Feb. 5, 1963

A. J. CERASANI ETAL

3,076,392

XEROGRAPHIC REPRODUCING APPARATUS

Filed Aug. 31, 1959

3 Sheets-Sheet 1

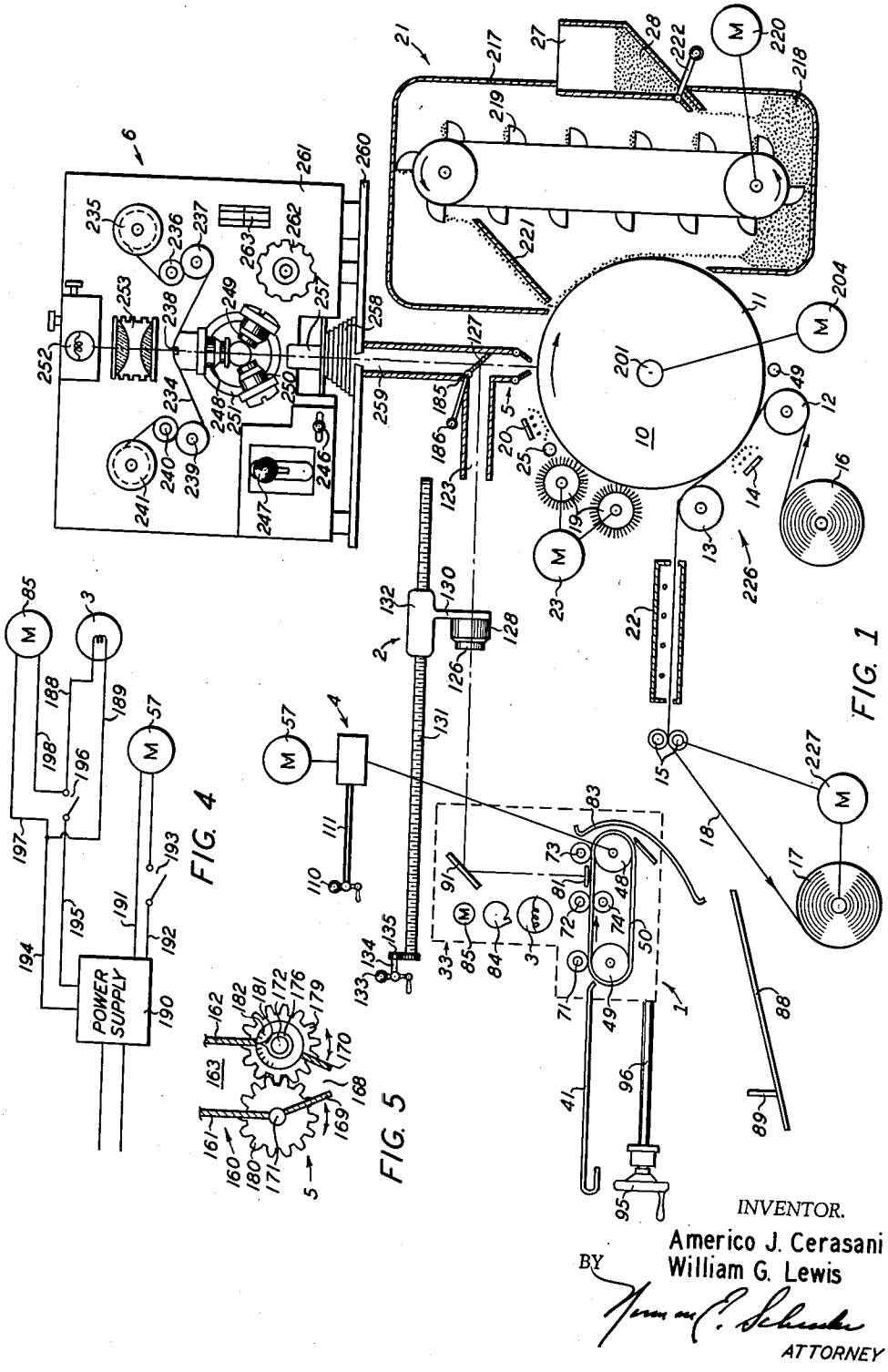

FIG. 1

FIG. 4

FIG. 5

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XEROGRAPHIC REPRODUCING APPARATUS

