

Dec. 24, 1935.

R. F. DIRKES ET AL

2,025,679

TAPE PULLER CONTROL

Filed Nov. 16, 1932

FIG. 1

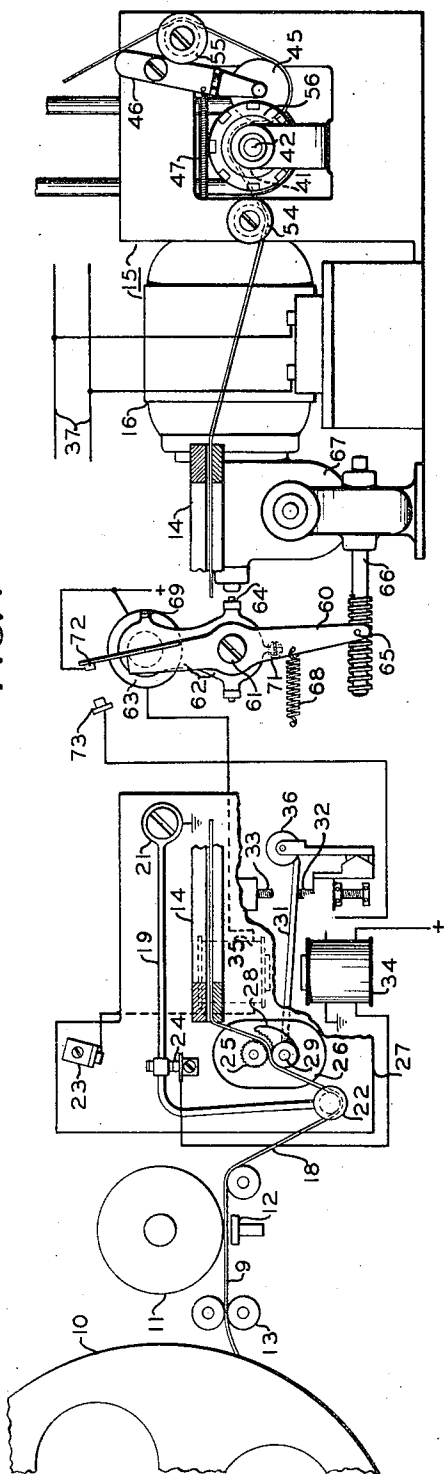


FIG. 3

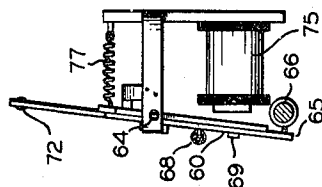
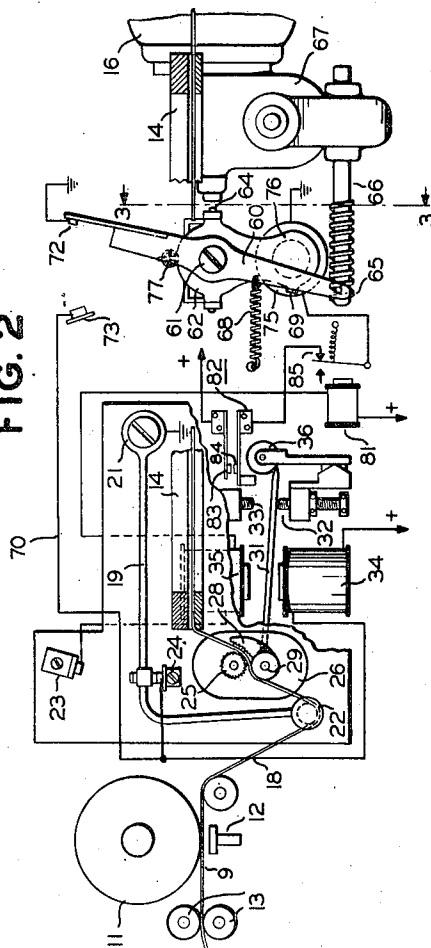


FIG. 2



INVENTORS
R. F. DIRKES
G. I. ROBERTS
BY *Eugene C. Brown*
ATTORNEY

UNITED STATES PATENT OFFICE

2,025,679

TAPE PULLER CONTROL

Robert F. Dirkes, Jamaica, and George I. Roberts,
New York, N. Y., assignors to The Western
Union Telegraph Company, New York, N. Y., a
corporation of New York

Application November 16, 1932, Serial No. 642,964

24 Claims. (Cl. 271—2.3)

This invention relates to a telegraph printer and projecting system in which information printed upon a tape is projected upon a screen for observation. More particularly, the invention relates to means for controlling the feeding of the tape through the projector, so that the projection upon the screen, of the material printed upon the tape, will occur with minimum delay under all conditions of operation.

Several projection systems are in general use in connection with stock or news items in which a ticker is employed for printing the quotations or other items of information upon a specially prepared tape from which they are projected on a screen for simultaneous observation by a large number of persons.

In order to prevent a jerky motion of the projected image it is the practice to employ a tape puller operated by an electric motor which draws the tape through the projector in a continuous movement at substantially the speed at which the tape is ejected from the ticker. Means is arranged to bear on the tape so as to maintain slack in the form of a loop between the ticker and the projector to absorb the jerky motion by which the tape is fed out of the ticker. A control or switch lever having its free end resting in the loop controls the operation of the tape puller, either through contacts closing and opening the motor circuit or through a clutch intermediate the motor shaft and the tape puller, or in some other suitable manner, according to the length of or slack in the loop.

