

[54] **DEVICE FOR FORMING RESERVES OF A TAPE**

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[22] Filed: Feb. 19, 1974

[21] Appl. No.: 443,570

[30] **Foreign Application Priority Data**

Mar. 2, 1973 Italy 12494/73

[52] U.S. Cl. 226/11; 226/34; 226/114; 226/118; 242/182

[51] Int. Cl. B65h 17/42

[58] Field of Search 226/1, 11, 12, 44, 91, 226/113, 114, 95, 118, 34, 195; 242/182, 183, 184, 185, 58.4

[56]

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[57]

ABSTRACT

Mechanical tension regulator means together with a temporary storage means having a vacuum type feed-in and feed-out control means for providing a continuous feed of a flexible material tape maintained under controlled tension to a continuous demand machine from a supply source where the tape is wound on bobbins, and tape feed and splicing means are provided.

6 Claims, 3 Drawing Figures

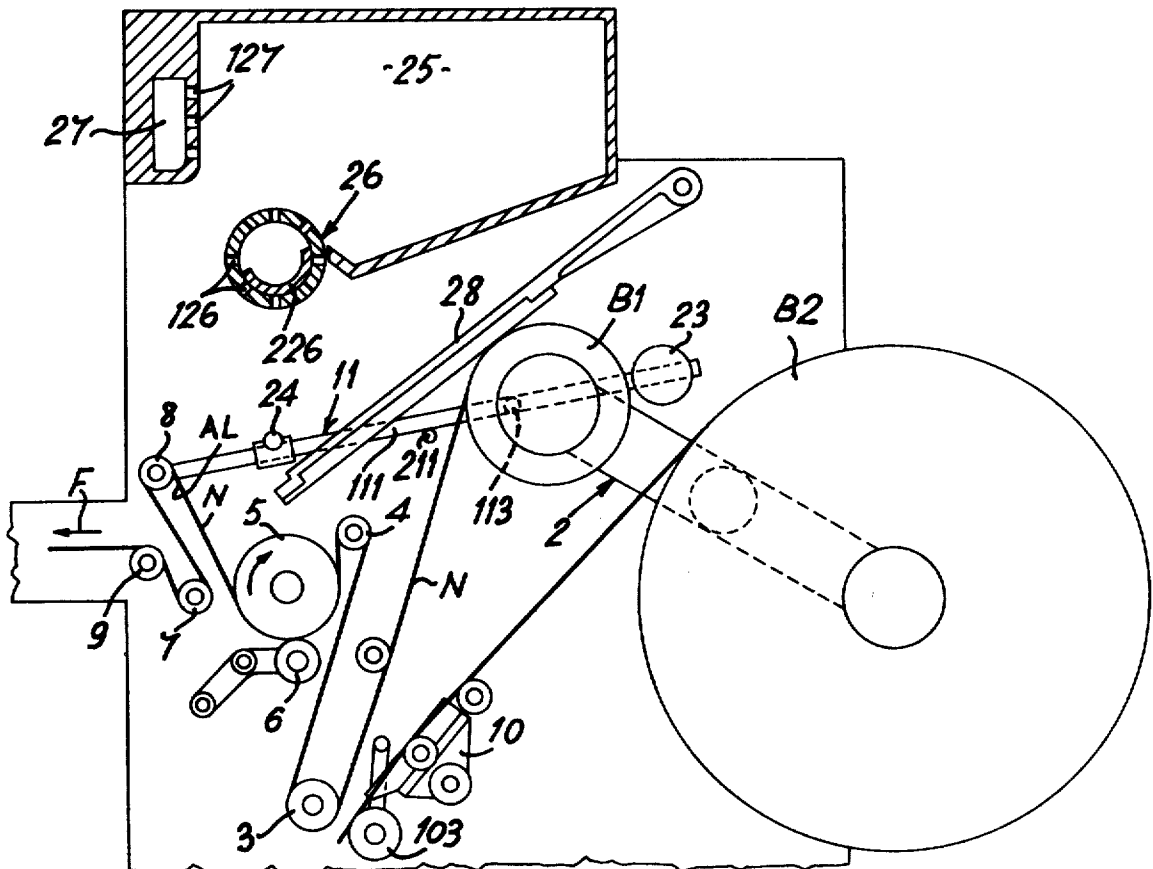
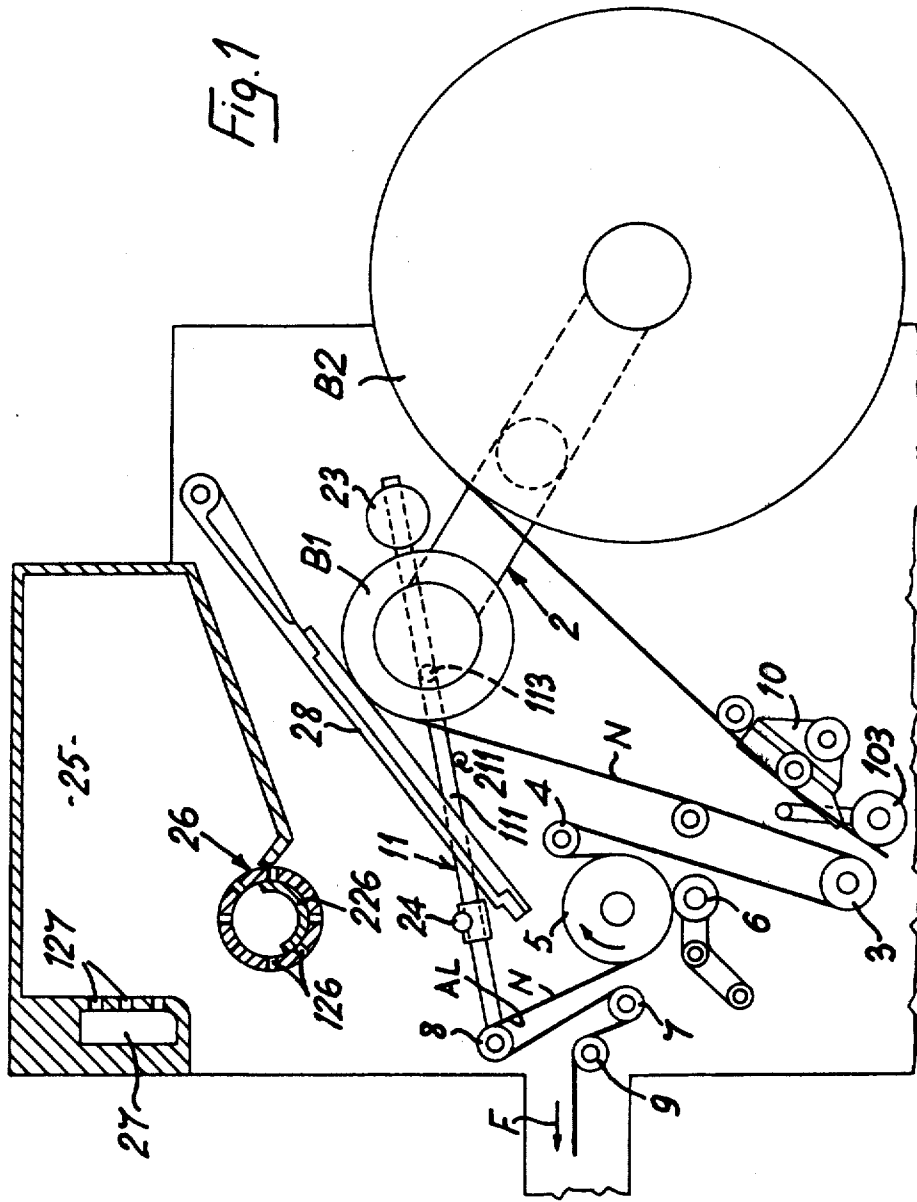
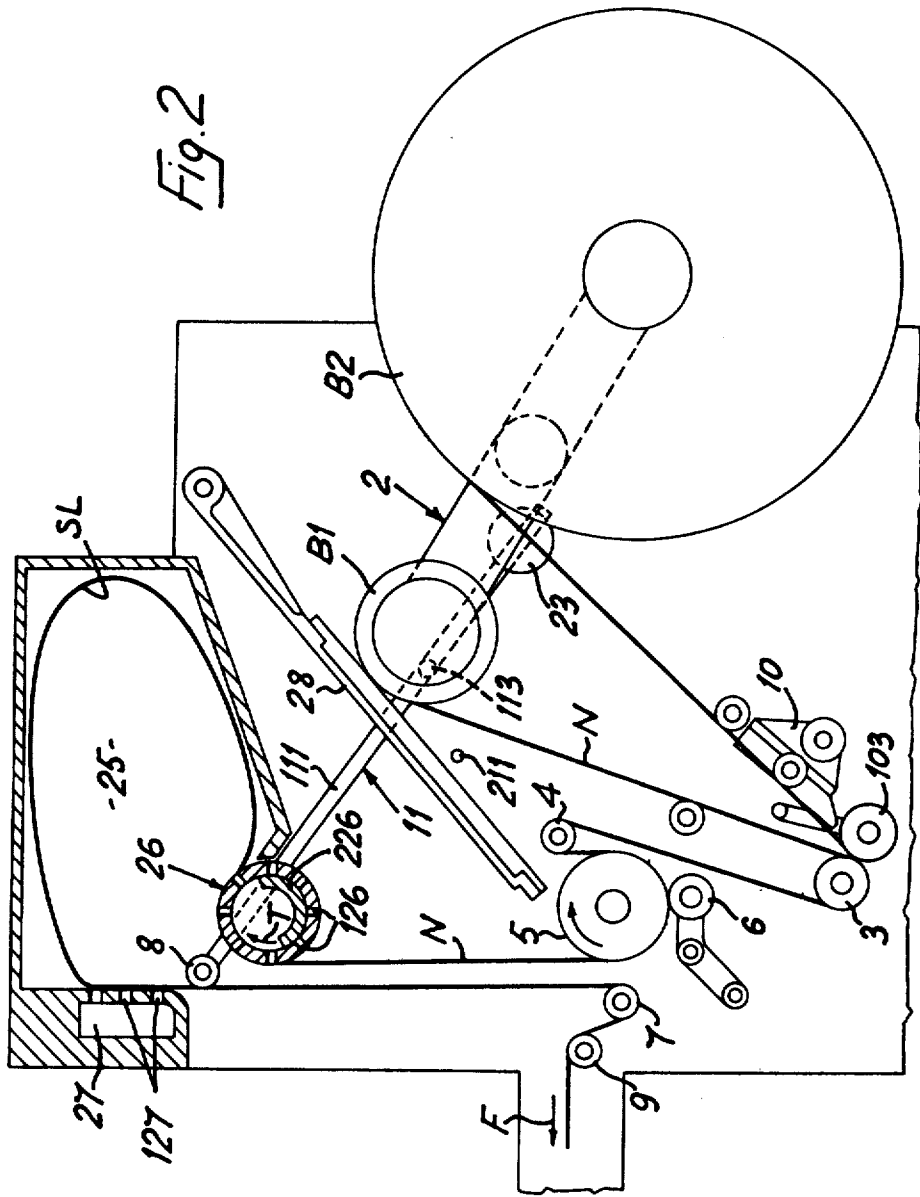
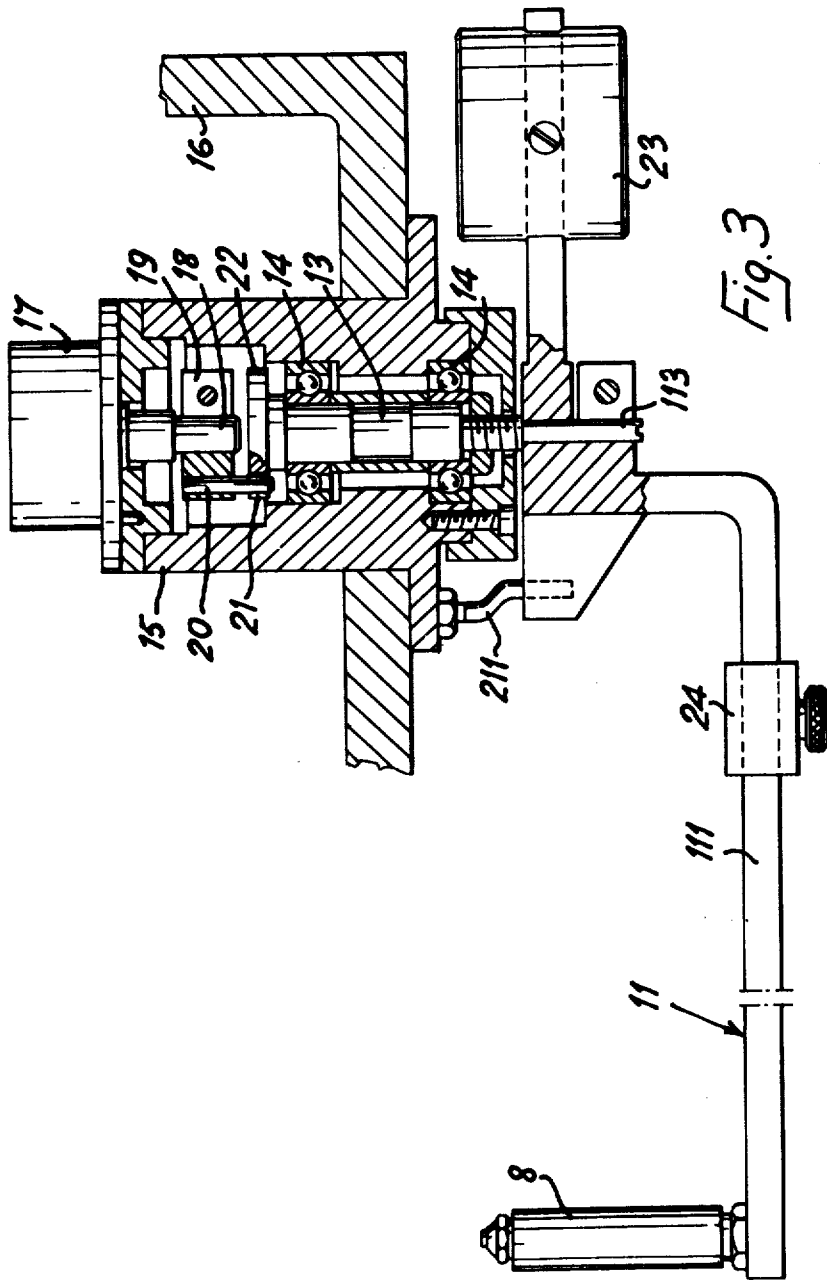


