Aug. 9, 1966 S. L. HERSH ETAL 3,264,970

PHOTOGRAPHIC PROCESSING APPARATUS

Filed May 5, 1964

FIG. 1

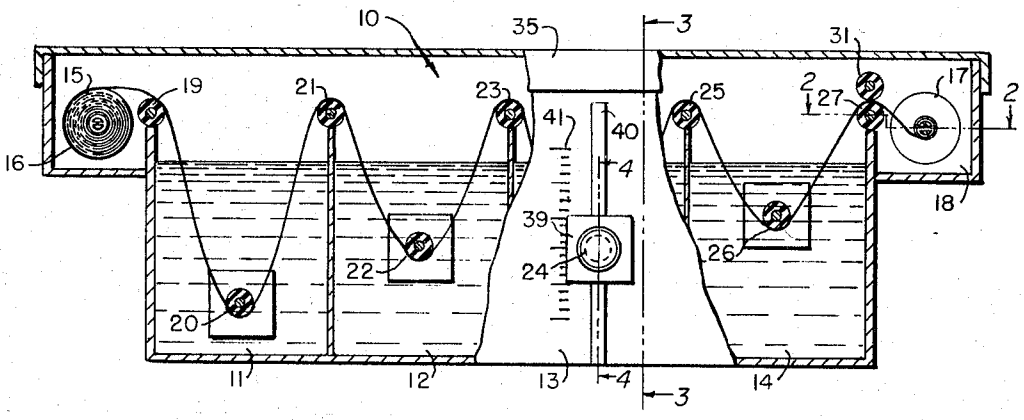


FIG. 2

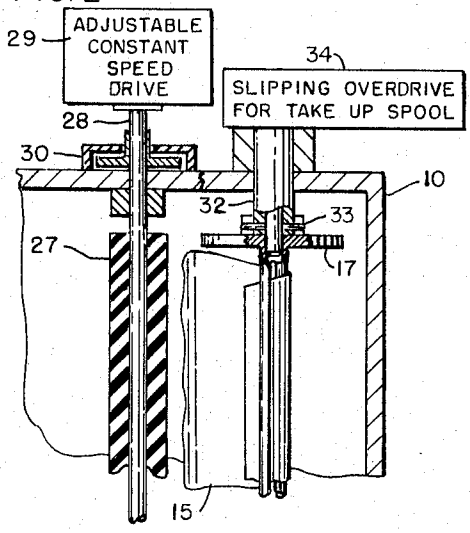


FIG. 4

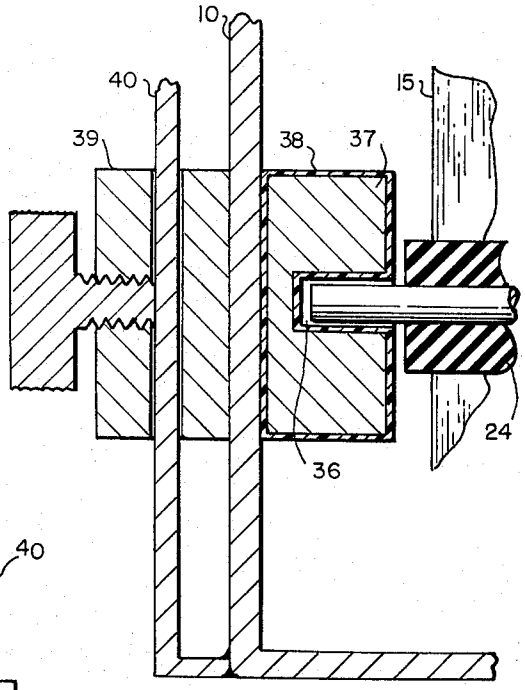
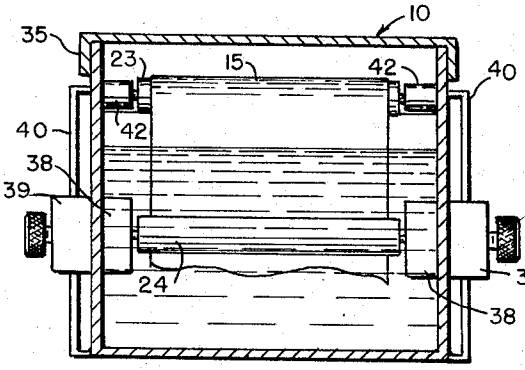


FIG. 3



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United States Patent Office 3,264,970 Patented August 9, 1966

3,264,970

PHOTOGRAPHIC PROCESSING APPARATUS

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Filed May 5, 1964, Ser. No. 365,217
12 Claims. (Cl. 95—94)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment of any royalty thereon.

