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J. M. WOLFF

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DEVICE FOR MAINTAINING CONSTANT TENSION IN A SYSTEM FOR
TREATING A CONTINUOUS STRIP OF FILM, OR THE LIKE

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FIG. 1

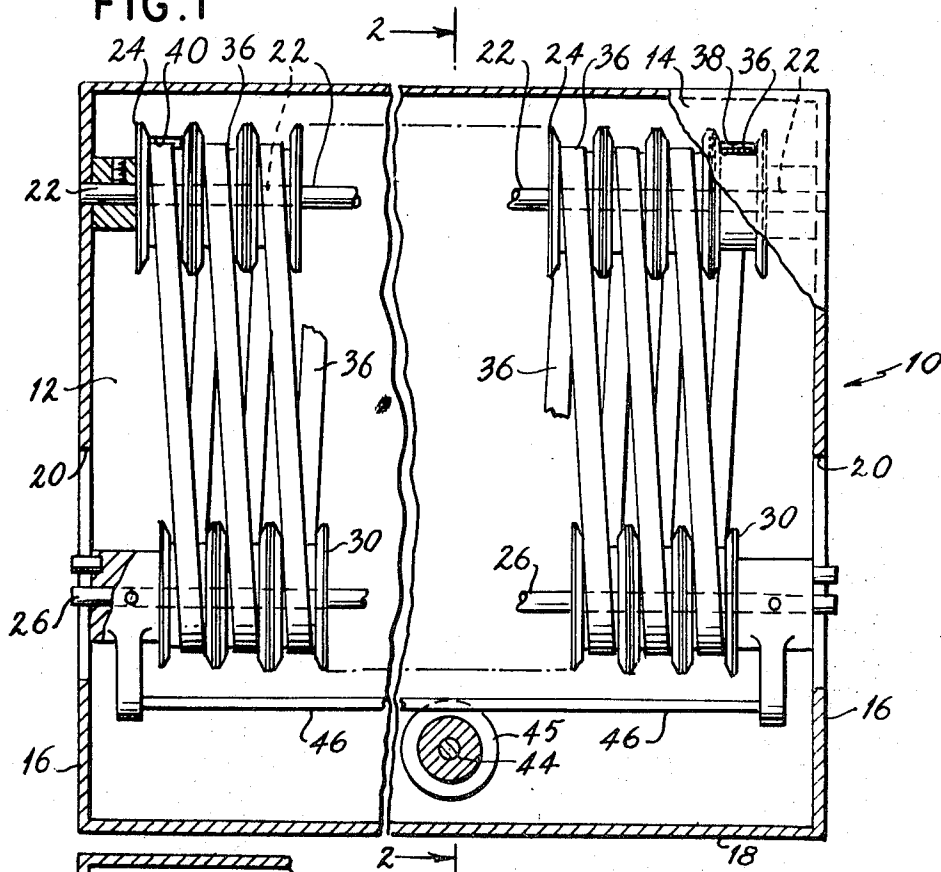


FIG. 2

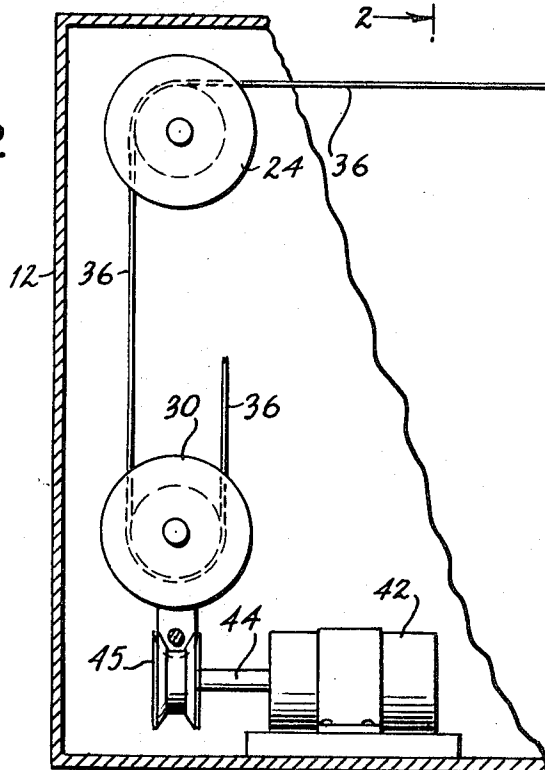
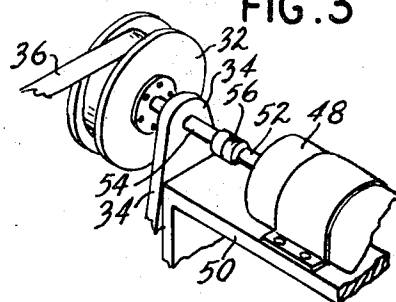