An improved arrangement has been devised for operating the tape puller which eliminates the possibility of the control lever taking, under certain conditions of operation, a critical position with relation to its contacts which would cause the tape puller to start and stop for substantially each character or small group of characters printed, thereby producing a jerky motion on the screen.

The form of this arrangement is disclosed in a copending application of Dirkes et al. Serial No. 554,574, filed August 1, 1931. In accordance therewith, the tape is drawn through the field of the projector by a constantly rotating motor acting through a slip clutch, the tape being arrested, by a gripping or snubbing action thereon, whenever the loop between the ticker and the projector decreases to a pre-determined minimum. The snubber for producing the snubbing action is operated by means of a magnet or other suitable device. The circuit through the magnet is either opened or closed, to effect engagement

of the snubber whenever a loop of sufficient size has accumulated between the tape printer and the projector. When the circuit to the proper magnet has been conditioned so as to disengage the snubber to release the tape and permit the same to start moving through the projector, the snubber cannot be reengaged until the loop of the tape has decreased to a size below that at which it caused the snubber to be released, equivalent to a predetermined number of characters, 10 as for instance, five or six. Conversely, once the snubber has been actuated to stop the tape it cannot be released again until the loop increases in length and amount equivalent to said predetermined number of characters. 15

However, when there is a "slow market" considerable time may elapse before the predetermined number of characters necessary to cause the snubber to be released are printed. During this time the length of the tape between the 20 printer and the projector contains previously printed characters which remain unexposed, causing considerable delay in projecting the items represented by these characters upon the screen. This is very objectionable when dealing with 25 such items as stock quotations from the current market.

One of the objects of the present invention is to provide a tape puller having the characteristics of the arrangement described above, but 30 having in addition a second or supplementary control means operative after a predetermined lapse of time, subsequent to the printing of one or more characters upon the tape after the tape puller has been arrested, to automatically release 35 the tape and permit it to be pulled forward until it reaches its minimum length.

Another object is to provide a tape puller embodying means to pull the tape forward to take up the slack therein, due to the ticker feeding the 40 tape out or otherwise, a predetermined time after the slack occurs.

A further object is to provide a primary and secondary control means for the tape pulling device operative to start same after slack occurs, 45 the primary one of which is controlled by the length of the loop of the tape formed between the printer and the projector or other mechanisms through which the tape is fed, the secondary of which is controlled by time delay means which 50 acts to automatically start the pulling device after a predetermined interval.

According to this invention, the tape is pulled through the field of the projector with a speed substantially the same or slightly above that at 55

which it is fed out by the printer, by a constantly rotating motor acting through a slip clutch, the tape being arrested, by a gripping or snubbing device when the loop between the ticker and the projector decreases to a predetermined minimum and released thereby when the loop increases to a predetermined maximum. The snubber is actuated by upper and lower magnets, one causing it to close or engage the tape, the other causing it to disengage the same. These magnets are controlled by a switch lever pivoted at one end and having its free end resting in the loop of the tape formed between the ticker and projector. The lever is moved between upper and lower contacts by the variations in the length of the loop.

When the ticker lags behind the tape puller the loop shortens until the control lever is brought against the upper contact where the circuit to the snubber closing magnet is completed, causing the tape to be arrested, the snubber being held closed by a suitable detent. Then as the ticker feeds out the tape the loop lengthens, dropping the control lever, opening the upper contact and finally permitting the lever to come against the lower contact where the circuit to the snubber opening magnet is closed.

In addition to the above provisions the arrangement according to this invention has means for setting in operation a suitable time delay switch, as soon as the controlled lever drops sufficiently to open the upper contact. If the length of the loop of tape has not increased sufficiently to cause the same to be released before the elapse of the predetermined time the tape is caused to be released by the operation of mechanism actuated by the time switch. On the other hand, if the loop increases to the predetermined maximum length before the elapse of the time interval the operation of the control mechanism functions in substantially the same manner as described briefly above and set forth in full in the application heretofore referred to.

In order that invention may be more fully understood reference will be had to the accompanying drawing in which:

Fig. 1 is a partially diagrammatic front elevation of a tape puller and control arrangement illustrating one embodiment of this invention;

Fig. 2 is a similar elevation illustrating another embodiment of this invention; and,

Fig. 3 is a side view of the timing mechanism taken along the line 3—3 of Fig. 2.

Referring first to Fig. 1 a tape 9 which is wound upon a reel 10 is fed through a ticker or other printing telegraph apparatus represented conventionally by the typewheel 11, platen 12 and feed rollers 13. The feed rollers serve to step the tape forward intermittently as the printing occurs thereon. These provide a source of tape to be utilized by a projector or the like and controlled by a puller as will presently be described. Obviously, any type of tape printer may be employed, operated either by a uniform code such as the Baudot code, or by step-by-step signals. In addition, other suitable sources may be employed. The tape is drawn over a support 14 forming part of a projector or other tape utilizing device, by means of a tape puller indicated generally at 15, driven by an electric motor 16 through a slip clutch which will be subsequently described. The tape is rewound upon a reel located above the tape puller, not shown.

