March 17, 1959 E. F. MAYER ET AL 2,878,120

INTERMITTENT ELECTROPHOTOGRAPHIC RECORDER

Filed July 3, 1956 2 Sheets-Sheet 1

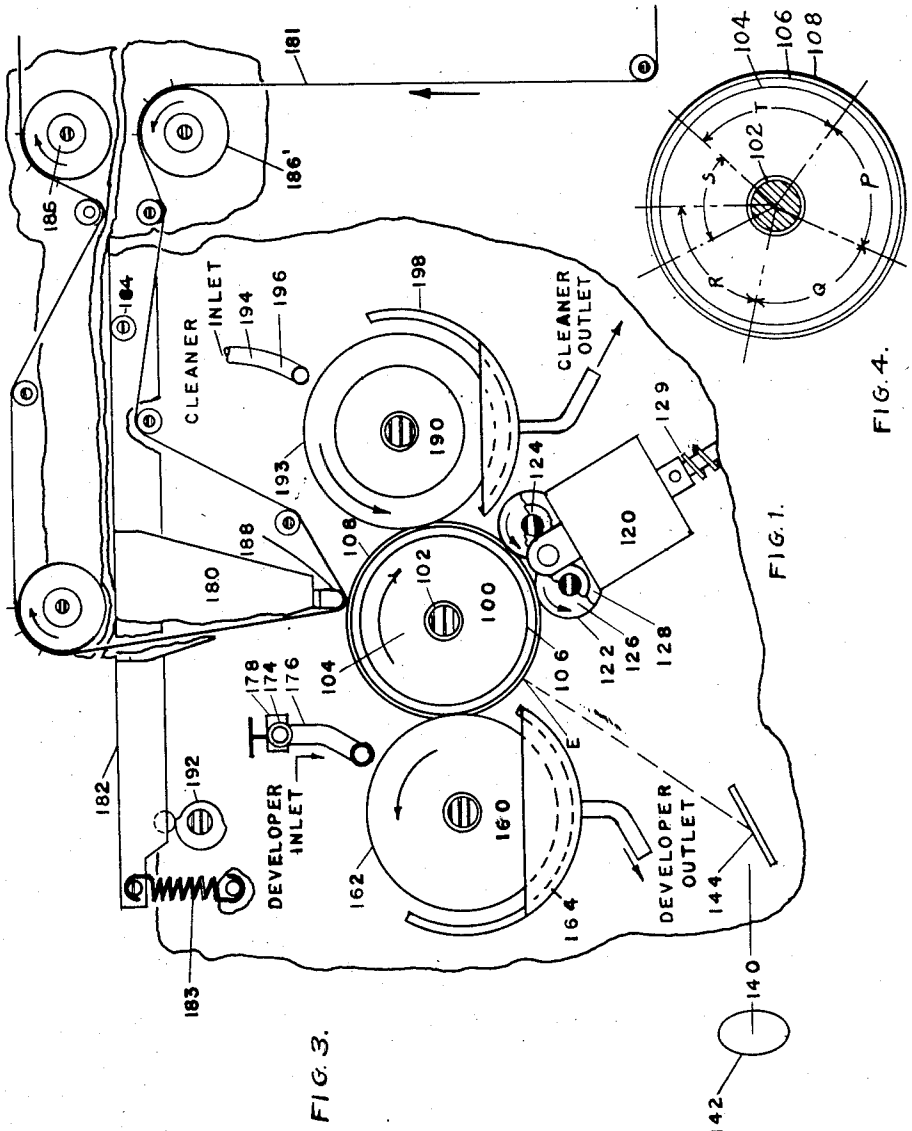


FIG. 3.

FIG. 4.

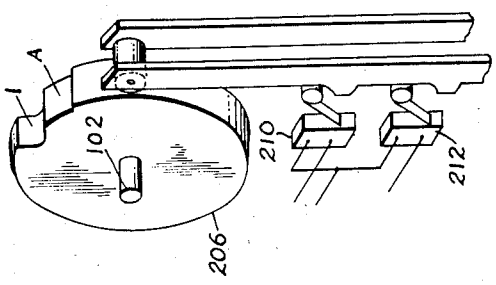


FIG. 1.

