Oct. 21, 1952 B. E. LUBOSHEZ 2,614,472

CENTRIFUGAL SPRAY PROCESSING APPARATUS FOR SENSITIZED MATERIALS

Filed Dec. 28, 1949 2 SHEETS—SHEET 1

FIG. 1.

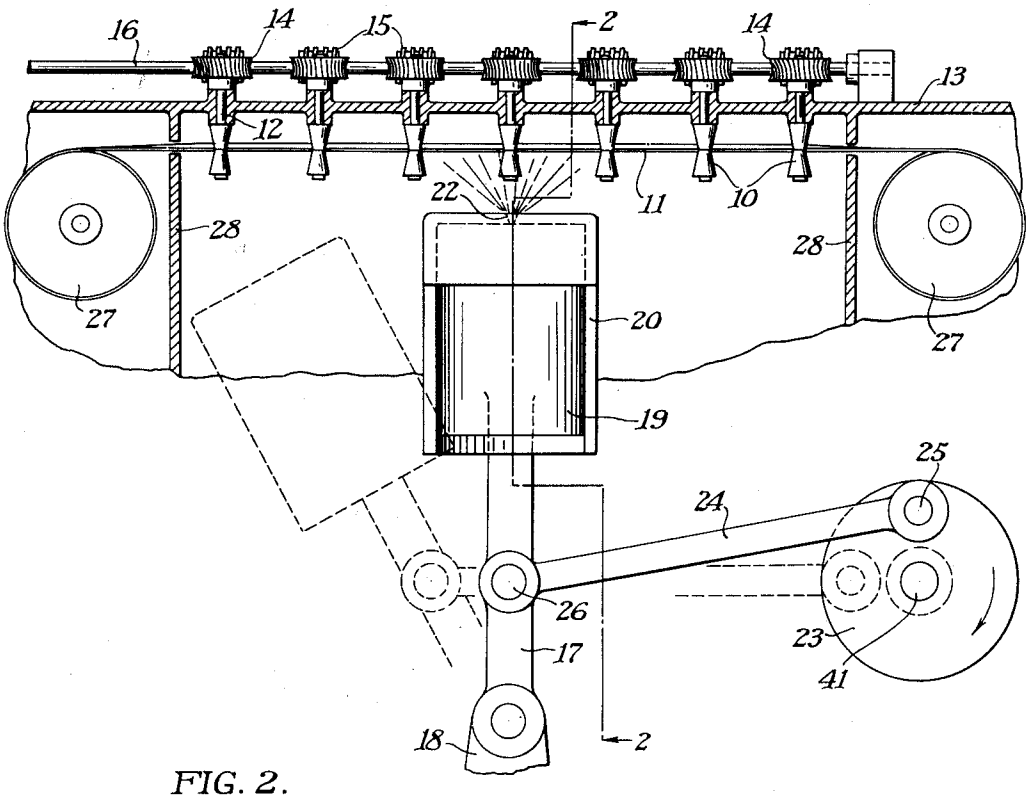
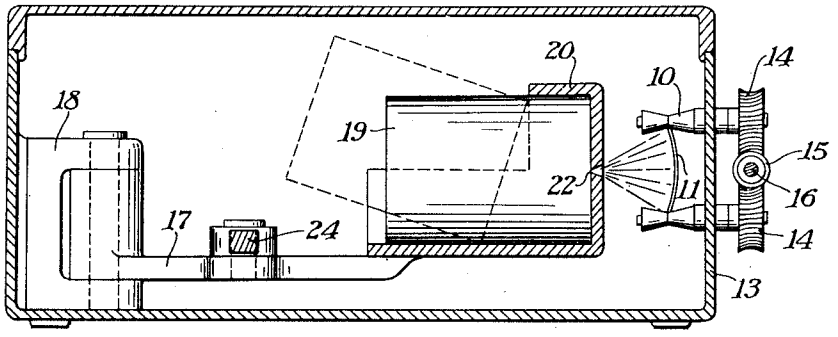


FIG. 2.