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3 Sheets-Sheet 2

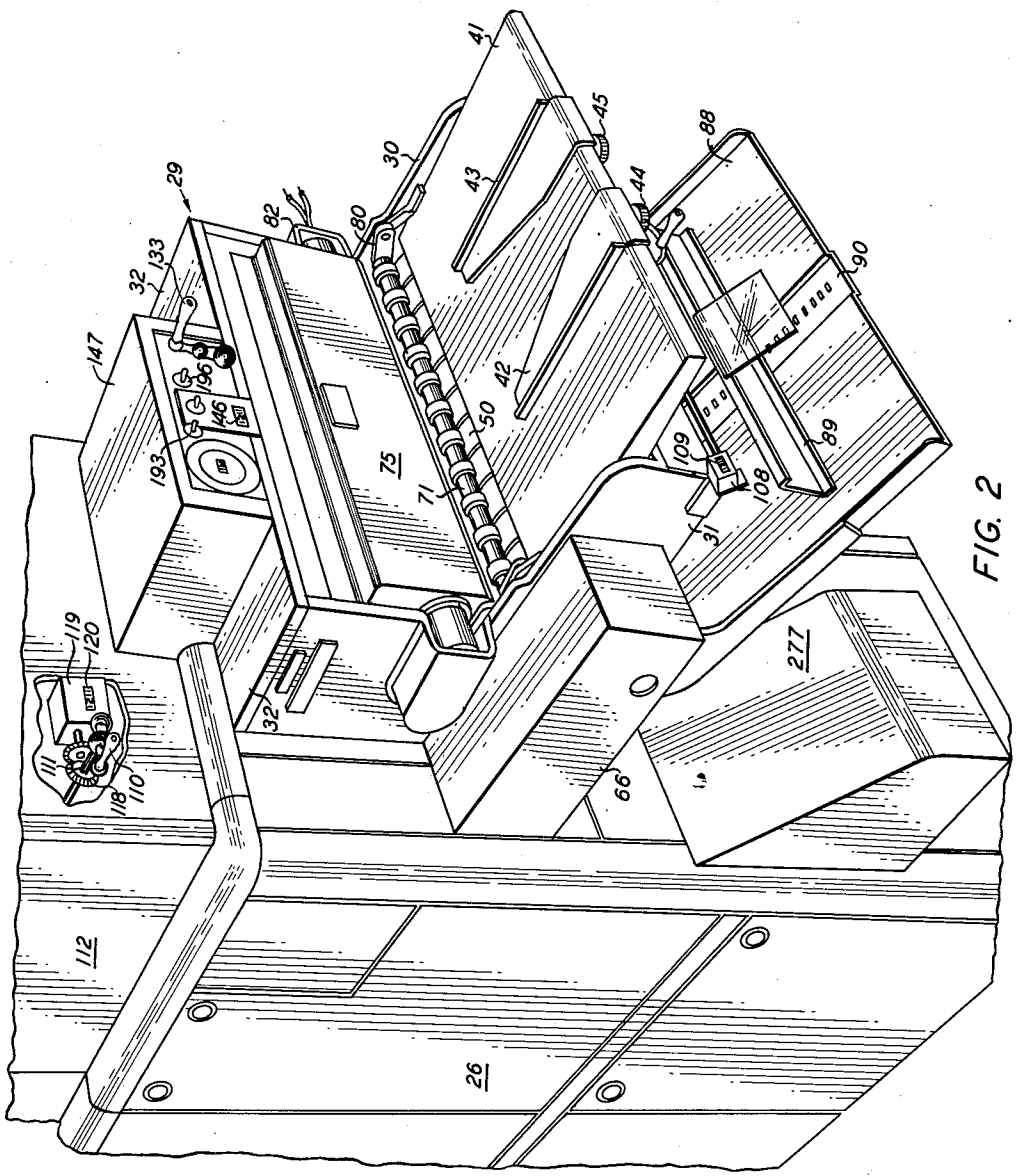

FIG. 2

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XEROGRAPHIC REPRODUCING APPARATUS

