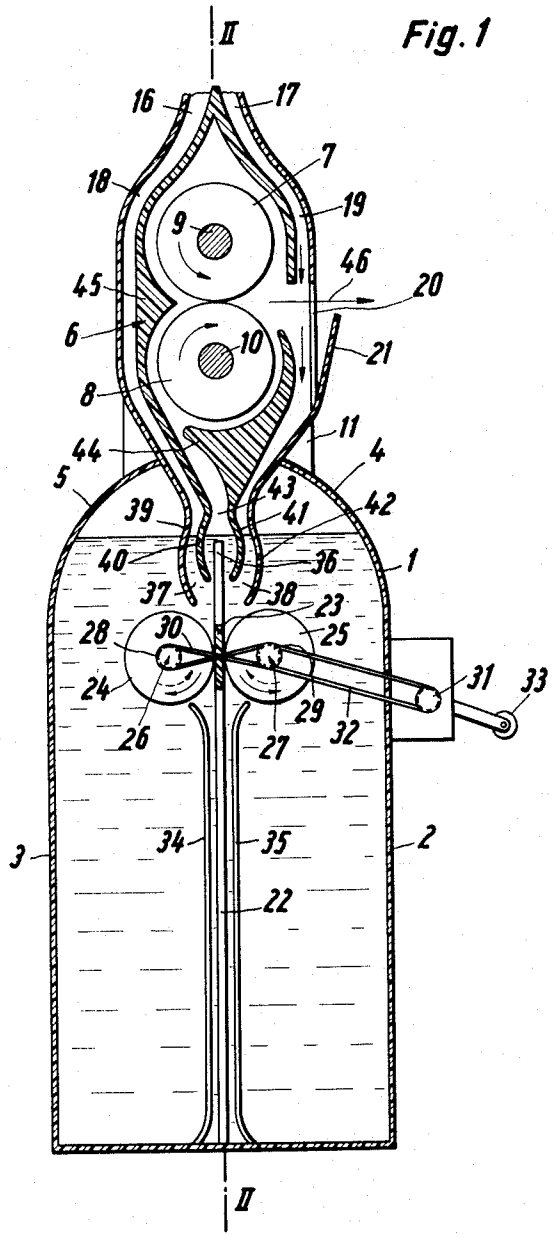
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APPARATUS FOR DEVELOPING COPIES

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Fig. 1



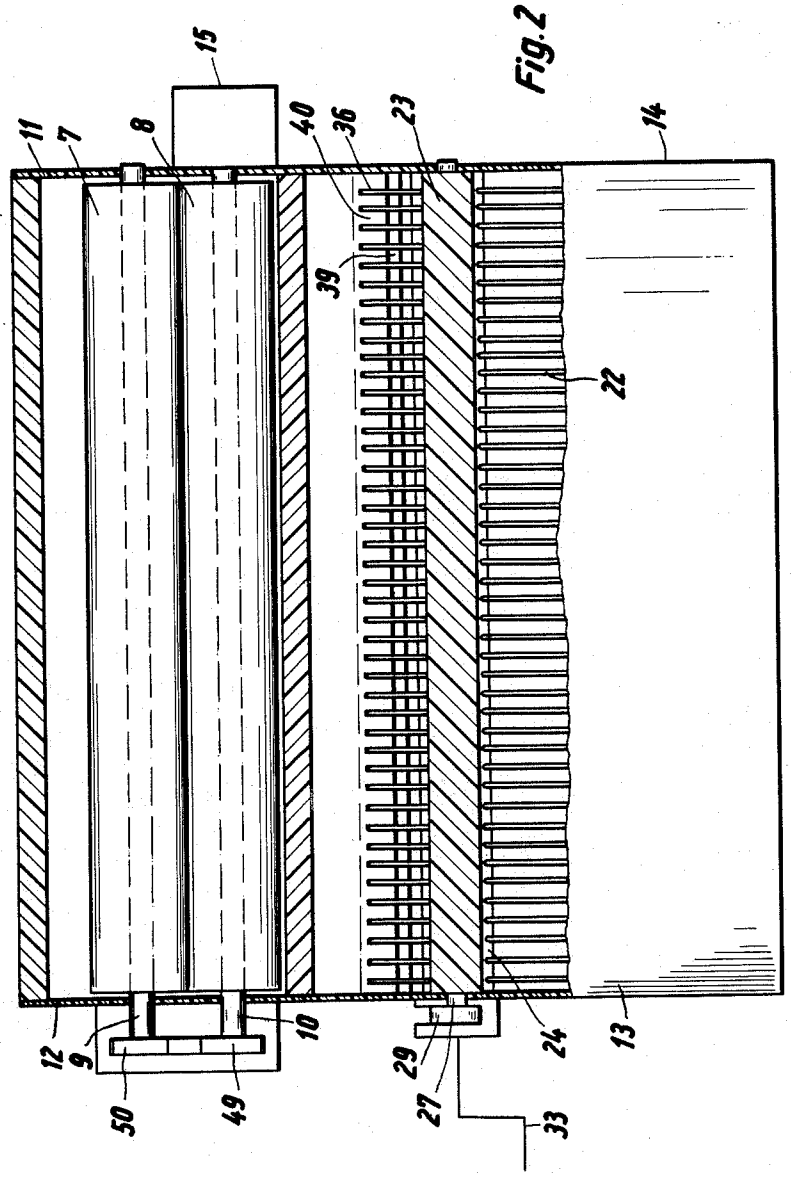
Inventor:
Walter Limberger,
by Singer, Stern & Carlberg
Attorneys.

