Nov. 23, 1965 R. A. HUNT 3,219,326

XEROGRAPHIC FUSING APPARATUS

Original Filed Nov. 28, 1958 3 Sheets-Sheet 1

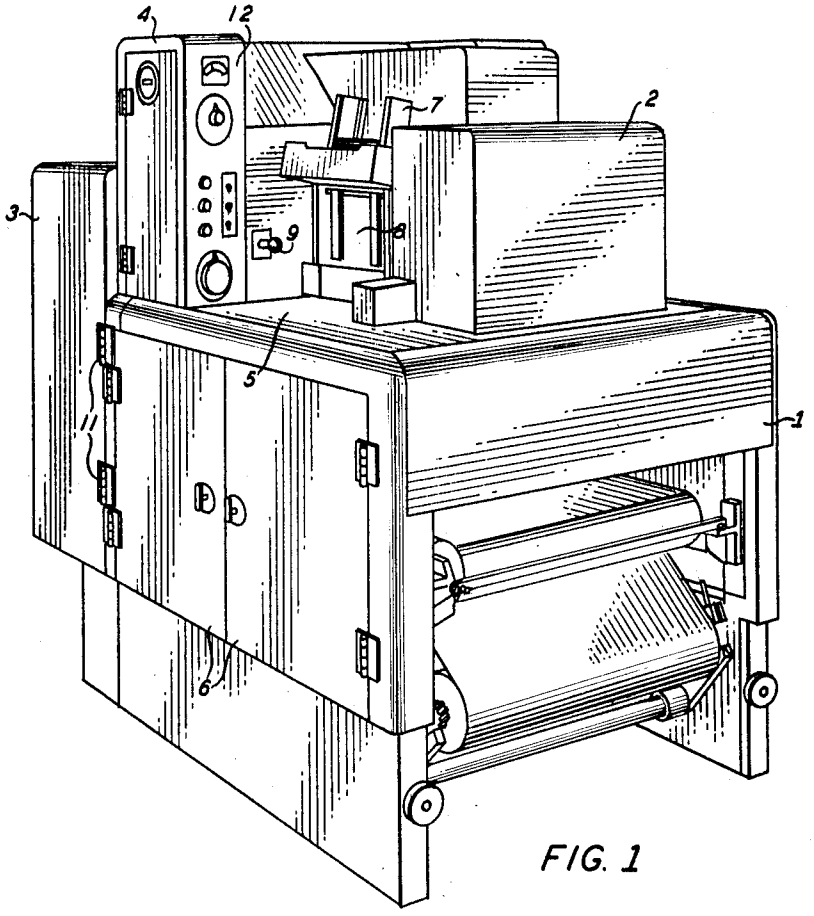


FIG. 1

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XEROGRAPHIC FUSING APPARATUS

