July 26, 1960 A. ALLENDORF 2,946,534

TAPE CONTROL WINDER

Filed Feb. 20, 1956 2 Sheets-Sheet 1

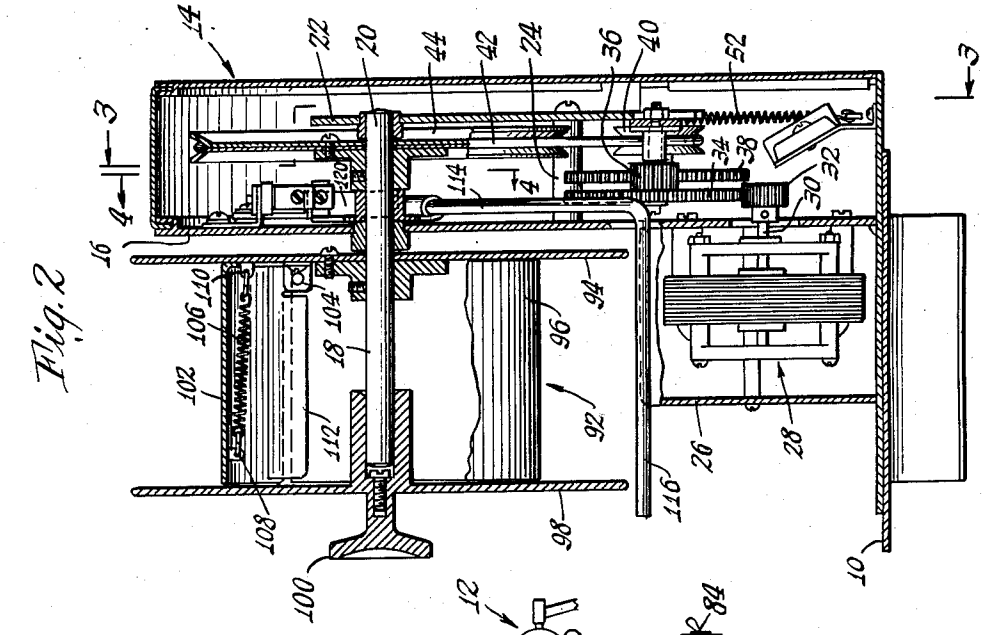

Fig. 2

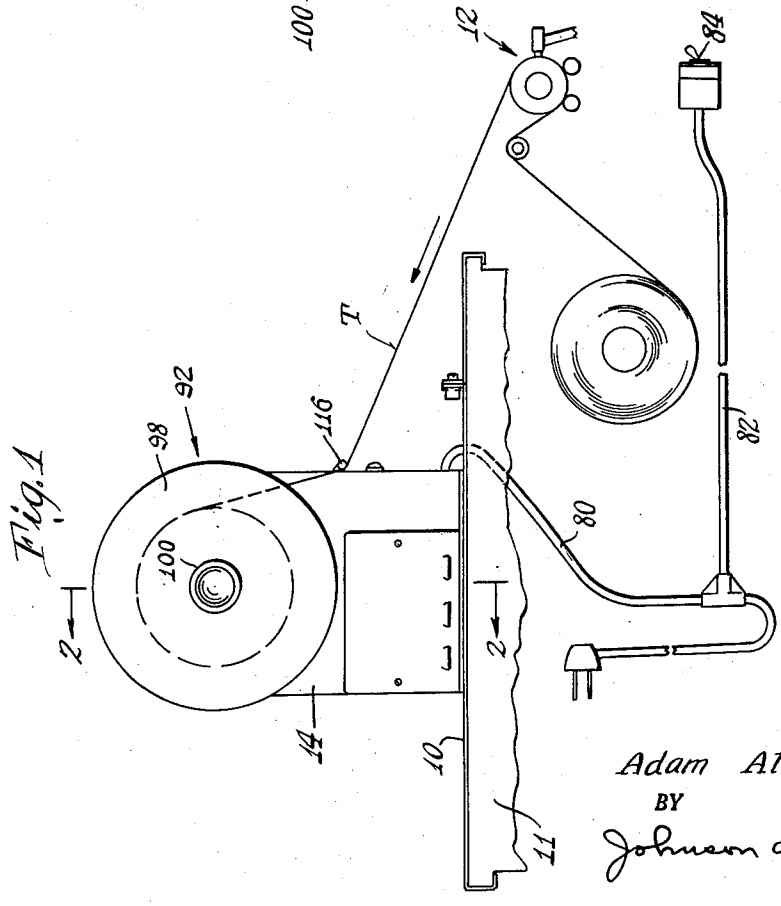

Fig. 1

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Fig. 3

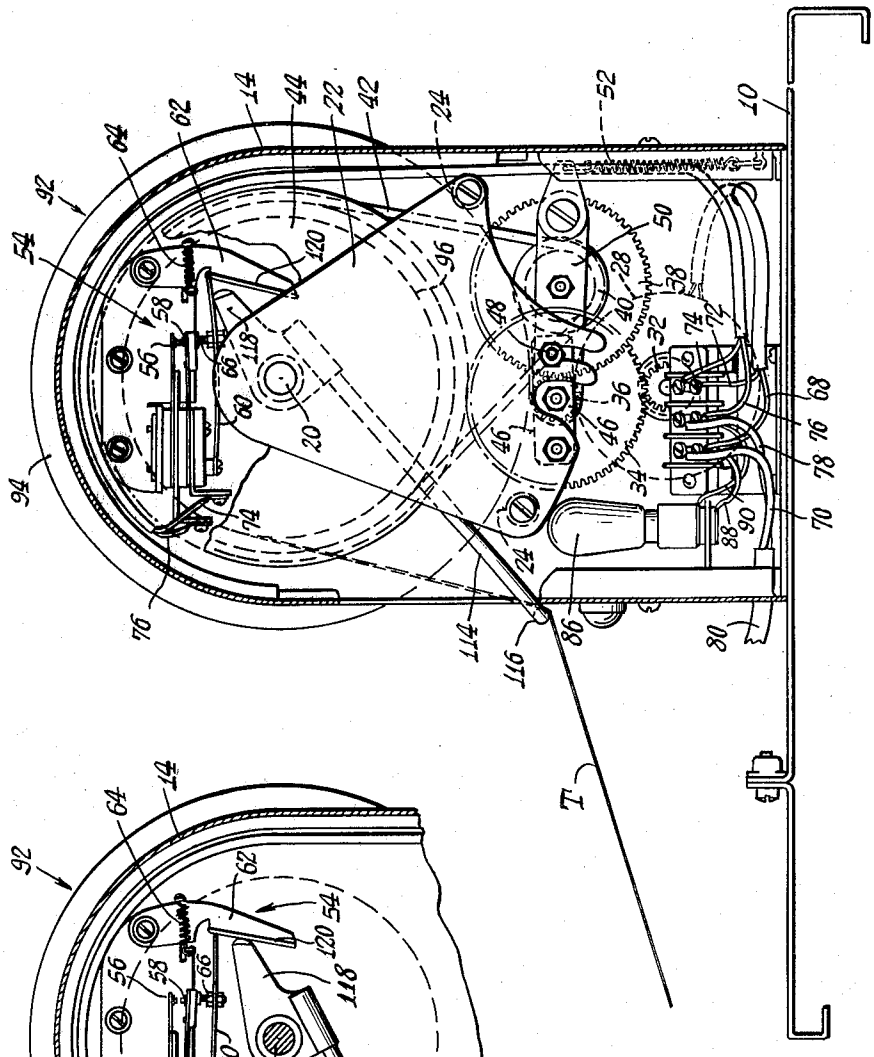
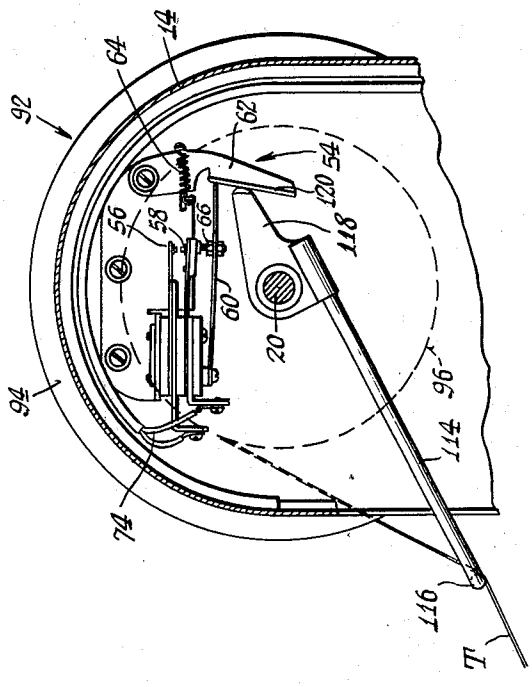


Fig. 4



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TAPE CONTROL WINDER

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6 Claims. (Cl. 242—75.51)

This invention relates to winding, and more especially to the take-up of record tapes as they issue either uniformly or step-by-step from marking or other tape processing machines, for example in business offices.

