Feb. 14, 1961 C. ORLANDO 2,971,445

PHOTOGRAPHIC METHOD AND APPARATUS

Filed Dec. 3, 1957

FIG. 1

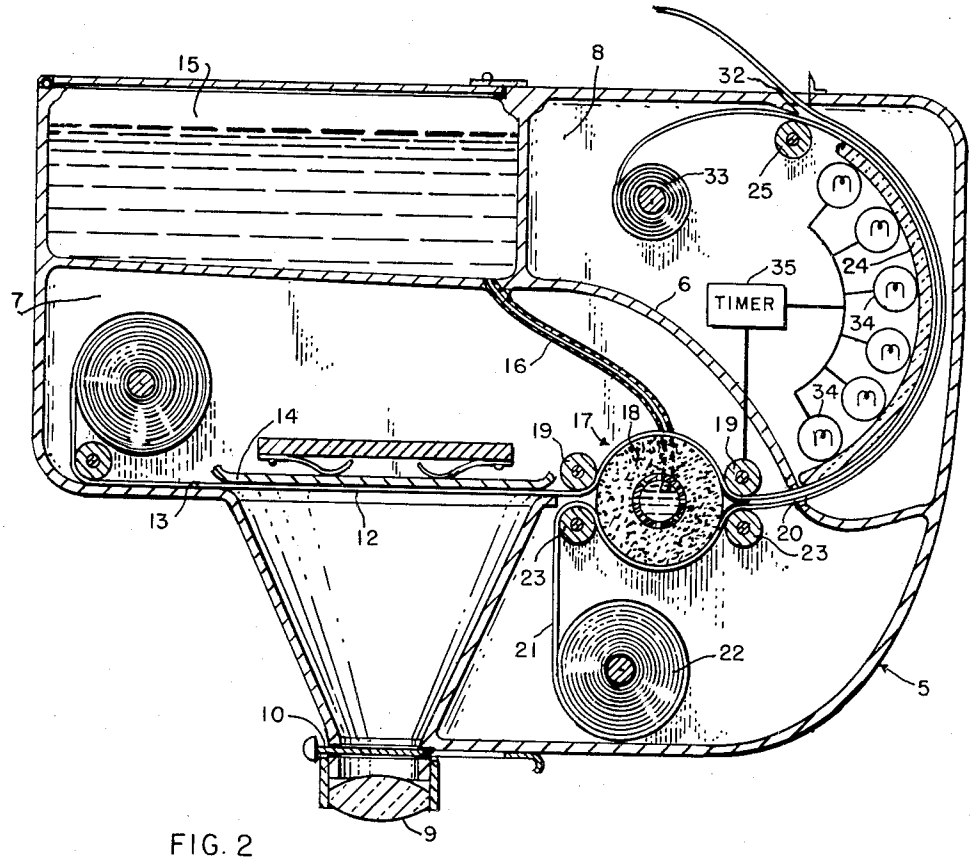
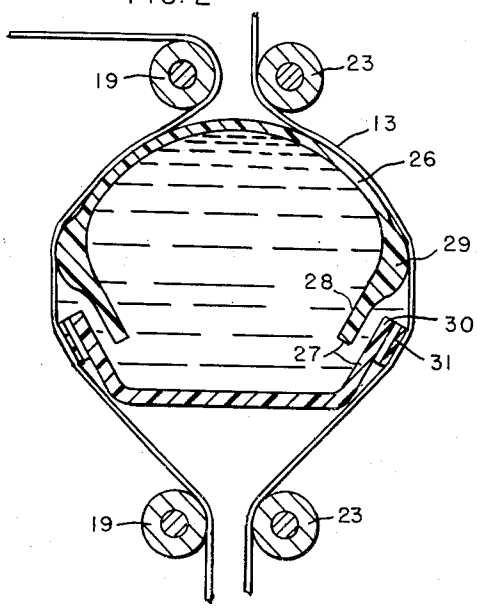


FIG. 2



INVENTOR,
CARL ORLANDO

BY
Harry M. Saragovitz
ATTORNEY.