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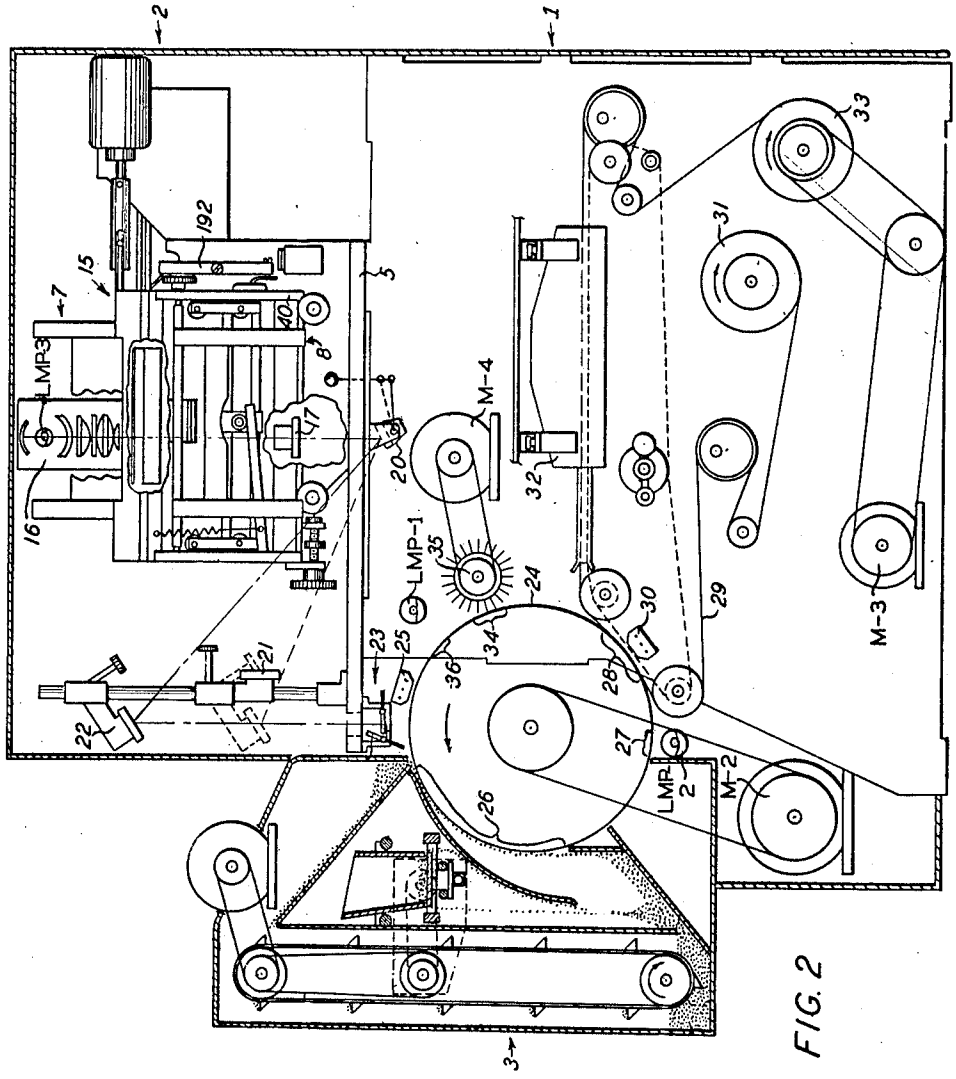


FIG. 2

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XEROGRAPHIC FUSING APPARATUS

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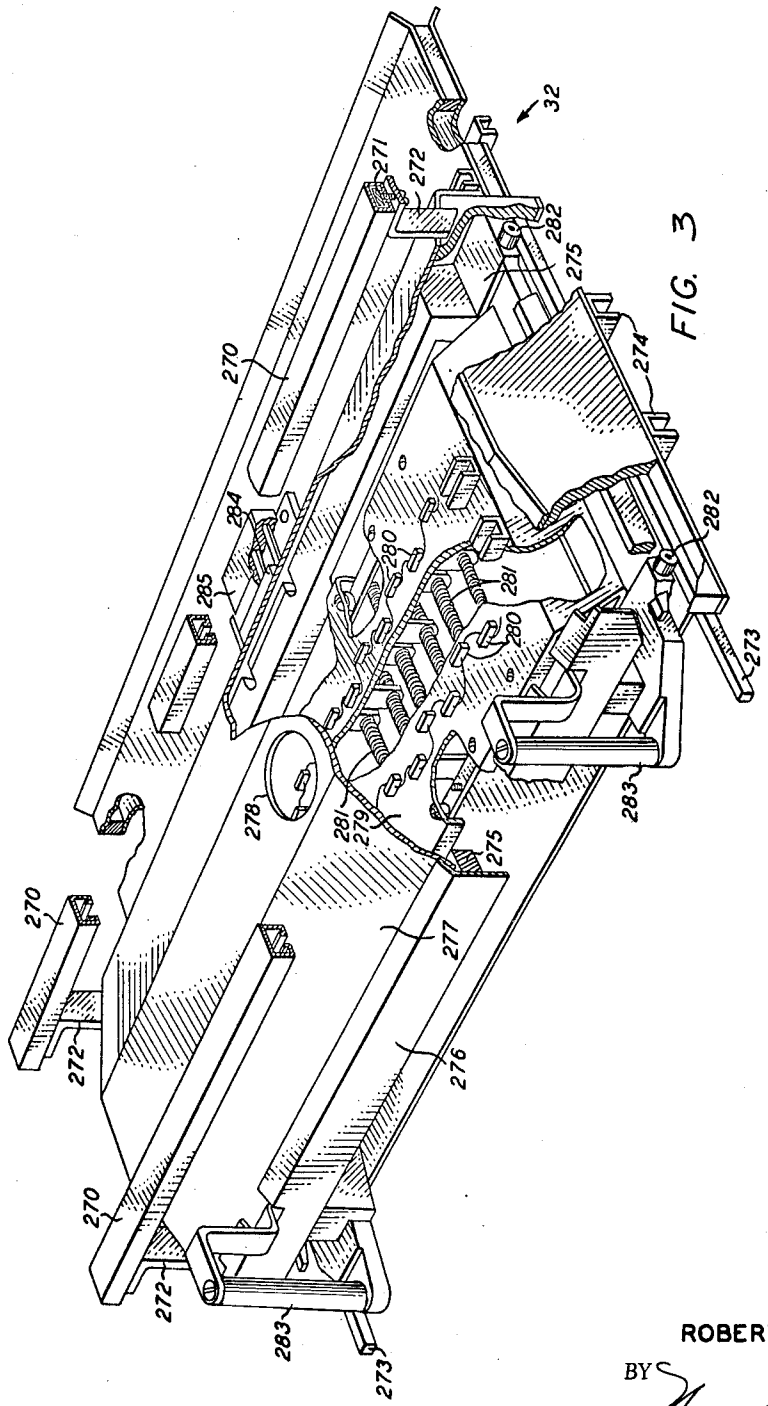