Equipment heretofore devised for the take-up of tapes as they issue from tape processing machines have had certain drawbacks. In the first place some devices have not been arranged to permit convenient retraction of the tape in order to inspect a tape portion which has already been wound. Where such retraction is possible, it frequently happens that an injudicious backward pull on the tape by the operator may cause the winding element or spool to spin and loosen a large number of the wound convolutions, with attendant inconvenience.

Many of the take-up devices heretofore devised rely upon a slack feeler which opens and closes a switch governing the operation of an electric take-up motor and, in such instances, the switch is in almost continuous operation, starting and stopping the motor. This type of operation of the switch with more or less continuous arcing at the contacts is detrimental to the operating life of the equipment and necessitates frequent shut-downs for repairs. For example, the destructive effect on the switch of the continuous arcing is manifest. Perhaps more important, however, is the operation of the electric motor at a varying and indeterminate voltage below rated voltage due to the partially closed condition of the switch. This switch condition increases the external resistance by an unknown amount, and, under the conditions described, obtains during a large percentage of the running time of the motor to the detriment thereof. Under certain circumstances it would also be possible to develop a feedback situation, i.e. it would be possible for the opening and closing of the switch (which will produce a slight tape jerk) to fall into a period corresponding to the natural period of oscillation of the slack feeler, so that the tape motion would gradually reinforce feeler oscillation until the amplitude becomes such that the normal control functioning breaks down.

It is an object of the present invention to provide a take-up device which is simple in structure and economical to construct, but which at the same time overcomes some or all of the disadvantages hereinbefore set up.

A feature of the present invention is the provision of a take-up mechanism having a reversible reducing transmission embodying a large speed reduction between the motor shaft and the winding spool, which by its reversibility provides for retraction of the tape by the operator when desired, and also due to the speed reducing action applies an inherent resistance to high speed spool rotation which avoids the danger of overspinning the spool during the retraction maneuver.

Another feature of the present invention is the provision of a novel switch actuating mechanism arranged so that the switch controlling the take-up motor will be operated only intermittently and after a significant movement of the slack feeler in either direction, to prevent the rapid alternation which is responsible for excessive switch arcing, poor control of the voltage supplied to the

motor, and the possibility of control breakdown due to mechanical feedback experienced in devices of this kind.

Additional features and advantages will appear as the description proceeds.

In the drawing:

Figure 1 is a side elevation showing a take-up according to the present invention, in association with a diagrammatically illustrated tape processing device.

Fig. 2 is a vertical section to a larger scale of the device of Fig. 1 taken substantially on line 2—2 of Fig. 1, but with the wiring omitted for simplicity.

Fig. 3 is a vertical section of the device of Figs. 1 and 2 taken substantially on line 3—3 of Fig. 2, but with the wiring included.

Fig. 4 is a fragmentary sectional view taken substantially on line 4—4 of Fig. 2, and illustrating the parts in a different position.

Referring to the drawing, the take-up device of this invention includes a base 10 which is arranged to be clamped or otherwise mounted on a supporting surface 11 adjacent a tape processing device 12. Extending upwardly from the base 10 at one side thereof is a housing 14, one wall 16 of which rotatably mounts a spindle 18, having a drive end 20 projecting within the housing and rotatable in a bearing plate 22 which is supported on the housing by suitable spacing posts 24.

