United States Patent

James

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[54] CONTROL APPARATUS AND METHOD FOR A PHOTOGRAPHIC DEVICE

[72] Inventor: **Claire L. James**, Pittsford, N.Y.

[73] Assignee: **Eastman Kodak Company**, Rochester, N.Y.

[22] Filed: **Sept. 2, 1969**

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[52] **U.S. Cl.** .....**95/13**, 95/89 R, 355/28

[51] **Int. Cl.** **G03b 17/50**

[58] **Field of Search**.....95/13 R, 89 R, 94 R, 89 G; 355/27, 28

[56] **References Cited**

UNITED STATES PATENTS

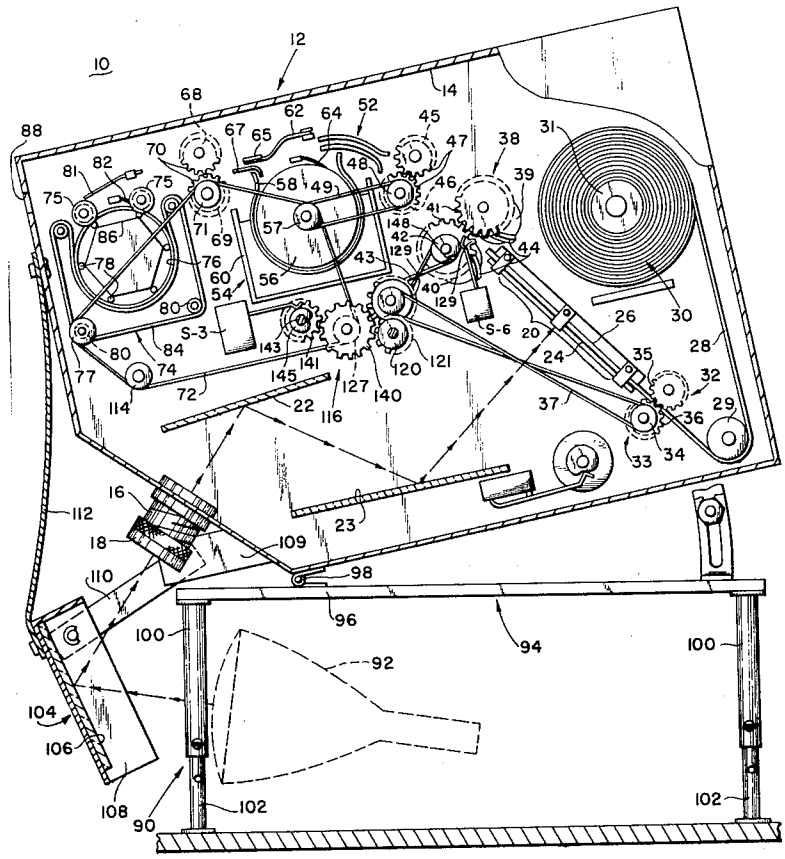
3,143,940	8/1964	Brown et al.	95/89 X
3,425,777	2/1969	White	95/89 X
3,442,589	5/1969	Ishikawa et al.	95/89 X
3,472,590	10/1969	Fairbanks et al.	355/28
3,500,734	3/1970	Lewis et al.	355/28 X

Primary Examiner—Samuel S. Matthews
Assistant Examiner—Fred L. Braun
Attorney—Robert W. Hampton and R. Lewis Gable

[57] **ABSTRACT**

Apparatus for controlling the operation of a processor of photographic materials. More specifically, the control apparatus functions to advance a predetermined length of the sensitized, photographic material from a supply thereof to an exposure station, expose the sensitized material to an image, advance and sever the exposed portion of the sensitized photographic material at a first relatively high velocity and direct the exposed sheet of sensitized material through a heated station at a second slower speed. Further, the first velocity of the severed sheet is maintained until the sheet is disposed substantially within the processing station to insure that the sheet is uniformly developed. Once the leading edge of the exposed sheet leaves the processing station, the velocity of the sheet of sensitized paper is increased to the first relatively high speed.

