March 17, 1970 J. L. STUART ET AL 3,501,076

DRIVE SYSTEM FOR FILM PROCESSING APPARATUS

Filed Jan. 25, 1968 2 Sheets-Sheet 1

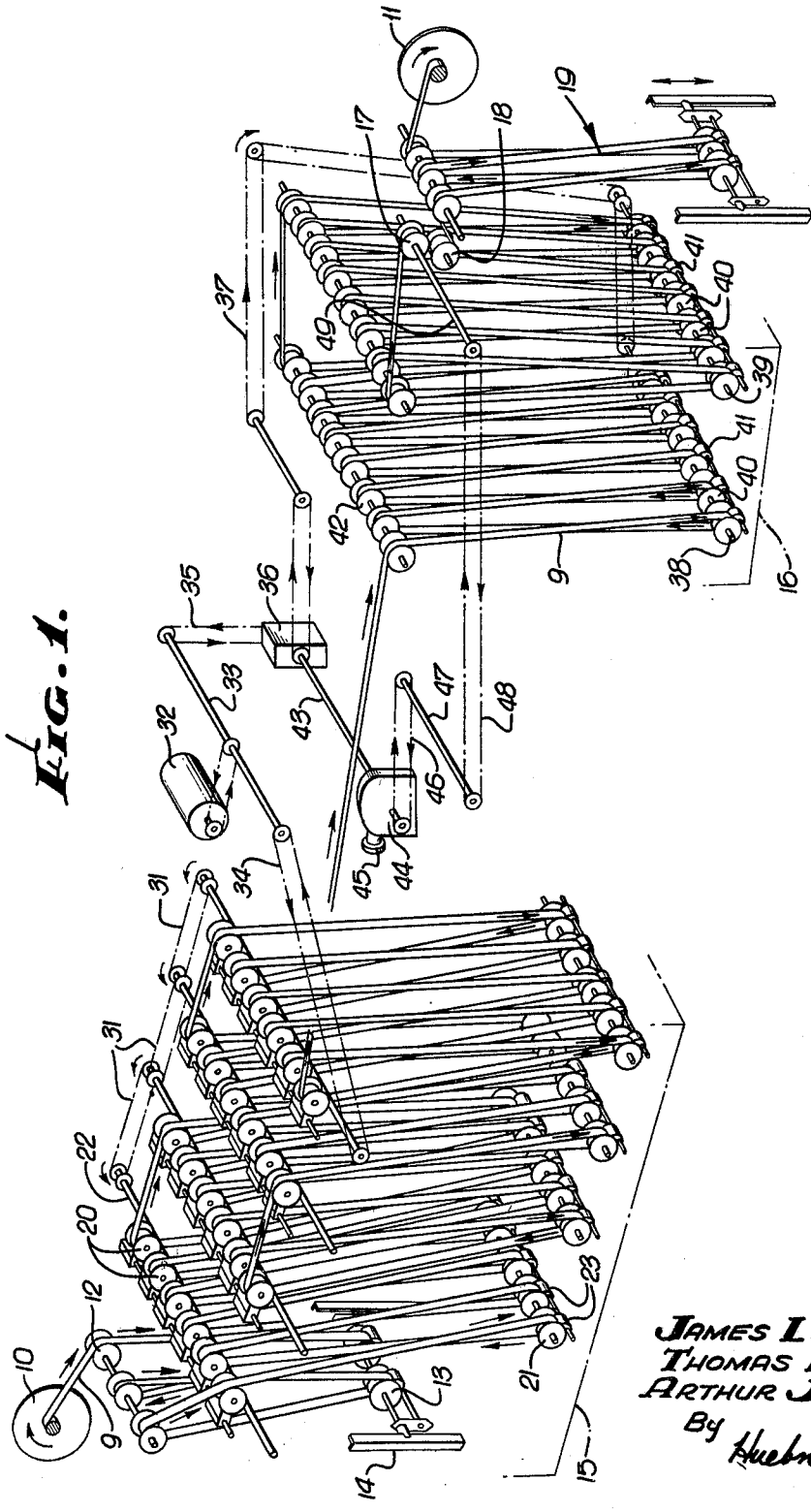


FIG. 1.

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FIG. 2.