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3 Sheets-Sheet 3

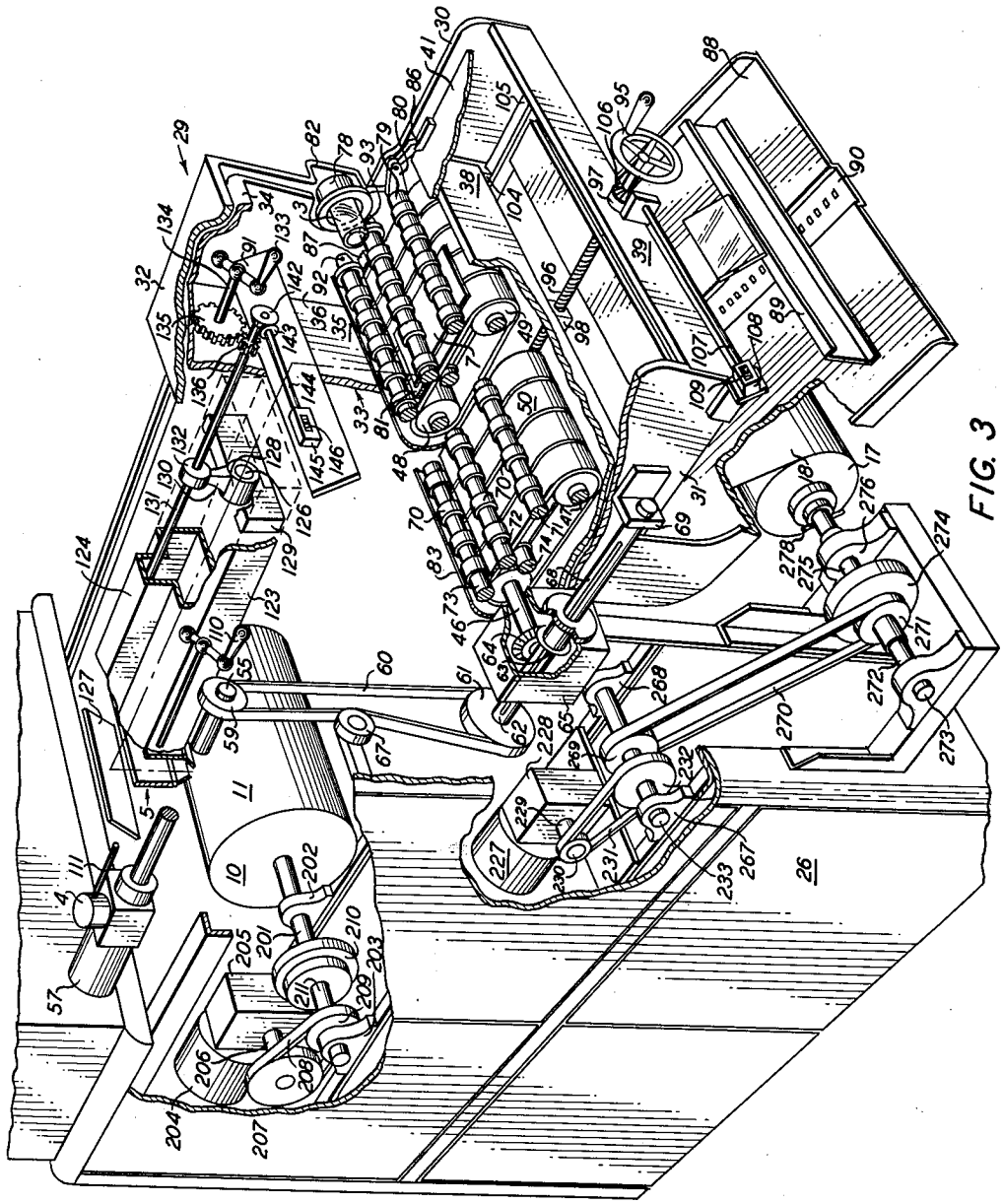

FIG. 3

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United States Patent Office 3,076,392
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3,076,392

XEROGRAPHIC REPRODUCING APPARATUS

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Filed Aug. 31, 1959, Ser. No. 837,173
5 Claims. (Cl. 95—1.7)

This invention relates to a projection apparatus and, particularly, to an improved apparatus to effect projection of opaque original images to be reproduced at variable magnification ratios onto the photoconductive surface of a xerographic plate which is moving at constant rate normal to an exposure slit.

More specifically, the invention relates to an improved apparatus to be used in conjunction with automatic xerographic reproduction apparatus whereby opaque originals to be reproduced can be projected at variable magnification ratios onto an electrostatically charged surface of a xerographic drum rotating at constant rate normal to an exposure slit and subsequently therefrom effecting a permanent magnified xerographic reproduction on a transfer support surface.

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. This exposure discharges the plate areas in accordance with the radiation 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 that is brought into surface contact with the photoconductive layer and is held thereon electrostatically in a pattern corresponding to the electrostatic latent image. Thereafter, the developed xerographic powder image is usually powder image is usually transferred to a support surface to which it may be fixed by any suitable means.

Projection of opaque originals onto a stationary surface is usually achieved by employing conventional projection techniques which may or may not employ means to effect magnification between the original and the image projected. Where magnification is desired, conventional enlarging means are usually employed which includes an objective lens having a variable focus and with means provided for varying the optical path length for any magnification ratio. However, where the surface receiving the projected image is constantly moving, the opaque original must be projected while moving at a synchronized rate relative to the rate of the receiving surface with the lens projecting advancing portions of the original during the course of its movement. The relative rates of the moving original and receiving surface must be perfectly synchronized and for each separate magnification ratio desired, a corresponding synchronization must be effected, that is, in a non-magnified projection, every lineal inch of an opaque original projected exposes a lineal inch on the constantly moving receiving surface; whereas, in an enlarged projected magnification ratio of two to one, the moved length of opaque original projected corresponds to one-half the moved length of the receiving surface, or in this instance, two inches of receiving surface is exposed per inch of opaque original projected. Thus, to effect projection over a wide range of magnification ratios onto a surface moving at constant rate requires cooperating apparatus enabling an inversely corresponding range of speeds for transporting the opaque originals. In addition, an objective lense capable of being focused in accordance with a selected magnification ratio must be

provided and the length of the optical path from the opaque original being projected to the receiving surface must be capable of being precisely varied and set in accordance with a magnification ratio selected. In the instant invention the receiving surface is an electrostatically charged photoconductive surface of a xerographic plate whereto a light image of an original is projected normal through an exposure slit.

The principal object of the invention is to improve means for projecting opaque originals to be reproduced at variable magnification ratios onto a xerographic plate which is moving at constant rate normal to an exposure slit.

A further object of the invention is to provide correlating means in accordance with a selected magnification at which opaque originals are to be reproduced to synchronize relative movement rates of the original being reproduced and the xerographic plate, to focus the lens and to set the length of the optical path.

A still further object of the invention is to provide a compact, convenient, and efficient apparatus for projecting opaque originals at variable magnification ratios onto a photoconductive surface of a xerographic plate moving normal to an exposure slit at constant rate.