In an auxiliary housing 26 is mounted an electric motor 28 having a shaft 30 on which is mounted a pinion 32. A suitable driving train comprising, for example, gears 34, 36 and 38, and pulley and belt drive 40, 42 and 44 is arranged to connect the pinion 32 with the driving section 20 of shaft 18 to drive the latter at a suitable speed. A large ratio of the speed of the motor shaft to that of the shaft 18 is provided by the train 34—42. In one exemplary form of the invention a ratio of about 70:1 has proved highly satisfactory. The train, however, is constructed without worm gearing or other irreversible means so that it may be driven from either end, for reasons which will presently appear. In the form shown, the mounting for the shaft of corotating gears 34, 36 includes a swinging arm 46 which may be set in any desired fixed position by clamp screw 48 to provide the most accurate and efficient mesh between gear 34 and pinion 32. Another feature which is preferably incorporated in the driving train is the mounting of gear 38 and corotating pulley 40 on a shaft carried by a swinging arm 50. The arm 50 swings about the axis of gears 34, 36 so as to maintain gears 36 and 38 in constant mesh. The free end of the arm 50 is urged by a spring 52 is such direction that the belt 42 is held taut and in good driving relation with the pulleys 40 and 44.

A switch assembly 54 is mounted within the housing 14 for controlling the operation of motor 28. The assembly includes a fixed contact 56, a movable contact 58, a switch operating spring arm 60, and an operating arm latch 62. The latch 62 is movable between a latching position in which it holds the operating arm 60 in position to cause making of the contacts 56, 58, and a release position in which it permits the arm 60 to spring away. A spring 64 is provided for urging the latch 62 to latching position. Preferably the spring arm 60 carries an adjustable tappet 66 so that its time of meeting with and moving the contact 58 may be accurately predetermined.

Turning to Fig. 3, one side of motor 28 is connected to the line by conductors 68 and 70. The other side is connected to contact 58 by conductors 72, 74. Contact 56 is connected to the line by conductors 76 and 78. A cable 80 carrying line conductors 70 and 78 leads to a suitable source of electric power. The cable 80 (Fig. 1) is preferably provided with a branch cable 82 carrying conductors which break into either one of the conductors 70 and 78 and connect with a main switch 84 for turning the power to the take-up off or on. By

reason of the cable extension 82, the switch 84 may be arranged at any convenient location near the tape processing device 12 for the operator's convenience. A lamp 86 (Fig. 3) is connected between the conductors 70, 78 by conductors 88, 90 and is lighted whenever switch 84 is closed.

On the spindle 18 is drivingly mounted a spool 92 comprising a head 94 and a drum 96 attached thereto. A head 98 provided with a handle 100 is arranged to removably close the other end of the spool 92 and may be mounted by having a friction fit on the spindle 18, for example. As seen in Fig. 2, a sector 102 of the drum surface is displaceable inwardly of the drum by rocking about pivots 104. A spring 106 is connected as at points 108 and 110 to the sector 102 and head 94 respectively, and serves to urge the sector to its outermost or drum completing position. The sector 102 is provided at its ends with lips 112 which underlie the adjacent drum margins and form therewith light gripping means for receiving and holding the end of a tape being wound.

The spool 92 is arranged for winding a tape T which is fed to it from the processing machine 12 and the winding is controlled by a tape slack feeler 114, in this instance comprising an arm having a portion 116 bent to lie against the upper surface of the tape approaching spool 92. The feeler 114 is maintained in a position to one side of a selected normal tape track by a suitable force. In the preferred arrangement shown, the feeler is held normally in the lowered position by gravity. In other circumstances a spring urging of the feeler may prove desirable. The feeler 114 is pivotally mounted in housing 14 preferably on the portion 20 of spindle 18 and has integrally connected therewith a cam portion 118 arranged in lowered position of the feeler 114 to engage the spring arm 60 and in raised position of the feeler to engage an operating tongue 120 on the latch 62.