This invention relates to the processing of sensitive photographic materials and particularly to apparatus adapted for regulating the timing of the processing steps involved.

In the photographic arts it is common practice to provide a series of processing tanks arranged closely adjacent and in line and to feed a roll of film at a controlled rate successively from tank to tank to complete a multistep processing cycle.

To provide flexibility in timing the processing cycle in such systems the length of film strip immersed in each tank is made adjustable. This adjustment together with a feed thru driving means whose speed is adjustable provides the required range of processing times to insure high quality in the finished product.

In equipments of the above nature a dip roll is used to maintain the film loop extending into the processing solutions. The dip roll is arranged to be raised and lowered in the tank and thus to change the length of film dipping into solution. To accomplish this the prior practice has been to provide one or more vertical adjusting rods secured to the roll and extending upward thru a support member at the top of the tank having locking means to secure the roll in its adjusted position.

This structure or other similar structures are unsatisfactory because they impose mechanical and chemical difficulties and also interfere with maintaining light tight protection for the sensitive material. In prior structures the manipulating rod or other elevating means must have close sliding engagement at the point where it passes thru the tank covering means to prevent light entering the tank. The unavoidable corrosive action of the chemicals upon even the most resistant materials act in time to interfere with adjustment of the dip rolls particularly at the point of sliding friction. In this construction there is always the possibility of light leaks where the operation is carried on in actinic room lighting.

The structure of the present invention overcomes the above adverse features. In the invention the suspension and adjustment of the dip rolls is accomplished from outside the tank walls with no openings or slots in the tank. This is made possible by the transmission of magnetic flux from outside the tank to freely movable dip roll bearing blocks of magnetic material inside the tank and contacting the tank wall. Trunnion shafts at the ends of the dip roll are received in bearing apertures in the bearing blocks. External magnets disposed opposite the bearing blocks act to secure the roll in a fixed position and when moved up or down cause the roll to follow such movement thereby providing external manipulation of the roll to position it at any height within the tank. Desirably the external magnets are provided with means for locking them in adjusted position.

It is a primary object of the invention to provide a processing apparatus wherein the adjustment of dip rolls for controlling the length of the immersed film loops is controlled by completely light tight means necessitating no wall or cover apertures.

A further object of the invention is to provide strip film processing apparatus wherein the dip rolls for adjusting

the length of the immersed film loops are vertically adjustable by external magnets whose flux is coupled thru the tank walls to armature members in which the rolls are journaled.

A further object of the invention is to provide a processing apparatus wherein the tanks are reduced in size which conserves solutions, such reduction being possible because the mechanical control hardware is external to the tanks and no hardware extends above the tank proper.

A further object of the invention is to provide a processing system wherein most of the dip roller manipulator parts are not contacted by the corrosive processing solutions.

A still further object of the invention is to provide a processing system wherein the location and use of mixers and beaters in the tanks is not restricted by dip roll elevator mechanisms.

A further object of the invention is to provide a processing system wherein the inside surfaces of the tanks are smooth and without obstruction thereby permitting easy and thorough cleaning.

Other objects and features of the invention will more fully appear from the following detailed description and will be particularly pointed out in the claims.

To provide a better understanding of the invention a suitable embodiment thereof will be described and illustrated in the accompanying drawings wherein:

FIG. 1 is a general view of the apparatus partly in section.

FIG. 2 is a cross section on line 2—2 FIG. 1.

FIG. 3 is a cross sectional view on line 3—3 FIG. 1.

FIG. 4 is an enlarged detail cross section on line 4—4 FIG. 1.

The invention will be described in connection with a container having a plurality of tank sections for containing different processing solutions. However the invention may be applied to one or more such tank sections. A suitable arrangement is shown in the drawings wherein the apparatus consists of a unitary tank structure **10** provided with four tank sections each of which contain different chemicals. For example the tank **11** may contain developer, the tank **12** acid rinse, the tank **13** fixer and the tank **14** wash water.

