

United States Patent

Huber

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[54] PORTABLE DOCUMENT ABTRACTOR

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[58] Field of Search 355/7, 3, 8, 16, 10, 81, 84

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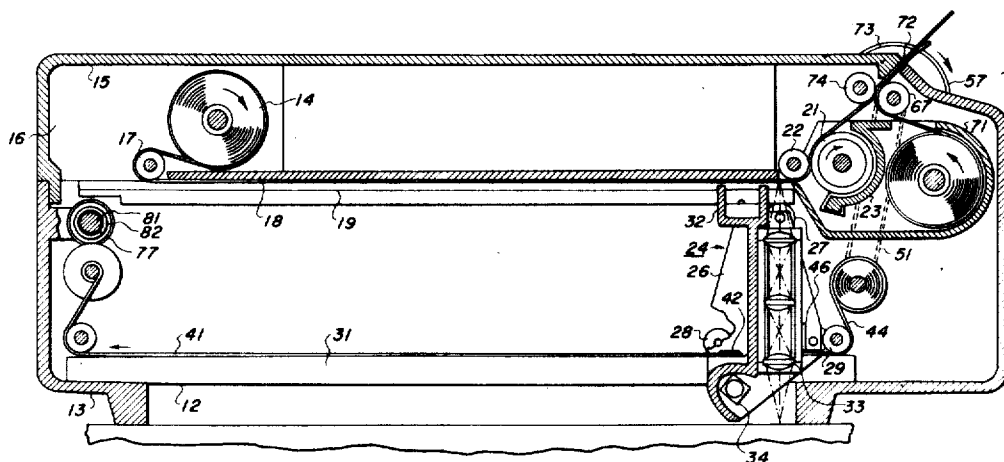
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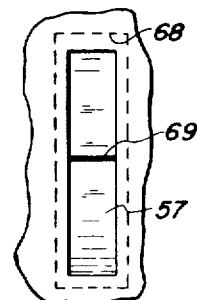
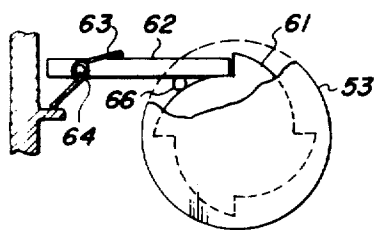
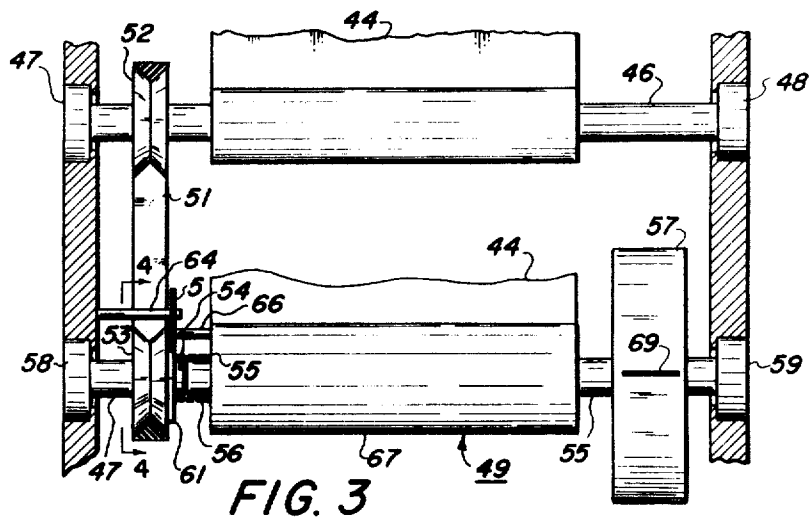
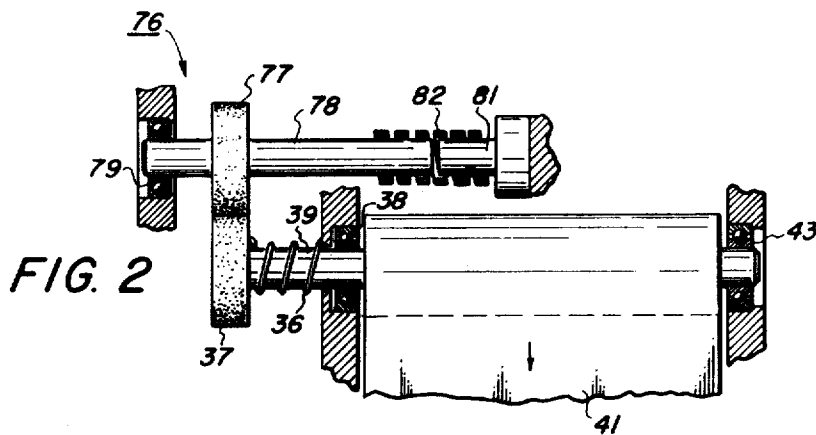
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[57] ABSTRACT