INVENTORS
Edward F. Mayer
Virgil E. Straughan

BY Lawrence & Field
Harney

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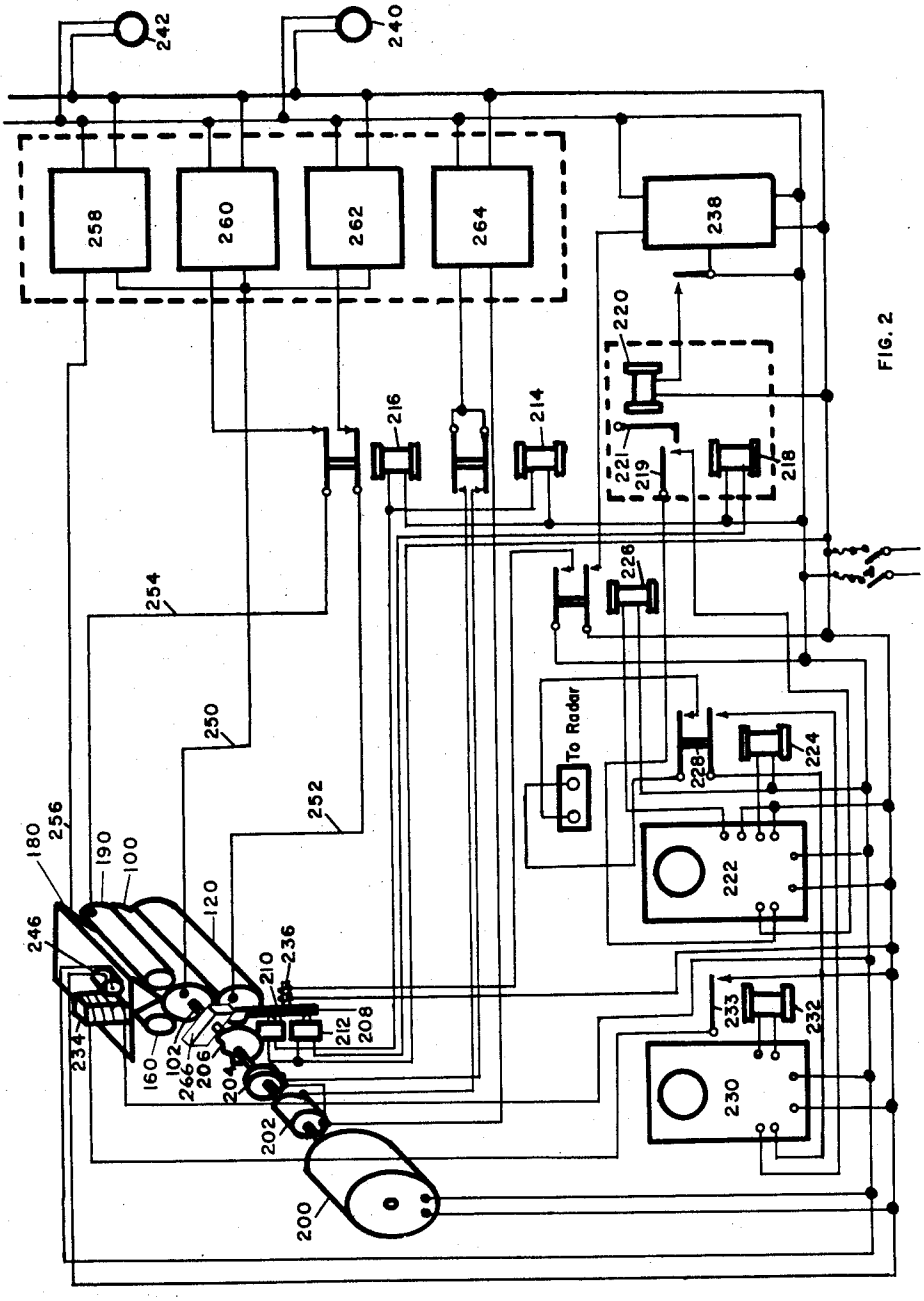


FIG. 2

INVENTORS
Edward F. Mayer
Virgil E. Straughan
BY
Lawrence J. Field
Attorney

United States Patent Office 2,878,120 Patented Mar. 17, 1959

2,878,120

INTERMITTENT ELECTROPHOTOGRAPHIC RECORDER

Edward F. Mayer, Cleveland, and Virgil E. Straughan, Euclid, Ohio, assignors to Horizons Incorporated, Princeton, N. J., a corporation of New Jersey

Application July 3, 1956, Serial No. 595,685

8 Claims. (Cl. 96—1)

This invention relates to photographic devices and more particularly to a device for use in an electrophotographic process.

One object of this invention is to improve the devices heretofore used in electrophotography by providing a means for intermittently recording information received by an apparatus from which this record is continuously obtained.

