April 7, 1959 P. D. BARTLETT 2,880,657

PHOTOGRAPHIC APPARATUS

Filed Jan. 29, 1957 3 Sheets-Sheet 1

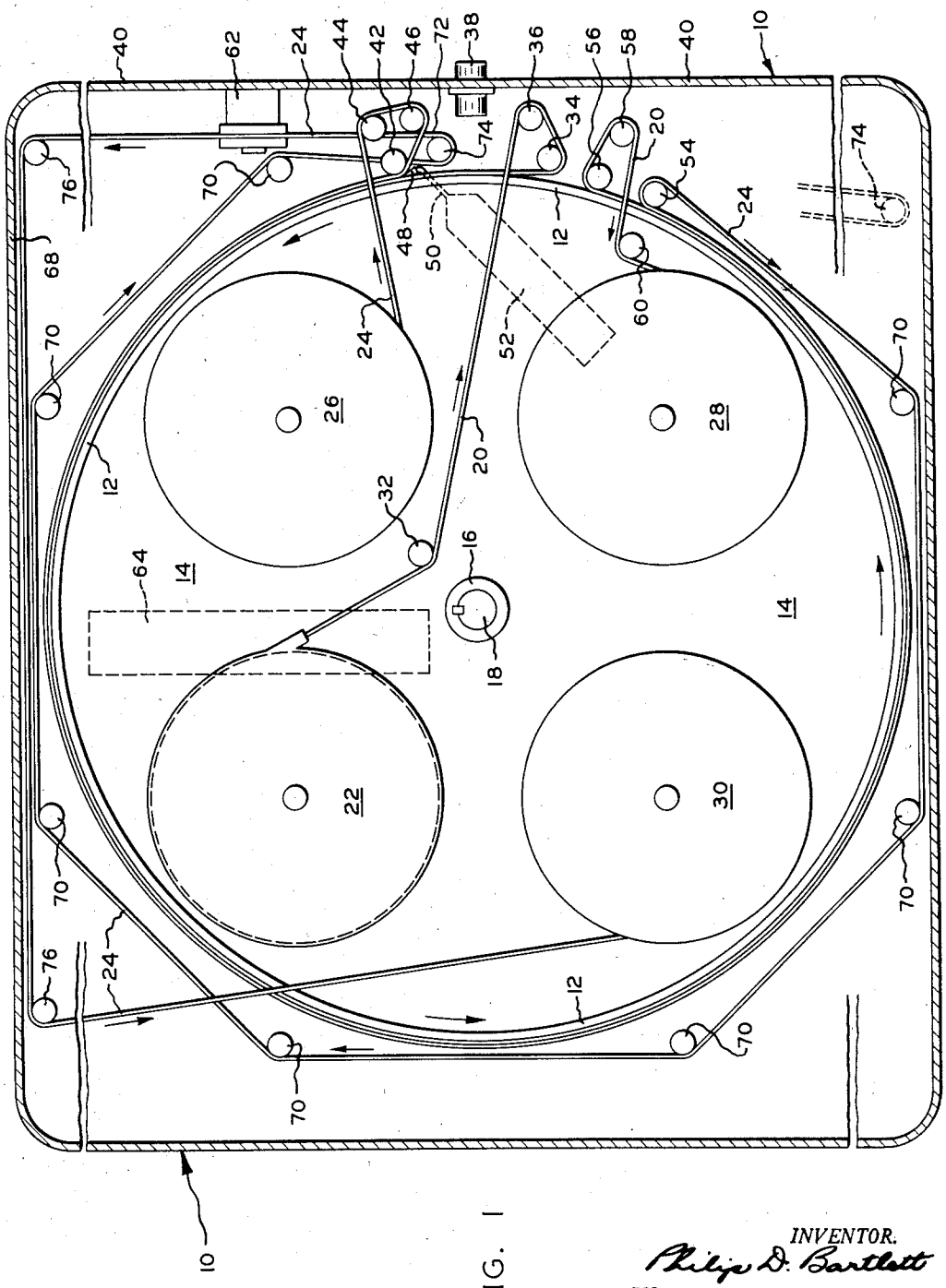

FIG. 1

INVENTOR.
Philip D. Bartlett
BY Brown and Mikulka
and
Robert E. Cord
ATTORNEYS

April 7, 1959 P. D. BARTLETT 2,880,657

PHOTOGRAPHIC APPARATUS

Filed Jan. 29, 1957 3 Sheets-Sheet 2

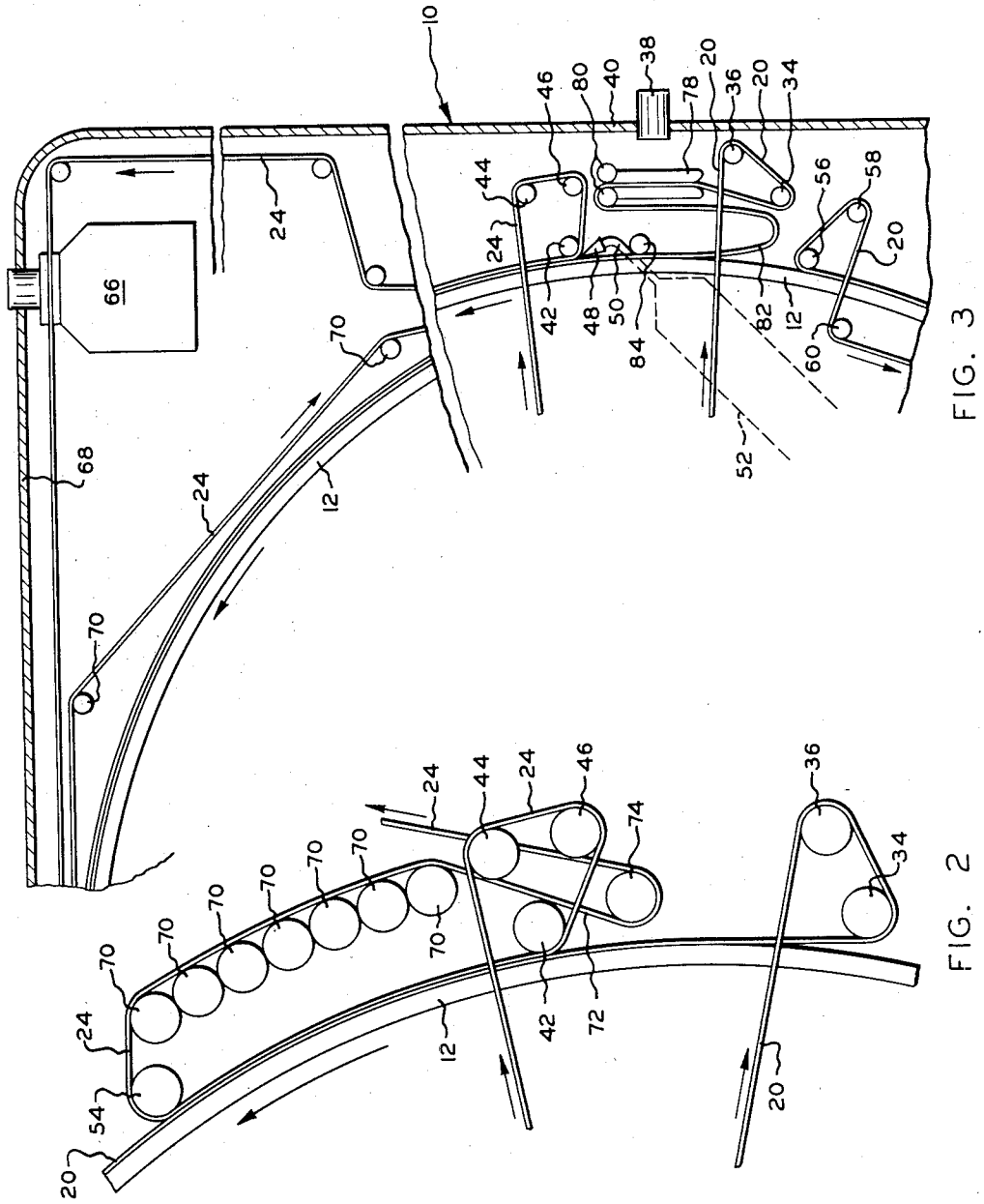

FIG. 3

FIG. 2

INVENTOR.
Philip D. Bartlett
BY Brown and Mikulka and Robert E. Cobb
ATTORNEYS

April 7, 1959 P. D. BARTLETT 2,880,657

PHOTOGRAPHIC APPARATUS

Filed Jan. 29, 1957 3 Sheets-Sheet 3

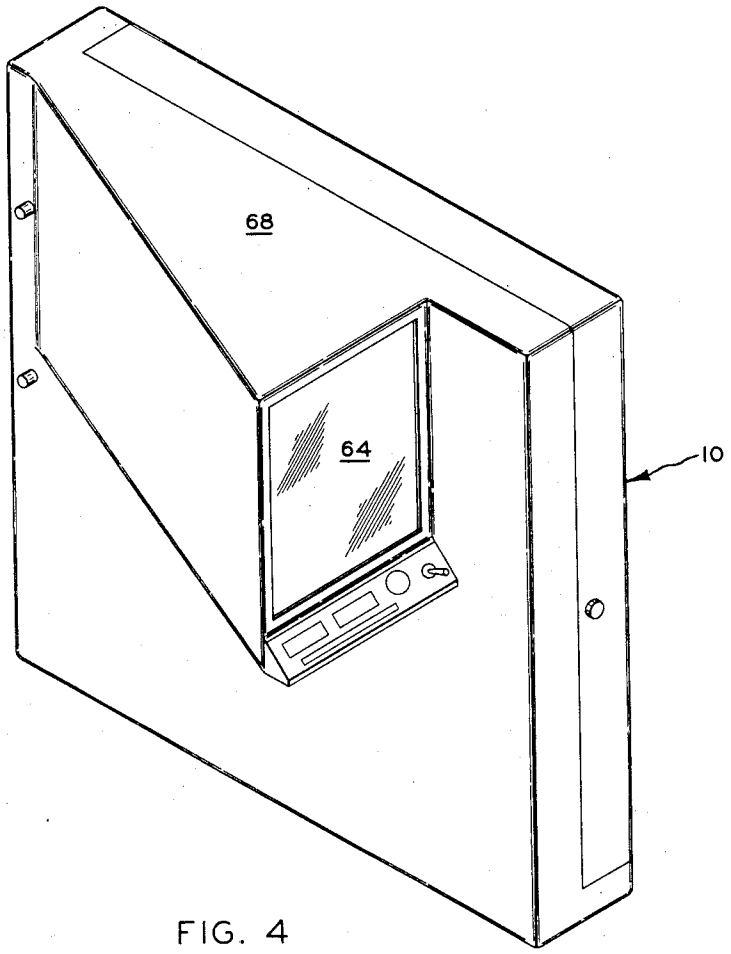

FIG. 4

INVENTOR.
Philip D. Bartlett
BY Brown and Mikulka
and
Robert E. Corb
ATTORNEYS

United States Patent Office 2,880,657 Patented Apr. 7, 1959

2,880,657

PHOTOGRAPHIC APPARATUS

Philip D. Bartlett, Worcester, Mass., assignor to Polaroid Corporation, Cambridge, Mass., a corporation of Delaware

Application January 29, 1957, Serial No. 637,039

21 Claims. (Cl. 95—12)

This invention relates to photography and, more particularly, to photographic apparatus for exposing and processing photosensitive sheet materials.

A variety of forms of photographic apparatus have been proposed for exposing an elongated strip of photosensitive sheet material and thereafter treating the exposed strip with a fluid reagent to produce a visible image. In the form of apparatus with which the present invention is concerned, the exposed photosensitive strip is treated in conjunction with a second strip superposed therewith by a layer of fluid reagent distributed between the strips. The treatment is such as to require that portions of the two strips be maintained in superposition with a layer of fluid processing reagent therebetween for a processing period which may be allowed to vary only within certain predetermined limits and, at the end of this period, the two strips are separated from one another. The photosensitive strip may be exposed substantially continuously to produce a continuous trace or it may be exposed intermittently as a series of distinct frames and, immediately following exposure, the photosensitive strip is superposed with the second strip and the processing fluid is distributed between the strips as they are superposed.