FIG. 3



INVENTOR.

Joe Wolff

BY

Joe Wolff
ATTORNEY

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3,532,282 DEVICE FOR MAINTAINING CONSTANT TENSION IN A SYSTEM FOR TREATING A CONTINUOUS STRIP OF FILM, OR THE LIKE

Joe M. Wolff, New York, N.Y.
(84—37 170th St., Jamaica, N.Y. 11432)
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5 Claims

ABSTRACT OF THE DISCLOSURE

In a system for processing a continuous strip of film or the like, including means for maintaining tension on said film, comprising a first axle fixed in position and mounting a plurality of rollers thereon, a second axle having a plurality of rollers mounted thereon, said rollers on said first and second axles adapted to have the film passed thereabout in a continuous spiral, said second axle suspended from said first axle by said spirals, and a film supply reel supplying film to said rollers mounted on a shaft supported for free rotation; means for maintaining the tension on said film created by the weight of said second axle and said rollers comprising a pair of selsyn motors interconnected for simultaneous rotation and stopping of their shafts, the first of said motors carrying a brake wheel on its shaft and positioned to have the brake wheel engaged by said second axle, the second of said motors coupled to the reel-mounting shaft.

The present invention relates to a constant-tension-maintaining apparatus or device for use in a system for processing continuous strips of material, such as ribbons, film, or the like, especially in a system for processing continuous lengths of photographic film such as moving picture film, or the like, as a film elevator generally used in such system.

Generally stated, the constant-tension-maintaining device or means of the present invention, such as a film elevator, may in the main be of conventional construction; comprising a housing or tank into which a ribbon or film from a supply-reel is fed, and wherein such ribbon or film is passed, in a spiral path, alternately over substantially juxtaposed idler rollers rotating about an axle which is fixed in position at the top of the housing or tank, and under a plurality of similar, substantially juxtaposed, idler rollers rotating around an axle which is supported by the film or ribbon itself, below the fixed axle; the ends of the last-named axle entering into and guided within vertical slots provided in the walls of the housing or tank.

In a device or apparatus of the conventional type described above, serious problems arise in the maintaining of constant tension of the material being fed into the apparatus, due to the fact that, as the diameter of the roll of material or film being fed into the apparatus from the supply reel decreases, the required hold-back torque on the shaft mounting the ribbon reel must be constantly decreased, due to the change of leverage, resulting from the increased unrolling speed required to supply the same length of ribbon or film in a given time into the apparatus. Therefore, if the supply of ribbon or film from the supply reel is to remain constant, the hold-back torque on the mounting shaft must be constantly monitored and corrected.

The purpose of the arrangement described above in which a lower axle mounting the film about rollers is permitted to travel upwardly toward a fixed upper axle mounting rollers about which the same film is axially wound is to store a supply of film in the film elevator,

The purpose of such storing is to permit the stopping of the supply of film into the apparatus as, for instance, when the roll of film on the supply reel comes to an end and the start of a new roll is to be attached to it. During this change-over stoppage, or any other stoppage or retardation of film movement, the apparatus need not be stopped, since the rising of the lower axle permits the feeding of the reserve film stored in the elevator into the apparatus. The lower rollers must be in maximum down position, to provide maximum stored film reserve to allow maximum change-over time. Constant tension control is essential on the material in the elevator, as any excessive slackening will cause the film to fall off the rollers and snarl. Any increase in the tension over the determined amount will cause the movable axle to rise and contact the fixed axle rollers. A fixed hold-back torque on the supply reel cannot, therefore, be employed, since if it were adjusted to operate well with a full roll, the elevator would start to rise as the roll on the supply reel diminished in diameter.