FIG. 3

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3,219,326

XEROGRAPHIC FUSING APPARATUS

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Original application Nov. 28, 1958, Ser. No. 776,848. Divided and this application Dec. 14, 1961, Ser. No. 159,267

1 Claim. (Cl. 263—6)

This application is a divisional application of the copending application to the same inventor, Serial No. 776,848, filed November 28, 1958, now abandoned

This invention relates to improvements in automatic xerographic reproduction systems and, particularly, to improvements in image fusing devices utilized in these systems.

In the process of xerography, for example, as disclosed in Carlson Patent 2,297,691, issued October 6, 1942, a xerographic plate comprising a layer of photoconductive insulating material on a conductive backing is given a uniform electric charge over its surface and is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure discharges the plate areas in accordance with the light intensity that reaches them, and thereby creates an electrostatic latent image on or in the photoconductive layer. Development of the latent image is effected with an electrostatically charged, finely divided material, such as an electroscopic powder, which is brought into surface contact with the photoconductive layer and is held thereon electrostatically in a xerographic powder image pattern corresponding to the electrostatic latent image. Thereafter, the developed xerographic powder image is usually transferred to a support surface to which it may be fixed by any suitable means.

Since the disclosure in Carlson, many improvements have been made in xerographic devices and techniques, within the scope of the basic Carlson invention. As a result, both manual and automatic machines for carrying out xerographic reproduction processes are in wide commercial use. The present invention constitutes a further improvement in automatic xerographic processing systems whereby such systems may more readily be employed in integrated data processing systems, particularly those known as unitized data processing systems.

An object of the invention is to improve fusing apparatus for fixing xerographic powder images to support surfaces.

These and other objects of the invention are attained by means of a xerographic processing system that is provided with card handling apparatus for feeding microfilm cards seriatim to a card carriage whereby they are transported past the optical axis of a projection system in time relation to the movement of a sensitized xerographic plate whereby the image on the microfilm is effective to form an electrostatic latent image on the xerographic plate in an enlarged configuration of the microfilm image. Thereafter, the electrostatic latent image is developed by means of a cascade developing system to form a xerographic powder image of the microfilm image on the drum. In addition, a web feeding and tensioning device is arranged to present a web of transfer material into surface contact with the xerographic plate and the electrostatic force developed in the transfer of the xerographic powder image to the transfer material is effective electrostatically to tack the transfer material web to the plate surface to ensure synchronism of movement therewith. After image transfer, the transfer material web is passed through an improved fusing apparatus wherein the xerographic powder image is permanently affixed to the web. The invention also includes means for

controlling the operation of the card handling apparatus whereby a predetermined number of reproductions of each microfilm card may be made, as required. Furthermore, the card handling apparatus may be positioned relative to the axis of the optical system, as desired, whereby microfilm cards having different longitudinal dimensions may be processed without loss of time or waste of material.

A preferred form of the invention is shown in the accompanying drawings in which:

FIG. 1 is a perspective view of an automatic xerographic processing system embodying the invention;

FIG. 2 is a schematic sectional view of the apparatus shown in FIG. 1; and

FIG. 3 is an isometric view of the fusing apparatus.