17 Claims, 3 Drawing Figures



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SHEET 1 OF 3

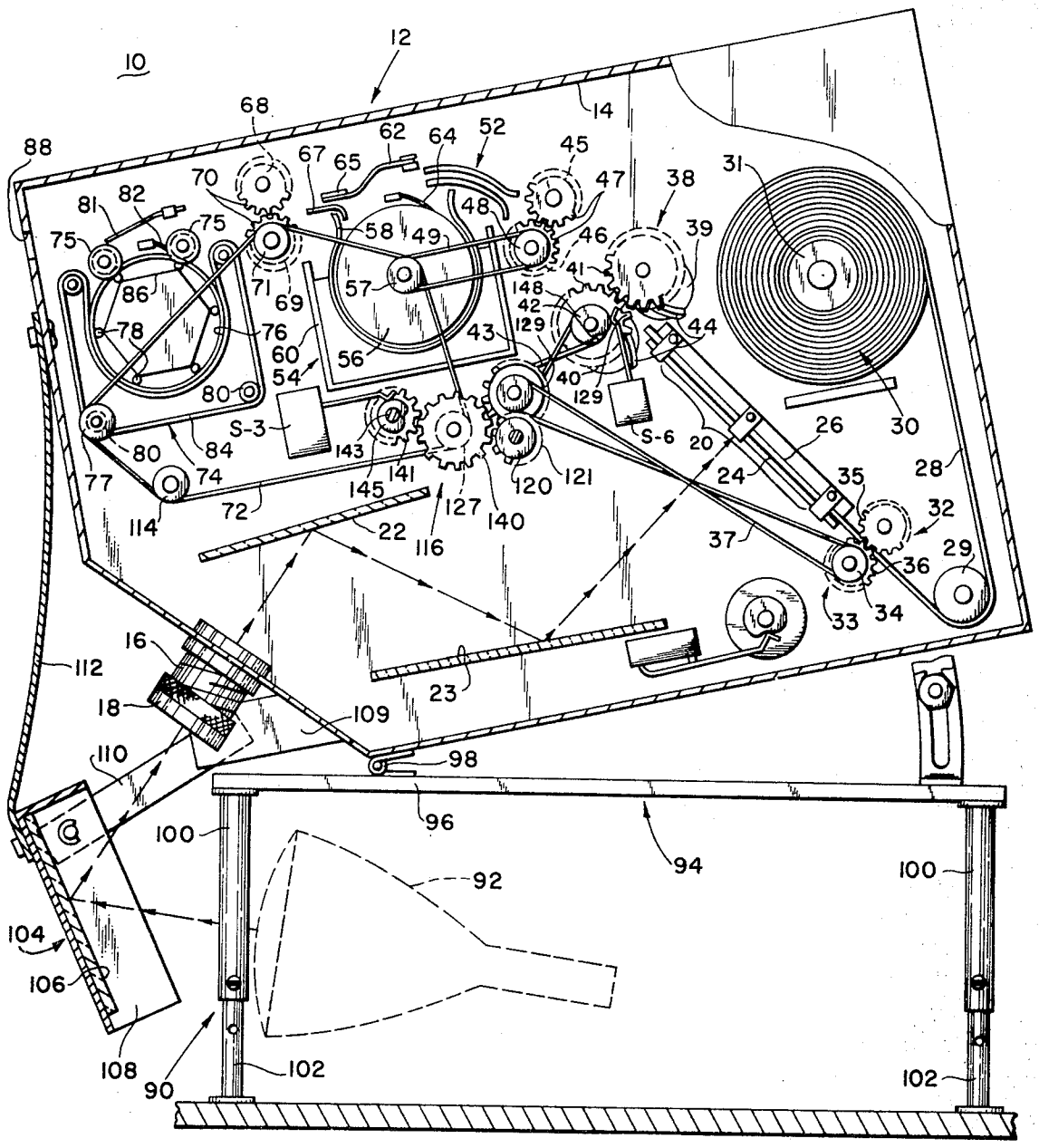


FIG. 1

CLAIRE L. JAMES
INVENTOR.

BY R. Lewis Gable
Robert W Hampton

ATTORNEYS

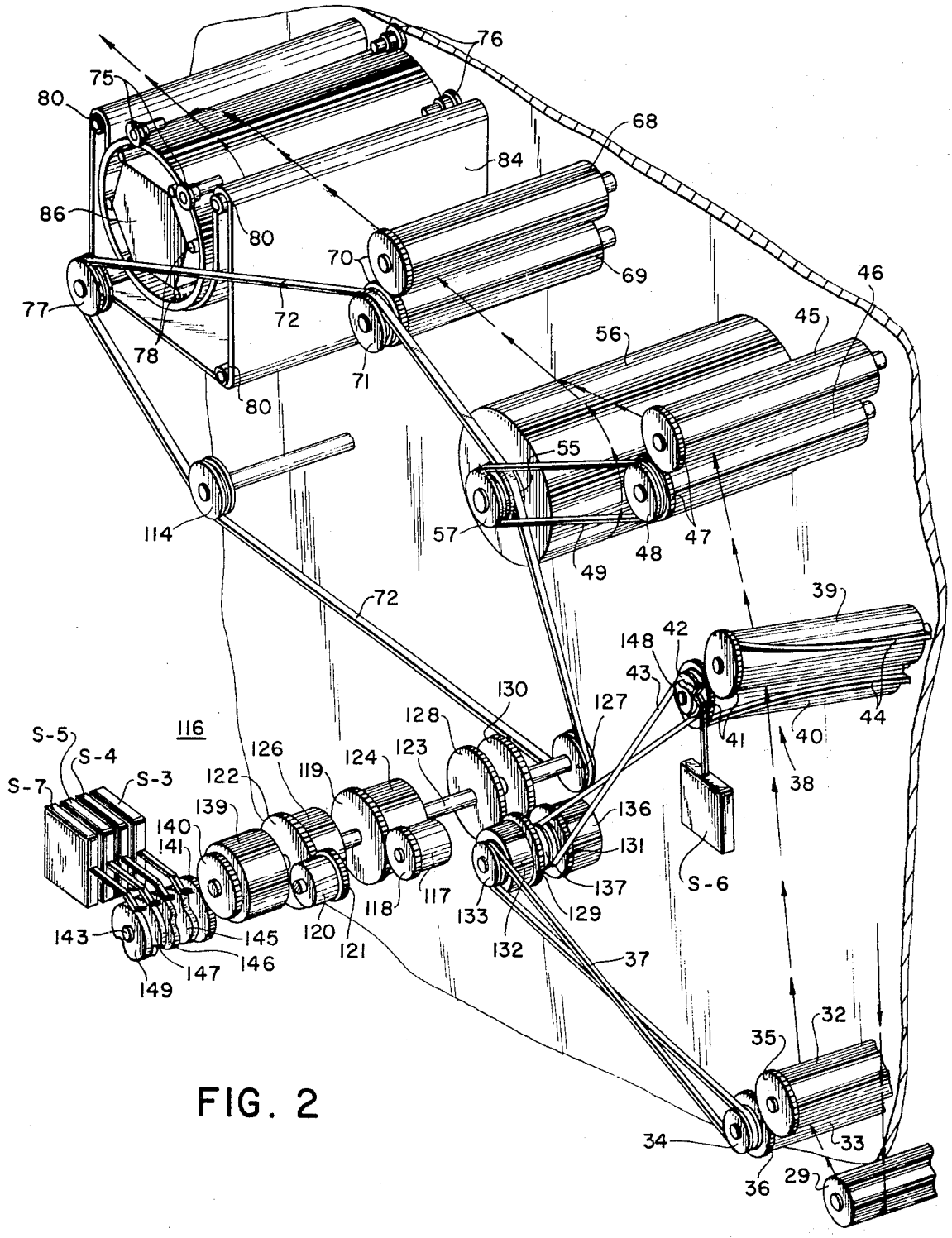


FIG. 2

CLAIRE L. JAMES
INVENTOR.