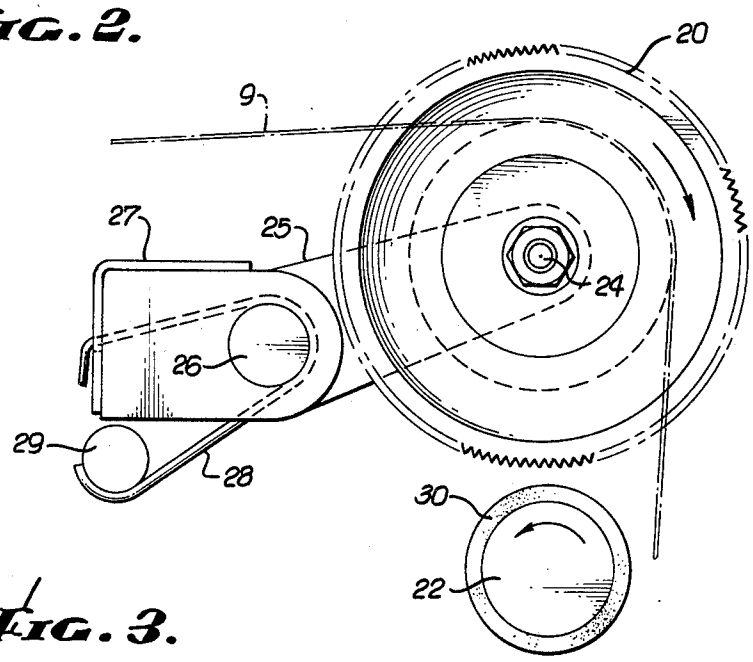


FIG. 3.

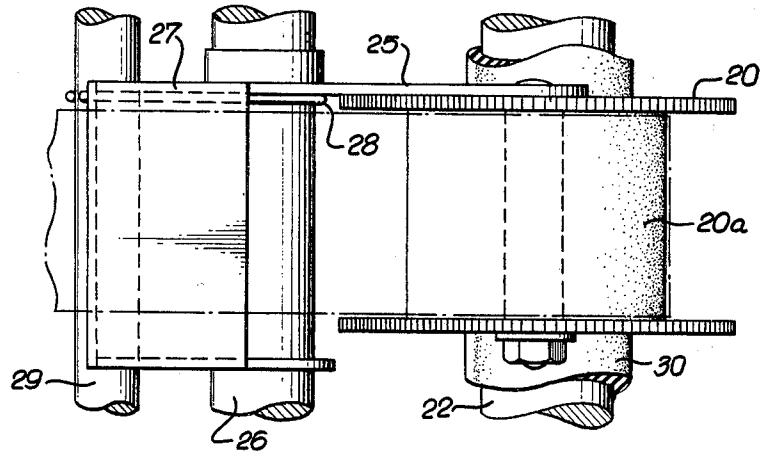
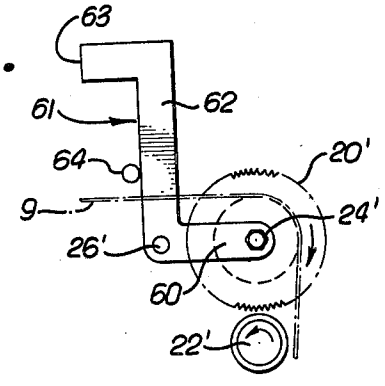


FIG. 4.



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United States Patent Office 3,501,076
Patented Mar. 17, 1970

3,501,076

DRIVE SYSTEM FOR FILM PROCESSING APPARATUS

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Filed Jan. 25, 1968, Ser. No. 700,432
Claims priority, application Great Britain, July 21, 1967, 33,722/67
Int. Cl. B65h 25/00, 23/18
U.S. Cl. 226—25 5 Claims

ABSTRACT OF THE DISCLOSURE

A film processing apparatus having a pair of sets of rollers arranged for repeated passage of a continuous strip of film from one roller of one set to a roller of the other set and back to a succeeding roller of the one set through a processing zone located between the sets. Means in addition to commonly used elevators is provided for minimizing the buildup of tension in the film passing through the apparatus.

BACKGROUND OF THE INVENTION

The present invention relates to film processing apparatus of the type having a pair of sets of rollers arranged for the repeated passage of a continuous strip of film from one roller of one set to a roller of the other set and back to a succeeding roller of the one set through a processing zone located between the sets and, more particularly, to improved means for minimizing the buildup of the tension in the film passing through the apparatus.

