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Edelman et al.

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[54] TREATING APPARATUS

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[58] Field of Search **95/94 R, 89 R; 118/423, 428; 68/181 R**

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[57]

ABSTRACT

An apparatus for treating or coating flexible sheet or film-like materials with a fluid. The material to be treated and the treating fluid move past an elongated and grooved plate member with the fluid between the material and the plate member. The grooves are closely spaced and extend in a direction normal to the path of the fluid.

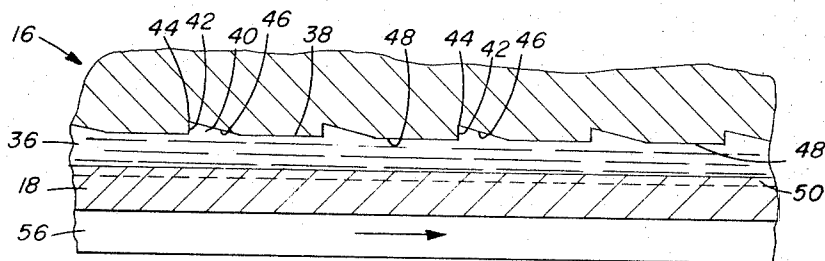
3 Claims, 3 Drawing Figures

[56]

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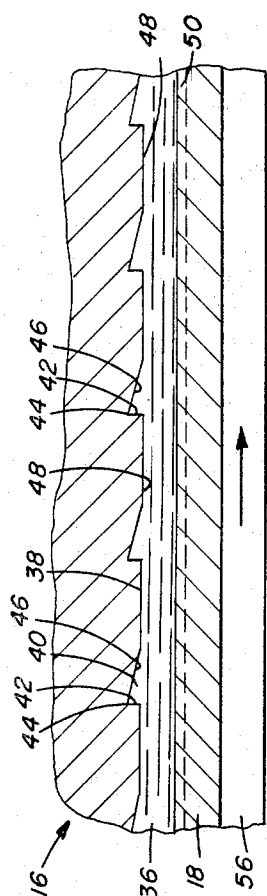


FIG. 3

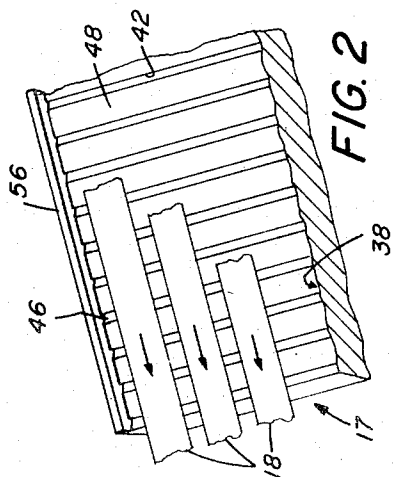


FIG. 2

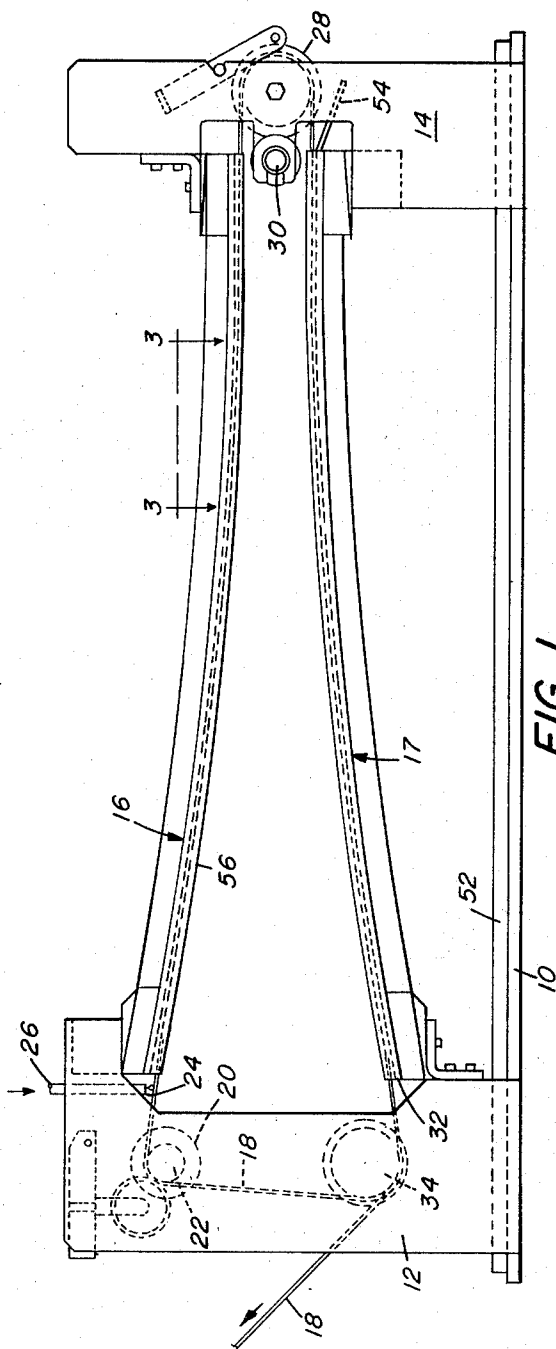


FIG. 1

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TREATING APPARATUS

This invention relates generally to apparatus for treating or coating flexible materials in sheet or film form and more particularly to a photographic film processor.