Various mechanical means have heretofore been employed to accomplish such control. Such devices have been complicated linkages and springs and have also governed the proximity of the feed supply to the rest of the apparatus, which is not always most desirable.

It is a general object of the present invention to provide, in a film, or the like processing system, of the character described, means for maintaining a constant tension on the ribbon or film being processed in the system, regardless of any variation in the speed or cessation in the movement of the ribbon or film being processed.

It is a particular object of the present invention to provide constant-tension-maintaining means, of the character described, which is of highly simplified character and which is, nevertheless, highly certain and highly effective in its operation.

It is another object of the present invention to provide constant-tension-maintaining means, of the character described, which is fully automatic; which is substantially instantaneously responsive to loosening tension on the ribbon or film within the system below a predetermined degree; and which is more or less easy and economical to install and use.

More specifically, the present invention is directed to a tension-maintaining device of the general, conventional character described, in which means are also provided for automatically stopping the film supply reel before tension on the film is completely destroyed by the lowering of the suspended reels to maximum position within the housing, where they will come to rest on the bottom thereof.

The foregoing and other objects and advantages of the tension-maintaining device of the present invention will become more readily apparent to those skilled in the art from the one embodiment thereof more or less schematically illustrated in the drawings, and from the description following. It is to be understood, however, that such embodiment is shown by way of illustration only, to make the principles and practice of the invention more readily comprehensible and without any intent of limiting the invention to the specific details therein shown.

In the drawings:

FIG. 1 is a more or less schematic, sectional and partly elevational view of one section of a tension-maintaining device of the present invention, in the form of a film elevator;

FIG. 2 is a similar, fragmentary, sectional view taken on line 2—2 of FIG. 1, of the device; and

FIG. 3 is a fragmentary, more or less schematic isometric view of the film-feeding control means of a device of the present invention.

Referring now, in greater detail, to the embodiment

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of the invention illustrated in the drawings, the device therein shown includes a housing, generally designated as 10, including a rear wall, 12, a front wall, 14, side walls, 16, and a bottom wall, 18. Side walls 16 are each provided, in their lower portions, with vertical slots, 20. Fixed in the upper part of housing 10 between the side walls 16 is a horizontally-disposed axle, 22, on which are rotatably mounted, in preferably closely juxtaposed relation, a plurality of rollers, 24, which may preferably be supplied with roller bearings for facilitating their rotation about the axle 22.

A second axle, 26, is disposed between side walls 16; axle 26 being of greater length than axle 22 and having its ends extend into the slots 20 to be guided therein for vertical reciprocation in the lower part of the housing 10. Axle 26 likewise has mounted thereon, for rotation thereabout, a plurality of rollers, 30, similar to and similarly arranged on their axle as roller 24.

Front wall 14 may be provided at an upper corner thereof with an inlet opening, 38, through which film, 36, may be introduced into the housing and passed in spiral arrangement, alternately, over successive rollers 24 and under successive rollers 30 to leave the housing 10 through an outlet opening, 40, formed in an upper corner of the rear wall 12 whence it may be drawn out by positive means such as the motor of a motor-controlled winding wheel arranged in the film-processing system, neither of which is illustrated in the drawing because they do not constitute any part of the invention.

Film is generally supplied from a supply reel 32 mounted on a shaft, 54, which may be journaled in an upright post, 34.

All of the foregoing described structure is conventional in the art and represents a film elevator as heretofore used. However, as will be apparent from the described structure, it will not be adequate to maintain tension on the film, except to a limited extent, should the film be withdrawn from the elevator at a rate less than its feeding thereinto, as there is no way provided in the described device for controlling the rate of feeding of the film into the elevator in conformity with its rate of withdrawal therefrom. Thus, should withdrawal of the film be at a lesser rate, the movable axle of the elevator will eventually contact the bottom of the elevator structure, causing excess slack and a resulting displacement and snarling of the film.

