

[54] **ELECTROSTATOGRAPHIC FUSING
PROCESS EMPLOYING REPLACEABLE
LINER**
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Related U.S. Application Data

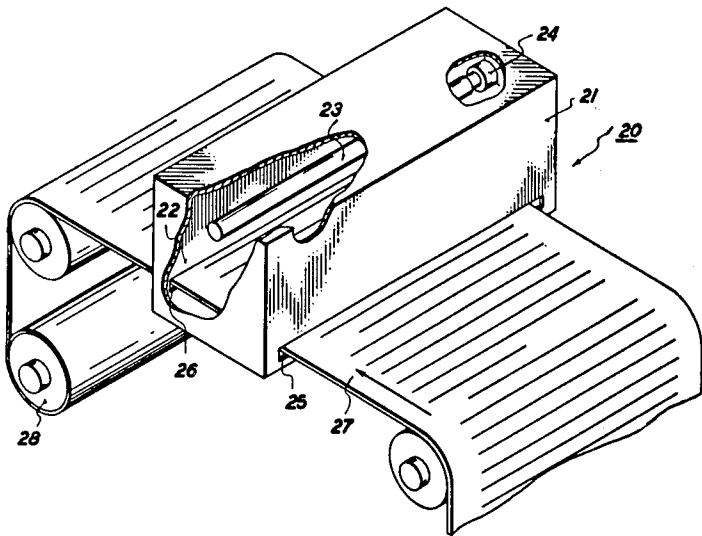
[62] Division of Ser. No. 104,342, Jan. 6, 1971.
[52] **U.S. Cl.**..... **117/6, 117/17.5, 117/21,**
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219/461, 464; 161/169, 170, 406, 410;
117/21, 119.6, 6, 17.5: 134/6; 118/641, 504

References Cited			
UNITED STATES PATENTS			
2,825,326	3/1958	Flynn.....	219/347
3,086,101	4/1963	Scofield.....	219/464
3,165,201	1/1965	Woodman.....	219/464
3,319,062	5/1967	Falk.....	219/347
3,432,640	3/1969	Shelby.....	219/348
3,529,129	9/1970	Rees.....	219/216

Primary Examiner—Michael Sofocleous

[57] **ABSTRACT**
A flash fusing process is disclosed which utilizes a re-
movable inner surface lining comprising a highly re-
flective material. The implementation of this particu-
lar fuser provides a technique for maintaining the
inner surface of the fusing cavity at its highest level of
efficiency.