Other objects of the invention will be apparent from the following description.

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

FIG. 1 is a diagrammatic view of the apparatus of the invention employed in conjunction with an automatic xerographich printing apparatus and complemented with a microfilm projection apparatus;

FIG. 2 is an isometric view of the front of an automatic xerographic reproduction apparatus equipped with the apparatus of the invention;

FIG. 3 is an isometric view similar to FIG. 2 with covers broken away to disclose details of the mechanism of the invention;

FIG. 4 is a wiring diagram; and

FIG. 5 illustrates the exposure control system of the invention.

In the arrangement shown, the invention includes a transport assembly generally designated as **1** for transporting opaque originals to be reproduced through an optical path, a projection system generally designated as **2** to project images at variable magnification ratios, and an exposure control system **5**.

The apparatus of the invention is shown (refer FIGS. 1, 2 and 3) in conjunction with the basic components of an automatic xerographic printer and are substantially enclosed in cabinet housing **26** and include a xerographic plate in the form of xerographic drum **10** having a photoconductive peripheral surface **11**. The drum is secured to shaft **201** rotatably supported in journal **202** and at the end opposite in bearing means (not shown). Through clutch **210** shaft **201** is coupled to shaft **211** which is rotatably supported in journal **203**. Drum **10** is rotated through a charging, exposing, developing and transfer station at constant rate by the drive action of synchronous motor **204** which transmits its driving force through gear box **205** to its drive shaft **206** thence to pulley **207** secured thereon. From pulley **207** belt **208** transmits the motion thereof to pulley **209** secured on shaft **211**.

For applying an electrostatic charge on surface **11**, corona generating device **20** is employed which may be of a type disclosed in Walkup Patent 2,777,957 that is energized from a suitable high potential source. The charge applied is discharged in part by the apparatus of this invention which exposes a light image of an opaque original to be reproduced to the surface to form an electrostatic latent image corresponding to the original.

After exposure the electrostatic latent image is de-

veloped by the use of developing unit 21 which may be of a type disclosed in copending application S.N. 393,058 filed November 19, 1953, in the name of Mayo et al. Unit 21 includes a housing 217 in which is stored a two-component developing material 218 for cascading over the drum surface which may be of a type disclosed in Walkup Patent 2,638,416. Toner component 28 of developing material which is consumed in development is replenished from dispenser 27 at a rate determined by control means 222 thereby to maintain proper material concentration. Conveyor 219, driven through suitable drive means by motor 220, scoops developing material and discards it onto slide 221 wherefrom it cascades down and over the electrostatic latent image on surface 11 adhering to the charged portion thereof.

After developing, the xerographic powder image passes lamp 49 whereby residual charges on the non-image areas of the drum surface are completely discharged. Thereafter the powder image is transferred to a support surface web 18 transported by handling mechanism 226 which may include the means disclosed in Crumrine et al. Patent 2,781,705. The support surface to which the powder image is transferred may be of any convenient type although in preferred embodiment is usually of paper and is obtained from a supply spool 16. Syncronous motor 227 drives takeup spool 17 and drive rolls 15, while guide rolls 12 and 13 serve to direct the support surface into surface contact against the drum in the vicinity of corona generating device 14, which may be of a type similar to unit 20 mentioned above and thereby electrostatically transfer the powder image to the support surface.

For operating the handling mechanism, the driving force of motor 227 is transmitted through gear box 228 to its drive shaft 229 thence to pulley 230 secured thereon. Belt 231 transmits the force therefrom to pulley 232 secured to shaft 233 which is rotatably supported between journals 267 and 268. Pulley 269, also secured to shaft 233, transmits the rotative motion therefrom through belt 270 to pulley 271 secured on shaft 272 which is rotatably supported in journal 273 and is coupled through clutch 274 to shaft 275 rotatably supported in journal 276. Take-up spool 17 is secured to shaft 275 and at end opposite on shaft and bearing means (not shown) and may be removed from the apparatus by retracting suitable detent means 278. Cover 277 encloses the drive mechanism extending forward of housing 26.

After transfer the support surface is guided through a suitable heat fusing apparatus 22 which may of a type disclosed in Crumrine et al. Patent 2,852,651, whereby the powder image is permanently affixed to the support surface.

Lamp 25 serves to dissipate any residual electrostatic charge on surface 11 after the surface has been cleaned by brushes 19 which are driven by motor 23.

Apparatus 6 serves to project microfilm images to be reproduced onto surface 11 at variable magnification ratios to effect a similar result as the projection of opaque originals by the apparatus of this invention as will be described below. It is to be noted that apparatus 6 complements the present invention but is not a functional part thereof and may be omitted without affecting or altering the scope of this invention. In its operation a web of microfilm 234 is continuously transported from supply spool 235 over guide rolls 236 and 237 normal to slit 238 over guide rolls 239 and 240 onto take-up spool 241. Transporting of microfilm is effected at variable speed synchronized relative to the speed of drum 10 in accordance with a selected magnification ratio by a two-speed motor (not shown) operative from selector switch 246 and a variable speed transmission (not shown) operative through selector handle 247. Projection at desired magnification is attained through the use of lens assemblies 248, 249 or 250 each having a film track mounted rear thereof and each having an adjustable lens of different focal length. The assemblies are secured to a rotatable turret 251 whereby the lens of each of said mounts has its optical axis radial to and its nodal point on a common radius from the rotation axis of turret 251. By rotation of turret plate 251, any one of said lenses can have its optical axis aligned into an optical path from the film over slit 238, through exposure system 5 normal to surface 11.

