Oct. 22, 1957 P. O. DIGNAN 2,810,332

FILM PROCESSING APPARATUS

Filed June 2, 1955 2 Sheets-Sheet 1

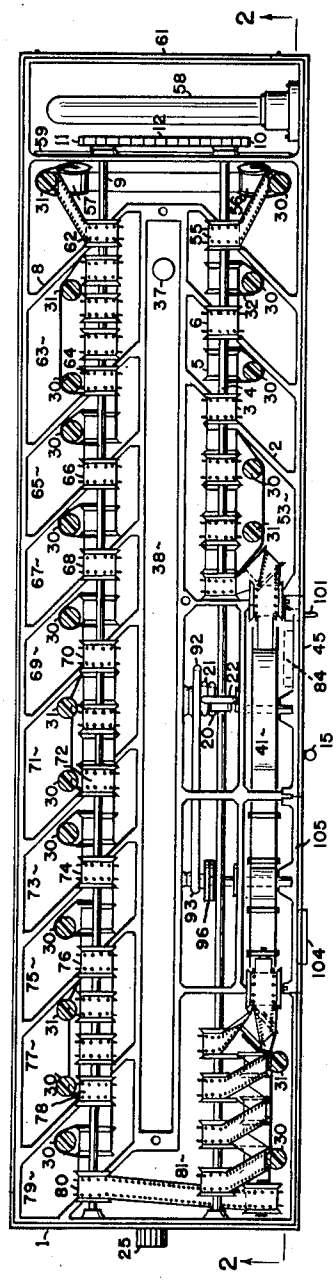


FIG. 1.

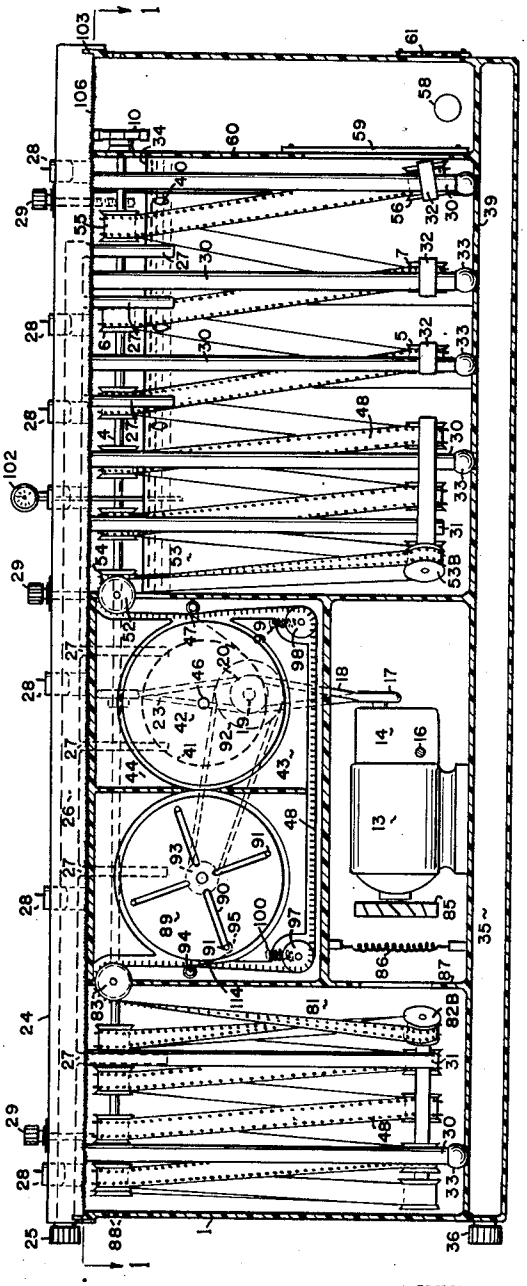


FIG. 2.

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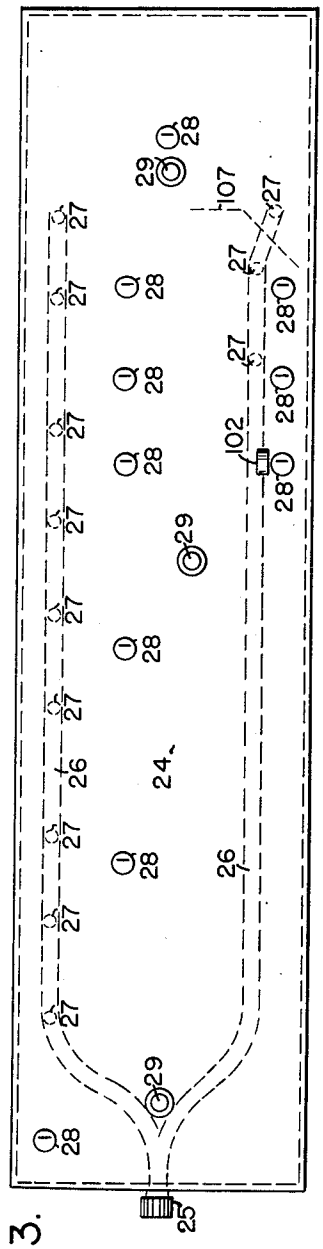


FIG. 3.