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Fig. 2



Inventor:
Walter Limberger
by Singer, Stewart & Carlberg
Attorneys

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3,261,277

APPARATUS FOR DEVELOPING COPIES

Walter Limberger, Hamburg-Poppenbuttel, Germany, assignor to Lumoprint Zindler K.G., Hamburg, Germany, a corporation of Germany

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5 Claims. (Cl. 95—89)

This invention relates to an apparatus for developing copies in which the layer carrier is introduced into a liquid and at least two such layer carriers are transported from the liquid under contact pressure by means of a pair of squeeze and transporting rollers, as described in my patent application Ser. No. 19,835, filed on April 4, 1960, now Patent No. 3,117,507 of which the present application in a continuation-in-part.

This invention relates therefore to diffusion development apparatus in which photographic layer carrier sheets are guided into a container containing development liquid and then discharged therefrom through the nip of a pair of pressure rollers to squeeze out superfluous liquid from the sheets.

Apparatus of this general kind are known in the prior art in which the layer carriers are inserted into the container through entrance slots in a wall thereof and then guided through the liquid along paths defined by guide means to the nip between the pressure rollers and out from the container through one or more discharge slots in the same or a different wall of the container. Said guide means usually include transfer rollers designed to aid in the passage of the layer carriers along said paths.

These prior art developing machines have several serious disadvantages. Thus, for example, the arrangement of the guide means and pressure rollers in the container necessitates a comparatively large exposed development liquid surface susceptible to contamination and excessive evaporation. It also renders it practically impossible to retain the layer carriers in the liquid for a desired period of time without causing uneven treatment of the layer carriers due to more efficient exposure of portions thereof to the liquid than other portions.

It is a principal object of the present invention to provide a novel and improved diffusion development apparatus which is free from the above-mentioned and other disadvantages inherent in prior art apparatus for similar purposes.

Another object of the invention is to provide an apparatus of the kind indicated in which the exposed liquid surface is comparatively small, whereby contamination and evaporation of the development liquid is kept to a minimum.

Still another object of the invention is to provide an apparatus of the kind indicated in which the layer carriers may conveniently be retained totally immersed in the development liquid for any desired period of time with all portions of the layer carriers equally and evenly exposed to the action of the development liquid.

Another object of the invention is to provide an apparatus of the kind indicated which is of comparatively small overall size and of such configuration as to render it conveniently suited for ready combination with a conventional exposure apparatus.

Another object of the invention is to provide an apparatus combining small dimensions with a minimum evaporation surface for the liquid.

Another object of the invention is to provide an apparatus which may easily be attached to an exposure apparatus, whereby such available exposure apparatus may be completed to form a complete copying device without noticeable increase in the space required therefor.

According to a further feature of the invention, there is provided a method, whereby the layer carrier is treated

in the liquid whilst carrying out a reciprocating to-and-fro movement.

It is yet another object of the invention to provide an apparatus in which the layer carriers are introduced in superimposed state into two adjacent inlet slots and in which they are delivered through a delivery orifice, the plane of which is substantially perpendicular to the plane formed by the two adjacent inlet slots.

These and other objects of the present invention are realized in the manner set forth in the following.

The method according to the invention for the diffusion-developing copies by means of an exposed negative layer carrier with a latent image, and a positive layer carrier to which the developed image is transferred, is effected by wetting both these layer carriers with the developing liquid and pressing them together, wherein both layer carriers are introduced into a bath containing the developing liquid, in which they are immersed and moved reciprocatingly forwards and backwards; they are removed from the bath in the opposite direction and squeezed together for a short duration after they have left the bath.

