May 7, 1968 D. G. BANKS 3,381,599

PHOTOGRAPHIC METHOD AND APPARATUS

Filed June 27, 1966

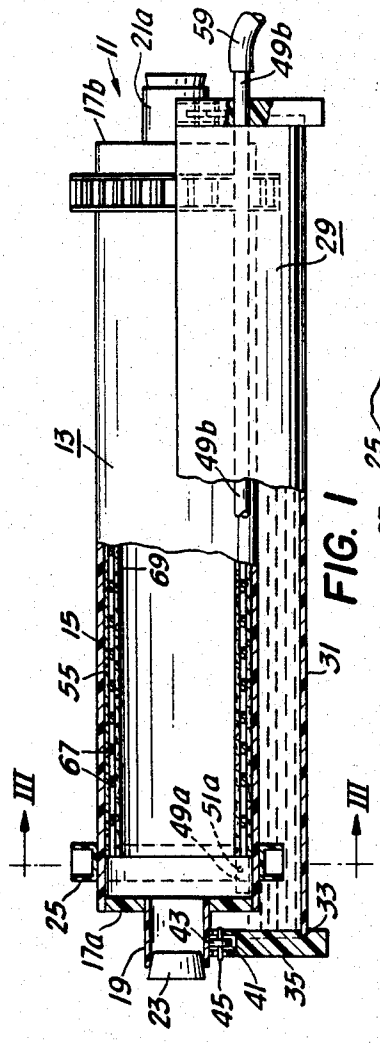


FIG. 1

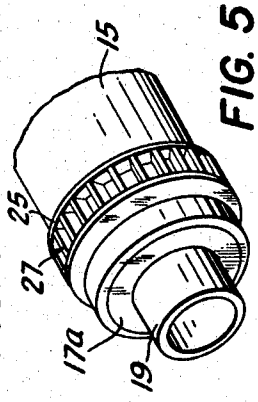


FIG. 5

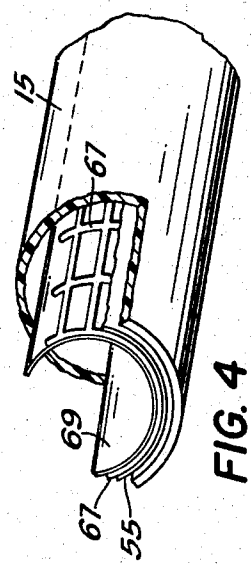


FIG. 4

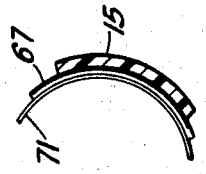


FIG. 6

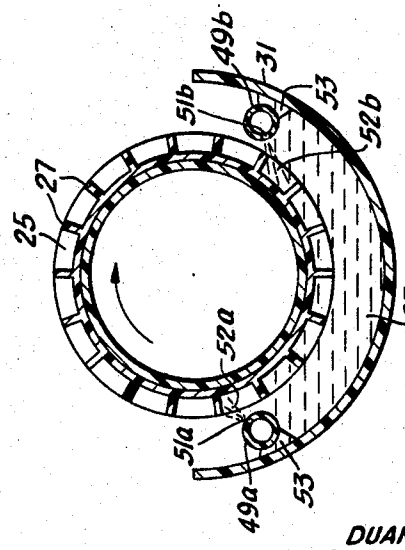


FIG. 3

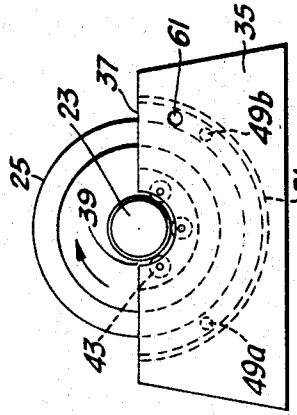


FIG. 2

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PHOTOGRAPHIC METHOD AND APPARATUS

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This invention relates to photography and, more particularly to improved method and apparatus for processing photographic film and paper prints.

Amateur and professional photographers heretofore have used apparatus for processing both film and paper prints, that included light tight tanks for films and open trays for paper prints; each tray holding a different photographic solution. Generally, several sets of trays were required, especially if a wide range of sizes of prints were to be made, for the reason that the size of the trays is selected to suit the size of print. It is desirable, of course, that each tray hold a minimum of photographic solution and yet be large enough to hold a print when submerged in the solution. For example, trays that will hold prints as large as 16″ x 20″ are much too large for prints as small as 5″ x 7″, or 8″ x 10″. The use of oversized trays then results in a large waste of photographic solution. Hence, several sizes of trays are usually kept on hand for different size prints.