The tape puller is preferably geared to operate at a maximum speed slightly greater than the

maximum output of the printer and in order that the movement of the tape across the field of the projector will be smooth, a loop 18 of the tape is allowed to form between the printer and the guide 14. The movement of the tape along the guide is controlled in accordance with the size of the loop 18 through the medium of a first control means provided by an autocontrol arm 19, pivoted at 21 and having its depending end 22 resting on the loop of the tape and moving between two electrical contacts 23 and 24 and carrying corresponding contacts to complete a circuit from the aforesaid contacts to ground. When a loop of sufficient size occurs, the arm 19 rests upon its lower contact 24 as shown.

For the purpose of arresting the movement of the tape when the loop decreases to a minimum length, a snubbing arrangement is provided comprising a narrow stud 25 mounted upon a plate 26 carried in turn by the main supporting plate 27 of the control apparatus. A snubbing member 28, carried by a pin 29 journaled in a plate 27, is adapted to be moved into engagement with the stud 25 to grip the tape therebetween. The snubbing member 28 is operated by an arm 31 rigid with the pin 29 and disposed at the opposite or back side of plate 27. The arm 31 forms an armature movable between two adjustable stops 32 and 33 by oppositely disposed electromagnets 34 and 35. The armature is held in either set position by means of a spring pressed jockey roller 36. The magnet 34 has its lower winding included in a circuit with the lower contact 24, its upper winding being included in circuit with the control mechanism as will be presently described. The magnet 35 is in circuit with the upper contact 23.

The motor 16 is operated from the power means 37 and rotates continuously while the projector is being operated. The motor is employed to drive the puller mechanism from one end and the timing mechanism from the other. The tape pulling mechanism includes a roller 41 loosely mounted upon a shaft 42 and driven thereby through a friction clutch arrangement not shown. The shaft 42 is driven through a suitable reduction gear, not shown, connecting the same with the shaft of the motor 16. A roller 45 mounted upon a pivoted arm 46 presses the tape against the feed roller 41 by means of a spiral spring 47. The tape passes from the guide 14 under an idler roller 54, thence between the rollers 41 and 45 and over a second idler roller 55 to a takeup reel not shown. The tension of the friction clutch may be adjusted by the knurled nut 56 to provide a suitable pull upon the tape to cause the same to be drawn readily along a guide 14 when the gripping member 28 is disengaged from the tape but to slip freely when the member 28 is held in contact with the tape.

The timing mechanism including its circuit closing means provides a second control means which operates by causing the snubbing member 28 to disengage the tape after a predetermined time interval. An arm 60 is pivoted about a screw 61 upon the armature 62 of a control magnet 63. The armature of the control magnet is pivoted transversely by means of pin 64 extending through its lower end. The outer end of the arm 60 carries a pin 65 arranged to engage the threads of a wormshaft 66. The wormshaft is driven at slow speed through a suitable reduction gear enclosed in housing 67 and connecting the wormshaft with the shaft of the motor 16. The control magnet 63 when energized operates to hold the pin 65 out of engagement with the

wormshaft. At the same time coil spring 68 holds the lower end of the arm 60 to an extreme left position. The extreme position of the arm is determined by a detent comprising a stud or pin 69 suitably located on the armature 62.

When the magnet is de-energized, the arm 60 is pulled downwardly by means of a coil spring 71 at the lower extremity of the armature 62 so that the pin 65 engages the threads of the wormshaft 66. In this position the arm 60 is carried counterclockwise to an extreme right position by the pin 65 and wormshaft 66, and retained there while the pin plays about the extreme right end of the thread of the wormshaft 66. This action closes contacts 72 and 73. The contact 72 is mounted on a leaf spring extension of arm 60 and arranged to engage contact 73 just before the pin 65 reaches the end of the thread of the wormshaft 66. In this manner, the contacts are held closed notwithstanding the movement of the arm 60 due to the pin playing over the end of the rotating wormshaft thread.

The length of time required for the pin 65 to travel to the end of the wormshaft thread determines the time delay in the operation of the tape puller. The time delay period may, of course, be varied by varying the speed of the wormshaft 66, and the length of thread along which pin 65 must travel before reaching the end.

As will presently be explained, the snubber remains disengaged until contacts 72 and 73 are opened as a result of magnet 63 being energized. When the magnet is energized, the upper end of the armature 62 is pulled downwardly, lifting the pin 65 out of engagement with the threads of the wormshaft. The contacts 72 and 73 are then opened by the arm, being returned to an extreme left position by the coil spring 68. It is held in this position until the armature 62 is released again by the magnet.

The operation of the embodiment of the invention illustrated in Fig. 1 is substantially as follows. Assuming that the loop 18 of the tape has increased until the arm 19 has engaged the contact 24, the tape will be released from between the snubber members 25 and 23 by armature 31 being pulled downwardly past the detent 36 by means of the magnet 34. This action is brought about by the circuit being completed at contact 24 from ground through arm 19 and the lower winding of the magnet 34 to plus battery, energizing the magnet. The tape is now permitted to be pulled forward along the guide 14 by means of the roller 41 carried by the slip clutch. During this time the timing mechanism is in the position illustrated in the drawing. When the tape puller according to the preferred embodiment, is running at a higher rate of speed than the ticker the loop 18 will finally become shortened, lifting the arm 19 until it engages the contact 23. As soon as this takes place a circuit is completed from ground through the snubber actuating magnet 35 and through the timer control magnet 63. Magnet 35 then lifts arm 31 past the detent bringing the member 28 in gripping engagement with the tape stopping the slip clutch operated roller 41. Simultaneously, the energization of the magnet 63 lifts the timer arm 60, disengaging the pin 65 from the threads of the wormshaft, permitting the former to be pulled to an extreme left position.