Further objects and advantages of the invention will become apparent from the following description of an embodiment thereof, given by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a cross-section of an embodiment of the invention along the line I—I in FIG. 2; and

FIG. 2 shows a partially sectionalized, partially broken away view along the line II—II in FIG. 1.

The apparatus shown in the drawings has the advantage that the paper to be developed or treated may be introduced side by side into two adjacent slots and on either side of a pair of transporting and squeezing rollers, whilst at the same time the construction of the apparatus is simplified.

This embodiment has also the additional advantage that the layer carriers are removed in a direction perpendicular to the direction in which they are introduced. A housing **1** may be conveniently mounted on an exposure device. This housing is comparatively narrow, and its dimension in the direction normal to the plane of the drawing corresponds to the width of the layer carrier.

The side walls **2**, **3** of the housing converge at their upper ends or are provided with a cover. Within this cover, or within the converging portions **4**, **5** of the side walls, there is a structure, shown generally at **6**, comprising the pair of transporting and squeezing rollers **7**, **8**, arranged vertically one under the other. The shafts **9**, **10** of this pair of transporting and squeezing rollers are journalled in raised webs **11**, **12** (FIG. 2) of the housing end walls **13**, **14**. One of the said rollers **7** or **8** is resiliently urged against the other roller. The rollers may be provided, for example, with an elastic covering. The rollers **7** and **8** are driven in the direction of the arrows by a motor **15**, not shown in the drawing, and mounted, for example, on the web **11** of the housing end wall **14**. FIG. 1 shows only the rearward web **11**.

The introduction or inlet slots **16**, **17** are arranged above the pair of transporting and squeezing rollers **7**, **8**, and open into channels **18**, **19** which extend on both sides around the pair of rollers **7**, **8** and into the tank formed by the housing **1**. The channel **19** is open at the level of the line of contact between the rollers **7** and **8**. The portion **21** extending downwardly from the opening **20** is widened to form a funnel so that the layer carrier coming from the upper portion of the channel **19** is reliably guided into the part **21**.

Within the housing **1** and substantially extending along the longitudinal centre plane thereof, there is a frame **22**, having at **23** an abutment surface which co-operates with two rollers **24**, **25**, journalled in the housing end walls.

The shafts 26, 27 of these rollers project at least on one side from the housing 1, and are interconnected, for example, by pulleys 28, 29 fitted to these shaft ends and an endless helical spring 30. A manually operable bell crank 33 is mounted either directly on the shaft of, e.g. the roller 25 or on the shaft of a take-off pulley 31 of an endless helical spring drive 32, enabling the rollers 24, 25 to be driven at choice in opposite directions.

It should here be mentioned that the distance at which the said rollers 24, 25 revolve in front of the abutment surface 23, is preferably less than the thickness of the layer carrier.

However, these rollers may also be affected by a resilient contact pressure acting thereon.

Laterally of the perforated frame structure 22 and below the rollers 24, 25, there are arranged basket-shaped guide members 34, 35, loosely guiding the layer carriers along the frame 22 and so designed that they are freely permeable to the developing liquid.

The frame 22 terminates at 36 above the rollers 24, 25. The lower openings 37 and 38, respectively of the channels 18, 19, are preferably located at a somewhat lower level than the end 36, and are directed inwardly relative to the upper portion of the frame 22.

It may be seen that the lower portions of the channels, defined each by two guide members 39, 40, and 41, 42, respectively, extend in spaced relationship so as to form thereinbetween a channel 43.

The upper end 36 of the frame 22 extends into the said channel 43, which leads on the side remote from the opening 20 of the channel 19, to the gap between the transporting and squeezing rollers 7, 8. The positive and reliable guide to this point is ensured by guide members 44, 45 associated with the rollers 7, 8.

In this manner, layer carriers introduced through the slots 16, 17 pass through the channels 18, 19 and to the rollers 24, 25.

By the appropriate manipulation of the bell crank 33, the layer carriers are transported downwardly between the frame 22 and the basket-shaped guide members 34, 35, may remain there as long as desired, and may be moved in the liquid up and down by moving the bell crank 33 reciprocatingly to and fro.

The arrangement is such that the trailing edges of the layer carriers leave reliably the openings 37, 38 and reach the liquid in the tank.

When the layer carriers are to be transported out of the tank, the bell crank 33 is operated in the appropriate manner. This causes the layer carriers to be guided through the channel 43 and, by means of the guide members 44, 45, between the transporting and squeezing rollers 7, 8, in order to be delivered from the apparatus in the direction indicated by the arrow 46.

The said crank drive may also be replaced by a reversible motor which may be connected to the mains for example, through a timing control or a cam drum.