The apparatus shown may be used in connection with a complete photographic system for exposing the sensitive strip and including different types of treatment after chemical processing. In the latter case a dark room with non-actinic lighting would be required. In this type of system the film strip would pass from an exposing device directly into the developing tank and then thru the remaining chemical processing steps after which the strip would be dried and given any other final treatment. Other suitable arrangements may be made to make use of the advantages of the invention.

The apparatus shown in the drawings is a self contained system wherein a strip of exposed film **15** may be processed while being protected from actinic light by the processing vessel itself. In this structure the exposed film **15** is placed in a light tight compartment **16** secured to the unit **10**. Desirably the film strip or other sensitive material is wound upon a spool such as that which is used to receive the exposed film in a camera and the spool is rotatively supported in the compartment. In addition a conventional friction left-off device should be coupled to the spool to control the film as it is unwound from the spool. The strip after processing is wound upon a spool **17** at the opposite end of the unit **10** in a compartment **18** integral with the unit.

The tank unit is provided with rolls for guiding the film into successive processing tank sections. The path of the exposed strip during processing is first over the roll **19** into the solution in tank **11** around the dip roll **20** up and

over guide roll **21** into tank section **12** around dip roll **22** from where it passes up and over guide roll **23**. The strip continues in the same manner engaging successively dip roll **24**, guide roll **25**, dip roll **26** and finally the processed strip passes over roll **27** and enters compartment **18**.

To facilitate threading the dry strip thru the system the dip rolls desirably are moved into a position above the level of the solutions in the tanks in a manner to be described which permits a substantially straight feed thru movement of the strip and avoids undesirable contact with solutions while performing the threading operation. The dip rolls are then moved down into their processing positions which are individually predetermined to provide their necessary processing time period.

After the lead portion of the strip **15** has been threaded thru the apparatus it is connected to suitable driving means to transport the strip during the processing cycle. Such means may be manual but preferably should be power means designed to feed the strip at a predetermined uniform rate based upon the type of emulsion, the characteristics of the solutions and their temperature. Such means may consist of a take up spool and a constant speed film feeding means. Any suitable arrangement may be provided for driving these elements. As shown the roll **27** over which the finished film travels has its shaft **28** extended outside the tank unit and coupled to an adjustable constant speed drive unit **29**. If desired the bearing for the extended shaft may be light trapped as shown at **30**.

To provide positive traction between roll **27** and the film strip **15** a pinch roll **31** is journaled in the sides of the tank in position to engage the film and press it against the drive roll **27**. If desired the roll **31** may engage only the marginal edges of the strip to thus protect the emulsion containing the image.

The take up spool **17** is rotatably supported at one end in the compartment **18** by a short stud not shown fixed to the compartment wall and extending into an axial aperture in the spool. The other end of the spool is supported by a short shaft **32** projecting a short distance into the spool aperture and provided with a disengageable clutch device **33** which couples the shaft to the spool **17**. The shaft **32** extends thru a bearing in the compartment wall and is coupled at its outer end to a slipping overdrive unit **34** which loosely winds the film fed to it by the roll **27** upon the spool **17**.

To remove the spool containing the processed film strip the shaft **32** and its drive unit are pulled axially outward which acts to disengage the coupling clutch **33** and remove the shaft **32** from the spool thus permitting removal of the spool from the apparatus. To prepare for processing another film an empty spool is placed on the fixed pivot in compartment **18** and the shaft **32** reinserted in driving position in the spool which act reengages the coupling clutch. The apparatus is then ready for threading another film along the same path as described above. With the solutions at predetermined temperature and the timing of the drive unit **27** adjusted the units **29** and **33** are started to process the film. It should be noted that the apparatus described is provided with a light tight removable cover **35** which when removed provides complete access for threading the film and changing film strips.

An important feature of the invention resides in its capability for readily adjusting the length of film strip immersed in the various solutions with optimum facility, complete protection from light leaks, and avoidance of the disadvantages of prior devices. Each of the guide rolls are made of non-corrosive material such as plastic or non-magnetic stainless steel and are provided with trunnion shafts at their ends. Each of the dip rolls are rotatably received in apertures **36** formed in bearing blocks **37** made of magnetic material positioned against the inner surface of the tank. The blocks **37** have a coating **38** of non-corrosive material such as polytetrafluoroethylene completely covering the metal and lining the apertures **36**. The walls of the tank unit are made of non-magnetic stainless steel or a suitable plastic material. The blocks **37** are held in position by strong magnets **39** situated outside the tank walls opposite the blocks **37**. In this manner the dip rolls are held at the desired elevation in the respective tank sections. The magnets shown are of the permanent type. However electromagnets may also be used in which case a degree of control over the flux intensity of the magnets is available and also the magnets may be switched off to permit ready removal of the dip rolls.