The tape is held by the gripping or arresting device and the timing mechanism is held in the position just described as long as the arm 19 is held against the upper contact 23 by the tape.

However, as soon as the printer begins operation the loop forms again in the tape and permits the arm 19 to drop away from the upper contact 23, whereupon the circuit to the snubber engaging magnet is opened. The tape is not released, however, because of the fact that the arm 31 is held in its upper position by means of the jockey roller 36 until it is pulled beyond the latter by the action of the lower magnet. As the printer continues to feed out the tape the loop increases until the arm 19 moves down into engagement with the contact 24 at its lower limit of travel. When the arm engages the lower contact the circuit is completed through the lower winding of magnet 34 as previously described. The magnet being energized the arm 31 is pulled downwardly past the jockey roller releasing the tape and permitting the same to be pulled forward until the loop has been shortened again to its minimum length.

It sometimes happens that during conditions of slow market only a few characters are printed at a time on the tape. Under these conditions the arm 19 would drop away from the upper contact 23 but would remain in an intermediate position quite an extended period of time before the loop of the tape accumulated sufficient length to cause the snubber to be released in the normal manner. It is under these conditions that the automatic time delay mechanism comes into operation. As stated above, at the moment that the circuit through the snubber engaging magnet is opened the circuit through the magnet 63, which holds the timer mechanism in inoperative position, is opened also. This permits the timer to be set in operation immediately. The timer thereupon causes the snubber to be released after an elapse of a predetermined time. As already explained, said time period may be of any length desired as determined by the speed of the wormshaft and the length of the thread over which the pin 65 must travel in order to accomplish the release of the snubbing device.

Upon deenergization of magnet 63, spring 71 pulls the lower end of the arm 60 downwardly until the pin 65 engages the worm of the rotating worm shaft 66. The arm 60 then begins to move in a counterclockwise direction at a predetermined rate of speed. As the pin 65 approaches the end of the threads on the worm shaft, contact 72 will be moved into engagement with contact 73 completing the circuit through the upper winding of the disengaging magnet 34, the remaining movement of the arm being taken up in the yieldable extension member upon which the contact 72 is carried. If in the meantime the length of the loop 18 in the tape has increased sufficiently to permit the arm 19 to drop into engagement with the lower contact 24 and complete the circuit through the lower winding of the snubber disengaging magnet 34, the tape will have been released and the time delay will have no effect. On the other hand, if arm 19 has not already engaged contact 24, the completion of the circuit through contacts 72 and 73 will energize the upper winding of the magnet 34 thereby releasing the tape at the end of the predetermined time irrespective of the length of the loop 18. During such time as there is sufficient slack in the tape to prevent the arm 19 from being carried to the upper contact 23, the time delay releasing the magnet 63 will remain deenergized and the arm 60 will be held in contact closing position with the pin 65 playing about the end of the threads on the worm shaft. As soon as the

slack has been taken up sufficiently to bring the arm against contact 23, circuits through magnets 35 and 63 will be completed the former causing the snubber to engage the tape and the latter causing the arm 60 to raise the pin 65 out of engagement with the threads of the worm shaft. The mechanism will remain in this position until slack again occurs in the tape when the cycle of operation will be repeated.

From the above description it will be noted that an arrangement is provided for controlling a tape puller device by means of a loop formed in a tape which is arranged to move an arm between upper and lower limits of travel to cause the tape to be arrested and released in accordance with the length of the loop. In addition, an automatic time delay mechanism is provided for causing the tape to be released and the length of the loop taken up to its minimum or taut position a predetermined time after slack begins to accumulate in the tape, if in the meantime slack does not accumulate sufficiently to reach its maximum during the period required for the time delay mechanism to perform its releasing action. In other words, an arrangement is provided for overcoming the delay occasioned by the ordinary loop control tape puller under conditions of slow market or slow operation of the printer, such as when two or three characters are printed on the tape at widely separated intervals of time, by causing the tape to be automatically released a short period of time after any additional characters have been printed on the tape by each of the successive widely separated periods of printer activity.

Fig. 2 illustrates another embodiment of this invention. The tape pulling mechanism is omitted from this view, it being identical with that illustrated in Fig. 1. The snubber arrangement is likewise substantially identical with that illustrated in Fig. 1. It is shown, however, because of the fact that the circuit arrangement employed to operate the snubber is different.

In this embodiment the arm of the timer switch is normally held by the spring 77 with the traveling pin out of engagement with the worm shaft, whereas in the foregoing embodiment the spring normally holds the pin in engagement with the worm shaft.

The embodiment differs from the foregoing embodiment in that the mechanism for providing the time delay is arranged to comprise a magnet 75 disposed between the pivot point of the movable armature 76 and the worm shaft 66 instead of beyond the pivot point from the shaft. The movable portion of the armature of the magnet is pivoted about a pin 64, passing through the yoke formed by the stationary part of the armature. A traveling arm 60 is pivoted about a screw 61, which secures it to the movable portion of the armature 76. The outer end of the movable portion of the armature is provided with a projection to which a spiral spring 77 is attached so as to exert a force in a downward direction and maintain the lower end of the armature raised so as to hold the pin 65 out of engagement with the worm shaft. A spiral spring 68 holds the lower end of the arm to an extreme left position when disengaged from the worm shaft. The position is determined by a detent comprising a lug 69. With this arrangement when the magnet 75 is energized the pin 65 is brought into engagement with the constantly rotating worm shaft 66, which carries the arm 60 in a counterclockwise direction until the pin has reached the right end of the threaded section of the worm shaft. In this po-

sition a contact 72, mounted at the upper end of a resilient section of the arm 60 closes upon a corresponding stationary contact 73. As soon as a circuit is broken to the magnet 75, the lower end of the armature 76 is released and pulled upwardly by means of the spring 77 disengaging the pin 65 from the worm shaft, whereupon the spiral spring 68 immediately returns the arm to its extreme left position.