In order to prevent such disarrangement and snarling of the film, the present invention provides means for instantaneously inhibiting and interrupting the feeding of the film from the reel 32 when the slack on the film in the housing 10 reaches a predetermined point. To attain this object, the present invention utilizes electrical means actuated by axle 26, or by an appendage thereof, when it reaches a predetermined low point in the housing, that will instantaneously brake rotation of the film supply reel 32 and thereby prevent formation of additional slack on the film within the housing.

In the illustrated embodiment of the invention, such means comprises a pair of servo motors, preferably a pair of selsyn motors, that are electrically interconnected for simultaneous rotation and for simultaneous stopping. One of the selsyn motors, as 42, is mounted at or adjacent to the bottom of the housing 10; its shaft, 44, mounting a brake wheel, 35, that may be contacted by the brake bar, 46, preferably fixedly suspended from axle 26. The other selsyn motor, 48, may be mounted on a bracket, 50, fixed on the post 34 in position to have its shaft, 52, operatively connected with supply reel shaft, 54, as by the coupling, 56.

It will be clear that, by the foregoing arrangement, whenever slack on the film 36 becomes sufficiently great, for any reason, to lower the axle 26 to have the brake

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bar 46 attached thereto contact the brake wheel 45 of the selsyn motor 42, rotation of selsyn motor 42 will stop and simultaneously selsyn motor 48 will stop rotation of its shaft 52, and thereby stop rotation of the shaft 54 of supply reel 32, to thereby prevent any increase in the slack on the film within the housing 10.

Conversely, when tension on the film is resumed, as when its movement is resumed, brake bar 46 will be disengaged from brake wheel 45, to thereby permit resumption of the rotation of selsyn motor shaft 42, simultaneously permitting the rotation of selsyn motor 48 and of the supply reel 32 controlled by it.

This completes the description of the device of the present invention for maintaining tension on a film, or ribbon, or the like in a processing system. It will be clearly apparent that such device is of relatively simple construction, easy and economical to install, and highly efficient and effective for its purpose. It will also be apparent that such device is fully automatic and will require little attention from the operator of the processing system.

It will be further apparent that numerous variations and modifications may be made in the tension-maintaining means of the present invention, by anyone skilled in the art, in accordance with the principles of the invention hereinabove set forth, without the exercise of any inventive ingenuity. I desire, therefore, to be protected for any and all such variations and modifications that may be made within the spirit of the invention and scope of the claims hereto appended.

What I claim is:

1. In a system for processing a continuous strip of film, or the like, including means for maintaining tension on said strip, comprising a first axle supported in fixed position and mounting at least one roller, a second axle having at least one roller mounted thereon, said rollers of said first and second axles adapted to have said strip passed thereabout in a continuous spiral, said second axle freely suspended from said first axle by said film spirals, and a film supply reel supplying film to said rollers, said reel mounted on a shaft supported for free rotation, means for maintaining the tension on said film actuated by the weight of said second axle and said roller comprising an electric motor having its shaft coupled to said shaft mounting said supply reel, and means actuated by said second axle when disposed in predetermined position below said first axle for stopping rotation of said motor, to thereby stop the rotation of said supply reel.

2. The system of claim 1, wherein each said axle mounts a plurality of rollers.

3. The system of claim 1, wherein said motor is a selsyn motor and said means for controlling said motor comprises a second selsyn motor having a shaft and electrically interconnected with said first-named selsyn motor for simultaneous stopping and starting of the rotation of their shafts.

4. The system of claim 3, wherein said second selsyn motor has a brake wheel mounted on the shaft thereof, the said second selsyn motor positioned to have said brake wheel contacted by said second axle.

5. The system of claim 4, wherein said second axle supports a bar suspended therefrom for contacting said brake wheel.

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LEONARD D. CHRISTIAN, Priamry Examiner

U.S. Cl. X.R.

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