

Aug. 9, 1966

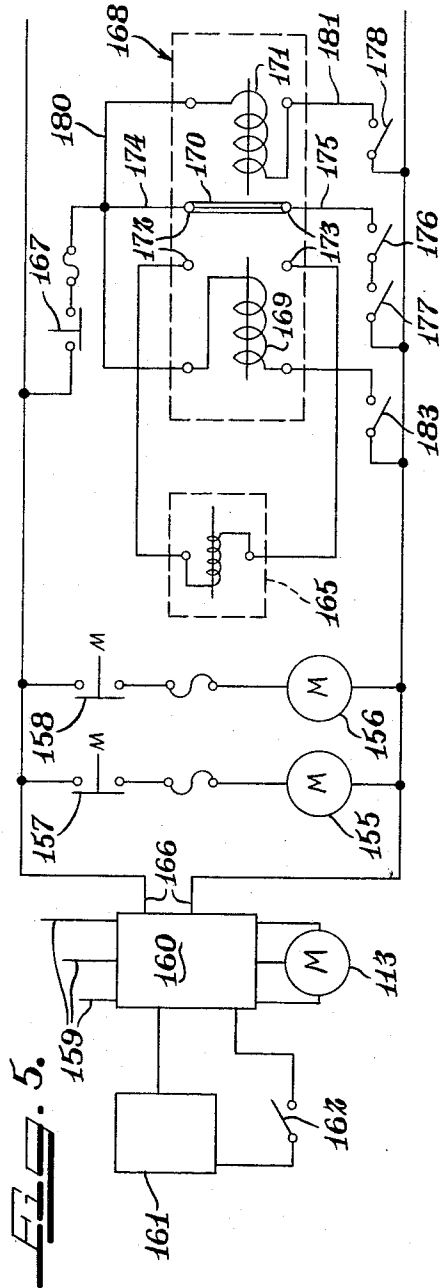
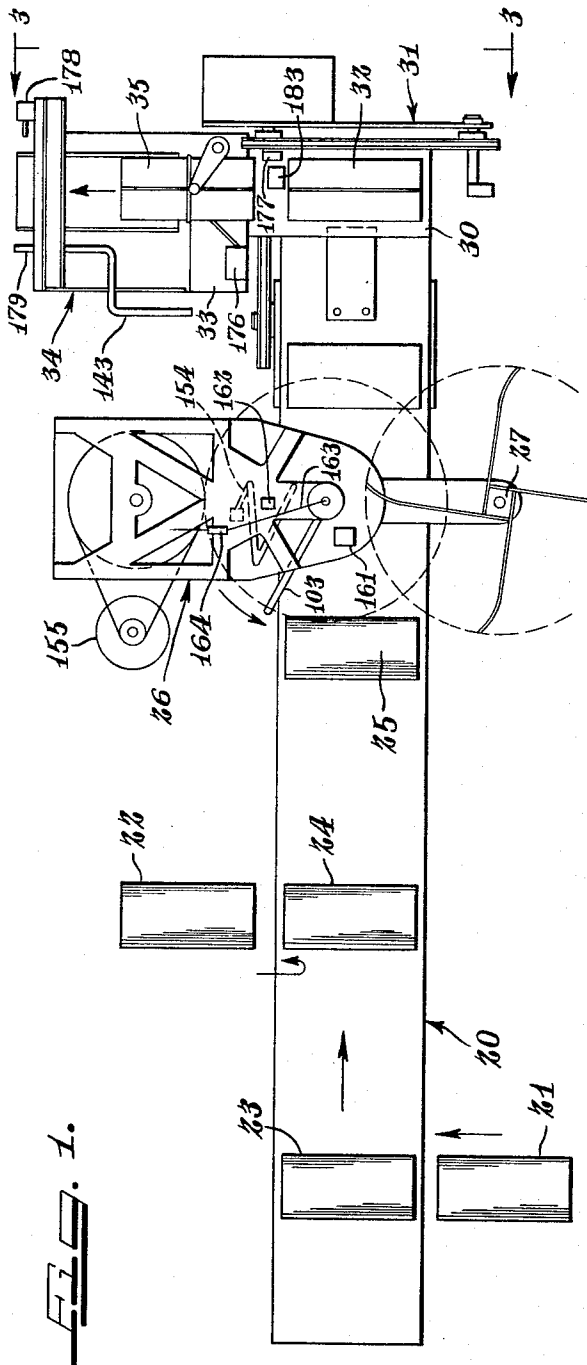
W. D. AYRES, JR

3,264,976

CONTROL FOR CONVEYORIZED BUNDLE TYING SYSTEM

Original Filed May 6, 1963

4 Sheets-Sheet 1



INVENTOR
WALTER D. AYRES, JR.

BY
Horton, Davis, Brewer & Brugman
Attys.