2 Claims, 2 Drawing Figures



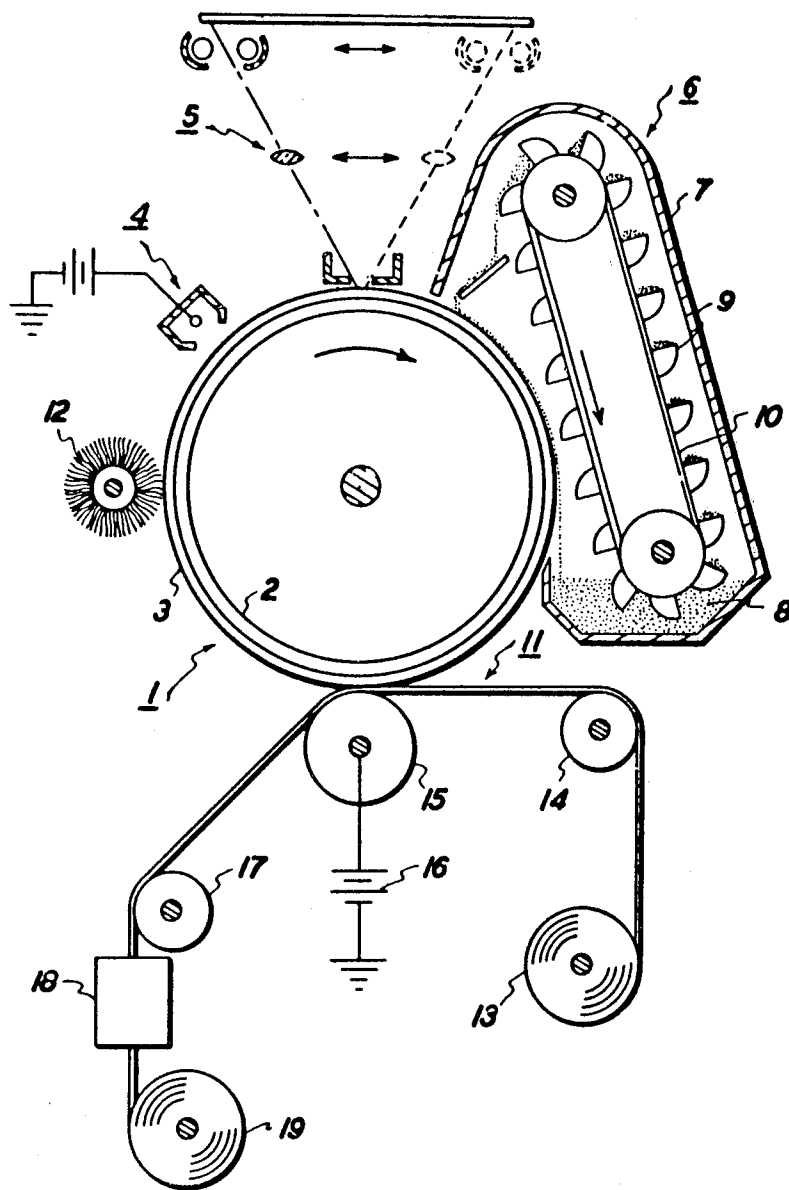


FIG. 1

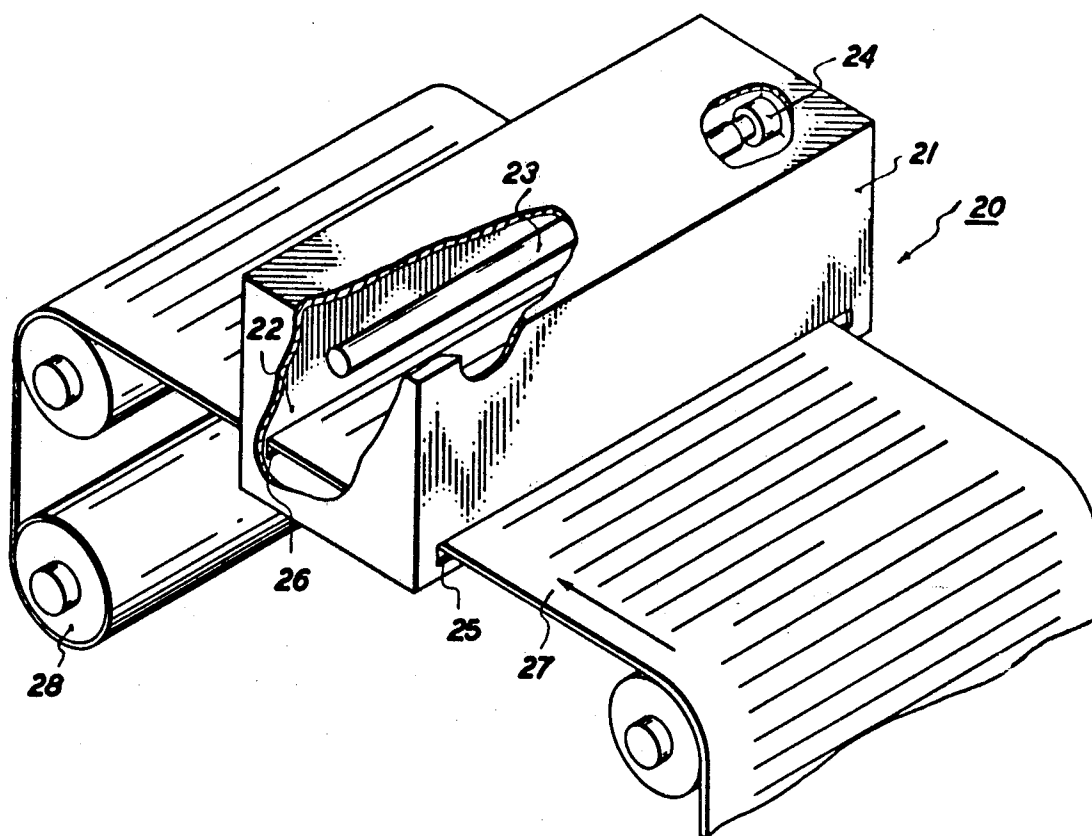


FIG. 2

ELECTROSTATOGRAPHIC FUSING PROCESS EMPLOYING REPLACEABLE LINER

This is a division, of application Ser. No. 104,342, filed Jan. 6, 1971.

