

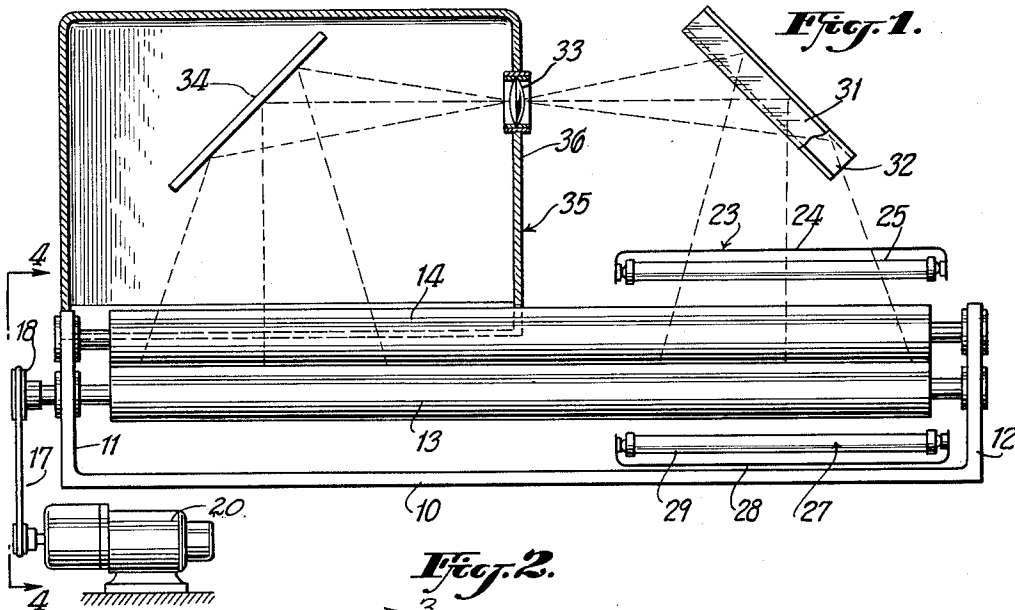
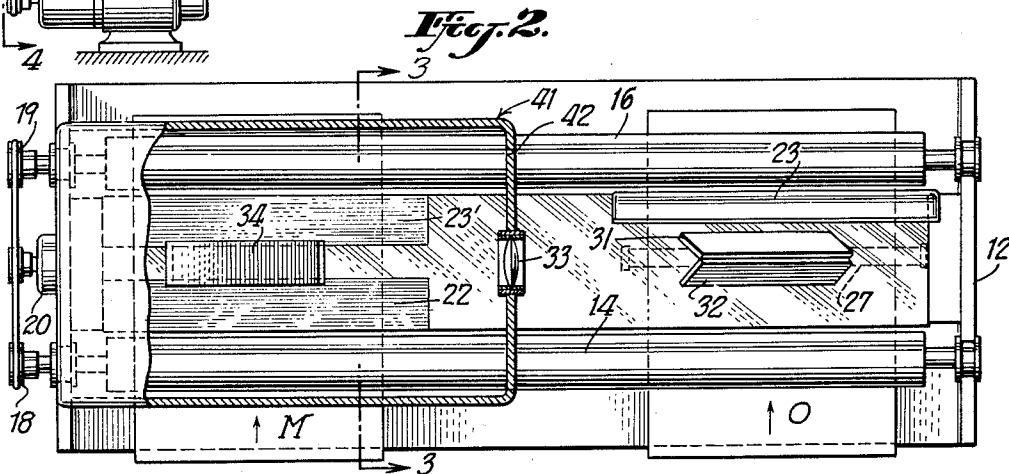
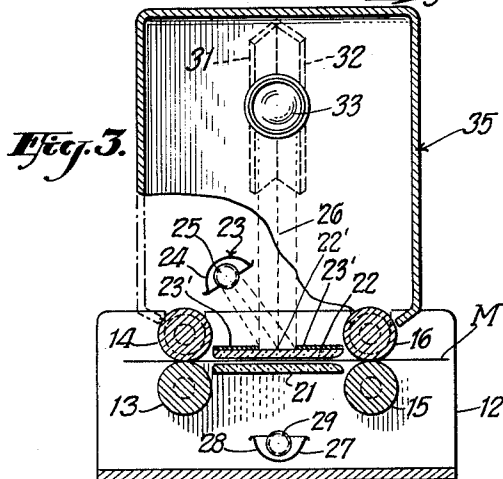
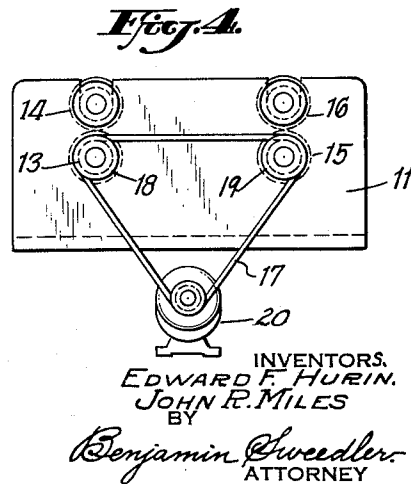
Sept. 4, 1962

