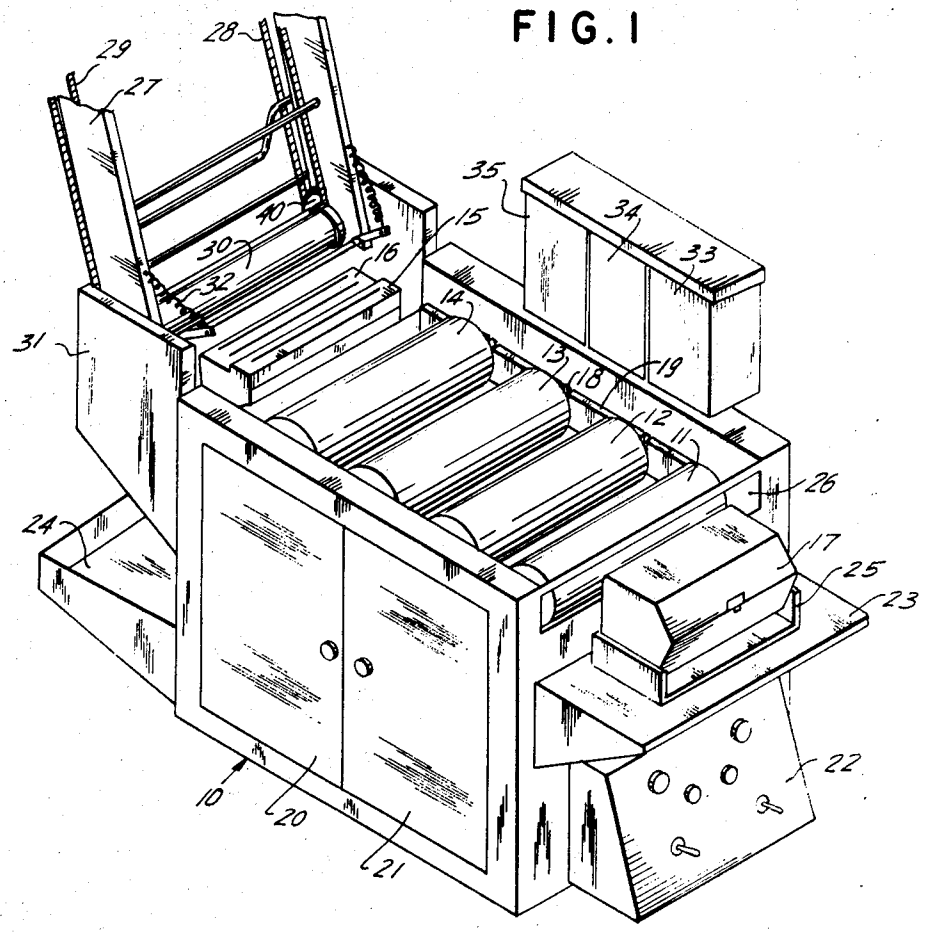
Oct. 14, 1969 O. FISHER 3,472,144

FILM PROCESSING APPARATUS

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FIG. 1



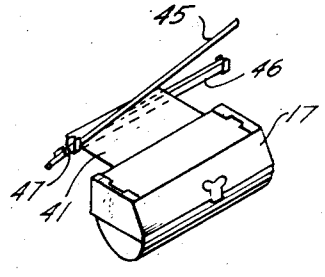


FIG. 3

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FIG. 2

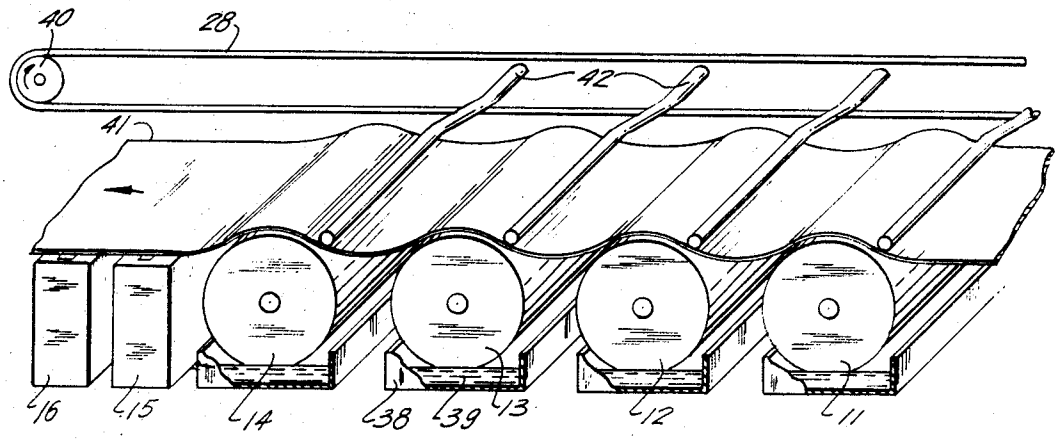
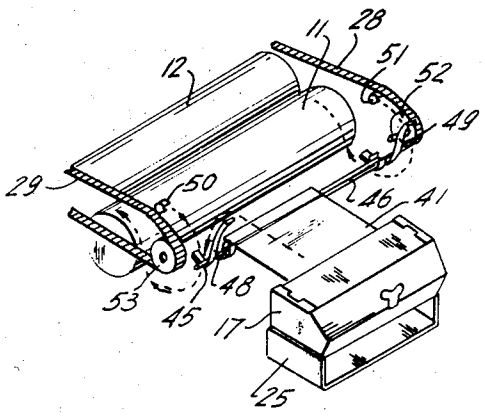


FIG. 4



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FILM PROCESSING APPARATUS

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U.S. Cl. 95—94 3 Claims

ABSTRACT OF THE DISCLOSURE

Automatic film processing apparatus having a film transport device, a cassette, an applicator and a dryer. The film transport device having a carriage and two drive chains transport the film across the apparatus. The applicator consists of a series of rotating drums disposed above trays containing processing fluid. The film to be processed is positioned within the cassette at one end of the apparatus. The dryer is comprised of a vacuum head to remove moisture from the processed film and a hot air head for drying the film. A retaining member rides on back of the film to insure that the film end does not push away from the drums. A clamping member is employed to secure the film edge transverse its direction of movement. Pick-up hooks provided on each of the film transport chains engage the clamping member and transport it with the film across the top of the drums.

This invention relates to film processing apparatus; more particularly, it relates to apparatus for the improved rapid processing of films that are coated with high speed emulsions.

Within the photographic art, the use of high speed film is becoming increasingly prevalent. The modern photosensitive materials used in order to obtain these high speeds are of necessity composed of layers of photosensitive emulsions. As known, these layers are built up upon backing material. After exposure, it becomes necessary to develop the film by the application of appropriate processing fluids to the photosensitive emulsions. Because of the thicker emulsion layers on high speed films, it is particularly important that the coated surfaces of the film are not unduly abraded during the processing.