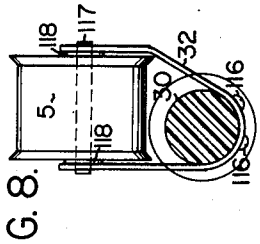


FIG. 8.

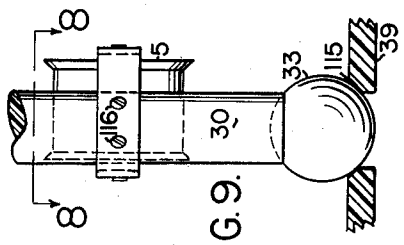


FIG. 9.

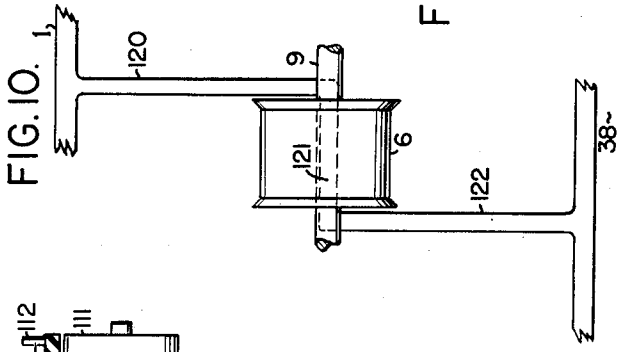


FIG. 10.

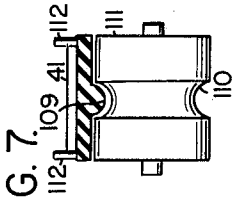


FIG. 7.

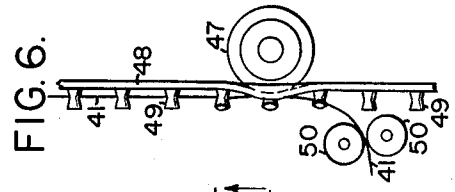


FIG. 6.

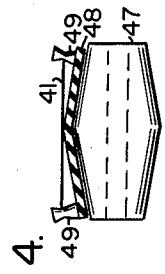


FIG. 4.

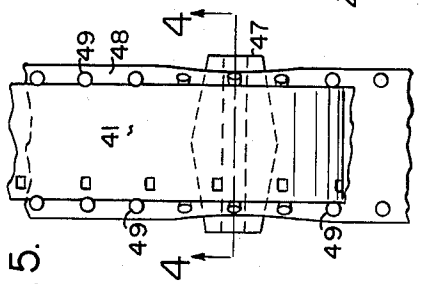


FIG. 5.

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FILM PROCESSING APPARATUS

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Application June 2, 1955, Serial No. 512,697

10 Claims. (Cl. 95—94)

My invention relates to apparatus for processing film in strip form, and particularly to multiple processing of motion picture film in apparatus of small size.

Color cinematography has become commonplace as compared to a decade ago when it first became a commercial reality. Processing may now be carried on independently rather than exclusively at the laboratory of the film manufacturer. However, apparatus for this art has been characteristically of large size, occupying considerable space in a room and often much space in several rooms. Such installations are unsuited for processing in temporary quarters, in vehicles, for occasional use in television stations, at isolated theatrical locations, or in the home or office.

On the other hand, automatic apparatus operating on the continuous principle is required rather than single step devices with which a great amount of in-process manipulation is necessary. Particularly is this true when it is desired to develop film in transit in an airplane or other vehicle in order to save time in television newsreel work. Furthermore, the apparatus must be relatively simple and foolproof in operation and be relatively inexpensive to manufacture.

Consequently, an object of my invention is to provide a multiple processing apparatus for strip film of small size.

Another object is to provide an apparatus which is easily operated and which may be maintained by relatively unskilled personnel.

Another object is to eliminate the need for film leader for threading the apparatus.

Another object is to reduce the size and complexity of the film transport mechanism of processing apparatus by establishing a novel relation between that mechanism and the configuration of the several tanks through which the film is carried.

Another object is to provide a simple film transport mechanism.

Another object is to provide an apparatus capable of processing all types of color as well as black and white film.

Another object is to arrange a novel means for draining the apparatus of liquids.

Another object is to establish a high degree of correlation and/or coaction between related elements of the apparatus in order to achieve simplicity and small size.

Other objects of the invention will become apparent upon reading the following detailed specification and upon examining the related drawings, in which:

Fig. 1 shows a plan view of a typical embodiment of my apparatus,

Fig. 2 shows a side elevation of the same, mostly in section to reveal the inner structure,

Fig. 3 shows a plan view of the lid of the apparatus,

Fig. 4 shows an enlarged detail of my spined belt and an angle roller for opening the same in end elevation and partly in section,

Fig. 5 shows the same in front elevation,

Fig. 6 shows the same in side elevation,

Fig. 7 shows an alternate tape and roller construction,

Fig. 8 shows a plan view of means for automatically emptying the apparatus of fluids in combination with a roller support,

Fig. 9 shows the same, in elevation, and

Fig. 10 shows an alternate partition structure in relation to the film rollers.