E. F. HURIN ET AL
APPARATUS FOR EXPOSING LIGHT SENSITIVE
SHEETS AND/OR WEBS

3,052,155

Filed Sept. 11, 1958

3 Sheets-Sheet 1



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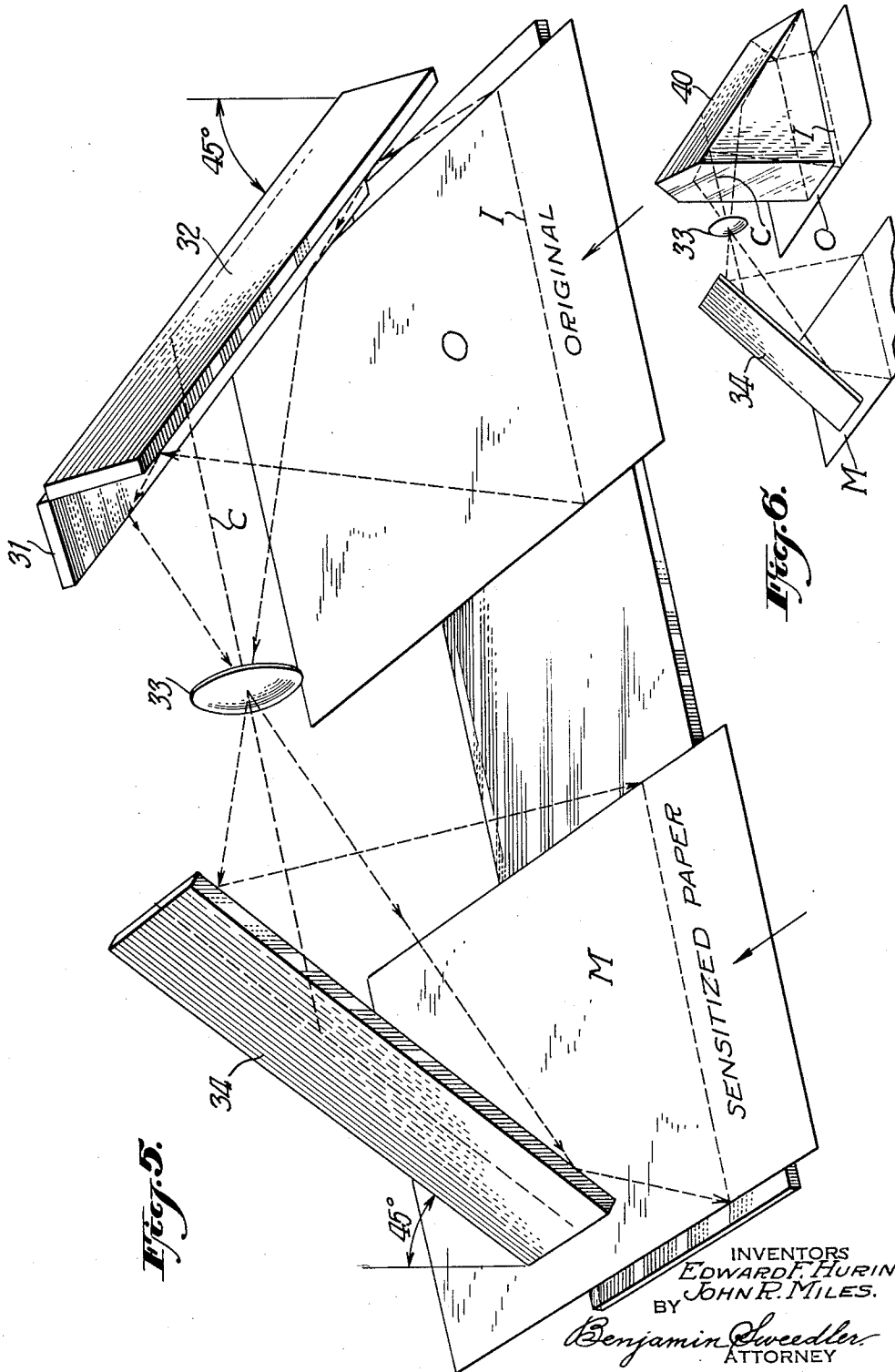
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3 Sheets-Sheet 3

Fig. 9.

