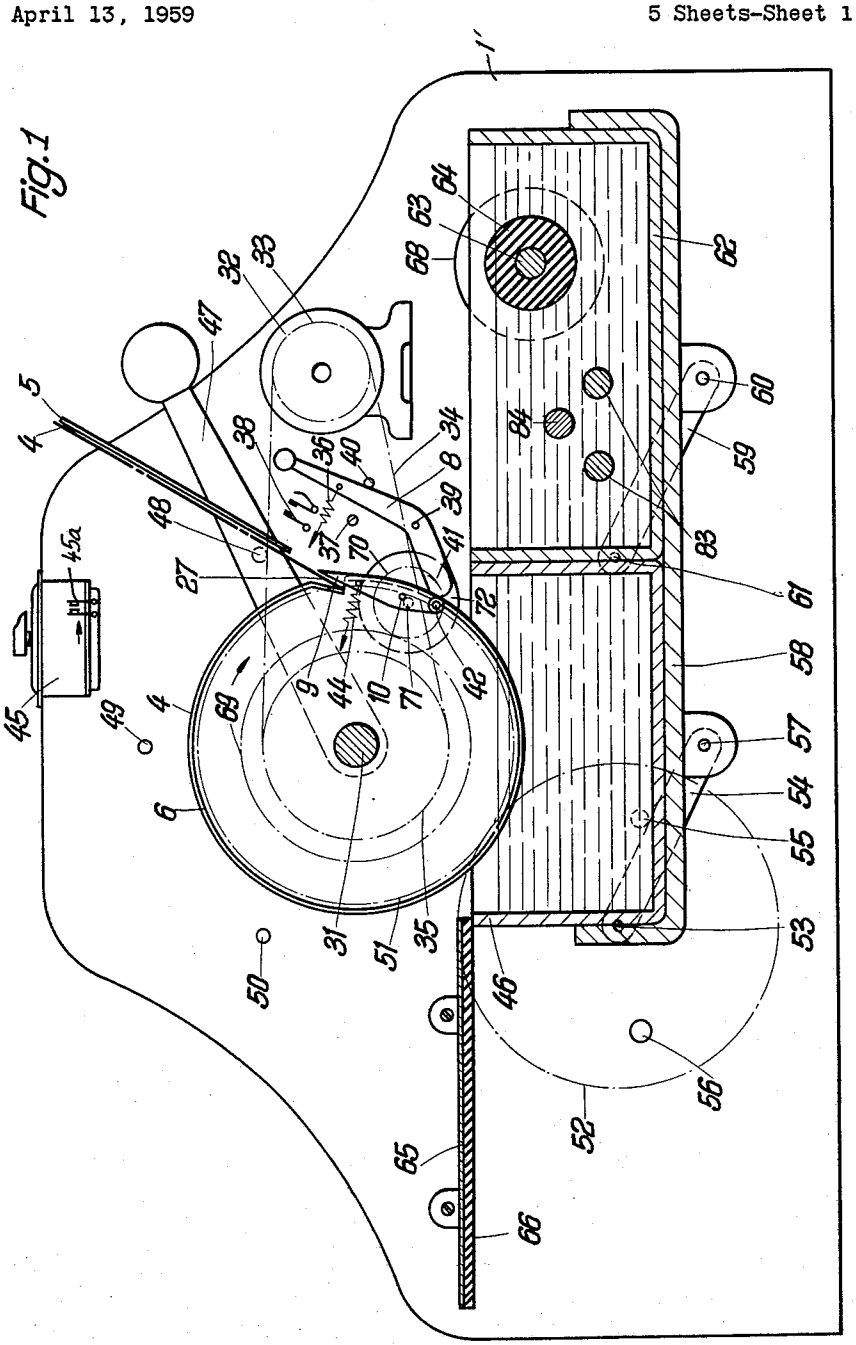
June 11, 1963 W. RITZERFELD ETAL 3,093,051