Apparatus for copying various types of information such as words, phrases, sentences, symbols or the like. This complete apparatus, which is adapted to copy selected portions of a complete text, is characterized by the incorporation of a shutter mechanism, which forms an integral part of a carriage transport structure, which carriage transport supports a lens system and lamp therefor, and a charging unit. The shutter is biased in one direction by means of a spring which serves to drive the carriage in the exposing mode. Another part of the shutter is so coupled to manually operable mechanism as to be capable of returning the carriage to its initial position.

5 Claims, 5 Drawing Figures





PORTABLE DOCUMENT ABTRACTOR

BACKGROUND OF THE INVENTION

This invention relates, in general, to copying and reproducing apparatus and, more particularly, to apparatus suitable for copying and reproducing selected portions of a complete text.

It is often desirable to reproduce printed or written matter from books, magazines, reports or the like. Sometimes it is desirable to copy an entire page while other times only certain portions may be desired. Presently, copying machines are available which can be used for such purposes; however, they are quite large and usually they have limited capability, in that, they cannot abstract portions of an entire document. For this reason, if one wishes to reproduce a single paragraph from a page in a book, for example, the entire page is usually copied with subsequent trimming of unwanted portions therefrom.

Machines of the foregoing type are further limited, in that, they are usually quite large and therefore, kept in a central location which requires taking the material to the machine to be copied.

One solution to the restriction of full-page printing and attendant waste has resulted in apparatus comprising a scanning or read-head in combination with reproducing apparatus. While such apparatus solves the problem of full-page reproduction, it does not overcome other shortcomings such as remote location and complexity.

Accordingly, the general object of this invention is to provide a new and improved copying and reproducing apparatus.

A more particular object of this invention is to provide a new and improved copying and reproducing apparatus which can copy selected portions from printed matter or the like.

Another object of this invention is to provide a new and improved portable copying and reproducing apparatus which can copy selected portions from printed matter which apparatus is simple in construction, easy to operate and relatively inexpensive to make.

BRIEF SUMMARY OF THE INVENTION

Briefly, the above-cited objects of the invention are accomplished by the provision of a casing structure having an open end and having supported therein a photosensitive member remote from said opening but in alignment therewith. A carriage assembly having a lens system, light source and corona charging unit is supported for movement relative to the photosensitive member and the opening over which material to be copied is disposed. A pair of shutter members in the form of flexible curtains are attached to either side of the carriage and, in turn, are attached to a rewind spring and a manually operable driving arrangement, respectively. The rewind spring serves to automatically transport the carriage in a copying mode upon release thereof while the manually operable driving arrangement is used to both wind or cock the spring and transport the photosensitive member and a transfer medium through the operative stations of the casing structure, which stations comprise a gravure roll and a pair of pressure rollers where transfer of a developed image to a record paper is effected. The manually operable driving arrangement also effects movement of the carriage back to its initial position where it is ready for making of another copy.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention as well as further objects and features thereof, reference may be had to the detailed description of the invention to be read in connection with the accompanying drawings wherein:

FIG. 1 is a vertical cross-sectional view of a copying apparatus incorporating the invention;

FIG. 2 is a diagrammatic view of a drive mechanism forming a part of the apparatus illustrated in FIG. 1;

FIG. 3 is a diagrammatic view of a manually actuable carriage release and coupling mechanism forming a part of the apparatus illustrated in FIG. 1;

FIG. 4 is a cross-sectional view taken on the line IV—IV of FIG. 3; and

FIG. 5 is a fragmentary view of an area of a casing structure forming a part of the apparatus wherein an index and carriage release wheel is disposed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, especially FIG. 1, reference character 10 designates a copying apparatus comprising a casing structure 11. The casing structure is provided with an elongated rectangular opening 12 in the bottom wall 13 thereof.

Electrostatic recording media in the form of a photosensitive web 14 is supported in the upper section 15 of the casing structure intermediate opposed side wall 16, only one of which is shown in FIG. 1. The photosensitive web is preferably a xerographic plate made up of a photoconductive insulating layer on a support such as plastic or paper. In preferred versions the support is at least partially conductive to facilitate charging and exposure-induced discharge. The photoconductor may comprise selenium or selenium alloys, phthalocyanine cadmium sulfide or zinc oxide in insulating binder layers or polyvinyl carbozol, or anthracene either alone or mixed with an insulating film forming material. The photosensitive web feeds from the roll, past a guide roller 17 between a support platen 18 and a combination upper carriage track and paper guide 19. Beyond the end of the platen 18, the web passes between a second guide roller 22 and a gravure roller 21 where the latent electrostatic image, formation of which will be discussed hereinafter, is developed.

The gravure roller 21 constitutes a developer dispensing element comprising a generally cylindrical base support having disposed on its surface a raised pattern (not shown) which may, for example, comprise a plurality of fine raised dots, lines or other similar elements. The foregoing structure is characterized by being wettable by the ink or developer employed in the depressions or valleys formed by the raised areas but substantially non-wettable along the peaks.

Prints of good quality and relative ease of operation can be obtained with a preferred gravure roll having a trihelical pattern of between 80 and 300 lines per inch, with about 180 to 250 lines per inch being preferred, cut at an angle from about 30° to about 60°, preferably about 45°, to the longitudinal axis and to a depth of from about 1½ mils to 6 mils. Typical material from which the gravure or applicator roller may be made include steel, brass, aluminum, nylon, or Lucite. The roll may typically comprise a shaft of one material with a shell or sleeve of a second material. Ink is supplied to the wettable valleys or depressions through rolling contact of the gravure roller with an ink or developer reservoir in the form of a pad 23 of cloth-like material. While the preferred ink supply or feeder constitutes a pad, due to size considerations, the developer feed surface may be of any suitable size and configuration. It may also take the form of a rotatably mounted roller. Like all materials employed, the feed surface should be relatively resistant to aging and wearing and chemical attack by the developer. Considerable latitude is permitted in the selection of the feed surface when it is employed only as the feed surface. That is, when it is employed merely to supply or load the applicator surface with unmetered quantities of developer in undoctored configuration, any developer feed system may be employed.

When, however, the feed surface is to serve both as a feeding and as a doctoring surface, the surface should preferably be smooth to avoid any disfiguring of the applicator surface with which it comes in moving contact during the doctoring operation. Also, the material employed for the combination feed and doctoring surface should be relatively resilient having a sure hardness (A scale) durometer of from about 40 to about 90. Optimum print quality may be obtained with a durometer from about 50 to about 60. Any suitable material may be selected for the feed surface. Typical examples of materials which may be employed for this surface include steel, silicone rubber, fluorosilicone rubber, synthetic rubbers, urethanes and polyurethanes.

