

Aug. 24, 1965

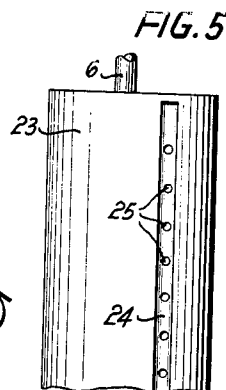
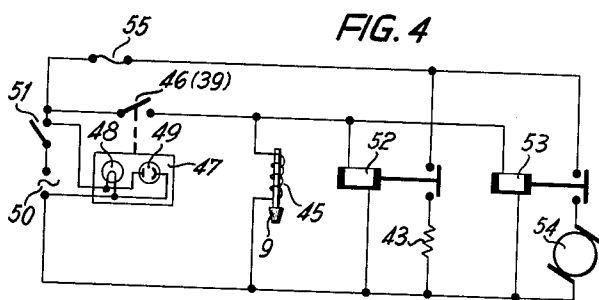
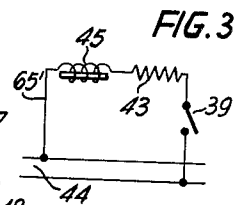
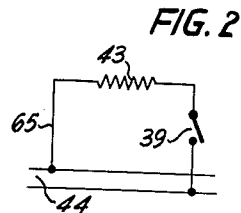
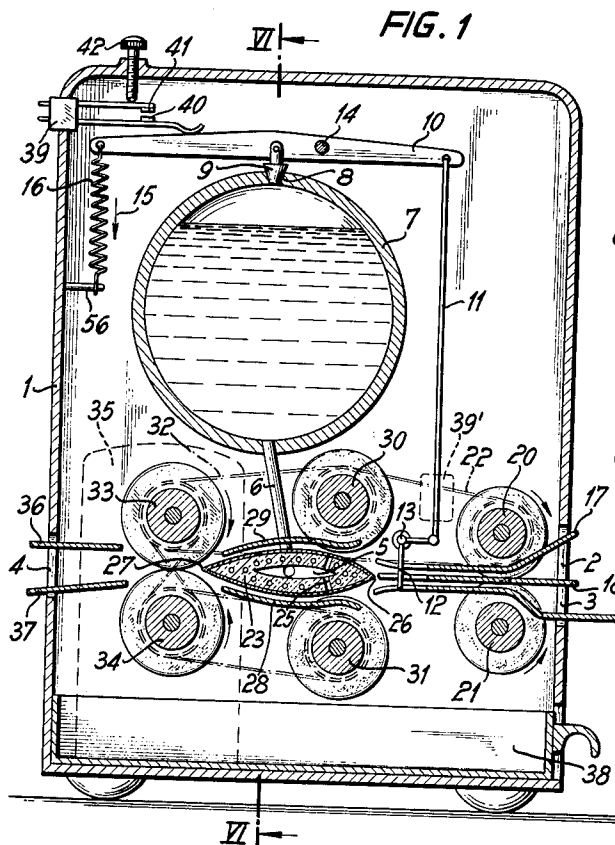
W. LIMBERGER

3,202,072

APPARATUS FOR TREATING SHEETS OF FILM BASE

Filed Feb. 14, 1963

2 Sheets-Sheet 1



INVENTOR
WALTER LIMBERGER

BY

Karl G. [Signature]