United States Patent Office 2,971,445
Patented Feb. 14, 1961

2,971,445

PHOTOGRAPHIC METHOD AND APPARATUS

Carl Orlando, New Shrewsbury, N.J., assignor to the United States of America as represented by the Secretary of the Army

Filed Dec. 3, 1957, Ser. No. 700,526

3 Claims. (Cl. 95—13)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment of any royalty thereon.

This invention relates to a method and apparatus for the rapid production of high quality photographs. Its practice permits the use of a wide variety of conventional photographic materials and constitutes a highly economical production technique.

Many procedures have been devised for rapid processing of sensitive materials. These systems have been characterized by certain inherent shortcomings of one type or another. In many cases some of the valuable characteristics attached to conventional practices have been sacrificed to provide a rapid and simplified photographic system. Some of such prior systems produce no satisfactory reprintable negative which obviously is a serious restriction not tolerable in any complete photographic process.

Practically all of such prior systems use specialized sensitive materials which are usable only in the specific procedure and with the specific apparatus designed for the given process. This of course means that the photographer is restricted to the types of sensitive materials made by a particular manufacturer who, in turn, is restricted to the particular inadequacies of his system.

The tremendous scope and high quality standards of the present day photographic art will not tolerate restrictions which depreciate such standards. The present invention provides a rapid and efficient photographic system wherein any and all types of conventional negative and positive sensitive materials are used and, in addition, conventional processing chemicals are used to produce a final print of highest quality.

The invention provides means for holding sensitive negative film in the focal plane of a lens or in position to receive a light pattern of any character. The film may be supplied from a roll to provide for plural exposures. Provided also is a roll of printing paper or any sensitive material capable of receiving a developed image. This printing material desirably may be of the conventional silver halide type. Both negative and positive sensitive material may be enclosed in a suitable light tight casing to provide a compact apparatus or the components may be installed in a dark room. A suitable lens and shutter, or other means, is arranged to impress a latent image upon the negative film.

The exposed film is then moved into printing position juxtaposed to an unexposed area of printing paper with emulsions facing. During this motion of film and paper a coating of processing liquid is automatically applied to the respective emulsions. Prior to arriving in printing position the negative and positive materials are adhered with a film of processing liquid therebetween. The adhered sensitive materials are protected from light until the lapse of a measured processing interval for processing the negative. At the end of this time a light is energized to print through the processed negative providing a positive image upon the processing liquid saturated printing paper emulsion which is also developed.

The processing liquid may be of the type commonly referred to as a monobath which combines developing and fixing components. Thus, at the end of the processing interval a developed and fixed negative is in contact with the developer and fixer saturated emulsion on the printing paper which, when exposed through the negative, produces a finished print. The finished adherent negative and print may then be drawn from the apparatus, cut from their respective strips and separated to provide a finished print and a reusable negative.

It is a primary object of the invention to provide a photographic system which is economical and rapid in operation.

A further object of the invention is to provide a high quality process wherein conventional sensitive materials may be used thereby making available a wide variety of types of photographic materials.

A further object of the invention is to provide complete photographic taking and processing equipment in a condensed and portable unitary device.

Other objects and features of the invention will more fully appear from the following description and will be particularly pointed out in the claims.

To provide a better understanding of the invention a particular embodiment thereof will be described and illustrated in the accompanying drawings wherein:

Fig. 1 is a partially schematic cross-section of an apparatus incorporating the invention; and

Fig. 2 is a detail view showing the construction of a desirable form of processing liquid applicator.