It is important, during the processing period, that the two strips be retained stationary with respect to one another and, for this reason, that the curvature of a sandwich comprising the two strips and layer of fluid reagent be maintained constant during the period of processing and superposition of the strips. The duration of the processing period is, of necessity, determined by the length of the path of movement of the sandwich between the point of superposition of the strips and formation of the sandwich, and the point at which the strips are separated, and the speed of movement of the sandwich along this path. In order to conserve space and to make the apparatus as small as possible, means are preferably provided for defining a circular path and moving the sandwich along this path.

The linear rate at which the photosensitive strip is exposed, the length of the path of travel of the sandwich and the linear rate of movement of the sandwich along this path must all be related to one another in view of the limits of the processing period, so that processing is initiated and the strips are thereafter separated within the limits of this predetermined period. In apparatus of the type proposed heretofore, the length of the path of the processing sandwich has been substantially constant so that the linear rates of exposure and movement of the strips are, of necessity, directly related to one another and could be varied only to the extent permitted by the permissible limits of the duration of the processing period. As a result, the permissible variation in exposure rate is very limited and, when the apparatus is in operation, such variations cannot be made readily.

Objects of the present invention are: to provide, in apparatus for exposing and thereafter processing an elongated photosensitive strip by superposing the strip with a second strip and distributing a fluid processing reagent between the superposed strips to form a sandwich, and advancing the sandwich along a path at the end of which said strips are separated from one another, means for varying the linear rates at which the photosensitive strip is exposed and the sandwich is advanced along said path and means for varying the length of said path directly as the rates of exposure and advancement, whereby the length of the processing period during which the strips are maintained in superposition with a layer of fluid reagent therebetween is maintained within certain predetermined limits; and to provide apparatus as described wherein the duration of the processing period is maintained at a substantially constant minimum and relatively large variations in the linear rate of exposure of the photosensitive strip can be effected at any time during the operation of said apparatus without varying the length of the processing period.

Other objects of the invention are: to provide, in apparatus as described, means for exhibiting the image or images formed by the processing in a portion or portions of one of the photosensitive and second strips after the two strips have been separated; and to provide means whereby movement of the image-carrying strip may be arrested to permit exhibition of an image thereon for a predetermined period without interrupting the exposure and processing of the photosensitive strip.

Still another object is to provide apparatus as described incorporating the features enumerated and characterized by its compactness.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

Figure 1 is a diagrammatic elevational view of apparatus embodying the invention;

Fig. 2 is a fragmentary view, similar to Fig. 1, showing another operative position of the apparatus;

Fig. 3 is a fragmentary view, similar to Fig. 1, of another embodiment of the apparatus; and

Fig. 4 is a perspective view of the apparatus of Fig. 1.