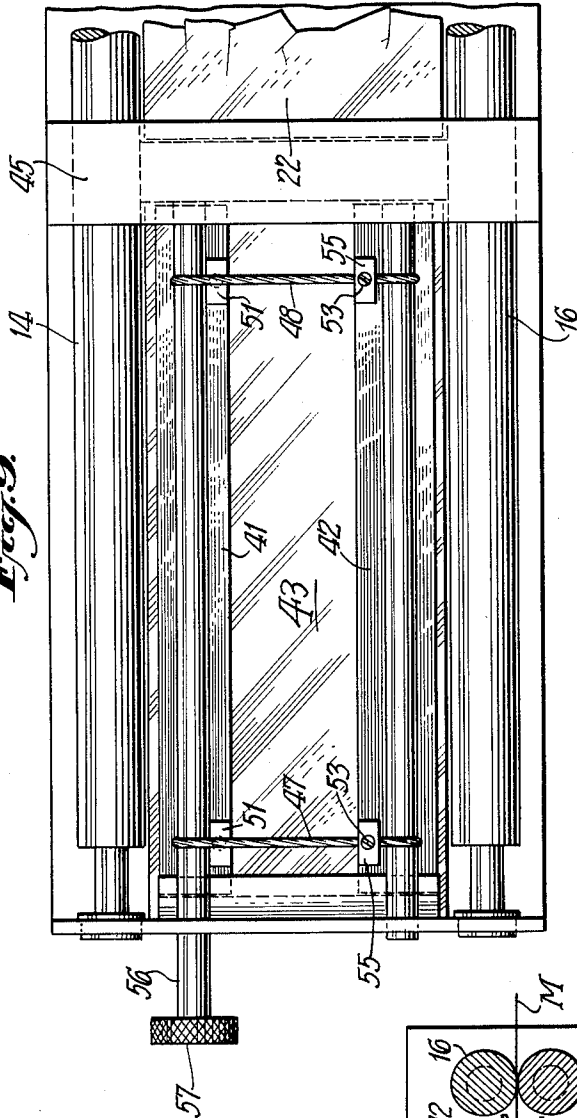


Fig. 8.

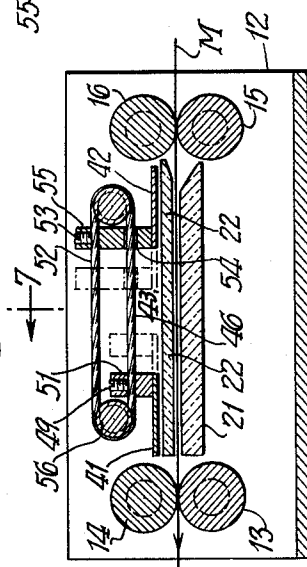
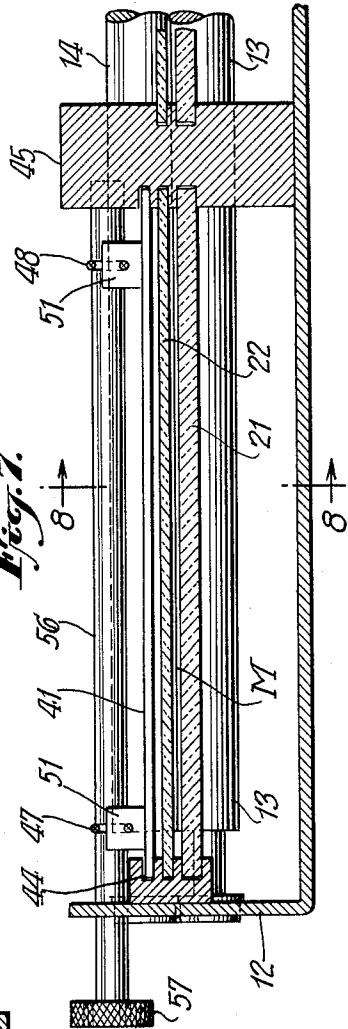


Fig. 7.



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3,052,155

APPARATUS FOR EXPOSING LIGHT SENSITIVE SHEETS AND/OR WEBS

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Filed Sept. 11, 1958, Ser. No. 760,316
9 Claims. (Cl. 88—24)

This invention relates to apparatus for exposing light sensitive sheets and/or webs to form thereon images of originals to be copied. More particularly this invention relates to apparatus for producing electrostatic images on charged photo-conductive insulating material which images thereafter have toner or developer powder applied thereto to form powder images which are fixed by fusion or otherwise to produce the desired copies.

It is among the objects of the present invention to provide an apparatus for producing electrostatic images of originals which apparatus is unusually flexible in that it is adapted to make prints or copies of translucent originals such as tracing paper as well as of opaque originals and is also adapted to make electrostatic images of individual sheets of any desired dimensions as well as of webs.

Still another object of the present invention is to provide such apparatus which is of comparatively compact and rugged design and is relatively inexpensive in initial cost and to maintain and operate.

Still another object is to provide such apparatus which produces sharp electrostatic images and this notwithstanding variations in the density of the originals. Accordingly, the present invention results in a marked improvement in the quality of the final prints.