APPARATUS FOR TREATING PRINTING FOILS

Filed April 13, 1959 5 Sheets-Sheet 1

Fig. 1



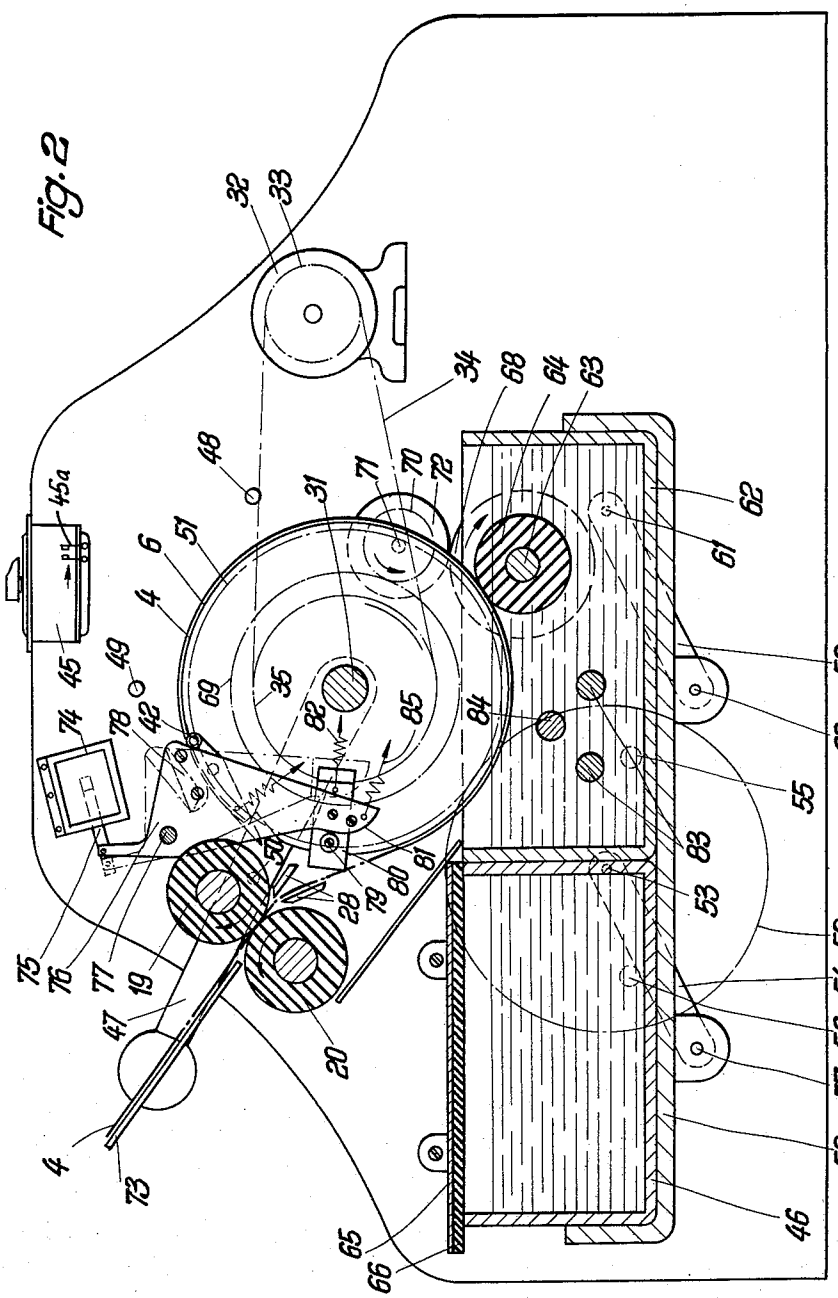
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APPARATUS FOR TREATING PRINTING FOILS

Filed April 13, 1959 5 Sheets-Sheet 2

Fig. 2



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APPARATUS FOR TREATING PRINTING FOILS

