

March 12, 1957

N. T. PIERCE ET AL
PHOTOGRAPHIC APPARATUS

2,784,653

Filed Aug. 27, 1953

7 Sheets-Sheet 1

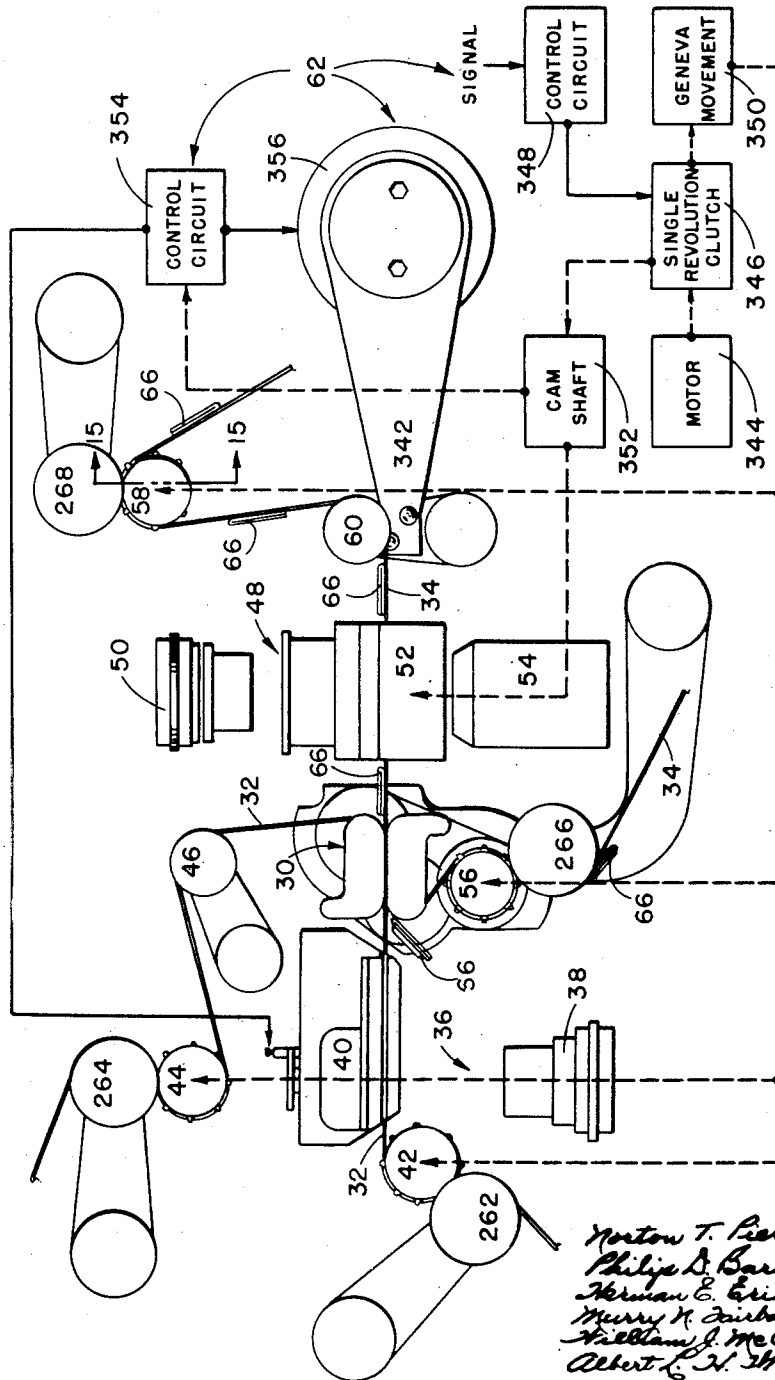


FIG. 1

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7 Sheets-Sheet 2

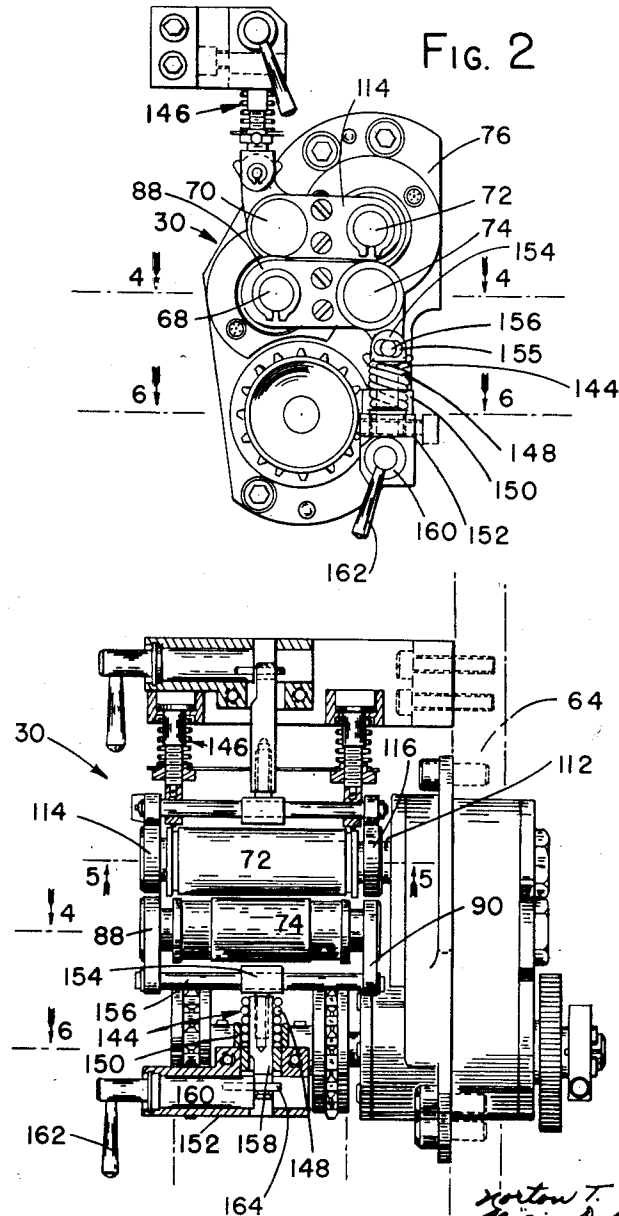


FIG. 3

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7 Sheets-Sheet 3

FIG. 4

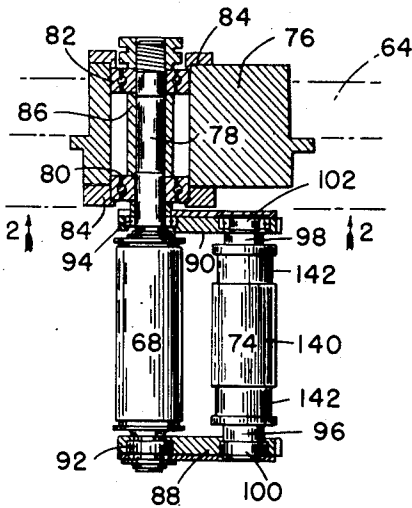
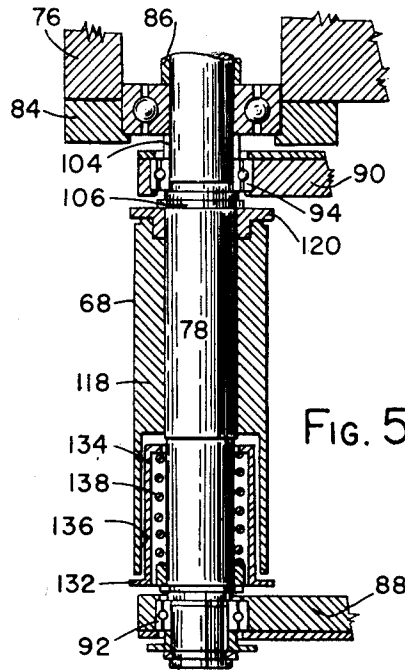


