A sheet transporting apparatus includes a housing, a rotating shaft, a roller and a gear assembly. The housing includes a first supporting member and a second supporting member. The rotating shaft is rotatably mounted in the housing. The rotating shaft has a first end portion mounted in the first supporting member, and a second end portion mounted in the second supporting member. The roller is attached to the rotating shaft and rotated by the roller to transport a document sheet. The gear assembly, coupled to the second end portion, transmits power to the rotating shaft. The gear assembly includes a gear member and a coupling member, rotatable with the gear member, for securing the second end portion to the second supporting member.
BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates to a sheet transporting apparatus, and more particularly to a sheet transporting apparatus having a gear assembly capable of securely mounting a rotating shaft.

[0004] 2. Related Art

[0005] A sheet transporting roller used in a conventional sheet transporting apparatus is mounted on a shaft, two ends of which are attached to a housing. In order to avoid the axial movement of the shaft, the two ends of the shaft are formed with ring-shaped grooves for the mounting of the E-rings, so that the shaft is rotatably mounted in the housing and is secured in the axial direction.

[0006] It is time-consuming and labor-consuming to secure the shaft using the E-rings. In order to place and remove the E-rings, dedicated tools or jigs have to be used. Nevertheless, more E-rings have to be used if more components are mounted on the shaft, and the removed E-rings cannot be reused if being bent.

SUMMARY OF THE INVENTION

[0007] It is therefore an object of the invention to provide a sheet transporting apparatus having a shaft, which is secured without using E-rings. The shaft is secured by a gear assembly, so that the sheet transporting apparatus is easily assembled and the number of components of the sheet transporting apparatus are decreased.

[0008] To achieve the above-identified object, the invention provides a sheet transporting apparatus, which includes a housing, a rotating shaft, a roller and a gear assembly. The housing includes a first supporting member and a second supporting member. The rotating shaft is rotatably mounted in the housing. The rotating shaft has a first end portion mounted in the first supporting member, and a second end portion mounted in the second supporting member. The roller, mounted on the rotating shaft and rotated by the rotating shaft, transports a sheet. The gear assembly, coupled to the second end portion, transmits power to the rotating shaft. The gear assembly includes a gear member and a coupling member, rotatable with the gear member, for securing the second end portion to the second supporting member.

[0009] Thus, the gear assembly easily secures the rotating shaft to the housing to solve the problems of the prior art.

[0010] Further scope of the applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention will become more fully understood from the detailed description given hereinafter and the accompanying drawings which are given by way of illustration only, and thus are not limiting of the present invention.

[0012] FIG. 1 is a schematic side view showing a sheet transporting apparatus according to a preferred embodiment of the invention.

[0013] FIGS. 2A and 2B are partially schematic front views respectively showing assembled and disassembled structures of the sheet transporting apparatus according to the preferred embodiment of the invention.

[0014] FIG. 3 is a partially schematic illustration showing a gear assembly of FIG. 2A.

[0015] FIG. 4 is a cross-sectional view taken along a line 4-4 of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present invention will be apparent from the following detailed description, which proceeds with reference to the accompanying drawings, wherein the same references relate to the same elements.

[0017] FIG. 1 is a schematic side view showing a sheet transporting apparatus 1 according to a preferred embodiment of the invention. FIGS. 2A and 2B are partially schematic front views respectively showing assembled and disassembled structures of the sheet transporting apparatus 1 according to the preferred embodiment of the invention. FIG. 3 is a partially schematic illustration showing a gear assembly of FIG. 2A. Referring FIGS. 1 to 3, the sheet transporting apparatus 1 of this embodiment, which may be included in a scanner or an image processing apparatus, such as a printer or a multi-function peripheral, includes a housing 10, a rotating shaft 20, a gear assembly 30 and a roller 40. In addition, the sheet transporting apparatus 1 may further include a second rotating shaft 20', a second roller 40', rotating shafts 60 and 60', driven rollers 70 and 70', a belt 80 and a driving gear 90.

[0018] The housing 10 includes a first supporting member 12 and a second supporting member 14, and serves as a frame for supporting the components of the rotating shaft 20, the gear assembly 30 and the roller 40. The first supporting member 12 and the second supporting member 14 may be integrally formed jointly with the housing 10, and may also be individual members disposed in the housing 10.