Attorney

Aug. 24, 1965

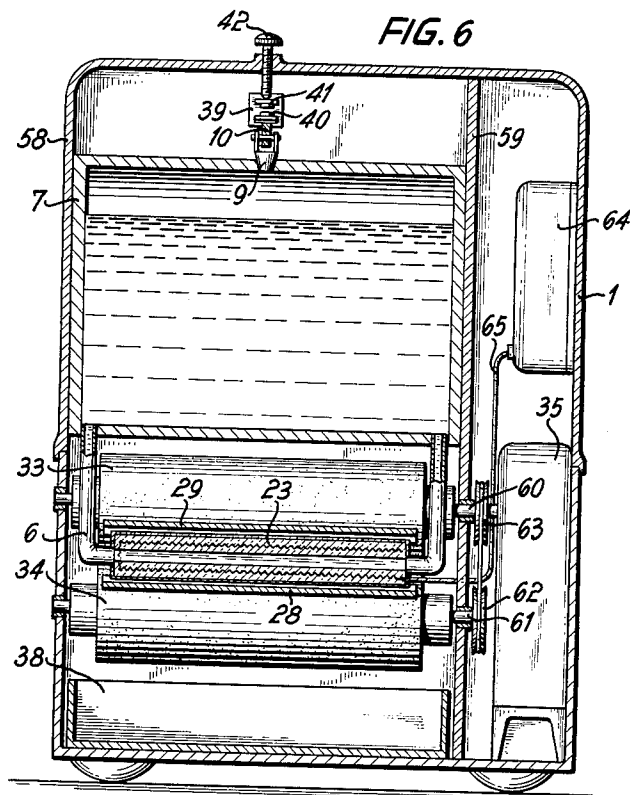
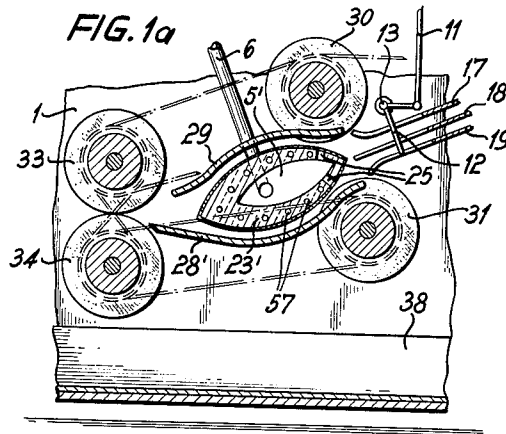
W. LIMBERGER

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APPARATUS FOR TREATING SHEETS OF FILM BASE

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2 Sheets-Sheet 2



INVENTOR
WALTER LIMBERGER

BY

Karl J. Rao

AGENT

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3,202,072

APPARATUS FOR TREATING SHEETS OF FILM BASE

Walter Limberger, Hamburg-Poppenbüttel, Germany,
assignor to Lumoprint Zindler KG., Hamburg, Germany

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L 41,253

11 Claims. (Cl. 95—89)

The present invention relates to apparatus for treating sheets of film base with a flowable substance, for example, for diffusion development using two sheets of film base. In particular, the invention relates to a system in which the sheets of film base are moistened on one side only.

In a device already proposed the sheets inserted into the device control the liquid flow to the coating unit by means of a scanning device. The object of the invention is to improve this known device, namely, to provide a new device with a measured supply of a flowable treatment substance, whose effect is improved by the device according to the invention, whereby on the one hand smaller amounts of treatment substance are sufficient so that the sheets leave the apparatus in a dry condition, and on the other hand the treatment substances can be used in combination with specially designed known film bases, which are previously unknown in this form for the treatment of film base sheets.

According to the present invention the treatment substance is coated in a heated state. In this way the onset of the reaction is intensified and accelerated. Furthermore, the advantageous drying of the film base is facilitated i.e. the drying period is shortened. The term "heated treatment substance" relates to a temperature above the surrounding temperature, in general the normal room temperature, for example up to a maximum of 80° C.

In the device according to the invention the coating unit is connected to a heating device, which heats the flowable treatment substance and/or the film base sheets during the process. According to one preferred embodiment the heating device is provided on the coating unit. Consequently it is found that not only the measured amount of substance which is expelled from the coating unit is warmed and moistened but the film of the film base sheet directed past the coating unit is warmed simultaneously, so that the reaction period is greatly accelerated.