Proceeding with a simplified explanation of my invention, it will be noted in Fig. 1 that the individual serially disposed tanks required in considerable number for processing color motion picture film are formed in a two-group rectangular tank by liquid-tight partitions, preferably oblique to the sides of the rectangle. Coacting therewith by way of film transport are single driven rollers associated with each partition. Because of the obliquity, the rollers can and are aligned on a single drive shaft for each group of tanks, resulting in an important saving of space and a very simple film drive arrangement.

The top or lid to the several tank compartments is a single piece and accomplishes two related functions in use. It is provided with a number of ducts to convey processing liquids, usually wash water, to most of the compartments and also with downward rigid extensions having resilient plugs coacting with holes in the bottom of the tank structure so that removal of the top automatically empties the processor of fluids.

In all compartments used for rinsing the water is maintained at a uniform level because the discharge therefrom it to a common narrow tank lying between the groups of compartments and a single overflow outlet in the common tank. Because of the central position of this narrow tank all baths tend toward a uniform temperature.

In order that the apparatus may be used for various kinds of color film and for black and white processing, both negative and positive or reversal, wash water ducts and overflow holes to the narrow tank are provided to all compartments, save those used for developing, drying and similar universally employed functions. Ducts and holes not required are stopped by snap-expanding stoppers.

The film to be processed is carried through the apparatus in the grip of a spined flexible belt, the spines of which hold the film at the edges. In entering the apparatus the unprocessed reel is merely placed therein and the film started into the belt at a roller having a larger center than edge diameter. This roller distorts the belt so that the spines are farther apart than normal. Upon the film and belt leaving the initial roller the film is firmly grasped by the spines of the belt throughout the whole path through the apparatus until a terminal roller is reached. This is similar to the initial roller and accomplishes disengagement of the film from the belt. A hook on the front end of the film coacts with a quasi-centrifugal pin reel to accomplish automatic reeling of the fully processed film.

A typical use for this apparatus is for processing 16 mm. color motion picture film, but is will be appreciated that by prividing appropriate solutions either 16 mm. black and white reversal film or negative or positive film may be processed. Eight millimeter film is, of course, in the form of two rows of exposures along a 16 mm. width as it comes from the camera and is split down the center after processing. For 35 mm. film an embodiment about twice the size of that for the 8 and 16 mm. film is employed.

Although my apparatus is relatively light in weight of itself, it is not easily lifted when filled with processing solutions and wash water. It is for this reason that I employ resilient plugs attached to extensions from the top of the apparatus. When the top is merely unfastened (or removed), all liquids drain out through the wash water discharge.

Fig. 1 shows the apparatus in plan with the top removed. Numeral 1 indicates the main tank structure, preferably formed of a strong plastic, such as acrylic polyester or Epon 828 resins. These casting type plastics should be reinforced with Fiberglas cloth or milled stock for added strength. The structure can be cast or made from laminated sheets of the plastic, or in a compression type moulding machine using Bakelite. For plastics, a metal, plastic or plaster of Paris mould can be used. Plastic may be used for a mould because when previously cast the material can withstand a higher temperature than required for the casting; i. e., 220° F. whereas only 110° F. is required in the moulding process.

Since most of the individual tanks in the structure contain film from which light should be excluded it is preferable that the plastic should be opaque. Suitable pigment, preferably black, may be added to the raw plastic, or a transparent or translucent structure may be painted black with a paint, such as a lacquer, which bonds securely to the plastic. Of course, the tank structure may be fabricated of stainless steel, Monel metal, glass or other chemically inert material.

The distinguishing characteristic of my tank is the number of partitions disposed obliquely to the sides of the structure, such as partition 2, the first one encountered in tracing the film path through the several solutions. By so orienting the partitions I am able to transfer the film from one processing tank to the next with only one roller, 3, and that roller aligned with all other drive rollers along a single drive shaft 4. The film path is formed between drive rollers such as 3 and 6 and intervening free rollers at the bottom of the tank compartments, such as rollers 5 and 7. See both Figs. 1 and 2. A second series of partitions, identified by the first one, 8, is required because of the multiple processing needed for most film and particularly for color motion picture film. Thus, a second drive shaft 9 is provided and is driven from the first one by a pair of sprockets 10 and 11 with a link chain or link belt 12. A positive drive is necessary in order that some degree of tension be maintained on the drive path.

The prime mover for the film drive is motor 13. This is of the usual relatively constant speed type, either an induction motor for 115 volt single phase alternating current or a shunt motor for 6, 12, 26 or 32 volt direct current operation depending upon what type automobile, airplane or farm lighting system the apparatus is expected to be used with. A single D. C. motor having winding connections for 12 or 24 volts, nominal, is preferred for direct current operation. For a six volt automobile an additional battery is provided in series while for voltages in excess of 24 any increase in speed may be compensated for by adjustment of speed control lever 15 which effects a change of gear ratio in box 14 through shaft 16.