Aug. 9, 1966

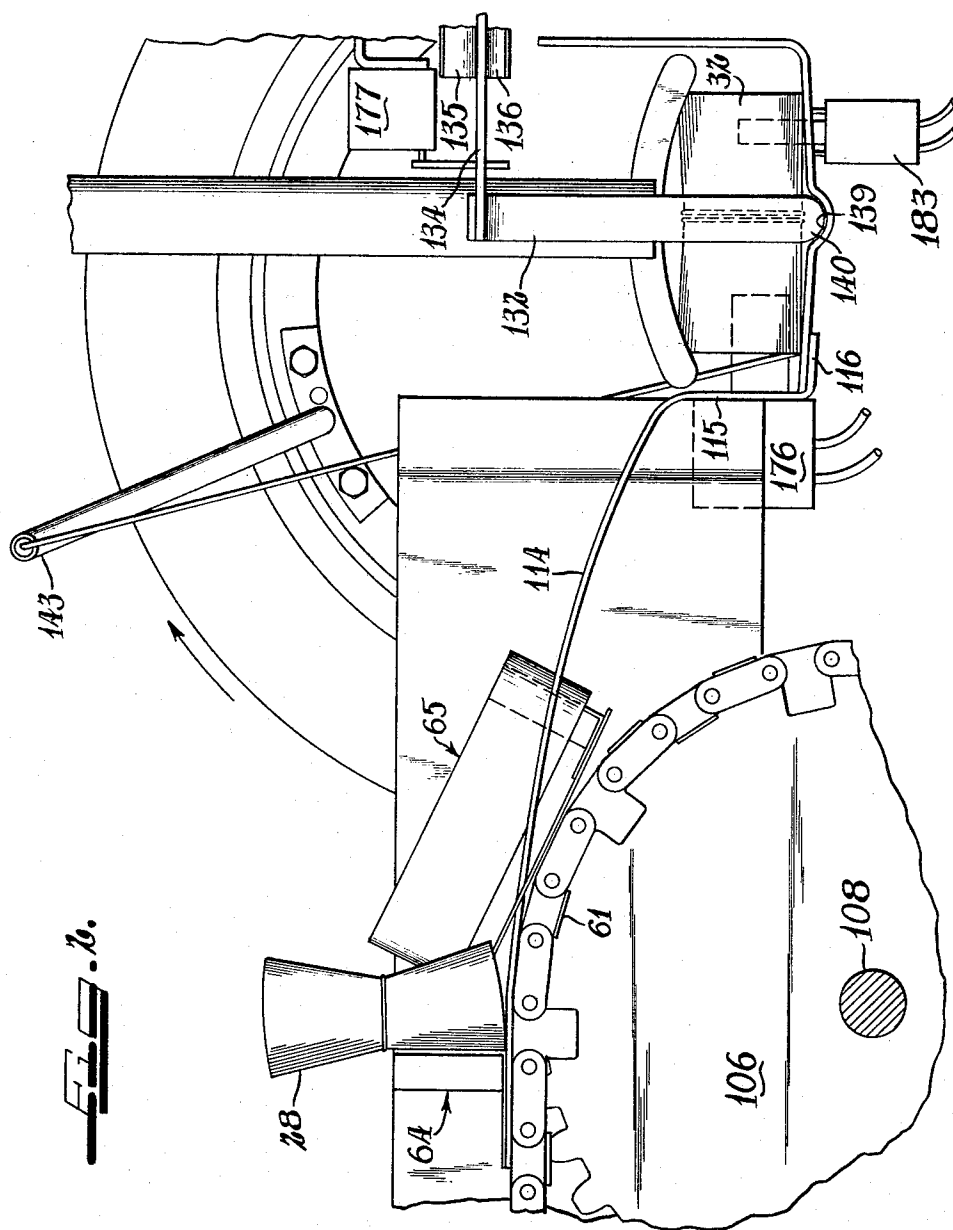
W. D. AYRES, JR

3,264,976

CONTROL FOR CONVEYORIZED BUNDLE TYING SYSTEM

Original Filed May 6, 1963

4 Sheets-Sheet 2



INVENTOR
WALTER D. AYRES, JR.

BY
Horton, Davis, Brewer & Brugman
Attys.