FIG. 5

FIG. 6

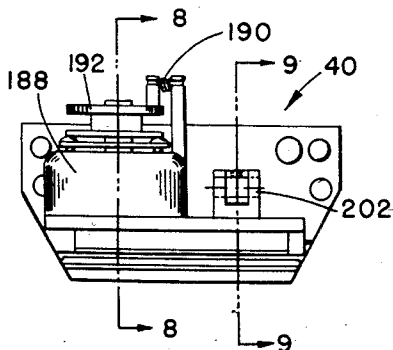
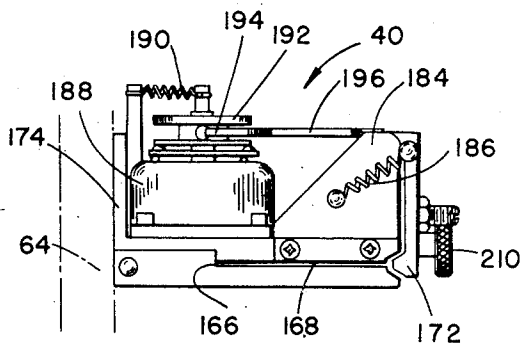


FIG. 7

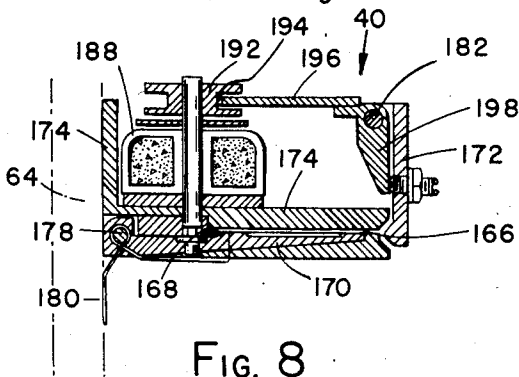


FIG. 8

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7 Sheets-Sheet 4

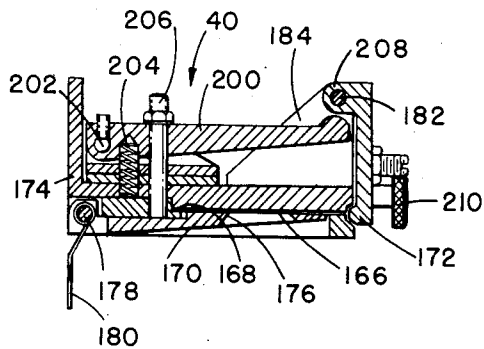


FIG. 9

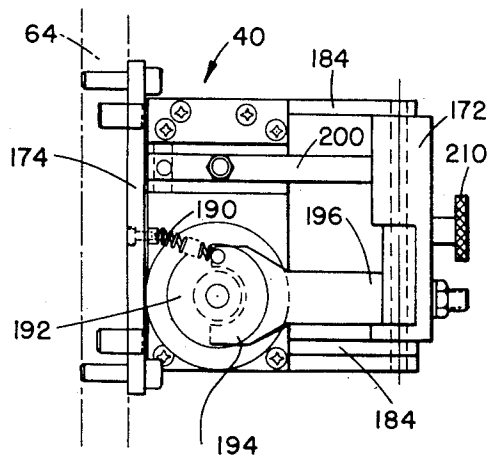


FIG. 10

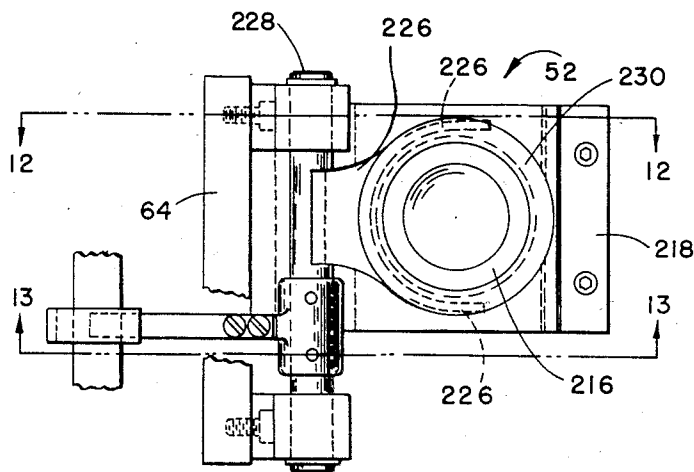


FIG. 11

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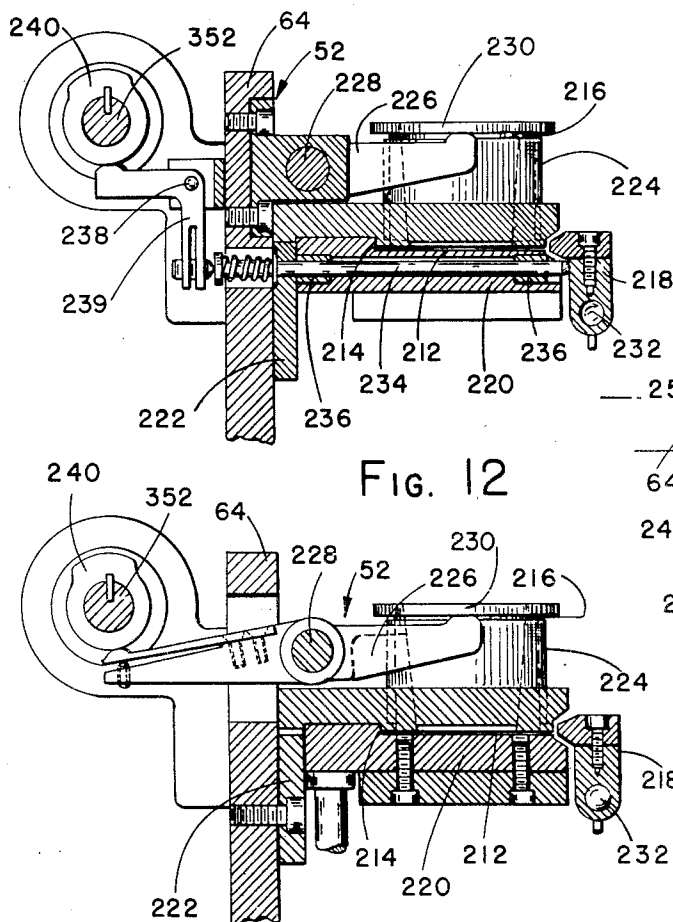