BY R. Lewis Gable
Robert W. Hampton
ATTORNEYS

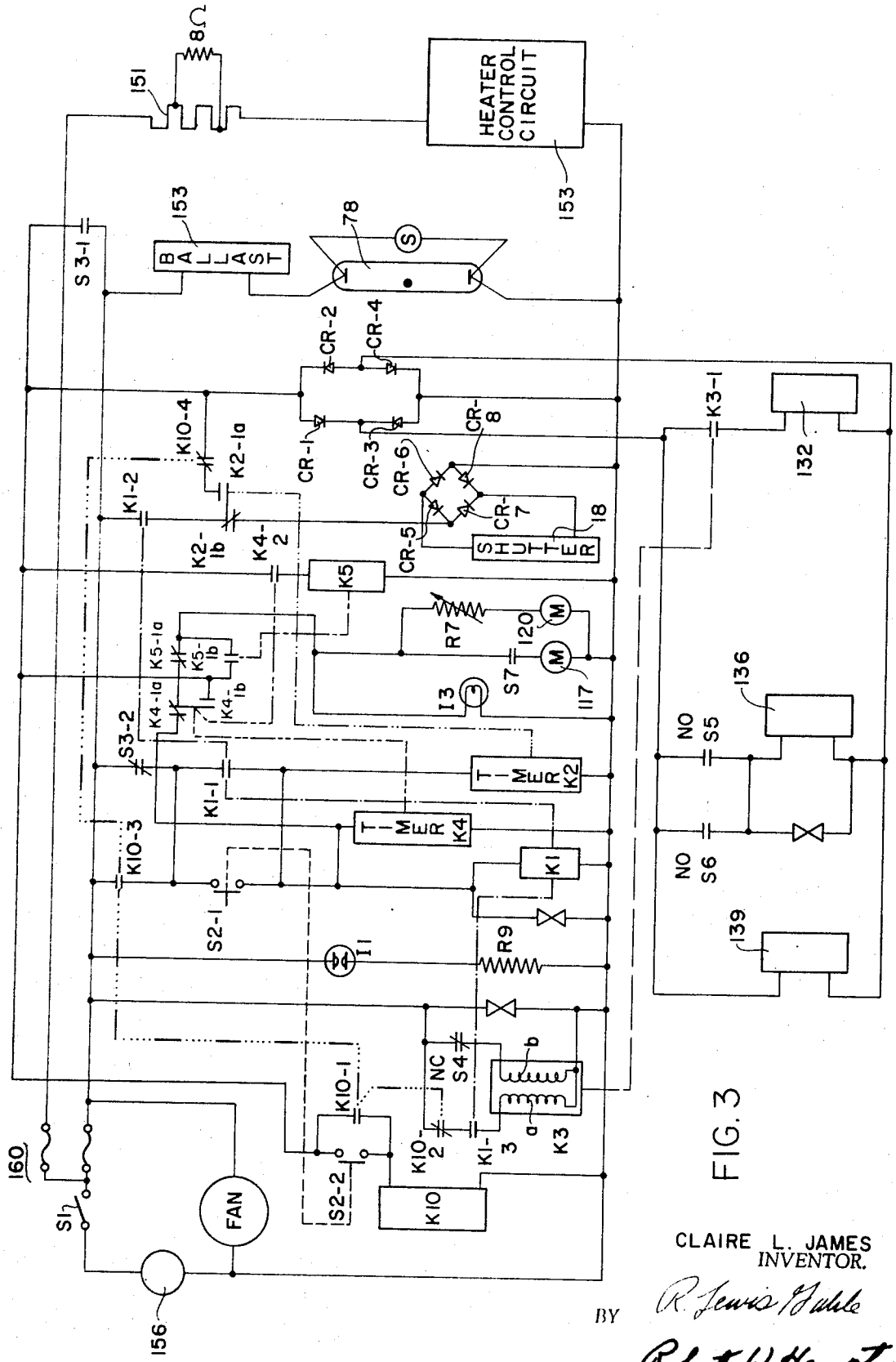


FIG. 3

CLAIRE L. JAMES
INVENTOR.

BY R. Lewis Gable

Robert W Hampton

ATTORNEYS

CONTROL APPARATUS AND METHOD FOR A PHOTOGRAPHIC DEVICE

CROSS-REFERENCES TO RELATED APPLICATIONS

Reference is made to commonly assigned copending U.S. Pat. application Ser. No. 625,590, entitled "Radiation Sensitive Silver Halide Systems," filed Mar. 24, 1967, now U.S. Pat. No. 3,447,927, in the name of Bacan and Barbier and U.S. Pat. application Ser. No. 481,918, entitled "Photodevelopment of Silver Halide Printout Materials," filed Aug. 23, 1965, now U.S. Pat. No. 3,418,122, in the name of Colt, U.S. Pat. application Ser. No. 854,870, entitled "Free Standing Camera Assembly" filed Sept. 3, 1969 in the name of John Morse, and U.S. Pat. application Ser. No. 854,993, entitled "Temperature Control Apparatus" filed Sept. 3, 1969, in the name of Raymond L. Nelson.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for exposing and developing a strip of sensitized material, and more particularly to apparatus for controlling the operation of such developing apparatus.

2. Description of the Prior Art

In the above-identified applications, Ser. Nos. 481,918 and 625,590, there is respectively described a sensitized material which may be exposed with a radiation image and a developing process in which sensitized material is successively heated for a controlled period and at a specified temperature, and then exposed to radiation in the ultraviolet range to develop the latent image. Typically, the sheet of sensitive material is withdrawn from a roll and then exposed at an exposure station where the sensitized paper is exposed to a radiation image, which exposure may require in the order of 3 to 5 seconds to complete. After exposure, the exposed portion is advanced and is severed by a suitable cutting mechanism before it is directed into a developing station which may illustratively take the form of a heating assembly and a photolyzing assembly in which the sensitized paper is heated and exposed to radiation of a selected wavelength. It is necessary that each sheet be uniformly heated and exposed to the source of radiation. In addition, it is also desirable to reduce the developing process time. If the velocity of the severed sheet of sensitized material through the processor is determined by the time required to heat and to expose the sheet to radiation, the access time for obtaining a reproduced copy of the image may be unnecessarily extended.