The control for the time delay mechanism also differs from that of the foregoing embodiment. It includes a relay 81 with contacts 85 in the circuit of the magnet 75, also a contactor 82 operated from the snubber arm 31. Following out the circuit diagram, the magnet 34 has a winding with plus battery at one end, the other connected to lower contact 24 which cooperates with the control arm 19. The control arm 19 is grounded so as to complete the circuit through the magnet 34 when the loop 18 of the tape has accumulated a sufficient length. The magnet 34 may be also grounded through an auxiliary circuit controlled by the time delay mechanism, as will be presently described. A wire from the contact 24 to the stationary contact 73 of the relay, which may be brought into engagement with the grounded moving contact 72, comprise this auxiliary grounding circuit.

The upper magnet 35 has its winding in a circuit which includes the winding of the relay 81, plus battery, being applied to the outer end of the winding 81, and the circuit being grounded when the upper contact 23 is engaged by the control arm 19. Current is supplied to the time delay operating magnet 75 from plus battery applied to an upper contact 83 of the contact 82. The circuit continues through the lower contact 84 to the contact 85 of the relay 81, the other contact of the relay being neutral. From the latter relay the circuit is completed by being grounded at the outer end of the winding of the magnet 75. In all cases it is assumed that the negative side of the battery supplying current to these circuits is grounded to complete the circuit.

The second embodiment of this invention as just described produces substantially the same type of control for the tape as the first embodiment. Assuming that the loop 18 of the tape is increased until the arm 19 has engaged the contact 24, the circuit through the magnet 34 will be completed, causing the same to pull the arm 31 of the snubber down past the jockey roller 36. This withdraws the gripping member 28 from engagement with the tape, releasing the same and permitting the tape puller mechanism, not shown, to pull the tape through the field of the projector. It will be observed that in this position the circuit through the time delay magnet 75 is opened at the contactor 82 but closed at the relay 81. The significance of this will presently appear.

As the puller takes up the tape the loop 18 will become shortened until finally the arm 19 engages the upper contact 23. This will complete the circuit through the upper magnet 35 and the relay 81. At the same time the contactor 82 will be closed, but the relay 81 on becoming energized opens the line, maintaining the circuit to the magnet 75 open. It will be observed that during all this period the magnet 75, instead of receiving current as does magnet 63 in Fig. 1, remains de-energized while the timing mechanism is held in its normal inoperative position by spring means 77. The arm 19 will remain against the upper contact until additional tape

is fed out from the printer and the loop 18 lengthens slightly. As soon as the loop 18 lengthens to permit the control arm to drop, the circuit to the upper magnet 35 is opened at the contact 23. The snubber, however, is maintained in gripping position by the jockey roller 36. When the last named circuit is opened the relay 81 is de-energized, permitting its armature to be carried against the contact 85 by its bias spring. This completes the circuit to the magnet 75 of the timer, the contactor 82 being held closed as long as the arm 31 is in its upper position, causing the arm 60 to be pulled downward, engaging the pin 65 in the threads of the worm shaft. The arm 60 now begins to travel in a clockwise direction. The timing mechanism having been set in operation, the snubber is actuated after a predetermined time interval if the loop 18 is not lengthened sufficiently during the interval to cause the snubber to release the tape in a normal manner, as when the number of characters printed thereon during the interval are less than the required amount to cause normal operation. The length of the time interval, of course, may be determined by the speed of the worm shaft and the length of the thread over which the pin runs. On the other hand if the loop 18 is lengthened sufficiently to permit arm 19 to come down upon contact 24 before the timing mechanism has actuated the magnet 34 is energized and the tape released when the arm 31 is pulled down over the jockey roller 36. As soon as the arm leaves its upper position the contacts 83 and 84 separate, opening the circuit to timer magnet 75 whereupon the arm 60 would be restored to its rest position, which, it will be observed, is not the case in the previous embodiment. There the timer was not restored until the slack in the tape had been reduced to the predetermined minimum, the pin remaining in engagement with the worm shaft in the meantime.

Assuming that normal release of the tape by the loop control does not occur the pin 65 will travel along the threads of the worm shaft 66 until arm 60 reaches a position where the moving contact 72 is closed against the stationary contact 73, and the circuit through the lower snubber magnet 34 completed, causing the arm 31 to be pulled down releasing the tape. The movement of the arm 31 opens the circuit to the time delay magnet 75 at the contactor 82. As soon as the time delay magnet is deenergized the arm 61 returns to its rest position leaving the tape puller to take up the slack in the tape in the normal manner.

From the above description it will be seen that this embodiment of the invention provides a timing mechanism which causes the tape to be automatically released at the end of the predetermined interval of time if the number of characters printed thereon during such time interval are less than that required to form the full length of the loop 18 for causing normal releasing of the tape. This is particularly advantageous when, during periods of slow market, matter which is represented by the characters in the portion of the loop extending between the printer and the projector would otherwise be prevented from coming into the field of the projector until a sufficient number of characters had been added to the loop to cause the control arm to release the tape through the normal operation. This assumes much importance in connection with posting items, such as stock, when a delay of a few

minutes, or even a few seconds, is quite a consideration.