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FIG. 3.

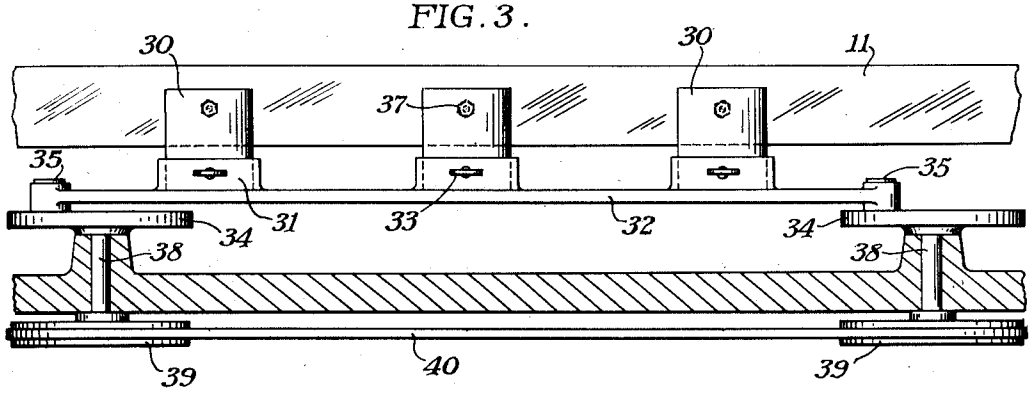
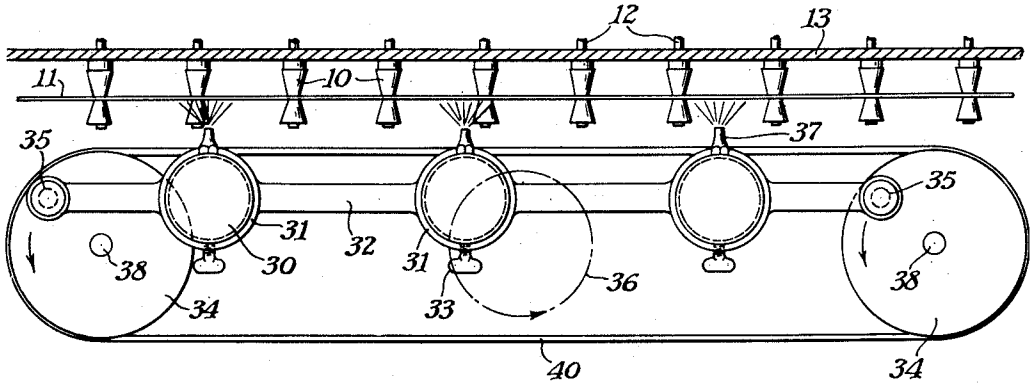


FIG. 4.



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CENTRIFUGAL SPRAY PROCESSING APPARATUS FOR SENSITIZED MATERIALS

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9 Claims. (Cl. 95—94)

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The present invention relates to processing machines for photographic materials and more particularly to a processing apparatus of the spray type in which the conventional pump is replaced by simple centrifugal devices for forming the spray. While the apparatus disclosed is particularly adapted to the processing of strip film, such as 16 mm. or 35 mm. film, it can be applied to the processing of films of other sizes or even individual sheets or, for that matter, to the processing of other photographic or sensitized materials, such as paper. The present invention is well adapted for use in rapid processing and in those operations where specialized personnel is not available for their execution.