Photographic apparatus of the type herein disclosed generally include means for processing an exposed photosensitive strip by superposing said photosensitive strip on a second strip and spreading a thin layer of processing composition between said strips. The photosensitive strip includes a layer of photosensitive material, preferably an emulsion of silver halide, in which a latent image may be attained by differential exposure to actinic light. The second strip may merely aid in the distribution of the processing liquid, but is preferably adapted to serve as a support for an image-receptive layer in which a visible print of a latent image in the photosensitive layer may be produced. The processing composition, when spread in a uniformly thin layer between the photosensitive and second strips, preferably effectuates a silver halide diffusion transfer-reversal process by which a latent image in the photosensitive strip is developed and a positive print is produced in the other strip. The processing composition, for example, may contain an aqueous solution of a silver halide developer such as hydroquinone, a silver halide solvent such as sodium thiosulfate and an alkali such as sodium hydroxide. In this processing the photosensitive and second strips are maintained in superposed relation with the layer of a processing composition inter-

posed between them for a predetermined processing period, during which the exposed silver halide of the photosensitive strip is reduced to silver and unreduced silver halide of the photosensitive strip forms a water-soluble complex silver salt which diffuses through the layer of composition to the second strip where, upon being reduced to silver, it forms a visible print. Examples of photographic materials useful in processes of the foregoing type are described in detail in Patent No. 2,543,181, issued to Edwin H. Land on February 27, 1951. It is, of course, to be understood that the processes and apparatus herein described are not limited to use with any particular species of photosensitive or second strips, the terms "photosensitive" and "second" being used in their broadest sense to indicate a first strip which is photosensitive and another strip which may merely aid in spreading the processing composition over the surface of the photosensitive strip and which may, if desired, possess other characteristics.

The apparatus of the invention is particularly advantageous when it is desired to expose and process an elongated photosensitive strip to produce a visible image or images and to exhibit the image or images as soon as possible after exposure, and wherein it is desired to vary considerably the rate at which the photosensitive strip is exposed and/or to arrest the movement of the image-carrying strip for the purpose of exhibiting the image on a portion of said strip for an extended period. Although the maximum limit of the allowable processing period may be several times the minimum limit of the processing period, since it is desired to exhibit the image as soon as possible after exposure, it is important that the duration of this processing period be maintained as close to the minimum as possible. If the length of the processing period is to remain substantially constant and the exposure rate is to be varied within a wide range, then the length of the path of the sandwich comprising the superposed strips and layer of fluid reagent therebetween must be varied since the rate at which the sandwich is moved along this path is a function of the rate of exposure. While it is possible to achieve variations in the rate of exposure by varying the length of the processing period within the maximum and minimum allowable limits, such a procedure will not allow for the wide range of permissible variation in the exposure rate which is possible by varying the length of path of movement of the sandwich. The invention offers another advantage in that the images resulting from the processing are characterized by a uniformity that is impossible to achieve with apparatus wherein the length of the processing period is varied to the extent of the limits permitted.

Processing of the exposed photosensitive strip, in the apparatus of the present invention, is preferably a continuous operation. The photosensitive and second strips are advanced into super-position and the fluid is supplied to and spread in a layer between the strips continuously. Movement of the strips and supplying of the fluid reagent, while being subjected to considerable variation in rate, is never arrested completely during the operation of the apparatus. Exposure of the photosensitive strip may be continuous, thereby producing an image in the form of a continuous trace, or exposure may be intermittent with the movement of the strip being arrested for a short period during exposure of each successive frame, as is done in conventional cinematographic cameras.

The image or images which are intended to be exhibited are preferably formed on the second strip which is separated from the photosensitive strip when processing is complete. The preferred method of exhibition is by transmitted light so that the second strip is preferably transparent and the image on each portion thereof comprises a positive transparency which may be viewed or projected in a conventional manner. The apparatus of the invention includes means making it possible to exhibit the image on a particular portion of the second strip for a period which exceeds by many times the duration of the exposure which produced the particular image. Thus, the apparatus not only provides means for making a permanent image record of a variety of scientific instruments but the instruments may be monitored and their record studied as the image record is being produced.

As previously noted, it is important that relative movement between the superposed strips be prevented during processing of the strips and to accomplish this and at the same time conserve space, the sandwich comprising the superposed strips and layer of fluid processing reagent is advanced along a circular path. This path is preferably defined by the periphery of a cylindrical drum around which the sandwich is moved between the point at which the strips are superposed and the point at which they are separated from one another. The maximum rate at which the photosensitive strip can be exposed is, of course, a function of the length of this path or the circumference of the drum, and the minimum processing time required. The processing period may be decreased by raising the temperature of the sandwich during processing, for example by heating the drum, but for high exposure rates the diameter of the drum and hence the overall size of the apparatus may necessarily be relatively large. The construction of the herein disclosed apparatus is quite compact with the various elements arranged so that two of the major dimensions of the apparatus exceed the diameter of the drum by only a relatively small amount, while the third dimension of the apparatus is only a fraction of the other two.

Reference is now made to the drawings wherein there is illustrated, somewhat diagrammatically, the construction and arrangement of apparatus embodying the present invention. This apparatus, in the form shown, comprises means for exposing a photosensitive strip, processing the photosensitive strip in conjunction with a second strip to produce visible images in portions thereof, and means for projecting the images. The apparatus includes a housing, designated **10**, for enclosing a cylindrical drum **12** mounted on a circular disk **14** which in turn is mounted for rotary movement about its center on a hub **16** keyed to a shaft **18** journaled in a wall of the housing. Suitable drive means are provided for rotating shaft **18** so as to rotate drum **12** in a clockwise direction (viewing Fig. 1). A supply of photosensitive strip **20** is provided in a preferably lighttight cassette **22** mounted on a wall of the housing within drum **12** adjacent the forward side of disk **14**, that is, the side of the disk which appears in the drawings. A supply of a second or image-receiving strip **24** is provided coiled around such means as a conventional spool **26** also mounted within drum **12** adjacent the forward side of disk **14**. Cassette **22** and spool **26** are mounted side by side within the upper portion of the drum and a pair of take-up spools **28** and **30** are provided mounted within the lower portion of the drum adjacent disk **14** for coiling strips **20** and **24** respectively after the strips have been processed and separated from one another.