FIG. 12

FIG. 13

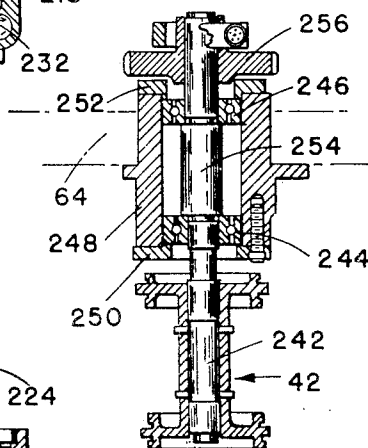


FIG. 14

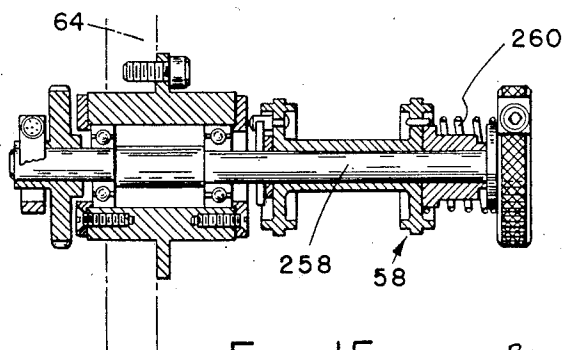


FIG. 15

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7 Sheets-Sheet 6

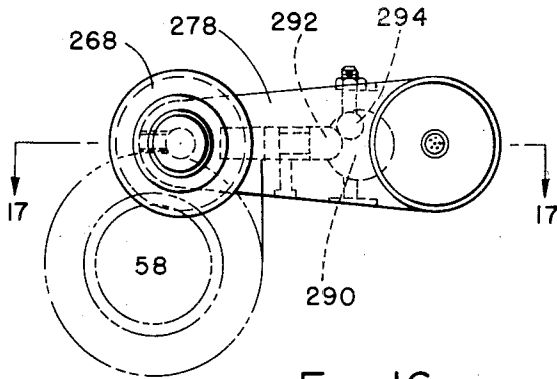


FIG. 16

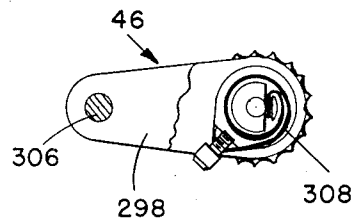


FIG. 19

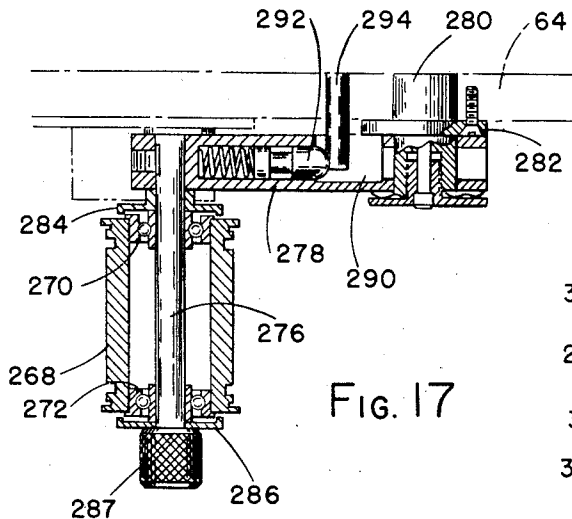


FIG. 17

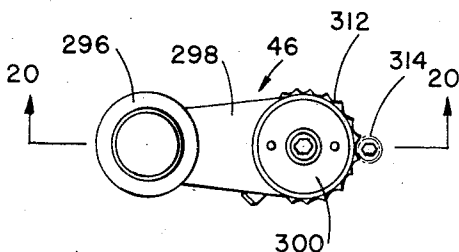


FIG. 18

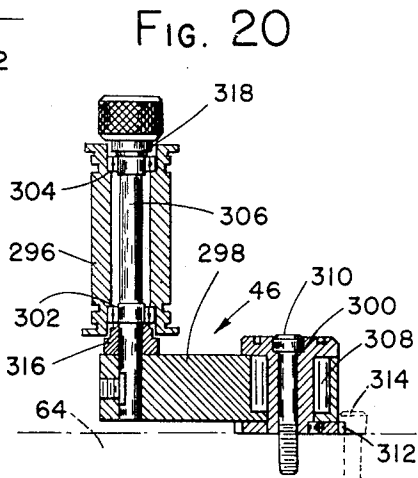


FIG. 20

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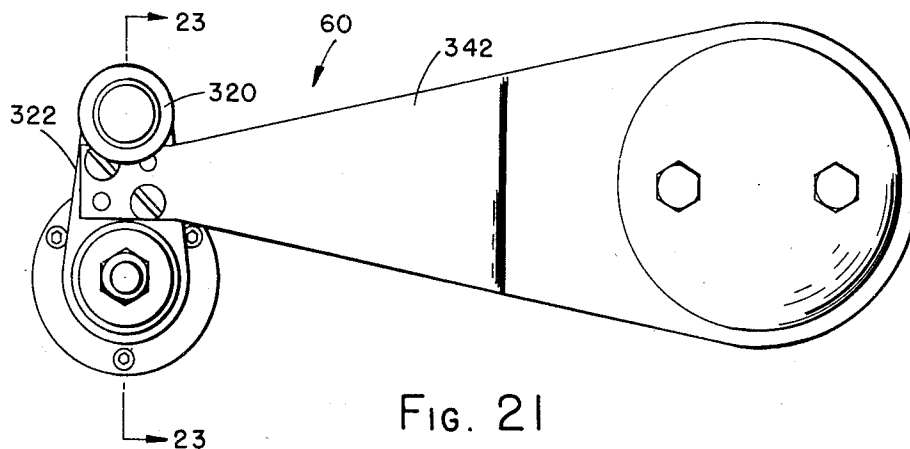


FIG. 21

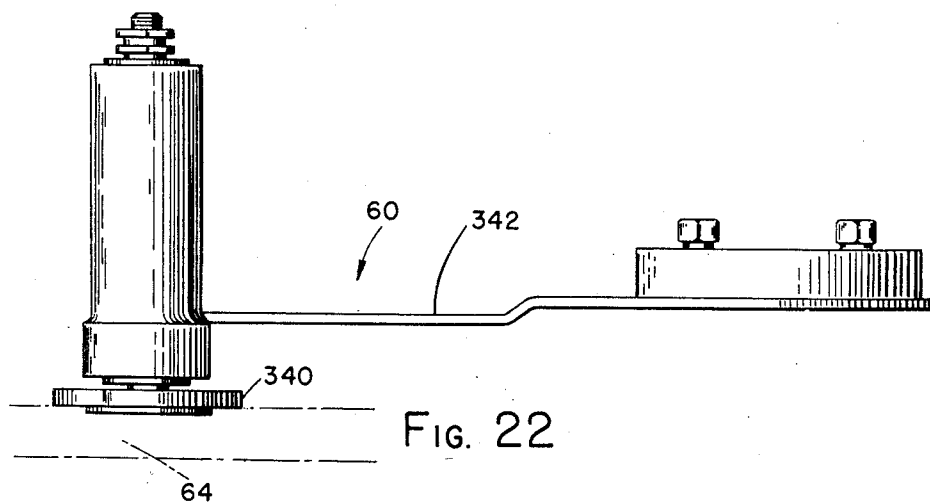


FIG. 22

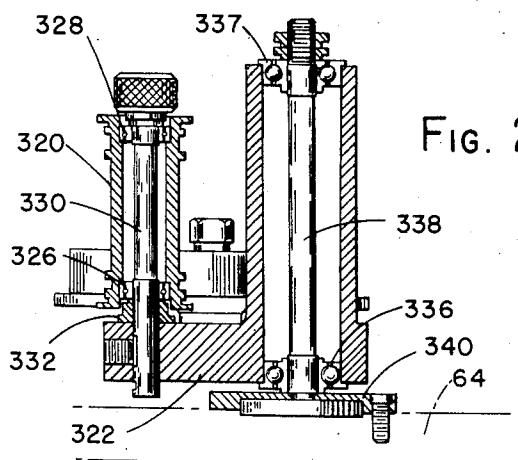


FIG. 23

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2,784,653

PHOTOGRAPHIC APPARATUS

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Application August 27, 1953, Serial No. 376,882

17 Claims. (Cl. 95—14)

This invention relates to photography and more particularly to photographic devices.

The invention contemplates a device of the type capable of automatically processing a succession of film areas. By means of such a device, for example, a latent image produced in motion picture film at a given moment may be processed almost immediately thereafter to form a visible print. Or a latent image of a representation produced by the cathode ray tube of television or radar apparatus at a given moment shortly thereafter may be processed to form a visible print, an image of which, shortly thereafter, may be projected onto a large viewing screen. Such a device, disclosed in the copending application of Edwin H. Land, Serial No. 244,822, filed on September 1, 1951, for Apparatus and Method for Indicating the Position and Motion of Phenomena in Space, is useful in the production of a plurality of visible prints, images of which are to be registered on a viewing screen.