It has been found that the pumps ordinarily used in spray processing are subject to contamination by the processing chemicals which impairs their efficiency and makes necessary their frequent cleaning and overhaul. Where the same pumps are employed to spray various chemicals as may be required for the complete treatment of films or where developing solutions of different compositions are used, as the occasion may demand, it is often necessary that the pumping apparatus be cleaned with each change. All of this places considerable additional burden on the use of pumps. The present invention is intended to remove this difficulty by the elimination of all present types of pumps and accessories and substituting for them simple mechanical devices which are substantially contamination-proof. These mechanical devices comprise essentially means which drive fluid containers in arcuate paths whereby the centrifugal force developed ejects the fluid through spray apertures in the containers upon the sensitized material which is to be treated. These mechanical devices are further unique in that they also cause the containers to be given an oscillatory movement whereby the apertures therein are always directed substantially toward the surface of the sensitized material which may be travelling in a substantially linear path. These devices include no bearings, stuffing boxes, connections or other parts immersed in fluids, as would be the case with pumps, that might give trouble in use by becoming contaminated with chemicals and there are consequently few adjustments that must be made or difficulties involved in cleaning.

The invention, too, is applicable to the use of processing liquids which are put up in sealed containers, such as ordinary tin cans, as will be apparent from the ensuing description. In this respect, the herein-disclosed spray processing apparatus is well adapted for use with those processing solutions which are toxic by nature and to which operators may be allergic, since, when so used, they would be subject to a minimum of handling by operating personnel.

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The centrifugal spray processing apparatus which embodies the present invention is well adapted to the development of strip film which is moved in a substantially linear path as, for example, by the drive mechanism employing a series of pairs of rollers, having reduced portions of less diameter than the remaining portions, which bow the film therebetween, such as is described in my copending application for a film processing machine, Serial Number 67,467, filed December 27, 1948, and in United States Patent Number 2,496,947 granted to me February 7, 1950.

It is, therefore, an object of this invention to provide an improved processing machine.

It is a further object of this invention to provide an improved processing machine which is especially adapted for rapid processing and whose operation does not require the use of specialized personnel.

It is a still further object of this invention to provide an improved processing machine which is adapted to the use of processing solutions which are toxic by nature and to which operating personnel may be allergic.

It is a still further object of this invention to provide a processing apparatus in which the treating fluids are sprayed upon the sensitized material by centrifugal force.

It is a still further object of this invention to provide an apparatus of the character described in which conventional pumps are eliminated as well as the usual bearings, stuffing boxes, connections, etc. immersed in fluids.

It is a still further object of this invention to provide a centrifugal spray apparatus of the character described in which the spray apertures remain at all times directed substantially toward the surface of the material to be sprayed.

It is a still further object of this invention to provide a spray processing apparatus of the character described which is relatively simple in construction and which will require a minimum of maintenance.

Other objects and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings, and it will be understood that many changes may be made in the details of construction and arrangement of parts shown and de-

scribed without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details shown and described as the preferred forms only have been shown by way of illustration.

In the drawings:

Fig. 1 is a top view, partly in section, of a spray processing apparatus embodying the present invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a front view, partly in section, of a modified form of the invention; and

Fig. 4 is a top view of the modified form illustrated in Fig. 3.

The embodiment of the invention illustrated in Figs. 1 and 2 includes a film drive or conveyor and a mechanism for holding a container of processing fluid to which it imparts an oscillating arcuate motion. The film conveyor like that disclosed in my copending applications, above referred to, includes the rollers 10 arranged in pairs along the path of travel of the film 11. These rollers have reduced portions of less diameter than the remaining portions thereof and, as illustrated, may take the shape of an hour glass, although obviously other configurations are possible. Each pair of rollers is so spaced that the distance between the reduced portions thereof is less than the width of the film 11. The rollers 10 are mounted upon shafts 12 which extend through a wall 13 of the processing apparatus. The opposite ends of the shafts 12 mount the worm gears 14 which mesh with the worms 15 pinned upon the shaft 16. The latter is driven by any conventional means. Each pair of rollers thus rotated in opposite directions by the worm and worm gears, functions to bow and grip the film therebetween and draw it through the apparatus. While the described film drive is particularly adapted to handle motion picture film or film strips, it is equally well adapted for use with sheet film.