It is therefore an object of this invention to reduce the time required to develop an exposed sensitized sheet of material by directing the sheet of sensitized material through the developing apparatus at two differing velocities.

It is a further object of this invention to direct a sheet of sensitized material through a developing station at first and second velocities and also of obtaining the uniform development of the sensitized material within the developing station.

SUMMARY OF THE INVENTION

In accordance with the teachings of this invention, these and other objects and advantages are realized by a control apparatus for regulating the velocity at which a sheet of sensitized paper is directed through a developing processor. More particularly, the control apparatus functions to direct a sheet of sensitized material from a supply thereof, e.g., a roll, into an exposure station where it is exposed to a radiation image; next, the exposed portion of the sheet of sensitized material is severed and is advanced at a first relatively high velocity to the developing station. The severed sheet of sensitized material is directed at the first velocity until substantially within the developing station, at which time the control apparatus decreases the velocity at which the sheet is moved through the developing station to a second slower velocity dependent upon the time required to develop the sensitized sheet of material. When the leading edge of the sheet of sensitized material has emerged a small amount from the developing station, the control apparatus operates to increase the speed of the sensitized material to thereby assure the uniform development of sensitized sheet within the developing station.

The invention and its advantages will become more apparent in the detailed description of the preferred embodiments presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

FIG. 1 is a sectioned, side view of apparatus for developing sheets of sensitized material by a control apparatus in accordance with the teachings of this invention;

FIG. 2 is an orthogonal view of the apparatus for controlling the developing apparatus shown in FIG. 1; and

FIG. 3 is a schematic view of an electrical circuit which operates in combination with the mechanical apparatus shown in FIG. 2 for controlling the step-by-step operation of the developing apparatus shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and in particular to FIG. 1, there is shown a free-standing camera assembly **10** including a camera or reproducing assembly **12** adjustably mounted by a camera support assembly **94** so as to be able to record and to provide a copy of images derived from varying display devices such as a cathode-ray tube display device **90**. The camera assembly **12** includes a housing **14** upon which there is disposed a lens assembly **16** for focusing a radiation image derived from the cathode-ray tube display device **90** onto an exposure station **20**. A shutter **18** is mounted upon the lens assembly **16** and allows a radiation image to be directed onto the exposure station **20** for a period of time sufficient to expose that portion of a web or strip **28** of sensitized paper inserted within the exposure station **20**. A plurality of reflective surfaces **106**, **22** and **23** serve to direct the radiation image derived from the cathode-ray tube display device **90** onto the exposure station **20**. As seen in FIG. **1**, the exposure station **20** includes a transparent platen **24** made of a suitably transparent material such as glass, and a backup platen **26**. A narrow opening is provided between the transparent platen **24** and the backup platen **26** through which the web **28** of sensitized material is directed. Illustratively, the material of which the web **28** is made may take the form of the photographic material more completely described in the above-identified copending application Ser. No. 481,918.

A roll of the web **28** of sensitized material is rotatably mounted upon a shelf within the housing **14** so that the leading edge of the web **28** may be withdrawn over a spacing roller **29** by a pair of metering rollers **32** and **33**. As will be explained in greater detail later, the metering rollers **32** and **33** have respectively associated therewith a pair of gears **35** and **36** which are intermeshed together and driven by a drive belt **37** through a pulley **34**. As shown in FIG. **1**, the pulley **34** is connected to the gear **33**. The metering rollers **32** and **33** serve to withdraw a measured length of the web **28** of sensitized paper. For example, it may be desired to produce a letter-size copy of the image derived from the display device **90**; thus, the metering rollers **32** and **33** may be rotated for a period sufficient to advance approximately 11 inches of the web **28** of the sensitized material. Next, the shutter **18** is activated to thereby expose that portion of the web **28** disposed at the exposure station **20** with a latent image. At the end of the exposure, the exposed portion of the web **28** is advanced by the metering rollers **32** and **33** to thereby bring an unexposed portion of the web **28** into the exposure station **20**.

The exposed portion of the web **28** is then severed by a cutting assembly **38** and advanced by intermediate drive rollers **45** and **46** to a heater assembly **54**. The cutting assembly **38** includes a pair of rollers **39** and **40** whose axes are angu-

larly disposed with respect to the path along which web **28** of sensitized material is driven. Each of the rollers **39** and **40** is attached to drive gears **41** which are intermeshed with each other and are driven through a pulley **42**. As will be explained later, the pulley **42** and thus the rollers **39** and **40** are rotated by a drive belt **43**. A pair of cutting edges **44** are disposed on the rollers **39** and **40** and when rotated in opposite directions sever the strip or web **28** of sensitized material as it is moved toward the intermediate rollers **45** and **46**. The intermediate rollers **45** and **46** are driven by a drive belt **49** connected to a pulley **48**; in turn, the pulley **48** is connected to one of a pair of gears **47**, which are connected to the intermediate rollers **45** and **46** and are intermeshed together.

The severed piece or portion of the web **28** is directed from the intermediate rollers **45** and **46** through a passage formed by a pair of guide plates **52** into the heater assembly **54**. The severed piece of sensitized material is subjected to heat in the heater assembly **54** and then sequentially directed to a photolyzing assembly **74** whereat the piece of sensitized material is exposed to radiation in the ultraviolet range. The steps and process by which this process may be carried out are more completely and illustratively described in the above-identified copending application Ser. No. 625,590.