The invention however envisages the use of film base sheets and developing substance, using dissolving means alone for the developing substance which when used in the heated state starts a particularly intensive and rapid reaction. If material is used which contains the developing and fixing substance already bound in the film, one essential feature of the invention is that water be provided in the storage container as the treatment substance, which in its warm state effects the dissolution and/or melting of the reaction means in the film on the sheet for effecting the developing and fixing process. It must be understood that two devices according to the invention can be provided one behind the other, by which the one effects the developing process and the other the fixing process.

According to a preferred embodiment the supply of liquid treatment substance to the coating unit is controlled by means of a scanning device itself controlled by the sheets passing through the device, which simultaneously switches the heating device on and off. The scanning device can comprise a photoelectric scanner or a mechanical scanner in the form of a rocking lever in

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the feed path for the sheet. The latter can have a linkage system for controlling a closure member or a switch. In a preferred embodiment the latter is connected into a circuit, which for example actuates an electromagnet for controlling the liquid supply and heating resistances of the heating device. In this way the means actuating the heating device is held ready by a relay in the above-mentioned circuit.

According to a further embodiment, motor driven drive rollers can be provided in the device controlled for feeding the sheet to the coating unit in dependence upon the supplying of the sheet, whereby the motor is started by the scanning device through a slow-releasing relay. The release time is adjusted so that the motor remains switched on until the sheet has completely passed through the device.

In order that the invention may be more readily understood preferred embodiments thereof are described below in conjunction with the accompanying drawing.

In the drawings:

FIG. 1 is a side view of one device according to the invention in section;

FIG. 1a is a partial side view of a further embodiment of the invention in section;

FIG. 2 is a schematic circuit plan for the heating device;

FIG. 3 is a schematic circuit plan for a further form of heating device according to the invention;

FIG. 4 is a circuit plan for a further embodiment of the invention;

FIG. 5 is a partial plan view of the heating device according to FIG. 1;

FIG. 6 is a section along the line VI—VI through FIG. 1.

In order to simplify the description, only the important and necessary parts of the invention are shown in the drawings.

According to FIGURE 1, a housing 1 is provided, having an inlet slit arrangement in one wall thereof with two inlet slits 2, 3 and one outlet slit 4 in the opposite wall of the housing, these slits forming the beginning and end of a feed path for the film base. A coating unit 5 is provided in the feed path in the form of a hollow member extending into a point at the front and back and elongated in longitudinal cross-section, and fed with coating substance from a storage container 7 via a conduit 6. This storage container 7, which is normally hermetically sealed, has an opening 8 provided in its upper part controlled by a closure member 9 which is actuable by means of a lever system 10, 11, and a mechanical stop 12 provided in the feed path. The stop 12 is pivotably mounted at 13 and the lever part 10 is pivotably mounted at 14 on a wall of the housing parallel to the plane of view of FIG. 1. The lever part 10 is formed as a two-armed lever, the arm away from lever part 11 being tensioned in the direction shown by arrow 15 by a spring 16, so as to close opening 8. The spring 16 is fastened at its lower end to a pin 55 which is provided in one wall of the housing. The opening 8 is opened against the action of the spring 16, by deflecting the mechanical stop 12 with the edge of a sheet inserted through the slit 2 or 3. The function of this arrangement is described in my copending application Serial No. 85,118, filed January 26, 1961, now Patent No. 3,143,056.

The feed path is provided with guide elements 17, 18, 19 defining slits 2, 3 and extending just short of the coating unit 5 and having slots provided in their ends nearest this unit, within which the mechanical stop 12 is movable, so that it can be pulled into one position extending into the feed path, by means of the spring 16, and can be pivoted into another position by the front edge of

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a film base sheet, whereby the feed path becomes free from obstruction. Furthermore a pair of drive rollers 20, 21 are provided in the cross-section of the feed path defined by guide elements 17, 18, 19. At this position the guide elements have openings provided therein having a width at least sufficient to receive therein circumferential flanges provided on the rollers, which run adjacent one another at least with their flanges in contact within the opening substantially in the plane of the guide element 18. For example, only the roller 20 is driven by a belt-drive 22, whereas the roller 21 is driven by contact with roller 20, directly or via the film base sheet.

