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3,490,841

PHOTOCONDUCTOR DRUM LOCATOR

Filed Jan. 15, 1968

2 Sheets-Sheet 1

FIG. 1

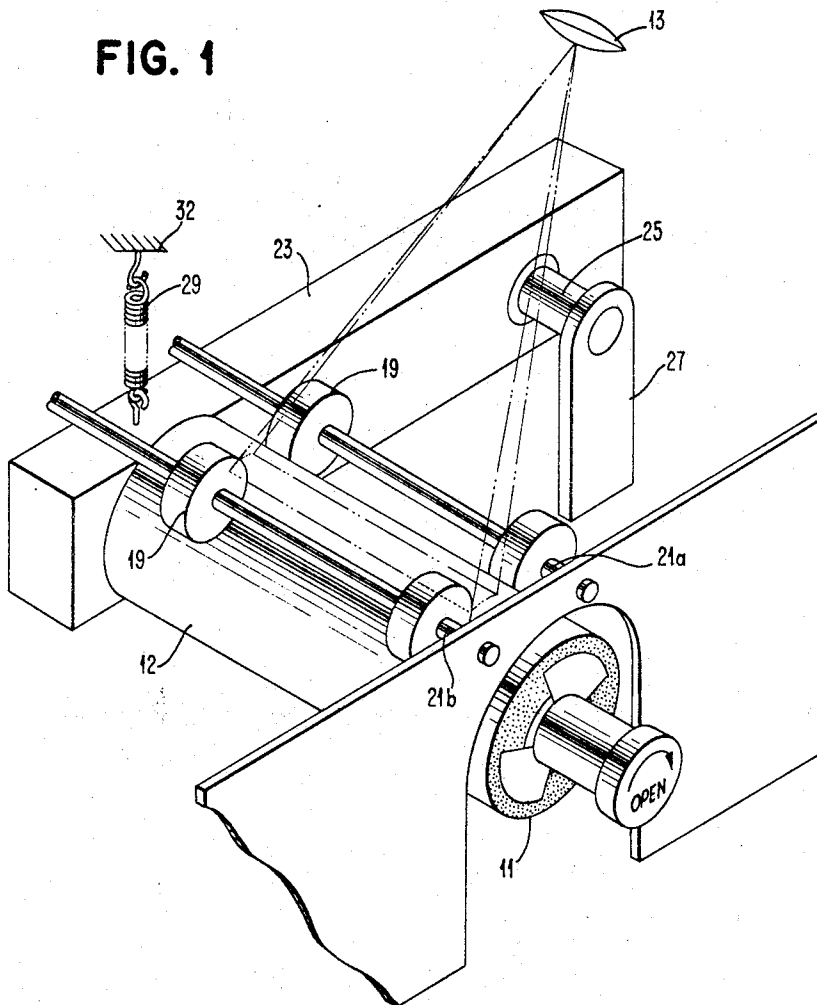
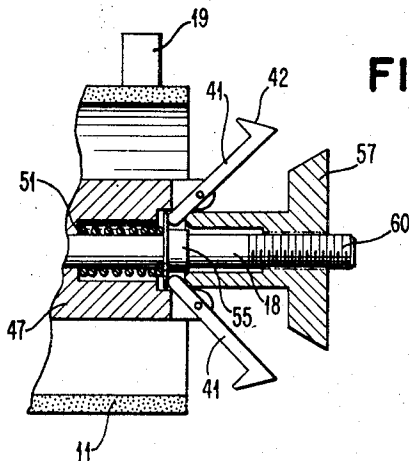