Fig. 1







DEVICE FOR FORMING RESERVES OF A TAPE

This invention relates generally to providing a machine with means for continuously feeding of a strip or tape-shaped material from a source to a point of use and more particularly to such means which permits continuous operation while a depleted bobbin of such material is replaced by another.

Certain machines such as cigarette makers and the like require an uninterruptedly feed of a tape-shaped material. In cigarette makers, a continuous cut tobacco braid is longitudinally wrapped in a paper tape to form what is called a "continuous rod" which is successively cut into equal segments to provide individual cigarettes. These machines require the paper tape provided by bobbins, to be fed in a substantially continuous manner to avoid stopping the machine every time a tape bobbin is depleted and must be replaced by a new bobbin.

Flexible tape material feeders and splicers generally are not new and have been proposed for this purpose. These devices provide a machine with regular tape feed and automatic splicing of the trailing end of the tape of a depleted bobbin to the leading end of the tape of a stand-by bobbin. Thereafter, the full and empty bobbins are operatively changed so that a full bobbin is always in an unwinding condition, while the empty bobbin will eventually be replaced with a full bobbin. The leading or starting end of the tape of the replacement is then conveniently arranged and positioned for the subsequent automatic splicing operation. However, for appropriate operation of a tape feeding device of a cigarette maker, the tape must be kept under constant tension and must be uninterruptedly fed at a preset rate even during automatic splicing and replacing depleted bobbins.

One object of the present invention is to provide for a machine a method to control and maintain the tension of a tape moving longitudinally and continuously from a main feeding source in which the tape is loaded in bobbins, said tape being pulled forward along a feed path to a machine, and for automatically forming an extemporary reserve of tape in the shape of a tortuous and loose loop which allows the tape to be fed uninterruptedly, under controlled tension, even during periods of inactivity of the main feed source when a depleted bobbin is replaced by a new bobbin involving the need of splicing the respective tape ends of said bobbins.

Another object of the present invention is to provide the foregoing method in which the formation of this reserve is obtained by pneumatic feeding means, always maintaining the tension of the tape under control while the tape is longitudinally pulled forward along the feed path by temporarily transferring the tension adjusting action from a normal fluctuating-loop tension equalizing device to a pneumatic tension regulator which is operatively active in concomitance with the formation of said extemporary tape reserve, by spontaneously releasing tape from this reserve to the said feed path according to the required preset rate of feed, increased by an amount which matches the temporary increases of the production speed of the machine.

And another object of the present invention is to provide for a machine means or a device for the uninterrupted feed of a tape of flexible material while it is pulled longitudinally with a controlled tractive force along a feed path from a source where the tape is

loaded on bobbins and is regularly unwound during feeding to a point of use of the machine requiring a continuous and regulated feed of the tape.

Still, another object of the present invention is to provide the foregoing means or device comprising at least a mechanical tension regulator for variable loop formation and which engages the tape at a section of the feed path located downstream of a tape pulling means which extracts the tape from its source and guides it to form a loop the depth of which is automatically changed by said mechanical tension regulator in agreement with possible fluctuations of the actual rate of feed required at the point of use of the machine, as compared to a preset rate of feed, to maintain a constant tractive force as a consequence of the forward pulling of the tape along said feed path; a storage means suitable for accommodating a reserve of tape in the shape of a continuous, tortuous and loose loop, and having a tape lead-in/lead-out opening which is defined between the periphery of a rotary pneumatic drum associated to actuating means capable of causing it to rotate to induce the tape to enter, from the pulling means, into the storing means, and an aperture which holds the tape, by suction as it leaves the storage means and upstream of the path where the tape is engaged by the mechanical tension regulator.

And still, another object of the present invention is to provide the foregoing means or device wherein the holding force exerted on the tape by pneumatic suction through the aperture permits the tape to move forward on the aperture with frictional resistance which is substantially equal to the predetermined tractive force which can be allowed for the tape; the mechanical tension regulator for loop variation and storing means are operatively correlated to each other so that a controlled movement of the mechanical regulator will move the loop to a position where the pneumatic drum and the pneumatic aperture take by suction the paper tape from the mechanical regulator; sequence coordinating means is provided to rotate the pneumatic drum at a peripheral speed higher than the maximum speed of the tape pulling means so that the temporary tape reserve will progressively be formed in the storage means while suction through the aperture maintains at the preset tractive force in the tape as it continues to move from the storage means towards the point of use of the machine to which it must be fed.

The foregoing and other objects and advantages will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawing wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for illustration purposes only and is not to be construed as defining the limits of the invention.

FIG. 1 is a schematic front elevational view of an embodiment of a device in accordance with the invention as it appears during the normal machine operation when the paper tape is fed directly and under controlled tension, from the bobbin feeder to the point of use of the machine.

FIG. 2 is a view similar to that of FIG. 1, with the novel device as it appears when a tape bobbin is about to deplete and a temporary reserves is formed while the tape, under controlled tension, continues to be uninterruptedly fed.