The processing of film and prints in this manner wastes much photographic solution, and open tray processing of prints subjects the photographer or the photo-technician to a health hazard from breathing fumes arising from the solutions in the open trays, some of which are toxic, especially when color prints are being so processed. Additionally, when color prints are being processed, several extra trays are required for additional process steps that are not normally carried out when processing the usual black and white prints.

In contrast to the foregoing, the method and apparatus of the present invention conserves photographic solutions; is simpler to use; and practically eliminates any hazard to the health of the personnel processing the film and prints.

The apparatus of the invention comprises an elongate cylindrical tube that has end walls wherein there are axially mounted tubular projections that communicate with the interior of the cylindrical tube. There is also provided an open fluid receptacle having in the end walls rolls that engage the cylindrical tubular projections and partially support the clindrical tube for rotation about its longitudinal axis in a horizontal attitude. Within the open fluid receptable there is mounted one or more elongate tubes wherein each there are apertures from which jets of water that is flowing in the tube emerge and impinge upon oppositely disposed sets of radial vanes mounted on the outer periphery of the cylindrical tube. The cylindrical tube is also partially buoyantly supported by water in the open receptacle and it freely rotates under the influence of the jets of water impinging on the vanes.

The method of the invention comprises placing a photographic medium, such as film or paper, in the cylindrical tube. If the photographic medium is film it is maintained in spaced relation from the inner wall of the tube by a spacing grid member. When paper is being processed, it is placed in the tube in such a manner that the emulsion side of the paper is not in contact with the inner wall of the tube. Then, in succession, various photographic solutions are introduced into the cylindrical tube. After each successive photographic solution is placed in the tube, it is placed in a horizontal attitude, and partially supported by the end walls of the open receptacle and partially buoyantly supported by the water in the open receptacle. The jets of water impinging on the radial vanes rotate the cylindrical tube so that the photographic solutions contact the photographic medium and process the same.

For a further understanding of the invention and for features and advantages thereof, reference may be made to the following description in conjunction with the accompanying drawing which shows, for the purpose of execplification, a preferred embodiment of the invention.

In the drawing:

FIGURE 1 is an elevational view, partly in section, of apparatus in accordance with the invention;

FIGURE 2 is a view of the left hand end of the apparatus of FIGURE 1;

FIGURE 3 is a sectional view along line III—III of FIGURE 1;

FIGURE 4 is an isometric view of a portion of the apparatus of FIGURE 1 with a portion thereof removed to more clearly show the structure;

FIGURE 5 is an isometric view of a portion of the apparatus of FIGURE 1; and

FIGURE 6 is a sectional view of a portion of the apparatus in accordance with another aspect of the invention.

Referring to FIGURE 1, the apparatus **11** of the invention comprises an elongate cylindrical container assembly **13** having a cylindrical tubular wall **15** and end walls **17** that may be of any suitable material, such as metal or, preferably, opaque plastic. Projecting outwardly from the end walls **17** are cylindrical tubular members **19, 21**, both of which may be fixed in the end walls **17*a*, 17*b*** in any suitable manner and communicate with the interior of the cylindrical container **13**. In a preferred embodiment of the invention, the end walls **17*a*, 17*b*** and the projections are adhesively secured in place.

The container assembly **13**, comprising the cylindrical tubular wall **15**, end walls **17*a*, 17*b***, and the projecting tubular members **19, 21**, is capable of holding and retaining liquids such as the fluids that are used in processing photographic films and papers. Further, the container assembly **13** is buoyant when placed in a liquid such as water. When necessary or desirable, the open ends of the projecting tubular members **19, 21** may be closed by means of resilient plugs **23**, or in any other suitable manner.

Surrounding the cylindrical tubular wall **15** and located adjacent each end wall **17*a*, 17*b*** there is a U-shaped channel **25** that is adhesively secured to the shell **15**, and a plurality of spaced apart vanes **27** mounted in the channel **25** extend radially outward from the surface of the shell **15**, as shown in FIGURES 3 and 5.