FIG. 3



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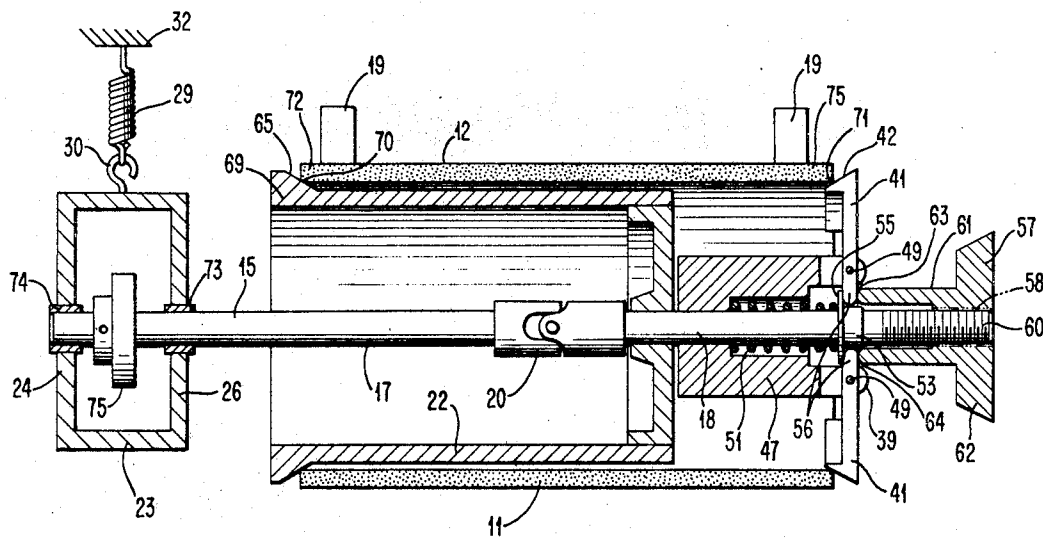
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FIG. 2



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3,490,841

PHOTOCONDUCTOR DRUM LOCATOR

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7 Claims

ABSTRACT OF THE DISCLOSURE

A photocopying drum apparatus which is detachably mounted for rotation on the outer section of a shaft having two sections which are connected by a universal joint. One end of the drum is supported by a sleeve. The other end of the drum is supported by a chuck having three circular segments which can be pivoted about a horizontal axis perpendicular to the rotational axis of the drum. The drum is removed by pivoting the outer ends of the circular segments to the side and down so that the drum can be removed over the chuck.

The inner section of the cantilevered shaft on a pivot arm. A force provided by a spring attached to the pivot arm, acts through the cantilevered shaft to the universal joint to cause the drum to pivot about the universal joint until the outer surface of the drum is urged into contact with a plurality of positioning rollers. The points of contact of the rollers with the drum are located at a fixed distance from the image focusing lens of the photocopying apparatus so that the image will remain focused on the surface of the drum to provide a sharp, clear image.

BACKGROUND OF THE INVENTION

In the process for making copies of documents by focusing a light image on a charged photoconductor to form a charged image corresponding to the document, which image is then developed by exposing the charged image to an oppositely charged, pigmented developer composition, it is necessary to correctly position the photoconductor surface with respect to the optical system of the apparatus so that a sharply focused charged image is produced on the photoconductor. A convenient way to accomplish such a photocopying process is to use a revolving drum whose surface is covered with a photoconductive material. Various stations are located around the drum for charging the photoconductor, exposing the photoconductor to produce the charged image, developing the image on the photoconductor, transferring the image to the desired substrate, such as a sheet of paper, and cleaning the surface of the photoconductor for the next cycle. While the photoconductor can be used a number of times which may run into the thousands, it nevertheless has a limited life and must be periodically replaced because the developer tends to coat the surface of the photoconductor and adversely affect its photoconductive properties. The repeated charging and discharging of the photoconductor also causes its photoconductive properties to gradually deteriorate.

Heretofore, expensive metal drums coated by special techniques with inorganic photoconductors have been used which drums are machined to close tolerances so that the distance of the surface of the drum from the optical system can be closely controlled.

It has now been found that relatively inexpensive photoconductor drums can be employed using organic photoconductive materials which can be easily coated on any substance, for example, cylinders of paper board, by conventional techniques. Therefore, when the photoconductor surface needs replacement, the cylinder can be

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discarded and a fresh cylinder inserted in its place. Such cylinders cannot, of course, be made to close tolerances nor do they have the ability of a rigid metal cylinder to retain their dimensional stability in service. Therefore, sharp copies cannot be produced unless a means is devised to correctly position the image area of the cylinders with respect to the optical system of the apparatus regardless of differing and constantly varying surface dimensions.

BRIEF DESCRIPTION OF THE INVENTION

An apparatus has now been constructed which permits an inexpensive, disposable photoconductor drum to be detachably mounted and accurately positioned in a copying apparatus.

In accordance with this invention, there is provided an apparatus for mounting a photoconductor drum and accurately positioning the image area of the drum which comprises a cantilevered shaft having two sections which are joined endwise by a connecting means which allows the movement of the axes of said sections relative to one another. Means are provided to mount the drum on the outer section of the shaft. Positioning means are located adjacent to the image area of the drum which are adapted to contact the surface of the drum and keep the image area of the drum a fixed distance from the optical system of a copying apparatus so that the image to be reproduced will be sharply focused on the photoconductor drum. A means is provided to apply a force to the shaft to cause the drum to pivot about the connecting means and thus maintain the surface of the drum in contact with the positioning means.

DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic representation of a preferred embodiment of the apparatus with parts broken away.

FIGURE 2 is a cross-sectional view of the apparatus of FIGURE 1 with parts broken away.

FIGURE 3 is a cross-sectional view of the apparatus of FIGURE 2 with parts broken away illustrating the releaseable chuck in the open position.

DETAILED DESCRIPTION

Referring now to FIGURE 1, drum 11, whose outer surface 12 is coated with a photoconductive material, is made of any convenient inexpensive material such as cardboard, thin metal sheet, or plastic. The image to be reproduced is focused on the image area (designated by dotted lines in FIGURE 1) by an optical system including focusing lens 13. Drum 11 is held in contact with rollers 19, which are located in pairs on shafts 21a and 21b, through the action of pivot arm 23 mounted to pivot around fixed pivot 25 which is carried by pivot support 27 as is hereinafter described. Pivot arm 23 is urged in an upward direction by spring 29 mounted to frame 32. Each pair of rollers 19 are mounted with carefully controlled concentricity at a fixed distance from lens 13.

Turning now to FIGURE 2, drum 11 is mounted to rotate with cantilevered shaft 15 by chuck 39 and sleeve 22. Shaft 15 has two sections, inner section 17 and outer section 18 which are connected by a universal joint 20. The inner end of section 17 of shaft 15 is mounted by bearings 73 and 74 to sides 24 and 26 of pivot arm 23. Shaft 15 is driven by any convenient prime mover, for example, an electric motor, connected by a power train (not shown) to pulley 75 which is mounted on shaft 15 inside of pivot arm 23.

Chuck 39 has a hollow hub 47 which is mounted to rotate with section 18 of shaft 15. Chuck 39 has three circular segments 41 which are pivotally mounted to

chuck 47 by studs 49. Compression spring 51 is mounted coaxially with shaft 15 within chuck 47. Spring 51 acts through collar 53 against the inner surfaces 55 of end portions 56 of circular segments 41 to urge segments 41 to rotate in a counterclockwise direction around studs 49. Knob 57 has an inner threaded portion 58 which is mounted to rotate on threaded portion 60 of section 18 of shaft 15. Knob 57 has a handle portion 62 which when rotated will cause knob 57 to move to the left or right, depending upon the direction of rotation of handle 62, on shaft 15 by means of coacting threaded portions 58 and 60. Hollow sleeve portion 61 of knob 57 has an end portion 63 which is adapted to contact outer surfaces 64 of end portions 56 of circular segments 41 and hold segments 41 in a fixed position against the rotating force of spring 51.

Sleeve 22 is mounted to rotate with section 18 of shaft 15. The tapered surface 65 of end 69 of sleeve 22 contacts the inner edge 70 of end 72 of drum 11. Drum 11 is urged against surface 65 by circular segments 41 whose tapered end portions 42 are urged into contact with the inner edge 71 of end 75 of drum 11 by spring 51.

To remove drum 11, handle 62 of knob 57 is turned so as to cause it to move to the left on shaft 15. This compresses spring 51 and causes circular segments 41 to be rotated in a clockwise direction around studs 49. Ends 42 move outwardly and downwardly away from end 75 of drum 11 until they are in the position illustrated in FIGURE 3. Drum 11 can then be removed to the right. To insert a new drum, the above process is reversed.

The image area of drum 11 is automatically located and maintained in the correct position with respect to lens 13 in the following manner as is illustrated in FIGURE 2. Pivot arm 23 is urged in an upward direction by an extension spring 29 which is mounted to hook 30 at one end and to frame 32 at the other so that pivot arm 23 pivots upwardly in a clockwise direction around fixed pivot 25 (FIGURE 1). This force acting through shaft 15, chuck 39 and sleeve 22 on drum 11 causes drum 11 to pivot around universal joint 20 until its outer surface 12 is in contact with all four rollers 19. This contact is maintained during the rotation of drum 11 because drum 11 is continuously and automatically pivoted about universal joint 20 by the action of pivot arm 23 which compensates for any variations in the dimensions of drum 11. The image area of drum 11 is thereby always maintained a fixed distance from lens 13.