Filed April 13, 1959 5 Sheets-Sheet 3

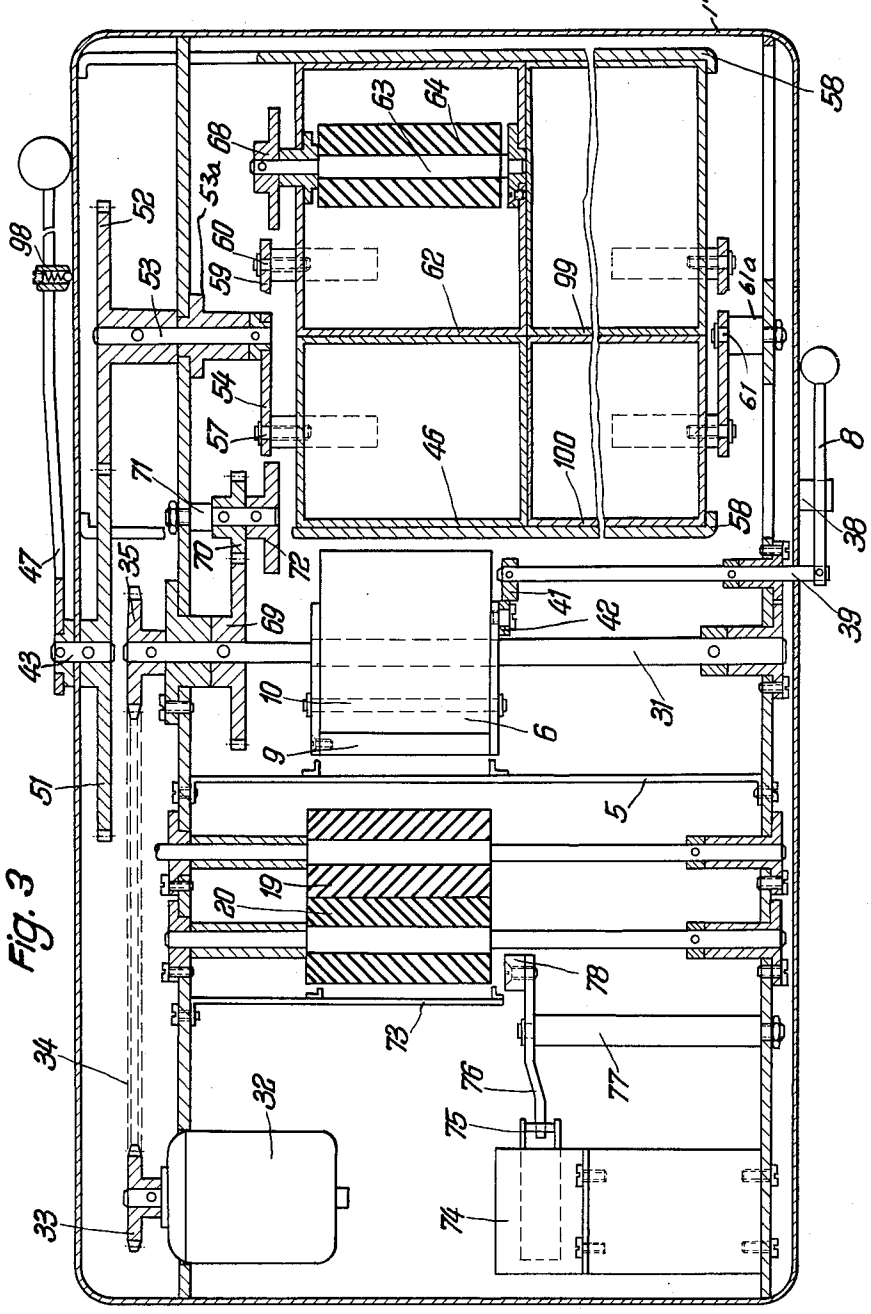


Fig. 3

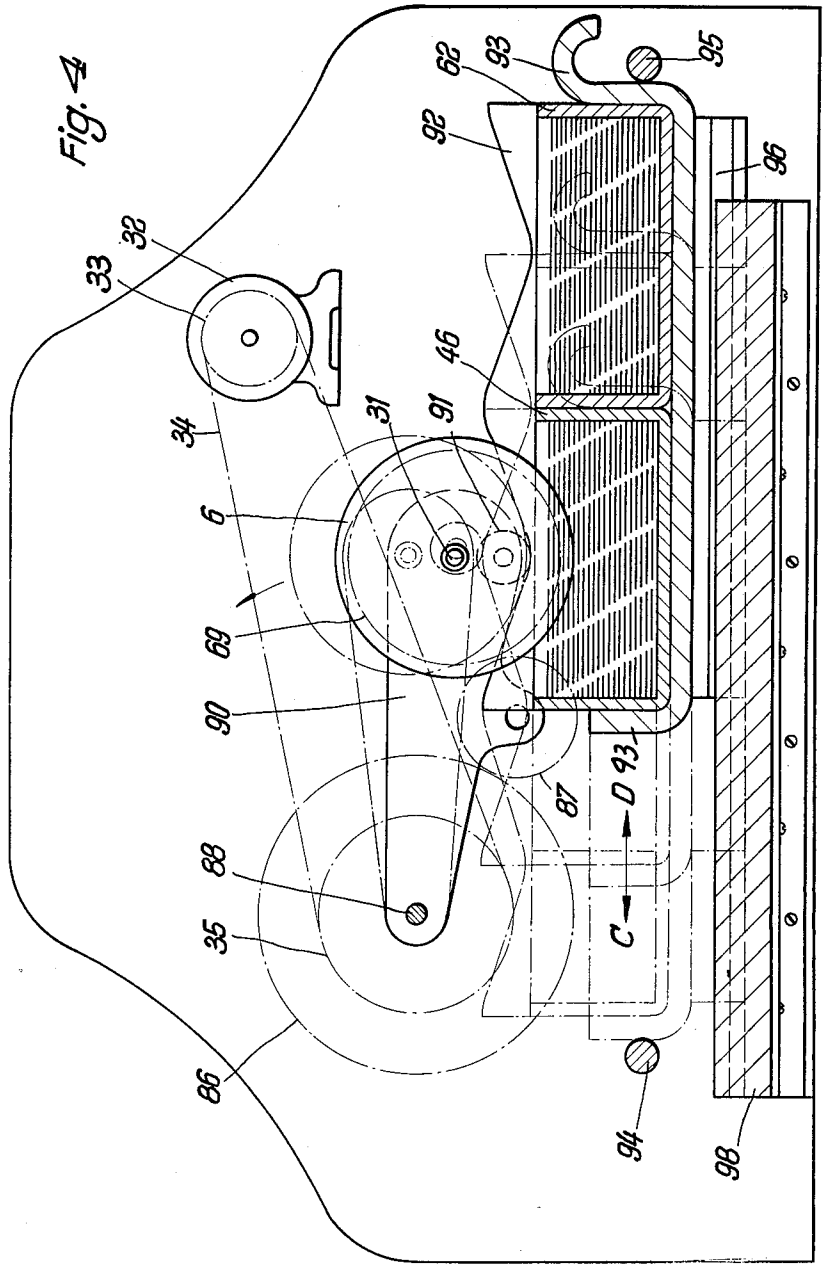
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APPARATUS FOR TREATING PRINTING FOILS