The photosensitive strip may be moved and exposed substantially continuously, although the rate of movement and exposure may be varied to produce a more or less continuous trace image; or the strip may be exposed as a succession of separate frames and its movement arrested during each exposure. In the form of apparatus shown in Figs. 1 and 2 of the drawings, the photosensitive strip is intended to be moved continuously and exposed during this movement. In this form of the invention the photosensitive strip is advanced into contact with the outer surface of the drum and is supported on the drum during both exposure and processing. Means are provided for guiding photosensitive strip **20** from cassette **22** to a position where the strip is brought into contact with the drum, that is, is superposed with the external surface of the drum. This means comprises three guide rolls designated **32**, **34** and **36** which guide

the photosensitive strip in front of the drum and then rearward to where it may be fed into contact with the drum surface.

The apparatus includes suitable exposure means comprising, in the form shown, a photographic objective lens **38** mounted in a side wall **40** of the housing in position to expose portions of photosensitive strip **20** supported on the drum. Guide roll **34** is located closely adjacent the outer surface of the drum and lens **38** is so positioned with respect to roll **34** as to expose the photosensitive strip immediately as it is superposed with the drum surface. The diameter of the drum is relatively large and the focal surface and the depth of field of the lens may be such as to readily permit exposure of the photosensitive strip in position supported on the drum surface.

Immediately as the photosensitive strip is exposed, second strip **24** is superposed therewith and a fluid reagent is spread in a thin layer between the superposed strips to form a sandwich within which processing occurs. The preferred method of forming the sandwich involves advancing the strips into superposition between a pair of pressure-applying members and feeding the fluid processing reagent, which is preferably quite viscous, to the space between the strips as they are being superposed. In the form of apparatus shown, drum **12** comprises one of the pressure-applying members and a pressure-applying roll **42** is provided as the other pressure-applying member. Pressure-applying roll **42** is located closely adjacent the surface of the drum near the upper region of the portion of the photosensitive strip being exposed so that the two strips may be superposed immediately at the photosensitive strip is exposed. As the photosensitive strip and second strip are advanced into superposition between the drum and roll, there is formed a converging space between the strips at the nip or bite of the drum and roll into which the fluid processing reagent is adapted to be introduced. Suitable means are provided for resiliently urging roll **42** toward drum **12** so as to apply compressive pressure to the strips as they are moved between the drum and roll. A pair of guide rolls **44** and **46** are provided for guiding second strip **24** from spool **26** in front of the drum and then rearwardly between the drum surface and pressure-applying roll **42**.

Means are provided for continuously feeding a fluid processing reagent to the space between the strips at the bite of drum **12** and roll **42**. This means comprises a nozzle or discharge mouth **48** located in the space between the sheets and connected by a tube or conduit **50** to means, designated **52**, for storing and feeding the fluid through the conduit to the discharge mouth. Fluid storage and feeding means **52** may comprise, for example, a cylindrical container and a piston for forcing the fluid contents of the container from the container through tube **50**. Movement of the piston is coordinated with the rotation of drum **12** so that the fluid is fed at a rate commensurate with the rate of linear movement of the strips on the drum surface.

The photosensitive and second strips comprising the sandwich are maintained in superposition on the surface of the drum for a predetermined processing time, at the end of which second strip **24** is separated from photosensitive strip **20**. A stripping roll **54** is provided for separating the second strip from the photosensitive strip. Roll **54** is located adjacent the surface of the drum and the second strip is drawn around roll **54** while the photosensitive strip remains supported on the drum. The length of the processing period, that is, the time during which the strips remain in superposition with a layer of processing reagent therebetween, is a function of the rotational speed of the drum and the length of the sandwich on the drum surface between pressure-applying roll **42** and stripping roll **54**. Accordingly, the length of the processing period may be maintained substantially constant, regardless of the rate of exposure of the photosensitive strip and rotation of the drum, by varying the length of the path of the sandwich supported on the drum surface between pressure-applying roll **42** and stripping roll **54**. Stripping roll **54** is mounted for movement in a circle, the center of which is located at the axis of shaft **18**, so that the angle subtended by radii through the drum axis and the centers of rolls **42** and **54** may be varied between a few degrees and well over 300°, depending on the rotary speed of the drum. This angle may range from approximately 30° as shown in Fig. 2, when the drum is being rotated at minimum speed, to approximately 330° as shown in Fig. 1, when the drum is rotating at maximum speed.