In the particular embodiment shown in the drawings, the invention is incorporated in a microfilm projection system that is a fully automatic, continuous printer for reproducing information contained on microfilm cards. This equipment reproduces copy on a continuous roll of paper, that may have a web width up to 24", from either positive or negative film, in either of two magnification ratios: 15x or 20x; whereby microfilm images of different sizes may conveniently be enlarged to the full width of the web. Referring to FIG. 1, the system may be considered to include four distinct sections for housing the several elements thereof, namely, a base section **1**, for housing the xerographic drum, the web tensioning and feeding apparatus, as well as the devices for effecting the xerographic functions of plate charging, image transfer, brush cleaning, etc.; an upper section **2**, for housing the card handling apparatus as well as the bulk of the optical system; an end section **3**, secured to the left end of the base section, for housing the xerographic developing apparatus; and a control section **4**, mounted on the base section and forward of the upper section, for housing certain of the electrical equipment required in the system and to provide a control panel whereon the operator may set selected ones of a plurality of switches for selecting the desired type of operation.

Base section **1** includes two side frames that are connected across their tops by a plate **5**, whereby the entire system is supported. Suitable cover plates are included to enclose the mechanism and access doors are provided on the front of the machine to facilitate repair and adjustment. Upper section **2** includes suitable cover plates for enclosing the bulk of the card handling apparatus and the optical system, as well as a card magazine **7** for holding microfilm cards from which reproductions are to be made, and a receiving magazine **8** to which cards are ejected after the microfilm image thereon is reproduced. End section **3** is enclosed by a dust-tight housing and is pivotally mounted on the base section by suitable hinges **11**, whereby the entire end section of the machine may be swung outwardly to permit access to the several elements of the developing system, and to permit convenient access to the surface of the xerographic drum for the purpose of cleaning. The entire structure is specifically arranged to form a light-tight enclosure in the areas of the optical projection system and the xerographic developing system.

General description of system (FIG. 2)

For a general understanding of the xerographic processing system in which the invention is incorporated, reference is had to FIG. 2 in which the various system components are schematically illustrated. As in all xerographic systems based on the concept disclosed in the above-cited Carlson patent, a light image of copy to be reproduced is projected onto thet sensitized surface of a xerographic plate to form an electrostatic latent image

thereon. Thereafter, the latent image is developed with an oppositely charged developing material to form a xerographic powder image, corresponding to the latent image, on the plate surface. The powder image is then electrostatically transferred to a support surface to which it is fused, whereby the powder image is caused permanently to adhere to the support surface.

In the system disclosed herein, microfilm cards are placed in a card magazine **7** from which they are fed seriatim to a card carriage of a card handling apparatus, generally designated by reference character **15**, arranged to the rear of the card magazine assembly. Suitable driving means are provided for the card carriage whereby it is caused to move the card past the optical axis of a projection lens system **16** that is illuminated by a projection lamp LMP–3 for the purpose of scanning the microfilm frame. The microfilm card image is projected downwardly through an adjustable objective lens assembly **17** and then reflected upwardly by an adjustable mirror element **20** to either of two transverse mirror assemblies **21** or **22**, in order to vary the length of the optical path, depending on the magnification ratio employed. From mirror assemblies **21** or **22**, the light image is projected downwardly through a variable slit aperture assembly **23** and onto the surface of a xerographic plate in the form of a drum **24**.

Xerographic drum **24** includes a cylindrical member mounted in suitable bearings in the frame of the machine and is driven in a counterclockwise direction by a motor M–2 at a constant rate that is proportional to the scan rate of the microfilm card, whereby the peripheral rate of the drum surface is identical to the rate of movement of the reflected light image. The drum surface comprises a layer of photoconductive material on a conductive backing that is sensitized prior to exposure by means of a screened corona generating device **35**, which may be of the type disclosed in Walkup Patent 2,777,957, that is energized from a suitable high potential source.

The exposure of the drum to the light image discharges the photoconductive layer in the areas struck by light, whereby there remains on the drum a latent electrostatic image in image configuration corresponding to the light image projected from the microfilm card. As the drum surface continues its movement, the electrostatic latent image passes through a developing station **26** in which a two-component developing material, which may be of the type disclosed in Walkup Patent 2,638,416, is cascaded over the drum surface.

After developing, the xerographic powder image passes a discharge station **27** at which the drum surface is illuminated by a lamp LMP–2, whereby residual charges on the non-image areas of the drum surface are completely discharged. Thereafter, the powder image passes through an image transfer station **28** at which the powder image is electrostatically transferred to a support surface web **29** by means of a second corona generating device **30** similar to corona charging device **25**, mentioned above.