Illumination of the film over slit 238 is furnished from lamp 252 through condenser lens 253 which conducts the illumination to an area of concentration. The image is projected through the lens selected and through a slit in enclosure 257, through bellows 258, thence through enclosure 259 and exposure control system 5 onto drum surface 11. Mirror 127, when using the microfilm projection apparatus, is pivoted vertically by handle 186 so as not to obstruct the optical path. The components above bottom plate 260 are secured to support wall 261 which is slidable vertically in relation to bottom plate 260 by rotation of adjustment knob 262 thereby to effect precise length of optical path between the film and surface 11 in accordance with a selected magnification ratio which position setting is indicated at scale 263.

When it is desired to reproduce opaque originals by the apparatus of this invention, an original to be reproduced is set on upper support tray 41 (refer FIG. 2) where it can be centered by the use of adjustable guides 42 and 43 each secured to tray 41 by knurled bolts 44 and 45 respectively. From this position, the original is manually fed into transport assembly 1 wherein it is caused to transport normally through an optical path wherefrom projection of the image is effected onto surface 11.

The drive components of transport assembly 1 are mounted within cover 112 whereas the transport elements are secured within open housing 29 (refer FIG. 3) which has side walls 30 and 31, top wall 32, and front brace 39. Within housing 29 and having substantially the same contoured exterior as the interior of housing 29 so as to be movable therewithin in a longitudinal direction to drum 10, is support frame 33 to which the transport elements of assembly 1 are secured and consisting of a top wall 34, back wall 35, a side wall 36, opposite side wall (not shown) and front brace 38.

For effecting transport of the opaque original, assembly 1 includes two lateral and parallel rotatable shafts 46 and 47 in spaced relation and supported in suitable bearing means (not shown) so as to have their axes of rotation parallel to the axis of drum 10. Secured to shafts 46 and 47 so as to be rotative therewith are cylindrical rollers 48 and 49, respectively, over and between which are adhering a plurality of parallel continuous belts 50 which preferably have a slightly abrasive outer surface whereby it causes an opaque original paper sheet 7 set thereon to move therewith. Synchronous motor 57 transmits its driving force through variable speed transmission 4 which may be model number 29MR5, commercially available from Graham Transmissions, Inc., of Menomonee Falls, Wisconsin. From its drive shaft 55 motion is transmitted to pulley 59 to non-slip belt 60 thence to pulley 61 secured to splined shaft 62. Slidably secured on shaft 62 is bevel gear 63 in mesh with bevel gear 64 secured to shaft 46, both gears 63 and 64 being housed in gear box 65. Splined shaft 62 is rotatably supported in bearings 68 of gear box 65 and journaled in bracket 69 secured to side wall 31. Idler roller 67, rotatably supported, maintains belt 60 under continuous tension.

For varying transport speed transmisison 4 is operative through handle 110 being secured to rotatable shaft 111 in turn secured to the variable mechanism (not shown) of transmission 4. Also secured to shaft 111 is bevel gear 118 (refer FIG. 2) to which is engaged a calibrated indicating mechanism 119 whereby relative

transmission speed and consequently belt transport speed, is precisely indicated in window 120.

With opaque original sheet 7 transporting on belts 50 contact therewith is assured by transporting underneath rubber rollers 70 normally in tangential contact with belts 50 and secured to rotatable parallel shafts 71, 72 and 73. The axes of shafts 71 and 73 are arranged parallel and vertical of shafts 47 and 46 respectively while shaft 72, having its axis in the same rotative plane as 71 and 73, is vertical and parallel to intermediate rotatable support shaft 74 also have rollers 70 secured thereto. Each of shafts 71, 72, 73 and 74 preferably has one roller 70 approximately centered and in tangential contact to each individual belt of belts 50. Shaft 71 is rotatably supported at each end in a bearing 79 of arms 80, which are removably supported in cup bracket 86 secured to tray 41 whereas shafts 72 and 73 are rotatably supported at each end in suitable bearing means of brackets 92 and 93 respectively secured to side walls 36 and 37. Shaft 74 is rotatably supported in bearing means (not shown).

Located approximately intermediate between shafts 72 and 73 and superposed laterally over belts 50 is a rectangular strip of transparent glass 81 supported at each end in spaced relation to belts 50 by brackets 87 secured to frame 33. Glass 81 serves to maintain sheet 7 flat and horizontal while passing thereunder substantially eliminating any creases which may be present. As sheet 7 transports below glass 81 an optical path emanates normally therefrom onto surface 11 as will be described.