BACKGROUND OF THE INVENTION

This invention relates to a high intensity radiation fixing system and more specifically to the utilization of flash fusing in conjunction with electrophotography.

In electrophotography a plate generally comprising a conductive substrate upon which is placed a photoconductive insulating layer is uniformly charged and selectively exposed to a pattern of light-and-shadow to produce an electrostatic latent image. The resulting image is developed utilizing electroscopic marking particles generally referred to as toner. The toner particles are electrostatically attracted to the latent image areas on the plate in proportion to the charge density. The developed image is either fixed in situ to the surface of the electrophotographic plate or transferred to the surface of a suitable support member and fixed thereto to form a permanent record or copy of the original.

Many forms of image fixing techniques are known the most prevalent of which are vapor fixing, heat fixing, radiant energy fixing, pressure fixing, or combinations thereof. Although these techniques have been found useful in electrophotography each, either alone or in combination, suffer from specific deficiencies. In general, it has been difficult to construct an entirely satisfactory heat fuser having a short warm up time, high efficiency and ease of control. A further problem associated with heat fusers has been their tendency to burn or scorch the support material. Pressure fixing methods whether hot or cold have created problems with image offsetting, resolution degradation and generally have failed to produce consistently acceptable fixed images. On the other hand, vapor fixing which typically employs a toxic solvent has been found to be commercially undesirable because of the inherent environmental problems.

With the advent of new materials and electrophotographic processing techniques it is now feasible to construct an automatic reproducing apparatus capable of producing copy at an extremely rapid rate. Radiant flash fusing is one practical method of image fixing which lends itself readily to use in a high speed automatic system. The primary advantage of the flash fuser over the other known methods is that the energy, which is propagated in the form of electromagnetic radiation, is instantaneously available and requires no intervening medium for its propagation. Such an apparatus does not require long warm up periods, nor does the energy have to be transferred through a relatively slow conductive or convective heat transfer medium.

Although the use of a flash fusing system provides an extremely rapid transfer of energy between the source and the receiving body, a major problem with flash fusing as applied to the xerographic fixing step has been designing an apparatus which will fully and efficiently utilize a preponderance of the radiant energy emitted by the source during the relatively short flash period. The primary consideration in designing a flash fusing cavity is the maximum internal reflectance. The goal is to minimize the total energy absorbed by the cavity walls during the many internal reflections, thus maximizing the cavity efficiency. One of the major problems

with which the industry is faced as a direct result of xerographic image flash fusing is image explosion whereby toner is evaporated with each flash and deposited on the wall of the fusing cavity. Over a period of time the internal reflectance decreases reducing the cavity efficiency and eventually leading to poor fusing. Previously, it has been considered necessary in order to eliminate this effect to refurbish the inner surface of the fusing cavity in order to restore it to its initial operational effectiveness. The presently known techniques for accomplishing this such as washing and spray coating have been found undesirable in that they are inherently cumbersome, inefficient and sometimes toxic.

It is, therefore, an object of this invention to provide a high intensity radiation fixing system which will overcome the above noted disadvantages.

Another object of this invention is to provide a novel image fixing system.

A further object of this invention is to provide an improved xerographic flash fusing apparatus.

Yet still another object of this invention is to provide an apparatus for rapidly fixing heat fusible images to a final support material.

Yet, another object of this invention is to provide a method of fixing toner images utilizing a flash fusing mechanism.