Aug. 9, 1966

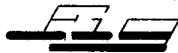
W. D. AYRES, JR

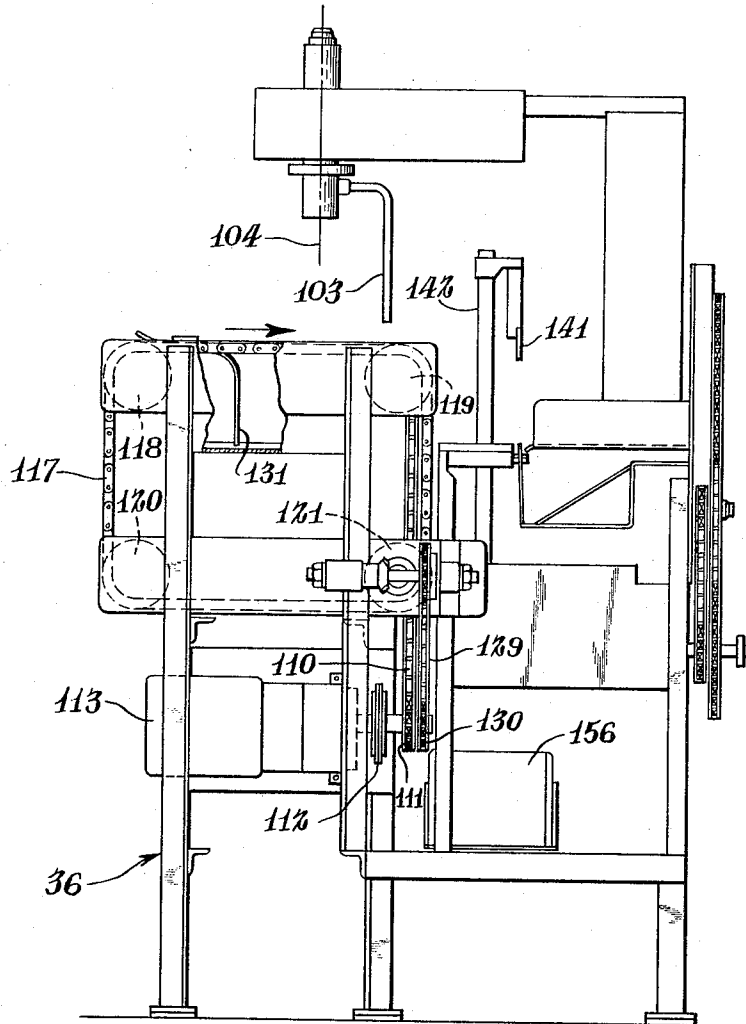
3,264,976

CONTROL FOR CONVEYORIZED BUNDLE TYING SYSTEM

Original Filed May 6, 1963

4 Sheets-Sheet 3

 3.



INVENTOR
WALTER D. AYRES, JR.

BY

Horton, Davis, Brewer & Brugman
Attys.