Slow speed pulley 17 on the motor gear box revolves at approximately eight revolutions per minute for color processing. For high speed black and white processing this speed may be as high as 24 revolutions per minute. Power is taken from pulley 17 by belt 18, or by an equivalent chain, link belt, etc. to an intermediate shaft 19 by pulley 20. Power is further conveyed from pulley 21 on shaft 19 to pulley 22 on drive shaft 4 via belt 23. Both drive shafts 4 and 9 revolve counterclockwise when viewed from the right hand end of Figs. 1 and 2, looking toward the left.

Top 24 functions to exclude light from the processing tank compartments and also to distribute wash water to several of the compartments. See Figs. 2 and 3. A female hose coupling 25 is provided in the top for fastening a plastic garden hose or equivalent thereto and to a suitable faucet for providing wash water. The top is cast of plastic, either solid or hollow in such a manner that interior passages 26 are formed above the several compartments. In order that the wash water shall not splash into adjacent baths short lengths of plastic pipe, 27, are provided. The top is further provided with holes to all compartments requiring solutions or the introduction of chemicals. Light-tight snap-expanding stoppers, 28, such as those known as Snap-Tite, are provided for each hole.

Thumb screws 29 attach top 24 to the main tank structure 1; being screwed into threaded inserts in the latter.

Attention is now directed to the several extensions 30 extending from the top downwardly into each compartment. These serve the dual purpose of supporting the lower rollers, such as 5 and 7, Fig. 2, by means of brackets 32 and to position the bottom pliant closures 33 for the corresponding holes in the bottoms of the compartments. It will be seen that when the top is securely in place each compartment is liquid and light tight. Conversely, when the thumb screws 29 of the top are loosened and the top is allowed to be elevated slightly above its attached position the closures 33 will no longer make a liquid-tight seal with the corresponding orifices. This allows the solutions in the several compartments, indicated as at the same level 34, to pass out to the common drain tank 35. This tank extends under the whole tank structure and has hose coupling 36 for attaching a hose to dispose of the solutions into a sink or elsewhere after these have been exhausted by the processing. Where supports for rollers are required but closures are not the extensions are modified to terminate above the bottom of the compartments as shown at 31.

During operation the drain tank 35 serves as the exit channel for the wash water. This is accomplished through overflow tube 37, located in the common wash water tank 38. Tube 37 is fastened to the bottom 39 of the main structure, having a height equal to the level 34 of the liquid shown and an exit orifice into tank 35. Each compartment utilized for washing has one or more holes, such as 40 shown, which communicate to the elongated wash tank 38. The wash water flow from the intake 25 to the discharge 36 has thus been traced. Because of the general circulation of wash water through my apparatus the temperature of the several baths can be largely determined by the temperature of the wash water. This can be conveniently adjusted by connecting the input hose, connected at coupling 25, to a dual faucet which is supplied with both hot and cold water. By simply adjusting the ratio of hot to cold water the temperature can be adjusted.

The general operation of my apparatus will now be described for processing exposed color negative film to obtain one color positive therefrom, such as for Ansco color film.

The undeveloped color negative film, say 16 mm. motion picture film, is shown at 41 on reel 42 upon which it was transported from the camera. It is shown in a light-tight compartment having light-baffles 43 and 44. A cover 45 (Fig. 1) with grooved ledge edge is provided on the side of the main structure to allow the film to be inserted. As inserted in the usual 16 mm. camera the first several turns are completely exposed in handling. Placing the reel in the processor does not expose any more film than was exposed when it was removed from the camera, thus the apparatus is of the daylight loading type.

The reel containing the film to be processed is placed on free-turning shaft 46 and the end of the film is provided with a small hook having its concave surface downward as the film approaches the initial roller 47. The hook is for automatic windup as will be explained later. The apparatus is shown in Figs. 1 and 2 as filled with film being processed, hence the reduced diameter of the roll of film 41 with respect to the diameter of reel 42. A spined continuous belt 48 passes through the whole apparatus and conveys the film. In this way the usual long leader is not required and the apparatus is

self-threading. Wear and scratching on the film is likewise eliminated.

By referring to Figs. 4, 5 and 6 the manner in which the film **41** is engaged by the belt **48** is shown in detail. Roller **47** has a greater diameter at the center than at both edges. Belt **48** is flexible, being formed of rubber, synthetic rubber, plastisol vinyl or other flexible plastic inert to film processing solutions and relatively transparent or translucent. A continuous series of spines **49** are formed integral with the belt near each edge. The space between the two series is such that the 16 mm. film is tightly gripped therebetween when the belt is running flat, as at the top of Figs. 5 and 6. As will be seen in Fig. 4 and at the center of Figs. 5 and 6 the spines tilt away from the center of the belt when the latter runs over initial roller **47**. This allows film brought into close proximity to the belt to enter between the series of spines and after passing the roller to have the spines grip the film. It is to be noted that when the film is introduced at the initial roller (Fig. 4) it inherently settles part way up the spines because of the distention of the center portion of the belt. Also, I prefer to reduce the cross-sectional dimension of each spine at the middle, as also detailed in Fig. 4 and in Fig. 6. This gives a desirable spacing of the film from the belt, insuring that solutions and re-exposure light shall reach both sides of the film. Additional rollers **50**, **50**, Fig. 6, may be employed to insure a constant attitude of the film entering the belt, as may a short piece of cellophane adhesive tape be used to guarantee attachment of the front end of the film to the belt.