The device herein disclosed is of the type which processes an exposed frame of a photosensitive sheet by superposing it on an area of an image-receptive sheet and by spreading a layer of processing composition between the frame and the area. In one such procedure, the photosensitive sheet includes a silver halide layer, the image-receptive sheet includes a silver precipitating layer, and the processing composition includes a developer, a silver halide solvent and an alkali. The layer of processing composition may be formed, for example, by advancing the sheets between a pair of pressure-applying members. In the presence of this layer of processing composition, a latent image in the frame is reduced to silver and a soluble silver complex from unreduced silver halide is formed, is transferred by imbibition to the area, and there is reduced to silver to produce a positive image. Photographic materials generally useful in the foregoing process are described in detail in Patent No. 2,543,181, issued to Edwin H. Land on February 27, 1951, for Photographic Product Comprising a Rupturable Container Carrying a Photographic Processing Liquid.

Objects of the present invention are: to provide a novel photographic device for repetitively performing the successive steps of producing a latent image on a photosensitive strip, processing the latent image to produce a visible print, and projecting an image of the print to enable its observation; to provide a novel photographic device of the foregoing type wherein an exposing station which produces latent images on a photosensitive strip a processing station which processes the latent images to produce visible prints, and a projecting station which enables the observation of these visible prints are so arranged that at one time, if the center one of three immediately adjacent frames is within the processing station, one of the remaining two frames is within the exposing station and the visible print associated with the other of the remaining two frames is within the projecting station; and to provide a device of the foregoing type wherein a processing station superposes frames of

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a photosensitive strip and areas of another strip in order to produce positive prints in the areas from latent images in the frames and wherein an exposing station and a projecting station are so arranged, with respect to the processing station, that, at one time, if one of a pair of immediately adjacent frames and one of a pair of immediately adjacent areas are within the processing station, the other of the pair of frames is within the exposing station and the other of the pair of areas is within the projecting station.

Other objects are: to provide a novel photographic device comprising an exposing station for producing successive latent images on a photosensitive strip, a processing station for producing successive visible images from the successive latent images, a pair of metering elements for advancing successive sections of the photosensitive strip within a path which extends from one of the metering elements of the pair through the exposing station and the processing station to the other of the metering elements of the pair, and tension means for maintaining the successive sections taut; and to provide photographic apparatus of the foregoing type comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between the associated frames and areas, an exposing station for producing latent images in the successive frames, first metering means for advancing successive sections of the first strip within a first path which extends through the exposing station and the processing station, tension means for maintaining the successive sections of the photosensitive strip taut, a projecting station for displaying images of visible prints in the successive areas, second metering means for advancing successive sections of the other strip within a second path which extends through the processing station and the projecting station, and tension means for maintaining the successive sections of the other strip taut.

Further objects of the present invention are: to provide, as a processing station in a device of the foregoing type, pressure-applying means for effectuating a photographic process of the type wherein an exposed frame of a photosensitive sheet is superposed on an area of another sheet while a processing composition is spread between the frame and the area, the pressure-applying means being capable of exerting compressional forces of precisely predetermined magnitude and direction; to provide pressure-applying means of the above type comprising two pairs of pressure-applying rollers, each pair having a first roller rotatable about an axis that is fixed with respect to a support and a second roller resiliently urged toward the first roller; to provide pressure-applying means of the above type comprising a support, a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, the second axis being fixed with respect to the support, means for urging the first axis in parallelism toward the second axis, the third axis being fixed with respect to the support, and means for urging the fourth axis in parallelism toward the first axis, the second axis being parallel to the third axis; to provide pressure-applying means of the above type wherein the opposite ends of one of the first and second rollers are provided with a first pair of guide means and wherein the opposite ends of one of the third and fourth rollers are provided with a second pair of guide means; to provide, for use in pressure-applying means of the above type, a roller comprising an intermediate portion providing a cylindrical surface of predetermined diameter and a pair of circular rims at opposite ends of the cylindrical surface, the rims being coaxial with the cylindrical

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surface and being of a diameter greater than the predetermined diameter, one rim of the pair being affixed to the cylindrical surface, the other rim of the pair being slidable with respect to the cylindrical surface, and means for resiliently urging the slidable rim toward the fixed rim.

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 partly diagrammatic, fragmentary, front elevation of a photographic device embodying the herein disclosed invention, a photosensitive strip and an image-receptive strip being mounted therein;

Fig. 2 is an enlarged front elevation of the processing station shown in Fig. 1;

Fig. 3 is a side elevation of the processing station of Fig. 2 with parts in section;

Fig. 4 is a sectional view taken substantially along the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken substantially along the line 5—5 of Fig. 3;

Fig. 6 is an enlarged front elevation of the exposing station shown in Fig. 1;

Fig. 7 is a side elevation of the exposing station of Fig. 6;

Fig. 8 is a sectional view taken substantially along the line 8—8 of Fig. 6;

Fig. 9 is a sectional view taken substantially along the line 9—9 of Fig. 6;

Fig. 10 is a top plan view of the exposing station of Fig. 6;

Fig. 11 is an enlarged top plan view of the projecting station shown in Fig. 1;

Fig. 12 is a sectional view taken substantially along the line 12—12 of Fig. 11;

Fig. 13 is a sectional view taken substantially along the line 13—13 of Fig. 11;

Fig. 14 is a sectional view taken substantially along the line 14—14 of Fig. 2;

Fig. 15 is a sectional view taken substantially along the line 15—15 of Fig. 1;

Fig. 16 is an enlarged front elevation of one of the pad rolls shown in Fig. 1;

Fig. 17 is a sectional view taken substantially along the line 17—17 of Fig. 16;

Fig. 18 is an enlarged front elevation of one of the tensor rolls shown in Fig. 1;

Fig. 19 is a view similar to that of Fig. 18 with parts broken away;

Fig. 20 is a sectional view taken substantially along the line 20—20 of Fig. 18;

Fig. 21 is an enlarged front elevation of the other of the tensor rolls shown in Fig. 1;

Fig. 22 is a bottom plan view of the tensor roll of Fig. 21; and

Fig. 23 is a sectional view taken substantially along the line 23—23 of Fig. 21.

Generally, with reference to Fig. 1, the illustrated embodiment of the herein disclosed invention comprises: a processing station 30 through which associated portions of a photosensitive strip 32 and an image-receptive strip 34 may advance in superposed relation with a layer of processing composition therebetween; an exposing station 36 including a lens and shutter 38 and a guide means 40 for predeterminedly positioning a frame of strip 32 in the focal surface of the lens; a metering means in the form of a pair of sprockets 42 and 44 for advancing suc-

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cessive sections of strip 32 through exposing station 36 and processing station 30; a tension means 46 for keeping the successive sections of strip 32 taut; a projecting station 48 including a lens and shutter 50, a guide means 52 for predeterminedly positioning an area of strip 34 in the focal surface of the lens, and a source of illumination 54; a metering means in the form of a pair of sprockets 56 and 58 for advancing successive sections of strip 34 through processing station 30 and projecting station 48; a tension means 60 for keeping the successive sections of strip 34 taut; and an electromechanical drive and control system 62.

Referring now in detail to the remaining drawings, there are shown at 64 portions of a housing (Figs. 3, 4, 7, 8, 10, 11, 12, 13, 14, 15, 17, 20 and 23) which mount the various components of the herein disclosed device.

Supplies of strips 32 and 34 are carried within the housing upon spools of conventional design. Mounted on image-receptive strip 34 are a plurality of containers 66 (Fig. 1) each of which carries a predetermined quantity of processing composition. As shown, containers 66 are affixed to image-receptive strip 34 at substantially regularly spaced intervals from its leading end to its trailing end, the containers being so spaced that one container is associated with one image-receiving area. Each container has a rupturable mouth which faces the trailing end of strip 34 and which is adapted to eject processing composition when opposed compressional forces are applied to the container.