The foregoing objects and others are accomplished in accordance with the present invention generally speaking by providing a high intensity radiation source capable of an intense emission of high energy radiation in a short time interval. The support material for the xerographic toner images is essentially nonabsorbent while the toner in image form absorbs nearly all of the incident energy and as a result heat fuse rapidly. The inner surface of the flash fusing chamber is provided with a removable highly reflective lining material such as a ceramic fiber felt which may be removed and replaced with a like material when the internal reflectance has decreased so as to reduce the overall efficiency of the fusing system. By so doing the flash fusing device is restored immediately to its maximum operating potential. In an alternate embodiment of the present invention the inner lining may be fabricated as a layered material so that when necessary a thin surface layer may be removed to restore the flash fusing device to its maximum efficiency and thus requiring the replacing of the entire liner less frequently.

The invention is further illustrated in the accompanying drawings wherein:

FIG. 1 represents a cross sectional view of a conventional electrophotographic continuous imaging apparatus; and

FIG. 2 represents an isometric blow-up of the fuser housing mechanism disclosed in FIG. 1, the fuser having portions thereof broken away to show the internal construction of the apparatus.

Referring now to FIG. 1 there is seen a xerographic copying apparatus in the form of a cylindrical drum identified as 1 comprising a conductive support substrate 2 and a photoconductive insulating layer 3. The drum when in operation is generally rotated at a uniform velocity in the direction indicated by the arrow so portions of the drum periphery pass the charging unit 4, and exposure mechanism 5. Subsequent to charging and exposure the drum surface moves past the developing unit generally designated 6. The developing unit is represented in the present illustration as a cascade type

developer which includes a powder container 7 with a bottom containing a supply of developing material 8. The developer is picked up from the bottom of the container and cascaded over the drum surface by a number of buckets 9 on an endless belt 10. This development technique is more fully described in U.S. Pat. Nos. 2,618,551 and 2,618,552. The developed image continues around until it comes in contact with a copy web or transfer substrate 11. After passing the transfer station the drum will continue around beneath cleaning brush 12 which prepares the surface of the plate for recycling.

The transfer sheet or copy web supplied from feed roller 13 passes over guide roller 14 and is brought into intimate contact with the surface of the photoconductor drum by conductive transfer roller 15 which is connected to ground by way of a power source 16. The transfer sheet then proceeds to a second guide roller 17 from where it is introduced to the fusing apparatus of the present invention generally designated 18 and is re-wound after fusing on takeup roller 19.

Any suitable photoconductive material may be used in compliance with the configuration of FIG. 1. Typical inorganic photoconductive materials include sulfur, selenium, zinc sulfide, zinc oxide, zinc cadmium sulfide, cadmium sulfoselenide and cadmium selenide. Typical organic photoconductors include sensitized polyvinylcarbazole, phthalocyanines, anthraquinones, triphenylamines and similar materials. In addition a photoconductive binder insulating layer may be used as disclosed in U.S. Pat. Nos. 3,121,006 and 3,121,007. When suitable, mixtures of the above mentioned materials may be utilized. Any suitable backing material for the xerographic plate may be used, generally the material will have an electrical resistance less than that of the photoconductive layer. Typical materials include aluminum, brass, steel, copper and suitable conductive plastics and glass.

Any suitable development means may be used such as the cascade development as herein illustrated, powder cloud development more fully described in U.S. Pat. Nos. 2,725,305 and 2,981,910 and magnetic brush development more fully described in U.S. Pat. Nos. 2,791,949 and 3,015,305. Any suitable technique may be used to transfer the developed image to the transfer sheet or substrate. The preferred approach comprises the electrostatic transfer technique represented in FIG. 1; however, other techniques may be utilized such as adhesive transfer.

Referring now to FIG. 2 there is seen a fuser housing generally designated 20 comprising outer chamber walls 21 and a removable inner surface lining 22. The inner surface lining may be held to the inner surface of the chamber walls by any suitable means, such as by clips built into the housing cavity, thus providing an expedient method for removing and replacing the inner reflecting lining when desired. The inner lining 22 comprises a highly reflective material more fully described below. An elongated generally tubular shaped source of radiant energy 23 is supported within the housing cavity at a predetermined distance above the surface to be heated and fixed by bracket 24. Means for activating the energy source is provided (not shown). Slits 25 and 26 are provided in the walls of the housing so as to allow for the passage of the image supporting member 27 through the fuser apparatus. The slits are represented as running parallel to the axial center line of the

energy source 23. The slits are positioned at the bottom portion of the side walls of the housing and permit the image bearing support member 27 to pass through the cavity of the housing. The image is fused, within the cavity. The fixed image support member is thereafter guided to take up roll 28.