The foregoing description illustrates two embodiments of this invention for providing time delay means, which are arranged to automatically feed the tape forward after a predetermined time when any slack occurs therein due to additional amount of tape being fed out of the printer. Two means of feeding the tape forward are provided, one of which is controlled by the length of the loop in the tape, and the other controlled by a timing device. It will be obvious to those skilled in the art that means other than illustrated may be employed for accomplishing the results set forth herein. It is desired, therefore, that only such limitations shall be placed on this invention as are imposed by the prior art or set forth in the appended claims.

What we claim is:

1. In combination, a source of tape including means adapted to eject tape therefrom, a support, means for feeding the tape across the support, tape gripping means for arresting the tape to control its motion across the support, first and second means for controlling said gripping means, the first control means being actuated by the slack in the tape between the source and the support to disengage the gripping means when a predetermined maximum amount of slack has accumulated in the tape, and being actuated to engage the gripping means when the slack has been reduced to a predetermined minimum, the second of said means being actuated by a timing device which is set in motion when slack occurs in the tape, said timing device including means for causing the gripping device to be disengaged automatically at the end of a predetermined time interval after slack occurs.

2. In combination a source of tape, means included in said source adapted to eject tape therefrom, a support adapted to extend across the field of a projector, a tape puller for moving said tape along said support, means for arresting the motion of the tape to control its movement along said support in accordance with the amount of tape ejected from the said source of tape, first and second means for controlling the arresting means, means for operating the first control means solely in accordance with predetermined maximum and minimum slack occurring between the source of tape and the support and means for operating the second control means at the end of a predetermined time after any slack greater than the aforesaid minimum occurs in the tape.

3. In combination, a source of tape, a tape support, a tape puller, means for permitting a loop of tape to form between the source and support of a length variable according to the slack occurring in the tape, an arm having its free end arranged to ride in said loop between first and second limiting positions, a first means for arresting the movement of the tape when the arm reaches one limiting position, a second means for releasing the tape when it reaches the other limiting position, and a third means initiated as soon as the arm leaves the first limiting position for automatically releasing the tape at the end of a predetermined interval of time if the tape has not been released during the lapse of said interval by said first means.

4. In combination, a tape supply, a support, a tape puller for moving the tape across said support, means for permitting a loop of tape to form between the tape supply and the support, an arm disposed with its free end riding in said loop be-

tween first and second limiting positions, a tape arrester for controlling the movement of the tape across the support, primary and secondary means for controlling the actuation of the arrester, said arm being included in said primary means, said arm controlling said primary means to cause the tape to be arrested when the arm moves into the first limiting position, and to cause the tape to be released when the arm moves to the second limiting position, said secondary means being controlled by time delay mechanism the action of which is initiated at the time that the arm leaves the first limiting position and which operates to cause the arrester to release the tape a predetermined time after the arm leaves said first position.

5. In combination, a tape supply, a support, a tape puller for moving the tape across said support, a tape arrester for controlling the movement of the tape, means for forming a loop in the tape between the supply and the support, said loop being variable in its length in accordance with the amount of slack occurring between the supply and the support, a first actuating means adapted to move the arrester into arresting position, a second actuating means adapted to move the arrester into releasing position, primary and secondary means to control the actuating means, said primary control means embodying an arm having its free end arranged to ride in said loop between upper and lower limiting positions, means controlled by said arms for operating the first actuating means to arrest the tape when said arm reaches the upper limiting position, and means controlled by said arm for operating the second actuating means to release the tape when said arm reaches its lower limiting position, said secondary control means embodying a time delay device, means to set the time mechanism of said device in operation when said arm leaves its upper limiting position, said time delay device having means actuated after the lapse of a predetermined time for operating said second actuating means to cause the arrester to release the tape.

6. In combination, a source of tape, means adapted to eject printed tape therefrom, a support adapted to be disposed across the field of a projector, a tape puller for moving said tape along the support, means for permitting a loop of tape to form between the source of tape and the support variable in its length in accordance with the amount of slack occurring in the tape, tape puller control means for arresting the action of said puller, a first puller control actuating electromagnet to move said control into puller arresting position, a second control actuating electromagnet for moving said control into releasing position, an arm having a free end arranged to ride in said loop between upper and lower limiting positions, said arm being arranged to complete a circuit to the first electromagnet when it reaches its upper limiting position and to complete a circuit to said second electromagnet when it reaches its lower limiting position, and a time delay device having delayed action means for completing the circuit to said second electromagnet, having a control circuit completed by said arm when in its upper limiting position, the timing function being actuated when said arm leaves its first limiting position to complete the circuit to the second electromagnet at the end of a predetermined time after said arm leaves its upper contact.

7. In combination, a source of tape, a tape

support, a tape puller, means for permitting a loop of tape to form between source and support variable in length in accordance with the slack occurring between the tape and the support, an arm riding in said loop between first and second limiting positions, means for arresting the movement of the tape when the arm reaches the first limiting position, means for releasing the tape when the arm reaches the second limiting position, and time delay means for causing the tape to be released a predetermined time after the arm assumes an intermediate position, said time delay means comprising a constantly rotating shaft having a worm of a definite length thereon, a member arranged to engage said worm and travel to one end of the latter in a predetermined time, said member operating as it reaches the end of the worm to cause the tape to be released, means to normally hold the member out of engagement with the worm, and means to engage the member with the worm as soon as said arm leaves its first limiting position due to slack occurring in the tape.