The support surface to which the powder image is transferred may be of any convenient type and is obtained from a supply roll **31** and is fed over suitable guide and tensioning rolls and directed into surface contact with the drum in the immediate vicinity of transfer corona generating device **30**. After transfer, the support surface is separated from the drum surface and guided through a heat fusing apparatus **32**, whereby the powder image is permanently affixed to the support surface. Thereafter, the support surface is fed over a further system of guide and tensioning rolls and onto a take-up roll **33** that is driven by motor M–3.

After transfer, the xerographic drum surface passes through a cleaning station **34** at which its surface is brushed by a cleaning brush assembly **35**, rotated by a motor M–4, whereby any residual developing material remaining on the drum is removed. Thereafter, the drum surface passes through a second discharge station **36** at

which it is illuminated by a fluorescent lamp LMP–1, whereby the drum surface in this region is completely flooded with light to remove any electrostatic charge that may remain thereon. Suitable light traps are provided in the system to prevent any light rays from reaching the drum surface, other than the projected microfilm image, during the period of drum travel immediately prior to sensitization by corona generating device **25** until after the drum surface is completely passed through the developing station **26**.

Fusing assembly

For affixing xerographic powder images permanently to the transfer material web, the apparatus includes an improved heat fusing apparatus. This apparatus, schematically designated by reference character **32** in FIG. 2, is disclosed in complete deail in FIG. 3. Preferably, it constitutes a unitary structure that may be removed from or inserted in the xerographic reproduction apparatus independently of other equipment and, when so inserted, be available immediately for operation.

For supporting the fusing assembly in the xerographic reproduction apparatus, there is provided a framework that is permanently secured between the side frames of the apparatus. This framework includes two inverted channels **270** that are fixed in the frame of the machine and are provided with turned-over flange portions for engaging a plurality of T-bolts **271** which, in turn, are employed to support and position four hanger members **272**. Fixed to hangers **272**, on either side of the machine, are longitudinal rail members **273** that are spaced apart and formed into a rigid frame structure by lateral channel members **274**. The members described thus form a rigid open framework for supporting the fuser assembly.

The fuser assembly per se is mounted in an open, rectangular aluminum frame member **275**. Fixed on the front and rear faces of frame member **275**, as viewed, in FIG. 3, are flange members **276** that extend over the upper edge of the frame member and serve to secure the heat shield **277**, whereby the remaining mechanism of the system is protected from direct radiation from the fuser coils. A vent hole **278** is formed on the upper face of the heat shield and is connected through a suitable exhaust duct (not shown) to remove excess heated air and fumes from the region of the fuser assembly.

Mounted on the upper faces of the front and rear rails of fuser frame **275** is an aluminum reflector element **279** in which are supported a plurality of porcelain insulating hanger members **280** which, in turn, support a plurality of Nichrome resistance elements **281** that are energized, by suitable circuitry, to radiate sufficient heat to fuse the thermoplastic material of xerographic powder images to the transfer material as it passes therebeneath.

For conveniently positioning the fuser assembly in the machine, rollers **282** are mounted at each of the corners of fuser frame **275** and are arranged to roll on rail members **273**. In addition, handle assemblies **283** are fixed to the forward rail of fuser frame **275**. Fixed on the rear rail of the fuser frame, with suitable insulating means, is a three-pound electrical plug **284** that is positioned to engage a mating connection **285** fixed in the frame of the machine. By this arrangement, it is apparent that the entire fuser assembly may conveniently be inserted and removed from the machine merely by manipulation of handle assemblies **283**.

To ensure even heating of the entire surface of a web of transfer material that passes under the heater, heating coils **281** are set at a slight angle to the longitudinal path of movement of the paper web. The spacing of the several coils is such that the rear end of each coil is longitudinally aligned with the front end of the next adjacent coil. By this arrangement, each incremental area of the transfer material web is caused to receive substantially the same degree of radiation.

Since many changes could be made in the above construction and many apparently widely different embodi-

ments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

An apparatus for fusing xerographic powder images on a support surface moving through a xerographic machine having means mounted on the machine for moving the support surface along a path of movement including the combination of:

a supporting frame mounted on the machine and overlying the path of movement of the support surface,

rail members suspended from said frame and arranged parallel to the path of movement of the support surface,

a fusing assembly including a plurality of heating elements arranged in spaced relation and subtending the path of movement of the support surface,

roller members rotatably mounted on the fusing assembly and arranged to ride on the rail members for permitting movement of the assembly relative to said frame and its removal therefrom.

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