Filed April 13, 1959 5 Sheets-Sheet 4

Fig. 4



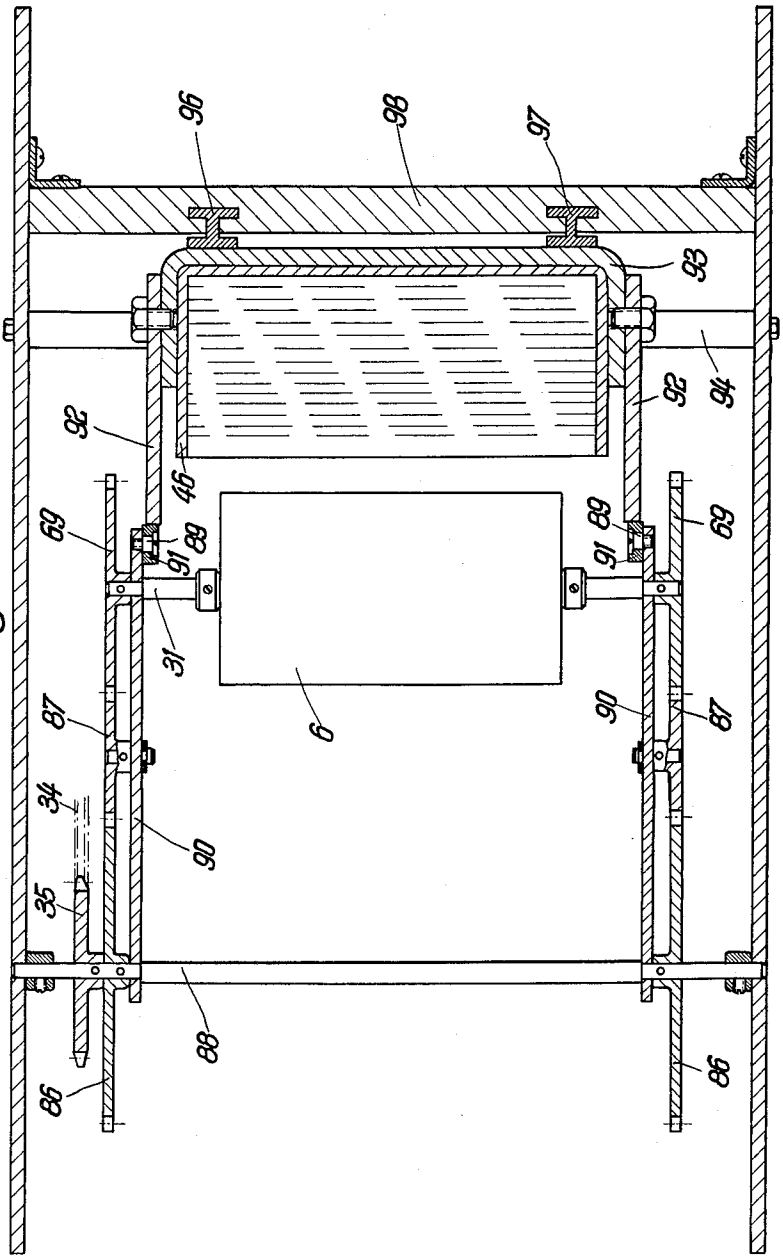
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APPARATUS FOR TREATING PRINTING FOILS

Filed April 13, 1959 5 Sheets-Sheet 5

Fig. 5



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United States Patent Office 3,093,051 Patented June 11, 1963

3,093,051

APPARATUS FOR TREATING PRINTING FOILS

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Filed Apr. 13, 1959, Ser. No. 805,958
Claims priority, application Germany Aug. 14, 1958
7 Claims. (Cl. 95—89)

The present invention relates to an apparatus for treating a printing foil, and more particularly to an apparatus for treating printing foil having a light-sensitive layer which after exposure has to be developed and cleaned to remove parts of the layer. The apparatus is also suitable for the chemical treatment of printing foils, such as the treatment of a printing foil in an acid bath, or in an oxidizing bath.

Known apparatus of this type include transporting rollers which grip a printing foil and transport the printing foil through a treating liquid. Since the development of the printing foil requires passing of the printing foil through a plurality of containers for different liquids, the devices of the prior art require a zig-zag path of the treated foil. Furthermore, it is difficult to provide the apparatus of the known art with friction roller means for rubbing the surface of the printing foil, as is required. Finally, the prior art apparatus requires the passage of the foils along guide passages before the foils are gripped by the transporting rollers. Frequently, the foils stick to such guide passages.

Other constructions of the known art require a dark room, since the complex nature of the devices prevented a complete enclosure of the treated foil in a casing.

It is one object of the present invention to overcome the disadvantages of the known apparatus for treating a printing foil, and to provide an apparatus of compact build, which can be easily operated, and inexpensively manufactured.