The film and belt having been joined, both pass over roller **52** and into the first processing bath. This is contained in compartment **53** and is the first developer. This step requires the longest time and so is carried out by means of several loops of film up and down in the compartment. The direction of the film and belt must be altered 90° from the direction given by free roller **52**. Thus, bottom roller **53B** is on essentially a 45° angle. From this roller the film and belt pass up to the first driven roller **54**. The threading is such in the apparatus that all rollers over which film is carried bear against the under side of the belt. This positions the spines radially outward from the rollers.

The belt and film leave the first bath by roller **3**. This roller is above partition **2** and is positioned so that it is diagonally bisected by the partition as viewed in plan in Fig. 1. The belt thus leaves one bath and enters the next by having passed over only one roller, and that roller aligned with the general direction from one tank to the next rather than transverse thereto as has the prior art.

The next bath is a stop bath in which only a brief immersion is required, hence there is only one bottom roller and a single down and up path for the belt and film. It is possible to place roller **5** further up the extension **30** to decrease the length of film in this compartment should it be desired to reduce the amount of film in the machine as a whole. Also, should less processing be desired the liquid level in the compartment may be reduced by simply providing less solution initially.

Roller **6** conveys the belt and film to the next bath, a hardener, in which one down and up pass provides sufficient time.

The end compartment accomplishes the first wash and re-exposure. Top roller **55** introduces the film to this across-beam compartment in which it is conveyed across near the bottom by rollers **56** and **57**. These are disposed at an angle to enhance the effort of re-exposure lamp **58** on the film. The light passes through transparent window **59**, preferably heat absorbing, which is cemented or otherwise affixed liquid-tight over a hole in partition **60**. Piece **61** at the end of the main structure is removably fastened for replacement of the lamp. Suitable ventilation holes are provided therein and above in the main structure. These serve to indicate when the apparatus is turned on. Both the end compartment and the lamp compartment are painted with a silver paint or equivalent in order that the light be reflected from all sides to the film. A light baffle **107**, attached to the top as shown in Fig. 3, telescopes with the adjacent partition in the tank structure to prevent re-exposure light from fogging the film in the fixer bath. As will be noted from the drawings, the compartment is filled with wash water. This accomplishes a washing while the second exposure takes place.

The belt and film start down the rear line of compartments by passing over roller **62** and into the color developer compartment **63**. Here several upper and lower rollers cause considerable time to be spent in the color developer, after which the film passes over roller **64** and into a stop bath in compartment **65**. After a single down and up pass therein the next bath is a hardener, in compartment **67**, into which ingress is provided over roller **66**. Similarly, over roller **68** the film is introduced to compartment **69**, where it is washed. From there, over roller **70**, it passes to a bleach in compartment **71**, where two lower rollers and three upper rollers provide a longer stay than in the several prior baths.

Over roller **72** the film enters compartment **73**, another wash. The color image is fixed in compartment **75** after passing over roller **74**. Via roller **76** an extended wash is provided in compartment **77** by traverse over three bottom and four top rollers. From there an alcohol or other quick drying bath is provided via roller **78** in compartment **79**, which is the last of the liquid-containing compartments.

The film and belt enter the drying compartment **81** over roller **80**, in which the path crosses over to the forward row of compartment and a considerable drying time is obtained by utilizing ten rollers. As initially, the next to last roller **82B** is oriented at an angle of 45° to the side of the main structure in order that the final film transporting roller **83**, having a transverse rather than longitudinal axis, may be properly fed.

The drying process is hastened by a flow of warm dry air. Outside air is taken into the compartment of drive motor **13** through an air filter **84** shown dotted in Fig. 1. It is urged to the drying compartment by fan **85** attached to the high speed shaft of the motor. Electric heater **86** heats, thus reducing the relative humidity of, the air and also further assists in drying the air by infra-red energy radiated through the opening directly adjacent in partition **87**. Holes **88** for outlet of the air from the drying compartment are in the diagonally opposite wall.

The processed film is automatically wound on special reel **89**. A plurality of radial slots **90** are formed with smooth edges in both sides of the reel. A smooth-surfaced cylindrical pin **91** is provided in each pair of opposite slots. Large pulley **92** on intermediate shaft **19** and a considerably smaller pulley **93** on the shaft of reel **89** cause the latter to revolve sufficiently rapidly to throw pins **91** to the outer ends of the slots, at least after a particular slot has passed below the horizontal, as the identified slot **90**. This calls for a speed of the order of 100 revolutions per minute.