FIG. 3 is a plan view partly in section, which illustrates more particularly a loop forming mechanism, particularly adapted to the invention.

Inasmuch as a preferred embodiment of the present invention is in cigarette making machines, it will now be described in such an environment. Referring now to the drawings and particularly FIGS. 1 and 2, a paper tape N is continuously fed from a bobbin B1, fitted to a main tape type feeder 2, to a cigarette maker (not illustrated), along a feed path along which the paper tape moves and is guided in the direction indicated by the arrow F to a point of use of the machine.

The feed path from the tape feeder 2 is defined by a set of rollers 3, 4, 5, 6, 7, 8 and 9. A splicer 10 is provided with a roller 103 which moves toward and away from roller 3 and cooperates therewith to splice the trailing end of the web N when the bobbin B1 is substantially depleted to leading end of the web or tape of bobbin B2. Thereafter, the tape feeder or support 2 is rotated 180° so that the bobbin B2 assumes the position of bobbin B1, as shown, and bobbin B1 is replaced with a new bobbin with tape to be spliced to the trailing end of the tape of bobbin B2 when depleted. This tape supply and splicing means is more fully shown, described and claimed in my U.S. Pat. No. 3,738,587 which issued June 12, 1973 and is assigned to the same assignee as is this application.

Roller 4 is an idler which guides tape N round a pulling roller 5 which is driven by a variable speed motor (not shown) interlocked with the operation of the cigarette maker (not shown) so that the peripheral speed and direction of roller 5 appropriately feeds in the direction indicated by arrow F and substantially corresponds with the advance speed of a tobacco braid being produced in this machine. Accordingly, the paper tape N is fed to the cigarette maker at approximately the same speed as the tobacco braid is produced. Thus, appropriate conditions exist for wrapping and sheathing the braid in a tube of such tape to form the well known continuous cigarette rod. A pressing roller 6 cooperates with pulling roller 5 to prevent possible slippage of the tape N pulled or drawn from the appropriate bobbin which, in this instance, is bobbin B1.

The tape N leaving roller 5, and before engaging idlers 7 and 9 which define the inlet end of the feed path to the cigarette maker (not shown), passes round a roller 8 which rotatably mounted on the end of an arm 11 of a device which maintains the tension exerted on the tape as a result of the pulling action substantially constant as the tape moves along the feed path. Referring particularly to FIG. 3, arm 11 of the device which the tension constant on the tape N is keyed at an intermediate point to a spindle shaped end 113 of a shaft 13 which is mounted rotatably in bearings 14 housed in a bushing 15 which is mounted stationary in the frame 16 of the bobbin feeder or support 2. Fitted to the bushing 15 is also the case of a potentiometer 17 which has a sliding contact actuation pin 18 coaxially aligned with shaft 13 and provided with a collar 19 into which a pin 20 is driven; the pin extending parallel to the pin 18 and outwardly from collar 19 until it engages an opening 21 in a flange 22 fastened to the end of the shaft 13 opposite from its spindle end 113.

A counterweight 23 is fastened to the end of the arm 11 opposite from the end on which the roller 8 is mounted while on that part 111 of arm 11, opposite from counterweight 23 there is slidably mounted a cali-

bration weight 24 which can be manually positioned and subsequently locked in conformity with a maximum required value of the tractive force admissible on tape N which passes around the idle pin 8. In other words, the calibration weight 24 is movable along part 111 of arm 11 an appropriate distance from the spindle end 113 of shaft 13 to a desired position where the net effect on the arm 11 provides the preset tension on the tape or web N. The calibration weight 24 is then locked in position. The armor compensator 11 being so adjusted or balanced by the weights 23 and 24 tends to move the roller 8 upwardly thus forming a loop AL in the tape N between the rollers 5 and 7.