Another object of the present invention is to move the printing foil, and a plurality of containers containing different treating liquids, relative to each other to achieve successive immersion of the printing foil into two liquids.

Another object of the present invention is to provide for automatic release of the printing foil from a carrier drum when the treatment in a liquid has been completed.

A further object of the present invention is to provide an apparatus in which the treated printing foil is enclosed in a casing during the treatment, while the printing foil can be inserted into the casing, and discharged from the casing through suitable slots.

A further object of the present invention is to partly immerse into a treating liquid the carrier drum supporting the printing foil, so that only during rotation of the carrier drum, the entire printing foil passes through the treating liquid.

With these objects in view, a preferred embodiment of the present invention provides an apparatus constructed for successively treating a printing foil in two different liquids. An apparatus according to this embodiment of the present invention comprises, container means including a first container for a first treating liquid and a second container for a second treating liquid; rotary carrier means having a portion for supporting a foil for movement about a circular path; means for rotating the carrier means; and supporting means supporting the container means for movement relative to the carrier means between a first position in which the carrier means is at least partly immersed in the first liquid, and a second position in which the carrier means is at least partly immersed in the second liquid. During rotation of the carrier means, the foil passes through the first liquid in the first position, and

through the second liquid in the second position so that the printing foil can be successively treated by the two liquids.

One of the liquids is suitable for cleaning the printing foil, and preferably a cleaning roller is provided in the respective container which engages the printing foil and removes from the same gelatin parts which were loosened in the preceding developing treatment. It is advantageous to rotate the cleaning roller at such a speed that its surface moves relative to the printing form, and in opposite direction thereto.

In one embodiment of the present invention, the containers are mounted on pivoted arms, and are swung relative to the carrier means between the two positions in which the carrier means is respectively located in the first container or in the second container. In a further embodiment of the present invention, the containers are shifted in straight movement, and are provided with cam means acting on the movably mounted carrier means for shifting the carrier means to permit movement of the carrier means with the attached printing foil over the walls which separate the two containers.

In all embodiments of the invention, it is preferred to provide means for arresting the respective shiftable means in its end positions. Furthermore, holding means for holding the printing foil on the carrier drum means are provided, and such holding means are preferably operable from the outside of the apparatus to effect clamping, or release, of the printing foil. In a preferred embodiment of the present invention, a timing device is provided which actuates control means for operating the holding means at a selected moment during rotation of the carrier means for the printing foil.

It is advantageous to dry the released printing foil before it is discharged from the apparatus, and such drying is accomplished by squeezing the printing foil between doctor rollers.

It is preferred to mount a plurality of additional containers in the casing in which the normally used containers are mounted, so that last mentioned containers can be exchanged for other containers whenever required.

Preferably, means for heating the treating liquids and thermostat means controlling such heating means are provided in at least one of the containers.

A particular advantage of the construction in which the container means are shiftable, resides in that the carrier means for the printing form is substantially stationary, and can be easily driven from suitable drive means, while its relative position with respect to the control means of the holding means, and to the apparatus for discharging the printing foil remains unchanged.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view of an embodiment of the present invention, and illustrating one operational position of the apparatus;

FIG. 2 is a longitudinal sectional view of the embodiment shown in FIG. 1, illustrating another operational position of the apparatus;

FIG. 3 is a horizontal sectional expanded view of the apparatus illustrated in FIGURES 1 and 2;

FIG. 4 is a longitudinal sectional view illustrating another embodiment of the present invention, with certain parts shown in FIGURES 1 and 3 omitted for the sake of clarity; and

FIG. 5 is a cross sectional expanded view of the apparatus shown in FIG. 4.

In the embodiment illustrated in FIGURES 1, 2 and 3, the carrier drum 6 is stationary, and container means 46, 62 are shifted between two positions in which the carrier drum 6 is respectively located in a first container 46, or in a second container 62. The container means include a casing 58 in which containers 46 and 62 are supported, and which preferably has sufficient room so as to support additional containers 99 and 100, see FIG. 3, which may be shifted in casing 58 to replace containers 46 and 62, whenever desired.

Carrier drum 6 is driven by a motor 32 through a chain drive 33, 34, 35, and is mounted on a shaft 31 on the housing 1' of the machine. The printing form 4 is guided by guide means 5 into the slot 27 in the carrier drum 6 in the open releasing position of the holding means which include a clamping means 9 turnably mounted on a shaft 10 and operated by a manually controlled lever 8. Lever 8 is turnable with a shaft 39, best seen in FIG. 3, which carries another lever arm 41 cooperating with the roller 42 on clamping means 9. Lever 8 is movable between two end positions defined by a pair of stops 37 and 40 on the housing means. Lever 8 controls a switch 38 which is opened when lever 8 engages stop 40, and is closed when lever 8 engages stop 37. A spring 36 urges lever 8 to close switch 38.