Still another object is to provide such apparatus in which both the original and the sensitized sheet can be fed conveniently by the operator from one and the same position.

In accordance with this invention, an original in sheet or web form is fed synchronously with a charged photo-conductive insulated sheet or web, i.e., a light-sensitive material, so that both move at the same relative rate in side by side relationship. Associated with the original and light-sensitive material is an optical system which projects a beam of light onto the original. This beam of light is reflected from contiguous increments of the original, which increments have a transverse extent (relative to the direct of movement through the machine) at least equal to the portion of the original to be copied.

Reflection of successive light image increments is correlated with the rate of movement of the original, which rate is the same as that of the light-sensitive material. Successive light image increments corresponding to contiguous portions of the original are thus reflected through a lens which focuses the images on a reflecting surface which in turn projects them onto the light-sensitive material moving at the same linear speed as the original. The light thus projected irradiates the electrostatic charge on the photo-conductive insulating material leaving the portion thereof not contacted by the light charged, thus producing electrostatic latent images. The electrostatic latent images thus produced on the photo-conductive insulating material are "right reading images"; i.e., not mirror images, but exact duplicates of the original. Since the rate of movement of the insulating material and the original is the same, successive right reading images of contiguous longitudinally extending increments of the original are projected onto the insulating material, thus producing an exact copy of the original in the form of a right reading electrostatic latent image. This electrostatic image can be developed as conventional by applying developer powder thereto and fixing the powder.

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The photo-conductive insulating material may be any of the known available materials of this type. For example, paper coated with a finely divided photo-conductor such as zinc oxide applied to the paper base as a solution or a suspension in an electrically insulating film-forming vehicle may be used. The vehicle may be a resin solution or suspension, including aqueous suspensions. For example, a solution of a silicone resin in suitable solvent or a suspension of a polyvinyl acetate resin in an aqueous medium may be used.

The resulting photo-conductive insulating material may be charged by any of the known charging techniques employed in this art. For example, it may be exposed to a corona discharge to produce the electrostatic charge thereon or it may be passed through charging rollers of the type disclosed and claimed in copending patent application Serial No. 580,592 filed April 26, 1956, now Patent No. 2,980,834, granted April 18, 1961.

Any known developer powder may be employed, for example, a mixture of finely divided magnetic carrier particles, such as finely divided iron, magnetite or ferrites and developer powder such as the developer powders described, for instance, in United States Patents 2,297,691, 2,618,552 and 2,638,416, including dyed or pigmented resin powders, e.g., Vinsol resin (treated pine resin) dyed with suitable dyes, coumarone-indene resins, gum copal, rosin, wax, etc.

The developer powder and the magnetic material are selected in accordance with their triboelectric properties, so that when mixed the developer powder has the desired charge depending on the charge carried by the electrostatically charged latent image. Thus, in developing photo-conductive insulating material carrying a positively charged latent image, the developer powder should be so chosen that when mixed with the magnetic particles, it is negatively charged. Conversely, if the photo-conductive insulating material has a negatively charged latent image, the developer powder should be chosen so that when mixed with the magnetic particles, it carries a positive charge. Developer powder which when mixed with magnetic particles, such as iron, acquire the desired charges by triboelectric action are well known and can be selected from many materials that have been tested and occupy recognized positions in a triboelectric series. Thus, for example, pigmented rosin when mixed with iron becomes positively charged and can be used as the developer powder for developing negatively charged images. Colored Vinsol resin when mixed with iron becomes negatively charged and can be used for developing positively charged images. Such mixtures containing developer powder and magnetic carrier particles are well known and per se do not form part of the present invention; hence further description thereof is considered unnecessary.

The developer powder may be fixed to the photoconductive surface, for example, by heat in those cases where the powder is resin or other material which can be fixed by heat or by application of a solvent or by other known fixing technique.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, forming a part of this specification, and showing, for purposes of exemplification preferred forms of this invention, without limiting the claimed invention to such illustrative instances. In the drawings:

FIGURE 1 is a front elevational view of a machine embodying this invention;

FIGURE 2 is a plan view of the machine of FIGURE 1;

FIGURE 3 is a vertical longitudinal section taken in a plane indicated by line 3—3 on FIGURE 2 in the di-

rection indicated by the arrows associated with the line 3—3;

FIGURE 4 is a side elevation showing the drive mechanism for this machine and taken in the direction indicated by the arrows 4—4 on FIGURE 1;

FIGURE 5 is a perspective view of an optical system involving the use of mirrors and a focusing lens;

FIGURE 6 is a perspective view showing a modified form of an optical system involving the use of a prism for reflecting successive light images through the lens which focuses the images on the reflecting surface positioned above the photo-conductive insulating material;

FIGURE 7 is a front fragmentary elevational view of a constant speed machine in which the time of exposure is controlled by adjusting the area of exposure;

FIGURE 8 is a vertical section through the machine of FIGURE 7 taken in a plane indicated by line 8—8 on FIGURE 7; and

FIGURE 9 is a plan view of the portion of the machine shown in FIGURES 7 and 8.