The coating unit proper is enclosed within a heating device 23. Electrical resistance heating elements are provided for example, in this heating device. It consists, for example, of a ceramic body, which on the one hand has channels therein for receiving the resistance heating elements and on the other hand has channels passing through the wall of the coating unit 5 to form coating nozzles 25. The diameter of the passages 25 depends upon the length and the structural properties of the ceramic material and is so chosen that the liquid is held therein solely by surface tension in the absence of any feeding pressure. The coating unit can have several openings or rows of openings displaced relative to one another, the casing of the heating device 23 being preferably provided on each side with at least one transverse groove 24 at which several nozzles 25 terminate. This outwardly opening transverse groove has the object of ensuring an equal distribution of the coating substance over the entire width of the film base sheets.

The heating device 23 is shown formed longitudinally elongated and having pointed ends 26, 27 in the longitudinal axis of the guide path, towards which the film base sheets are either passed away from or towards one another. The end 26 facing the inlet slit arrangement 2, 3 stops preferably adjacent the middle guide element 18. The coating unit 5 is encircled partially by guide surfaces 28, 29. These guide surfaces are provided spaced therefrom by a distance greater than the thickness of a film base sheet. The guide surfaces 28, 29 are provided at their ends with cutouts facing the inlet slit arrangement, through which, parts of transport rollers 30, 31 project. The transport roller 30 is for example driven by a belt-drive 32. A corresponding drive can be provided for the roller 31. The rollers 30, 31 are so arranged that their circumferential flanges or also their cover surfaces, if they are formed without flanges, are spaced from the cover surfaces of the heating device 23, but lying very close thereto and moreover preferably in a region in which the row of openings 25 open out, for example, into the groove 24. Consequently it is ensured that the film base sheets are passed directly towards the openings 25 over the heating device.

Behind the end 27 of unit 5 and the ends of the guide surfaces 28, 29 facing the outlet slit 4 there is provided a pair of squeezing and transport rollers 33, 34, one of which is pressed resiliently towards the other in a known manner, which is not described further. For example, these rollers can be made with a resilient outer covering such as rubber. At least one roller is driven. For example, it may be coupled directly to the output shaft of the motor drive unit 35 by which the belt-drives 32, 23 are driven. The film base sheets provided with the treatment liquid are squeezed together between the rollers 33, 34. These are then passed out through the outlet slit 4, which is defined by the guide surfaces 36, 37, which extend just up to the rollers 33, 34 and which, as shown by guide surface 37, ensures their release from the rollers in that flange-like extensions engage in circumferential grooves provided in rollers 33, 34.

A removable receptacle 38 is provided on the base of the housing 1 to receive any fluid dropped off. In the housing moreover a switch 39 is provided, which can be closed in dependence upon a deflection of the me-

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chanical stop 12 and moreover by means of the lever part 10. A movable switch contact 40 is supported on the lever part 10, whereas the fixed switch contact 41 can be so adjusted by an adjusting screw 42, and even a small movement effected substantially by the deflection of the closure member 9 and the transfer mechanism is sufficient to close the switch 39. This serves at least for regulating the heating element in the heating device 23. These elements are shown for example, by numeral 43 in FIGS. 2-4. Switch 39 is also shown in FIGS. 2 and 3, and it can be seen that it connects in a circuit 65 having resistances 43, which circuit is connected into circuit 44.

According to FIG. 3 the coil of a solenoid 45 is switched into a circuit 65'. With this construction the switch 39, namely the movable switch contact 40 is either provided directly in the feed path in place of the mechanical stop 12, so that direct actuation of the switch is effected, or on the lever arm of the mechanical stop 12. The solenoid serves to actuate the closure member 9 in a manner not shown or described, but known to the experts. With this form of construction the lever system 10, 11, 16 can be dispensed with and the switch 39 is coupled directly with the stop lever 13 as shown in dotted lines at 39'.