Aug. 9, 1966

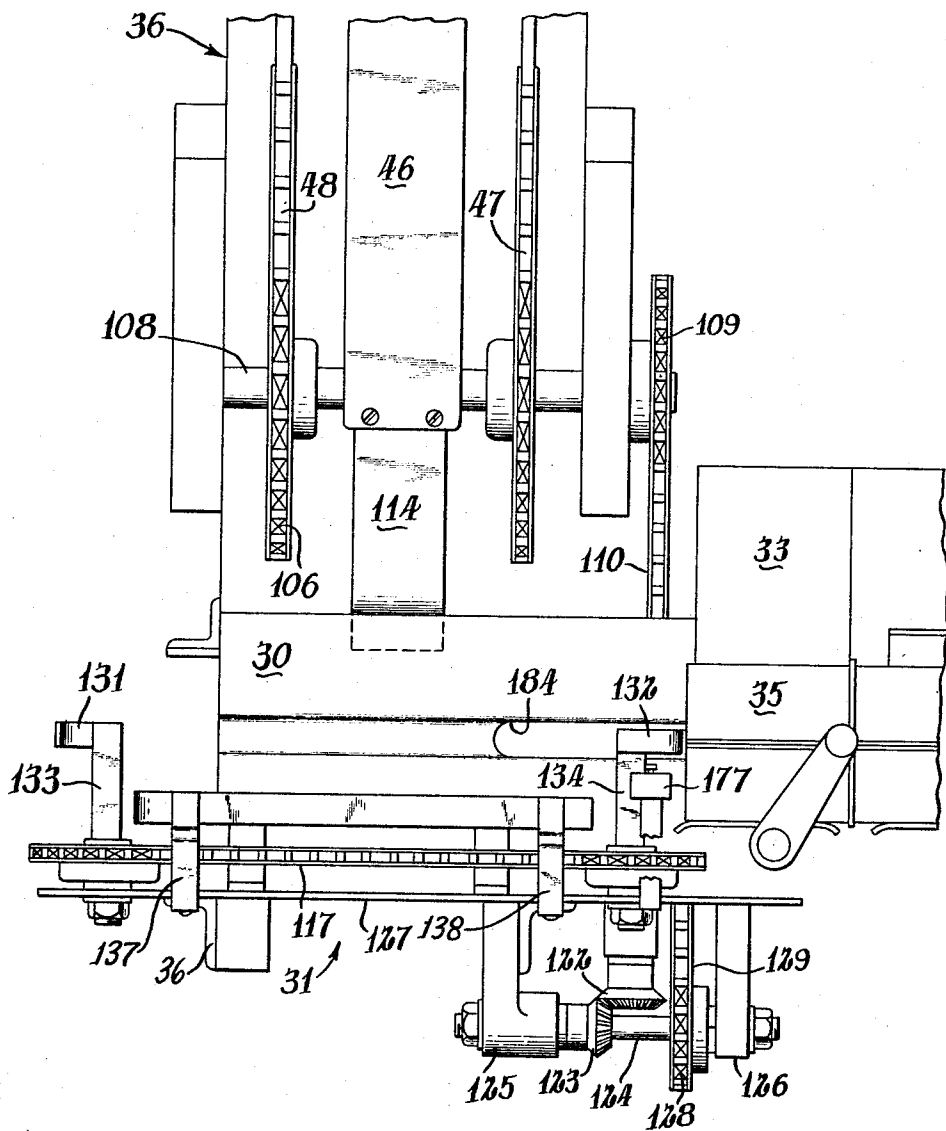
W. D. AYRES, JR

3,264,976

CONTROL FOR CONVEYORIZED BUNDLE TYING SYSTEM

Original Filed May 6, 1963

4 Sheets-Sheet 4



INVENTOR
WALTER D. AYRES, JR.

BY
Horton, Davis, Brewer & Brugman
Attys.

1

3,264,976

CONTROL FOR CONVEYORIZED BUNDLE TYING SYSTEM

Walter D. Ayres, Jr., Oaklawn, Ill., assignor to B. H. Bunn Company, Chicago, Ill., a corporation of Illinois
Original application May 6, 1963, Ser. No. 278,053, now Patent No. 3,189,163, dated June 15, 1965. Divided and this application June 1, 1965, Ser. No. 460,416
5 Claims. (Cl. 100-4)

This application is a division of my co-pending application S.N. 278,053 filed May 6, 1963, for Apparatus for Tying Moving Bundles, now Patent No. 3,189,163 which issued June 15, 1965, in which a means is disclosed and claimed for compacting a bundle of mail, or the like, while the bundle is moving on a conveyor past a stationary bundle tying machine.

This invention relates to a control system for bundle tying machines to which the bundles are automatically presented by a continuously operating conveyor.

In my aforementioned application, apparatus is disclosed for tying a long tie and a cross tie on a bundle of mail and for feeding the bundles to the tying apparatus by continuously operating conveyors. Two tying machines are used, one for tying the long tie and the other for tying the cross tie. One conveyor receives the bundle to be tied and transports the bundle past the first or long tie machine. A transfer mechanism then removes the bundle from the first conveyor and drops it on a transversely running push type conveyor which moves the bundle to the second tying machine for the cross tie. It is, of course, desired that no bundle shall leave the second tying machine which has not been properly tied with both a long tie and a cross tie and hence it is an object of this invention to provide a system of controls for the power sources for the conveyors and for the tying machines which will stop the operation of the entire system in the event of a failure of an essential function of the system.

Another object of this invention is to provide a control for the power source of a tying machine, to the latter of which, bundles of mail, or the like, to be tied are fed by a continuously running conveyor, wherein said power source is not energized, if no bundle to be tied is presented to the machine.

Yet another object of this invention is the provision of a control for a tying machine wherein the control is sensitive to the tension in the twine as it passes through the machine, such that when the twine tension is reduced below a predetermined value, as when the twine breaks or the supply is exhausted, the control will stop the operation of the machine.

These and other objects of this invention will become apparent from the following description of a preferred embodiment thereof when taken in connection with the accompanying drawings in which

FIG. 1 is a schematic plan view of a conveyORIZED apparatus for tying bundles of mail, said apparatus being made in accordance with this invention;

FIG. 2 is a fragmentary front elevational view, on an enlarged scale and partly in section, of the transfer mechanism by which a tied bundle is removed from the conveyor of FIG. 1 to a conveyor which moves the bundle to the second tying machine of the system;

FIG. 3 is an enlarged end elevational view of the system of FIG. 1, the view being taken in the direction of the arrows 3-3 of FIG. 1;

FIG. 4 is a fragmentary plan view on a reduced scale with respect to FIG. 2, of the transfer mechanism and conveyor system for moving a bundle from the first conveyor of FIG. 1 to the second tying machine; and

FIG. 5 is a schematic wiring diagram for the controls

2

and motor-operated mechanisms used in the system of FIG. 1.