The conventional manner of developing exposed film, whether in strip or sheet form, makes use of dip tanks or shallow baths containing the various processing fluids. The use of these shallow baths gives rise to a number of problems. Unless special, and sometimes complicated, equipment is employed, there is an uneven application of the processing liquid to the film. If the fluid is not applied in a uniform manner the resulting picture will be deficient in quality. Where a number of such tanks are used, as is commonly the case, they are employed by successively dipping the film in each tank. This gives rise to contamination and makes it necessary to change the fluid within the tanks at periodic intervals.

Another problem arising from the use of such dip tanks is the fact that the entire film is submerged in the tanks during the processing stages. This increases the subsequent drying time and in addition structurally weakens the film so that when strip film is being processed there is increased danger of breakage, and consequently a need for slower and more careful handling of the film. Still further, the necessary physical handling of the film often results in physical contact with the emulsion surface. Such physical contact causes scratches and streaks and greatly impairs the quality of the finished product. It is obviously critical that the film be a perfect reproduction of the image at this point, because in many cases it will be used for further preparation of visible images.

Many of the imperfections in the final product produced by presently available apparatus are a direct result of the physical handling of the film itself. Thus, it is physical contact with the emulsion layer that produces scratches and streaks. It is an object of the present invention to provide processing apparatus which applies the necessary processing fluids to the emulsion layer on a film without the possibility of making physical contact between the film and the apparatus.