A terminal roller **94** is the same as the initial one **47**, thus the processed film is disgorged from the spined belt at the terminal roller. A stripper **114** assists in this operation. Hook **95**, originally attached to the front end of the film, engages pin **91** as soon as the kinematics of the apparatus allows. Should one pin miss the hook the succeeding pin comes around very quickly relative to the film travel and the necessary catch is made. As soon as this occurs friction clutch **96**, Fig. 1, slips sufficiently to match the revolutions of reel **89** with the arrival of the processed film and to accommodate the change in this ratio as the reel becomes filled with film and thus of larger radius.

It is now seen how I am able to thread film to be processed through the apparatus by merely starting the front end, provided with a simple hook, into the endless belt. It will be noted that because of the automatic windup mechanism the apparatus does not need attention when once started and may continue to run for any interval

after processing has been completed without losing threading of a leader, as in the prior art. Furthermore, an oversize windup reel is not required to accommodate the whole length of the leader, thus reducing the size of my apparatus. These factors are important where my apparatus is expected to be used and with the type of supervision expected to be given to it, where the operator may properly have other concurrent duties.

The endless aspect of the belt is seen by considering rollers **97** and **98** at the bottom of the reel housings, Fig. 2. These rollers are narrow, being about 15 mm. wide for a 16 mm. apparatus. This allows the belt to pass thereover with the spines toward the rollers, these passing by on both sides of the rollers and acting as mobile guides to keep the belt properly aligned. Both rollers are spring loaded by springs **99** and **100**. This serves the double function of keeping a proper tension on endless belt **48** and also to allow the top of the apparatus to be raised to discharge the liquid solutions without requiring that the belt be removed from any roller.

Switch **101**, Fig. 1, gives "on-off" control of all electrical components of the apparatus. Thermometer **102**, Fig. 2, indicates the temperature of the first developer and in general the temperature throughout the several solutions.

A reentrant ridge **103** around the main structure **1** mates with a corresponding groove in top **24** to give a light-tight joint. A narrow window **104**, Fig. 1, allows visual access to the windup compartment so that the extent to which the film has been processed may be determined without removing cover **105** to that compartment. A thin layer of foam type rubber, isocyanates, etc. **106** is cemented to the bottom surface of top **24** (Fig. 2) to further insure that the joint between the top and the main structure is light and liquid tight from compartment to compartment.

It is now evident how that the above-described film processing apparatus affords automatic operation for color film processing and yet is relatively simple in film drive, of small size and convenient in operation.

An alternate construction for the film-conveying belt and the several rollers over which it passes in the main portion of the apparatus is shown in Fig. 7 in an end-on view with respect to the belt. A rounded center web **109** is formed in the belt. This mates with a similarly formed groove **110** in roller **111**. Two rows of spines **112** hold film **41** as before, although these spines are merely cylindrical. The spacing of the opposite rows is such that the film is embedded slightly in the flexible rubber. The advantage of this construction is saving of space, particularly along the axis of the roller.

Figs. 8 and 9 show a typical extension assembly in detail. Solid extension **30** may be cast monolithically with top **24**, or it may be screwed or cemented thereinto. Closure **33** is formed of soft rubber or of an equivalent plastic such as Plastisol. It is cemented into the concave end of extension **30**. Toluene is a solvent for such plastics and thus may be used as a cement. Duco cement is also satisfactory. A portion of the bottom **39** of the main structure is shown in Fig. 9 to indicate the chamfered top **115** of the orifice used to insure a good liquid seal. Bracket **32** is attached to extension **30** by screws **116** or by a suitable metal to plastic cement such as Duco. This bracket is preferably made of spring material and of a thickness such that some degree of spring loading is exerted on belt **48** as it passes through each compartment of the apparatus.

Roller **5** runs free on shaft **117**, with anti-friction washers **118** or equivalent ball bearings being utilized. In certain compartments, such as **53**, **63**, **71**, **77** and **81**, the bracket takes an extended form in order to accommodate several rollers on an elongated shaft **117**. Also, extensions **31** are used to fasten extended brackets but do not have closures **33** since one orifice per compartment is adequate.

Although oblique partitions such as **2** in Fig. 1 are to be preferred from the standpoint of ease in forming the main structure **1**, an important alternate is shown in Fig. 10. Here a typical top roller, such as **6** shown or the equivalent **111** of Fig. 7, surmounts the partition as before with the axis aligned parallel to the sides of the main structure **1**, but the partition is formed of three contiguous portions, i. e., portions **120** disposed perpendicularly to side **1**, **121** disposed parallel to that side and **122** disposed perpendicularly to the side of the wash discharge tank **38** which lies in the center of the structure of Fig. 1. Obviously, all the portions **1**, **120**, **121**, **122**, etc. are preferably cast monolithically as before, or are fabricated to be absolutely liquid-tight.

Certain alternate constructions are also possible in attaining the objects of my invention.

The overall structure may have more or fewer compartments.