The photosensitive strip is adapted to remain supported on the surface of the drum as the second strip is separated from the photosensitive strip and is moved on the drum to a position closely adjacent guide roll **34** where it is separated from the drum and coiled on take-up spool **28**. For this purpose there is provided a guide roll **56**, located closely adjacent the drum surface and guide roll **34**, around which the photosensitive strip is drawn for removing it from the drum. A pair of guide rolls **58** and **60** are provided for guiding photosensitive strip **20** from roll **56** in front of the drum and thence to take-up spool **28**. The apparatus includes drive means for rotating spool **28** at a rate which is proportional to the rotary speed of the drum. Spool **28** is driven through a slip clutch at a speed which is at least slightly faster than that required so as to maintain the photosensitive strip under tension and compensate for the varying length of strip **20** coiled thereon.

The apparatus includes means, preferably in the form of a projector, for exhibiting the image or images produced during processing on second sheet **24**. In the apparatus of Fig. 1 the projector, designated **62**, is of the conventional type, including a lamp housing, film gate and lens, and is mounted on wall **40** above pressure-applying roll **42**. The lens of projector **62** is directed toward the opposite side of the housing and rearwardly toward a screen **64** which may be provided as a component of the apparatus. In another form of the apparatus shown in Fig. 3, the means for exhibiting the second strip may comprise either a projector or viewer, designated **66**, mounted on the upper wall **68** of the housing.

A plurality of guide rolls **70** are provided for guiding second strip **24** from stripping roll **54** to the projector regardless of the position of roll **54**. Rolls **70** are mounted for movement in a circle around and concentric with drum **12**. The means for mounting rolls **70** are so coupled with the means for mounting roll **54** that, as roll **54** is displaced along the periphery of the drum away from pressure-applying roll **42**, rolls **70** are evenly spaced around the periphery of the drum so as to support and guide second strip **24** back around the drum out of contact with the drum from stripping roll **54** to a position near pressure-applying roll **42** and projector **62**. The two extreme positions of stripping roll **54** and the positions of rolls **70** relative thereto are shown in Figs. 1 and 2 of the drawings. In Fig. 1 the stripping roll is located about 330° around the drum surface from pressure-applying roll **42**, and guide rolls **70** (of which there are seven) are substantially evenly spaced around the drum so as to support and guide strip **24**. In Fig. 2 stripping roll **54** is spaced from pressure-applying roll **42** by less than 30° and guide rolls **70** are all located closely adjacent one another between strip **24** and the drum and between stripping roll **54** and pressure-applying roll **42**.

As previously noted, the apparatus of the invention includes means whereby movement of the second sheet through the projector may be arrested even though rotation of the drum and processing of the strips is continuous. For this purpose the second strip is advanced into

a take-up loop, designated 72, between the last guide roll 70 and the projector. The take-up loop extends behind drum 12 and is formed by a guide roll 74 which is mounted for movement from a position near pressure-applying roll 42 downward behind the drum to the position shown shown in dotted lines in Fig. 1 of the drawings.

From projector 62 second strip 24 is guided by a pair of rolls 76 located in the upper portion of the housing adjacent upper wall 68 across the upper portion of the housing and downward in front of the drum to take-up spool 30 which is driven through a slip clutch in the same manner as take-up spool 28.

The drum and various guide rolls may be provided with sprockets for engaging perforations in the margins of the strips, or movement of the strips may be accomplished by friction between the various driven components of the apparatus and the strips. The various rolls which come into contact with the photosensitive surface of the photosensitive strip or the image-carrying surface of the second strip are preferably provided with raised shoulders at their ends adapted to engage the margins of the strips and support the intermediate portions of the strips out of contact from the rolls. Pressure-applying roll 42 may also be provided with raised shoulders at its ends so that, as the two strips are superposed on the drum, a space is provided between the two strips between their margins within which the fluid reagent is distributed. The height of the shoulders on the pressure-applying roll is effective to control the thickness of the layer of fluid spread between the two strips.

In the form of apparatus shown in Fig. 3, photosensitive strip 20 is adapted to be advanced intermittently and to be exposed as a series of successive frames each held stationary during exposure. Accordingly, a film gate or guide 78 is provided behind lens 38 for locating portions of photosensitive strip 20 in position for exposure. Photosensitive strip 20 is guided from cassette 22 in front of the drum into film gate 78 by guide rolls 32, 34 and 36. A pair of drive rolls 80 are provided at the upper end of film gate 78 for engaging and advancing photosensitive strip 20 from the cassette through the film gate and into a take-up loop, designated 82. Take-up loop 82 is provided because it is preferred to rotate drum 12 continuously rather than intermittently, in view of its bulk. The provision of take-up loop 82 allows for the intermittent movement of the photosensitive strip during exposure and the continuous rotation of drum 12. A guide roll 84 is provided adjacent the drum surface behind film gate 78 for guiding photosensitive strip 20 from take-up loop 82 into contact with the drum surface.

A number of modifications may be made in the construction and operation of the apparatus of the invention. For example, the processing reagent may be spread between the photosensitive and second strips immediately prior to exposure of the photosensitive strip, so that the processing occurs spontaneously as the photosensitive strip is exposed. For this purpose the second strip and fluid reagent are both light-transmitting and preferably transparent. The exposure means of the apparatus is located between the means for forming the sandwich and the means for separating the strips, preferably quite close to the sandwich-forming means, so that the exposure can be made as soon as possible after the fluid is spread and the sandwich is formed. The sandwich is formed and supported on the drum and the photosensitive strip is exposed through the second strip and layer of processing reagent.