[0019] The rotating shaft 20 is rotatably mounted in the housing 10 and has a first end portion 22 and a second end portion 24. The first end portion 22 is mounted in the first supporting member 12, and the second end portion 24 is mounted in the second supporting member 14. Similarly, the rotating shaft 20' may also be rotatably mounted in the housing 10 in a similar manner.

[0020] The roller 40, mounted on the rotating shaft 20 and rotated by the rotating shaft 20, transports a document sheet S. The roller 40 may directly or indirectly drive the driven roller 70 to rotate. Similarly, the roller 40' is also mounted on the rotating shaft 20' in a similar manner. The second roller 40' and the driven roller 70' transport the document sheet S out of the sheet transporting apparatus 1.
The gear assembly 30, coupled to the second end portion 24, transmits power to the rotating shaft 20. The gear assembly 30 includes a gear member 32 and a coupling member 34, rotatable with the gear member 32, for securing the second end portion 24 to the second supporting member 14.

The gear member 32 includes gear teeth 32A and/or gear teeth 32B. In this embodiment, the gear teeth 32B mesh with gear teeth 92 of the driving gear 90 and transmit power to the rotating shaft 20. The coupling member 34 includes a sleeve 340 formed with elastic hooks 341 and 342 for securing the second end portion 24 to the second supporting member 14. To securely mount the second end portion 24 to the supporting member 14, the sleeve 340 is wedged into an opening 14A of the second supporting member 14 and fastened to the second supporting member 14 by the elastic hooks 341 and 342, such that the gear assembly 30 is immovable in the axial direction of the shaft 20.

The gear member 32 includes a hollow body 32E, for accommodating the second end portion 24 of the rotating shaft 20. The second end portion 24 passes through the hollow body 32E. In addition, the gear member 32 may further include a flange 32C, disposed between the gear teeth 32A and 32B, for restricting the position of the belt 80.

In addition, the sheet transporting apparatus 1 may further include a scanning module 50 and/or a scanning module 50'. The scanning modules 50 and 50', disposed in the housing 10, scan images on two sides of the document sheet S transported by the roller 40.

As shown in FIGS. 2A and 2B, the first end portion 22 of the rotating shaft 20 includes a small-diameter section 22A and a large-diameter section 22B coaxially disposed with the small-diameter section 22A. The diameter of the small-diameter section 22A is smaller than the diameter of the large-diameter section 22B, and the small-diameter section 22A is seated within an opening 12A of the first supporting member 12. Thus, the axial movement of the rotating shaft 20 may be restricted to prevent the rotating shaft 20 from getting loose. The two end portions 22 and 24 of the rotating shaft 20 may be respectively seated within the first opening 12A and the opening (also referred to as a second opening) 14A of the second supporting member 14. The second end portion 24 passes through the second opening 14A. The gear assembly 30 is coupled to the second end portion 24 by wedging into the second opening 14A in the direction as indicated by the arrow of FIG. 2B. FIG. 2A shows a resulting integration of the gear assembly 30 and the rotating shaft 20, where the rotating shaft 20 is securely fixed to the second supporting member 14.

As shown in FIG. 3, the gear assembly 30 is inserted into the second opening 14A of the second supporting member 14 from the outside of the housing 10, and the elastic hooks 341 and 342 of the coupling member 34 of the gear assembly 30 pass through the second opening 14A and hook the second supporting member 14 from the inside. An outer periphery 34A of the coupling member 34 of the gear assembly 30 rests against an inner peripheral wall 14B of the second opening 14A of the second supporting member 14.

A surface 31 of the gear assembly 30 facing a wall 14W of the second supporting member 14 is formed with a plurality of projections 31A and the plurality of projections are in direct contact with the second supporting member 14, so that the friction between the gear assembly 30 and the surface 31 would be well reduced.

FIG. 4 is a cross-sectional view taken along a line 4-4 of FIG. 3. As shown in FIG. 4, the hollow body 32E has a D-shaped cavity 32D. The second end portion 24 has a D-shaped cross section 24D matching with the D-shaped cavity 32D to fix the gear assembly 30 to the rotating shaft 20, so that the rotating shaft 20 is driven by the gear assembly 30. In addition, a set screw or other means may also be handled to fix the gear assembly 30 to the rotating shaft 20. According to the above-mentioned design, the rotating shaft 20 may be secured to the housing 10 as well as being driven by the gear assembly 30.