Doctoring of the developer loaded applicator surface may also be accomplished by means of doctor blades. A principle doctor blade extending the entire length of the applicator surface may be used alone or in conjunction with edge and corner doctor blades. The doctor blades may be made of any suitable material which is relatively resistant to aging, searing and chemical attack by the developer liquid. Typical materials include steel, silicone rubbers, fluorosilicone rubbers, urethanes, polyurethanes, mylar, (polyester). The principal doctor blade should contact the applicator surface along a line or narrow path to provide the desired metering of developer material to the applicator surface in doctored configuration. The edge and corner doctor blade should contact the edge of the applicator surface in the corner to move excess developer and prevent the accumulation of developer along the corner of the applicator surface.

Any suitable developer material may be employed, for example, polar or nonpolar liquids or dry powdered material such as electroscopic marking particles commonly referred to as "toner." It is desirable that the developers be compatible with the particular materials they come in contact with during the operation of the developer system. The developer may have pigments dispersed or dyes dissolved therein. Typical liquid developers useful may be selected from the commercially available water, oil and alcohol based inks and include among others as vehicles: mineral oil, oleic acid, polypropylene glycol, mineral spirits, glycerol and sorbitol.

To minimize spillage and contamination of the mechanical movements of the developer material, the housing structure for the gravure roller should be essentially fully enclosed to outside influence except for the supply of developer material to the developer bath in the housing structure and for the opening necessary for the applicator surface to be placed in developing engagement with the photosensitive paper. The housing structure for the developer material and components may be of one piece construction such as an extruded tray. To ensure longevity of operation the materials employed in the developer housing structure are preferably not subject to attack by the particular developer employed.

Development may be achieved through conventional liquid development techniques wherein electrophoretic movement of charged particles suspended in the developer liquid is obtained under the influence of an applied electric field. Preferably development is achieved with the polar liquid developer technique wherein it has been found that the developer deposits not by physical emission of the surface of the developer dispensing member, but instead by creeping up the sides of the pattern material and migrating to the image receiving surface. It is believed and understood that the mechanism of developer migration employs, in cooperation, the two forces of electrostatic attraction and surface tension in that surface tension retains the developer in cohesive configuration on the gravure roller while electrostatic attraction applies forces causing developer to creep up the sides of the patterned spacing material and transfer only in accordance with the pattern of electric charge. Thus, the developer remains in the valleys of the gravure roller surface except under the influence of the attracting electrostatic force.

To accomplish development through electrostatic attraction of the developer material on the gravure roller to the image bearing surface in image configuration, the support base of the gravure roller is biased (including ground) through connection to a potential source. When so connected, the image charges on the surface to be developed, induce, due to conductivity through the support base and into the conductive ink, charges which tend to neutralize charges on the surface of image bearing surface. Thus, when the support base is grounded and areas of the plate carry positive charges, negative charge induced through the support base into the liquid developer in those areas positioned adjacent to the positive charges, thus causing a field between the developer and the charge on the surface to be developed in such regions. In areas of ink corresponding to areas of the image bearing surface

without charge, no attractive field exists to cause charge to migrate into the conductive ink through the support base while the support base is grounded, and accordingly, no electric field of attraction is created to cause ink to creep up the raised areas of the gravure roller and to the surface bearing the charge pattern. Thus, development takes place only in charged areas when the support base is connected to ground or connected to a low potential generally about the level of the uncharged or substantially uncharged areas of the image bearing surface. It is noted that development in accordance with the foregoing is not polarity sensitive. Thus, development does take place in the sense that charged areas develop and uncharged areas do not develop if the charge areas are negative in polarity just as development takes place when the charges are positive in polarity. In such as case, positive charges would be induced into the areas corresponding to the negative charges on the electrostatic image bearing surface. A field would then exist to cause ink to creep up the raised area for deposition on the image bearing surface.

While the foregoing was described in conjunction with development of the charged areas, the uncharged areas may be developed by applying to the support base a potential of the same polarity and of the same amount as the charged areas of the electrostatic image bearing surface as through a change in the potential applied by varying a potentiometer.