As stated above the entire inner surface of the cavity of the fuser housing apparatus is lined with a material which is highly reflective with respect to the emissive band width of the particular flash lamp utilized. Any suitable highly reflective material may be used as the removable liner for the cavity of the flash fuser. Typical materials include various oxides such as silicon dioxide, magnesium oxide, titanium dioxide, aluminum oxide, calcium oxide, zinc oxide and carbonates such as calcium carbonate, magnesium carbonate barium carbonate, lead carbonate fabricated into ceramic felt materials or fibers such that it can be cut to fit the particular design of the fusing cavity employed and held in place by any selective means such as clips or fasteners built into the cavity. An example of a material which may be used is Fiberfrax paper, a thin felt of ceramic fibers available from the Carborundum Corporation. Numerous materials comprising glass fibers, such as Fiberglass and quartz wool are further examples of materials which may also be used. It is preferred to use a layered structure of sufficient density so that the toner diffusion will not contaminate the deeper layers of the configuration. As the top layer becomes contaminated, it is merely peeled or stripped from the surface to expose still another uncontaminated layer.

Any suitable high intensity radiation source may be used to supply the energy necessary to fix the images in the course of the present invention. Typical high energy electromagnetic radiation sources include xenon flash lamps, helium, neon, argon, and krypton flash lamps and combinations of iodine-xenon and/or krypton filled electric space discharge devices. In the present invention the radiant energy source and image bearing support member are placed with the reflective cavity of the fuser housing. As a result of the emission of high energy radiation in a short time interval the xerographic toner images on the image support member absorb nearly all of the incident energy and heat fuse rapidly. The support material is selected so as to substantially be nonabsorbent to the emitted radiation.

Although the utilization of the fusing device of the present invention has been taught with respect to a specific form of xerographic member any similarly developed image member may be adapted to the system herein described. It is, therefore, intended that the utilization of the fusing mechanism of the present invention in conjunction with an image developed photoconductive member as set forth in FIG. 1 be used for illustration purposes only. The instant fusing apparatus may be used with any number of the conventionally used techniques for forming and developing images utilizing resinous materials such as herein referred to as toner.

It is to be further understood that it is not intended that the structure arrangement of the apparatus described in the present invention, specifically with respect to the flash fusing apparatus, be restricted to the design as set out herein and it is intended to include all similar configurations which will satisfy the requirements of the present invention. In addition, although the present invention has been disclosed in relation to a xerographic fixing process it is in no way limited to

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such a system. It should be obvious that by properly selecting a lamp having a spectral output matched to the absorptive properties of the receiving material and making the interior surfaces of the cavity reflective to this output, it is possible to rapidly and efficiently uniformly heat the receiving material in accordance with the teachings of the present invention.

Anyone skilled in the art will have other modifications occur to them based on the teachings of the present inventions. These modifications are intended to encompass in the scope of this invention.

What is claimed is:

1. An imaging process comprising:

- a. providing a fuser housing including outer chamber walls the inner surface of which are lined with a layered, strippable, highly reflective material selected from the group consisting of glass fibers, silicon dioxide, magnesium oxide, titanium dioxide, calcium oxide, zinc oxide, calcium carbonate, magnesium carbonate, barium carbonate, lead carbon-

6

- ate, and quartz wool, and a high intensity radiation source supported within the cavity of said housing;
 - b. developing a toner image on the surface of an image support member;
 - c. introducing said image support member into the cavity of said housing and exposing said toner image to said high intensity radiation source to fuse said image; and
 - d. repeating steps (b) and (c) until the reflective material becomes contaminated and its reflectance becomes substantially reduced, at which time said contaminated layered, strippable reflective material is peeled from an underlying layer to expose a fresh uncontaminated layer of the reflective material thereby maintaining cavity efficiency.
2. A process as disclosed in claim 1 wherein said reflective material consists of a ceramic fiber felt formed in thin, dense layers and said radiation source comprises a xenon flash lamp.

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