As shown in FIG. **1**, the heater assembly **54** includes a drum **56** which may be rotatably driven through a pulley **55** (see FIG. **2**) by a drive belt **72**. A guide plate **58** provides a curved surface disposed about the drum **56** so that the sheet of sensitized material may be directed therebetween as the drum **56** rotates. The inner surface of the guide plate **58** may be coated with a suitable material such as Teflon in order to facilitate the movement of the sheets of sensitized material thereby. A plurality of heating elements (not shown) may be disposed or imbedded on the outer surface of the guide plate **58**. A set of guide fingers **62** serve to direct the sheet of sensitized material from the guide plates **52** into a passage formed between the guide plate **58** and the drum **56**. A plurality of recesses may be disposed within the surface of the drum **56** and a set of striping members **64** may be disposed within the recesses to thereby remove the sensitized material from the drum **56** and to direct the sheet into a fixed guide plate **67**. The sheet of sensitized material may be cooled by a heat sink formed by the fixed plate **67** and a plate **65** connected to the guide fingers **62**. A heat shield **60** may be disposed about the drum **56** to prevent the undesired transmission of heat to the other parts of the apparatus **10**.

As the piece of sensitized paper emerges from the heating assembly **54**, the piece of sensitized paper is directed through the passage formed by the pair of guide fingers **62** and guide plate **67** and is cooled by a heat sink **65** attached in a heat conductive relation with guide fingers **62**. A pair of intermediate drive rollers **68** and **69** are disposed to direct the piece of sensitized paper from the heater assembly **54** into the photolyzer assembly **74**. The drive belt **72** serves to drive the intermediate drive rollers **68** and **69** through a pulley **71** which is connected to one of a pair of gears **70** associated with the rollers **68** and **69**. The gears **70** are intermeshed to drive in opposite directions the intermediate drive rollers **68** and **69**.

The photolyzer assembly **74** includes a drum **76** made of a suitably transparent material. The drum **76** is suspended upon a belt **84** in floating relationship and is held thereon by a plurality of plastic bearing members **75**. Inside the drum **76**, there is disposed a plurality of suitable sources of ultraviolet radiation such as lamps **78**. A reflector assembly **86** is disposed within the drum **76** to present a plurality of reflective surfaces for directing the ultraviolet radiation onto the sensitized material directed about the drum **76** to thereby photolyze or develop the latent image disposed upon the piece of sensitized material. The belt **84** (or a plurality of such belts) is mounted on a plurality of rollers **80** so that a portion of the belt will follow the contour of the drum **76**. A drive pulley **77** is connected to one of the rollers **80** and is rotatively driven as shown in FIGS. **1** and **2** by the drive belt **72**. As is apparent from FIG. **1**, the belt **84** serves to place the severed sheet of sensitized material into intimate contact with the surface of the drum **76**. A set of guide fingers **81** is pivotally mounted to direct the piece of sensitized material from the intermediate drive roller **68** and **69** into the photolyzer assembly **74**. Further, a set of striping members **82** are flexibly disposed against the surface of the drum **76** to separate the piece of sensitized material from the drum **76** and to direct the piece to an exit opening **88** through the housing **14**.

As shown in FIG. **1**, the cathode-ray tube display device **90** includes a cathode-ray tube **92** having a display surface upon which images are disposed in a manner well known in the art. The cathode-ray tube **92** is disposed within a housing upon which the camera support assembly **94** mounts the camera assembly **12**. The camera support assembly **94** includes a mounting plate **96** upon which the camera assembly **12** is pivotally mounted as shown in FIG. **1** by a hinge **98**. As a result, the angular orientation of a camera assembly **12** with respect to the mounting plate **96** may be selectively adjusted so that the images derived from the display surface may be directed from the reflective surface **106** onto the camera assembly **12**. In addition, the height of the mounting plate **96** may be adjusted to accommodate housings of various sizes. More specifically, the mounting plate **96** is supported by four legs **100** having, respectively, raised extensions **102** which may be extended or retracted.

In FIG. **1**, there is shown a pulldown assembly **104** for adjustably disposing the reflective surface **106** from a first position remote from the display surface of the cathode-ray tube **92**, thereby allowing an operator to clearly view the cathode-ray tube **92**, to a second position as shown in FIG. **1**, wherein the reflective surface **106** is disposed to direct the radiation image derived from the cathode-ray tube **92** onto the camera assembly **12**. The pulldown assembly **104** includes a U-shaped light hood **108** upon which the reflective surface **106** is mounted. A flexible light shield **112** made of a suitably opaque material is secured at one end to the light hood **108** and at its other end to the housing **14**. It is noted that the flexible light shield **112** and the U-shaped light hood **108** serve to prevent ambient light from being directed into the lens assembly **16** when an exposure is being made. The light hood **108** is mounted upon the housing **14** by a pair of bracket members **109** (only one of which is shown) and a pair of pivoting members **110** rotatably connected to the bracket members **109**. In turn, the U-shaped light hood **108** is rotatably connected to the pivoting members **110** so that the light hood **108** and the reflective surface **106** may be adjustably disposed with respect to the display surface. For a more complete discussion of an illustrative embodiment of the camera support assembly **94** and the pulldown assembly **104** reference is made to the above-identified copending application of Mr. John Morse.

With reference to FIG. **2**, there is shown a programing assembly **116** for controlling the operation and energization of the various elements of the reproducing assembly **12**. In particular, the programming assembly **116** includes a high-speed motor **117** and a low-speed motor **120** which may be selectively coupled to a drive shaft **123** by overrunning clutches **124** and **126** respectively. The high-speed motor **117** is rotatively connected to a gear **118** which in turn meshes with a gear **119**, which is rotatively connected to the output of the overrunning clutch **124**. Similarly, the low-speed motor **120** is rotatively connected to a gear **121** which meshes with a gear **122** associated with the overrunning clutch **126**. Thus, either motor **120** or **117** may be energized without the necessity of disengaging the other motor from the drive shaft **123**. In turn, the drive shaft **123** is rotatively connected to a drive pulley **127** about which is disposed the drive belt **72** for imparting a rotational motion to the pulleys **55**, **57**, **71**, and **77**. A pulley **114** is disposed as shown in FIGS. **1** and **2** to provide an appropriate tension to the drive belt **72**. The drive belt **72** and the associated pulleys **57**, **55**, **71**, and **77** provide suitable means for transmitting a rotational motion to the cutting rollers **39** and **40**, the intermediate drive rollers **45** and **46**, the drum **56**, the intermediate drive rollers **68** and **69**, and the drum **76**.