In another form of the invention, the processing fluid may be spread between the drum and the photosensitive strip itself. In this case an image may be formed in the layer of fluid which is preferably quite viscous and adheres to the photosensitive strip as it is separated from the drum. This construction and operation may be employed when it is desired to treat the photosensitive strip without transferring any material to, or forming an image in a layer other than the photosensitive strip. Accordingly, the fluid reagent may be of the type which will adhere to the drum as the processed photosensitive strip is separated therefrom. The apparatus will then include suitable means in the form of a scraper for removing the fluid from the drum surface.

Instead of continuously supplying the fluid reagent to the strips as they are superposed, the fluid may be provided in a succession of rupturable containers attached to one of the strips, preferably the second strip, in association with areas thereof adapted to be superposed with successive frames of the photosensitive strip. The containers are ruptured and their fluid contents distributed between associated frames and areas of the superposed strips as they are moved between the drum and the pressure-applying roll. The ruptured containers can be made to adhere to either of the strips as the strips are separated when processing is complete and preferably to the photosensitive strip, so that the containers do not interfere with exhibition of the images carried by the second strip.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Photographic apparatus for exposing and thereafter processing a photosensitive strip and comprising, in combination, means for exposing successive portions of a photosensitive strip, means for superposing said successive portions of said photosensitive strip with a second strip and distributing a fluid processing reagent between said strips to form a sandwich, means for moving said sandwich at a variable rate of speed along a predetermined path, stripping means located adjacent said path of movement for separating said strips comprising said sandwich at a location on said path predeterminedly spaced from said means for forming said sandwich when said processing is complete, and means for varying the position of said stripping means relative to said sandwich-forming means so as to vary the length of the path of said sandwich in direct proportion to the variable rate of movement of said strips comprising said sandwich along said path.

2. In photographic apparatus as defined in claim 1 wherein said processing results in the production of visible images in portions of said second strip, means for exhibiting said images following separation of said second strip from said photosensitive strip, said stripping means being movable with respect to said exhibiting means and means for guiding said second strip from said stripping means to said exhibiting means at every position of said stripping means.

3. The photographic apparatus of claim 2 including means for feeding and guiding said second strip into a take-up loop between said stripping means and said exhibiting means whereby movement of said second strip through said exhibiting means can be arrested for predetermined periods while movement of said sandwich and processing of said photosensitive strip are continued.

4. The apparatus of claim 2 wherein said means for guiding said second strip from said stripping means to said exhibiting means comprises a plurality of guide members mounted for movement with respect to said means for moving said sandwich and with respect to one another along a predetermined path adjacent the path of movement of said sandwich between said superposing means and said stripping means.

5. The photographic apparatus of claim 1 wherein said means for moving said sandwich along said path comprises a generally cylindrical drum mounted for rotation about its axis and said means for forming said

sandwich comprises a pressure-applying member positioned closely adjacent the surface of said drum and urged toward said drum to apply compressive pressure to said strips as they are advanced between said drum and said pressure-applying member.

6. Photographic apparatus for exposing and thereafter processing a photosensitive strip comprising, in combination, means for moving successive portions of a photosensitive strip into position for exposure, means for exposing said successive portions of said photosensitive strip, means for superposing said photosensitive strip with a second strip and distributing a fluid processing reagent between said strips to form a sandwich, support means for supporting said sandwich and moving said sandwich along a circular path at a variable rate of speed, stripping means located adjacent said support means for separating said second strip from said photosensitive strip when processing of said photosensitive strip is complete, said stripping means being predeterminedly spaced along said path from said means for forming said sandwich, said stripping means being mounted for movement along said path toward and away from said means for forming said sandwich and for varying the length of the path of movement of said sandwich in proportion to the linear speed of movement of said strips comprising said sandwich so as to control the duration of processing.

7. Photographic apparatus for exposing and thereafter processing a photosensitive strip and comprising, in combination, means for moving successive portions of a photosensitive strip into position for exposure, means for exposing said successive portions of said photosensitive strip, a support member having a general cylindrical support surface, means for rotating said support member about the axis of said support surface at a variable speed which is commensurate with the rate at which said photosensitive strip is moved into position for exposure, means for guiding said photosensitive strip into contact with said support surface, means for superposing a second strip with said successive portions of said photosensitive strip and distributing a fluid processing reagent between said strips to form a sandwich supported on said support surface, stripping means located adjacent said support surface and predeterminedly spaced along said support surface from said means for forming said sandwich for separating said second strip from said photosensitive strip, means mounting said stripping means for movement relative to said sandwich-forming means about the axis of rotation of said support member so as to vary the angle subtended by said stripping means, said sandwich-forming means and said axis in direct proportion to variations in the rotational speed of said support member and thereby control the length of the processing period during which said strips are maintained in superposition.

8. The photographic apparatus of claim 7 wherein said means for exposing said photosensitive strip is so positioned with respect to said support member as to expose successive portions of said photosensitive strip while said portions are supported on said support surface.

9. In photographic apparatus as defined in claim 7 wherein said processing results in the production of visible images in said portions of said second strip, means for exhibiting said images following separation of said second strip from said photosensitive strip, said stripping means being movable with respect to said exhibiting means, and means for guiding said second strip from said stripping means to said exhibiting means at every position of said stripping means.