Processing station 30, shown in detail in Figs. 2 through 5, comprises a first pair of pressure-applying rollers 68 and 70, between which strips 32 and 34 are adapted to advance initially, and a second pair of rollers 72 and 74, between which the strips are adapted to advance thereafter. Rollers 68 and 70 are adapted to superpose exposed frames of strip 32 upon associated areas of strip 34 and to spread processing composition therebetween. Rollers 72 and 74 cooperate with rollers 68 and 70 to maintain associated frames and areas in superposition for predetermined processing periods during which latent images in the frames are processed and positive prints are formed in the areas. Rollers 72 and 74 enable uniform stripping of associated frames and areas in order to permit images of the positive prints so formed to be displayed.

In order to enable observation of a positive print as quickly as possible after a latent image has been produced, exposing station 36 and projecting station 48 are positioned closely adjacent to opposite sides of processing station 30 in order to permit a pair of immediately adjoining frames of strip 32 to be respectively located in the exposing station and the processing station and to permit a pair of immediately adjoining areas of strip 34 to be respectively located in the processing station and the projecting station.

In accordance with the present invention, pairs of rollers 68 and 70 and 72 and 74 are so mounted in housing 64 as to exert compressional forces of precisely predetermined magnitude and direction. As a means for mounting the rollers in housing 64, there is provided a casting 76 suitably secured to the housing.

Referring now to Figs. 4 and 5, roller 68 is suitably affixed to a shaft 78, one end of which is journaled in casting 76 as by a pair of bearings 80 and 82. Bearings 80 and 82 are retained within casting 76 by such means as caps 84 and are spaced from each other by a sleeve 86. As a means for rotatably mounting roller 74, there are provided a pair of links 88 and 90. These links are pivotally mounted on shaft 78 at opposite ends of roller 68 by such means as bearings 92 and 94. Projecting from the opposite ends of roller 74 are stud shafts 96 and 98 which are journaled in links 88 and 90 by such means as bearings 100 and 102. Link 90 is predeterminedly spaced from bearing 80 by such means as a collar 104 (Fig. 5) and roller 68 is predeterminedly spaced from link 90 by a shoulder 106 (Fig. 5) integral

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with shaft 78. This construction is such that roller 78 is precisely predeterminedly positioned with respect to casting 76.

With reference now to Figs. 2 and 3, roller 72 is rotatably mounted on casting 76 by means of a shaft 112 (Fig. 3) and roller 70 is rotatably mounted on a pair of links 114 and 116 which, in turn, are pivotally connected to shaft 112. Roller 72, shaft 112, roller 70 and links 114 and 116 need not be described specifically because they are respectively similar to roller 68, shaft 78, roller 74 and links 88 and 90.

The rollers of each pair are designed to cooperate both in guiding associated portions of the strips therebetween and in preventing processing composition between the strips from escaping therefrom. Roller 68 (Fig. 5), which is similar to roller 72, includes an intermediate portion 118 for applying pressure, a fixed reference flange 120 and a movable clamping flange 132 which, by bearing on the outer edges of associated portions of the strips, cause their inner edges to abut against the reference flange. Clamping flange 132 is integral with a thimble 134 which surrounds shaft 78 and which is urged into the hollow end 136 of intermediate portion 118 by a compression spring 138. Roller 74 (Fig. 4), which is similar to roller 70, includes an intermediate portion 140 and, adjacent to its opposite ends, peripheral channels 142 which, by preventing the exertion of pressure at the edges of strips superposed between rollers 74 and 72, prevent processing composition between the strips from escaping between their edges.

Resilient means are provided for causing the exertion of opposed compressional forces upon portions of strips 32 and 34 superposed between rollers 68 and 70 and between rollers 72 and 74. In the form shown, the resilient means comprise a pair of spring assemblies designated generally by 144 and 146 in Figs. 2 and 3. Assembly 144, which is generally similar to assembly 146, only need be described in detail. Receiving the lower end of a spring 148 is a seat 150 fixed with respect to housing 64 by a block 152. Abutting against the upper end of spring 148 is a clevis 154 having an elongated slot 155. This slot slidably and pivotally receives a rod 156, the opposite ends of which are affixed to links 88 and 90. A slide pin 158 is attached, at its upper end, to clevis 154 and extends through spring 148, seat 150 and a passage in block 152. A solid cylinder 160, the outer end of which is provided with a manually engageable handle 162, is rotatably mounted within block 152. Extending from the inner end of cylinder 160 into an opening in slide pin 158 is a pin 164 eccentrically located with respect to the axis of the cylinder. Rotation of the cylinder, by causing pin 164 to engage slide pin 158, moves clevis 154 into its lowermost position and thereby separates roller 74 from roller 72.

Guide means 40, shown in detail in Figs. 6 through 10, are provided for predeterminedly positioning successive portions of strip 32 transversely of and perpendicularly to its direction of advancement within the focal surface of lens 38. As shown, the guide means provides a pair of reference surfaces 166 and 168 against which the upper face and the inner edge, respectively, of strip 32 are adapted to abut, and a pair of clamps 170 and 172, which are adapted, by contacting the lower face and outer edge respectively of strip 32, to press the strip against the reference surfaces. As shown, reference surface 166 is provided by the horizontal portion of an L-shaped bracket 174, the vertical portion of which is secured to housing 64. Clamp 170, apertured at 176 (Fig. 9) to permit the photoexposure of a portion of strip 32 in contact with reference surfaces 166 and 168, is pivoted at 178 to bracket 174 and is biased upwardly by a torsion spring 180. Clamp 172, pivoted at 182 to a pair of plates 184 which are affixed to bracket 174, is biased inwardly by tension spring 186. Mounted upon

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the cross portion of bracket 174 is a solenoid 188 of conventional design, the core of which screws downwardly when the solenoid is energized and screws upwardly by virtue of a tension spring 190 when the solenoid is deenergized. The lower end of the core is journaled in clamp 170 so as to urge the clamp downwardly when the solenoid is energized. The upper end of the core carries a spool 192 which receives between its flanges the legs 194 of a fork 196. A bell crank 198, pivoted at 182, includes a cross portion secured to fork 196 and a depending portion associated with clamp 172. When solenoid 188 is energized, spool 192 screws downwardly to rotate fork 196 in a counterclockwise direction and to swing bell crank 198 and clamp 172 outwardly.

In order to permit strip 32 to be threaded easily through exposing station 36, manually controlled means are provided for simultaneously deactuating clamps 170 and 172. This means includes a lever 200 pivoted on a clevis 202 which is carried by the cross portion of bracket 174. Lever 200, urged upwardly by a compression spring 204, carries a depending pin 206, the lower end of which abuts against clamp 170 when the lever is depressed. The free end of lever 200 is associated with a cam portion 208 of clamp 172, which cam portion, when the clamp is swung outwardly, urges the free end of the lever downwardly. Clamp 172 may be swung outwardly by means of a manually operated knob 210.

