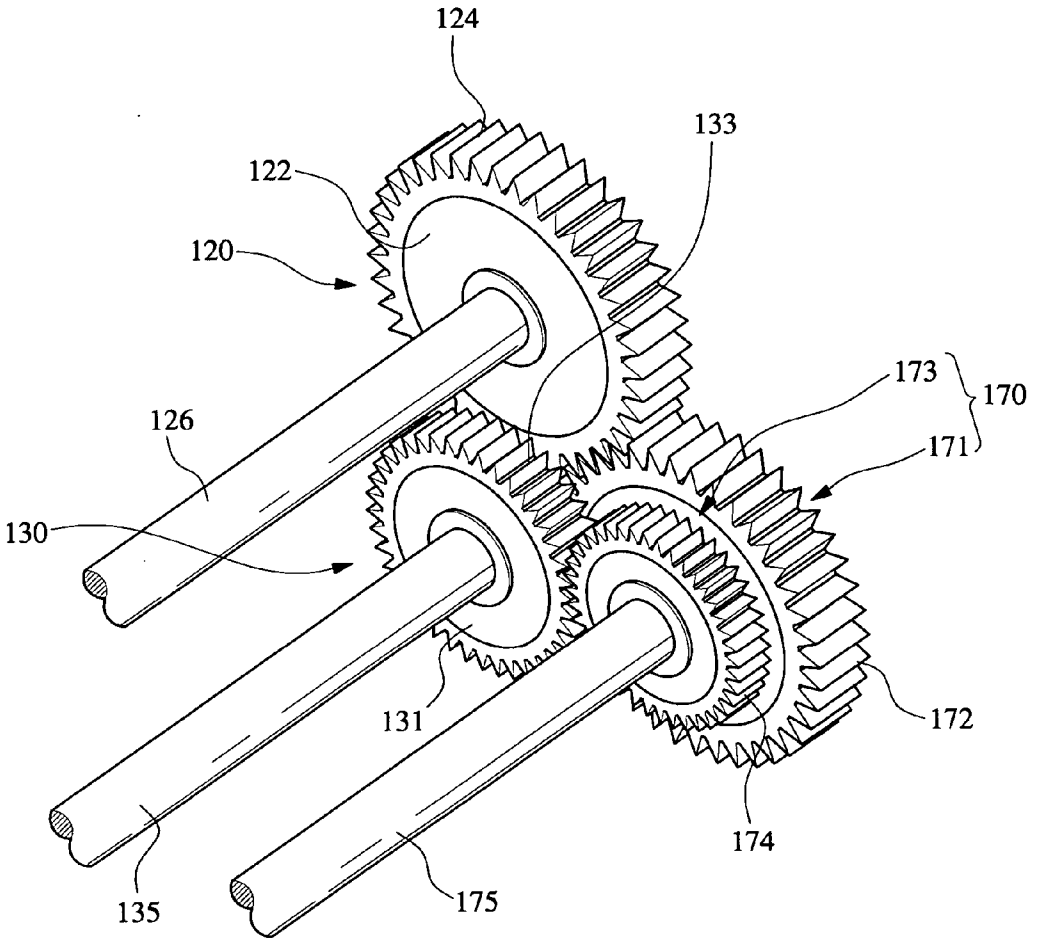
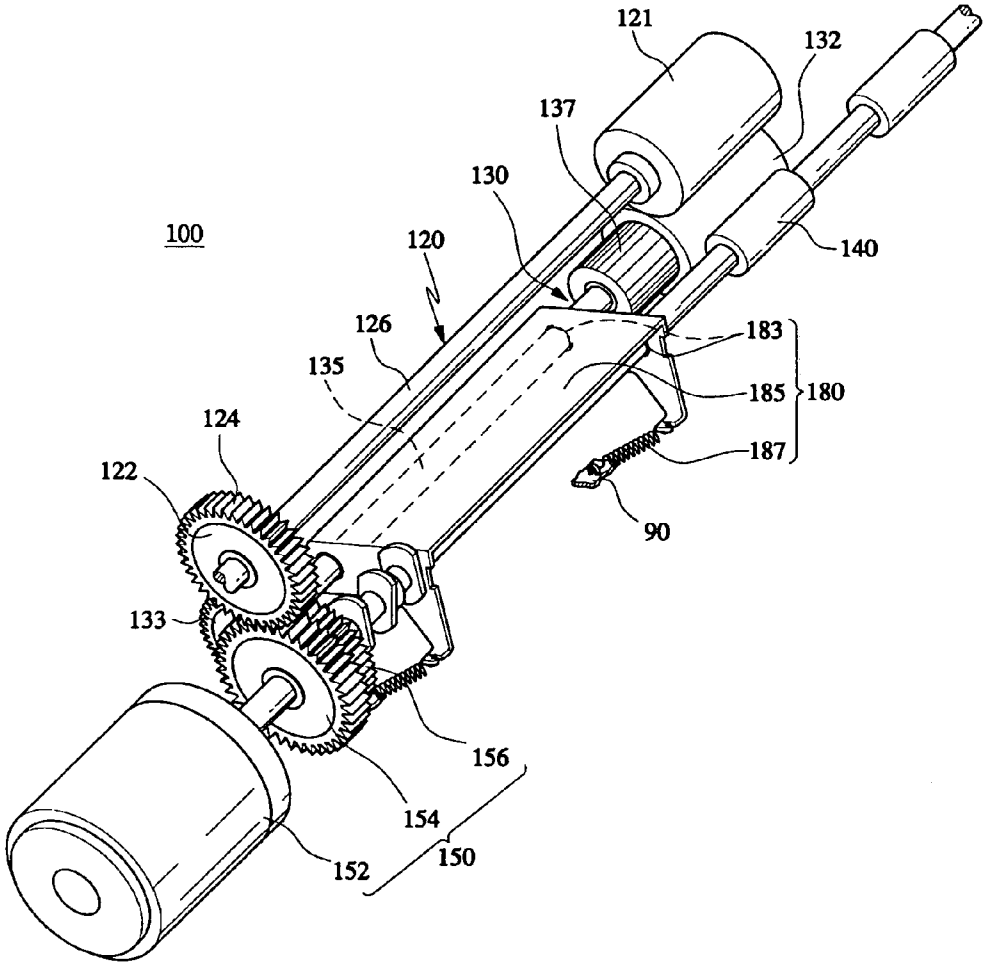