The operations of the sheet transporting apparatus of the invention will be described in the following. The driving gear 90 attached to a motor (not shown) rotates the gear assembly 30 through the gear teeth 32B, and the gear assembly 30 rotates the belt 80 and the gear teeth 32A through the gear teeth 32A. Thus, the rollers 40 and 40' can rotate the driven rollers 70 and 70' synchronously to transport the document sheet S past the scan regions of the scanning modules 50 and 50', so that the scanning modules 50 and 50' can scan the images of the document sheet S.

With the sheet transporting apparatus of the invention, the rotating shaft may be rotatably mounted in the housing by coupling with the gear assembly, without using any tools, and the coupling member of the gear assembly can function as a bearing. Thus, the components used in the prior art, including the E-rings and the bearings, are dispensable, and no further metal working has to be done to machine ring-shaped grooves into the ends of the rotating shaft. In addition, to the same degree of precision as in the prior art, the coupling portion of the rotating shaft and the gear assembly is tightly fitted to the opening of the supporting member within which the rotating shaft is seated. Furthermore, no tool is required to remove the gear assembly from the apparatus, and users could unfasten the gear assembly simply by pressing the two elastic hooks inwards. Thus, the sheet transporting apparatus of the invention not only retains the quality of high precision in the installation of the components, but also reduces the associated material and machining costs.

While the invention has been described by way of examples and in terms of preferred embodiments, it is to be understood that the invention is not limited thereto. To the contrary, it is intended to cover various modifications. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications.

What is claimed is:

1. A sheet transporting apparatus, comprising:
a housing comprising a first supporting member and a second supporting member;
a rotating shaft, which is rotatably mounted in the housing and has a first end portion mounted in the first supporting member, and a second end portion mounted in the second supporting member;
a roller, mounted on the rotating shaft and rotated by the rotating shaft, for transporting a document sheet; and
a gear assembly, coupled to the second end portion, for transmitting power to the rotating shaft, the gear assembly comprising:
a gear member; and
a coupling member, rotatable with the gear member, for securing the second end portion to the second supporting member.
2. The apparatus according to claim 1, wherein the coupling member comprises a sleeve formed with a plurality of elastic hooks for securing the second end portion to the second supporting member, wherein the sleeve is wedged into an opening of the second supporting member and fastened to the second supporting member by the elastic hooks, such that the gear assembly is immovable in an axial direction of the rotating shaft.

3. The apparatus according to claim 1, wherein the gear member comprises a hollow body for accommodating the second end portion of the rotating shaft.

4. The apparatus according to claim 3, wherein the hollow body has a D-shaped cavity, the second end portion has a D-shaped cross section matching with the D-shaped cavity to fix the gear assembly to the rotating shaft, so that the rotating shaft is driven by the gear assembly.

5. The apparatus according to claim 1, wherein the gear member comprises gear teeth for meshing with gear teeth of a driving gear and for transmitting power to the rotating shaft.

6. The apparatus according to claim 1, further comprising a scanning module, disposed in the housing, for scanning an image of the document sheet transported by the roller.

7. The apparatus according to claim 1, wherein the first end portion of the rotating shaft comprises a small-diameter section and a large-diameter section coaxially disposed with the small-diameter section, wherein a diameter of the small-diameter section is smaller than that of the large-diameter section, and the small-diameter section is seated within an opening of the first supporting member.

8. The apparatus according to claim 1, wherein a surface of the gear assembly facing a wall of the second supporting member is formed with a plurality of projections, and the plurality of projections are in direct contact with the second supporting member.

9. The apparatus according to claim 1, wherein the first supporting member has a first opening, and the second supporting member has a second opening.

10. The apparatus according to claim 9, wherein the first end portion is seated within the first opening, and the second end portion passes through the second opening.

11. The apparatus according to claim 10, wherein an outer periphery of the coupling member of the gear assembly rests against an inner peripheral wall of the second opening.

12. A scanner comprising the sheet transporting apparatus according to claim 1.

13. An image processing apparatus comprising the sheet transporting apparatus according to claim 1.

* * * * *