A conventional apparatus of this type may have several pairs of sets of rollers arranged to pass the film through one or a number of processing zones. Commonly, one set of each pair is arranged at the bottom of a processing tank, and the other set adjacent the top of the tank. A drive system is required to advance the film through the apparatus, and this must be designed to minimize the buildup of tension in any part of the film which could result in film breakage and consequent interruption and delay in the processing. To take up excessive tension and to allow for temporary stoppage of the film to enable a length of film to be detached or a new length attached, it is known to provide an elevator at each end of the apparatus which has one set of rollers freely slidable towards a second set of rollers to shorten the film path between the rollers when increased tension occurs in the film. However, such elevators are not completely successful in eliminating excessive tension in the film, with the result that film breakage is still a common problem in the conventional film processing apparatus.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide in a film processing apparatus of the character identified, improved means for minimizing the buildup of tension in the film passing through the apparatus.

Another object of the invention is to provide means for adjusting the rate of advance of film passing through an apparatus of the character identified, so that tension in the film may be controlled.

A further object of the invention is to provide a film processing apparatus through which film of different widths may be processed.

In accordance with the present invention there is provided a film processing apparatus having a pair of sets of rollers arranged for the repeated passage of a continuous strip of film from one roller of one set to a roller of the other set and back to a succeeding roller of the one set through a processing zone located between the sets, wherein a drive shaft is arranged to engage the peripheries of one set of rollers (the drive rollers) to effect drive of the rollers and advance the film. The drive rollers are individually mounted and biased against engagement with the drive shaft in such a manner that a predetermined film tension is required to hold each roller in engagement with the drive shaft. A film traction system is provided to draw the film through the apparatus, the film traction system being coupled to the drive shaft in such a manner that the rate of advance of the film by the drive rollers is higher than the rate at which the film traction system is drawing on the film.

Preferably, the set of drive rollers is mounted above the other set of rollers, the latter serving only as guides. The drive shaft is mounted below the drive rollers and drive rollers are biased upwardly away from the drive shaft. The film traction system may be a "come-along" or "spacer" roller around which the film passes before being led on to a take-up spool, the come-along roller being driven from the same motor as the drive shaft but through variable speed gearing enabling the rate of advance of the film to be adjusted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic perspective view of the film transport system of a film processing apparatus in accordance with the invention;

FIGURES 2 and 3 are, respectively, side and top views of a drive roller, the associated drive shaft, and one form of the mounting for the roller; and

FIGURE 4 is a side view of the drive roller, associated drive shaft, and a second form of the mounting for the roller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the apparatus shown in FIGURE 1, the film **9** passes from a feed-on spool **10** at the left-hand side of the apparatus to a take-up spool **11** at the right-hand side. It passes first over an elevator comprising a set of pulleys **12** and a movable set of pulleys **13** mounted for vertical sliding movement on guides **14**. The film then passes through a tank section **15** in which it is processed in one or more tanks containing processing solutions. From the tank section the film passes to a drying section **16** and then over a "come-along" roller **17** and a guide roller **18** to an elevator **19** and the take-up spool **11**.

In the tank section **15** the film passes over several pairs of sets of rollers, four pairs in the example illustrated. Each pair consists of a set of drive rollers **20**, and a set of guide rollers **21**. The drive rollers **20** of each set are driven by a drive shaft **22** in a manner to be described, and serve to advance the film through the tanks. Each set of guide rollers **21** is located in the tank below the associated set of drive rollers **20**. Keep rollers **23** are arranged to prevent the film escaping from the guide rollers **21**.

Referring now to FIGURES 2 and 3, each drive roller **20** is rotatably mounted on a pivot pin **24** fixed to one arm of a lever **25**, which is swingably mounted on a spindle **26** common to all the rollers **20** of a set. The other arm of the lever **25** carries a housing **27**. A biasing spring **28**, having one limb hooked through an opening in the housing **27** and the other limb engaged around a stop **29**, tends to maintain the roller **20** in the position shown, in which it is disengaged from the drive shaft **22**. By the action of the come-along roller **17** in cooperation with the guide roller **18**, the film **9** is drawn through the apparatus and the section of the film passing over any of the drive pulleys **20** is put under tension. The drive roller **20** is then drawn into engagement with the drive shaft

22. The drive shaft 22 has a rubber or plastic covering layer 30, and the periphery of the roller 20 is serrated to insure a good grip on the shaft 22. The speed of the shaft is such that while the roller 20 is in engagement with the shaft 22, the advance of the film is at a rate greater than the feed rate established by the come-along roller 17. The tension in the film forward of the roller 20 is thus rapidly relieved and fed back to the preceding drive roller. By the individual action of the drive rollers 20, the tension is fed back through the apparatus to the elevator 13 on the input or fed-on side and buildup of tension is prevented.