The apparatus **11** of the invention further includes an open fluid receptacle or tank **29** comprissing a hemi-cylindrical shell **31** fixed in a hemi-circular groove **33** in the end walls **35**. The hemi-cylindrical shell **31** and the end walls **35** also may be made of any suitable material such as metal; however, a suitable plastic material is preferred, in which case the shell **31** and end walls **35** may be adhesively secured together as a unit.

The end walls **35** are generally trapezoidal in shape

(FIGURE 2); the upper smaller parallel side having therein a hemi-circular cut-out 39, and there is a groove or channel 41 in the periphery of the hemi-circular upper portion, as shown in FIGURE 1. Mounted in the groove 41 are a plurality of rollers 43 that are fixed to shafts 45 journaled in the walls 47 of the groove 41 for a purpose that will be described hereinafter.

One end wall, which is the end wall 17*b* in FIGURE 1, is perforated in two locations to receive tubular conduits 49*a*, 49*b* that project into the interior of the fluid receptacle 29. The portion of the tubular conduits 49*a*, 49*b* within the receptacle 29 extends horizontally and terminates adjacent the left hand end wall 17*a*; the ends of the conduits 49*a*, 49*b* nearest the end wall 17*b* being sealed in any other appropriate manner.

The conduits 49*a*, 49*b* are each provided with apertures 51*a*, 51*b* (FIGURE 3) that are disposed in register with the vanes 27 at each end of the cylindrical tube 13. In the left hand conduit 49*a*, the apertures 51*a* are so disposed that water emerging therefrom as jets 52*a* are directed upwardly against the vanes 27, and the apertures 51*b* in the conduit 49*b* are disposed to direct similar jets of water 52*b* downwardly against the adjacent vanes 27. Each tubular conduit 49*a*, 49*b* is suitably supported in the horizontal attitude by one or more support brackets 53 (FIGURE 3).

The apparatus 11 of the invention is readily adapted to process photographic media such as film and either black and white or color paper prints in the following manner. However, for the purpose of this descrciption the embodiment of the invention illustrated in FIGURE 1 shows the apparatus in use for processing black and white paper prints, while FIGURE 6 shows how the apparatus is adapted to process film.

In preparation for processing paper prints, the fluid receptacle 29 is first filled with water 57 from a flexible hose 59 connected to both conduits 49*a*, 49*b*. The water 57 fills the receptacle 29 to a preselected level in which the container assembly 13 is partially buoyantly supported and at this level there is an overflow aperture 61. Thereafter, a sheet of exposed photographic paper is presoaked in water at a temperature of 100° F. for a period of about one minute. The pre-soaked sheet of paper is then rolled and inserted into the cylindrical tube 13 in such a manner that the emulsion side of the paper faces inward; that is the emulsion side of the paper faces away from the inner surface of the shell 15.

In a typical embodiment of the invention, the plastic tube 13 is about six inches in diameter, about twenty-two inches long, and the diameter of the projecting tubes 19, 21 are each about four inches. If desired, one end wall of the cylindrical tube 13 may be replaced by a conventional closure incorporating light trap of the type that are used in conventional film developing tanks; these closures are easily opened and closed; they prevent light from entering the tube 13; and they are large enough to accommodate a man's hand holding a rolled sheet of paper.

It should be apparent to those skilled in the art that the suggested dimensions for the apparatus, especially the cylindrical tube 13 given herein, are large enough to accommodate a standard 16" x 20" print. In such apparatus, purposely there will be, between the adjacent longitudinal edges, a gap extending lengthwise of the tube, and purposely there will also be gaps at both ends of the tube. Preferably, the gap betwen the edge of the sheet of paper and one end wall, the end wall 17*b* being typical, is larger than the other end gap for a reason that will be presently explained.

Before adding the developer to the tube, it is desirable and necessary that the water 57 in the open receptacle be at a temperature of 100° F., or an other preselected temperature. Then, if the water 57 in the open receptacle 29 is maintained at such selected constant temperature throughout the process, the temperature of the solutions in the container 13 will also be at the same temperature.

To add the developer, and other photographic solutions, the tube 13 is held in a nearly vertical position and the solutions poured thereinto through one of the projecting tubes 19, 21. The solution will partially fill the larger lower gap, but will not contact the paper. Thereafter, the tube 13, when placed in the horizontal attitude in the receptacle 29, is partially supported by the rollers 43 and partially buoyantly supported by the water 57. As soon as the container is supported in the receptacle 29, the jets of water from the apertures 51*a*, 51*b* impinge on the vanes 27, and the cylindrical tube 13 rotates. The developer solution then contacts the emulsion surface of the paper and processing commences.