When dry powdered material such as electroscopic marking particles or "toner" is used, it can be presented to the photosensitive web by either a fur or magnetic brush, the toner being attracted to the charged areas of the web.

The "toned" or developed image would be subsequently fused or rendered permanent by the application of heat and pressure which could be provided by means of transfer rolls suitable for such application.

In the fur brush type of development, a soft fur such as beaver is constructed in the form of a cylinder which is rotated through a sump of toner. The fur fibers take the place of the carrier particles associated with the cascade type of development thereby attracting the toner thereto as the result of triboelectric action. As the fur brush rotates in the area of the web, the charges on the web overcome the force of attraction between the fibers and toner whereby the toner is attracted to the areas of the web corresponding to a latent electrostatic image formed thereon.

In the magnetic brush type of development, a magnet having a mass of iron filings or ferromagnetic powder attached thereto by magnetic attraction, is employed. The filings or ferromagnetic powder simulates the fibers of the brush as discussed above.

A carriage assembly 24 comprises a frame member 26 supported for movement from left to right and vice versa, as viewed in FIG. 1, by a plurality of rollers 27, 28, and 29. The rollers are disposed intermediate and in contact with the combination paper and carriage track 19 and a lower carriage track 31. The carriage assembly supports for movement therewith, a corona charging unit 32, a lens structure or unit 33 and a lamp 34. The carriage assembly 24 traverses the opening 12 to thereby enable the corona charging unit to place a uniform electrostatic charge on the photosensitive web 14. The photosensitive paper is exposed through the lens unit 33 to an object not shown over which the casing structure may be placed such that the opening 12 is in registry with material to be copied.

Although other charging devices known to those skilled in the art may be utilized, it is preferable to charge the photosensitive web by corona discharge from a wire filament or wire filament array which is maintained at high potential as described, for example, in U.S. Pat. Nos. 2,588,699 to Carlson, 2,836,726 to Vyverberg, 2,777,957 to Walkup, 2,778,946 to Mayo, and others.

The power supply, not shown, for the corona charging unit may be of any construction well known in the art which provides approximately 7,000 volts D.C. from a commercial outlet of 110 volts, 60 cycle alternating current.

The lens structure or unit 33 may be of a construction well known in the art which produces an upright and reverse reading image upon the photosensitive web. Such a construction may comprise three lens strips each comprising a plurality of lens elements supported such that the lens elements are coaxial thereby forming a plurality of imaging devices extending transversely of the apparatus or perpendicular to the direction of carriage movement. Each of the imaging devices is adapted to scan an elemental or discrete area of the portion of the document to be copied which is in the focal plane of the lowermost elements and to project an image of that area upon the photosensitive web 14 which is in the focal plane of the uppermost lens elements. As will become apparent hereinafter, the purpose of producing a reverse reading image is so that image transfer can be accomplished. It will be appreciated, however, that the present invention may be carried out without image transfer, in which case, a highly specular surface would be utilized in conjunction with the lens unit 33 in order to produce a right reading image on the photosensitive web.

Movement of the carriage assembly, from right to left, as viewed in FIG. 1, for the purpose of forming a latent electrostatic image on the photosensitive paper is accomplished by means of a rewind spring 36 (see FIG. 2) which may be staked or otherwise suitably affixed to the rotating roller member 37 and a stationary bearing support 38. The support 38 serves to journal a shaft 39 to which one end of a curtain or shutter member 41 is attached, the other end being attached to the carriage assembly as indicated at 42, see FIG. 1. It should be apparent that the curtain 41 constitutes a flexible member which is substantially the size of the opening 12 and which is adapted to be rolled onto the shaft 39, the other end of the shaft 39 being journaled in a bearing support 43. The spring 36 is so constructed and attached to the members 37 and 39 that when the shafts 39 is rotated clockwise as viewed from the left in FIG. 2, the spring will wind tightly about the shaft. If, as in the instant situation the curtain is completely wrapped about the shaft 19, while the spring is in an unwound condition, then displacement of the curtain from the shaft will have the effect of winding or cocking of the spring so that it can automatically move the carriage assembly 24, upon release thereof in a manner to be discussed hereinafter, from right to left, as used in FIG. 1.