Preferably, a rubber or plastic covering layer 20*a* is provided on the roller 20, and the roller is sufficiently wide to accommodate 35 mm. film. Consequently, the apparatus may also accommodate motion picture films of different widths.

The drive shafts 22 are coupled together by driving chains or belts 31, and are driven by a driving motion 32 through a spindle 33 and a chain or belt 34. The spindle 33 is also coupled, by way of a chain or belt 35, to a gear box 36, and further chain and sprocket connections 37, to drive two spindles 38 and 39, carrying sets of rollers 40 for advancing the film through the drying section 16. The rollers 40 are provided with keep rollers 41. Above each set of rollers 40 is a set of guiding idler rollers 42.

The gear box 36 has an output shaft 43 coupling it to a variable speed gear 44 having a control knob 45. The output of the variable speed gear 44 is coupled by chain 46, shaft 47, chain 48, and shaft 49, to drive the come-along rollers 17. By the provision of the variable speed gear 44, the relative speeds of the drive shafts 22 and come-along roller 17 may be adjusted to control the tension in the film passing through the tank section 15 of the apparatus.

The take-up roller 11 is driven from the motor 32 through a magnetic clutch (not shown). The clutch is disengaged by a trip switch (not shown) when the movable set of rollers of the elevator 19 reaches a predetermined position, and is only re-engaged when the rollers again fall below that position, so that there is an adequate stock of film for reeling onto the take-up spool.

In an alternative construction, shown in FIGURE 4, drive roller 20′ is rotatably mounted on a pivot pin 24′ fixed to a lower arm 60 of a bell crank 61, pivotally mounted on a spindle 26′. The upper arm 62 of the bell crank carries a counterweight 63 which biases the roller 20′ away from the drive shaft 22′. A limiting stop 64 is provided against which the crank 62 abuts in the disengaged position of the drive roller.

Although the invention has been shown and described in what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention.

What is claimed is:

1. In a film processing apparatus having a pair of sets of rollers arranged for the repeated passage of a continuous strip of film from one roller of one set to a roller of the other set and back to a succeeding roller of the one set through a processing zone located between the sets, a drive shaft adapted for engagement by the peripheries of one set of rollers to effect drive of the rollers and advance the film, and film traction means including a come-along roller for drawing the film through the apparatus, the improvement which comprises:

means individually mounting and biasing the rollers of said one set against engagement with said drive shaft in such a manner that a predetermined film tension is required to hold each roller of said one set in engagement with said shaft;

means coupling said film traction means to said drive shaft in such manner that the rate of advance of the film by said rollers of said one set is higher than the rate at which the film traction means draws the film through the apparatus,

including manually adjustable means for controlling the rate at which said film traction means draws film through the apparatus, and said coupling means including a driving motor, first means connecting said motor to said drive shaft to rotate said shaft, second means connecting said motor to said come-along roller to rotate said roller, and said second connecting means including speed control means for controlling the speed of said come-along roller of said film traction means.

2. An apparatus as set forth in claim 1, wherein said speed control means comprises a variable speed gear arrangement.

3. An apparatus as set forth in claim 1, wherein said mounting and biasing means includes a counterweight urging the rollers of said one set against engagement with said drive shaft.

4. An apparatus as set forth in claim 1, wherein said mounting and biasing means includes a plurality of levers, means pivotally mounting said levers in series and intermediate the ends thereof thereby providing pairs of lever arms, means rotatably mounting each of the rollers of said one set to one of the arms of each of said levers, and spring means associated with each of the other arms of said levers urging said rollers against engagement with said drive shaft.

5. An apparatus as set forth in claim 1, wherein said mounting and biasing means includes a plurality of bell cranks mounted in series, each crank including a pair of arms, means rotatably mounting each of the rollers of said one set to one of the arms of each of said bell cranks, and a counterweight on each of the other arms of said bell cranks sufficient to urge said rollers against engagement with said drive shaft.

References Cited

UNITED STATES PATENTS

3,380,678 4/1968 Feasey et al. ------ 226—118 X

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U.S. Cl. X.R.

226—35, 37, 118, 189