For convenience of description, the longitudinal extent of the machine will be considered the same as the direction of movement of the photo-conductive insulating material through the machine. Reference herein to transverse median refers to a direction which is transverse to this longitudinal.

In the embodiment of the invention illustrated on the drawings, 10 indicates the U-shaped frame of the machine, in the side walls 11 and 12 of which are journaled for rotation a first pair of feed rollers 13 and 14. Suitably spaced from this pair of feed rollers is a second pair of feed rollers 15 and 16 journaled for rotation in the side walls 11 and 12. The distance between the first and second pair of feed rollers will depend chiefly on the length of the individual sheets to be processed. Thus, for example, where the machine is designed to handle sheets having a minimum length of five inches, the distance between the feed rollers should be about four and one-half inches.

A motor 20 drives a chain 17 which passes over sprockets 18 and 19 keyed to the shafts of feed rollers 13 and 15 thus driving the latter. The peripheries of the upper rollers 14 and 16 are in frictional contact with the peripheries of the lower rollers 13 and 15 respectively and are thus driven thereby. The pairs of rollers 13, 14 and 15, 16 feed the original O and the photo-conductive insulating material M in side by side parallel relationship through the same horizontal plane as shown in FIGURE 2. It will be understood that the driving mechanism for the feed rollers herein disclosed represents one suitable type of drive to which this invention is not limited; other drives may be employed.

Transparent guide plates 21 and 22 of glass or plastic are suitably mounted in the frame 10 between the two pairs of spaced feed rollers 13, 14, and 15, 16 as best shown in FIGURE 3. These guide plates are spaced apart from each other sufficiently to permit the original O and the photoconductive insulating material M to pass therethrough but are sufficiently close to each other to prevent the original O and the insulating material M from buckling.

The feed rollers 13, 14 and 15, 16 extend substantially the full width of the machine. The original O which may be translucent or opaque in sheet or web form is fed through the machine in a horizontal plane by the right hand end portion of these feed rollers, viewing FIGURES 1 and 2. The photo-conductive insulating material M which is of a width and length at least equal to the portion of the original to be copied, is fed through the machine by the left hand end portion of these feed rollers. Thus both the original and the photo-conductive insulating material are fed at the same rate; synchronization of the feed of the original relative to that of the photo-conductive insulating material is thus insured.

A lamp 23 comprising a reflecting surface 24 and a

lamp bulb 25 is positioned above the transparent guide plate 22 to the left viewing FIGURE 3 of the transverse median of the space between the pairs of feed rollers 13, 14 and 15, 16 which median is indicated by the dot and dash line 26. Lamp 23 may be any suitable lamp for generating a beam of light, desirably ultra-violet light in the region of the spectrum between 3,650 A. and 4,000 A. wave length. This lamp 23 is positioned to project a narrow beam of light through the transparent guide plate 22 onto the original in a narrow area thereof at the median 26 as clearly shown in FIGURE 3. Lamp 23 is employed at all times when the machine is in operation to project the light beam onto the original, i.e., it is employed both in the handling of opaque as well as translucent originals. It will be noted from FIGURE 2 that in the embodiment shown in this figure, the lamp 23 is so dimensioned that it projects a beam of light which extends completely across the full width of the original.

Suitably mounted on the frame of the machine below the transparent guide plate 21 is a second lamp 27 desirably constituted of a reflecting surface 28 and a light source 29. Lamp 27 is positioned substantially on the transverse median 26 so that it projects a beam of light, desirably also ultra-violet light of substantially the same wave length as generated by lamp 23, upwardly through the original. Lamp 27 is employed when treating translucent originals which may vary in density. While copies of translucent originals such as tracing paper may be made employing only lamp 23, it is preferred to use both lamps when handling translucent originals because some translucent papers have poor reflectivity. The use of the second lamp 27 which projects a beam of light upwardly through the translucent material results in better definition and copying speeds.

A pair of mirrors 31, 32 are suitably mounted on the machine with the upper edges of these mirrors in abutment and positioned so that the abutting edges are disposed on the transverse median 26. These mirrors 31, 32 lie in intersecting planes at right angles to each other with the longitudinal axes of these planes at a 45° angle to the optical center as shown in FIGURE 5. The mirrors are of the same length; which length is sufficient to form a light image of the width of the portion of the original to be copied.

Focusing lens 33 of any desired type capable of focusing the light image reflected from the mirrors 31, 32 onto the reflecting surface 34 is positioned on the longitudinal median of the machine at the optical center of the optical system. Reflecting surface 34 desirably in the form of a mirror is positioned directly above the photo-conductive insulating material and in transverse alignment with the mirrors 31, 32 to receive the optical image focused thereon by the lens 33. This reflecting surface extends at a 45° angle to the vertical as shown in FIGURE 5, in a direction just the opposite of the direction of inclination of mirrors 31 and 32.