Each time the tractive force exerted on tape N which is pulled or drawn forwardly along the feed path changes because of fluctuations of the continuous rod production speed and the peripheral speed of pulling roller 5 is constant, the arm 11 will appropriately rotate and move the roller 8, commonly known as a dancer roller, upwardly or downwardly thereby decreasing or increasing the size of the loop AL to absorb short excess tape lengths or to release short needed tape lengths and maintain a constant tension on the tape N when the tape feed rate fluctuates.

The potentiometer 17 is operatively connected in a regulator detector circuit (not shown) which controls the speed of a motor (not shown) motor driving pulling roller 5 so that the movement of arm 11 and the corresponding rotation of shaft 13 and pin 18 causes in the potentiometer a fractionary adjustment which changes the motor speed as required to cancel the effect of the tape fluctuation which caused the arm 11 to move. Thus, for instance, a decrease in the speed of tape resulting from a decreased speed of the continuous tobacco rod in the maker will cause a temporary excess of tape along the feed path. The excess tape N will be absorbed by the compensator 11 by increasing the size of the tape loop AL due to the upward movement of the dancer roller 8. This movement will, however, act through the potentiometer 17 on the circuit regulating the speed of the motor driving roller 5 to decrease the speed of roller 5 commensurate with the said decrease of the speed of the rod being produced by the maker.

Associated to the main paper tape feeder assembly 2 is a storing unit 25 which consists of a box type housing, having a lead-in/lead-out aperture defined between the periphery of a suction drum 26 and a pneumatic port 27. This aperture is so arranged that roller 8 enters into it when arm 11 has the greatest upward inclination and the roller 8 is at its maximum elevation. The periphery or shell of the suction drum 26 is provided with a plurality of holes or ports 126 which communicate through the drum cavity with a suitable vacuum source (not shown). A shoe 226 is mounted internally against part of the periphery of drum 26, intercepts suction through those holes 126 disposed adjacent the shoe and in a selected angular extension of the periphery. Drum 26 is mounted for rotation on its own geometrical axis and is rotatably driven so that its peripheral speed is at least close to the maximum speed at which the pulling roller 5 can be driven.

When a bobbin B1, being unwound, is close to depletion or is close to the conditions in which it must be considered depleted, an element 28 which senses the actual quantity of tape still existing in said bobbin, controls the increase of the peripheral speed of pulling roller 5 beyond the speed correlated with the actual rate

of tape feed required at that moment by the maker. Accordingly, arm 11 is inclined upwardly and elevates the roller 8, since the opposing adjusting action of the control circuit with the potentiometer 17 has obviously already been deactivated.

In conjunction with this movement of arm 11 which raises roller 8, suction drum 26 is caused to rotate in the direction indicated by arrow T (see FIG. 1) and suction is provided to the drum 26 and port 27. Thus, when roller 8 is about to enter the opening defined between drum 26 and the rounded edge of port 27, tape N of the loop AL at the roller 8 is taken or removed from the roller by suction of drum 26 on one side and by suction of port 27 on the other. Also the rotational speed of drum 5 will have been brought to its maximum so that the pneumatic pulling action of the vacuum drum 26 will form in the storage area 25 a temporary reserve of paper tape having the shape of a long meandering, loose and tortuous loop SL, which occupies the storage area 25 and which continuously supplies tape to the maker at the preset rate of feed and under constant tension. In other words, at the same time, tape N continues to be released by said storing area to the maker, at the rate of feed requested by the maker, it is pulled or drawn across holes 127 to which they tend to adhere to because of the suction available in port 27. Thus suction is so adjusted that the pulling effort which must be applied to the paper tape to make it slide on the perforated surface of port 27 is substantially equal to the pulling effort for which the arm 11 and dancer roller 8 have been calibrated.

On the other hand, the suction retaining force exerted by drum 26 on the tape N arriving from the pulling drum 5 will permit the tape to slide on without tearing or breaking the tape in case the peripheral speed of drum 26 becomes higher than that of drum 5. Thus a temporary tape reserve is formed while the tape is always fed continuously, with a controlled pulling force or tension, to the cigarette maker.

