AUTOMATIC BOBBIN SUPPLY SYSTEM

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5 Claims. (Cl. 199—45)

This invention relates generally to bobbin handling apparatus and more particularly to an improved system to automatically transfer bobbins from a moving conveyor to a bobbin transfer apparatus and to automatically maintain a preselected supply of bobbins in the bobbin transfer apparatus.

In recent years the textile industry has been developing and using automatic and semi-automatic bobbin drafting and dressing apparatus for textile processing machines such as spinning frames. In order to more fully automate such drafting and dressing apparatus, it is desirable to have a mechanized bobbin transfer arrangement for transferring bobbins from a central source to a plurality of user stations, such as loading stations for loading the empty supply bobbins onto the drafting and dressing apparatus. To effect such transfer efficiently, transfer belt arrangements such as that shown in U.S. Patent No. 3,090,476, Sanders, May 21, 1963, have been employed to transfer the empty bobbins from a conveyor to a receiving belt at the loading station. To most efficiently use such a system it is necessary to automatically maintain a constant supply of bobbins in the chute which supplies bobbins from the conveyor to the transfer cone.

It is therefore an object of this invention to provide an automatic bobbin supply system in which the bobbin chute is automatically supplied bobbins from the bobbin supply point.

Another object of the invention is to provide an automatic article handling apparatus which automatically and efficiently maintains a constant supply of articles in the feed system to an automatic transfer mechanism.

A further object of the invention is to provide a bobbin transfer system in which the supply of bobbins in the feed mechanism to the transfer apparatus is automatically controlled by the number of bobbins in the feed mechanism.

Other objects and advantages will be clearly apparent as the specification proceeds to describe the invention with reference to the accompanying drawings, in which:

FIGURE 1 is a schematic cross-sectional view of the chute feed control mechanism;

FIGURE 2 is a top view of the lower section of the conveyor shown in FIGURE 1;

FIGURE 3 is a cross-sectional view taken on line 3—3 in FIGURE 1;

FIGURE 4 is a blown-up view of the bobbin jam-up mechanism shown in FIGURE 1;

FIGURE 5 is a schematic control circuit showing the preferred control circuit for the bobbin feed control mechanism;

FIGURE 6 is a modification of the control circuit shown in FIGURE 5; and

FIGURE 7 is a cross-sectional view similar to FIGURE 1 incorporating the modification shown in FIGURE 6.

Locally drawn and in particular to FIGURE 1, the general arrangement of the herein disclosed apparatus is shown. Bobbins, quills, or the like B are delivered from a common supply source, such as a hopper or bin 10 to an endless conveyor belt 12 travelling in the direction indicated by the arrows with the upper belt portion 14 supported on a platform 16 and the lower belt portion 18 supported on the lower platform 20. The conveyor belt 12 delivers empty bobbins B to a plurality of discharge stations 22 in a manner generally similar to that shown in copending application Ser. No. 143,421, filed Oct. 6, 1961, now Patent No. 3,173,543. Bobbins B are carried on the conveyor belt 12 normal to the direction of movement of the belt between cleat members 24 suitably connected to the belt 12. For reasons hereinafter set forth selected cleats 24 have apertures 26 provided therein. Also for reasons set forth hereinafter certain recesses 28 between the cleats 24 have been filled with a cleat member 30.

As indicated above bobbins B are conveyed from the bin 10 on upper belt portion 14 of the endless conveyor 12 between the cleats 24. The conveyor then reverses direction and conveys the bobbins B toward the bin 10 with the bobbins B laying on the platform 20 in the recesses 28 between the depending cleat members 24 to a plurality of discharge stations 22 in a case group of which is shown for the sake of illustration. At the discharge station the desired amount of bobbins B is automatically delivered from the lower belt portion 18 to the bobbin feed chute 32 from which bobbins B are supplied to the transfer cone 34. From the transfer cone 34 bobbins B are supplied to a receiving belt, not shown, in any suitable manner, such as that disclosed in U.S. Patent No. 3,090,476, supra.