In addition, the rotational motion imparted to the drive shaft **123** may be selectively applied to the metering rollers **32** and **33** by a magnetic clutch **132**. More specifically, a gear **128** is rotatively connected to the drive shaft **123** and engages a gear **129** associated with the input to the selective clutch **132**. When energized, the selective clutch **132** applies a rotational motion to the pulley **133**, which in turn drives the pulley **34** through a belt **37**. The pulley **34** is connected as explained above to rotate the metering rollers **32** and **33**. In a similar fashion, the drive shaft **123** is selectively connected by a magnetic clutch **136** to rotate the cutting rollers **39** and **40**. More specifically, a gear **130** is rotatably connected to the drive shaft **123** and further meshes with a gear **131** connected to the input of the selective clutch **136**. When energized, the selective clutch **136** transmits the rotational motion to a pulley **137** which in turn transmits the rotational motion to the cutting rollers **39** and **40** through the belt **43** and the pulley **42**. The pulley **42** is rotatively coupled to a timing cam **148**, which serves to selectively actuate switch S–**6**. Further, the drive shaft **123** is selectively connected to a timing shaft **143** by a selective clutch **139**. More particularly, the rotational output from the clutch **139** is connected to a gear **140** which meshes with a gear **141** rotatively coupled to the timing shaft **143**. The timing shaft **143** is connected to a plurality of timing cams **145**, **146**, **147**, and **149** which are respectively associated in an actuating relationship with switches S–**3**, S–**4**, S–**5**, and S–**7**. As the timing shaft **143** is selectively rotated, the timing cams will selectively open and/or close the switches S–**3**, S–**4**, S–**5**, and S–**7**.

Referring now to FIG. **3**, there is shown an electrical circuit **160** for controlling the operation of the various elements of the camera assembly **10** and in particular for timing the energization of the various switches and clutches shown in FIG. **2**. More specifically, a source **156** of alternating current potential is applied by an "on/off" switch S**1** to the electrical circuit **160**. With the closing of switch S**2**, potential is applied through normally closed switch contact S**3**–**2** and switch contact S**2**–**1** to energize relay K**1** to thereby operate contacts K**1**–**1**, K**1**–**2** and K**1**–**3**. As contact K**1**–**1** closes, potential is applied to timer K**2** to initiate a timing cycle, and potential is applied through contacts K**1**–**2** and K**2**–**1***b* to a bridge made up of diodes CR–**5**, CR–**6**, CR–**7**, and CR–**8**. The rectified potential derived from this bridge is applied to activate the shutter **18** thereby exposing that portion of the sensitized material **28** disposed in the exposure station **20**. After a period of time corresponding to the desired exposure, timer K**2** will open contact K**2**–**1***b* thereby closing the shutter **18**. As contact K**1**–**3** is closed, potential is applied to energize the pickup coil *a* of relay K**3**; as a result, contact K**3** will be closed. As contact S**2**–**1** is closed, potential is applied to a timer K**4** which after an adjustable delay operates K**4**–**1***a*, and K**4**–**1***b*. During the delay set by timer K**4**, potential is applied through contacts K**4**–**1***a* a and normally closed contact K**5**–**1***a* to the high-speed motor **120** which rotates the heater drum **156** for approximately one-half of a revolution to maintain the drum **156** uniformly heated.

After timer K**2** has timed out, normally open contact K**2**–**1***a* is closed thereby applying a potential through contact K**1**–**2** and contact K**10**–**4** to a bridge formed of diodes CR–**1**, CR–**2**, CR–**3**, and CR–**4**. The rectified output from this bridge is applied to the selective clutch **139** thereby coupling the drive shaft **123** to the timing shaft **143** to initiate a timing cycle of the programming assembly **116**. As the timing shaft **143** begins to rotate, switch S**3** is the first to be actuated thereby closing contact S**3**–**1**. In addition, contact S**3**–**2** now opens and the timing shaft **143** continues to rotate as switch S**4** is activated to thereby close contact S**4**. As contact S**4** closes, the dropout coil *b* of relay K**3** is energized to thereby open contact K**3** and to deenergize selective clutch **132**. It is to be pointed out that the time period between the energization of selective clutch **139** and the deenergization of relay K**3**, i.e., the operation of switch S**4**, is selected to be sufficient to move the desired length of the web **28** of sensitized material into the exposure station **20** and subsequently to move the previously exposed portion of the web **28** into the developing station. For example, if the desired length of the copy sheet is 11 inches, the time period would be selected to permit the metering rollers **32** and **33** to advance approximately 11 inches of the web **28** of sensitized material before the clutch **132** is deenergized.

As the timing shaft **143** continues to rotate, switch S**5** is momentarily actuated to thereby close normally open contact S**5** and energize selective clutch **136**. As clutch **136** is energized, a rotational motion will be translated to the cutting rollers **39** and **40** to thereby bring the cutting edges **44** into contact with the web **28** and to sever that portion of the web **28** which has been exposed. As the cutting rollers **39** and **40** continue to rotate, cam **148** will actuate switch S**6** thereby closing contact S**6**; after switch S**6** has been closed, switch S**5** will be deactivated to thereby open contact S**5**. Next, switch S**6** will be deactivated and contact S**6** will be opened to thereby deenergize the selective clutch **136**. The period between the energization and deenergization of clutch **136** is selectively set to allow the cutting rollers **39** and **40** to rotate through a full revolution to thereby set the cutting edges **44** in a ready position for cutting the next portion of the web **28** of sensitized material.