The arrangement and structure of the components of the apparatus may have many variations within the meaning and scope of the claims. For purposes of illustration, however, particular embodiments are illustrated and will be described. As shown, the components of the apparatus are inclosed in a light tight casing 5. It is within the scope of the invention, however, to set up the components for operation in a darkroom or in any manner to suit particular requirements. The casing 5 desirably is internally divided into a plurality of chambers. A partition 6 divides the space into two main chambers 7 and 8. The chamber 7 contains the elements for taking the picture and the supply of unexposed negative and positive sensitive material. The chamber 8 incloses the means for making a positive print from a processed negative.

The invention is adaptable to any system for impressing a latent image upon a sensitive sheet. For example, the image may be applied to the film by the use of a light permeable sheet bearing the subject matter to be reproduced and held in contact with the negative film while a light source makes the required impression. Another commonly used procedure, and the one illustrated herein, is to provide a lens 9 and a shutter 10 located to project an image of a subject upon the focal plane 12. Suitable means, not shown, may be provided to focus the lens 9.

An elongated strip of negative film 13 is wound upon a spool within the chamber 7. Film from the spool is guided across the exposure format and held in the focal plane 12 by a backing plate 14. After exposure to a light pattern representing a subject the film is fed to a station where processing liquid is applied to its emulsion. This station, desirably but not necessarily, also applies precessing liquid to sensitized printing paper in a manner to be described.

The solution for processing the sensitive materials is of the type commonly called a monobath and contains both developing and fixing ingredients. For this solution

a conventional monobath formula may be used such as the following:

Water, 125° F.	cc	750
Metol	gm	12.9
Sodium sulphate	gm	70.9
Hydroquinone	gm	25.7
Sodium hydroxide	gm	25.7
Benzotriazole	gm	10.0
Sodium thiosulfate	gm	180.0

Water to make 1 liter.

The solution should be suitable for processing both the negative and positive material. Such solutions are available and the formula therefor constitutes no part of the invention. The solution may be stored and applied in any desired manner. A portion of the casing is lined with material (not shown) which is unaffected by the solution. This portion of the casing then becomes a storage tank **15** having a conduit **16** leading therefrom to an applicator device **17** which, desirably, is cylindrical in shape and at least as long as the film is wide. The applicator is composed of liquid absorbent material **18** which is kept in a state of saturation by an extension of the conduit **16** projecting substantially through the dispenser in an axial position and provided with perforations for feeding liquid to the material **18**. Other suitable means may be used to maintain a processing liquid impregnated surface for wetting the sensitive emulsion coated surfaces of the negative and positive materials. For example, means may be provided for presenting the respective emulsions to the surface of a pool of solution. Separate solution applying means may also be provided for the negative and positive material.

The negative film as it leaves the exposure area, bearing a latent image, is fed to the applicator **17** and held in contact therewith in any desired manner such as by the pivoted rolls **19**. Processing liquid from the applicator is thus applied to the negative emulsion and the film then travels through the slot **20** in the wall **6** and into the printing chamber **8**.

At the same time a section of unexposed positive printing paper **21** from a roll **22** is fed to the applicator **17** and its emulsion side is held in contact with the lower portion thereof by guiding rolls **23**. The left hand rolls **19** and **23** are positioned to cause the film **13** and paper **21** to form an assembly consisting of the two strips and a film of liquid therebetween. This assembly is then passed to an exposing zone which may be any desired construction. The example shown in the drawings comprises an arcuate section **24** of a hollow cylinder of transparent or translucent material, such as glass or chemical resistant plastic. The assembled sheets are fed along the outer surface of the member **24** and held in position by a friction device **25**.

A different and highly satisfactory applicator is shown in Fig. 2 wherein the negative and positive materials are fed along the surface of a hollow processing liquid container **26** in the manner described in connection with Fig. 1. The container **26** is of special construction and is made of flexible material which is unaffected by chemicals. At the areas of contact of the sensitive strips **13** and **21** with the applicator, valve structures **27** are provided extending across the width of the strips.