The chute 32 is defined by a pair of side plates 36 and 38 which can be integral with or suitably connected to the side walls 40 of the conveyor system. The back of the chute 32 is formed by a sheet metal member 42 connected between side walls 36 and 38 in any suitable manner. The front portion of the chute 32 is formed by a pair of angle iron members 44 riveted or otherwise secured at 46 to the side walls 36 and 38. Sheet metal members 45 and members 44 and 46 are flared outwardly adjacent the conveyor 12 in order to more readily accommodate bobbins dropped therein. Openings 48 and 50 are provided in sheet metal member 42 to allow contacts 52 and 54 of microswitches 56 and 58, respectively, to protect the bobbin chute mechanism for reasons hereinafter explained.

To gain access to the chute 32, the bobbins in the chute are removed by means of the chute cone 34 and the loading station, not shown, so that when the chute cone 34 is rotated against the bias of spring 70 away from the microswitch 66, thereby breaking the circuit to the transfer cone 34 and loading station drive means in order to stop operation thereof.

In order to prevent jamming and breaking of the bobbins B in the chute 32 and in the transfer cone 34 another microswitch 72 is mounted on side plate 28 with a spring loaded actuator arm 74 pivotally supported on a stacker mounted shaft 76 supported in and extending between side plates 36 and 38. Shown in detail in FIGURE 4, spaced tab members 78 and 80 are integrally connected to shift 76 adjacent the outlet of chute 32 so that in case of jamming of the bobbins in the chute or between the chute 32 and the transfer cone 34 the jammed bobbins will contact one or the other of the tabs 78 or 80, thereby rotating the actuator arm 74 against the bias of spring 79 away from the microswitch 72 in order to cut off the power to the drive means for the transfer cone 34 and the loading stations, not shown. The operator
can then clear the bobbin jam and then spring 79 will pull the actuator 74 into contact with the microswitch 72 and the conveyor belt will be re-energized if the angular iron members 60 and 62 have been closed by the operator after clearing the bobbin jam.

Mounted on each side of the conveyor belt 12 is a solenoid operated knife gate 82 to control the flow of bobbins into the chute 32 from the lower belt portion 38 of the conveyor 12. Each knife gate 82 consists basically of a rotary solenoid 84, a rotor shaft 86 operated by the solenoid 84 and an elongated blade member 88 rigidly secured to the shaft 86. Preferably rotary solenoids 84 are power open and spring return but it is within the several embodiments the invention to employ power open and power close type of rotary solenoids. A slot 90 is cut in the lower platform to allow bobbins B to drop into the chute 32 when required. Preferably the blade members 88 are rotated from the position shown in dotted lines in FIGURE 2 through an arc of approximately 25° to allow the bobbins in the chute 32 to fall through the slot 90 into the chute 32. Arcuate portions 92 are also cut out of the lower platform to allow the blade members 88 to be rotated to the position shown in solid lines in FIGURE 2.

To actuate the solenoids 84 a photocell 94 and a light source 96 are located upstream of the gate members 82. If the contact 54 connected to microswitch 58 indicates a need for bobbins in the chute 32, photocell 94 receives light from light source 96 at periodic intervals through apertures 26 spaced along the conveyor belt 12 and actuates rotary solenoids 84 to rotate blade members 88 and allow bobbins B to drop into chute 32.

The location of the photocell 94, light source 96 and the apertures 26 depends on the number of bobbins that you desire to drop into the chute 32 at one time. In the preferred embodiment it is desired to drop three bobbins into the chute 32. To enhance this operation it is preferred that each series of three bobbins be separated by a distance approximately equal to three cleats. As pointed out previously cleat 30 was provided to fill certain preselect recesses 28. The filling of such recesses provides the preselect distance between each set of three bobbins. This preslected closed area allows time for the gate member 82 to open completely before the first bobbin is dropped into the chute 32 and alleviates the possibility of catching a bobbin between the conveyor belt 12 and the blade member 88. Further, this preslected closed area allows the gate member to close without jamming a bobbin which has been only partially dropped from the recesses 28 into the chute 32.