FIG. 4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PAPER SUPPLY DEVICE OF IMAGE FORMING APPARATUS AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit under 35 U.S.C. § 119(a) of Korean Patent Application No. 2003-100468, filed on Dec. 30, 2003, the entire contents of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an image forming apparatus and method. More particularly, the present invention relates to a paper supply device of an image forming apparatus designed to convey a printing medium or paper inward along a paper conveying path and a method thereof.

[0004] 2. Description of the Related Art

[0005] An electrophotographic image forming apparatus such as a laser printer, a facsimile or a copier typically performs an image forming operation by developing an electrostatic latent image formed on a photosensitive member into a visible image by means of a toner, transferring the visible image by the toner to paper conveyed from a paper cassette, and fixing the transferred image onto the paper.

[0006] For the purpose of this operation, the image forming apparatus is provided with a paper pick-up unit for sequentially picking up sheets of paper loaded in the paper cassette, and a paper supply device for conveying the picked-up paper one sheet at a time toward a paper conveying path formed inside the image forming apparatus.

[0007] Therefore, the paper supply device conveys the picked-up sheet of paper inward along the paper conveying path, when the paper pick-up unit picks up a sheet of paper placed on the top of the paper loaded on the paper cassette using a pick-up roller and so on.

[0008] Occasionally, due to paper-to-paper friction forces and so on, two or more sheets of paper may be picked up at once and conveyed inward along the paper conveying path (hereinafter, a phenomenon that two or more sheets of paper are conveyed is called "multiple-feed"). Accordingly, this multiple-feed brings about various problems, for example a jam, inside the image forming apparatus.

[0009] Hence, in recent years, a variety of approaches for preventing the multiple-feed have been proposed.

[0010] One example of the approaches is a retard roller method for preventing the multiple-feed using a torque limiter having a predetermined critical torque value, a retard roller connected to the torque limiter and so forth. Here, the torque limiter performs a forward rotation when the paper feed friction force is greater than the predetermined critical torque value, while it performs a reverse rotation when the paper feed friction force is smaller than the predetermined critical torque value. Further, the retard roller performs either the forward or reverse rotation depending on the torque limiter.

[0011] To be more specific, the retard roller method prevents the multiple-feed by installing the torque limiter and the retard roller on a lower side of the paper conveying path along which the paper is conveyed. With this configuration, when either no or one sheet of paper is conveyed along the paper conveying path, the paper feed friction force becomes greater than the critical torque value of the torque limiter, so that the torque limiter and the retard roller rotate in the paper feed direction, thus conveying the paper.