Each valve has a flexible gate **28** which is integral with a gate actuating portion **29** projecting from the applicator wall. The gate actuators are engaged respectively by the two sensitized strips. The flexibility of the applicator wall is such that tension of the strips as they are moved along the apparatus is sufficient to move the gates **28** inward away from fixed inwardly bent lip portions **30** to thus open the valves and apply a film of solution to the sensitive surfaces of the strips. When movement of the strips is stopped, tension therein is released and the valves close. As the liquid in the applicator is consumed the applicator collapses under the applied tension of the strips **13** and **21**. Thus, in operation substantially all of the solution is withdrawn from the applicator at which time a full applicator may replace the used one.

Suitable means may be provided for preventing the sensitized strips from restricting flow of solution as they pass over the valves. This may be done by providing each valve with a relatively stiff partition **31** extending lengthwise of the valve and spaced from the applicator wall adjacent the valve lip **30** thus forming a noncollapsible duct for the solution. The strips pass over the partitions and are thus held out of engagement with the applicator wall to avoid restriction of the flow of solution to the respective emulsions. The size of the applying orifice thus formed may be adjusted to supply the correct amount of solution to the strips. Directional rolls such as the rolls **19** and **23** guide strips **13** and **21** in the same manner as described in connection with Fig. 1.

In the above description the processing solution is assumed to be a free flowing liquid. It is possible, however, to add substances to the liquid to increase its viscosity which may be advantageous for certain working conditions.

By using an applicator such as that shown in Fig. 2, or a modified structure for the applicator **17**, the whole apparatus may be incorporated in an efficient hand camera. The applicator shown in Fig. 2 may be divided into two compartments to supply different solutions respectively to the strips **13** and **21**.

Beyond the member **25** the strips may be handled in a number of ways, for example, at this time, as will appear hereinafter, a completely finished negative and positive print are available. Both print and negative may be fed through a slot **32** in the casing, severed from the strip and separated for use. As shown in the drawings the negative strip is separated from the positive prints and wound for storage upon a roll **33** within the chamber **8** where, if desired, individual finished negatives may subsequently be cut from the roll. In this case the finished prints are led outside the casing and cut from the strip.

From the above description it will be understood that the complete procedure is, or may be, a substantially continuous process. By proper selection of sensitivity values for the negative and positive strips, the actinic value of the printing light and the speed of travel of the strips, the operation may be carried on without interruption.

The illumination for exposing the print may be supplied in any manner, such as by a single electric lamp placed at the center of curvature of the member **24**, or a plurality of lamps **34** may be arranged along the inner surface of the member **24**.

In operation, a subject is placed upon a suitable easel, the lens focused to produce a sharp image at the focal plane **12**, and an exposure is made upon the negative strip **13** by the shutter **10**. The exposed portion of the strip is then moved along by pulling upon the end of the strip projecting from the slot **32** or by rotating the roll **33**. This also moves the strip **21** and both strips pass over the applicator **17** to saturate their respective emulsions. This causes the latent image in the film to start developing. The exposed area of the film and the adherent printing paper are then moved into printing position. A time period must elapse sufficient to complete the processing of the negative by the action of the monobath solution. This time period may be consumed during the traverse of the film or in any suitable manner. The printing lamp is then turned on which impresses the light pattern of the negative upon the printing strip **21**. The duration of this exposure is timed to provide the maximum quality in the print for the use desired. The timing may be accomplished by a suitable timing device, not shown, connected in the lamp circuit.

At this time the processing liquid in the emulsion of

the printing strip develops and fixes the picture upon the strip **21**. If it should be found in certain instances the positive image tends to develop too quickly, as for example before the negative is completely normal, it may be found advantageous to preharden the positive emulsion at least upon its surface. In this manner penetration of the processing liquid may be retarded to a controlled degree thereby insuring that the negative is normal in density and gradation while the print is being exposed.