As previously pointed out a contact 52 of microswitch 56 is provided in chute 32. In normal operation there will be sufficient bobbins in the chute 32 to maintain contact 52 in the down position. If for some reason, such as a lack of a sufficient number of bobbins in the conveyor 12 or the transfer cone 34 is taking bobbins faster than they are being supplied to the chute 32, contact 52 will rise to the position shown in FIGURE 1 when the supply of bobbins is below the contact 52, thereby breaking the circuit to the transfer cone and bobbin loading station drive means until such time that an additional supply of bobbins is supplied to the chute 32 and close contact 52 due to the weight thereof.

Looking now in particular to FIGURES 1 and 5 the operation of the system will be explained. Assume for the sake of explanation that the conveyor 12 is moving in the direction indicated by the arrows and that the bobbin supply in the chute 32 is above the contact 54 causing the switch 58 to assume the down position shown in solid lines in FIGURE 5.

The control circuits of FIGURES 5 and 6 preferably include silicon controlled rectifiers 98 and 100 are employed. Silicon controlled rectifiers 98 and 100 are four layer, three terminal devices with performance similar to a thyatron. The gate terminals 102 and 104 correspond to the control grid of the thyatron in this analogy except that it is current rather than voltage controlled. A few milliamps fed into the gate terminals 102 and 104 at a small positive voltage will turn on the controlled rectifiers 98 and 100. The gate terminals 102 and 104 then lose control and the controlled rectifiers 98 and 100 can be turned off only by removing B+ or by reducing anode current below the holding value. The latter turn off method is used in the circuit.

Assuming the above conditions the direct resistance of photocell 94 is high enough to limit gate terminal voltage Ig to a value less than that to turn on controlled rectifiers 98 and 100. As the lower belt portion 18 moves to the position indicated in FIGURE 1 where the light source 96 shows on the photocell through the aperture 26 in the cleat 24 the resistance of the photocell 94 will drop allowing the gate terminal current Ig to increase and turn on the controlled rectifier 98. Since the micro switch 58 is in the solid line position controlled rectifier 100 cannot turn on since no current is injected into its gate terminal 104. Therefore, anode voltage V2 is equal to B+ and the commutating capacitor 106 charges through controlled rectifier 98 and rotary solenoids 84 to B+ potential. This charging current does not last long enough for the actuate the solenoids 84 and the blade members 88 remain in the dotted line position shown in FIGURE 2. Further, pulses of current due to illumination of the photocell 94 by the light source 96 through the apertures 26 have no effect since the silicon controlled rectifier 98 is still off.

Assuming now that the bobbin level in the chute 32 drops to a point below the contact 54. Microswitch 58 will then move to the dotted line position shown in FIGURE 5. At this point the controlled rectifier 100 does not turn on if the photocell 94 is dark. When the light source shines on the photocell 94 through the next aperture 26 to pass there over, the gate terminal current Ig increases due to a drop of resistance in the photocell and causes the controlled rectifier 100 to turn on, thereby actuating rotary solenoid 84 to rotate both blade members to the solid line position shown in FIGURE 2 and allows bobbins to drop into the chute 32 through the slot 90. At the same time the positive side of the capacitor 106 is shorted to the cathode through controlled rectifier 100, thereby applying the voltage across the controlled rectifier 98 in the reverse direction. The capacitor discharge current flows initially through the control rectifier 98 in the reverse direction causing the controlled rectifier 98 and the blade members 88 to turn off quickly. Capacitor current continues to flow through resistance 108 and controlled rectifier 100 until the capacitor 106 is charged to B+ with the opposite polarity. This sets the circuit so that when the bobbin level in the chute rises to a point where the bobbins overtake the contact 54 to cause microswitch to again assume the position shown in solid lines in FIGURE 5 and when the light source again strikes the photocell 94, controlled rectifier 98 will be turned on and the current discharge of the capacitor 106 will turn controlled rectifier 100 off, thereby de-energizing the spring return rotary solenoids 84 allowing the blade members 88 to rotate to the closed position as indicated in dotted lines in FIGURE 2.