After the prescribed developing time has expired, the developing solution, which may be assumed to be the first solution used in the process, may be poured out of the tube, and the other photographic fluids may be introduced successively therein; the tube supported in the receptacle 29 and rotated as before, until the processing is completed. The foregoing developing process may be accomplished in a dark room under the usual safelight conditions.

In some instances it may be desirable to load the tube in the photographic darkroom under a safelight or in darkness and then process the prints or film in daylight or incandescent light. In such cases, the resilient plugs 23 may be inserted into the open ends of the tubular projections after the tube is loaded to prevent harmful light from contacting and fogging the print or film.

Washing of the print may be readily accomplished by inserting a spray head or other apparatus into one of the tubular projections 19, 21 and the water spray will wash the print without removing it from the tube 13.

While the foregoing has described the method for processing a single photographic print, the apparatus 11 may be used also to process two or more prints simultaneously in the following manner. The first exposed sheet of photographic paper is introduced into the tube 13 in the manner described hereinbefore. Then, a flexible grid member 67 (FIGURES 1 and 4), preferably made of plastic, is inserted into the tube 13, wherein it assumes a position in contact with the emulsion surface of the first sheet of paper. In a preferred embodiment of the invention the grid 67 has rather small openings, but in some applications a grid having somewhat larger openings may be suitable. Thereafter, a second sheet of paper 69 is inserted into the tube 13 and is placed in contact with the grid members 67. Thus, the second sheet of paper 69 is maintained in spaced relation to the first sheet of paper 55. The second sheet 69 is, of course, also pre-soaked as was the first sheet of paper before it was placed within the tube 13 and the emulsion side of the second sheet of paper also faces inward.

The steps for processing the two sheets of paper 55, 69 are the same as the steps for processing the single sheet of paper 55 described hereinbefore.

The apparatus 11 may be used to process photographic film in a similar manner. However, in this instance the grid 67 is first inserted into the tube 13 (FIGURE 6), and then film 71 is placed in the tube so that it contacts the grid and is held in spaced apart relation from the wall 15 of the tube. Preferably, the emulsion side of the film 71 faces inward and is not in contact with the grid 67. Thereafter, the steps for processing the film may be carried out in the same manner as for processing the paper prints.

From the foregoing, several advantages and features are apparent. The apparatus of the invention is inexpensive, is easily set-up, cleaned, and requires a small amount of storage space when not in use. Further, only minimal quantities of photographic solutions are used during processing of both film and paper. Moreover, the apparatus eliminates the need for several sets of different sizes of trays that are now used to process small, intermediate and large size prints. Generally only two sizes of cylindrical

tubes and fluid receptacles are needed to process the largest and smallest size prints.

A feature of the invention is that large murals may be readily processed in the apparatus of the invention, using the grid 67 to prevent overlapping of the mural upon itself and to so maintain it that photographic solutions act on all of the emulsion surface.

A feature of the invention also is that the water in the fluid receptacle can be maintained at a constant temperature, and the several solutions used in the cylindrical tube will be also at the same temperature. A further feature of the apparatus is that black and white as well as color prints may be processed with the same facility, and there is a minimum health risk to the photo-technician during the processing operations, because the solutions may be sealed within the tube and the toxic fumes are not necessarily breathed by the technician.

A feature of the invention is that the cylindrical tube is rotated by jets of water from the same source that also buoyantly supports the tube in the fluid receptacle. Thus, the tube rotates constantly as long as solution is in contact with the film or paper and processing is more effective.

While the invention has been described herein with a certain degree of particularity, it is understood that changes and modifications may be made within the scope of the invention defined by the appended claims.