Another object of the invention is to provide a processing apparatus wherein the film is kept as dry as possible throughout the entire process.

Yet another object of the invention is to provide processing apparatus capable of operation at relatively high speeds which effectively distributes the processing fluids uniformly across the entire emulsion surface of the film.

Yet another object of the invention is to provide processing apparatus particularly useful for the handling of films, whether the film be in strip or sheet form.

In brief, the invention relates to apparatus for processing photosensitive materials comprising at least one drum rotatable about a horizontal axis. Means are provided for passing the surface of the drum through a required liquid processing medium in order to form a substantially uniform coating upon the surface thereof. The film is then fed into contact with the coated drum surface and the processing fluid thereon is distributed uniformly across the emulsion layer only of the film.

The illustrative embodiment described hereinafter, comprises a plurality of rotatable drums arranged along a series of parallel horizontal axes. The processing fluid is located in receptacles located beneath each drum and in contact with the bottom of the drum. During operation, the drums are rotated at high speed and the fluid within each receptacle is caused to form a uniform coating upon the drum surface. The film is then transported across the top of the successive drums in contact with the processing fluid, but suspended from the drum surface itself by the interposed layer of fluid. Thus, the film at no time touches the drum surface.

Among the unique features of the invention, are means for transporting the film across the drums in order to successively bring it into contact with the required processing fluids. It is also possible to effect rotation of the drums in different directions. In this way, a more uniform deposition of processing fluid can be attained and the independence of the film transport mechanism from the drums is more clearly appreciated.

All of the above objects and features, as well as others, will become apparent to those skilled in the art from the following detailed description of an illustrative embodiment of the invention. The description is made in conjunction with the accompanying drawing wherein:

FIGURE 1 is a perspective illustration of apparatus in accordance with the invention;

FIGURE 2 is a schematic drawing illustrating the features of the present invention;

FIGURE 3 is an illustration of a film cassette and clamping bar arrangement that may be employed in conjunction with the described embodiment of the invention; and

FIGURE 4 is an illustration showing the manner in which the apparatus of this invention picks up film and

leads it across the first of a plurality of processing stages.

The apparatus **10** in FIGURE 1 embodies both the basic principles of the invention and a number of more sophisticated improvements that may be incorporated. This apparatus may be of a size suitable for mounting upon a table. It includes a plurality of drums **11**, **12**, **13**, and **14** serially arranged on horizontally disposed axes. The drums are mounted for rotation and can be driven by any convenient means. For example, each drum may be fitted with a gear on one end which meshes with a driving gear chain. On the other hand, belt and pulley arrangements or a chain drive can be used. Access to the drive mechanism and/or the fluid containing trays to be discussed hereinafter, is made convenient via doors **20** and **21**. The film to be processed is positioned on the right end of the apparatus within a light-tight cassette **17**. This cassette may be mounted upon a stand **25** in order to provide the necessary height. During processing, the film is extracted from the cassette and transported across each of the rolls from right to left. Having completed the processing, the film is passed over a vacuum head **15** in order to remove excess moisture and then a hot air head **16** for drying.

In FIGURE 1 the film transport means has been pivoted back in order to fully expose the rotating drums. The carriage **27** is shown projecting in an upward direction from the lefthand portion of the figure. Two chain drives **28**, **29** are mounted upon carriage **27** and are driven continuously in order to transport the film across the apparatus. In operation, carriage **27** is pivoted within support member **31** and assumes a horizontal position across the top of the equipment. It is held in place by means of springs **32**.

In order to appreciate the invention more clearly, attention is directed to the schematic diagram of FIGURE 2. In this diagram, the four drums **11**, **12**, **13**, and **14** are depicted from right to left. The vacuum head **15** and hot air head **16** are also shown. Disposed below each drum is a tray **38**. The trays are shown with one end broken away in order to disclose the processing fluid **39** disposed therein.

The drums **11-14** all rotate with sufficient speed to draw up the fluid with the associated trays and form a uniform coating on the surface thereof. The direction of rotation may vary from drum to drum; it being noted that the drum rotation does not directly determine advancement of the film. In addition, the action of the drum continually rotating within the fluid of the tray, effects a continual agitation thereof. The film **41** is guided across the top of the film from right to left; the film transport means being described hereinafter. Due to the high speed rotation of the drums and the subsequent fluid coating thereon, the film at no time touches the surface of the drum. On the other hand, the uniform coating of processing fluid comes in contact with only the emulsion side of the film and leaves the other side completely dry.