The invention permits the use of relatively inexpensive, disposable photoconductor drums. The image area of the drum is automatically positioned during use to maintain the correct focusing relationship between the optical system of the copying apparatus and the photoconductor surface.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for mounting a photoconductor drum and accurately positioning the image area of the drum with respect to the optical system of a copying apparatus comprising:

a cantilevered shaft having inner and outer sections, connecting means joining said section so as to allow movement of said outer section relative to said inner section,

means for mounting said drum on said outer section of said shaft for rotation with said shaft,

positioning means located adjacent to the image area of said drum, said means being adapted to contact the surface of said drum at a fixed distance with

respect to the optical system of said copying apparatus, and

means to apply a force to said cantilevered shaft to cause said drum to be pivoted about said connecting means and urged into contact with said positioning means.

2. An apparatus for mounting a photoconductor drum and accurately positioning the image area of the drum with respect to the optical system of a copying apparatus comprising:

a cantilevered shaft having inner and outer sections, a universal joint joining said sections so as to allow movement of the axes of said sections relative to one another,

means to drive said cantilevered shaft,

means for detachably mounting said drum on said outer section of said shaft for rotation with said shaft,

positioning means located adjacent to the image area of said drum, said means being adapted to contact the surface of said drum at a fixed distance with respect to the optical system of said copying apparatus, and

means to apply a force to said cantilevered shaft to cause said drum to pivot about said universal joint and be urged into contact with said positioning means.

3. An apparatus for mounting a photoconductor drum and accurately positioning the image area of the drum with respect to the optical system of a copying apparatus comprising:

a cantilevered shaft having inner and outer sections, a universal joint joining said sections so as to allow movement of the axes of said sections relative one another,

means for mounting said drum for rotation with said outer section of said shaft,

positioning means located adjacent to the image area of said drum said means being adapted to contact the surface of said drum at a fixed distance with respect to the optical system of said copying apparatus, and

means to apply a force to said cantilevered shaft to cause said drum to pivot about said universal joint and be urged into contact with said positioning means.

4. The apparatus of claim 2 wherein said means for detachably mounting said drum comprises:

a sleeve mounted to rotate with said outer section of said shaft, said sleeve having a tapered flange portion adapted to engage the inner edge of one end of said drum,

a releasable chuck having a core mounted to rotate with said outer section of said shaft and a plurality of circular segments pivotally mounted to said core with the outer portions of said circular segments being adapted to contact the inner edge of the other end of said drum and urge said drum into contact with the tapered portion of said sleeve such that said drum, sleeve and chuck rotate with said shaft,

and means for pivoting said circular segments outwardly and downwardly away from said inner edge of said drum to permit said drum to be removed over said chuck.

5. The apparatus of claim 4 wherein said positioning means comprises a pair of shafts located adjacent to the surface of said drum, said shafts being substantially parallel to the axis of said drum, and a pair of positioning rollers concentrically mounted on each of said shafts such that the outer edges of said rollers contact the surface of said drum adjacent to the image area of said drum at a fixed distance from the focusing lens of said copying machine.

6. The apparatus of claim 5 wherein said means to apply a force to said cantilevered shaft comprises a pivot

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arm near one end of which the inner end of said cantilevered shaft is mounted for rotation, a fixed pivot mounting said pivot arm near its other end, and means to continuously urge the end of said pivot arm carrying said shaft to tend said arm to rotate about said pivot in a direction to move said cantilevered shaft and drum toward said positioning means.

7. An apparatus for detachably mounting a photoconductor drum in a copying apparatus and accurately positioning the image area of the drum with respect to the optical system of said copying apparatus comprising:

a cantilevered shaft having two sections said sections being connected by a universal joint, the inner section of said shaft being mounted for rotation to one end of a pivot arm,

a fixed pivot for mounting said pivot arm at its other end,

means to drive said cantilevered shaft,

a releasable chuck mounted to rotate with said cantilevered shaft on its outer section, said chuck being adapted to detachably engage the inner edge of one end of said drum,

a sleeve mounted on the outer section of said cantilevered shaft to rotate with said shaft and located between said universal joint and said chuck, one end of said sleeve having a flange portion adapted to frictionally engage the inner edge of the other end of said drum such that said drum will rotate with

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said cantilevered shaft and pivot about said universal joint,

a pair of shafts located adjacent to the surface of said drum, said shafts being substantially parallel to the axis of said drum,

a plurality of positioning rollers mounted on each of said shafts, the outer edges of said rollers being adapted to accurately locate the image area of said drum with respect to the optical system of said copying machine when the surface of said drum is brought into contact with said rollers,

and means to apply a force through said pivot arm and said cantilevered shaft to cause said drum to be pivoted about said universal joint and urged into contact with said positioning rollers.

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96—1; 101—212