The spray mechanism comprises a bar 17, one end of which is pivotally secured in a forked bearing 18, the other end being adapted to mount a fluid container 19. This mounting consists of a cylindrical shell or holder 20, one end and a portion of the cylindrical wall of which is cut away to receive therein the container, as clearly indicated by the dashed lines in Fig. 2. The fluid container is preferably a sealed can in which correctly compounded processing solutions are put up by the manufacturer, the can being disposable after the contents are expended. By punching a hole in one end of the can just prior to use a spray aperture is formed therein, the only precaution that need be taken being that this aperture align itself with the opening 22 in the end of the cylindrical shell 20. For the sake of convenience, the can may carry a marking on the end to indicate the proper location at which the hole is to be punched. The container which is readily slidable into the holder 20 is securely held therein by the centrifugal force developed by the operation of the mechanism, which same force is responsible for the ejection of the fluid through the spray aperture, as will be apparent.

The bar 17 is oscillated about its pivot by the action of a rotary drive element 23 and a connecting rod 24. The latter is connected eccentrically to the rotary drive element by crank pin 25 and to the bar 17 by pivot pin 26. It is obvious that rotation of the drive element 23 by any conventional means (not shown) will impart an oscillatory motion to the bar 17, one extreme position thereof being shown in dashed lines in Fig. 1. The spray mechanism is so oriented to the film drive that at the mid position of the oscillating bar 17 the bar is normal to the linear path of the film and the spray is directed substantially normally to the surface of the film. At the extreme positions of the bar the spray aperture is still directed toward the surface of the film. Thus, the spray is ejected only in the direction of the film. While rotation of the drive element 23 causes the bar 17 to oscillate within a predetermined angle, depending upon the relative dimensions of the several elements and the location of the points at which they are interconnected, the same motion causes the holder 20 on the end of the bar and the fluid container 19 secured therein to travel in an arcuate path. It is this motion of the container which results in the development of the centrifugal force which drives the solution in the container through the spray aperture and upon the moving film band. Since the value of the force depends in part upon the angular velocity of the bar 17, the drive element 23 will be rotated at a relatively high speed.

While a film reel 27 is depicted diagrammatically in Fig. 1 at each end of the single spray unit beyond a wall or baffle 28, it should be understood that it is within the scope of this invention to incorporate a number of such spray units in a single apparatus, each separated from the others by baffles and each performing one of the several distinct operations necessary to completely process film, as developing, fixing, washing, etc. As a matter of fact, a plurality of such spray units may be used in combination with a drier and automatic film takeup device of the type disclosed in my copending application Serial No. 67,467, filed December 27, 1948, to provide a complete processing machine.

In a second form of the invention, illustrated in Figs. 3 and 4, the spray mechanism has been modified, although, like the previously described form, it produces an oscillating motion of the fluid container mounting whereby the container is driven in an arcuate path, developing a centrifugal force which causes the fluid to be sprayed through an aperture in the said container. The film drive or conveyor is essentially a duplicate of that described in connection with the form of invention illustrated in Figs. 1 and 2, the rollers 10 alone being shown in Fig. 4, and no more than the film 11 being shown in Fig. 3. The spray mechanism is adapted to mount a plurality of fluid containers 30 which are secured in cup-like holders 31 integral with the bar 32. Lock screws 33, threaded into the cup-like holders, serve to secure the containers in their respective holders. To the bar 32 is imparted an oscillating or reciprocating motion by the rotation of a pair of crank wheels 34, to which the ends of the bar are eccentrically secured by crank pins 35. It is apparent from an inspection of Fig. 4 of the drawing that, while rotation of the crank wheels will oscillate the bar back and forth, the bar will at all times remain parallel to its original position. However, each holder 31 thereon and the fluid container 30 secured therein will traverse an arcuate path, the locus of which is the circle, indicated by the dashed line 36.