Guide means 52, shown in detail in Figs. 11, 12 and 13, are provided for positioning successive portions of strip 34 transversely of and perpendicularly to its direction of advancement. As shown, the guide means provides a pair of reference surfaces 212 and 214 against which the lower face and inner edge of strip 34, respectively, are adapted to abut, and a pair of clamps 216 and 218 which are adapted, by contacting the upper face and outer edge, respectively, of strip 34, to press the strip against the reference surfaces. As shown, reference surfaces 212 and 214 are provided by a plate 220 affixed to an L-shaped bracket 222, the depending portion of which is secured to housing 64. Clamp 216 is in the form of an annulus which is slidably received by a sleeve 224 projecting through the cross portion of bracket 222. The legs of a fork 226, which is pivotally mounted on the housing at 228, straddle clamps 216 and abut against a flange 230 with which the upper edge of clamp 216 is provided. Clamp 218, pivotally mounted at 232, is biased inwardly by a suitable spring (not shown). Clamps 216 and 218 are deactuated in the following manner during advancement of strip 34 through the projecting station. Slidably mounted within plate 220 is a rod 234, the right end of which is in contact with clamp 218. Pivoted to fork 226 at 238 is the apex of a bell crank 239 one arm of which is in contact with the left end of rod 234 and the other arm of which follows a cam 240. Rotation of cam 240, which is controlled in a manner to be described below, causes counterclockwise rotation of bell crank 239, upward movement of the legs of fork 226, consequent deactuation of clamp 216, outward movement of pin 234, and consequent deactuation of clamp 218.

The metering means provided for advancing successive sections of strip 32 through exposing station 36 and processing station 30 and for advancing successive sections of strip 34 through processing station 30 and projecting station 48, as indicated above, include four synchronized intermittent sprockets 42, 44, 56 and 58. In practice, strip 32 extends from its supply spool, to sprocket 42, into the focal plane of lens 38, between pairs of rollers 68, 70 and 72, 74 to sprocket 44 and toward a takeup spool. Similarly, strip 34 extends from its supply spool, to sprocket 56, between pairs of rollers 68, 70 and 72, 74 into the focal plane of lens 50, to sprocket 58 and toward a takeup spool. The tension means for keeping strips 32

and 34 taut as they advance through their respective paths are in the form of spring-biased rollers. By virtue of this construction, the predetermined over-all length of that section of strip 32, which extends from sprocket 42 to sprocket 44, and the predetermined over-all length of that section of strip 34, which extends from sprocket 56 to sprocket 58, are substantially maintained notwithstanding local expansion of portions of the strips located within processing station 30 and local contraction of portions of the strips which have advanced from the processing station.

A cross-sectional view of sprocket 42 appears in Fig. 14. As shown, sprocket 42 is suitably affixed to one end of a shaft 242, the medial portion of which is journaled by a pair of bearings 244 and 246 in a casting 248 which is secured to housing 64. Bearings 244 and 246 are retained within casting 248 by such means as caps 250 and 252 and are spaced from each other by a sleeve 254 which is affixed to shaft 242 and which predeterminedly positions sprocket 42 with respect to casting 248. Affixed to the other end of shaft 242 is a pinion 256 by means of which the sprocket is intermittently driven. Sprockets 44 and 52 are similar in construction and operation to sprocket 42.

Strips 32 and 34, if composed of different materials, tend to expand to different degrees during processing. In the present case, for example, in processing station 30, strip 32 tends to expand to a greater degree than does strip 34. It has been found that if this differential expansion is allowed to continue, tension in that section of strip 34 extending from processing station 30 to sprocket 58 increases until it gradually overcomes the friction between portions of strips 32 and 34 within processing station 30 and suddenly causes strip 34 to slip forward with respect to strip 32. Means are provided to prevent such a build-up of tension. In the illustrated embodiment, this means takes the form of sprocket 58, a cross section of which is shown in Fig. 15. In order to prevent a build-up of tension in strip 34, sprocket 58 begins its rotational cycle slightly before sprockets 42, 44 and 56 begin theirs and, thereby, causes strip 34 to slip slightly with respect to strip 32 at the start of each advancement of the strips through the processing station. Thus, sprocket 58 controls slippage between strip 32 and strip 34 and renders it harmless. Sprocket 58 is rotatable with respect to a shaft 258 which is journaled on the housing in the same manner as is shaft 242 of sprocket 42. When shaft 258 is driven, power is transmitted to sprocket 58 by means of a torsion spring 260 one end of which is connected to the shaft and the other end of which is connected to the sprocket. Spring 260 prevents too sudden a build-up of tension, which might result from the early initiation of the rotational cycle of sprocket 58, in that section of strip 34 extending from processing station 52 to sprocket 58.

In order to keep strips 32 and 34 in mesh with sprockets 42, 44, 56 and 58, pad rolls 262, 264, 266 and 268 are provided. Pad roll 268, which is similar in construction and operation to pad rolls 262, 264 and 266 and details of which are shown in Figs. 16 and 17, only need be described. Pad roll 268 is rotatably mounted by means of bearings 270 and 272 on a spindle 276, one end of which is secured to an arm 278. Arm 278, pivotally mounted on a stud shaft 280, is predeterminedly spaced from housing 64 by a ring 282 which is integral with the shaft. Pad roll 268 is predeterminedly spaced from arm 278 by a cap 234 which abuts against the arm and the journal of bearing 270. This construction is such that pad roll 268 is precisely predeterminedly positioned with respect to housing 64 and aligned with sprocket 58. A cap 286, which abuts against the journal of bearing 272, retains pad roll 268 in this position. A knurled nut 287, at the outer end of spindle 276, may be manually engaged in order that strip 34 may be threaded between sprocket 58 and pad roll 268. In

order that pad roll 268 be urged toward sprocket 58, arm 278 is provided with an opening 290 and a plunger 292 which is spring-pressed into the opening. Secured to housing 64 and extending into opening 290 is a pin 294 which is engaged by plunger 292 in order to urge arm 278 and pad roll 268, as viewed in Fig. 16, in a counterclockwise direction.

Tension means 46 for keeping the successive sections of strip 32 taut, as shown in Figs. 18, 19 and 20, includes a roll 296 rotatably mounted on an arm 298 which is pivoted to housing 64 by an arbor 300. Roll 296 is rotatably mounted by means of bearings 302 and 304 on a spindle 306, one end of which is secured to arm 298. Arm 298, as viewed in Figs. 18 and 19, is resiliently urged in a counterclockwise direction by means of a helical spring 308, one end of which is connected to arbor 300 and the other end of which is connected to arm 298. Arbor 300, which is secured to housing 64 by means of a screw 310, enables the tension of spring 308 to be controlled. Arbor 300 is locked in position by a serrated washer 312 affixed to the inner end of the arbor and a socket cap screw 314, the head of which engages the washer. Arm 298 is predeterminedly spaced from housing 64 by washer 312 and roll 296 is predeterminedly spaced from arm 298 by a shouldered collar 316 which abuts against the arm and the journal of bearing 302. This construction is such that roll 296 is precisely predeterminedly positioned with respect to housing 64 so as to be aligned with the rollers of processing station 30 and sprockets 42 and 44. A collar 318, which abuts against the journal of bearing 304, retains tensor roll 296 in this position.

Tension means 60 for keeping the successive sections of strip 34 taut is shown in Figs. 21, 22 and 23 as including a roll 320, rotatably mounted on an arm 322 which is pivoted to housing 64. Roll 320 is rotatably mounted by means of bearings 326 and 328 on a spindle 330, one end of which is secured to arm 322. Roll 320 is predeterminedly spaced from arm 322 by a collar 332 which abuts against arm 322 and the journal of bearing 326. Arm 322 is pivotally mounted by means of bearings 336 and 337 on a spindle 338, one end of which is secured to housing 64. Arm 322 is predeterminedly spaced from housing 64 by a washer 340 which abuts against housing 64 and the journal of bearing 336. This construction is such that roll 320 is precisely predeterminedly positioned with respect to housing 64 and aligned with the rollers of processing station 30 and sprockets 56 and 58. Roll 320 and arm 322, as viewed in Fig. 21, are urged in a clockwise direction by means of weighted lever 342 to which arm 322 is affixed.