Switch 38 is connected into the circuit of motor 33 in a conventional manner, so that the motor is energized when lever 8 is released, while at the same time the clamping means 9 is also released by lever 41 and moves to the holding position holding the printing form 4 under the action of spring 44.

Motor 32 drives carrier drum 6 through chain drive 33, 34 and 35 so that the printing form 4 is wound about the cylindrical surface of the carrier drum 6 and passes repeatedly through the treating liquid in container 46, for example a developing liquid for a light sensitive layer on the printing form 4. The time required for the developing process is set on the timing device 45 which may produce a signal when the time required for developing process has passed. The switch 45*a* of the timing device represents a plurality of switches which may be used for performing various control operations at the termination of the time set at the timing device.

The casing 58, which carries the containers, is provided with a pair of brackets in which a pair of arm means 54 and 55 is pivotally mounted on pins 57 and 60. The upper ends of the parallel arm means 54 and 59 are mounted by pins 53 and 61 on bushings 53*a* and 61*a* on the frame of the machine. Pin 53 is secured to the hub of a gear 52 which meshes with a gear 51 which is fixedly secured by a pin 43 to a lever 47, as best seen in FIG. 3. Lever 47 has a catch means 98, which cooperates with corresponding parts 48 and 50 on the wall of the apparatus. In this manner two positions of lever 47, and of gear 52 are defined. When lever 47 is turned, gear 52 also turns under control of gear 51, and turns pin 53 so that the arms 54 also turn, and shift the casing 58, together with a container 46 and 42 from the position shown in FIG. 1 to the position shown in FIG. 2.

A cover 65 with a sealing member 66 is secured to the housing of the machine, and is so arranged that in the shifted position of the container means shown in FIG. 2, the first container 53 is closed on top, preventing either evaporation or spilling of the liquid therein. During the shifting of the container means, the intermediate adjacent walls of the containers 46 and 62 have passed underneath the carrier drums 6 due to the curved path of the container means effected by the pivoted arm means 54 and 59. However, in each of the positions illustrated in FIGURES 1 and 2 the lower portion of the carrier drum 6 is located in one of the containers and is immersed in the respective liquid. Consequently rotation of the carrier drum with the printing form will result in repeated passage of the printing form through the respective liquid.

A cleaning and washing roller 64 is mounted on container 62 and is preferably driven by shaft 63 which turns with a friction wheel 68 cooperating with another friction wheel 72. Friction wheel 72 is mounted on a shaft 71 and is driven from shaft 31 by gears 69 and 70.

As explained above, the carrier drum 6 is first rotated in container 46 until the printing form is sufficiently developed, which is determined by a signal from the timing means 44. When the timing device indicates completion of developing process, the operator turns lever 47 so that the container means are shifted, and the carrier drum with the printing form is partly immersed into the cleaning liquid in container 62 as shown in FIG. 2. The carrier drum is rotated by motor 32 so as to be cleaned in the cleaning liquid in container 62. After the time required for cleaning and washing of the printing form has passed, the switch means 45*a* of the timing device 45 energizes the electro-magnetic means 74 through a circuit, not shown in the drawing. The armature 75 of the electromagnetic means 74 is connected to a control means 76 which is turnably mounted on a pin 77, and includes a control cam 78 cooperating with the roller 42 of the clamping means 9. Electro-magnetic means 74 shifts control means 76 from the inoperative position shown in dash and dot lines to the operative position shown in solid lines, in which cam 78 is engaged by roller 42 during rotation of the carrier drum 6, whereby the holding means 9 is opened to release the printing form. At the same time, the roller 79 of a discharge member 80 is engaged by the control means 76, and discharge member 80 is moved outwardly against the action of a spring 82 to push the printing form out of slot 27 in which its edge was clamped. Further rotation of the carrier drum 6 effects movement of the printing form along guide means 28 between a pair of squeezing doctor rollers 19 and 20 which dry the printing form before it passes along a guide means 73 out of the housing. The rollers 19 and 20 are driven from motor 32 or from the carrier drum 6 by a suitable chain drive, not shown in the drawing. The timing device 45 interrupts the current to electro-magnetic means 74, so that control means 76 returns to its inoperative position, permitting return of the discharge member 18 under the action of 82 to a retracted position in a recess of carrier drum 6. The holding means 9 return to clamping position when the control means 76, 78 move to an inoperative position, so that the initial position of the elements on the carrier drum is again obtained. Lever 47 can now be operated to return the container means to the position shown in FIG. 1 in which the process can be repeated with another printing foil.

The arresting part 49 defines an intermediate position of lever 47 and cooperates with the arresting means 98. In this intermediate position, the carrier drum 6 is located above the partitioning walls between containers 46 and 62, permitting removal of the containers, or substitution of the containers 99 and 100, if desired.

Preferably, heating elements 83 are provided in at least one of the containers, and a thermostat means 84 is connected to the heating means 83 to control the operation of the same in accordance with the temperature of the liquid in the container 62. Stops 56 and 55 on gear 52 cooperate with arm means 54 to define the two positions of the container means.