With the energization of switch S**3**, potential is applied through contact S**3**–**1** and normally closed contact K**4**–**2** to a relay K**5** to thereby close normally open contact K**5**–**1***b* . With the closing of contact K**5**–**1***b* , potential may be applied through contact S**3**–**1** and contact K**5**–**1***b* to the switch contact S**7**. As timing shaft **143** and cam **149** continue to rotate, switch S**7** will be activated to thereby energize the high-speed motor **117**. Due to the presence of the overrunning clutch **126**, the drive shaft **123** will be rotated at the higher speed to thereby drive the web **28** of sensitized material into the exposure station **20** at a higher speed and also to rotate the intermediate drive rollers **45** and **46** at a higher speed until the severed sheet of sensitized material is substantially disposed within the heater assembly **54**. At this point, switch S**7** is deactivated thereby opening contact S**7** and deenergizing the high-speed motor **117**. Thus, the relatively low-speed motor **120** will continue to rotate the drive shaft **123** and the exposed sheet of sensitized material will be driven through the heater assembly **54** at a relatively slow speed dependent upon the time required to stabilize the exposed image by the application of heat. As explained more fully in the above-identified copending application to Raymond L. Nelson, a heater element **151** is disposed within the heater assembly **54** and its energization is regulated by a heater control circuit **153** including a temperature-responsive element for controlling the heat applied to the sensitized material.

As the leading edge of the severed sheet of sensitized material emerges from between the drum **56** and the guide plate **58**, the switch S**7** is again activated to close switch S**7** and to energize motor **117**. As a result, the drive shaft **123** will be driven at a relatively high speed and the intermediate drive rollers **68** and **69** and the drum **56** will be rotated at a higher speed to thereby move the severed sheet of sensitized material more rapidly from the heater assembly **54** and into the photolyzer assembly **74**. After substantially the entire severed sheet of sensitized material has been disposed between the drum **76** and the belt **84**, the switch S**7** will be again rendered inoperative by the cam **148** to thereby open contact S**7** and deenergize the motor **117**. As a result, the drive shaft **123** will be driven by the slow-speed motor **120** to direct the severed sheet of sensitized material through the photolyzer assembly **74** at the slower speed. The sensitized material will be exposed to ultraviolet radiation emanating from a plurality of sources **78** which are energized as shown in FIG. **3** by a potential derived from source **156** and applied through a ballast **153** to the source **78**. Though a single source **78** and ballast **153** is shown in FIG. **3**, it is realized that a plurality of sources and ballasts could be connected in parallel across the source **156**. As the developed piece of sensitized material emerges from between the drum **76** and the belt **84**, switch S**7** will again be

operated to close contact S7 and energize motor 117. As a result, the piece of sensitized material will be delivered from the photolyzer assembly 74 at the higher speed to be discharged from the camera assembly 14 through the exit opening 88. After the developed sheet has been discharged through the exit opening 88, switch S3 will be rendered inoperative to thereby return contact S3–1 to its normally open position and to thereby deenergize motors 117 and 120. When switch S3 is opened, the programing assembly has completed a single program cycle and is now ready for the next cycle, which may be initiated by operating switch S2.

An additional feature of the control circuit 160 provides that a second exposure may be made within the exposure station 20 while the first exposed portion of the web 28 is being processed through the heater assembly 54 and the photolyzer assembly 74. In particular, after the timer K2 has finished its timing operation and S3 has been activated indicating that fresh paper is available, the switch S2 may again be operated to commence the second exposure of the next portion of the web 28 while the first portion thereof is being developed. When the switch S2 is thrown, potential is applied through contact S3–1, contact S2–2 to energize relay K10 to thereby operate contacts K10–1, K10–2, K10–3 and K10–4. As contact K10–3 closes, potential is applied through contact K10–3, and switch contacts S2–1 to energize relay K1 and also timer K2. With contact K1–2 closed, potential is now applied through contact K1–2 and contact K2–1*b* to energize the shutter 18 thereby giving an exposure of the second portion of the web 28 of sensitized material. Because contact K10–4 has been opened by the energization of relay K10, no further energization of the shutter 18 will occur when timer K2 times out and contact K2–1*b* opens. Thus, the second portion is exposed and is now ready to be developed as soon as the first portion has been completely developed. More specifically, at the end of the first cycle switch S3 will be reopened indicating the completion of the development of the first exposed portion and the deenergizing of relay K10. As a result, contact K10–4 will be reclosed to thereby energize the bridge composed of diodes CR–1 to CR–4 and the clutch 139 and to start a second cycle which will develop the second exposed portion of the web of sensitized material. At the end of the second cycle, switch S3 will open thereby completing the cycle and preparing the camera apparatus 14 to expose and reproduce a new image.

The invention has been described in detail with particular reference to a preferred embodiment thereof but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. Apparatus for exposing and developing successive portions of a web of sensitized material, said apparatus comprising:

a. supply means for providing the web of sensitized material,
b. an exposure station,
c. shutter means for exposing that portion of the web disposed at said exposure station,
d. first feed means for moving a measured portion of the web from said supply means to said exposure station,
e. a developing station for receiving and developing the exposed portion of the sensitized material,
f. a drive shaft,
g. second feed means coupled to said drive shaft for moving the exposed portion of the sensitized material through said developing station,
h. means for rotating said drive shaft at a first speed and at a second speed greater than said first speed,
i. a selective clutch means for coupling said drive shaft to said first feed means, and
j. control means for energizing said shutter means to expose a portion of the web, for energizing said selective clutch means for a given length of time to move the exposed portion of the web from said exposure station and to advance a measured length of the web from said supply means into said exposure station, for operating said means for rotating at said second speed to advance the exposed portion rapidly to said developing station, and for operating said means for rotating at said first speed to direct the exposed portion through said developing station at a slower speed.