Top guide plate 22, on the left hand end portion of the machine shown in the drawings, i.e., on the side of the machine where the insulating material M is fed, is masked with an opaque material 23'. For example, black paint or dark masking tape may be used for this purpose. There is thus left a transparent area 22' between the masked areas, through which transparent area light (projected light image) passes onto the insulated material M. The width of the transparent area 22' should not exceed the width of the reflecting mirrors 31, 32 or 34.

In the case of a variable speed machine, as disclosed in FIGURES 1 to 7, inclusive, i.e., a machine in which the original O and the sensitized material M can be fed at different rates through the machine by employing a motor or other drive capable of so driving the feed rollers, the width of area 22' is preferably about 1½ inches. Originals O having higher reflectivities and hence requiring less exposure time, would be fed through the machine at a faster rate, thus controlling the exposure time.

The printing or copying speed, it will be appreciated, is in part dependent on the width of the reflecting mirrors and the width of the transparent area 22'. For reasonably satisfactory speeds, mirrors of a width of about 1½ inches have been found useful. Narrower or even somewhat wider mirrors can be used. Depending on the desired printing or copying speed, the width of transparent area 22' can be varied, but as noted should not exceed the widths of the mirrors 31, 32 or 34.

All the mirrors including mirror 34 are first surface mirrors, i.e., the reflector surface of each, which may be aluminum, silver or other suitable reflecting material, is on the side of the mirror facing the image. This eliminates a double reflection which would take place from the surface of the glass and the reflecting coating if back coated mirrors were used.

As best shown in FIGURES 1 and 3, a light proof box 35 is disposed on the side of the machine through which the insulated material M passes. The inside walls of this box have a dull black surface to absorb light and thus prevent reflected light from blurring the image produced on the sensitized sheet. Mirror 34 is suitably mounted inside this box and the lens 33 is disposed in front wall 36 of the box. Light can enter the box only through the lens 33. The base of the box, not shown, is disposed beneath the lower guide plate 21 and positioned relative to rollers 13, 15 to prevent light from entering through the base. If desired, feed rollers 13, 14 and 15, 16 may be suitably mounted relative to the walls of the box so as to in effect form the entering and leaving light-proof seals for the insulating material M passing therethrough.

While not essential, an iris can be used on the lens 33 to vary the f opening to suit the original being copied.

In the modification of FIGURE 6 as a prism 40 of any known type having the desired light reflecting characteristics is employed instead of the pair of mirrors 31, 32. This prism as shown in FIGURE 6 is triangular in cross section and reflects and transmits light along the same paths hereinafter described in connection with the operation of the mirrors 31, 32.

In FIGURES 5 and 6, C indicates the optical center line of the optical system.

In operation the original O which may be individual sheets or a web and the charged photo-conductive insulating material M are fed through the machine at the same rate by the feed rollers 13, 14 and 15, 16. The original may be translucent or opaque. As noted, synchronous feed is insured because the same feed rollers feed both the original O and the photo-conductive insulating material M. The rate of feed is such that a narrow increment of the original, indicated at I on FIGURE 5 is moved under the optical system and has projected thereon light from lamp 23. In the case of a translucent original of poor light reflecting properties, light is projected therethrough from lamp 27; the light thus projected is in the form of a narrow band I. Successive narrow bands of light (light images) thus pass from the original onto the mirror 32.

Satisfactory operation results with a speed of movement of the original and photo-conductive insulating material M of from 10 to 15 feet per minute and projecting a beam of light 1½ inches wide employing a 12 inch wide mercury arc lamp having a wattage of 600 watts (50 watts per inch of length). It will be understood the invention is not limited to these conditions of operation, but they are given as exemplary only. For any given original and machine, optimum conditions of rate of feed and width of light beam as well as the wave length thereof can readily be determined by a few trial runs.

It will be appreciated that when lamp 27 is in operation, the light rays which are projected onto mirror 32 include both reflected light emanating originally from lamp 23 as well as light projected directly from lamp 27. The narrow beam of light projected through the original O from lamp 27 is correlated with the rate of movement of the original and hence also that of the conductive

material M so that the beam of light passes through successive portions with no practical overlapping of such successive portions. Thus there is produced on the reflecting surface of mirror 32 successive light images of contiguous portions of the original.

These light images of successive portions of the original are reflected from mirror 32 to mirror 31 which in turn reflects them through lens 33 as indicated by the dotted lines on FIGURE 5. This lens focuses the light images on reflecting surface 34. Lens 33 and cooperating reflecting surface 34, as indicated by the dotted lines, effect a transposition of the light images, so that the images projected on the photo-conductive insulating surface M are right-reading images, i.e., exact duplicates of successive portions of the original. The light thus projected on the photo-conductive insulating material M discharges the portions of the electrostatic charge thereon irradiated by the light rays producing electrostatic images; the remainder of the surface of the photo-conductive insulating material is left in the charged condition. The electrostatic images thus produced are rendered visible by applying toner or developer powder thereto forming powder images which are fixed in any conventional manner as hereinabove described.