The principal elements of the system of this invention are shown in FIG. 1 in schematic form and comprise a substantially horizontally disposed conveyor 20, which may be disposed in an aisle located between series of sorting stations 21 and 22, where incoming mail is sorted by hand according to destination. The sorters segregate the mail into bundles 23, 24, 25 of similarly oriented envelopes which are placed upon conveyor 20 in such manner that the bundles rest upon the long edges of the envelopes of which they are comprised. Said conveyor moves from left to right as viewed in FIG. 1, past a tying machine 26 to a transfer conveyor 31 and to a second tying machine 34.

The first tying machine 26 is a substantially standard tying machine, such as is shown in B. H. Bunn Patent No. 2,898,847 dated August 11, 1959. It has been modified, however, to eliminate a table, since the bundle to be tied is already supported during the tying operation upon conveyor 20. The machine has also been modified in that it is turned 90° from the horizontal and hence lies on its side. It is not believed necessary for the purposes of this invention to described the details of the machine, such details being given in the aforesaid Bunn patent. Suffice it to say that said machine is provided with a twine arm 103 (FIG. 1 and FIG. 3), which rotates about a vertical axis 104 in a counter clockwise direction as viewed in FIG. 1. The movement of the twine tends to compress a bundle against a frictionally retarded star wheel 27 while the bundle is being tied, said star wheel being fully described in my aforesaid application S.N. 278,053, now Patent No. 3,189,163 which was issued June 15, 1965.

A bundle is removed from the conveyor 20 to the table 30 of a transfer device 31 by the means shown in FIG. 2. In the horizontal position of conveyor 20 a bundle of mail 28 is held between the two parts 64 and 65 of a clamping device. As the two parts move around a conveyor drive sprocket they separate as shown in FIG. 2, thereby freeing a bundle such as 28 therefrom.

Sprocket 106 is mounted on a shaft 108 appropriately supported in bearings on conveyor frame 36 (FIG. 3) so as to be driven thereby. Said shaft 108 is driven through a sprocket 109 (FIG. 4) and chain 110 from a sprocket 111 (FIG. 3) and a slip clutch 112 driven by a motor 113 mounted on frame 36.

The means by which a bundle 28 is transferred from conveyor 20 to table 30 comprises a cam plate 114 (FIGS. 2, 4) which is secured at one end to longitudinal plate 46 disposed between endless chains 47 and 48 of conveyor 20. Its other end as viewed in FIG. 2, is bent downwardly as at 115 and then horizontally at 116 where it is secured to the underside of said table 30. A bundle 28 is urged forward by appropriate elements (not shown) of conveyor 20 to transfer from horizontal plate 46 to cam plate 114 over which the bundle then rides. Cam plate 114 is curved downwardly so that initially bundle 28 is urged along the cam plate by the conveyor 20. At about the point where the conveyor is no longer in contact with the bundle, said bundle 28 will slide down the cam plate 114 by gravity and be turned by said cam plate so that it will fall upon table 30 on its side as viewed in FIG. 2. Thus, although a bundle may start on conveyor 20 with the edges of the envelopes contacting the conveyor and the planes of the envelopes disposed in a generally vertical direction, said bundle will be turned through 90° in its transfer from conveyor 20 to the table 30 and will lie on said table 30 on its side.

With a bundle, such as 32, on table 30, the next step is to transfer said bundle to the second tying machine 34

where a cross-tie can be tied. The transfer mechanism is shown in FIGS. 3 and 4 and is comprised essentially of an endless roller chain 117. Sprocket 121 is a drive sprocket and is driven from a bevel gear 122 which, in turn, is driven by a mating bevel gear 123 mounted on a shaft 124 supported in bearings 125 and 126 from a plate 127 secured to the frame 36 of the machine. Shaft 124 is driven by a sprocket 128 and chain 129 from a drive sprocket 130 rotatable with sprocket 111 and driven through slip clutch 112 from the same motor 113.

Curved drive fingers 131 and 132 are secured through horizontal extensions 133 and 134, respectively, to chain 117 so as to be driven thereby. Fingers 131 and 132 are designed, as shown in FIG. 2, to contact the end of a bundle 32 and to move said bundle from table 30 to a table 33 on the second tying machine 34. Chain 117 moves in a clockwise direction, as viewed in FIG. 3, so that a drive finger moves horizontally until it reaches an upper sprocket 119 at which point the chain begins to pass around said sprocket, and finger 131 is thereby rotated clockwise. This means that finger 131 is halted in its movement toward the second tying machine 34 and then begins a reverse and upward movement, until it is turned 90°, after which it moves downwardly toward drive sprocket 121, through a slot 184 in table 30, and then under table 30, and back to the left, as viewed in FIG. 3. It passes around sprockets 120 and 118, each sprocket turning it 90°, and it returns to the vertical bundle-driving position shown in FIG. 3.