Retaining members **42** ride upon the back of the film and properly position it with respect to the drum surfaces. These members hold the film down by the gravitational force of their own weight. Due to the complete independence of each tray of processing fluid, and the fact that the film at no time is submerged within a processing tank, there is a minimum of contamination between the chemicals within the successive tanks. Of course, it will be appreciated that the chemical content of each tray depends upon the processing required. As a typical example, the first tray associated with drum **11** may contain developer; the second tray associated with drum **12** may contain short-stop; the third tray associated with drum **13** may contain fixer; and the fourth tray associated with drum **14** may contain water for washing. As the fluids are gradually used up, means are provided for their replenishment. Thus, tanks **33**, **34**, and **35** which are illustrated in FIGURE 1, may contain the necessary fluids for increasing the material in the trays associated therewith. Simple valve means may be provided for either manually or automatically controlling fluid lever within each tray. In addition, drain valves are provided for removing the fluids as required.

In connection with the removal of the trays or the drums themselves, this may be very easily accomplished in apparatus of the nature shown in FIGURE 1. Thus, each drum is mounted upon an axis **18** which at one end may simply be seated within semi-circular bushings on a carrying bar **19**. In order to remove the drums, it is merely necessary to lift them upward and away from whatever driving means is employed on the opposite end. Once the drums have been removed, the trays are directly accessible from the top.

Attention should now be given to the means for transporting the film across the top of the equipment. FIGURES 3 and 4 show the manner in which the film emerging from typical cassette **17**, may be secured and picked up for transportation across the developing stages.

As shown in FIGURE 3, the lead portion of film **41** extends slightly from the light-tight cassette **17**. A clamping member comprising clamp bar **45** and lower channel **46** is employed to secure the film edge. This is accomplished by rotating clamp bar **45** in a counterclockwise direction about pivot **47**, placing the leading edge of the film **41** between clamp bar **45** and channel member **46**, and subsequently depressing bar **45** in order to press the film into the channel. Bar **45** is then locked in position and the film is secure.

The manner in which the film is picked up and transported across the various processing drums, can most clearly be seen from the partial schematic in FIGURE 4. As shown in this figure, the clamp bar **45** with the secured film is seated within retaining brackets **48**, **49** which are secured to the apparatus itself. The continuously moving chains **28**, **29** come in close proximity to the position at which the clamp bar is mounted. Pick-up hooks **50** and **51** are provided on the inside edge of each film transport chain. As the chain rotates in a clockwise direction about gears **52**, **53**, the pick-up hooks engage clamp bar **45** and in so doing force flexible retaining members **48** and **49** in a downward direction. The continued travel of the pick-up hooks with the chain is illustrated by the broken arrow in FIGURE 4. Thus, it will be seen that the clamp bar with the attached film is carried around and underneath gears **52**, **53** and along across the top of drums **11**, **12**, etc. When the end of the film emerges from the cassette, a switch is automatically triggered (not shown) and when this end has been fully processed, the equipment can be automatically turned off. The film retaining members **42**, illustrated in FIGURE 2, insure that the end of the film does not push up away from the drums as it is finally carried across.

The embodiment of the invention that has been described hereinabove, may of course be modified by those skilled in the art.

What I claim is:

1. Apparatus for processing a film containing photosensitive materials, comprising a plurality of drums arranged adjacent to one another and rotatable about parallel horizontal axes, means for applying processing fluid to the surface of said drums, a continuously moving loop disposed above said drums, means for clamping the film transverse its direction of movement, and means on said loop adapted to engage said clamping means and transport it with the film following across the top of said drums.

2. Apparatus according to claim **1**, wherein said clamping means comprise a channel member and a pivotally attached member adapted to fit within said channel member, the film being engaged between said members.

3. Apparatus according to claim **2** wherein said clamping means is wider than the film and said moving loop comprises two separate units each having a portion dis-

posed along the line of desired film movement, said separate units each having elements adapted to engage the ends of said clamping means.

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U.S. Cl. X.R.

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