[0012] In contrast, when two or more sheets of paper are conveyed along the paper conveying path, the paper feed friction force becomes smaller than the critical torque value of the torque limiter, so that the torque limiter and the retard roller rotate opposite to the paper conveying direction. Thereby, it is possible to prevent a multiple-feed.

[0013] One example of the paper supply device for the image forming apparatus to which such a retard roller method is employed is disclosed in U.S. Pat. No. 5,571,265 (issued on Nov. 5, 1996) titled "SHEET SUPPLYING APPARATUS".

[0014] The disclosed sheet supplying apparatus is provided with a torque limiter and a retard roller to prevent multiple-feeds of the sheets of paper, in which the torque limiter and the retard roller are arranged on a lower side of a path along which the sheets of paper are conveyed sequentially. A retard gear for driving the retard roller is constructed to receive a driving force from a gear, which, in turn, is installed to receive a driving force from a motor, namely a drive gear coupled to a drive roller, and simultaneously via a plurality of idle gears. Further, the torque limiter, which performs a forward or reverse rotation according to paper feed friction force of the paper, is disposed on an intermediate path along which the driving force is transmitted. Thus, for the conventional sheet feeding apparatus, when driving the motor causes a supply roller and the driver roller to rotate to convey the sheets of paper, the retard gear also receives the driving force through the drive gear coupled to the drive roller and the plurality of idle gears engaged with the drive gear, thus rotating in the same direction as that of the drive roller to convey the sheets of paper. However, when two or more sheets of paper are conveyed, the rotational direction becomes different from the previous direction. Specifically, when two or more sheets of paper are conveyed, the paper feed friction force becomes smaller than a critical torque value of the torque limiter, so that the torque limiter rotates in a direction opposite to that in which the sheets of paper are conveyed. Therefore, the retard roller also rotates in a direction opposite to that in which the sheets of paper are conveyed with the torque limiter, thereby preventing multiple-feeding of the sheets of paper.

[0015] In this manner, the conventional paper feeding apparatus prevents multiple-feeding of sheets of paper using the retard roller, but it employs a very complicated gear train in order to drive the retard roller. This causes a problem in that the driving force suffers a considerable loss when in use. Moreover, this loss of the driving force results in an increase in a load which is applied to the motor.

[0016] Further, because the conventional paper feeding apparatus prevents multiple-feeding of the sheets of paper using the complicated gear train, it has low operational stability as well as high production costs.

SUMMARY OF THE INVENTION

[0017] Therefore, an objective of the present invention is to provide a paper supply device for an image forming

apparatus, capable not only of minimizing loss of power, but also of driving a retard roller.

[0018] Another objective of the present invention is to provide a paper supply device of an image forming apparatus, capable of maximizing operational stability through a simplified gear train and a method thereof.

[0019] In order to accomplish these objectives, there is provided a paper supply device of an image forming apparatus and a method thereof. The apparatus and method comprise a driving motor, a driving gear coupled to the driving motor rotating at a predetermined speed; a paper conveying unit for rotating via the driving gear, installed on any one of upper and lower sides of a paper conveying path, and conveying paper disposed inward along the paper conveying path, and a multiple-feed preventing unit for rotating via the driving gear, installed on the other side of the paper conveying path which corresponds to the paper conveying unit, for preventing multiple-feeding of the paper.

[0020] Preferably, the driving gear is connected to a first idle gear rotated by the driving gear, and the paper conveying unit and the multiple-feed preventing unit are rotated by the first idle gear.

[0021] Further, the paper conveying unit, preferably, includes a forward gear which is installed to engage with the first idle gear, a forward gear rotational shaft which is installed to pass through the forward gear and rotates with the forward gear, and a forward roller which is installed on the forward gear rotational shaft and rotates with the forward gear rotational shaft to convey the paper.

[0022] Preferably, the multiple-feed preventing unit includes a retard gear which is installed to engage with the first idle gear, a retard gear rotational shaft which is installed to pass through the retard gear and rotates with the retard gear, a torque limiter which is installed on the retard gear rotational shaft and rotates with the retard gear rotational shaft and performs a forward or reverse rotation according to paper feed friction force of the paper, and a retard roller which is connected to the torque limiter and rotates with the torque limiter and prevents the multiple-feed of the paper.