In view of the cantilever construction of the finger supporting extensions 133 and 134 and the eccentric forces which might be imposed thereupon by the resistance of a bundle 32 to forward movement, a pair of opposed flat horizontal guides 135 and 136 supported by straps 137 and 138 (FIG. 4) from frame 36 are used to lend additional support to the extensions 133 and 134 during their operative or driving movement. The entrance ends of guides 135 and 136 are curved to diverge from one another to facilitate entry of the extensions 133 and 134 therebetween.

It is desirable that the curved drive fingers 131 and 132 contact the lowermost envelope of a bundle to avoid putting such lowermost envelopes out of line with the rest of the bundle. To this end, table 30 is provided with a groove 139 extending the length of table 30 in the direction of movement of fingers 131 and 132.

The second tying machine 34 may again be of any of the standard forms presently commercially available. The one selected to illustrate this invention is of the type known as a "ring tie machine" and is disclosed in B. H. Bunn Patent No. 2,471,304 dated May 24, 1949. Said machine, as stated previously, is provided with a table 33, upon which a bundle, such as 35, is pushed by the transfer mechanism 31. As is customary, however, a compacting mechanism is provided for holding the bundle firmly against table 33 while the cross-tie is being made. The details of the compacting mechanism are not material in this invention and hence will not be given herein. The compacting mechanism, however, may be of the type shown in B. H. Bunn Patent No. 1,606,290, dated November 9, 1926, and incorporates a clamp 141 secured to a vertically reciprocable rod 142 appropriately driven in timed relation to the operation of the tying machine, so that pressure is exerted by clamp 141 on a bundle 35 while the tying machine is in operation. The twine arm for the machine is shown at 143, and as explained in the aforesaid Bunn Patent No. 2,471,304, it is driven by a ring from which the machine gets its name, and the tied bundle is then ejected through the ring to the opposite side of the machine.

The controls for the system comprise a mechanical trip 154 shown on FIG. 1 and adapted to operate the standard trip for tying machines of the type as shown at 26 in FIG. 1 (see B. H. Bunn Patent No. 2,898,847), and a plurality of micro switches, which are shown sche-

matically in FIG. 5, together with the devices controlled thereby. The mechanical trip 154 is located in such manner relative to conveyor 20 that the trip will be contacted by a bundle moving on conveyor 20 and operated by said bundle, but it will not be operated otherwise. Thus it is located above clamp 64, 65 but below the top of the shortest bundle, measured vertically of conveyor 20, that the apparatus is intended to handle. In addition, certain manually operated switches are also employed, as also shown schematically in said FIG. 5. The electrical motors used in the system comprise the aforesaid conveyor motor 113 and individual tying machine motors 155 and 156, motor 155 being used to operate tying machine 26 and motor 156 being used to operate tying machine 34. Fused switches 157 and 158, manually operated, control the operation of motors 155 and 156, respectively. The power for motors 113, 155 and 156 is derived from a 3-wire 220 volt, 3-phase Y-type line shown at 159, said line 159 being connected through a fused switch box 160 and a master start-stop switch 161 to motor 113. A 110 volt tap 166 is taken from switch box 160 and used to power tying machine motors 155 and 156 and the control circuit for the second tying machine 34.

In series with the start switch 161 is a twine tension switch 162 which is operated by the twine 163 (FIG. 1) as it leaves the twine tensioner of the machine, shown schematically at 164 in FIG. 1 switch 162 is of the same type as those shown at 176 and 183 in FIGS. 1 and 2, and is clearly shown in my Patent No. 3,221,642 which was issued on December 7, 1965. It has a control arm which rides on the taut twine and is controlled thereby. The twine tensioner is also of a well-known type and is likewise shown in my aforesaid Patent No. 3,221,642 as well as in U.S. patent to B. H. Bunn, No. 2,451,197 which was issued October 12, 1948. It is contemplated that should the twine in the first tying machine 26 either break or run out, the entire conveyor will be immobilized to avoid feeding untied bundles of mail to the transfer device 31 where such untied bundles would be scattered and would be a source of great inconvenience and delay in retrieving the scattered mail, not to mention possible damage thereto.

The second tying machine 34 is controlled by a solenoid operated trip rather than by a mechanical trip operated by a bundle as in machine 26. The solenoid is shown schematically at 165 in FIG. 5 and is adapted to be energized from the 110 volt line 166. A master switch 167 of the fused variety is manually operated and comprises a master control for the energization of relay 165. It is connected to one side of 110 volt line 166. Intermediate manual switch 167 and solenoid 165 is connected a latching relay shown generally at 168, said latching relay including an energizing coil 169, an armature 170, and a reset coil 171. Armature 170 is adapted to be latched in operative position until released therefrom by the reset coil 171. Said latching relay is of standard design and hence the details of construction thereof will not be described herein.