A more particular object is to provide an apparatus and method for recording radar information or other information received in the form of low intelligence information, by means which integrate signals which in and of themselves are not readily distinguishable from a background of extraneous signals (noise) but which after integration and processing emerge as a visible image from which an intelligible and significant interpretation of the input information can be made.

Another object is to produce a visible record of information received within about thirty seconds from the time it is received, from an input having the above characteristics, which, in order to produce the full advantage of integration involves a slow paper speed of about 2'/hour and hence only about ¼ of an inch of the record medium is available for the entire process during the allotted thirty second interval.

Another object of this invention is the provision of an improved apparatus for imparting a charge to the photoconductive element in an electrophotographic apparatus.

Still another object of this invention is the provision of an improved means for developing a latent electrostatic image to produce a visual manifestation of said image.

A further object of this invention is the provision of an improved means for cleaning any adherent developer from the surface of the photoconductor prior to a reinitiation of the electrophotographic cyclic process.

These and other objects will be apparent from the following description and accompanying drawings taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts and manner of operation exemplified in the following disclosure, including the illustration in the drawings.

In the drawings:

Figure 1 is a diagrammatic view of a machine embodying features of the present invention, as seen from one side;

Figure 2 is a semi-exploded diagrammatic view of the apparatus;

Figure 3 is a more detailed view of the control cam and follower shown schematically in Figure 2; and

Figure 4 is a schematic representation of the photoconductive element, as seen from the same side as Figure 1.

In the earlier patents of Chester F. Carlson, exemplified by United States Patent 2,297,691 among others, a method of photography is described in which the surface of a layer of photoconductive material is charged with an electric charge and is thereafter exposed to a light image, or light and shadow pattern, under conditions such that the charge on the illuminated regions of the photoconductor is permitted to leak away and escape through a conductive material on which the photoconductor is supported, while the charge on the unilluminated regions of the photoconductor is retained by the photoconductor. In this manner a latent electrostatic image is formed on the photoconductor in the regions which have retained the charge originally imparted to the photoconductor.

The Carlson patents further disclose the development of the latent electrostatic image into a visible image by contacting the photoconductor with an electrostatically attractable particulate material in the form of powder or mist. As further disclosed in the patents, the image may be rendered permanent by transfer to an appropriate medium such as paper, plastic, or other medium, on which and into which the powder is either absorbed or permanently fixed as by fusing.

The present invention is especially designed to photograph information portrayed as a single horizontal line having an intensity which is modulated along its length, such as the signal on a cathode ray tube face, and to process that information into a visible permanent paper record about one-half minute after it is transmitted to the apparatus.

Efforts to adapt the disclosures of the Carlson patents to the solution of the problem have been unsuccessful because of the rate of charge decay on the photoconductor when operating at the speed contemplated in the present invention.

The process is based on a photoconductor-liquid developer system in which a selenium-coated cylinder is the photosensitive element. The selenium surface of the selenium-coated cylinder is first given an electrostatic charge of several hundred volts by means of a semiconductive rubber roller during rotation of the selenium-coated cylinder, after which the cylinder is rotated through an arc. A light image produced is directed onto the charged photoconductor surface by means of a cathode ray tube, lens, and mirror. The charge on the photoconductor is reduced in those areas struck by light in an amount corresponding to the intensity and length of exposure. Thus a latent electrostatic charge image is formed.

Again the cylinder is rotated through an arc. During this rotation the latent charge image is carried through a body of liquid developer and pigment attaches to the exposed areas of the photoconductor, thereby producing a visible image corresponding to the light image directed onto the photoconductor. The liquid developer film is maintained between the close spacing of a metal developer roller counter electrode and the photosensitive drum by surface tension.

As the photoconductor cylinder indexes through another arc the developed image is brought to a dead stop directly beneath a print nose bar over which recording paper is being constantly moved. While the photoconductor is stopped in this position, the print nose forces the paper strip down onto the photoconductor cylinder directly along the portion of the cylinder bearing the visible image. Sufficient pigment is transferred to the paper to produce a line corresponding to the light image.

The print nose is then retracted before the cylinder indexes to a new position. One line at a time is thereby recorded for each cycle. With a rate of paper travel of 2 ft./hr., .020" is allotted to each line which results in a resolution of 50 lines/inch. With a ⅛" radius on the print nose it is found in actual practice that separation of the lines can be achieved with as many as 60 lines/inch.