BACKGROUND OF THE INVENTION

In the treating or coating of flexible materials such as film or sheet, the material may be passed over a plate member with the treating or coating fluid between it and the plate member. As for example, in the processing of photographic film, the film may be passed over a rotating drum with the processing fluids being placed on the drum in contact with the film.

Difficulties have been experienced in the utilization of some rotating drum film processors. The moving film tends to force the fluid outwardly with the result that the film does not remain in contact with the processing fluid the required length of time for development or other processing. If too much fluid is allowed to escape, the film contacts the drum rather than the fluid and the film may be scratched or otherwise damaged.

SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide an improved apparatus for applying a treating or coating fluid to a moving web of sheet or film. A further object of this invention is to provide an apparatus for applying a treating or coating fluid to a moving film web wherein the fluid substantially remains in contact with the film. Another object of this invention is to provide an improved apparatus on which photographic film may be processed. An additional object of this invention is to provide a photographic film processor wherein the moving film carries and agitates the processing fluids. A further object of this invention is the provision of a film processing apparatus which is constructed to hold the fluid in contact with the film.

These and other objects and advantages of this invention are accomplished by passing the flexible sheet or film to be treated or coated over a plate member with the treating fluid or coating applied to the sheet or film to separate the sheet or film from the plate member and to be carried along by the sheet or film as it moves over the plate. The surface of the plate member is provided with a plurality of closely spaced grooves constructed and arranged to provide periodic abrupt decreases and gradual increases in pressure on the fluid as it moves along the plate member.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of a treating apparatus embodying this invention;

FIG. 2 is a partial perspective view to an enlarged scale of the plate member forming a part of the apparatus of FIG. 1 looking downwardly on the same; and

FIG. 3 is a partial cross-sectional view to an enlarged scale of the plate member, processing fluid and film taken in the general direction of line 3—3 of FIG. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The drawing illustrates the invention when incorporated into one section of a photographic film

processing machine. The usual film processing apparatus would include several of these sections with one section being supplied for each different processing fluid. The film would be passed from section to section in conventional manner until the processing was completed. The sections could be stacked upon each other or arranged side by side.

Referring now to the drawing, reference number 10 denotes a base for a photographic film processor, which base 10 supports a pair of front end plates 12 and a pair of rear end plates 14. The end plates 12 and 14 are located on opposite sides and ends of the base 10 and support therebetween a pair of shoes or plate members 16 and 17, the details of which will be described hereinafter.

The film 18 to be processed (developed) is fed from a storage reel (not shown) to the first of a series of in-feed spools 20. The in-feed spools 20 are mounted for free rotation on a shaft 22 extending between and carried by the front end plates 12. The film 18 passes under the outlet 24 of a fluid feeder 26 which feeder is connected to a supply of processing fluid (not shown). As the film passes under the feeder, it picks up fluid and carries it to the top shoe 16. The film 18 continues beyond the end of the shoe 16 to the first of a series of overdrive spools 28 which are driven by a drive roll 30 and then to the lower shoe 17.

The film and fluid are then passed over the surface of the lower shoe 17. As the film exits from the front end 32 of the lower shoe 17, it is passed partially around the first of a series of spools 34 and upwardly to the second of the series of in-feed spools 20. From this spool 20, the film proceeds to the second of the spools 34 and then to the third of the in-feed spools 20. This cycle is repeated several times depending upon the length of time that the film is to be in contact with the processing or treating fluid. As the film proceeds it will progress across the shoes 16 and 17 until it reaches the edge; the film may then proceed to another section or be removed from the unit.

In order to assist in maintaining the film or sheet material near the surfaces of the shoes 16 and 17 and to convey the fluid along such surfaces, each shoe 16 and 17 is bowed slightly to provide a convex cross-sectional configuration in the longitudinal direction. In the drawing, the shoe 16 is bowed toward the base 10 and the shoe 17 is bowed away from the base 10. The degree of convexity of the shoes 16 and 17 is relatively large in order that there will be only a slight curvature of the shoes.