Armature 170 operates a single throw double-pole switch, one pair of contacts of which is shown at 172 and the other pair of contacts of which is shown at 173. One of the contacts of the pair 172 is connected to a line 174 from switch 167 and one of the contacts of the pair 173 is connected to a line 175 which, in turn, is connected through a pair of switches 176 and 177 in series to the other side of the 110 volt line 166. Switch 176 is a micro-switch which, as shown in FIG. 1, is mounted on tying machine 34 in the path of a bundle 35, so that when a bundle is in place in machine 34 in position to be tied thereby, said switch 176 is closed. Switch 177 is mounted on the guide 135 of FIG. 2 of transfer conveyor 31 and is adapted to be operated by one of the horizontal extensions 133 or 134 for the drive fingers 131 and 132 respectively (FIG. 2). It will be appreciated that switch 176 is oper-

ated just as soon as the forward edge of a bundle 35 begins to pass said switch, but at this point the bundle is not properly located on tying machine 34 for a tying operation and, accordingly, operation of the tying machine is delayed until the bundle is fully advanced. The latter point is determined by the forward position of the finger 132 (FIG. 4), which may be pushing said bundle, and said finger 132 is at its foremost position when it reaches and begins to go around sprocket 119. When both switches 176 and 177 are made, solenoid 165 is energized through the pairs of contacts 172 and 173, and the mechanical trip on machine 34 is operated to commence the tying operation.

It is necessary, of course, to reset relay 168 for the next cycle, so that solenoid 165 is de-energized and the trip which controls the operation of tying machine 34 is released. The resetting operation is controlled by a switch 178 which, as shown in FIG. 1, is located on the frame of tying machine 34 in such position that its operative element is in the path of movement of a short projection 179 at the rear of the twine arm carrying ring of tying machine 34. The exact location of switch 178 is not critical, it only being necessary that said switch be operated by projection 179 after the ring on which said projection is mounted has been set in motion by the operation of the trip mechanism controlled by solenoid 165.

The reset coil 171 of the relay 168 is connected, through a line 180, to switch 167, and one side of the 110 volt line 166, and the other side of the coil 171 is connected through a line 181 and switch 178 to the other side of said 110 volt line 166. Thus, after the twine arm has been set in motion, the latch of the latching relay 168 is released to restore the relay to the condition shown in FIG. 5 wherein switch contact pairs 172 and 173 are open and solenoid 165 is de-energized. This allows the trip mechanism in the second tying machine 34 to return to the condition wherein it is adapted to halt the operation of the twine arm until said trip mechanism is again operated by solenoid 165. As described in the aforesaid Bunn Patent 2,471,304, the trip mechanism will not halt the operation of twine arm until a complete tying cycle has been effected.

The operation of the device is as follows:

Bundles of mail which have been sorted, such as are shown at 21 and 22, are manually placed upon conveyor 20 and pushed from the star wheel side of the conveyor into clamping device 64, 65 to compress said bundle and hold it firmly on conveyor 20. As the conveyor and its bundles move to the right as viewed in FIG. 1, a bundle will strike one of the fingers of the star wheel compacting device 27, which, because of the resistance to rotation produced by the friction therein will compress said bundle during the travel of the bundle past star wheel 27. Shortly after contacting said star wheel and becoming compacted at its star wheel end the bundle will contact the mechanical trip 154 of tying machine 26 which, as described in the aforesaid Bunn Patent No. 2,898,847 starts the twine arm 103 to rotating and effects the tying of the bundle with a long tie. If, at any time, however, twine 163 breaks or runs out so that there is no tension in the section between the twine tensioner 164 and the twine arm 103, the twine tension switch 162 will open and will stop the operation of the entire apparatus, including conveyor 20, transfer device 31, and both tying machines 26 and 34.

The moving bundle with its long tie then reaches the right hand end (FIG. 1) of conveyor 20 where the conveyor begins to pass around sprocket 106 while the central portion of the tied bundle engages the cam plate 114. The passage of the conveyor around this sprocket opens the clamping device, as shown in FIG. 2, to free the tied bundle, and the bundle then slides along the downwardly curved cam plate 14 and is turned thereby through substantially 90° as it falls off said cam plate 114 upon table 30. It now lies upon its side and is in position to be ad-