The next and final operation on the photoconductor element is that of removing all residual pigment to present a clean surface for the next cycle. This is achieved by a soft gelatin composition roller turning in the same contact surface direction as the photoconductor element at about 1½ times the speed of the selenium-coated cylinder. Clean solvent is applied to the cleaning roller to assist in removal of pigment. The solvent is preferably the same as the solvent used in the developer solution. In this manner the apparatus is restored to its original condition and its original relative position, except for the selenium-coated roller which has rotated only a fraction of a full 360°, in order to minimize wear on the surface and to permit the succeeding images to be produced on other portions of the surface.

Figure 1 illustrates in diagrammatic form the several component parts of one form of electrophotographic apparatus contemplated within the scope of the present invention. In the figure there is shown a rotating drum **100**, preferably in the form of a cylinder of metal on which there is secured a thin layer of a photosensitive material having a resistivity of at least 10^{10} ohm centimeters. Located around the periphery of drum **100** are a means **120** for charging the drum, an optical system **140** for conveying information to the photoconductive cylinder, a means **160** for developing a latent electrostatic image formed on the drum into a visual manifestation of said image, a printing means **180** and a means **190** for cleaning the drum to restore it to a condition suitable for a repetition of the process of charging, exposing, developing, printing and cleaning. Each of the several components will now be described in greater detail.

The cylindrical drum **100** consists of a shaft **102** on which there is mounted an electrically conductive supporting cylinder **104** which may be formed either of metal or of non-metallic material provided with a conductive coating of metal **106** or any other electrically conductive material known in the art, and a photoconductive material **108** secured to and supported on the electrically conductive base. The photoconductive layer should have a resistivity in the dark of at least 10^{12} ohm centimeters and experience a decrease in resistivity of at least a factor of one hundred when exposed to the light derived from the information source; that is, the resistivity of the photoconductive layer should decrease to below 10^{10} ohm centimeters when it receives the information fed in by the optical system **140**. The photoconductive material should be in the form of a continuous layer and may be advantageously vacuum deposited onto the electrically conductive substrate. We prefer amorphous selenium as the photoconductive material, but many other materials possessing the required combination of properties are known in the art. Photoconductive layers of these materials have been produced which are capable of receiving a charge of several hundred volts and of being discharged and recharged many thousands of times without impairing their usefulness in the process.

As seen in Figure 1, the charge is rolled onto the photoconductor surface by charging means **120**, through the use of two charging rollers **122**. These rollers consist of an electrically conductive core **124** preferably of metal and a cover **126** of a semiconductive material such as a neoprene rubber composition. The charging rollers **122** are each proportioned so as to have a resistance of 10^8 ohms, measured from the core to a point on the surface of the rollers. Because of the relative electrical properties of the charging rollers and photoconductive drum, when a suitable potential is made to exist between the metal cores **124** of the rollers and the electrically conductive material **106** supporting the photoconductor, an electrostatic charge is imparted to the photoconductor surface. Potentials of between 600 and 2,000 volts D. C. have been found to be suitable to impart the desired charge to the surface of the photoconductor.

The two charging rollers **122** are mounted in bearing blocks **128** which are free to toggle and are insulated to permit the rollers to be maintained at a desired potential. Rollers **122** are spring loaded by means of springs **129** and are driven by friction when forced against the photoconductor drum. Other means (not shown) may be provided for changing the pressure of the rollers **122** against the photoconductor drum, or for adjusting the spacing of the rollers relative to the drum. Other means (not shown) are provided to retract the rollers away from any contact with the photoconductor surface, during periods when the printer is not in use.

In the process as presently contemplated, after an electrostatic charge is applied to the photoconductor, the photoconductor is exposed to the information which is to be recorded. To accomplish this, means are provided for rotating the drum **100** while applying the electrostatic charge to the drum, after which it comes to a stop, and the potential impressed on rollers **122** is removed. While drum **100** is at rest, it is exposed to information derived from any suitable source. The present apparatus is designed specifically to photograph information portrayed as a single horizontal line of light, the intensity of which is modulated along its length. Information on this form may be derived from a film illuminated by a slit of illumination, or from a cathode ray tube face scanned in a single direction.

An optical system **140** conveys the information from a source (not shown) to a point E on the photoconductor drum surface, by means of a lens **142** and a mirror **144**, both mounted to permit any necessary adjustment. The lens and mirror chosen may, if desired, transmit the information either reduced or magnified in size or intensity, by the use of means common in the science of optics.

The light image striking the photoconductive cylinder at E discharges the charge on the cylinder, at the points illuminated by the image, in an amount corresponding to the intensity of the illumination and the length of exposure to the illumination, while the unilluminated portions retain the charge thereon. In this manner there is provided what is termed a latent electrostatic image.