FIG. 2 shows a preferred embodiment, in which, for example, a pulley 29 is mounted on the shaft 27. The projecting end of the shaft 9 carries a further pulley 50, and a crossing belt is arranged on this pulley so as to drive the rollers 7, 8 through the driving means 33 in the direction indicated by the arrows.

Obviously, the said guide members 34, 35 may consist of rods, extending substantially vertically or slantingly, arranged side by side parallel to the plane of the drawing as in FIGURE 1, and connected by horizontally extending stays. Also the frame 22 may be built up from such stays,

In one embodiment, the said transporting and squeezing rollers 7, 8 may be actuated manually directly by means of a bell crank. Conveniently, the squeezing rollers are equipped at one end with gear wheels 17, 18 ensuring the positive drive of these squeezing rollers.

The invention is obviously not restricted to the embodiments shown in the drawings, but may be modified

in many ways known to the expert without thereby departing from its principle. The extent of the present invention is merely defined by the claims annexed hereto.

Having thus fully disclosed my invention, what I claim and desire to secure by Letters Patent is:

1. An apparatus for diffusion-developing copies by means of a positive layer carrier and a negative layer carrier, comprising a fluid tank having an inlet orifice in its upper range; a pair of transporting and squeezing rollers, journalled in the side walls of the fluid tank immediately above and adjacently to the said inlet orifice; driving means for the said pair of transporting and squeezing rollers; guiding means for guiding the negative and the positive layer carrier to the inlet orifice, said guiding means being equipped with inlet means above the pair of transporting and squeezing rollers and with outlet means under the pair of transporting and squeezing rollers and within the tank; a pair of rollers arranged within the tank under the said outlet means; driving means for driving this pair of rollers in opposite directions; frame means which are substantially permeable to liquid, extending through the pair of rollers and serving at the same time as guide members whereby the layer carriers leaving the outlet means are guided to the pair of rollers; channeling means arranged between the upper end of the said frame and the zone of contact of the transporting and squeezing rollers, and adapted to guide layer carriers coming from the tank to the transporting and squeezing rollers, whereupon the layer carriers after having been pressed together are freed in the direction perpendicular to the direction in which they were introduced through the inlet means.

2. An apparatus for the diffusion-developing of copies, comprising a housing with an opening at its upper edge, said housing forming a fluid tank; upwardly extended side walls of the said housing, forming bearing means; an arrangement of a pair of transporting and squeezing rollers the generatrices of which are in contact with one another and which are journalled in the upwardly extended side walls; first flat frame means which are permeable to liquid and located within the said housing under the rollers and parallel thereto; a pair of rollers comprising two rollers journalled in the housing and arranged in either side of the first frame means parallel to the transporting and squeezing rollers, but located in a substantially horizontal plane; an inlet orifice between the upwardly extending side walls, adapted to receive a transmitting or negative material and a receiving or positive material; first channeling means forming a closed channel or conduit and leading on the one side of the transporting and squeezing rollers to one side of the upper end of the first or centre frame means above the said pair of rollers; second channeling means leading along the other side of the transporting and squeezing rollers to the other side of the upper end of the first frame means, terminating in spaced relationship therefrom above the said pair of rollers, said second channeling means having a perforation at the level of the zone of contact between the transporting and squeezing rollers; third channeling means, the lower end of which is located between the lower ends of the said first and second channeling means, and into which projects the upper end of the first or centre frame means, and which lead along the first channeling means to the zone of contact between the transporting and squeezing rollers, first drive means for the transporting and squeezing rollers adapted to drive the same in one direction, whereby copying material supplied through the said third channeling means is delivered to the said perforation; second drive means for the second pair of rollers, said second drive means being reversible, in order to carry the copying material out of the first and second channeling means into the lower part of the housing and from the same into the third channeling means.

3. An apparatus for the diffusion-developing of copies, substantially as set forth in claim 2, wherein the portion, extending downwardly from the orifice of the said sec-

ond channeling means at the level of the zone of contact between the transporting and squeezing rollers is widened after the manner of a funnel.

4. An apparatus for the diffusion-developing of copies, substantially as set forth in claim 2, comprising, in addition to the said first frame means, second and third frame means adjacent to, and in spaced relationship to the first frame mean and extending from the bottom of the housing to underneath the said second pair of rollers.

5. An apparatus for the diffusion-developing of copies, substantially as set forth in claim 2, wherein the first frame means between the rollers are formed as a closed plate.

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NORTON ANSHER, *Primary Examiner.*

C. B. PRICE, *Assistant Examiner.*