[0023] Furthermore, it is preferred that the first idle gear is a multi-stage gear and includes a first-stage idle gear provided for engagement with the forward gear and a second-stage idle gear provided for engagement with the retard gear, and that the second-stage idle gear has a number of gear teeth smaller than that of the first-stage idle gear so that the retard gear has a rotational speed slower than that of the forward gear.

[0024] Meanwhile, the first idle gear is preferably provided with a first idle gear rotational shaft which allows the first idle gear to be rotated with the first idle gear. The first idle gear rotational shaft is preferably provided with a shaft distance maintaining unit for maintaining at least one of a shaft distance between the first idle gear rotational shaft and the retard gear rotational shaft and a shaft distance between the first idle gear rotational shaft and the forward gear rotational shaft within a predetermined range. It is preferred that the shaft distance maintaining unit includes at least one coupling plate having two coupling holes spaced apart from each other by a predetermined distance, the two coupling holes being inserted by the first idle gear rotational shaft and a shaft shifting up and down while maintaining a predetermined distance from the first idle gear rotational shaft, respectively.

[0025] Further, it is preferred that the coupling plate is further provided with a pressing means for shifting and pressing one of the retard and forward rollers toward each other so that the retard and forward rollers are brought into contact with each other at a predetermined pressure. The pressing means, preferably, includes an extension spring installed to pull one end of the coupling plate toward the shifted roller, the one end of the coupling plate being more adjacent to the first idle gear rotational shaft.

[0026] Furthermore, it is preferred that the first idle gear rotational shaft is further provided with a plurality of feed rollers which are installed to rotate with the first idle gear rotational shaft and conveys the paper inward along the paper conveying path.

[0027] In addition, preferably, the paper supply device further comprises a second idle gear between the driving gear and the first idle gear, the second idle gear being engaged with both the driving gear and the first idle gear so as to transmit a rotational force of the driving gear to the first idle gear.

[0028] Hereinafter, a detailed description will be made of a paper supply device of an image forming apparatus according to an embodiment of the present invention as well as the image forming apparatus to which the paper supply device is applied.

[0029] With regard to the image forming apparatus to which the paper supply device of the embodiments of the present invention are applied, it comprises a main body forming an external appearance and provided with a paper conveying path inside, a paper cassette detachably mounted to the main body and loads a plurality of sheets of paper, a paper pick-up unit mounted to the main body and picking up the sheets of paper loaded in the cassette one by one from the top sheet of paper, a paper conveying unit conveying the picked-up paper inward along the paper conveying path, an image transferring apparatus transferring a predetermined image to the conveyed paper, a fixing apparatus semi-permanently fixing the transferred image, and a central control apparatus controlling the image forming apparatus as a whole.

[0030] Here, two or more sheets of paper are often picked up and conveyed by the paper pick-up unit. The paper supply device functions not only to convey the picked-up paper inward along the paper conveying path, but also to prevent multiple-feed of the picked-up paper.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The above and other features and advantages of embodiments of the present invention will become more apparent to those of ordinary skill in the art by describing in detail embodiments thereof with reference to the accompanying drawings in which:

[0032] **FIG. 1** is a perspective view illustrating a paper supply device of an image forming apparatus according to an embodiment of the present invention;

[0033] **FIG. 2** is a perspective view illustrating a state where the paper supply device of the image forming apparatus shown in **FIG. 1** is driven;

[0034] **FIG. 3** is an enlarged perspective view illustrating a state where a first idle gear, a forward gear and a retard gear of the paper supply device of the image forming apparatus shown in **FIG. 1** are assembled; and

[0035] **FIG. 4** is a perspective view illustrating a paper supply device of an image forming apparatus according to another embodiment of the present invention.

[0036] Throughout the drawings, it should be noted that the same or similar elements are denoted by like reference numerals.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0037] A description will now be made in detail with regard to a paper supply device **100** of an image forming apparatus according to embodiments of the present invention with reference to FIGS. **1** to **4**.

[0038] As shown in the drawings, the paper supply device **100** of the image forming apparatus according to embodiments of the present invention comprise a driving unit **150** which generates a driving force, a paper conveying unit **120** which is driven by the generated driving force and conveys paper **80** picked-up by a paper pick-up unit (not shown) toward a paper conveying path **70** (see **FIG. 2**), a multiple-feed preventing unit **130** which is driven by the generated driving force and prevents multiple feeding of the paper, and a driving force transmitting unit which transmits the driving force of the driving unit **150** to the paper conveying unit **120** and the multiple feed preventing unit **130**.