Lamp 3 serves to illuminate the opaque original passing below glass 81, which is secured at each end in lamp sockets 78 mounted laterally and housed in opposite pockets 82 of side walls 30 and 31. To prevent overheating of lamp 3, blower 84, driven by motor 85, directs a stream of room ambient air across the lamp surface. Lamp 3 is a commercially available lamp fixture of a type having high luminous intensity which in preferred embodiment emits a highly luminous mercury vapor light, although it is to be understood that other forms of illumination could be substituted therefor. Cover plate 75, hinged to side walls 30 and 31, shields the operator from the radiation effects of lamp 3.

After transporting below glass 81 and shaft 73, sheet 7 collids with return guide 83 whereat its direction is reversed as it falls to lower support tray 88 supported below housing 29 whereat original 7 is stored in an organized position by the effects of guide catch 89 secured in slot 90 of tray 88.

The image of the original below glass 81 is reflected by mirror 91 which is secured to frame 33 parallel and in spaced relation above glass 81 whereby its reflecting surface spans and is angularly inclined to the horizontal surface of belts 50 so as to reflect an image from opaque original 7 through projection system 2.

For varying the length of the optical path, frame 33 with the components secured thereto is movable in a direction toward and away from drum 10. Mirror 91 and glass 81 move therewith and the length of the optical path between surface 11 and sheet 7 passing below glass 81 can be varied by setting the position of frame 33 in accordance with a selected magnification ratio at which opaque original 7 is to be reproduced.

Handwheel 95 is utilized to position frame 33. The handwheel is secured to lead screw 96 which is rotatably supported in brace 39 and threaded to block 98 secured to brace 38 of frame 33. Rotation of handwheel 95 thereby effects movement thereof through block 98, and causes saddles 104, secured to the underside of frame 33 to slide over guide rails 105 secured to housing 29. In order that the position of frame 33 be precisely obtained, bevel gear 106, secured to lead screw 96, transmits the relative position of frame 33 to a bevel gear (not shown) secured to shaft 107 thence to calibrated indicating means 108 whereat the relative position is precisely indicated in window 109.

Projection system 2 includes, in addition to mirror 91, an objective lens 126 and a second mirror 127 having its reflecting surface spanning and angularly inclined to the axial normal of surface 11. Lens 126 is supported in a lens barrel 128 supported in shield plate 129 which has shape to fit snugly and slidably perpendicularly inside of longitudinally extended duct 123. Lens barrel 128 is integrally connected to brace 130 which is supported onto rotatable lead screw 131 through tapped boss 132. Longitudinal duct 124 is shaped internally to permit longitudinal movement of boss 132 and brace 130 and in cooperation with duct 123 forms a light-tight or radiation-tight peripheral enclosure to prevent against the admission of outside stray light or radiation into the optical path. Image reflection from mirror 91 is intended to pass only through the optical axis of lens 126, and to prevent against the leakage of light or radiation thereabout a felt or other pliable material (not shown) is fitted around the components so that a substantially light or radiation block is formed perpendicular across the interior of ducts 123 and 124. Focusing of the lens 126 in the optical path is effected by rotating handle 133 which is secured to shaft 134 rotatably secured to back wall 35. Secured also on shaft 134 so as to rotate therewith is gear 135 in constant mesh with pinion 136 secured to lead screw 131.

To effect precise focus of the lens 126 in the optical path in accordance with a magnification ratio selected, bevel gear 142, secured to lead screw 131, meshes with bevel pinion 143 secured to shaft 144 of calibrated indicating mechanism 145 whereat its position for focus is precisely indicated in window 146.

When the xerographic reproduction apparatus is equipped with microfilm projection apparatus 6, mirror 127 is pivotally mounted about pin 185 and positioned by handle 186 whereby it can be positioned to direct the optical path as aforesaid for the apparatus of the invention or it can be swung clockwise so as not to obstruct the projection of image from microfilm projection apparatus 6. When apparatus 6 is not included, mirror 127 is permanently secured in the arrangement shown in FIG. 1.

For controlling exposure, exposure control system 5 (refer FIGS. 1 and 5) includes a box-like structure 160 having side walls 161 and 162, front wall 163 and rear wall (not shown) all extending vertically downward towards drum 10. At the lower extremity of 160, a variable width slit 168 spanning the axial length of drum 10 is formed by leafs 169 and 170 secured to rotatable pins 171 and 172 respectively which are rotatably secured to side walls 161 and 162 respectively. The width of slit 168 is varied by rotating control knob 176 also secured to pin 172 and to which is also secured pinion 179 meshing with pinion 180 secured on pin 171. Control knob 176 has a pointer 181 which is correlated to indicate the width of slit 168 from calibrated dial 182. Slit opening 168 corresponds to a shutter of a camera in that it is capable of varying the time factor of exposure, that is, when opening 168 is set for maximum, the projected image is in contact with the constantly moving drum surface 11 for the greatest length of time allowing the maximum exposure and when set for a minimum the contra is true.

The electrical system is schematically indicated in the wiring diagram of FIG. 4 in which potential for electrically driven components hereof is obtained from potential source 190 wherefrom current is conducted by leads 191 and 192 through switch 193 to transport-motor 57. Potential obtained by leads 194 and 195 is conducted through switch 196 wherefrom it is conducted by leads 197 and 198 to blower motor 85 and by leads 188 and 189 to lamp 3.