For developing the latent electrostatic image into a visible representation of the information producing the latent image, developing means **160** is provided. Means **160** consists of a roller **162** and a recirculation-system for delivering developer to the roller and for returning excess developer from the roller to a tank from which it is withdrawn and recycled. The recirculation system comprises a tank and pump (not shown) a conduit **174** leading from the pump outlet to a manifold **176** provided with four needle valves **178** through which the liquid developer is dripped onto the developer roller, a pan **164** into which excess liquid falls and from which the excess liquid flows by gravity back to the tank and thence to the pump by which it is delivered to the manifold, under sufficient pressure to provide the desired rate of flow. A drip rate of about one drop every 5 seconds, from each of the needle valves, has been found to be satisfactory, but the rate would obviously depend upon the composition of the developer and the density desired in the visible image.

The visible image so produced is carried along the travel of drum **100** to arrive at a printing means **180**. After drum **100** comes to rest, the visible image is transferred to a permanent record medium **181**. As shown, a spring **183** urges means **180** into contact with drum **100**. Means **180** includes a carriage **182** pivoted at **184** and supporting a paper feed mechanism comprising synchronously driven pin feed drive rollers **186, 186'**. The latter pull the paper over a print nose or print bar **188**

which may advantageously be a freely rotatable cylinder. The print bar is brought into contact with the visible image on drum **100** by a suitable mechanical system such as a pair of cams **192**, solenoid actuated cam followers and pivot **184** which permit the print bar and the permanent record medium to move into close contact with the drum **100** while the machine is at rest and to be retracted before the drum **100** begins to rotate again. Any suitable adjusting means is provided for varying the time of dwell during which the print bar forces the paper into contact with the developed image on the photoconductor drum.

To restore the photoconductor drum to a condition suitable for a repetition of the process, cleaning means **190** is provided. This means consists of a soft composition roller **193**, preferably of gelatin, drive means (not shown) for rotating it so that at the point of contact between roller **193** and drum **100**, the surfaces are travelling in the same direction although at different speeds, and means **194** for applying clean solvent to the drum in order to wash off any residue of particulate material remaining after transfer of the visible image to a permanent record medium. Clean solvent is applied to roller **193** by means of a manifold **196**. The cleaning liquid and any material removed from the surface of drum **100** is collected in a pan **198** and may, if desired, be filtered or otherwise separated, so as to permit the repeated use of the cleaning fluid. Alternatively, the recovered liquid may be utilized in the preparation of additional developer.

Either an electrical or a mechanical system may be provided for the purpose of controlling the initiation and duration of the individual operations in the cycle. In the embodiment illustrated in this application we have shown an apparatus in which the exposure and printing are controlled by electrical timers. Obviously, mechanical equivalents may be employed to obtain the same results, without departing from the spirit of this invention.

Referring now to Figure 2, a semi-exploded view of the electrophotographic device and the mechanical and electrical means for operating the device, **200** designates a synchronous motor coupled to the apparatus through a magnetic clutch **202** and brake **204**. The motor runs continuously and drives the individual means for charging, developing, printing and cleaning by way of a gear box **266** between the cam shaft drive and the photoconductor drum **100** which is designed so that one revolution of the cam shaft is equivalent to the desired arc of rotation of the photoconductor drum. These parts are driven only when the magnetic clutch is energized. The intervals during which the several means are stopped or deenergized are controlled by a detent cam **206** and a cam follower **208**. Cam **206** is keyed to brake **204** and magnetic clutch **202** and makes one complete revolution in 1.5 seconds when directly coupled to the synchronous motor **200**. The timed operations of the electrophotographic processor depend on the cam **206** and on cam follower **208** which is mounted to travel along the surface of the cam. The movement of this bar controls the action of two microswitches **210** and **212** which are actuated by follower **208** and which control the timing.

As shown, cam **206** has two levels of actuation. When the cam follower reaches the first detent level A it actuates microswitch **210** which is connected in series with the coils of two control relays **214** and **216**. Relay **214** is a single pole relay whose normally closed contact is in series with the brake **204** and whose normally open contact is in series with the magnetic clutch **202**. When the relay is disconnected by microswitch **210**, the magnetic clutch is deenergized, the brake is energized, and power to drive the apparatus is no longer furnished by the motor **200**. Relay **216** is normally closed, and when opened, as by excitation of its coil by the action of microswitch **210**, it operates to disconnect the voltage to the charging roller. After the first microswitch is actuated, the drive shaft continues to rotate due to inertia until the cam follower **208** reaches the second detent level I, which is the index position for the apparatus.