8. In combination, a source of tape, means adapted to eject printed tape therefrom, a tape support adapted to be disposed across the field of a projector, a tape puller for moving said tape along the support, means for permitting a loop to form in the tape between the source of supply and the support variable in length between a predetermined effective minimum and maximum according to slack occurring in the tape, a first means conditioned by the tape, including an electromagnet for arresting the movement of the tape when the slack reaches a predetermined minimum, second means conditioned by the tape, including a second electromagnet for releasing the tape when the slack reaches a predetermined maximum, and third means conditioned by the tape for releasing the same at the end of a predetermined interval after a slack occurs in the tape of an amount intermediate said maximum and minimum, said third means embodying a constantly rotating shaft having a worm of a definite length thereon, a member arranged to engage said worm and travel to one end of the latter in a predetermined time, means to normally hold the member out of engagement with the worm and means operated as soon as slack occurs in the tape, to engage the member with the worm and hold it in engagement therewith until it reaches the end of the latter, said member operating as it reaches the end of the worm to complete a circuit to said tape releasing magnet and cause the tape to be released.

9. In a tape puller controlled by a loop formed from slack in the tape, a tape arresting magnet and a tape releasing magnet, means actuated by the arresting magnet for arresting the action of said puller and the releasing magnet for releasing said puller, means for energizing the arresting magnet when slack in the tape reaches a predetermined minimum, means for energizing the releasing magnet when slack in the tape reaches a predetermined maximum, and additional means including a time delay device energizing the releasing magnet for automatically releasing the tape a predetermined time after slack greater than the predetermined minimum occurs in the tape, said time delay means embodying a constantly rotating worm shaft having a worm of a definite length thereon, a member arranged to engage said worm and travel to one end of the latter in a predetermined time, said member hav-

ing means cooperating therewith to normally bias it toward an engaging position, electromagnetic means to hold it out of engaging position and means to energize said electromagnetic means simultaneously with the tape arresting magnet and means to de-energize said electromagnetic means as soon as the arresting magnet is de-energized so that said worm engaging member is thereupon released for engaging the worm, said member operating as it reaches the end of the worm to complete a circuit to the tape puller releasing magnet for automatically releasing the tape at the end of the predetermined time interval.

10. In combination a source of tape, a tape utilizing device embodying a puller for pulling the tape from the source into the utilizing device, the tape being supplied from said source at a rate independent of the utilizing device, means for arresting the action of the tape puller when the tape becomes taut between the source and the utilizing device, time delay means for causing the tape to be released a predetermined time after slack occurs between the source and the utilizing device, a second means for causing the tape to be released if slack greater than a predetermined amount accumulates before the tape puller is released by the time delay means.

11. In combination a source having means for supplying tape at a variable rate, a support, means for drawing the tape over said support, means for rendering said drawing means effective when a predetermined maximum slack occurs in the length of tape between said support and said tape supplying source, means for rendering the drawing means ineffective when a predetermined minimum slack occurs in said length of tape, and means for rendering the drawing means effective a predetermined time after slack occurs of an amount intermediate said minimum and maximum in said length of tape.

12. In combination a source supplying tape at an indeterminate rate, a utilizing device for said tape arranged to utilize the tape at a predetermined rate slightly greater than the greatest rate of supply, means to permit a loop to form in the tape when slack occurs between the source and utilizing device, said utilizing device embodying take-up means to gather the tape after it has entered the utilizing device, means to control the take-up means in accordance with the amount of slack in the tape, said control means embodying means operative when slack in the tape reaches a predetermined minimum to arrest the take-up means and means to release the take-up means so that the tape may be taken up after a loop of the predetermined length has formed, and means comprising a time delay device to release the take-up means a predetermined time after slack occurs in the tape of an amount intermediate said minimum and maximum.

13. In combination, a tape supply, a support, a tape puller for moving said tape across said support, means for forming a loop of tape between said supply and support variable in length in accordance with slack occurring in the tape between the supply and support, an arm having its free end riding in said loop between first and second limiting positions between which it is moved as the length of the loop varies between a predetermined maximum and minimum, means for arresting the movement of said tape, oppositely disposed magnets adapted to move said arresting device into engaging position and into releasing position respectively, separate circuits to the respec-

tive magnets, said arm being arranged to complete the circuit to the arresting magnet when the loop of the tape carries the arm to its first limiting position, said arm being arranged to complete the circuit to the releasing magnet when the loop of the tape carries the arm to the second limiting position, auxiliary means for completing the circuit to the releasing magnet, said auxiliary means embodying a time delay device arranged to complete said circuit at the end of a predetermined lapse of time after the circuit to the engaging magnet is opened.