In FIG. 4 a switch 46 corresponding to the switch 39 is provided which can be actuated either in the same way as switch 39 as described above, or according to a modification, by a photoelectric scanner, which is shown schematically at 47 and a light source 48 as well as a photo-cell 49, an amplifier unit (not shown) and a relay, which is actuated by the switch 46. In the practical embodiment, the elements 48, 49 are arranged for example at the position of the mechanical stop 12 of FIG. 1, above and below the guide path, whereby the light radiation passes through the slit provided in the guide surfaces 17, 18, 19. It can be seen that this arrangement is constructed as a closed circuit connection, so that the switch 46 is actuated upon obstruction of the light radiation.

According to FIG. 4, the unit 47 of the photo-electric scanner is connected to a current source 50 in a manner similar to the other circuit parts. The apparatus is brought into readiness by a switch 51. By closing the switch 46 the magnet 45 actuates a closure member corresponding to member 9 as well as a relay 52 for switching on the heating resistance 43 and a slow-releasing relay 53 for switching on motor 54 of the motor drive unit 35 shown in FIG. 1. The circuit for motor 54 and the heating resistance 43 includes a fuse shown particularly at 55. When the rear edges of the sheets have passed through the photo-electric scanning unit 47 the switch 46 opens. Consequently the closure member 9 is brought into its closed position. The part of the sheet still to pass, pulls sufficient liquid thereafter due to the adhesion effect and, in particular, takes up the liquid from the grooves 24. The switching-off of the heating element 43 can be effected directly, because the heat residue is still sufficient for use during the rest of the process to be carried out on the rest of the sheet. The release time of the relay 53 is so adjusted that the motor 54 runs sufficiently long for the end of the sheet to be transported through the pressure and transport rollers 33 and 34.

According to the last described embodiment the rollers 21, 20 are constructed as free-running rollers with an automatic switch for the motor 54. In this case a similar passage through the driven rollers 30, 31 is ensured. If the motor drive unit 35 is connected separately in a manner not described but easily understood by the expert, then the driven rollers 21, 20 ensure a definite passage velocity directly according to the insertion.

In FIG. 1a similar parts to those in FIG. 1 are as shown with the same reference numerals. A modified arrangement is provided for the coating unit and the

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heating device which is designated by 5' and 23'. The coating unit and heating device are preferably constructed for the purpose of vapourizing the liquid and preferably inclined to the horizontal. The heating device 23' is strengthened for a greater loading than that in FIG. 1, in order to facilitate the vapourization of the liquid fed thereto. With this construction the supply conduit 6 opens out into the lower half of the coating unit 5' whereby the heating which is effected by the heating resistance rods 57 vapourizes the liquid in the openings 25.

Owing to the construction of the heating device 23 with a longitudinally elongated ceramic body, which encircles the correspondingly longitudinally elongated coating unit 5' along which the coated sheets pass, it is found therefore that after feeding the liquid either in the form of vapour or in its liquid state, the sheet becomes heated during the reaction so that the reaction is improved. It is found that this advantage also holds for the embodiment of FIG. 1 so that the treating substance becomes heated as well as the sheet during and after feeding the treatment substance, which is the feature of the invention.

With the inclined mounting of the coating unit 5' and the heating device 23' according to FIG. 1a, the lower guide element 28' is lengthened in order to feed, jointly with element 29, a pair of converging sheets toward the squeezing and transport rollers 33, 34.

All parts are mounted parallel to the walls of the housing or intermediate walls and extend in the plane of the drawing of FIG. 1.