Degree of development in both negative and positive images is automatically determined by the proportions of the ingredients in the monobath in the known manner. Such processing solutions are adjusted to permit development to proceed to a normal gamma without permitting degradation of the final print by the action of the fixing ingredients in the processing solution.

Means may be provided to automatically time the processing period for the negative. This may be done in various ways. A desirable mechanism is shown diagrammatically in Fig. 1 wherein the left hand guide roll **23** is mechanically connected to a timing mechanism **35** in which a spring is wound by the rotation of the roll **23** as the sensitive strips move through the distance occupied by successive latent images. Winding the spring starts an escapement timing device which closes a switch in the lamp circuit at the end of a preset period. Another timing device may be used to time the duration of the exposure of the print.

It is also possible to practice the invention by applying processing solution to the emulsion of only one of the sensitive sheets **13** and **21**, as for example, the negative material **13**. In this instance some of the solution from the negative material will be absorbed by the positive emulsion by reason of its contact therewith. Thus the positive image receives its final processing.

In the above description the terms negative and positive materials should not be construed in a limiting sense. The term negative materials refers to any photosensitive material capable of receiving a latent image of a subject and which can be processed to produce a light permeable representation of a subject suitable for making a reproduction therefrom by passing light therethrough. Positive material refers to the material upon which the reproduction is made.

What is claimed is:

1. Photographic apparatus comprising a supply of photographically sensitized negative and positive material, means to impress a latent image on said negative material, a processing solution applicator filled with a combination developing and fixing solution, means to move said positive and negative material into operative engagement with said applicator, said applicator comprising a flexible walled hollow body to contain the solution and at least one liquid applying narrow slot in said wall extending transversely across the negative and positive material, valve means for each slot having a resilient gate portion and a closing lip cooperating to close said slots, a projection from said wall at each valve engaged by the sensitive material and operable by the tension therein to open said gates, said gates acting automatically to close said slots in the absence of tension, means to adhere the emulsion faces of the negative and positive material with a film of solution therebetween and a source of light positioned to expose said positive material through the processed negative material bearing an image of the subject while the negative and positive materials are adhered.

2. Photographic apparatus according to claim 1 and noncollapsible solution ducts at each valve over which the said negative and positive strips travel whereby when the valves are open tension in the strips will not restrict flow of solution to the respective emulsions.

3. Photographic apparatus for strip feed continuous production of positive prints comprising a light tight casing for housing the apparatus, a strip of negative photosensitive material having a transparent base, a strip of positive photosensitive material, the sensitive emulsions of both strips being of the conventional silver halide type, a supply of monobath type processing solution for conventional developing and fixing of said emulsions, camera means for impressing a latent image on said negative strip, means for feeding said strips from station to station of the apparatus, solution applying means having at least one roll wetted with solution from said supply, said roll having an interior chamber to hold processing liquid and walls of liquid permeable material, means for engaging the emulsions of both strips with said roll at a position adjacent to where the exposed negative area emerges from said camera means, means for adhering the emulsion faces of said strips with the solution therebetween, a light tight chamber in said casing into which the adhered strips are fed, a platen in said chamber, means to hold said strips against said platen and a printing light source in said chamber arranged for exposing said positive strip thru the developed and fixed negative while the strips are engaging said platen thereby to produce a positive print developed by said solution.

References Cited in the file of this patent

UNITED STATES PATENTS

1,585,388	Ives et al.	May 18, 1926
1,918,061	Simjian	July 11, 1933
1,952,100	Simjian	Mar. 27, 1934
2,157,128	Hershberg	May 9, 1939
2,431,041	Hassler	Nov. 18, 1947
2,586,772	Ashby	Feb. 26, 1952
2,780,972	Fairbanks	Feb. 12, 1957
2,817,279	Ellsworth	Dec. 24, 1957

FOREIGN PATENTS

814,449	France	Mar. 15, 1937
470,197	Great Britain	Aug. 11, 1937