The containers 30 are each provided with a

spray aperture in the side thereof and near one end. These apertures may be, like those described in connection with the container **19**, merely a hole punched in the side of the can, or they may take the form of a small jet such as is designated by the reference numeral **37** in the drawing. These, too, may be threaded for the reception of a screw cap to seal the container. In securing each container **30** in the holder **31**, the container is oriented so that the spray aperture **37** is directed toward the film strip. Since, as above described, the bar **32** remains at all times parallel to its initial position and since this is also parallel to the linear path traversed by the film, the spray apertures will continue to be directed toward the film throughout the entire motion of the drive. Moreover, the same centrifugal force which sprays the contents from the cans or containers, as they sweep past the film, prevents egress of the liquids on the return stroke when the bar **32** is furthest from the film, since the force then operates to press the liquid against the container wall opposite to the spray aperture. This also permits air to enter the container through the aperture on the return stoke precluding the development of a partial vacuum therein as the liquid becomes exhausted, which would gradually render ineffective the spray mechanism. In the form of invention illustrated in Figs. 1 and 2, an intake of air will occur when the container **19** reaches each end of its arcuate path, at which time the linear velocity of the container, and, therefore, the centrifugal force, becomes zero.

The crank wheels **34** are supported on shafts **38** on the opposite ends of which are mounted pulleys **39**, both of which are connected by a belt **40** to a motor or any other conventional drive means (not shown).

While the several containers **30** may all spray the same fluid in any one operation, it should be understood that with proper dimensioning of the apparatus, such as the length of the bar **32** between containers, and with regulation of the speed of travel of the film, it is possible to have each container handle a different processing fluid, developer, fixer, water, etc., so that the film is completely processed by a single passage through the apparatus. Like the apparatus of Figs. 1 and 2, this modification may be used in combination with drier and automatic film take-up device, such as is described in my copending application Serial Number 67,467, above referred to, to provide a complete processing machine. Although the apparatus of Figs. 3 and 4 illustrate the bar **32** mounting three containers, it is apparent that a lesser or larger number may be so secured to a similar bar. The containers **19** and **30** have been illustrated as being separate fluid receptacles, such as sealed cans, which are readily secured in the apparatus and in which manufacturers may put up properly compounded solutions. Where these solutions are toxic, such an arrangement permits their use with a minimum of handling by personnel who may be allergic thereto. Instead of separate containers, however, fluid holders may be formed as a permanent and integral part of either oscillating bar **17** or **32**, into which the solutions are poured prior to the operation of the apparatus. To shorten the time of processing, the containers of liquid may be heated prior to their use. This can be accomplished separately of the apparatus or by the use of electric heating coils which can be located in the container holders **20** or **31** themselves.

Although the preferred film drive or conveyor has been described as being similar in principle to that disclosed in my copending applications, above identified, it is obvious that other types of conventional film drives may be employed which will convey the film in a substantially linear path with the sensitized surface exposed to the centrifugal spray. Again, while I have described the apparatus as a film processing apparatus, especially adapted for strip film, it can obviously be used for processing films of any size or shape and, for that matter, the spray-producing mechanism is itself readily adaptable to the processing of other sensitized materials, such as paper.

From the foregoing description, it will be apparent that I have provided means for obtaining all the objects and advantages of this invention.

What I claim and desire to secure by Letters Patent of the United States is:

1. A processing apparatus for sensitized material comprising conveyor means for moving the material in a substantially linear path, said conveyor including a plurality of pairs of spaced rollers, each roller having a portion of reduced diameter for engaging an edge of said sensitized material and each pair of rollers being so spaced that the sensitized material passing therebetween is bowed transversely between the reduced portions, means for rotating the rollers to drive the sensitized material through the aparatus in a path defined by the rollers, a fluid container having a spray aperture therein, a mounting element for the container constrained to move in an arcuate path and adapted to support the container so that the spray aperture is at all times directed toward the surface of the sensitized material, a crank disc, connecting means between the disc and the mounting element, said connecting means being eccentrically pivoted to the crank disc whereby rotation of the latter will oscillate the connecting means to impart an arcuate motion to the mounting element and the container whereby fluid will be sprayed through the aperture by centrifugal force upon the sensitized material.