A second microswitch **212** is actuated when the follower **208** reaches the second detent level I on cam **206**. When this microswitch is actuated, it causes a latching relay **218** to become energized. The relay's contacts **219** remain closed until released by coil **220** and latch **221**. Latching relay **218** is connected so as to initiate electronic delay timer **222**. Timer **222** is connected so that relay **224** is energized at the start of the time delay and is deenergized at the end of the time delay. When relay **224** opens, relay **226** closes and will stay closed until the latching relay **218** opens. Contacts **228** on relay **224** initiate the operation of a radar or other source of the information received through the optical system **140**, and also initiate the operation of a second timer **230**. This timer is an interval timer and is employed to initiate and control the duration of the interval during which the nose of the print bar **188** is in contact with the photoconductor drum. When relay **224** is energized, timer **230** is energized and the contacts of control relay **232** in series with a solenoid **234** close, energizing the solenoid. This causes the print bar to be dropped so as to press the web of paper against the visible image on drum **100**. Relay **232** is deenergized at the end of the interval set by timer **230** and the paper covered print bar is then raised out of contact with the photoconductor cylinder.

At the end of the time delay as set by timer **222**, relay **226** closes. This energizes a solenoid **236** controlling the movement of cam follower bar **208**. Cam follower bar **208** is urged against the surface of cam **206** by means of a spring (not shown) and solenoid **236** is provided for pulling the bar away from the cam surface. When energized, the solenoid retracts the bar **208** to a position in which it is out of contact with cam **206**. When the cam follower is retracted, microswitch **210** returns to its normally closed position and relays **214** and **216** become energized, removing the braking action of brake **204** and placing the magnetic clutch **202** and the voltage supply to the charging rollers in operation. A second set of contacts on relay **226** initiate the time delay on a timer relay **238** which is provided to return cam follower bar **208** to the surface of cam **206** at the end of the present delay time. In this manner cam follower **208** is positioned on the periphery of the cam before the bar reaches the first detent position. The cycle then repeats.

As shown in Figure 2, the pump **240** for the cleaning fluid, the pump **242** for the liquid developer and the paper feed drive **246** are all continuously energized. Each of the remaining driven portions of the apparatus is controlled by the motor **200**, clutch **202** and brake **204** and gear box **266**, as above described. In this manner each of the driven means **100**, **120**, **160**, **180** and **190** is caused to move or to remain at rest for intervals determined by action of the detent cam and follower and the associated control means as has been described above.

From time to time it may be found desirable to improve the quality of the recorded image. For this purpose voltage may be impressed between the photoconductor and either the charging roller, the developing roller, or the paper take-off (i. e. the print nose **188**). Lines **250**, **252**, **254** and **256** to appropriate power supplies of direct current voltage are shown, and all of the rollers in the printer, that is, the drum **100**, charging rollers **122**, developer roller **162** and cleaning roller **193** are mounted in insulating bearing blocks to permit holding any of these rollers at any desired potential relative to ground potential. Power is supplied by sources **258**, **260**, **262** and **264** to provide the necessary relative potential between drum **100** and the several portions of the apparatus, and to the clutch and brake.

In Figure 4 drum **100** is represented as if it were divided into five imaginary sections: P, Q, R, S, and T, in which each of the operations of the process is performed. Charging, developing and cleaning are performed with the drum in motion, and exposure and priniting are effected with the drum at rest.

With the drum in motion, a clean portion P of the drum free of all traces of developer or charge from prior operations, or initially clean, moves through an arc sufficient to carry it through the charging zone, where a uniform electrostatic charge is rolled onto the photoconductor **108** covering drum **100**, by means of charging rollers **122**. Sector P of the drum comes to rest with the center of the sector approximately at the point E where information enters the apparatus through the optical system **140**. With drum **100** at rest, the charged portion of the photoconductor is exposed to this information in the form of a light and shadow pattern of illumination which falls on the photoconductor. After exposure for the desired length of time, the drum **100** rotates through the same arc as before, causing the sector P to pass developer means **160** by which developer liquid is being continuously trickled onto drum **100**. In this manner the latent image formed on sector P when this portion of the cylinder was exposed, is converted to a visible image.