14. In combination a tape supply, a support, a tape puller for moving the tape across said support, means for forming a loop of tape between said supply and support variable in length in accordance with slack occurring in the tape, an arm having its free end riding in said loop and having upper and lower limiting positions between which it moves as the length of the loop varies between a predetermined minimum and maximum, an arresting device, upper and lower magnets disposed oppositely and having a common armature adapted to move said arresting device into and out of engaging position, means cooperating with said arm for completing a circuit through the upper magnet for moving said armature into an arresting position when the arm reaches its upper limit, means cooperating with said arm for completing a circuit through the lower magnet for moving said armature into releasing position when the arm reaches its lower limiting position, and auxiliary means for completing a circuit through said lower magnet when said arm is in an intermediate position, said auxiliary means embodying a time delay device having an electromagnet for holding the same into inoperative position, and means for opening the circuit to said magnet at the instant when the said arm leaves its upper limiting position to assume an intermediate position, said time delay device operating to complete the circuit through the tape arrester releasing magnet a predetermined length of time after said arm has left its upper limiting position.

15. In combination a tape supply, a support, a tape puller for moving the tape across said support, means for forming a loop of tape between said supply and support variable in length in accordance with slack occurring in the tape, an arm having its free end riding in said loop and having upper and lower limiting positions between which it moves as the length of the loop varies between a predetermined minimum and maximum, an arresting device, upper and lower magnets disposed oppositely and having a common armature adapted to move said arresting device into and out of engaging position, and means for completing a circuit through the arrester engaging magnet when the arm reaches its upper limiting position, means for completing a circuit through the arrester releasing magnet when said arm reaches its lower limiting position, and auxiliary means for completing the circuit to the releasing magnet a predetermined time after said arm assumes an intermediate position, said auxiliary means including time delay device, electromagnetic means for initiating the time measuring function of said device and means for closing the circuit to said magnetic means as soon as said arm leaves its upper limiting position.

16. In combination, a tape supply including means to eject tape therefrom at a variable rate, means for pulling the tape forward after it has been ejected, means providing for a loop to form in the tape between said supply and pulling

means variable in accordance with the slack occurring between the supply and pulling means, a first control means for arresting the action of the puller when it has reduced the loop to a predetermined minimum and for restoring the action of the puller when a predetermined maximum has accumulated, and a second control means for restoring the action of the puller at the end of a predetermined time after the loop begins to accumulate if, in the meantime, it has not reached the predetermined maximum.

17. In combination, a tape supply including means to eject tape therefrom at a variable rate, means for pulling the tape forward after it has been ejected, means providing for a loop to form in the tape between said supply and pulling means variable in accordance with the slack occurring between the supply and pulling means, a first control means for arresting the action of the puller when it has reduced the loop to a predetermined minimum and for restoring the action of the puller when a predetermined maximum has accumulated, and a second control means for restoring the action of the puller at the end of a predetermined time after the loop begins to accumulate if, in the meantime, it has not reached the predetermined maximum, both of said control means being governed by means actuated in accordance with the slack in the loop.

18. In combination, a tape supply including means to eject tape therefrom at a variable rate, means for pulling the tape forward after it has been ejected, means providing for a loop to form in the tape between said supply and pulling means variable in accordance with the slack occurring between the supply and pulling means, a first control means for arresting the action of the puller when it has reduced the loop to a predetermined minimum and for restoring the action of the puller when a predetermined maximum has accumulated, and a second control means for restoring the action of the puller at the end of a predetermined time after the loop begins to accumulate if, in the meantime, it has not reached the predetermined maximum, both of said control means being governed by means riding in the loop.

19. In a tape handling system, a tape supply including means to eject tape therefrom, means for pulling the tape forward after it has been ejected, means providing for slack to occur in the tape between said supply and pulling means, means for arresting the movement of the tape when the slack is reduced to a predetermined amount, and means operating independently of the amount of slack accumulation to initiate the action of said pulling means at the end of a predetermined period of time after the slack has increased beyond said predetermined amount.

20. In a system for handling tape ejected from

a printer as characters are printed thereon, a first means operative to cause the tape to be advanced from the printer at the end of a predetermined time after a character is printed, a second means operative to cause the tape to be advanced if a predetermined amount of slack should occur in the tape before said first means becomes operative.

21. In combination, a source of tape including means to eject tape therefrom at a variable rate, pulling means for advancing the tape from the source, first and second control means operative alternately to control said pulling means, one of said control means being arranged to act in accordance with the amount of tape accumulated between the source and the pulling means, the other of said control means arranged to act in accordance with the time which has elapsed since the first ejection of tape occurring during a period in which the action of the puller is arrested.

22. In combination, a tape supply including means to eject tape therefrom at a variable rate, means for advancing the tape from the source, means for rendering the advancing means ineffective when a taut condition occurs between the advancing means and the supply, primary and secondary control means operative to initiate the action of the advancing means after the taut condition has been relieved by the ejection of tape, said primary means operative to restore the effectiveness of the advancing means a predetermined time after a taut condition has been relieved, said secondary means operative to restore the effectiveness of the advancing means before said primary control when the interim slack reaches a predetermined amount.

23. In a tape handling system, a source of tape having means operative to eject the tape therefrom, means for advancing the accumulated ejected tape, a timing device, said device comprising means which passes through a complete timing cycle, means initiated by any ejection of tape from said source independently of the amount of tape accumulated for starting said timing device through said cycle, and means operated at a predetermined point in said cycle for starting the operation of said advancing means.

24. In a system for handling tape ejected from a printer as characters are printed thereon, means for advancing the accumulated printed tape, a control for the advancing means embodying means which initiates a time delay means upon the printing of the first character after all the printed tape has been previously advanced, said means acting independently of the number of characters printed to start the operation of the advancing means a predetermined time after said first character is printed.

ROBERT F. DIRKES.
GEORGE I. ROBERTS.