[0039] Specifically, the driving unit **150** includes a driving motor **152** for generating a predetermined rotational force, and a driving gear **154** coupled to the driving motor **152** and rotating at a predetermined Revolution per Minute (RPM).

[0040] The paper conveying unit **120** is installed on one of upper and lower sides of the paper conveying path **70** and functions to convey the paper **80**. The paper conveying unit **120** includes a forward gear **122** which is installed to engage a first idle gear **170** of the driving force transmitting unit to be mentioned below, a forward gear rotational shaft **126** which is installed to pass through the forward gear **122** and rotates with the forward gear **122**, and a forward roller **121** which is installed on the forward gear rotational shaft **126** and rotates with the forward gear rotational shaft **126** to convey the paper **80** inward along the paper conveying path **70**. Here, the paper conveying unit **120** is preferably installed on the upper side of the paper conveying path **70**.

[0041] The multiple feed preventing unit **130** is installed on the other side, corresponding to the paper conveying unit **120**, of the upper and lower sides of the paper conveying path **70** and functions to prevent multiple-feeding of the paper **80**. The multiple-feed preventing unit **130** includes a retard gear **131** which is installed to engage with the first idle gear **170**, a retard gear rotational shaft **135** which is installed to pass through the retard gear **131** and rotates with the retard gear **131**, a torque limiter **137** which is installed on the retard gear rotational shaft **135** so as to have a predetermined critical torque value. The torque limiter **137** performs a forward rotation when a predetermined paper feed friction force is greater than the critical torque value, and performs a reverse rotation when the predetermined paper feed friction force is smaller than the critical torque value, and a retard roller **132** which is connected to the torque limiter **137**, performs a forward or reverse rotation with the torque limiter, and prevents multiple-feeding of the paper **80**. Preferably, the multiple-feed preventing unit **130** is installed on the lower side of the paper conveying path **70**. Further, the retard roller **132** of the multiple-feed preventing unit **130** is preferably installed on a lower side of the forward roller **121** so as to come into rolling contact with the forward roller **121**. Preferably, the torque limiter **137** performs the forward or reverse rotation depending on the paper feed friction force of the paper which is conveyed between the forward roller **121** and the retard roller **132**. Further, the multiple-feed preventing unit **130** including the retard roller **132** and the retard gear rotational shaft **135** is preferably installed to shift up and down at a predetermined distance so that the paper **80** can be introduced and conveyed between the retard roller **132** and the forward roller **121** which are brought into rolling contact with each other.

[0042] The driving force transmitting unit includes the first idle gear **170** which is engaged with both the forward gear **122** of the paper conveying unit **120** and the retard gear **131** of the multiple-feed preventing unit **130**, a second idle gear **160** which transmits the rotational force of the driving gear **154** to the first idle gear **170**, and first and second idle gear rotational shafts **175** and **163** which are installed to pass through the first and second idle gears **170** and **160** and rotate with the first and second idle gears **170** and **160**.

[0043] Here, the first idle gear **170** is formed of a multi-stage gear, which is engaged with the forward gear **122** and the retard gear **131**. To this end, the first idle gear **170** is provided with a first-stage idle gear **171** for engagement with the forward gear **122**, and a second-stage idle gear **173** for engagement with the retard gear **131** (see **FIG. 3**). With this configuration, both the forward gear **122** and the retard gear **131** are engaged with the first idle gear **170**. The second-stage idle gear **173** with which the retard gear **131** is meshed has a smaller number of teeth than that of the first-stage idle gear **171** with which the forward gear **122** is meshed. In this manner, the forward and retard gears **122** and **131** which are engaged with the first idle gear **170** rotate in proportion to the number of teeth of the first- and second-stage idle gears **171** and **173**, and the retard gear **131** meshing with the second-stage idle gear **173** rotates at a relatively low speed compared with the forward gear **122** meshing with the first-stage idle gear **171**.

[0044] Further, the first and second idle gear rotational shafts **175** and **163** are installed to pass through the first and second idle gears **170** and **160** so that the first and second idle gears **170** and **160** can rotate respectively, and are fixed to a main body **90** of the image forming apparatus. Here, the first and second idle gear rotational shafts **175** and **163** are preferably installed on an upper side of the paper conveying path **70** similar to the foregoing paper conveying unit **120**. Hence, at least one of the first and second idle gear rotational shafts **175** and **163**, for example, the first idle gear rotational shaft **175** is additionally provided with a plurality of feed rollers **140** so as to more smoothly convey the paper **80** conveyed by the forward roller **121**. In this case, the paper **80** conveyed by the forward roller **121** is more smoothly conveyed inward along the paper conveying path **70** by the feed rollers **140**.