By further application of the hollow passage construction exemplified by **26** in top **24** other separate hollow passages may be provided to supply developer, etc. to desired compartments rather than through individual holes **28**. Other hollow passages may also be used for supplying concentrated solutions for replenishment while the apparatus is in operation.

Film may be transported through the machine over the rollers shown in the absence of the flexible belt **48** by resorting to the usual leader technique.

Infra-red sealed lamps may replace the electric air heater **86**.

Should films other than color be processed certain solutions are either omitted or modified. For straight black and white negative or positive development the first compartment **53** contains developer, the next a stop bath, and the next fixer, all as before. The end compartment may also contain fixer, in which case the wash water inlets and outlets thereof are plugged with snap-expanding stoppers of the same type shown at **28** in Fig. 2. Thereafter, all compartments through **77** are provided with wash water and compartment **79** with alcohol for drying as before

For black and white reversal development there are several possible arrangements of solutions. One is; develop in the first compartment as before, wash in the next, bleach in the third, wash and re-expose in the end tank as before, second develop in compartment **63**, rinse in compartment **65**, fix in compartment **67**, wash in compartment **69** and those remaining until the alcohol is reached as originally set forth for the Ansco color film.

For other color films, such as Ektachrome, development is accomplished in the first compartment, washing in the second, hardening in the third, wash and re-expose in the end compartment, color develop in compartment **63**, wash in compartment **65**, clearing bath in compartment **67**, rinse in compartment **69** and continue the processing as originally set forth for the Ansco color film.

While the exact size of a typical embodiment of my invention is not to be interpreted as restricting it, the 16 mm. color processing apparatus illustrated in the figures is only three feet long, less than nine inches wide and fourteen inches high. This substantiates the accomplishment of small size. For 35 mm. film the apparatus is 3½ feet long, 20 inches wide and 20 inches high. The larger size is required largely because more volume for processing solutions is required and also because of the greater width of the film. No other modifications are required for the 35 mm. apparatus from that shown save a wider spined belt and proportionate increases in motor size, shaft diameters, etc. as would be expected and as within the skill of one skilled in the art.

It will be understood that an electric timer may be used with any embodiment of my apparatus and that by connecting the same to the electrical input circuit thereof will shut off the apparatus upon the completion of processing. Similarly, known accessories may be provided, such as a footage counter attached to the film drive, addi-

tional thermometers in other baths, a spirit level for leveling the apparatus, a water softener and/or filter attached to the wash water intake, or specific apparatus heating or refrigerating means.

Not only may the spines of the belt be thus described but also as flexible projections, and the top or lid to the apparatus as a cover.

Dimensions and numerous other structural details have been given in this specification in order to most fully teach how my invention may be practiced. Wide variations may be taken from the dimensions and changes in details, size and proportions made without departing from the spirit and domain of the invention.

Having thus fully described my invention and the manner in which it is to be practiced, I claim:

1. A strip film fluid processing apparatus comprising a monolithic multiple tank structure having a row of successive partitions at least a part of each of which is disposed other than perpendicular to a straight line intersecting all said successive partitions, at least one roller surmounting each said partition colinearly related one to the other along a shaft coincident with said straight line, means to drive said shaft, one tank adjacent to each tank element formed by said successive partitions, orifices between said one tank and selected said tank elements, a top to said monolithic tank structure, said top having channels to selected said tank elements, further orifices in the bottoms of selected tank elements, a yielding closure for each said further orifices, said closure attached to said top and adapted to allow fluid in said selected tank elements to drain out thereof upon removal of said top, other rollers adjacent said closures, flexible means to cause said strip film to pass over all said rollers for processing in said apparatus, and means to store said film after processing.

2. The processing apparatus of claim 1 in which the means to cause said strip film to pass over all said rollers is a flexible belt having a series of flexible spines near each edge of said belt standing perpendicularly away from the same side of said belt and adapted to hold the edges of said strip film when said belt is without transverse stress and to release said film when said belt is arched convex on the spined side.

3. The processing apparatus of claim 1 in which the means to store said film is an automatic windup reel having a hub and a plurality of radial slots in each side thereof, a free-fitted pin bridging from side to side of said reel in each pair of oppositely aligned slots, each said pin adapted to reach the outer ends of said slots at a point of engagement and to engage a hook on the front end of the film having been processed, thereafter to converge to said hub upon said film winding upon said reel.

4. The processing apparatus of claim 1 in which said partitions lie wholly at one angle to said straight line and the axis of the surmounting roller associated with each said partition lies at the same angle thereto.

5. The processing apparatus of claim 1 in which said partitions lie perpendicularly to said straight line adjacent the sides of said tank and lie along said straight line away from the sides of said tank, the axis of the surmounting roller associated with each said partition lying along said straight line.