In operation, the end of a tape T, after being threaded through the processing device 12, is led under arm 116 of feeler 114 and then clamped to spool 92, as by pressing the sector 102 inwardly against the force of spring 106 and slipping the tape end between one of the lips 112 and the adjacent margin of drum 96 and allowing the sector to return and grip the tape. The operator then closes the main switch 84 lighting the light 86. In the threading process the tape is normally left slack so that feeler 114 will probably be in the lowered or slack tape position of Fig. 3. This means that cam 118 has raised spring arm 60 and, with it, contact 58 until switch 56, 58 is closed. Incidentally, just as the switch 56, 58 was closed, the end of arm 60 moved into a position where it freed the operating tongue 120 of the latch 62 so that the latch was allowed to swing in under the influence of spring 64 and latch the arm 60 in its contact closing position as seen in Fig. 3. This closing action of contacts 56, 58 completes a circuit to motor 28 and winding rotation of the spool 92 commences and proceeds. Assuming that the processing machine 12 is not operating and hence is feeding no tape, the winding will continue until the tape is first brought snug against the arm 116 as in Fig. 3, and then further as the feeler 114 is being raised. Raising of the feeler 114 has no effect upon the contacts 56, 58, however, due to the latched condition of the spring arm 60, until the cam finally strikes the operating tongue 120 releasing the latch 62 as the feeler reaches the Fig. 4 or taut tape position. Release of the latch 62 allows spring arm 60 to drop and permit separation of the contacts 56, 58, thus breaking the motor circuit and stopping the winding. Now if the processing machine 12 operates and starts feeding the tape T, the slack provided will gradually permit the feeler 114 to drop, but without affecting the position of the switch assembly 54, for the latch 62 is now blocked in its right hand position by the end of spring arm 60. The feeler 114 drops gradually until it finally approaches the Fig. 3 position again where the contacts 56, 58 are made by spring arm 60, and the end of arm 60 is raised by cam 118 to a point where it again clears the operating tongue 120 and the arm 60 is thus latched in contact making position.

From the foregoing description it can be seen that each time a winding is commenced, it continues for a significant travel of the feeler and is then stopped. The stopped condition is then automatically held until enough slack accumulates to admit of another worthwhile winding operation. Thus there is no danger of the feeler 116 hovering at the point where the contacts are being rapidly made and broken as in devices heretofore employed. The feeler travel permitted before contact actuation is effected will normally be sufficient to provide for several increments of feed between winding operations where the tape processing device embodies an incremental feed such as a conventional line spacing means.

It should be noted that even in the taut tape position of feeler 114 the arrangement is such that the approaching tape T is bent slightly by the feeler. This provides sufficient leeway in case the spool should drift slightly due to inertia after the motive power is cut off, and would permit the tape to straighten further by raising the freely moving feeler 114 rather than risk breaking of the tape.

If at any time the operator desires to review a portion of the tape, he merely opens main switch 84 (which turns off light 86) whereby the winding tendency is removed and pulls the tape back off the spool 92 as far as desired. The high gearing ratio described makes the motor 28 act as an effective damping brake so that even if the tape is inadvertently jerked, the spool 92 will not spin to throw loose coils of tape which would be difficult to rewind properly. In this connection the reversible gearing described and having a ratio of about 70:1 is preferred. However, any reversible gearing of about 50:1 ratio or more will serve adequately for this purpose. Whenever resumption of winding is desired, the operator merely closes main switch 84 supplying power to light 86 and motor 28, whereupon all of the backed-off tape is rewound until the slack disappears and feeler 116 is raised to Fig. 4 position where winding stops. Thereafter operation continues under the control of feeler 114 as heretofore described.

Whenever the operator wishes to remove the wound tape from spool 92 he severs the tape between the spool and processing device 12, grasps handle 100 and removes the head 98. The coil of tape is then slipped endwise off the drum 96. If the tape is tightly wound, any resistance to removal may be overcome by merely rocking the sector 102 about its pivots 104, inwardly towards the spindle 18 whereupon the tape roll may be readily slid from the drum 96.

From the foregoing description it can be seen that the spring arm 60 and the spring urged latch 62 act as mutually interfering elements so that neither can move to its free, normal position when blocked by the other, and releasing of either one from its blocked position permits it to move to a location where it acts to block the return of the other. The cam 118 is arranged in such a way that near the extremities of its travel it encounters one or the other of these mutually interfering elements and is further so arranged that when the feeler 114 is in a position to release one of the mutually interfering elements, substantial travel is required to move to a position where the other interfering element will be encountered.

Thus the invention provides a novel take-up arrangement in which the disadvantages of prior devices relative to inability to unwind for review or inconvenience in unwinding, and poor functioning due to rapid and unpredictable contact operation are simply and expeditiously overcome.