A second curtain 44 also has one edge attached to the carriage assembly 24 as indicated at 46. It will be seen that this attachment is on the opposite side of the carriage 24 from the attachment of the curtain 41 and therefore opposes the direction of movement imparted by the spring 36 to the carriage assembly 24. The other edge of the curtain 44 is attached to a shaft 45 (FIG. 3) such that it may be wound thereon. The shaft 45 which is journaled in support bearings 47 and 48 is coupled to an escapement mechanism generally indicated 49, through a belt 51 and a pair of pulleys 52 and 53.

The pulley 53 and its shaft 54 forming a part of the escapement mechanism 49 is coupled through a shaft 55 by means of a spring clutch 56 such that rotation of the shaft 54 by an indexing and carriage release wheel 57 integral therewith, in a clockwise direction as viewed from the left in FIG. 3 causes rotation of the pulleys 52 and 53 in the same direction. However, if the shaft 55 is held stationary, the shaft 54 and therefore pulleys 52 and 53 are free to rotate in a counterclockwise direction as viewed from the left in FIG. 3, such rotation being due to the tendency of the spring 36 to uncoil or unwind. The shafts 54 and 55 are suitably supported in bearing structures 58 and 59. In order to prevent inadvertent or undesired rotation with the pulleys 52 and 53 and therefore movement of the carriage assembly 24, cam wheel 61 and escapement arm or pawl 62 biased by means of a suitable spring 63 into engagement with one of a plurality of cam surfaces of the wheel 61 are provided. The pawl 62 is rotatably supported by a protuberance 64 extending from one of the side walls 16. The stationary end of the spring 63 is suitably secured to the protuberance 64. An overriding member in the form of a shoulder 66

carried by one end of a pressure roll 67 serves to raise the pawl 62 upwardly upon rotation of the wheel 57 in a clockwise direction as viewed from the left in FIGS. 3 and 4 to effect disengagement of the pawl 62 from the cam wheel 61. As long as this disengagement is maintained, the pulley 53 will be free to rotate under the influence of the spring 36.

The indexing wheel 57 extends through an elongated aperture 68 in the casing structure 11 for convenience in manual manipulation thereof. A plurality of lines 69, the number of which corresponds to the number of cam surfaces on the cam wheel 61, are provided on the surface of the indexing wheel 57. In the carriage-locked position, one of these lines is positioned approximately in the center of the aperture 68. When it is desired to release the carriage assembly 24 the line 69 is moved adjacent the lower edge of the aperture 68 (FIG. 5) and maintained in that position. Simultaneously the photosensitive paper and a transfer or record paper 71 are moved through a slit 72 in the top wall of the casing structure 11 and past a serrated edge 73 provided for facilitating tearing of the papers. Such movement is accomplished through cooperation of the elongated pressure roll 67 and a second pressure roll 74. One or the other or both of the rolls 67 and 64 may be biased in a well-known manner to give the desired results.

Motion control mechanism generally indicated by reference character 76 (FIG. 2) comprises a friction wheel 77 and integral shaft 78, the latter of which is journaled in a bearing support 79 on the one end and coupled to a fixed shaft 81 by means of a spring clutch 82. The construction and installation of the spring clutch which is well known is such as to allow rotation of the shaft 78 in a counterclockwise direction as viewed from the left in FIG. 2 and to prevent rotation in the reverse direction. The roller 37 is in engagement with the friction wheel 77, thus, the wheel 77 will have the effect of retarding rotation of the rollers 37 in one direction only, while rotating therewith in the opposite direction.