[0045] The retard gear **131** of the multiple-feed preventing unit **130** is installed to engage with the first idle gear **170**.

This engagement of the retard gear **131** must continue to be maintained even when the multiple-feed preventing unit **130** shifts up and down at a predetermined distance, so that the paper **80** can be introduced and conveyed between the retard roller **132** and the forward roller **121**.

[**0046**] Therefore, in order to maintain this engagement, the paper supply device **100** of the embodiments of the present invention is realized by maintaining a distance between the shafts of the gears **170** and **131** in a predetermined range. For this purpose, the first idle gear rotational shaft **175** passing through the first idle gear **170** is provided with a shaft distance maintaining unit **180**, which functions to maintain a shaft distance between the first idle gear rotational shaft **175** and the retard gear rotational shaft **135** in a predetermined range.

[**0047**] The shaft distance maintaining unit **180** is implemented as a coupling plate **185** having two coupling holes **183** spaced apart from each other by a predetermined distance (i.e., a distance which must be maintained between the first idle gear rotational shaft **175** and the retard gear rotational shaft **135**), in which one of the two coupling holes is inserted by the first idle gear rotational shaft **175** and the other is inserted by the retard gear rotational shaft **135** as the shaft capable of shifting up and down while maintaining a predetermined distance from the first idle gear rotational shaft **175**. In this case, the coupling plate **185** is preferably provided with at least two pairs of coupling holes **183**. In addition, the coupling plate **185** is formed in a "Π" or "U" shape, where both its ends are bent at a predetermined angle. These paired coupling holes **183** are preferably formed on the both ends, which are bent either downward or upward. Therefore, even when the multiple-feed preventing unit **130** shifts up and down at a predetermined distance, the shaft distance between the first idle gear rotational shaft **175** and the retard gear rotational shaft **135** continues to be maintained by the shaft distance maintaining unit **180** at a predetermined distance, so that the retard gear **131** and the first idle gear **170** continue to be engaged with each other. Meanwhile, the shaft distance maintaining unit **180** may be equally applied between the first idle gear rotational shaft **175** and the forward gear rotational shaft **126** except between the first idle gear rotational shaft **175** and the retard gear rotational shaft **135**.

[**0048**] Further, after the paper **80** is introduced between the forward roller **121** and the retard roller **132**, the retard roller **132** installed to come into rolling contact with the forward roller **121** must contact the forward roller **121** with a predetermined pressure in order to smoothly convey the paper **80**. Therefore, the coupling plate **185** of the shaft distance maintaining unit **180** is provided with a pressing means, which shifts and presses one of the retard and forward rollers **132** and **121** toward each other (herein, one example will be taken from the case of shifting and pressing the retard roller **132** toward the forward roller **121**).

[**0049**] The pressing means is preferably implemented as an extension spring **187**, which is installed to pull one end of the coupling plate **185** which is inserted by the first idle gear rotational shaft **175** and the retard gear rotational shaft **135** and is closer to the first idle gear rotational shaft **175**. Preferably, one end of the extension spring **187** is hooked on the one end of the coupling plate **185** which is adjacent to the first idle gear rotational shaft **175**, and the other end of the extension spring **187** is hooked on the main body **90** located at a lower portion of the retard roller **132**. Hence, elastic tension of the extension spring **187** is applied to the one end of the coupling plate **185**, as shown in **FIG. 2**. As a result, the retard gear rotational shaft **135** inserted into the coupling plate **185** in parallel shifts upward by a predetermined distance by a turning movement generated by the elastic tension of the extension spring **187**, thus pressing the retard roller **132** toward the forward roller **121**.

[**0050**] In the drawings, each of reference numerals **124**, **133**, **156**, **165**, **172** and **174** represents a gear tooth.

[**0051**] Hereinafter, a detailed description will be provided regarding operation and effects of an image forming apparatus according to an embodiment of the present invention as well as the paper supply device **100** of the image forming apparatus.

[**0052**] When a plurality of sheets of paper **80** are loaded in a paper cassette (not shown) and the paper cassette (not shown) is mounted into the main body **90** of the image forming apparatus, the top sheet of paper **80** in the paper cassette is picked up.