vanced by the transfer device 31 into the second tying machine. With the transfer device 31 operating, one of its curved drive fingers 132 will contact the rear of a bundle, as shown in FIG. 2, and will start to move said bundle along table 30 toward the second tying machine 34. As the bundle begins to move along table 30, however, it actuates a switch 183 connected in series with coil 169, which energizes the coil 169 of latching relay 168 and closes the pairs of contacts 172 and 173. Solenoid 165, however, is not yet energized since switches 176 and 177 must still be closed to complete the circuit through said solenoid. The preceding bundle is completing its tie and will be released from its clamp to allow the oncoming untied bundle to push it through the machine and into a waiting receptacle. As finger 132 moves along the upper horizontal portion of the transfer device toward sprocket 19, the bundle will engage the switch 176 to close the contacts thereof, thus leaving only switch 177 open to restrain the operation of solenoid 165. When the finger reaches sprocket 119, it also engages said switch 177 to close its contacts and thus complete the circuit through solenoid 165, which then is energized to operate the trip mechanism on the second tying machine 34 to set it in operation. Finger 132 does not advance any farther and is then brought around sprocket 119 downwardly through the slot 184 provided for that purpose in table 30. As it rounds the sprocket 119, it allows switch 177 to be opened, thereby de-energizing solenoid 165. This, in turn, allows the trip mechanism which had been operated in tying machine 34 to reset itself for the next operation after the tying operation is completed. It is understood that the clamping device will be automatically brought down upon the bundle, held there while the bundle is being cross-tied, and then will be raised to release the bundle for movement through the machine by the succeeding untied bundle.

In the event that there is no bundle on table 30, but a bundle is passing the first tying machine 26 so that conveyor 20 and transfer mechanism 31 are in operation, switches 176 and 183 will not be operated and, accordingly, the second tying machine 34 will not be set in motion needlessly. It may also be apparent that if an empty clamping device 62 should pass trip 154 of the first tying machine 26, said trip will not be operated because the empty clamping device will pass under the trip and hence the tying machine will not be set in motion. Furthermore, since conveyor 20 and transfer device 31 are driven through sprockets and chains from the same motor 113 and shaft, said conveyor and transfer device will always be operated in synchronism with one another so that a finger 132, for example, will not be moving across table 30 while a bundle is falling thereon.

It is understood that the foregoing description is merely illustrative of a preferred embodiment of the invention and that the scope of the invention, therefore, is not to be limited thereto, but is to be determined by the appended claims.

I claim:

1. In combination, a tying machine comprising a rotatable twine arm, an article-supporting table adjacent the twine arm, and electrically operated means for energizing the machine to rotate the twine arm; conveyor means for moving an article to an article-tying position on the machine, switch means operable by the conveyor, and switch means operable by the article when in said article tying position on the machine to energize said electrically operated means, said conveyor operated switch means and article operated switch means being connected in series to prevent operation of the tying machine until the article is in article-tying position on the machine and to prevent operation of the tying machine in the event that there is no article moved by the conveyor.

2. The combination described in claim 1, an additional tying machine, a supply of twine for said additional tying machine, means on said additional tying machine for ren-

7

dering a reach of said twine taut, said conveyor means including a motor, and means controlled by the taut twine for controlling the energization of said conveyor motor.

3. The combination described in claim 1, said electrically operated means comprising a solenoid, a latching relay having a pair of contacts for energizing said solenoid, said latching relay including an operating winding and a reset winding, a switch operated by the article for energizing the operating winding, and a switch operated by the tying machine for energizing the reset winding.

4. In combination, a tying machine for tying a reach of twine around an article, a conveyor adapted to carry bundles of envelopes to said machine, a second tying machine, means for removing a bundle from the conveyor, a transfer conveyor for moving a removed bundle to the second tying machine, mechanical trip means on the first tying machine operated by a bundle on the conveyor to initiate operation of said first tying machine, switch means contacted by a bundle moved by said transfer conveyor for initiating the operation of the second tying means, and, means operated by said second tying machine for deactivating the switch means contacted by a bundle.

5. In combination, a tying machine for tying a reach of twine around an article, a conveyor for moving a bundle to said tying machine, a solenoid-operated trip mechanism for initiating the operation of the tying machine, a source of electrical energy for energizing said solenoid, a

8

manually operated switch and a latching relay in series with the source and solenoid, said latching relay having an energizing coil and a reset coil, switches operated by said energizing coil to connect said solenoid to said source, a pair of switches in series with said source and said energizing coil switches, one of said pair of switches being operated by the said bundle and the other of said pair of switches being operated by the conveyor, and a switch, operated by the tying machine for completing a circuit from said source of energy to said reset coil for opening said pair of switches to deenergize said solenoid-operated trip mechanism.

References Cited by the Examiner

UNITED STATES PATENTS

1,875,259	8/1932	Parker	100—4 X
1,964,070	6/1934	Mertis	53—55
2,100,004	11/1937	Gibling	100—7
2,749,837	6/1956	Hayford et al.	100—4 X
2,867,166	1/1959	Saxton et al.	100—7 X
2,942,715	6/1960	Miller	100—4 X
3,085,501	4/1963	Wimmer	100—7 X
3,104,606	9/1963	Kerrigan	100—4

WALTER A. SCHEEL, *Primary Examiner.*

BILLY J. WILHITE, *Examiner.*