A further embodiment of the present invention is illustrated in FIGURES 4 and 5. A carrier drum means 6 is again provided, and has holding means, not shown, of the type described in detail with reference to FIGURES 1 and 3. Control means for clamping the printing form in such holding means, and for releasing the printing form from the holding means, as described with reference to FIGURES 1 to 3, are also provided in the embodiment of FIGURES 4 and 5, but not shown in these figures for

the sake of simplicity and clarity. The embodiment of FIGURES 4 and 5 is different from the embodiment of FIGURES 1 to 3, inasmuch as the carrier drum 6, and more particularly its shaft 31, is mounted on a lever 90 which is pivotable about a shaft 88 mounted in the housing of the machine. A gear 69 is connected to carrier drum 6 for rotation therewith, and meshes with another gear 87 mounted on the lever means 90. Gear 87 is driven by another gear 86 which is secured to shaft 88 for rotation therewith, so that the carrier drum 6 turns when shaft 88 is driven by the chain wheel 35 which is connected by a chain 34 to a chain wheel 33 on the shaft of the motor 32. The gear train 86, 87, 69 permits driving of carrier drum 6 in pivoted positions of lever means 90. Lever means 90 has mounted thereon a pair of cam follower rollers 91 which are turnable about pins 89.

Rollers 91 engage the cam tracks of a pair of cams 92 which are secured to the container means, and more particularly to a casing 93 in which the containers 46 and 62 are mounted. The container means, and more particularly casing 93 have a slide member 96 secured thereto which is slidable in a guide means 98 in the directions of the arrows C—D.

The two end positions of the container means are determined by stops 94 and 95. The arrangement is such, that in one end position the carrier drum 6 is located in the region of container 62, and in the other position is located in the region of container 46, as shown in FIG. 4. The cam means 92 are so designed that the carrier drum 6 is lowered into the respective containers in the two end positions of the container means, and is raised to pass over the partitioning walls between the two containers during the shifting of the container means. The raising and lowering of a carrier drum 6 is possible due to the fact that the carrier drum is mounted on the pivoted lever means 90 which constitute movable supporting means for the carrier drum 6.

The embodiment of FIGURES 4 and 5 is operated in the following manner: In the position of FIG. 4, the printing form is attached to the holding means of the carrier drum 6, whereupon the motor 32 rotates the carrier drum so that the printing form passes repeatedly through the developing liquid in container 46. Thereupon, the container means are manually shifted in the direction of arrow C so that the carrier drum 6 rides over the partitioning walls between the containers, and assumes a position immersed into the liquid in container 62. The motor continues to rotate the carrier drum so that the printing form is passed repeatedly through the cleaning liquid in containers 62. A cleaning roller, doctor rollers, and heating elements, as described with reference to FIGURES 1 to 3, are preferably provided in the embodiment of FIGS. 4 and 5. After the cleaning operation has been completed, the automatic discharge means described with reference to FIGURES 1 to 3 are operated, if desired by a timing device, so that the printing form is discharged. The container means can then be returned to the position shown in FIG. 4 in which a new printing form may be inserted into the prospective holding means of the carrier drum 6.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of treating devices for foils differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for developing and cleaning a printing foil having a light-sensitive layer, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for treating a printing foil having a treatable surface layer, the apparatus comprising, in combination, container means including a casing, a first container adapted to contain a first treating liquid and a second container adapted to contain a second treating liquid, said containers being supported on said casing adjacent each other and having adjacent wall means; rotary carrier drum means having a surface portion for supporting the printing foil for movement about a circular path; stationarily supported drive means for rotating said carrier drum means with the printing foil; a support supporting said carrier drum means for rotation; a pair of parallel arm means pivotally connected at the ends thereof to said support and to said casing and supporting said casing with said containers below said carrier drum means for movement between a first position in which the lower part of said carrier drum means is located in said first container, an intermediate position in which said adjacent wall means are located below said carrier drum, and a second position in which the lower portion of said carrier drum means is located in said second container so that said surface portion and the printing foil are partly immersed in said liquids whereby the printing foil passes during rotation of said carrier drum means through said first and second liquids in said first and second positions, respectively, for successive treatment of the foil by the liquids; and a handle operatively connected to one of said arm means for turning the same to move said casing between said positions.

2. An apparatus as set forth in claim 1 and including a horizontal plate mounted on said support and closing one of said containers in one of said positions, while said carrier drum means is located in the other of said containers.

3. Apparatus for treating a foil and comprising, in combination, container means including a first container adapted to contain a first treating liquid and a second container adapted to contain a second treating liquid; rotary carrier means having a portion for supporting a foil for movement about an endless path; stationarily supported drive means for driving said carrier means; holding means on said carrier means movable to a releasing position and a holding position for holding the printing foil on said carrier means; supporting means supporting said container means for movement relative to said carrier means and including a support casing supporting said first and second containers adjacent each other at the same horizontal level for simultaneous movement of corresponding parts of said containers parallel to each other so that said containers move in the same relative position between a first position in which said rotary carrier means is at least partly located in said first container so that said portion and the foil are at least partly immersed in said first liquid, and a second position in which said rotary carrier means is at least partly located in said second container so that said portion and the foil are at least partly immersed in said second liquid whereby the foil passes during rotation of said carrier means through said first liquid in said first position and through said second liquid in said second position for successive treatment by said liquids; means for rotating said carrier means in each of said positions; and control means including a timing device and being operatively connected to said holding means for moving the same to said releasing position a selected time after said container means has assumed said second position.