[**0053**] When the top sheet of paper **80** is picked up, the paper supply device **100** drives the driving motor **152** so as to convey the picked-up sheet of paper inward along the paper conveying path **70** provided in the main body **90**.

[**0054**] As the driving motor **152** rotates, the driving gear **154** coupled to the driving motor **152** rotates.

[**0055**] As the driving gear **154** rotates, the second idle gear **160** engaged with the driving gear **154** rotates, and simultaneously the first idle gear **170** engaged with the second idle gear **160** rotates.

[**0056**] Subsequently, the first idle gear **170** rotated by the second idle gear **160** rotates the forward and retard gears **122** and **131** in a direction in which the paper is conveyed, wherein the forward and retard gears **122** and **131** are engaged with the first and second-stage idle gears **171** and **173** of the first idle gear **170** respectively.

[**0057**] Thus, the forward roller **121** coupled to the forward gear **122**, and the torque limiter **137** and the retard roller **132** which are coupled to the retard gear **131** rotate to convey the picked-up sheet of paper **80** inward along the paper conveying path **70**. In this case, the reason the torque limiter **137** rotates in the direction in which the picked-up sheet of paper **80** is conveyed is that the paper **80** conveyed between the two rollers **121** and **131** is one sheet. In other words, the paper feed friction force of the paper **80** is greater than the critical torque value of the torque limiter **137**.

[**0058**] However, when two or more sheets of the paper **80** are picked up and conveyed in this manner, the paper feed friction force of the conveyed paper **80** is smaller than the critical torque value of the torque limiter **137**, so that the torque limiter **137** rotates in a direction opposite to that of the paper **80**. Thus, the retard roller **132** rotates in the direction opposite to that in which the paper **80** is conveyed with the torque limiter **137**, so that it is possible to prevent multiple-feeding of the paper **80**.

[**0059**] Meanwhile, when the paper **80** is conveyed inward along the paper conveying path **70** by the paper supply device **100**, an image transferring apparatus (not shown)

transfers a predetermined image to the paper **80**, and a fixing apparatus (not shown) fixes the transferred image on the paper **80**. Then, the paper **80** is discharged. Thereby, the image forming operation of the image forming apparatus is completed.

[**0060**] As can be seen from the foregoing, the paper supply device of the image forming apparatus according to embodiments of the present invention drive the retard roller and forward roller using a relatively small number of gears, thus minimizing the energy lost during power transmission of the gears. Thus, a load applied to the motor is reduced, so that it is possible to considerably save electric power consumed by the driving of the motor.

[**0061**] Further, the paper supply device of the image forming apparatus according to embodiments of the present invention provide numerical minimization and structural simplification of the idle gears to convey the paper without the multiple-feed, so that it is possible to provide improved operation stability and minimized production costs.

[**0062**] Furthermore, the paper supply device of the image forming apparatus according to embodiments of the present invention maintain the shaft distance between the first idle gear rotation shaft and the retard gear rotation shaft at a predetermined distance by means of the shaft distance maintaining unit. Thus, even when the multiple-feed preventing unit with the retard roller shifts up and down at a predetermined distance, the retard gear can continue to engage with the first idle gear.

[**0063**] In addition, the paper supply device of the image forming apparatus according to embodiments of the present invention is provided with the pressing means capable of pressing the retard roller toward the forward roller, so that the retard roller can continue to come into contact with the forward roller at a predetermined pressure. Thus, the multiple-feed of the paper conveyed between the retard roller and the forward roller can be minimized.

[**0064**] Moreover, the paper supply device of the image forming apparatus according to embodiments of the present invention is additionally provided with the feed roller on the first idle gear shaft, so that the paper conveyed inward along the paper conveying path by the forward roller can be more smoothly conveyed by such a feed roller.

[**0065**] It should be understood by those skilled in the art that while the present invention has been described with reference to certain embodiments, the described embodiments are simply illustrative of the principle of the present invention, and that various other modifications and changes may be devised. Thus, the scope of protection of the present invention should be limited only by the scope and equivalent of the following claims.

What is claimed is:

1. A paper supply device of an image forming apparatus, comprising:

a driving motor;

a driving gear coupled to the driving motor for rotating at a predetermined speed;

a paper conveying unit for rotating by the driving gear, and conveying paper inward along a paper conveying path; and

a multiple-feed preventing unit for rotating by the driving gear, and preventing multiple-feeding of the paper.

2. The paper supply device according to claim 1, wherein the driving gear is connected to a first idle gear rotated by the driving gear, and the paper conveying unit and the multiple-feed preventing unit are rotated by the first idle gear.