To produce a permanent record of the visible image on the surface of drum **100**, sector P has rotated past the developing means and comes to rest with the visible image opposite the nose of the print bar. After drum **100** has rotated through the necessary arc and come to rest, the print bar nose and the web of paper carried on the print bar carriage is brought into contact with the surface of the drum to effect transfer of the developed image from the drum **100** to the paper. The print bar assembly **180** is retracted before rotation of drum **100** resumes. Following printing, sector P of the drum is rotated past a cleaning means to restore the sector to a condition suitable for a repetition of the process. It will be understood that while sector P is being charged, exposed, developed, printed or cleaned, sectors Q, R, S and T are being simultaneously processed by the other means located around the periphery of drum **100**. Thus, while sector P is being developed, Q is being charged; while P is being printed Q is being exposed, and while P is being cleaned Q is being developed and R is being charged.

For purposes of illustration, the 360° of arc of drum **100** has been shown as divided into five sectors, each 72° in extent. Obviously this would produce undue wear on limited areas of the surface and hence sectors P, Q, R, S and T will be either slightly greater than 72° or somewhat smaller. We have used an arc of 78° in order to offset the line of exposure around the drum, during repetitions of the process, but the arc may be chosen sufficiently small that repetition of the process moves the image around the surface of the drum by an offset amount equal to the width of the line image being recorded. Obviously this may involve storing the latent or visible image for a short interval while it approaches or departs from the zone of development, but with suitable photoconductors no difficulties along this line have been experienced.

Suitable photoconductors for the present apparatus are well known in the art and include those enumerated in Carlson Patent 2,297,691 as well as amorphous selenium. Liquor developer compositions which may be used include those described in The Journal of Scientific Instruments, volume 32, No. 2, February 1955 (British), particularly in a note by K. A. Metcalf on pages 74 and 75 thereof. The cleaning liquid may be any of the hydrocarbons employed as vehicles for the liquid developer, kerosene being particularly suitable where the hazard of fire is minimal.

For purposes of illustration, there follow an outline of one complete cycle of operation.

One cycle of operation

Seconds	Operation
0	*a.* Follower 208 riding on cam 206 approaches first detent level A on cam. *b.* Charging voltage on photoconductor.
0.9	*a.* Follower 208 reaches first detent level A on cam 206. (1) magnetic clutch deenergized. (2) charging voltage off.
1.0	*a.* Follower 208 reaches second level I on cam 206 and indexes the shaft. (1) delay timer 222 initiated; (*a*) radar triggered. (2) interval timer 230 initiated; (*a*) print bar and paper to move into contact with drum 100.
1.2	*a.* End of timer 230 time delay. (1) print bar retracted.
2.5	*a.* End of timer 222 time delay. (1) radar sweep stopped. (2) timer 238 initiated. (3) Follower 208 retracted from cam 206.
2.55	*a.* Microswitch 210 actuated. (1) magnetic clutch energized; drive shaft rotates. (2) charging voltage on.
2.86	*a.* End of timer 238 time delay. (1) follower 208 replaced on periphery of cam 206. (2) timers reset.
3.00	Same as 0 seconds.

We claim:

1. An electrophotographic apparatus comprising: a photosensitive element composed of an electrically conductive support and a photoconductive coating thereon; means for causing said photosensitive element to move intermittently and to remain at rest, selectively; means for imparting a uniform electrostatic charge to the photoconductive coating while said photosensitive element and said means for charging are in motion relative to one another; means for exposing said photosensitive element to information in the form of a light and shadow pattern of intelligence while said photosensitive element is at rest, thereby reproducing said pattern in the form of a latent electrostatic image on said photoconductive coating; means for converting said latent image into a visible image while said photosensitive element and said means are in motion relative to one another; means for transferring said visible image to a continuously moving permanent record medium while said photosensitive element is at rest; and means for cleaning the photosensitive element to prepare it for a repetition of the process, said means for cleaning being operative during a period of motion of the photosensitive element.

2. An electrophotographic apparatus comprising: a photosensitive element composed of an electrically conductive support and a photoconductive coating thereon; means for causing said photosensitive element to intermittently move and to remain at rest, selectively; means for rolling a uniform electrostatic charge on the photoconductive coating while said photosensitive element and said means for charging are in motion relative to one another; means for exposing said photosensitive element to information in the form of a slit-like light and shadow pattern of intelligence while said photosensitive element is at rest, thereby reproducing said pattern in the form of a latent electrostatic image on said photoconductive coating; liquid developer means for converting said latent image into a visible image while said photosensitive element and said means are in motion relative to one another; means for transferring said visible image to a continuously moving permanent record medium while said photosensitive element is at rest; and means for cleaning the photosensitive element to prepare it for a repetition of the process, said means for cleaning being operative during a period of motion of the photosensitive element.