Electromechanical drive and control system 62, shown schematically in Fig. 1, includes a suitable electric motor 344 which, when the device is in operation, rotates continuously. A single revolution clutch 346 of conventional design is driven through one cycle by motor 344 when a control circuit 348, operatively connected to the single revolution clutch, receives an appropriate signal indicating that shutter 38 has been tripped. Single revolution clutch 346 drives sprockets 42, 44, 56 and 58 through a Geneva movement 350. Single revolution clutch 346 further operates a cam shaft 352 to which cam 240 (Figs. 12 and 13) is keyed and actuates a control circuit 354 which energizes solenoid 138 and an electromagnet 356. Electromagnet 356, in order to prevent roll 320 from being forced upwardly when rotation of sprocket 58 is initiated, is adapted temporarily to clamp arm 322 in fixed position at that time.

The components of the device, once strip 32 has been threaded from sprocket 42 through exposing station 36 and processing station 30, past tension means 46 to sprocket 44, and once strip 34 has been threaded from sprocket 56 through processing station 30 and projecting station 48, past tension means 60 to sprocket 58, operate in the following cycle. At a signal indicating that shutter

38 has been tripped, single revolution clutch 346 is released and cam shaft 352 and Geneva movement 350 begin their rotational cycles with the following effect: clamps 216 and 218 of guide means 52 are deactuated and control circuit 354 is energized; solenoid 188 is energized and clamps 170 and 172 of guide means 40 are deactuated; and electromagnet 356 is energized whereby tension means 60 is locked in a fixed position. At this point, sprocket 58 begins its rotational cycle and immediately thereafter sprockets 42, 44 and 56 begin their rotational cycles. At this point, electromagnet 356 is deenergized and tension means 60 is unlocked from its fixed position. As a result: a frame of strip 32 advances into exposing station 36; the frame of strip 32 which has been within exposing station 36, together with a frame of strip 34, advances into processing station 30 in superposed relation with processing composition from a container 66 therebetween; and the area of strip 34 which has been within processing station 30 advances therefrom and is stripped from the frame of strip 32 with which it has been in superposed relation. At the termination of the rotational cycle of single revolution clutch 346, clamps 216 and 218 of guide means 52 are reactuated and control circuit 354 is deenergized whereby solenoid 188 is deenergized and clamps 170 and 172 of guide means 40 are reactuated. At this point, shutter 50 is tripped and an image of the print of strip 34, now positioned within projecting station 48, is displayed. Similar cycles occur at regular intervals or as desired whenever shutter 38 is tripped. Where the cycles occur at regular intervals, it is desirable that the processing composition employed be in such quantity and be so constituted as to perform its function when spread between strips 32 and 34 in a thin layer for a period of time which is predeterminedly related to the intervals between the initiation of successive cycles.

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 comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, said exposing station providing a pair of reference surfaces and comprising a pair of clamps which are adapted to cause one edge and one face of said photosensitive strip to abut against said reference surfaces, said clamps being normally actuated, first metering means for advancing successive sections of said first strip within a first path which extends through said exposing station and said processing station, each of said sections of said photosensitive strip having at least a pair of immediately adjacent frames, a projecting station for displaying images of visible prints in said successive areas, said projecting station providing a pair of reference surfaces and comprising a pair of clamps adapted to cause one edge and one face of said other sheet to abut against said reference surfaces, said clamps being normally actuated, and second metering means for advancing successive sections of said other strip within a second path which extends through said processing station and said projecting station, each of said sections of said other strip having at least a pair of immediately adjacent areas, said exposing station and said projecting station being so arranged, with respect to said processing station, that, at one time, one of said immediately adjacent frames and one of said immediately adjacent areas are within said processing station, the other of said immediately adjacent frames is within said exposing

station and the other of said immediately adjacent areas is within said projecting station.

2. Photographic apparatus comprising a base, a processing station on said base for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, said processing station comprising a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said base, means for biasing the other of said first and second axes toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said base and means for biasing the other of said third and fourth axes toward said one of said third and fourth axes, said one of said first and second axes being parallel to said one of said third and fourth axes, an exposing station mounted on said base for producing latent images in said successive frames, first metering means for advancing successive sections of said first strip within a first path which extends through said exposing station and said processing station, each of said sections of said photosensitive strip having at least a pair of immediately adjacent frames, a projecting station for displaying images of visible prints in said successive areas, and second metering means mounted on said base for advancing successive sections of said other strip within a second path which extends through said processing station and said projecting station, each of said sections of said other strip having at least a pair of immediately adjacent areas, said exposing station and said projecting station being so arranged with respect to said processing station that at one time one of said immediately adjacent frames and one of said immediately adjacent areas are within said processing station, the other of said immediately adjacent frames is within said exposing station and the other of said immediately adjacent areas is within said projecting station.

3. Photographic apparatus comprising a base, a processing station on said base for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, said processing station comprising a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said base, means for biasing the other of said first and second axes toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said base and means for biasing the other of said third and fourth axes toward said one of said third and fourth axes, said one of said first and second axes being parallel to said one of said third and fourth axes, an exposing station on said base for producing latent images in said successive frames, a first pair of sprockets on said base for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, each of said sections of said photosensitive strip having at least a pair of immediately adjacent frames, a projecting station on said base for displaying images of visible prints in said successive areas, and a second pair of sprockets on said base for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, each of said sections of said other strip having at least a pair of immediately adjacent areas, said exposing station and said projecting station being so arranged with respect to said processing station that, at one time, one of said immediately adjacent frames and one of said immediately adjacent areas are within said process-

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ing station, the other of said immediately adjacent frames is within said exposing station and the other of said immediately adjacent areas is within said projecting base.

4. Photographic apparatus comprising a base, a processing station on said base for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, said processing station comprising a first roller mounted on said support for rotation about a first axis, said first axis being fixed with respect to said support, a second roller mounted on said support for rotation about a second axis, said second axis being fixed with respect to said support, link means mounted for pivotal movement about said second axis, a third roller mounted on said link means for rotation about a third axis, link means mounted for pivotal movement about said first axis, a fourth roller mounted on said second link means for rotation about a fourth axis, resilient means for biasing said third roller toward said first roller and resilient means for biasing said fourth roller toward said second roller, an exposing station on said base for producing latent images in said successive frames, a first pair of sprockets on said base for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station on said base for displaying images of visible prints in said successive areas, and a second pair of sprockets on said base for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other of said second pair.

5. Photographic apparatus comprising a base, a processing station including a first roller mounted on said base for rotation about a first axis, said first axis being fixed with respect to said base, a second roller mounted on said base for rotation about a second axis, said second axis being fixed with respect to said base, link means mounted for pivotal movement about said second axis, a third roller mounted on said link means for rotation about a third axis, link means mounted for pivotal movement about said first axis, a fourth roller mounted on said second link means for rotation about a fourth axis, resilient means for biasing said third roller toward said first roller and resilient means for biasing said fourth roller toward said second roller, said first and third rollers defining a region of initial superposition therebetween within which associated frames and areas of a photosensitive strip and another strip, respectively, are adapted to advance in superposed relation with a layer of processing composition therebetween, said third roller and said fourth roller, together with said first roller and said second roller, being adapted to maintain said associated frames and areas in superposition, said third and fourth rollers defining a region of terminal superposition through which said frames and areas are adapted to advance in order to be stripped from each other, an exposing station on said base for producing latent images on said successive frames, a first pair of sprockets on said base for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said regions of initial and terminal superposition to the other sprocket of said first pair, a projecting station on said base for displaying images of visible prints in said successive areas, and a second pair of sprockets for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said regions of initial and terminal superposition to the other sprocket of said second pair, that portion of said first path extending through said exposing station and said regions of initial and terminal superposition being disposed substantially within a plane, that portion of said second path extending through said regions of initial and terminal superposition

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through said projecting station being disposed substantially in a plane.