2. Apparatus as claimed in claim 1, wherein there is included cutting means for severing the exposed portion from the remainder of the web of sensitized material, and second selective clutch means for coupling said drive shaft to said cutting means to thereby activate said cutting means.

3. Apparatus as claimed in claim 1, wherein said developing station includes heating means for generating and directing thermal energy onto the exposed portion of the sensitized material, and radiation means for generating and directing radiation onto the exposed portion of the sensitized material.

4. Apparatus as claimed in claim 3, wherein said control means operates sequentially said means for rotating to advance at said second speed the exposed portion of the web of sensitized material rapidly to said means for heating, for rotating said drive shaft at said first speed to direct the exposed portion of the web of sensitized material at a slower speed through said heating means, for rotating said drive shaft at said second speed to move the exposed portion of the web of sensitized material from said heating means to said radiation means at a faster speed, and for rotating said drive shaft at said first speed to direct the exposed portion of the web of sensitized material through said radiation means at the slower speed.

5. Apparatus as claimed in claim 3, wherein said heating means includes a drum rotatively coupled to said drive shaft, said control means including timing means for energizing said means for rotating for a given period of time to facilitate the rotation of said drum before the advancement of an exposed portion of the sensitized material to said means for heating.

6. Apparatus as claimed in claim 1, wherein said control means includes a timing shaft, second clutch means for selectively coupling said drive shaft to said timing shaft, first switch means responsive to the rotation of said timing shaft to be disposed from a first condition to a second condition, second switch means being actuatable from a first condition to a second condition, timing means responsive to the second condition of said second switch means for initiating a timing operation and for energizing after a preselected delay said said second clutch means, and third switch means responsive to the repetitive disposition of said second switch means to its second condition and the disposition of said first switch means to its second condition to energize said shutter means, said third switch means responsive to disposition of said first switch means in its first condition to energize said second clutch means.

7. Apparatus as claimed in claim 1, wherein there is included a timing shaft and second clutch means for selectively coupling said drive shaft to said timing shaft.

8. Apparatus as claimed in claim 7, wherein there is included a plurality of switch means disposed to be operated as said timing shaft is rotated by said drive shaft.

9. Apparatus as claimed in claim 8, wherein said control means includes first switch means disposed to be activated as said timing shaft is rotated by said drive shaft, first and second conductive paths, timing means for providing a predetermined delay before the energization of said second clutch means along said first path, said first switch means responsive to the movement of said timing shaft to energize said second selective clutch means along said second conductive path.

10. Apparatus as claimed in claim 7, wherein there is included cutting means for severing the exposed portion from the remainder of the web of sensitized material, third clutch means for selectively coupling said drive shaft to said cutting means to thereby activate said cutting means to sever the exposed portion of the web of sensitized material, said control means including timing means for energizing said shutter means for a given length of time and thereafter energizing said second clutch means, and switch means disposed to be

operated in response to movement of said timing shaft to thereby deenergize said third selective clutch means.

11. Apparatus as claimed in claim 7, wherein said control means includes first and second switch means disposed to be activated by the rotation of said timing shaft, said first switching means responsive to the motion of said timing shaft to operate said means for rotating at said first speed, said second switching means responsive to the motion of said driving shaft to operate said means for rotating at said second speed.

12. Apparatus as claimed in claim 1, wherein said control means includes first and second conductive paths, timer means for energizing said shutter means for a predetermined length of time, first switch means for initiating the timing operation of said timing means, second switch means responsive to said timer means to deenergize said shutter means and to energize said first selective clutch means along said first conductive path, and third switch means responsive to a repetitive actuation of said first switch means to be disposed from a first state in which said third switch means energizes said first selective clutch along said first conductive path to a second state to deenergize said shutter means along said second conductive path.

13. Apparatus as claimed in claim 1, wherein said control means includes first and second conductive paths; a timing shaft; second clutch means for selectively coupling said drive shaft to said timing shaft; first switch means responsive to the motion of said timing shaft to be disposed from a first position to energize said first clutch means along said first conductive path, to a second state to deenergize said first mentioned clutch means; second and third switch means disposable in first and second states; timing means responsive to the actuation of said second switch means to operate after a predetermined delay said third switch means from a first state in which said shutter means is actuated to expose a first portion of the web, to said second state to energize said second clutch means; and fourth switch means responsive to the concurrent actuation of said first switch means and said second switch means to be disposed from a first state in which said first clutch means is energized, to a second state to prevent the energization of said shutter means along said first conductive path.

14. A method for exposing and developing a web of sensitized material in apparatus including a supply of the sensitized material, an exposure station, a shutter, and a developing station including a heating station and a photolyzing station, said method comprising the steps of:

a. advancing a portion of the sensitized material into the exposure station;
b. exposing the advanced portion of the sensitized material by operating the shutter;
c. advancing the exposed portion of the sensitized material at a first speed from the exposure station;
d. severing the exposed portion of the sensitized material from the web as it is advanced at said first speed from the exposure station;
e. subjecting the severed portion of the sensitized material to thermal energy at the heating station, advancing the severed portion of the sensitized material therethrough at a second speed, said second speed being relatively slower than said first speed;
f. advancing the severed portion of the sensitized material from the heating station to the photolyzing station at said first speed;
g. subjecting the severed portion of the sensitized material to radiation of a preselected wavelength at the photolyzing station, advancing the severed portion of the sensitized material therethrough at said second speed; and thereafter
h. increasing the speed of the severed portion of the sensitized material to said first speed as the leading edge thereof emerges from the photolyzing station.

15. The method according to claim 14 wherein a second portion of the web of sensitized material is exposed at the exposure station while the first-mentioned severed portion of the sensitized material is being developed at the developing station.

16. The method according to claim 15 which comprises the additional step of cooling the severed portion of the sensitized material as it is advanced between the heating and photolyzing stations.

17. The method according to claim 14 which comprises the additional step of cooling the severed portion of the sensitized material as it is advanced between the heating and photolyzing stations.

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