3. An electrophotographic apparatus comprising: a photosensitive element composed of an electrically conductive support and a photoconductive coating thereon; means for causing said photosensitive element to move intermittently and to remain at rest, selectively; means for imparting a uniform electrostatic charge to the photoconductive coating while said photosensitive element and said means for charging are in motion relative to one

another; means for exposing said photosensitive element to information in the form of a slit of light and shadow pattern of intelligence while said photosensitive element is at rest, thereby reproducing said pattern in the form of a latent electrostatic image on a narrow band of said photoconductive coating; means for converting said latent image into a visible image while said photosensitive element and said means are in motion relative to one another; means for transferring said visible image to a continuously moving permanent record medium while said photosensitive element is at rest; and roller means for cleaning the photosensitive element to prepare it for a repetition of the process, and roller means for cleaning being in contact with said photoconductive coating during a period of motion of the photosensitive element and moving relative to said photoconductive coating.

4. An electrophotographic apparatus comprising: a rotatably mounted cylindrical photosensitive element having a photoconductive coating supported on an electrically conductive support; drive means for rotating said cylinder and for interrupting the rotation of said cylinder; and means for controlling said drive means to cause said cylinder to pass the following in sequence: a charging means for applying a uniform electrostatic charge to a sector of the photoconductive coating on said cylinder during rotation of said cylinder; means for exposing said charged sector to information in the form of a pattern of illumination while said sector is at rest; means for applying a liquid developer to the latent image formed by said illumination, to develop said image into a visible image during a period of rotation of said sector; means for transferring said information to a continuously moving permanent record medium during a period when the motion of said sector is arrested; and cleaning means for removing any residue of said information, during a period of rotation of said cylinder.

5. An electrophotographic apparatus comprising: a rotatably mounted cylindrical photosensitive element having a photoconductive coating supported on an electrically conductive support drive means for rotating said cylinder and for interrupting the rotation of said cylinder; solenoid controlled means for moving a permanent record medium into and out of contact with the photoconductive coating on said cylinder, and means for controlling said drive means to cause said cylinder to pass the following in sequence: a charging means for applying a uniform electrostatic charge to a sector of the photoconductive coating on said cylinder during rotation of said cylinder; means for exposing said charged sector to information in the form of a pattern of illumination while said sector is at rest; means for applying a liquid developer to the latent image formed by said illumination, to develop said image into a visible image during a period of rotation of said sector; means for transferring said information to a continuously moving permanent record medium during a period when the motion of said sector is arrested; and cleaning means for removing any residue of said information, during a period of rotation of said cylinder.

6. An electrophotographic apparatus comprising: a rotatably mounted cylindrical photosensitive element having a photoconductive coating supported on an electrically conductive support; drive means for rotating said cylinder and for interrupting the rotation of said cylinder; solenoid controlled means for moving a permanent record into and out of contact with the photoconductive coating on said cylinder; and means for controlling said drive means to cause said cylinder to pass the following in sequence: a charging means for applying a uniform electrostatic charge to a sector of the photoconductive coating on said cylinder during rotation of said cylinder; means for exposing said charged sector to information in the form of a slit of illumination while said sector is at rest; means for applying a liquid developer to the latent image formed by said illumination, to develop said image into a visible image during a period of rotation of said sector; means for transferring said information to a continuously moving permanent record medium during a period when the motion of said sector is arrested; and cleaning means for removing any residue of said information, during a period of rotation of said cylinder.

7. An electrophotographic method in which information in the form of a slit of light the intensity of which varies along the length of the slit, is converted into a permanent visible record according to the following procedure: exposing a photosensitive element comprising an electrically conductive support coated with a photoconductive material carrying a uniform electrostatic charge to the information to be recorded; developing the latent electrostatic image formed as a result of said exposure into a visible image of the information, by application of a liquid containing particles of an electrostatically attractable powder to exposed photoconductive material; and transferring said visible image from said photoconductive element to a continuously moving permanent record medium while said photoconductive surface is at rest.

8. An electrophotographic method in which information in the form of a slit of light the intensity of which varies along the length of the slit, is converted into a permanent visible record according to the following procedure: exposing a photosensitive element comprising an electrically conductive support coated with a photoconductive material carrying a uniform electrostatic charge to the information to be recorded; developing the latent electrostatic image formed as a result of said exposure into a visible image of the information, by application of a liquid containing particles of an electrostatically attractable powder to exposed photoconductive material; transferring said visible image from said photoconductive element to a continuously moving permanent record medium while said photoconductive surface is at rest, and thereafter cleaning said photoconductive surface to prepare it for a repetition of the process.

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