In order to make a copy utilizing the apparatus 11, the apparatus is placed over the material to be copied such that the elongated opening 12, which may be approximately 2 inches by 5 inches, registers with the portion of the material which is to be copied. Rotation of the indexing wheel 57, clockwise, as viewed in FIG. 1, or from the left as viewed in FIG. 3, accomplishes two things. First, the leading edges of the web 14 and paper 71 are moved beyond the slit 72 where they terminate due to the previous tearing thereof on the serrated edge 73 and secondly, effects disengagement of the pawl 62 and cam 61 which allows the carriage assembly 24 to move, under the influence of the spring 36, from right to left as viewed in FIG. 1. As the carriage assembly moves to the left, the corona unit 32 places a uniform charge on that portion of the photosensitive web contiguous the platen 18. Immediately following the aforementioned charging, the web is discharged in accordance with light activity from the lamp 34 in accordance with the exposure through the lens unit 33 as it passes over the material being copied.

While the lamp 34 moves with the carriage assembly 24, cooperating with the lens unit 33 to produce selected discharging in accordance with the material to be copied, a source of continuous illumination could be employed.

After the carriage has traversed the desired distance, the leading edges of the paper 14 and 71 extending from the slit 72 are pulled outwardly by hand, thereby effecting clockwise rotation of the pressure roll 67 (as viewed from the left in FIG. 3) and due to the clutch 56, rotation of the pulley 53 in the same direction. Rotation of the shaft 46 is also accomplished through the belt 51 and pulley 52 thereby winding the curtain 44 onto the shaft 46 which as viewed in FIG. 1 results in the movement of the carriage assembly 24 from left to right until it returns to its starting position where it again is locked in position by the pawl 62 and cam 61. Movement of the photosensitive web into contact with the gravure roller 21 will effect transfer of a sufficient quantity of ink to the latent electrostatic image. Suitable grounding and power sources (not shown) are provided in order to accomplish proper discharge

of the charge from the photosensitive web and proper transfer of ink from the gravure roller to the paper. Further transport of the web and paper brings them into contact with each other in the area of the pressure rolls 67 and 74 where the upright wrong reading developed image is transferred to a portion of the web 71. Both papers are simultaneously torn with the aid of the serrated edge 73 whereupon the apparatus is ready for reuse.

It will be appreciated by those skilled in the art that the housing structure 11 can be molded of any suitable material, for example, plastic, and that the dies can be constructed so as to provide integral bearing supports for the aforementioned shafts as well as mounting structure (not shown) for other components of the apparatus.

It should now be apparent that there has been provided a copying machine which is simple in construction and easy to operate and which can be utilized for copying portions of a full text.

What is claimed is:

1. Copying apparatus comprising:

casing structure;

means in said casing structure for supporting a photosensitive surface;

means for selectively exposing said photosensitive surface to an object to be copied to thereby print a latent image on said surface;

carriage means supporting said exposing means for movement relative to said surface and said object between first and second positions;

means for selectively moving said carriage from said first position to said second position to thereby form an image on said photosensitive surface; and

means including said photosensitive surface for manually returning said carriage to said first position after said latent image has been formed on said surface.

2. Structure as specified in claim 1 including means for developing said latent image on said charge-retentive surface simultaneously with the return of said carriage to said first position.

3. Structure as specified in claim 1 including record paper to which a developed image is transferred simultaneously with movement of said carriage to said first position.

4. Copying apparatus comprising:

casing structure;

means in said casing structure for supporting a charge-retentive surface;

means for selectively exposing said charge-retentive surface to an object to be copied to thereby print a latent image on said surface;

means for charging said charge-retentive surface;

carriage means supporting said exposing means and such charging means for movement relative to said surface and said object in first and second position;

means for selectively moving said carriage from said first position to said second position to thereby form an image on said charge-retentive surface; and

means including said charge-retentive surface for manually returning said carriage to said first position after said latent image has been formed on said surface.

5. Structure as specified in claim 4 wherein said means for selectively moving said carriage from said first position to said second position comprises a spring which is wound by said means for returning said carriage to said first position.

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