Each magnet has an aperture therein thru which an external vertical guide rod **40** extends. The rods **40** are of non-magnetic metal and are secured at top and bottom to the tank walls. Each magnet may be supplied with a locking thumb screw acting to secure the magnets in adjusted position on the rods. To adjust the length of the immersed loop of film in the individual tank sections the magnets are raised or lowered to the desired degree and locked in position. The magnetic coupling between the magnets and the blocks move the blocks and dip rolls a corresponding amount and thereby provide for their adjustment from outside the tank unit **10**. Such adjustments may be made with the tank cover in position and during the processing cycle.

When making these adjustments the magnetic coupling between the magnets and the blocks **37** is sufficient to cause the blocks to be carried along the inner face of the tank walls when the magnets are moved. The coating **38** assists in reducing the sliding friction between the tank walls and the blocks **37**.

Reference scales **41** may be inscribed upon the outer face of the tank sections to serve as a guide in setting the dip rolls to their proper height.

Rolls **19**, **21**, **23** and **25** are rotatably supported in bearings **42** fixed upon the inner face of the tank walls.

What is claimed is:

1. Photographic processing apparatus comprising at least one solution containing tank, means for feeding an exposed photosensitive strip into and out of said solution, a dip roll submerged in said solution around which the sensitive strip is passed to thus establish the length of the submerged loop of sensitive material, a bearing block of magnetic material at each end of said dip roll, each block having a journal within which the roll is rotatively received, vertically adjustable magnets situated outside of the tank wall opposite said bearing blocks and magnetically coupled thereto.

2. Photographic processing apparatus according to claim **1** and wherein said bearing blocks are completely coated with non-corrodible material.

3. Photographic processing apparatus according to claim **1** and means to lock said magnets in adjusted position.

4. Photographic processing apparatus according to claim **1** and wherein the said tank is made of non-magnetic material.

5. Photographic processing apparatus comprising a plurality of solution containing tanks arranged in linear sequence, each tank containing a processing solution, a strip of exposed photosensitive material, a plurality of guide rolls for conveying said sensitive material from tank to tank, a dip roll for each tank submerged in solution and around which the strip is passed to determine the length of the submerged loop of sensitive material, a freely movable magnetic bearing block at each end of said dip rolls bearing against the tank wall and having a journal in which the dip rolls rotate, magnets outside of the tanks opposite the bearing blocks whereby the bearing blocks become armatures movable with the magnets and constitute the sole support for the rolls, and means to guide the magnets vertically along the tank walls.

6. Photographic processing apparatus according to claim **5** and means to lock said adjustable magnets in adjusted position.

7. Photographic processing apparatus according to claim 5 and wherein said bearing blocks are completely coated with non-corrodible material.

8. Photographic processing apparatus according to claim 5 and wherein the tank walls are made of non-magnetic material.

9. Photographic processing apparatus according to claim 5 and a removable light tight cover for the whole tank group.

10. Photographic processing apparatus for sensitive strip material comprising a plurality of processing solution tanks arranged closely adjacent each other, a removable light tight cover means providing access to all tanks and protecting the sensitive strip from actinic light during processing, roller means for guiding the strip from tank to tank, a dip roll for each tank submerged in solution and around which the strip passes to determine the length of the submerged loop of sensitive material in each tank, freely movable bearing blocks at each end of said dip rolls having journals thereon for rotatably supporting said rolls, said blocks constituting the sole support for said rolls and being positioned close to the inner face of the tank walls, magnets outside the tanks opposite said bearing blocks and magnetically coupled thereto, means to guide the magnets vertically along the tank walls

whereby the height of the dip rolls in the tank may be adjusted, a dry light tight compartment to receive an unprocessed film strip and adjustable constant speed power means to feed the strip thru the apparatus during processing thereof.

11. Photographic processing apparatus according to claim 10 and a power driven take up spool to receive the processed film.

12. Photographic processing apparatus according to claim 10 and wherein the tank walls are made of non-magnetic material.

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NORTON ANSHER, *Primary Examiner.*