This can be seen from FIG. 6 in which like parts to those in FIG. 1 are given the same reference numerals in order to supply the description. It can be seen that the storage container 7 is supported on the housing side walls 58, 59. Moreover the heating device 23 and guide elements 28, 29 are mounted stationary on the side walls. The rollers 33, 34 are mounted rotatable in the same manner as the rollers according to FIG. 1. Their shafts 60, 61 pass through the intermediate wall 59 and carry the drive pulleys 62, 63 thereon. The roller 33 is directly connected to the motor drive unit 35 for drive thereby. Numeral 64 shows an electric circuit and switching unit which among other things is connected by cable 65 to the heating unit 63. It can be seen that two conduits 6, 6' are provided between the container 7 and the heating device 23.

I claim:

1. An apparatus for the treatment of sheets provided with photographic layers, comprising a housing having an inlet for a sheet to be treated and an outlet for said sheet remote from said inlet, guide means in said housing forming a channel for the passage of said sheet from said inlet to said outlet, said guide means including a hollow body with a perforated surface positioned for contact with the photographic layer of a sheet passing therealong, a container for treatment fluid connected to the interior of said body for the discharge of said fluid through the perforations of said body onto said layer, heating means for said fluid and said sheet in said body, transport means in said housing for advancing said sheet through said channel past said body, and actuating means for concurrently operating said heating means and said transport means.

2. An apparatus as defined in claim 1 wherein said actuating means comprises sheet-controlled sensing means in said channel between said inlet and said body.

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3. An apparatus as defined in claim 2, further comprising fluid-control means at said container coupled with said sensing means for supplying fresh fluid to said body upon operation of said heating and transport means.

4. An apparatus as defined in claim 2 wherein said sensing means comprises a mechanical feeler responsive to the leading edge of an oncoming sheet.

5. An apparatus as defined in claim 2 wherein said sensing means comprises photoelectric detector means.

6. An apparatus as defined in claim 5 wherein said actuating means further comprises first relay means responsive to said detector means for energizing said heating means throughout the movement of said sheet past a control point, and slow-releasing second relay means responsive to said detector means for operating said transport means concurrently with said heating means and for a predetermined period thereafter.

7. An apparatus as defined in claim 1 wherein said channel extends generally horizontally, the interior of said body being a chamber of elongated vertical cross-section in a plane parallel to the direction of sheet travel.

8. An apparatus as defined in claim 7, for use with an aqueous liquid for the treating fluid, wherein said body is tilted upwardly in the direction of the oncoming sheet, the end of said chamber proximal to said inlet being elevated above the opposite end, thereby facilitating vaporization of said liquid in the region of first contact between said sheet and said perforated surface.

9. An apparatus for the treatment of photographic sheets, comprising a housing having two adjacent inlets for a negative and a positive sheet to be treated and an outlet for said sheets remote from said inlets, guide means in said housing forming a pair of juxtaposed channels for the passage of said sheets from said inlets to said outlet, said guide means including a hollow body between said channels with two perforated surfaces positioned for contact with confronting sides of two sheets simultaneously passing therealong in said channels, a container for treatment fluid connected to the interior of said body for the discharge of said fluid through the perforations of said body onto said sheets, heating means for said fluid and said sheets in said body, transport means in said housing for advancing said sheets through said channels past said body, actuating means for concurrently operating said heating means and said transport means, and squeezing means beyond said body for pressing the two treated sheets together on their way to said outlet.

10. An apparatus as defined in claim 9 wherein said channels extend generally horizontally above and below said body, the interior of said body being a chamber of elongated vertical cross-section in a plane parallel to the direction of sheet travel, both said chamber and the exterior of said body having wedge-shaped extremities facing said inlet and said outlet.

11. An apparatus as defined in claim 10, for use with an aqueous liquid for the treating fluid, wherein said body is tilted upwardly in the direction of the oncoming sheets, the end of said chamber proximal to said inlet being elevated above the opposite end, thereby facilitating vaporization of said liquid in the region of first contact between said sheets and the upper and lower surfaces of said body.

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NORTON ANSHER, *Primary Examiner*.