In the machine above described, the speed of the feed rollers is changed to accommodate originals which may require more or less exposure (all originals do not reflect the same amount of light). Thus, in the case of originals requiring longer exposure, the speed of the feed rollers is slowed down so that both the original and the insulating material M passes through the machine at a slower rate resulting in longer exposure of the insulated material M. Correspondingly those originals requiring less exposure are fed through the machine at a faster rate, giving shorter exposure times.

The modification of FIGURES 7, 8 and 9 involves a constant speed machine in which the desired time of exposure is controlled by changing the area of exposure. Thus, for example, the area of exposure can be varied by the shutter mechanism hereafter described to provide different width openings, which openings in all cases do not exceed the width of the mirrors. By doubling the width of the opening, the exposure time is doubled, because it takes twice as long for the insulating material to pass under an opening of double width, the rate of movement of the insulating material being the same for both widths of opening. Conversely, reducing the width of the opening correspondingly decreases the exposure time, bearing in mind the rate of feed of the insulating material always remains the same.

In the construction of FIGURES 7, 8 and 9, the transparent guide plate 22 is not provided with masking material 23' as in the modification of FIGURES 1 to 6 inclusive, but instead shutters 41 and 42 are mounted above plate 22 so that they can be moved towards each other, say from the full line to the dotted line position shown in FIGURE 8, or away from each other to adjust the width of the shutter opening 43. In general, these shutters can be adjusted to provide an aperture from about ½ inch to 1½ inches wide. Originals O having the highest reflectivity and which therefore require the narrowest opening to prevent over-exposure require an adjustment of the shutter to its narrowest width and conversely originals having relatively low reflectivity would require an adjustment of the shutter to provide a relatively wide aperture.

The shutters 41 and 42 are mounted for sliding movement in guide grooves 44 disposed in side 12 and support 45. Shutter 41 is fixed to the lower run 46 of a pair of spaced endless cables 47, 48. As shown in FIGURE 8, the lower run 46 of these cables 47 and 48 is pinned as at 49 to the support 51 carrying the shutter 41. Shutter 42 is fixed to the upper run 52 of these cables 47 and 48 by being pinned to the support 55 for the shutter 42 as

at 53. The lower run 46 of the cables 47 and 48 pass through the openings 54 in the support 55.

Cables 47 and 48 at one end pass over rod 56 rotatable by knob 57. Rotation of knob 57 effects movement of cables 47 and 48 to open or close the shutters 41 and 42 depending upon the direction and rotation of knob 57. Thus, the width of the aperture between shutters 41 and 42 can be controlled as desired.

The operation of the modification of FIGURE 6 will be clear from the above description. The prism 40 of FIGURE 6 effects the reflection of successive light images of contiguous portions of the original, along substantially the same paths as the cooperating mirrors 31, 32.

It will be noted that the present invention provides apparatus for producing sharp electrostatic images of originals and this notwithstanding variations in the density of the originals, which apparatus is adapted to handle both individual sheets and webs. Hence the apparatus is unusually flexible in irradiating photo-conductive insulating material to produce latent electrostatic images which can be processed to make copies. It will be further noted that the apparatus of this invention is compact, rugged and relatively inexpensive to construct and operate. In that both the original and the sensitized sheet can be fed conveniently by the operator from one and the same position, the energy and effort expended by the operator in running the machine is materially reduced.

It will be noted that in the present invention, the original O and the sensitized sheet M both move at exactly the same speed. As each area of the original passes through the transparent area 22' or aperture defined by the shutters 41, 42, its moving image is formed on the sensitized sheet. Since the image thus formed moves at the same speed as the sensitized sheet, a continuous scanning effect is produced. No blurring occurs because the projected image moves at exactly the same speed as the sensitized sheet or web.

While the present invention has been described in connection with the irradiation of photo-conductive insulating material to produce electrostatic images, it will be appreciated the invention is not limited thereto and the novel principles are applicable to the irradiation of other light-sensitive materials.

Since certain changes in the above described apparatus for producing latent images, which embodies this invention, may be made without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limited sense. Thus, for example, while the original and light-sensitive material are shown as fed in the same horizontal plane, they could be fed in side by side relationship through an arc, i.e., in a curved plane.