It can readily be seen that as long as the bobbin level in the chute 32 is below the contact 54, microswitch 58 will remain in the dotted line position, causing the controlled rectifier to stay on, the rotary solenoid energized and keeping the blade members 88 in the open position to allow bobbins to drop into the chute regardless of the number of light pulses which strike the photocell 94 through the apertures 26.

The modification of FIGURES 6 and 7 is similar to the preferred embodiment of FIGURE 5 except the microswitch arrangement has been replaced by a solid state switch arrangement in which light source 110, photocell 112 and Zener diode 114 replace the contact 54 and microswitch 58. The photocell 112 is so placed to receive
light from the light source when the level of bobbins in the chute 32 drops below a predetermined point. Looking at FIGURE 6 the open contact condition or dotted line position of switch 58 in FIGURE 5 for the controlled rectifier 98 is simulated by the high impedance of the diode 114 in the blocking condition when voltage at point V3 is less than the breakdown voltage of the diode. The closed contact or solid line position of switch 58 in FIGURE 5 is simulated in FIGURE 6 by the very low breakdown impedance of the diode 114 when the voltage V3 exceeds the breakdown voltage of the diode.

For the silicon controlled rectifier 100 the open contact condition or dotted line position of the switch 58 is simulated by the high impedance of the dark photocell 112 and its closed contact condition equivalent to the dotted line position of switch 58 in FIGURE 5 is simulated by the low impedance of the photocell 112 when energized by the light source 110. When the photocell 94 is dark, the gate terminal current Ig is too small to fire or turn on either of the controlled rectifiers 98 or 100. This condition is true whether theobbobin demand switch is mechanical or solid state. Therefore in the remaining discussion, photocell 94 is assumed to be energized by the light source 96.

When the chute 32 is full, the light from light source 110 is blocked from the photocell 112. At the same time voltage V3 is greater than the breakdown voltage of the diode 114 thereby firing or turning on the controlled rectifier 98 and allowing return rotary solenoid 84 to close the blade members 88 since the impedance of the dark photocell 112 is high preventing the firing of the controlled rectifier 100. When the bobbin level in the chute 32 falls below the predetermined point, photocell 112 will be contacted by a light pulse from light source 110. The resistance of photocell 112 will then be decreased allowing the gate terminal current Ig to fire the controlled rectifier 100 and energize the spring return rotary solenoid 84 to open the blade members 88 and allow bobbins to be supplied to the chute 32. At the same time voltage V3 drops to a value less than the breakdown voltage of the diode 114 so the diode 114 will block the flow of current to the controlled rectifier 98, thereby allowing the capacitor discharge current to turn off the controlled rectifier 98. The circuit is now again ready to close off the opening 90 when the photocell 112 is blocked from the light source 110 when the chute 32 has an adequate supply of bobbins.

As herein disclosed the bobbin system automatically and electrically maintains a supply of bobbins in the feed mechanism to a bobbin loading station. Such system does not require the constant attention of an operator and provides safety devices to shut the system down in case of a malfunction.

Although we have described in detail the preferred embodiments of our invention, we contemplate that many changes may be made without departing from the scope or spirit of our invention, and we desire to be limited only by the claims.

That which is claimed is:

1. A bobbin transfer mechanism comprising an endless belt, means forming pockets in the outer surface of said endless belt, means supplying bobbins to said pockets, said belt having at least one run in which said pockets open downwardly, belt guiding means operably associated with said one run and preventing said bobbins from dropping out of said downwardly opening pockets, means forming an opening in said belt guiding means of sufficient size to allow a bobbin to fall through, gate means operably associated with said opening to prevent bobbins from falling through said opening from said one run, bobbin receiving and guiding means located below said opening, means operably associated with said one run, said gate means, and said bobbin receiving and guiding means to periodically open and close said gate means to allow bobbins to be supplied to said bobbin receiving and guiding means, said means operably associated with said one run, said gate means, and said bobbin receiving and guiding means including a detecting means in operative relationship with said bobbin receiving and guiding means to detect the absence of bobbins in a certain predetermined area of said bobbin receiving and guiding means, and further including a photocell and light source to actuate said gate means when said detecting means has detected the absence of bobbins to open said gate means to drop bobbins into said bobbin receiving and guiding means, said pockets being formed by cleat members spaced from one another on said endless belt and means forming apertures through certain preselected cleat members, said photocell being mounted on one side of said cleat members and said light source being mounted on the other side of said cleat members in line with said photocell whereby a light beam from said light source will hit said photocell when said apertures in said cleat members pass therebetween.