2. In a processing apparatus for sensitized material having drive means for moving the material in a substantially linear path, a fluid container having a spray aperture therein, a mounting element for holding the container adapted to move in an arcuate path and adapted to support the container so that the spray aperture is directed toward the surface of the sensitized material, a crank disc, connecting means between the disc and the mounting element, said connecting means being eccentrically pivoted to the crank disc whereby rotation of the latter will oscillate the connecting means to impart an arcuate motion to the mounting element and the container whereby fluid will be sprayed therefrom through the aperture by centrifugal force upon the sensitized material.

3. In a processing apparatus for sensitized material having drive means for moving the material through the apparatus, a fluid container having a spray aperture therein, a holder for mounting the container adapted to be oscillated and to simultaneously move the container in an arcuate path, a rotary drive element, an eccentric connection between the rotary drive element and the holder whereby the latter is oscillated and arcuate motion is imparted to the container whereby fluid will be sprayed therefrom through the aperture by centrifugal force upon the material and

the spray aperture will be at all times directed toward the surface of the material.

4. In a film processing apparatus having drive means for moving film through the apparatus, a fluid container having a spray aperture therein, a bar pivotally mounted at one end and having means for securing the container thereon, a rotary drive element, a connecting rod pivotally secured eccentrically to the rotary drive element and pivotally secured to the said bar, said rotary drive element and connecting rod being adapted to impart an arcuate motion to the bar and the container whereby fluid will be sprayed therefrom through the aperture by centrifugal force upon the moving film, the spray aperture being at all times directed toward the surface of the film.

5. In a film processing apparatus having drive means for moving film through the apparatus, a fluid container having a spray aperture therein, a reciprocating bar having means for securing the container thereon, a pair of crank wheels, a pair of crank pins connecting the ends of the reciprocating bar to the crank wheels, the rotation of the latter imparting a reciprocating and arcuate motion to the bar whereby fluid will be sprayed from the container through the aperture by centrifugal force.

6. In a processing apparatus for sensitized material having drive means for moving the material in a substantially linear path, a fluid container having a spray aperture therein, a pivotally mounted element, means on the end of said element for removably mounting the container, a crank wheel, a connecting rod secured at one end by means of a crank pin to the crank wheel and pivotally secured at the other end to said element, rotation of the crank wheel imparting an oscillatory arcuate motion to the container mounted upon the element to develop a centrifugal force whereby fluid will be sprayed from the container through the spray aperture upon the material.

7. In a processing apparatus for sensitized material having drive means for moving the material in a substantially linear path, a fluid container having a spray aperture therein, a bar subtantially parallel to said linear path of the material and having means for removably mounting the fluid container, a pair of crank wheels, a pair of crank pins connecting the ends of the bar to the crank wheels, the rotation of the latter imparting a reciprocating motion to the bar and moving the container in an arcuate path to develop a centrifugal force whereby fluid will be sprayed from the container through the spray aperture upon the material.

8. In a film processing apparatus having drive means for moving film through the apparatus, a fluid container having a spray aperture therein, an oscillatory element having means at one end adapted to hold the container with the spray aperture directed toward the surface of the moving film, the other end of said element being mounted for pivotal movement, a rotary drive element, a connecting rod eccentrically pivoted at one end to the rotary drive element and pivotally secured at the other end to the oscillatory element, rotation of the rotary drive element being adapted to move the fluid container in an oscillating arcuate path whereby fluid will be sprayed by centrifugal force from the container through the spray aperture upon the film, the spray aperture being at all times directed toward the surface of the film.

9. In a film processing apparatus having drive means for moving film in a substantially linear path, a plurality of fluid containers each having a spray aperture therein, a bar substantially parallel to said linear path of the film and having means for mounting each of said plurality of containers so that the spray aperture of each is directed toward the surface of the moving film, a pair of crank wheels, a pair of crank pins connecting the ends of the bar eccentrically to the crank wheels, rotation of the latter being adapted to oscillate the bar and to move the fluid containers in an arcuate path to develop a centrifugal force whereby fluid will be sprayed from each of said plurality of containers through the spray apertures upon the film, the spray apertures being at all times directed toward the surface of the film.

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