In operation, with electrical components operative, an opaque original 7 to be reproduced is first set on upper

support tray **41** where it is aligned between guides **42** and **43**. A magnification ratio is selected at which opaque original **7** is to be reproduced which may include any of the following ratios: 0.458*x*, 0.50*x*, 0.55*x*, 0.60*x*, 0.65*x*, 0.70*x*, 0.75*x*, 0.80*x*, 0.90*x*, 1.00*x*, 1.20*x*, 1.40*x*, 1.60*x*, 1.80*x*, 2.00*x*, although it is apparent that by substitution of other component capacities and/or sizes, other magnification ratios are just as easily attainable.

Having selected a magnifiication ratio, lens **126** is focused in the optical path by rotating handle **133** until a value corresponding to the requisite lens position appears in window **146**. Proper transport speed of belts **50** is then obtained by rotating handle **110** until a value corresponding to the requisite transport speed appears in window **120**. The length of the optical path is then precisely effected by rotating handle **95** until a value corresponding to the requisite position of frame **33** appears in window **109**. By the means thus described, the apparatus of the invention is correlated to effect magnified projection of the original image at the selected ratio, although the chronological order in which the above settings are effected need not be in the order above described.

Knob **176** is then rotated to a position whereby slit **168** will effect proper exposure of a projected image onto constantly rotating drum surface **11**.

Having prepared all of the necessary adjustments, opaque original **7** is then manually fed from tray **41** into and between the belts **50** and the rollers **70** on shaft **71**. Original **7** transports on belts **50** at a rate coincident with belt transport rate until passing below glass **81** at which position the optical path between belts **50** and mirror **91** is normally intercepted. The incidence of the optical path is reflected at a right angle by mirror **91** so as to pass through the optical axis of lens **126** wherefrom it is projected onto mirror **117** which again reflects the incidence of the optical path so as to direct it through exposure control system **5** normal to and along the axial length of surface **11** previously charged. Opaque original **7** continues transporting until colliding with return guide **83** whereat its direction is reversed and it falls to lower support tray **88** where it is stopped by guide catch **89**. After exposure, the electrostatic latent image formed thereby is developed into a xerographic powder image by developing unit **21** and is subsequently electrostatically transferred onto paper web **18** and permanently affixed thereto by heat fuser **22** through the course effected by paper handling mechanism **226**. Finished reproduction of original **7** is then wound onto take-up spool **17** from where it may be removed. Whereas the reproduction of a single opaque original has been described above, any number or quantity of opaque originals may be continuously and successively reproduced at the same magnification ratio without resorting to any apparatus adjustments.

With use of the apparatus thus described, finished xerographic printed copy can be produced at variable magnification ratios from an opaque original in approximately 15 seconds. With the use of the apparatus of this invention in conjunction with an automatic xerographic apparatus, rapid and accurate correlation between transport speed of the opaque original relative to the drum surface, length of the optical path, and lens focus can be easily effected to produce a magnified reproduction of an opaque original. When the apparatus of this invention is assembled to a continuous xerographic reproduction apparatus, and complemented by a microfilm projection apparatus, the versatility of the xerographic apparatus is greatly enhanced.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without department 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:

1. In a xerographic printer for reproducing copy, a projection apparatus to project opaque original images to be reproduced at variable pre-selective magnification ratios onto a xerographic plate moving normal to an exposure slit at constant rate, wherein said xerographic printer includes a xerographic plate moving at constant rate; said projection apparatus including in combination a first support means for supporting opaque original copy to be reproduced, a second support means for supporting opaque originals received from said first support means, an enclosure having a variable pre-settable width exposure slit which spans at least a partial width of the plate and its opening extends normal to the surface thereof, variable rate transport means for moving opaque originals at a predetermined rate from said first support means toward said second support means, said transport means including a plurality of parallel belts motor driven through a presettable variable speed transmission; optical means to effect projection of original images in an optical path from a projection position in transport through said slit onto the plate surface, said optical means including a first mirror supported in spaced relation from and having its reflecting surface inclined toward and spanning said projection position, a second mirror optically aligned with said first mirror and supported in spaced relation from the plate having its reflecting surface inclined toward and spanning at least a portion of said exposure slit, a pre-settable variable focus objective lens supported with its principal axis in the optical path between said first and second mirrors, presettable means to vary the length of optical path between said projection position and the surface of the xerographic plate, means to illuminate an opaque original image in said projection position, and correlating means to indexingly guide in accordance with a selected magnification ratio at which opaque originals are to be reproduced the appropriate settings for transport rate, optical path length, and focus of said lens.

2. The aparatus according to claim 1 including a second projection means to project images at pre-selected magnification ratios from continuously advancing micro-film through said slit onto the plate surface, and means selectively operative to permit alternative operation of the first and said second projection means.