While the invention has been described in terms of a take-up device, it will be understood that the same principles of feeler control may be applied to a let-off device if the operation of the switch **56, 58** is reversed and the direction of motor rotation is properly adjusted.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A device for controlling tape comprising a spool; an electric motor driving said spool; a pivotally mounted slack feeler for sensing the amount of slack in the tape adjacent said spool and movable between a determinate taut tape position and a determinate slack tape position spaced therefrom; means operated by said feeler for effecting one predetermined condition in the motor circuit when said feeler reaches said slack tape position and additional means for maintaining said one condition until the tape carries the feeler to said taut tape position; said additional means being operated by said feeler for effecting another predetermined condition in the motor circuit when said feeler reaches said taut tape position and for maintaining said other condition until the tape allows the feeler to return to said slack tape position.

2. A device for winding tape comprising a take-up spool; an electric motor driving said spool; a pivotally mounted slack feeler for sensing the amount of slack in the tape approaching said spool and movable between a determinate taut tape position and a determinate slack tape position spaced therefrom; means operated by said feeler for closing the motor circuit when said feeler reaches said slack tape position and additional means for keeping the same closed until the tape carries the feeler to said taut tape position; said additional means being operated by said feeler for opening the motor circuit when said feeler reaches said taut tape position and for keeping the same open until slackening of the tape allows the feeler to return to slack tape position.

3. A device for winding tape fed to it in small increments comprising a take-up spool; an electric motor driving said spool; a pivotally mounted slack feeler for sensing the amount of slack in the tape approaching said spool and movable between a determinate taut tape position and a determinate slack tape position spaced therefrom; means operated by said feeler for closing the motor circuit when said feeler reaches said slack tape position and additional means for keeping the same closed until the tape carries the feeler to said taut tape position; said additional means being operated by said feeler for opening the motor circuit when said feeler reaches said taut tape position and for keeping the same open until the feeler moves back through said determinate slack tape position and reaches said slack tape position as a result of the predetermined advancement of the tape through several small increments.

4. A device for winding tape comprising a take-up spool; an electric motor driving said spool; a pivotally mounted slack feeler for sensing the amount of slack in the tape approaching said spool and movable between a determinate taut tape position and a determinate slack tape position spaced therefrom; an electric switch controlling said motor; a switch closing arm resiliently urged away from switch closing position; a latch for latching said arm in switch closing position resiliently urged to latching position, and having an operating tongue for engaging said slack feeler, said arm and latch constituting mutually cooperating elements; said switch closing

arm being operated by said slack feeler for closing said switch to energize said motor when the feeler is in said slack tape position and said latch holding said switch closed until the feeler is in said taut tape position, said switch closing arm being free of said feeler operation during travel of said feeler between said positions; and said feeler dislodging the latch to release said switch closing arm and deenergize said motor when the feeler is in said determinate taut tape position.

5. A device for winding tape comprising a take-up spool; an electric motor driving said spool; a pivotally mounted slack feeler for sensing the amount of slack in the tape approaching said spool and movable between a determinate taut tape position and a determinate slack tape position spaced therefrom; means operated by said feeler for closing the motor circuit when said feeler reaches said slack tape position and additional means for keeping the same closed until the tape carries the feeler to said taut tape position; said additional means being operated by said feeler for opening the motor circuit when said feeler reaches said taut tape position and for keeping the same open until slackening of the tape allows the feeler to return to slack tape position; and a reversibly operable drive train between said motor and said spool having a speed ratio such that the ratio of motor speed to spool speed falls between about 50:1 to about 70:1, whereby a damping action is effected preventing excessive tape uncoiling in any tape withdrawal from said tape winding device for tape inspection purposes.

6. A device for handling tape for transfer from a source of supply of tape to a tape accumulating spool; an electric motor for driving said tape accumulating spool; a tape-responsive pivotally mounted feeler means for sensing the amount of slack in the tape adjacent said driven spool and interposed between said driven spool and the source of supply of said tape; a switch for controlling said motor and a switch actuating means operable for closing said switch, said feeler means operating said switch actuating means to close said switch upon movement of said feeler means to a drive establishing position in response to the attainment of a predetermined amount of slack in said tape; and additional means for keeping the switch actuating means locked in switch closing position until the tape carries the feeler means away from its position at said predetermined amount of slack in said tape and in response to a predetermined tensioning of said tape to actuate said additional means to release the switch actuating means and hold the latter out of switch actuating position until the tape again attains the predetermined amount of slack necessary to cause said feeler means to again operate said switch actuating means.

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