3. The paper supply device according to claim 2, wherein the paper conveying unit includes a forward gear which is installed to engage with the first idle gear, a forward gear rotational shaft which is installed to pass through the forward gear and rotates with the forward gear, and a forward roller which is installed on the forward gear rotational shaft and rotates with the forward gear rotational shaft to convey the paper.

4. The paper supply device according to claim 3, wherein the multiple-feed preventing unit includes a retard gear which is installed to engage with the first idle gear, a retard gear rotational shaft which is installed to pass through the retard gear and rotates with the retard gear, a torque limiter which is installed on the retard gear rotational shaft and rotates with the retard gear rotational shaft and performs a forward or reverse rotation according to paper feed friction force of the paper, and a retard roller which is connected to the torque limiter and rotates with the torque limiter and prevents the multiple-feeding of paper.

5. The paper supply device according to claim 4, wherein the first idle gear is a multi-stage gear and includes a first-stage idle gear provided for engagement with the forward gear and a second-stage idle gear provided for engagement with the retard gear.

6. The paper supply device according to claim 5, wherein the second-stage idle gear has a number of gear teeth smaller than that of the first-stage idle gear so that the retard gear has a rotational speed slower than that of the forward gear.

7. The paper supply device according to claim 4, wherein:

the first idle gear comprises a first idle gear rotational shaft which allows the first idle gear to be rotated and rotates with the first idle gear; and

the first idle gear rotational shaft is provided with a shaft distance maintaining unit for maintaining at least one of a shaft distance between the first idle gear rotational shaft and the retard gear rotational shaft and a shaft distance between the first idle gear rotational shaft and the forward gear rotational shaft within a predetermined range.

8. The paper supply device according to claim 7, wherein the shaft distance maintaining unit includes at least one coupling plate having two coupling holes spaced apart from each other by a predetermined distance, the two coupling holes being inserted by the first idle gear rotational shaft and a shaft shifting up and down while maintaining a predetermined distance from the first idle gear rotational shaft, respectively.

9. The paper supply device according to claim 8, wherein the coupling plate is further provided with a pressing means for shifting and pressing one of the retard and forward rollers toward the other so that the retard and forward rollers are brought into contact with each other at a predetermined pressure.

10. The paper supply device according to claim 9, wherein the pressing means includes an extension spring installed to pull one end of the coupling plate toward the shifted roller,

the one end of the coupling plate being more adjacent to the first idle gear rotational shaft.

11. The paper supply device according to claim 7, wherein the first idle gear rotational shaft is further provided with a plurality of feed rollers which are installed to rotate with the first idle gear rotational shaft and conveys the paper inward along the paper conveying path.

12. The paper supply device according to claim 2, further comprising a second idle gear between the driving gear and the first idle gear, the second idle gear being engaged with both the driving gear and the first idle gear so as to transmit a rotational force of the driving gear to the first idle gear.

13. The paper supply device according to claim 1, wherein the paper conveying unit is installed on any one of upper and lower sides of a paper conveying path.

14. The paper supply device according to claim 1, wherein the multiple-feed preventing unit is installed on the other side of the paper conveying path which corresponds to the paper conveying unit.

15. A method for supplying paper for an image forming apparatus, comprising:

providing a driving motor;

coupling a driving gear to the driving motor for rotating at a predetermined speed;

rotating a paper conveying unit via the driving gear, and conveying paper inward along a paper conveying path; and

rotating a multiple-feed preventing unit via the driving gear, and preventing multiple-feeding of the paper.

16. The method according to claim 15, further comprising:

connecting the driving gear to a first idle gear rotated by the driving gear; and

rotating the paper conveying unit and the multiple-feed preventing unit via the first idle gear.

17. The method according to claim 16, wherein the paper conveying unit comprises a forward gear.

18. The method according to claim 17, further comprising:

engaging the forward gear with the first idle gear.

19. The method according to claim 18, further comprising:

providing a forward gear rotational shaft.

20. The method according to claim 19, wherein the forward gear rotational shaft passes through the forward gear.

21. The method according to claim 20, further comprising:

rotating the forward gear rotational shaft with the forward gear.

22. The method according to claim 19, wherein the paper conveying unit comprises a forward roller which is installed on the forward gear rotational shaft.

23. The method according to claim 22, further comprising:

rotating the forward roller via the forward gear rotational shaft in order to convey the paper.

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