4. Apparatus for treating a printing foil having a treat-

able surface layer, the apparatus comprising, in combination, container means including a casing, a first container adapted to contain a first treating liquid and a second container adapted to contain a second treating liquid, said containers being supported on said casing at the same horizontal level adjacent each other and having adjacent wall means; rotary carrier drum means having a surface portion for supporting the printing foil for movement about a circular path; holding means on said carrier drum means for holding the printing foil and being movable between a releasing position and a holding position for holding said printing foil on said surface portion; stationarily supported drive means for rotating said carrier drum means with the printing foil; a support supporting said carrier drum means for rotation and supporting said casing with said containers below said carrier drum means for movement between a first position in which the lower part of said carrier drum means is located in said first container, an intermediate position in which said adjacent wall means are located below said carrier drum, and a second position in which the lower portion of said carrier drum means is located in said second container so that said surface portion and the printing foil are partly immersed in said liquids whereby the printing foil passes during rotation of said carrier drum means through said first and second liquids in said first and second positions, respectively, for successive treatment of the foil by the liquids; control means mounted on said support for movement between an inoperative position and an operative position, said control means engaging said holding means in said second position of said carrier drum means in a predetermined position of said holding means during rotation of said carrier drum means for moving said holding means to said releasing position; operating means for moving said control means to said operative position; and a device for actuating said operating means after a selected time of rotation of said carrier drum means in said second position.

5. Apparatus for treating a printing foil having a treatable surface layer, the apparatus comprising, in combination, container means including a casing, a first container adapted to contain a first treating liquid and a second container adapted to contain a second treating liquid, said containers being supported on said casing at the same horizontal level adjacent each other and having adjacent wall means; rotary carrier drum means having a surface portion for supporting the printing foil for movement about a circular path; stationarily supported drive means for rotating said carrier drum means with the printing foil; a movable supporting means supporting said carrier drum means for rotation; a support supporting said movable supporting means for movement between a higher position and a lower position and supporting said casing with said containers below said carrier drum means for movement between a first position in which said first container is located in the region of said carrier drum means, an intermediate position in which said adjacent wall means are located below said carrier drum, and a second position in which said second container is located in the region of said carrier drum means; and cam means secured to said container means and moving with the same, said cam means engaging a portion of said movable supporting means for moving said carrier drum means between said higher and lower positions during movement of said casing, said cam means having a cam track of such a shape that said carrier drum means is in said lower position when said casing is in said first and second positions and that said carrier drum means is in said higher position in said intermediate position of said casing for passing over said adjacent wall means of said first and second containers, said carrier drum means in said lower position having the lower part thereof located in said first container in said first position, and located in said second container in said second position so that said surface portion and the printing foil are partly immersed in said liquids whereby the printing foil passes during rotation of said carrier drum means through said first and second liquids in said first and second positions, respectively, for successive treatment of the foil by the liquids.

6. An apparatus as set forth in claim 5 wherein said movable supporting means includes a lever pivotally supported on said support and a cam follower roller cooperating with said cam track and constituting said portion of said supporting means; wherein said carrier drum means is mounted at one end of said lever; and including gear means mounted on said lever, and a driven wheel connected to one of said gear means; and motor means for driving said driven wheel.

7. Apparatus for treating a printing foil having a treatable surface layer, the apparatus comprising, in combination, container means including a casing, a first container adapted to contain a first treating liquid and a second container adapted to contain a second treating liquid, said containers being supported on said casing; rotary carrier drum means having a surface portion for supporting the printing foil for movement about a circular path; holding means on said carrier drum means for holding the printing foil and being movable between a releasing position and a holding position for holding said printing foil on said surface portion; stationarily supported drive means for rotating said carrier drum means with the printing foil; a support supporting said carrier drum means for rotation and supporting said casing with said containers below said carrier drum means for movement between a first position in which the lower part of said carrier drum means is located in said first container and a second position in which the lower position of said carrier drum means is located in said second container so that said surface portion and the printing foil are partly immersed in said liquids whereby the printing foil passes during rotation of said carrier drum means through said first and second liquids in said first and second positions, respectively, for successive treatment of the foil by the liquids; control means mounted on said support for movement between an inoperative position and an operative position, said control means engaging said holding means in said second position of said carrier drum means in a predetermined position of said holding means during rotation of said carrier drum means for moving said holding means to said releasing position; a timing device; and electro-magnetic means operated by said timing device for moving said control means to said operative position and adapted to be operated after a selected time of rotation of said carrier drum means in said second position.

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