Finally, when bobbin B1 is completely depleted or has reached the condition in which it must be considered depleted, pulling roller 5 is stopped and the splicer 10 is actuated to splice the trailing end of the tape of bobbin B1 and the leading end of the tape of the new stand-by bobbin B2. While these operations are under way the tape is, therefore, fed continuously and at a constant tension from the storage area 25. Subsequently, the pulling roller 5 is re-started and its speed is progressively increased to the desired predetermined speed which corresponds to the continuous cut tobacco braid advancing speed. When the extemporary tape reserve in storage area 25 is close to depletion, tape N drops across the roller 8, and arm 11 moves down again resuming its normal functions of a loop regulator.

Although but a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may also be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. Apparatus for maintaining uninterrupted the feed of flexible material tape advancing longitudinally, pulled by a controlled tractive force along a feed path from a main tape feed source where the tape is unwound from a bobbin as it is fed to a machine which re-

quests a continuous and regulated tape feed, comprising tape pulling means for withdrawing the tape from the main feed source, a variable loop forming mechanical tension regulator engaging the tape and forming a loop thereof in said feed path downstream of a tape pulling means, the size of the loop being automatically changed by the mechanical tension regulator in response to fluctuations of the actual rate of feed requested by the machine compared to a predetermined rate of feed by said tape pulling means to keep a constant tractive force in the tape, a storage means suitable for accommodating a tape reserve in the shape of a continuous tortuous and loose tape, said storage means having a tape lead-in and lead-out opening with the periphery of a rotary pneumatic drum driven at a controlled speed to move the tape from the pulling means to the storage area and suction port means for holding the tape on the side of the path leading to the machine and downstream of said mechanical tension regulator, the retaining force exerted on the tape by pneumatic suction through said port means permitting the tape to slide forward on said port and providing a forward motion frictional resistance substantially equal to the predetermined rate of tractive force controlled by said mechanical tension regulator, said tension regulator and said storage means being operatively associated with each other so that said mechanical regulator moves the loop to a position where said pneumatic drum and said pneumatic port means removes said tape from said mechanical regulator, sequence coordinating means for rotating said pneumatic drum at a peripheral speed which is higher than the maximum speed of said tape pulling means to form a temporary tape reserve in said storage means while the suction from said port means maintains the tractive force on the tape which continues to be fed from said storage means to the machine.

2. Apparatus according to claim 1, and said mechanical traction regulator being separated from said storage means and being operated to form a loop and to guide said loop towards the tape lead-in and lead-out opening of said storage means when required to allow the loop tape to be taken by suction by the pneumatic drum and by the pneumatic port means which define the said opening.

3. In apparatus for providing a continuous feed path for a flexible material between a main tape source including pulling means for unwinding the tape from a bobbin and a machine having a continuous demand for such tape, comprising mechanical regulator means engaging and forming a loop in the tape between the tape source and the machine, said regulator means being operable in response to fluctuations in demand of the machine to maintain the tape under a substantially constant tension, storage means for a temporary reserve of tape having a feed-in and feed-out opening with a rotatable suction drum at the feed-in side of the opening with a peripheral speed at least equal to the maximum speed of the pulling means and a suction surface at the feed-out side of the opening holding the tape in contact therewith and permitting the tape to slide thereon as it is fed to the machine, said mechanical regulator means being movable to a position drawing the loop into the opening of said storage means, and said vacuum drum and surface removing the tape loop from said regulator means to provide a temporary reserve in said storage means.

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4. Apparatus according to claim 3 and said suction drum feeding said tape from the pulling means into said storage means, and said suction surface controlling the feed of the temporary tape reserve to the machine.

5. Apparatus according to claim 4 and said suction surface subjecting the tape to tension substantially equal to the tension from the mechanical regulator

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means.

6. Apparatus according to claim 5 and said mechanical regulator means automatically varying the size of the tape loop in response to fluctuations in the demand for tape by the machine to maintain the tension on the tape constant.

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