2. The structure of claim 1 wherein said photocell and said light source will actuate said gate member to close.

3. A bobbin transfer mechanism comprising: an endless belt, means forming pockets on the outer surface of said endless belt, means supplying bobbins to said pockets, said belt having at least one run in said pockets open downwardly, belt guiding means operably associated with said one run and preventing said bobbins from dropping out of said downwardly opening pockets, means forming an opening in said belt guiding means of sufficient size to allow a bobbin to fall through, a first gate member mounted on one side of said endless belt adjacent said opening, a second gate member mounted on the other side of said endless belt adjacent said opening, said first and second gate members having an elongated blade member projecting under a portion of said opening to prevent bobbins from falling therethrough, bobbin receiving and guiding means mounted below said gate members, control means operably associated with said gate members to open said gate members in response to the level of bobbins in said bobbin receiving and guiding means, said gate members being operated by a rotary solenoid, said control means including a bobbin level detecting means in said bobbin receiving and guiding means electrically interconnected to said rotary solenoids, said control means further including a photocell and light source electrically interconnected to said rotary solenoids to actuate said solenoids when said detecting means has detected an absence of bobbins in a certain predetermined area of said bobbin receiving and guiding means, said pockets being formed by cleat members spaced from one another on said endless belt, means forming apertures through certain preselected cleat members, said photocell being mounted on one side of said cleat members and said light source being mounted on the other side of said cleat members in line with said photocell whereby a light beam from said light source will hit said photocell when said apertures in said cleat members pass therebetween.

4. The structure of claim 3 wherein said photocell and said light source will actuate said rotary solenoids to close said gate members.

5. A bobbin transfer mechanism comprising an endless belt, means forming pockets in the outer surface of said endless belt, means supplying bobbins to said pockets, said belt having at least one run in which said pockets open downwardly, belt guiding means operably associated with said one run and preventing said bobbins from dropping out of said downwardly opening pockets, means forming an opening in said belt guiding means of sufficient size to allow a bobbin to fall through, gate means operably associated with said opening to prevent bobbins from falling through said opening from said one run, bobbin receiving and guiding means located below said opening, means operably associated with said one run, said gate means, and said bobbin receiving and guiding means to periodically open and close said gate means to allow bobbins to be supplied to said bobbin receiving and guiding means, said means operably associated with said one run, said gate means, and said bobbin receiving and guiding means including a detecting means in operative relationship with said bobbin receiving and guiding means, and further including a photocell and light source to actuate said gate means when said detecting means has detected the absence of bobbins to open said gate means to drop bobbins into said bobbin receiving and guiding means, said pockets being formed by cleat members spaced from one another on said endless belt and means forming apertures through certain preselected cleat members, said photocell being mounted on one side of said cleat members and said light source being mounted on the other side of said cleat members in line with said photocell whereby a light beam from said light source will hit said photocell when said apertures in said cleat members pass therebetween.
allow bobbins to be supplied to said bobbin receiving and guiding means, said means operably associated with said one run, said gate means, and said bobbin receiving and guiding means including a detecting means in operative relationship with said bobbin receiving and guiding means to detect the absence of bobbins in a certain predetermined area of said bobbins receiving and guiding means, and further including a photocell and light source to actuate said gate means when said detecting means has detected the absence of bobbins to open said gate means to drop bobbins into said bobbin receiving and guiding means.

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