6. A strip film fluid processing apparatus comprising a rectangular tank structure, more than five successive partitions at least a part of each of which is disposed other than perpendicular to a side of said rectangular tank structure, one roller surmounting each said partition to convey said film from one to an adjacent individual tank formed by said partition, each of said rollers drivably attached to common shaft lying parallel to a side of said structure and above said partitions, means to drive said shaft, another roller in each said individual tank formed by said successive partitions, all said rollers defining a single path for said film through said structure for processing, means to introduce said film to and to store said film from said path, an elongated tank disposed adjacent to each said individual tank and having sides parallel to said rectangular tank structure, orifices near the top of and between said elongated tank and certain said individual tanks, an exit orifice in said elongated tank removed from the bottom thereof, a top to said tank structure, means to fasten said top to said tank structure, said top having fluid-conveying channels to the certain said individual tanks, further orifices in the bottoms of selected individual tanks, and extensions from said top extending into said selected individual tanks, a deformable solid substance on the ends of said extensions away from said top, said extensions located in said top to lie above said further orifices, the length of said extensions being such as to deform said substance to a liquid-tight seal at each said further orifices when said top is fastened to said tank structure by said means and to allow egress of liquids from said selected individual tanks when said top is unfastened from said tank structure, said other roller in each said tank attached to said extension in said tank near said deformable substance.

7. In an apparatus for fluid processing motion picture film the combination of a rectangular tank having plural liquid-tight partitions, each said partition disposed at least in part other than perpendicular to the sides of said rectangular tank, a single roller adapted to convey said film from one side to the other of one said partition, said roller surmounting the part of said partition other than perpendicular, a shaft parallel to the sides of said rectangular tank above said partitions, each said single roller colinearly attached along said shaft above one of said partitions; a cover for said rectangular tank, means to fasten said cover to said rectangular tank, plural liquid-tight ducts in said cover, said ducts extending from a common opening to above certain compartments formed by said partitions, an elongated tank within said rectangular tank adjacent each said compartment, orifices near the top of and between said elongated tank and the said certain compartments, an exit orifice in said elongated tank removed from the bottom thereof; orifices in the bottoms of compartments formed by said partitions, plural projections from said cover extending downwardly into said compartments, deformable material attached to the lower end of each said projection, the length of each said projection being such as to cause said deformable material to be deformed to a liquid-tight seal at each said orifice when said cover is attached to said rectangular tank by said means; only one endless flexible belt having a series of flexible spines near each edge of said belt standing perpendicularly away from the same side of said belt, an initial roller, said initial roller having a larger diameter at the center than at the edges thereof, said belt passing over said roller with said spines away therefrom whereby said belt flexes to separate the tops of said spines located near one edge farther away from said spines located near the other edge for receiving motion picture film for transport over each of said single rollers, further rollers within said compartments, said further rollers resiliently attached to said projections near said deformable material, said belt passing also over said further rollers contra to the resilient attachment for keeping said belt taut, each said roller related to said belt to bear upon the side thereof away from said spines, a terminal roller, said terminal roller constructed similarly to said initial roller and related to said belt for discharging said film after transport through said apparatus to an automatic windup reel having a hub and a plurality of radial slots in aligned pairs in opposite sides of said reel, a free-fitting pin bridging from side to side of said reel in each pair of oppositely aligned slots, each said pin adapted to reach the outer end of its slot adjacent said terminal roller as said reel is revolved, to engage a hook on the front end of said film having been transported through said apparatus, and thereafter to converge to said hub upon said film winding upon said reel.

8. A strip film fluid processing apparatus comprising a

monolithic multiple tank having successive partitions, at least one roller for each partition, said roller surmounting said partition, said rollers colinearly related one to the other along a straight line and affixed to a shaft, means to drive said shaft, one tank element adjacent to each compartment formed by said successive partitions, orifices between said tank element and selected said compartments, a top to said monolithic tank, said top having channels to selected said compartments, further orifices in the bottoms of selected said compartments, a yielding closure for said further orifices, said closure attached to said top and adapted to allow fluid in selected said compartments to run out thereof upon the removal of said top.

9. In an apparatus for fluid processing strip film by passing the same over rollers through plural fluids, the combination of a rectangular tank having plural liquid-tight partitions, an orifice in the bottom of said tank in each of selected compartments formed by said partitions, a top to said tank, means to attach said top to said tank, extensions from said top into said selected compartments, a deformable substance on the end of said extensions away from said top, said extensions so placed and of such length as to form a liquid-tight seal at each said orifice when said top is attached to said tank by said means and to allow egress of liquids from within said selected compartments when said top is unattached from said tank.

10. In an apparatus for processing motion picture film by passing the same through plural liquids contained in plural aligned tanks, the combination of a single structure in which said tanks are formed by parallel oblique liquid-tight partitions, a lid for said structure, means to fasten said lid to said structure, plural liquid-tight ducts in said lid, said ducts extending from common openings to above each of less than the previously mentioned plurality of tanks, an orifice in the bottom of each of said plural tanks, a projection from said lid extending downwardly into each of said plural tanks above each said orifice, deformable material attached to the lower end of each of said plural projections, the length of each of said projections being that which causes said deformable material to be deformed to a liquid-tight seal at each said orifice when said lid is fastened to said structure by said means.

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