In order to restrain lateral flow of fluid 36 off the edges of the film 18 as it passes longitudinally along the under surface 38 of the top shoe 16 and to promote transporting of the fluid 36, the surface 38 of the shoe 16 is provided with a multiplicity of shallow and closely spaced grooves 40. The grooves 40 extend across the surface 38 in a direction substantially normal to the longitudinal axis of the shoe, which axis is in the direction of travel of the film 18 and fluid 36. Each groove 40 is formed by an inwardly directed surface 42, which surface is substantially perpendicular to the surface 38 of the shoe, and which allows for an abrupt decrease in the pressure within the fluid 36 as the fluid flows over the shoe. The inward end 44 of the surface 42 merges with an outwardly inclined surface portion

46 which merges with a flat portion 48 which flat portions define the general plane of the surface 38 of the shoe 16. The outwardly inclined surface portion 46 allows for a gradual increase in pressure on the fluid as the fluid is conveyed over the groove 40. The pressure remains substantially constant as the fluid 36 and the film are moved over the flat portion 48 which pressure may be sufficient to force the fluid outwardly toward the film edges. As the fluid and film reach the next groove there is an abrupt decrease in pressure within the fluid, and as the fluid moves over the inclined surface 46, the pressure gradually increases. The abrupt decrease in pressure tends to pull the fluid 36 back in from the edges of the film. This cycle is repeated as the film 38 is moved along the shoe 16.

The film 18 is illustrated when an emulsion coating 50 in contact with the processing fluid 36 which may be a photographic developer. When the film 18 reaches the overdrive spool 28, it reverses its direction and some of the fluid 36 will fall off and onto the drip pan 52. To insure a sufficient supply of fluid, additional processing fluid 36 may be injected between each run of the film and the lower shoe 17 through pipes 54 under pressure from a source (not shown). The surface of the lower shoe 17 is substantially the same as that of the upper shoe 16, therefore, as the film passes over the surface of this shoe, the grooves pull the fluid back under the film. This fluid falls off the end of the shoe at the front end 32 and onto the drip pan 52 from which it may be discarded or reused but is prevented from running off the edges by side rails 56. As the film passes around the next in-feed roller 20 additional fluid may be supplied to that run through an appropriate aperture in the fluid feeder 26.

In processing film on this device, it may be necessary to maintain the processing fluid within a specified temperature range. In such event, the shoes 16 and 17 may be provided with heaters suitably controlled to maintain the required temperature.

After the film or sheet material has been processed, developed, coated or treated on these shoes 16 and 17 and possibly others, the fluids used may be discarded or reused. These shoes may be set up in sections wherein different processing fluids would contact the film to complete its development.

In the illustrated embodiment, the depth of the grooves 40 is 0.005 inch and the grooves are 0.03 inch long. The spacing between each groove is 0.100 inch. Other groove configurations may be utilized with acceptable results. For example, the inward directed surface 42 may be inclined at any angle of less than about 45° to the vertical to provide a somewhat abrupt decrease in pressure on the fluid as it passes along the surface of the shoe. The outwardly inclined surface 46 may be rounded somewhat to provide a different degree of pressure increase and be at a different angle

to the general plane of the shoe. In addition, the grooves may be in the nature of saw teeth with the flat portions 48 eliminated. Various combinations may be used so long as the inwardly directed surface is at a greater angle to the horizontal than the outwardly inclined surface.

This invention has been described with reference to the processing of photographic film, it should be understood that the shoes of this invention may be used equally well in applying any fluid to a moving flexible sheet or film either for treating, coating or processing purposes.

The invention has been described in detail with particular reference to preferred embodiments thereof but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. Apparatus for treating or coating flexible materials with fluids comprising, a plate member having a surface adapted to be contacted by said fluid, means for moving said material in one direction past said surface, means for supplying said fluid to said surface at one end thereof, whereby said fluid is in contact with said surface and said material, said fluid being at least partially moved along said surface by said material, said surface being provided with a plurality of grooves extending normal to said one direction, said grooves being separated by substantially flat surface portions, each of said grooves being formed by an inwardly directed surface portion at substantially a right angle to the adjacent flat surface portion at the upstream side of said groove, and an outwardly inclined surface portion merging at one end with said directed portion and at its other end with the adjacent flat surface portion at the downstream side thereof.

2. An apparatus for treating or coating flexible materials according to claim 1 wherein said surface in longitudinal cross section is slightly convex.

3. Apparatus for treating or coating flexible sheet or film materials with fluid substances comprising, an elongated shoe having a surface convex in cross section, means for supplying fluid to said surface at one end thereof, means for moving said material over said surface and in contact with said fluid, said fluid being at least partially moved along said surface by said material, said shoe being provided with a plurality of closely spaced transverse grooves, a substantially flat surface portion separating each pair of adjacent grooves, each of said grooves having an inwardly directed portion at substantially a right angle to the adjacent flat surface portion at the upstream side of said groove and an outwardly inclined portion merging at one end with said inwardly directed portion and at its other end with the adjacent flat surface portion at the downstream side thereof.

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