3. In a xerographic printer for reproducing copy, a projection apparatus to project opaque original images to be reproduced at variable magnification ratios onto a xerographic plate in the form of a cylindrical drum and comprising a photoconductive insulating surface on a conductive substrate moving normal to an exposure slit at constant rate, wherein said xerographic printer includes a copy feeding station at which to receive copy to be reproduced and a xerographic plate moving at constant rate; said projection apparatus including in combination an enclosure having a variable pre-settable width exposure slit which spans at least a partial width of the drum substantially at the top thereof and its opening extends normal thereto, variable rate transport means for moving opaque originals to be reproduced from said feeding station at a predetermined rate with the copy surface to be reproduced facing upwardly, optical means having optical elements in fixed optical alignment to effect projection of original images in an optical path from a projection position in transport through said slit onto the drum surface, said optical means including a first reflective means supported in spaced relation from and having its reflecting surface inclined toward and spanning said projection position, a second reflective means optically aligned with said first reflective means and supported in spaced relation from the plate having its reflecting surface inclined toward and spanning at least a portion of said exposure slit, a pre-settable variable focus objective lens supported with its principal axis in the optical path between said first and second reflective means to project images through a range of selective magnification ratios exceeding the lens focus depth when changing from one extreme ratio to the other, and pre-settable means coupled to said first reflective means to relocate said projection position in a direction parallel to the direction of

copy movement whereby to vary the length of said optical path between said projection position and the surface of the xerographic plate; means to illuminate an opaque original image in said projection position; and correlating means to indexingly guide in accordance with a selected magnification ratio at which opaque originals are to be reproduced the appropriate settings for transport rate, optical path length, and focus of said lens.

4. In a xerographic printer for the reproduction of copy wherein a xerographic plate in the form of a cylindrical drum and comprising a photoconductive insulating surface on a conductive substrate is moved at constant rate, and which includes means to apply electrostatic charge to the surface of the plate and a copy feeding station at which to receive copy to be reproduced, projection apparatus to project a focused radiation image of copy to be reproduced at variably pre-selective magnification ratios onto the previously charged xerographic plate, said projection apparatus including in combination, a copy exposure station at which an image of copy is positioned for projection, means to illuminate copy at said exposure station, a radiation-tight enclosure extending from the vicinity of said exposure station to adjacent the path of drum movement at substantially the top of the xerographic drum, an exposure slit in said enclosure extending transversely across the path of plate movement, an optical system having optical elements in fixed optical alignment and supported at least partially within said enclosure and adapted to project an image of copy from said exposure station in a pre-set length of optical path through said exposure slit onto the surface of the xerographic plate moving therepast, said optical system having a projection lens adapted to project images through a range of selective magnification ratios exceeding the lens focus depth when changing from one extreme ratio to the other, said lens being adjustably movable along its principal axis for focusing a projected image onto the plate, copy transport means to advance copy from said copy feeding station through said exposure station with the copy surface to be reproduced facing upwardly at a predetermined rate relative to the rate of plate movement, means pre-settable to vary the operating rate of said copy transport means, means pre-settable to relocate said exposure station in a direction parallel to the direction of copy movement whereby to vary the length of said optical path, and means to indexingly guide the appropriate pre-adjustment settings to focus said lens, to set the operating rate of said copy transport means, and to set the length of said optical path, whereby lens focus, copy transport rate and optical path length are correlatively pre-set for a selective magnification ratio at which copy is to be reproduced.

5. In a xerographic printer for the reproduction of copy wherein a xerographic plate in the form of a cylindrical drum and comprising a photoconductive insulating surface on a conductive substrate is moved at constant rate,

and which includes means to apply electrostatic charge to the surface of the plate and a copy feeding station at which to receive copy to be reproduced, projection apparatus to project a focused radiation image of copy to be reproduced at variably preselective magnification ratios onto the previously charged xerographic plate, said projection apparatus including in combination, a copy exposure station at which an image of copy is positioned for projection, means to illuminate copy at said exposure station, a radiation-tight enclosure extending from the vicinity of said exposure station to adjacent the path of drum movement substantially at the top of the xerographic drum, an exposure slit in said enclosure extending transversely across the path of plate movement, a folded optical system supported at least partially within said enclosure and adapted to project an image of copy from said exposure station in a pre-set length of optical path through said exposure slit onto the surface of the xerographic plate moving therepast, said optical system having optical elements in fixed optical alignment and including a projection lens adapted to project images through a range of selective magnification ratios exceeding the lens focus depth when changing from one extreme ratio to the other, a first reflective surface supported to reflect a copy image from the exposure station into said lens, and a second reflective surface supported to reflect onto the xerographic plate an image projected by said lens, said lens being adjustably movable along its principal axis for focusing a projected image onto the plate, an endless conveyor to transport copy from said copy feeding station through said exposure station with the copy surface to be reproduced facing upwardly at a predetermined rate relative to the rate of plate movement, a pre-settable variable speed drive operatively connected to the endless conveyor and adapted to control the operating rate thereof, pre-settable means coupled to said first reflective surface to shift said exposure station in a direction parallel to the direction of copy movement and relative to the position of said exposure slit whereby to change the length of said optical path, and means to indexingly guide the appropriate preadjustment settings to focus said lens, to set the operating rate of said drive means, and to shift said exposure station whereby lens focus, copy transport rate and optical path length are correlatively pre-set for a selective magnification ratio at which copy is to be reproduced.

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