What is claimed is:

1. Apparatus for use in processing flexible photographic media having a light-sensitive coating on one surface comprising:

(a) a tubular container comprised of a cylindrical shell and spaced apart end walls;

(b) a tubular conduit fixed in each end wall and communicating with the interior of said tubular container, said tubular conduits being in axial alignment with the longitudinal axis of said container;

(c) an open container for holding a fluid having a shell and end walls wherein each there are mounted a plurality of rollers adapted to engage said tubular conduits and rotatably support said container in a horizontal attitude, there being an annular space between the shell of said container and the shell of said receptacle;

(d) a plurality of radial vanes mounted to and extending from the shell of said tubular container, said vanes lying in a plane generally perpendicular to the longitudinal axis of said tubular container;

(e) a tube mounted lengthwise to the inside surface of the shell of said open container and having therein an aperture located opposite said vanes; and

(f) conduit means mounted to said tube for flowing water therein, said water emerging from said aperture as a jet in an angular direction against said vanes whereby said cylindrical tube rotates about its longitudinal axis, said water also partially filling said open container and partially buoyantly supporting said tubular container.

2. The method of processing flexible photographic paper having an exposed light sensitive coating on one surface comprising the steps:

(a) inserting an exposed first sheet of paper into a cylindrical container so that said sheet of paper lies against the tubular wall thereof with the light sensitive surface away from said wall;

(b) placing spacing means in contact with the light sensitive coated surface of said sheet of paper;

(c) inserting an exposed second sheet of paper into said cylindrical tube against said spacing means so that the light sensitive surface of said second sheet of paper is not in contact with said spacing means;

(d) introducing photographic solution into said container for processing said paper;

(e) buoyantly supporting said container in water so that the same is rotatable about its horizontal longitudinal axis;

(f) rotating said container about said axis, said solution acting on said paper simultaneously;

(g) removing said solution from said tube; and thereafter,

(h) introducing into said container successive photographic solutions and rotating said container in said water until said paper is processed.

3. Apparatus for use in processing exposed photographic film comprising:

(a) a tubular first container comprised of a cylindrical shell and spaced apart end walls fixed thereto and having apertures therein;

(b) means for placing said exposed film in said container;

(c) means disposed between said film and the wall of said container for supporting and maintaining said film in spaced apart relation to said container wall;

(d) means for introducing a first photographic solution into said container;

(e) a second container for holding water wherein said first container is horizontally buoyantly supported and is rotatable about its horizontal axis while said photographic solution reacts on said film; and

(f) removing said first solution from said container and introducing thereinto successively other solutions and rotating said container about its horizontal axis until said film is processed.

4. The method for processing flexible photographic film having an exposed light sensitive coating on one surface comprising the steps:

(a) inserting spacing means against the inner wall of a tubular first container comprised of a cylindrical shell and spaced apart end walls;

(b) placing said exposed film in said container so that said film contacts said spacing means and the light sensitive coating is not contacting said spacing means;

(c) introducing a photographic solution into said container;

(d) horizontally buoyantly supporting said container in water;

(e) rotating said container about its horizontal axis while said photographic solution reacts on said film; and

(f) removing said photographic solution and successively introducing other photographic solutions into said container and thereafter rotating said container and successively removing said solutions until said film is processed.

5. The invention of claim 1 including:

(a) means to maintain in said open container a level of water wherein said container is buoyantly supported as the same rotates about its horizontal axis.

6. The invention of claim 2 including:

(a) maintaining said water at a prescribed temperature whereby successive solutions in said cylindrical container are maintained at substantially the temperature of said water.

7. Apparatus for use in processing exposed photographic media having light-sensitive surfaces comprising:

(a) a close-ended tubular container adapted to be rotated about a horizontal axis;

(b) tubular members projecting coaxially from said container;

(c) means for introducing into said container at least one exposed photographic medium in such a manner that the light sensitive surface thereof is not in contact with the inner surface of said container;

(d) a receptacle adapted to hold a fluid;

(e) means associated with said receptacle for engaging said tubular projecting members while said container is in a horizontal attitude;

(f) means for introducing said fluid into said receptacle whereby when said container projecting members engage said means on said receptacle said container is partially supported by said receptacle means

and partially supported by said fluid in a buoyant condition; and

(g) means to rotate said container when photographic solutions are in said container and said solutions engage and process said photographic medium.

8. The invention of claim 7 wherein:

(a) said engaging means on said receptacle are rollers that are journally mounted to said receptacle.

9. The invention of claim 8 wherein:

(a) said means to rotate said container includes vanes extending from the periphery of said container; and

(b) said means to introduce said fluid into said receptacle includes a tubular conduit wherein there are apertures from which said fluid exits and impinges upon said vanes whereby said container rotates about said horizontal axis.

10. The invention of claim 9 including:

(a) means disposable in said container adapted to maintain said photographic medium in spaced relation from the inner surface of said container.

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