6. Photographic apparatus comprising a base, a processing station on said base for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, said processing station comprising a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said base, means for biasing the other of said first and second axes toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said base, and means for biasing the other of said third and fourth axes toward said one of said third and fourth axes, said one of said first and second axes being parallel to said one of said third and fourth axes, an exposing station on said base for producing latent images in said successive frames, a first pair of sprockets on said base for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the sprocket of said first pair, a tension roller adapted to be spring biased against said successive sections, a projecting station on said base for displaying images of visible prints in said successive areas, a second pair of sprockets on said base for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, and a second tension roller adapted to be spring biased against said sections of said other strip.

7. A photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, a first pair of sprockets for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station for displaying images of visible prints in said successive areas, and a second pair of sprockets for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, said processing station comprising a support, a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said support, means for urging the other of said first and second axes in parallelism toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said support and means for urging the other of said third and fourth axes in parallelism toward said one of said third and fourth axes, said one of said first and second axes being parallel to said one of said third and fourth axes.

8. A photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, a first pair of sprockets for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station for displaying images of visible prints in said successive areas, and a second pair of sprockets

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for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, said processing station comprising a support, a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said support, means for urging the other of said first and second axes in parallelism toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said support, means for urging the other of said third and fourth axes in parallelism toward said one of said third and fourth axes, said one of said first and second axes being parallel to said one of said third and fourth axes, a first pair of guide means on opposite ends of one of said first and second rollers and a second pair of guide means on opposite ends of one of said third and fourth rollers.

9. A photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, a first pair of sprockets for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station for displaying images of visible prints in said successive areas, and a second pair of sprockets for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, said processing station comprising a pair of pressure-applying rollers, one of said pressure-applying rollers providing a first cylindrical surface, the other of said pressure-applying rollers comprising an intermediate portion providing a second cylindrical surface and end portions having peripheral channels, said pressure-applying rollers being of substantially the same length, said rollers comprising a pair of circular rims at opposite ends of said first cylindrical surface, said rims being coaxial with said first cylindrical surface and being of a diameter greater than the diameter of said first cylindrical surface, one rim of said pair being affixed to said first cylindrical surface, the other rim of said pair being slidable with respect to said first cylindrical surface, and means for resiliently urging said other rim toward said one rim.

10. A photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, a first pair of sprockets for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station for displaying images of visible prints in said successive areas, and a second pair of sprockets for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, said processing station comprising a pair of pressure-applying rollers, one of said pressure-applying rollers providing a cylindrical surface of predetermined diameter, a pair of circular rims at opposite ends of said cylindrical surface, said rims being coaxial with said cylindrical surface and being of a diameter greater than said predetermined diameter, one rim of said pair being affixed to said cylindrical surface, the other

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rim of said pair being slidable with respect to said cylindrical surface, and means for resiliently urging said other rim toward said one rim, the other of said pressure-applying rollers comprising an intermediate portion and end portions, said intermediate portion providing a cylindrical surface, said end portions providing peripheral channels at opposite ends of the latter cylindrical surface, said pressure-applying rollers being of substantially the same length.

11. A photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, a first pair of sprockets for advancing sections of said first strip within a first path which extends from one sprocket of said first pair through said exposing station and said processing station to the other sprocket of said first pair, a projecting station for displaying images of visible prints in said successive areas, and a second pair of sprockets for advancing successive sections of said other strip within a second path which extends from one sprocket of said second pair through said processing station and said projecting station to the other sprocket of said second pair, said processing station comprising a support, a first roller mounted on said support for rotation about a first axis, said first axis being fixed with respect to said support, a second roller mounted on said support for rotation about a second axis, said second axis being fixed with respect to said support, link means mounted for pivotal movement about said second axis, a third roller mounted on said link means for rotation about a third axis, link means mounted for pivotal movement about said first axis, a fourth roller mounted on said second link means for rotation about a fourth axis, resilient means for urging said third roller toward said first roller and resilient means for urging said fourth roller toward said second roller.

12. A photographic apparatus comprising an exposing station for producing latent images in the successive frames of a photosensitive first strip, a processing station for successively superposing said associated frames on the areas of a second strip and for spreading a processing composition between said frames and said areas, said processing station including a first pair of rollers and a second pair of rollers, a first pair of sprockets for advancing sections of said first strip within a first path in sequence from one sprocket of said first pair through said exposing station between said pressure-applying rollers of said first pair, between said pressure-applying rollers of said second pair to the other sprocket of said first pair, a second pair of sprockets for advancing successive sections of said second strip within a second path in sequence from one sprocket of said second pair between said first pair of pressure-applying rollers, between said second pair of said pressure-applying rollers and to the other sprocket of said second pair, a first tension roller biased toward said first path in order to maintain said successive sections of said first strip taut, a second tension roller biased toward said second path in order to maintain said successive sections of said second strip taut, means for driving said first pair of sprockets and said second pair of sprockets through predetermined rotational cycles, the rotational cycle of said other of said second pair of sprockets beginning before the rotational cycles of the remaining sprockets, said other of said second pair of sprockets being operatively connected to said drive means through a torsion spring.

13. The photographic apparatus of claim 12 wherein a clamping means is provided for temporarily fixing the axis of said second tension roller when said rotational cycles are initiated.

14. The photographic apparatus of claim 13 wherein said clamping means is electromagnetic.

15. Photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive strip and another strip, respectively, and for spreading processing composition between said associated frames and areas, an exposing station for producing latent images in said successive frames, said exposing station providing a first pair of reference surfaces and comprising a pair of clamps which are adapted to cause one edge and one face of said photosensitive strip to abut against said first pair of reference surfaces, said clamps being normally actuated, a first pair of metering elements for advancing successive sections of said first strip within a first path that extends in sequence from one metering element of said first pair through said exposing station and said processing station to the other metering element of said first pair, a projecting station for displaying images of visible prints in said successive areas, said projecting station providing a second pair of reference surfaces and comprising a pair of clamps adapted to cause one edge and one face of said other sheet to abut against said second pair of reference surfaces, said clamps being normally actuated, a second pair of metering elements for advancing successive sections of said other strip within a second path which extends from one metering element of said second pair through said processing station and said projecting station to the other metering element of said second pair, a Geneva movement operatively connected to said metering elements of said first pair and said metering elements of said second pair, a control means, when operative, for deactuating said first pair of clamps and said second pair of clamps, a single revolution clutch operatively connected to said Geneva movement and to said control means, a motor operatively connected to said single revolution clutch, said motor, when operative, rotating continuously, said single revolution clutch, when operative, rendering said control means operative, and a control circuit for rendering said single revolution clutch operative in response to a predetermined signal.

16. The photographic apparatus of claim 15 wherein said control means includes a cam shaft operatively connected to said second pair of clamps and a solenoid operatively connected to said first pair of clamps, said sole-

noid being operative to deactuate said first pair of clamps in response to a signal from a control circuit responsive to a predetermined rotational position of said cam shaft.

17. Photographic apparatus comprising a processing station for successively superposing associated frames and areas of a photosensitive first strip and a second strip, respectively, and for spreading processing composition between said associated frames and areas, said processing station comprising a first roller rotatable about a first axis, a second roller rotatable about a second axis, a third roller rotatable about a third axis, a fourth roller rotatable about a fourth axis, one of said first and second axes being fixed with respect to said base, means for biasing the other of said first and second axes toward said one of said first and second axes, one of said third and fourth axes being fixed with respect to said base, and means for biasing the other of said third and fourth axes toward said one of said third and fourth axes, said one of said first and second axes being parallel with one of said third and fourth axes, a first pair of sprockets for advancing successive sections of said first strip in continuously taut condition under continuously positive control within a first path which extends through said processing station, first rotating means biased toward said successive sections of said first strip in order to maintain said successive sections thereof in said continuously taut condition, a second pair of sprockets for advancing successive sections of said other strip in continuously taut condition under continuously positive control within a second path which extends through said processing station, and second rotating means biased toward said successive sections of said second strip in order to maintain said successive sections thereof in said continuously taut condition.

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