10. The apparatus of claim 9 wherein said means for guiding said second strip from said stripping means to said exhibiting means comprises a plurality of guide members mounted for movement relative to one another, said stripping means and said exhibiting means, in a circle about said axis of rotation of said support member.

11. The photographic apparatus of claim 7 including means located adjacent said support surface for retaining said photosensitive strip in contact with said support surface during stripping of said second strip from said photosensitive strip and thereafter separating said photosensitive strip from said support surface.

12. The photographic apparatus of claim 7 wherein said means for forming said sandwich comprises a pressure-applying member located closely adjacent said support surface and means for urging said pressure-applying member toward said support surface for applying compressive pressure to said strips as they are advanced between said pressure-applying member and said support member.

13. Photographic apparatus for exposing and thereafter processing a photosensitive strip and comprising, in combination, means for moving successive portions of a photosensitive strip, at a rate which may be varied, into position for exposure, means for exposing said successive portions of said photosensitive strip, a support member having a generally cylindrical support surface, means for continuously rotating said support member about the axis of said support surface at a variable speed which is commensurate with the rate at which said photosensitive strip is moved into position for exposure, means for guiding said photosensitive strip into contact with said support surface, means for superposing a second strip with said successive portions of said photosensitive strip and distributing a fluid processing reagent between said strips to form a sandwich supported on said support surface, stripping means located adjacent said support surface and predeterminedly spaced along said support surface from said means for superposing said strips and forming said sandwich for separating said second strip from said photosensitive strip, means mounting said stripping means for movement relative to said sandwich-forming means about the axis of rotation of said support member, and means for moving said stripping means about said axis so as to vary the angle subtended by said stripping means, said sandwich-forming means and said axis in direct proportion to variations in the rotational speed of said support member and thereby control the length of the processing period during which said strips are maintained in superposition.

14. In photographic apparatus as defined in claim 13 wherein said processing results in the production of visible images in said portions of said second strip, means for exhibiting said images following separation of said second strip from said photosensitive strip, said stripping means being movable with respect to said exhibiting means between different positions, and means for feeding said second strip from said stripping means to said exhibiting means at every position of said stripping means.

15. The photographic apparatus of claim 14 including means for feeding and guiding said second strip into a take-up loop between said stripping means and said exhibiting means whereby movement of said second strip through said exhibiting means can be arrested for predetermined periods while movement of said sandwich and processing of said photosensitive strip are continued.

16. The photographic apparatus of claim 14 wherein said means for guiding said second strip from said stripping means to said exhibiting means comprises a plurality of guide rolls and means mounting said guide rolls for movement relative to one another, said stripping means and said exhibiting means, in a circle generally concentric with, and having a diameter greater than, said support surface.

17. The photographic apparatus of claim 13 wherein said means for exposing said photosensitive strip comprises means for retaining each of said successive portions of said photosensitive strip substantially stationary during exposure thereof, and means for feeding said photosensitive strip into a take-up loop between said

exposure means and said means for guiding said photosensitive strip into contact with said support surface.

18. The photographic apparatus of claim 13 wherein said means for forming said sandwich comprises a pressure-applying roll positioned closely adjacent said support surface and means for urging said pressure-applying roll toward said support surface for applying compressive pressure to said strips as they are advanced in superposition between said pressure-applying roll and said support member.

19. Photographic apparatus for exposing and thereafter processing a photosensitive strip and comprising, in combination, a generally cylindrical drum, means mounting said drum for rotation at variable speed about its axis, supply means for a photosensitive strip and a second strip and take-up means for said strips mounted within said drum, said drum having an outer support surface, means for guiding said photosensitive strip from said supply means to said support surface, and means for superposing said photosensitive strip on said support surface, means for exposing successive portions of said photosensitive strip on said support surface, means for guiding said second strip from said supply means into superposition with said photosensitive strip on said support surface and distributing a fluid processing reagent between said strips to form a sandwich, stripping means located adjacent said support surface of said drum for stripping said second strip from said photosensitive strip when processing is complete, means for moving said stripping means in a circle about said axis of said drum relative to said means for superposing said strips whereby the length of said sandwich supported on said drum is varied directly as the speed of rotation of said drum,

means for guiding said second strip from said stripping means to said take-up means, and means for retaining said photosensitive strip in superposition on said support surface during stripping of said second strip from said photosensitive strip and thereafter separating said photosensitive strip from said support surface and guiding it to said take-up means.

20. In photographic apparatus as defined in claim 19 wherein said processing results in the production of visible images in portions of said second strip, means for exhibiting said images following separation of said second strip from said photosensitive strip, said stripping means being movable with respect to said exhibiting means, and means for guiding said second strip from said stripping means to said exhibiting means at every position of said stripping means.

21. The photographic apparatus of claim 20 wherein said exhibiting means includes a viewing device having means for holding said portions of said photosensitive strip stationary during exhibition of the images carried on said portions, and including means for feeding and guiding said second strip into a take-up loop between said stripping means and said viewing device whereby movement of said sandwich and rotation of said drum may be continued during exhibiting of said images on said second strip.

References Cited in the file of this patent

UNITED STATES PATENTS

2,186,637	Green	Jan. 9, 1940
2,586,772	Ashby	Feb. 26, 1952
2,780,972	Fairbanks	Feb. 12, 1957