What is claimed is:

1. Apparatus for exposing light-sensitive material comprising in combination, two spaced pairs of feed rollers each pair comprising elongated feed rollers, one cylindrical portion contiguous to one end of each of said feed rollers positioned for feeding originals and another cylindrical portion contiguous to the opposite end of each of said feed rollers positioned for feeding light-sensitive material in the same horizontal plane spaced from and parallel to the feed of said originals, means for projecting a narrow beam of light onto the originals in the area thereof at substantially the transverse median of the space between said feed rollers, two mirrors at right angles to each other having their top longitudinal edges substantially abutting and inclined at approximately 45° to their optical center, the abutting edges of said mirrors being disposed on the transverse median of the space between said feed rollers, a reflecting surface positioned above said light-sensitive material at a 45° angle to the vertical and extending in an inclined direction opposite to the inclination of said mirrors, and a lens positioned

at the optical center of said mirrors and reflecting surface.

2. Apparatus for exposing light-sensitive material as defined in claim 1 having means for projecting light through said originals, said last named means being positioned below said originals and positioned on said transverse median of the space between said feed rollers.

3. Apparatus for exposing light-sensitive material as defined in claim 1 having transparent guide plates between said feed rollers, said guide plates being spaced apart sufficiently to permit passage of said originals and light-sensitive material therebetween yet sufficiently close to prevent buckling of said originals and said light-sensitive material.

4. Apparatus for exposing light-sensitive material comprising, in combination, two sets of feed rollers in spaced relationship for feeding both originals and light-sensitive material in substantially parallel spaced side by side relationship, transparent guide plates between said feed rollers, said guide plates being spaced apart sufficiently to permit passage of said originals and light-sensitive material therebetween yet sufficiently close to prevent buckling of said originals and said light-sensitive material, and in which the upper guide plate has masking material thereon defining an exposure aperture, means for projecting a narrow beam of light onto said originals, a reflecting surface for receiving a narrow beam of reflected light from said originals, a second reflecting surface, and a lens for focusing light received from the first reflecting surface onto said second-mentioned reflecting surface, said second-mentioned reflecting surface being arranged to project said light through said exposure aperture onto said light-sensitive material.

5. Apparatus for exposing light-sensitive material as defined in claim 4, in which a light proof housing is disposed above the portion of said feed rollers feeding said light-sensitive material; said second mentioned reflecting surface is positioned in said light proof housing and said lens is disposed in a wall of said light proof housing.

6. Apparatus for exposing light-sensitive material which comprises in combination, two sets of feed rollers defining a pathway therebetween for feeding both originals and light-sensitive material in substantially parallel spaced side by side relationship, means for projecting a narrow beam of light toward one side of said pathway between said feed rollers to illuminate said originals thereat, a first reflecting surface disposed near said one side of said pathway for reflecting light from said originals, a second reflecting surface disposed near the opposite side of said pathway for reflecting light from said first reflecting surface to said light-sensitive material at said opposite side of said pathway, and a lens for focusing light received from said first reflecting surface to said second reflecting surface.

7. Apparatus for exposing light-sensitive material comprising in combination, two spaced pairs of elongated feed rollers so positioned as to define a pathway therebetween for feeding both originals and light-sensitive material in the same horizontal plane spaced from and parallel to one another, means for projecting a narrow beam of light toward substantially the transverse median of one side of said pathway between said feed rollers to illuminate said originals, two mirrors at right angles to each other having their top longitudinal edges substantially abutting and inclined at approximately 45° to their optical center, the abutting edges of said mirrors being disposed on said transverse median for reflecting light from said originals, a reflecting surface positioned near the opposite side of said pathway for reflecting light from said mirrors to said light-sensitive material, said reflecting surface oriented at a 45° angle to the vertical and extending in an inclined direction opposite to the inclination of said mirrors, and a lens positioned at the optical center of said mirrors and reflecting surface.

8. Apparatus for exposing light-sensitive material com-

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prising, in combination, two sets of feed rollers in spaced relationship for feeding both originals and light-sensitive material in substantially parallel spaced side by side relationship, transparent guide plates between said feed rollers, said guide plates being spaced apart sufficiently to permit passage of said originals and light-sensitive material therebetween yet sufficiently close to prevent buckling of said originals and said light-sensitive material, and including adjustable shutters positioned above said upper guide plate defining an exposure aperture, means for projecting a narrow beam of light onto said originals, a reflecting surface for receiving a narrow beam of reflected light from said originals, a second reflecting surface, and a lens for focusing light received from the first reflecting surface onto said second-mentioned reflecting surface, said second-mentioned reflecting surface being arranged to project said light through said exposure aperture onto said light-sensitive material fed by said feed rollers beneath said aperture.

9. Apparatus for exposing light-sensitive material comprising, in combination, two spaced pairs of elongated feed rollers, the peripheries of the rollers of each of said pairs being in feeding engagement with one another, each

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of said rollers being of a length to feed in spaced side by side parallel relation both an original and a light-sensitive material in the same direction, means for projecting a beam of light onto the original to illuminate and form a light image of said original and optical means positioned between said spaced pairs of rollers for projecting said light image of said original onto said light-sensitive material.

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