APPARATUS FOR ORIENTING AND PACKAGING ELONGATED PARTS

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This invention relates generally to an apparatus for orienting and packaging elongated parts, and more specifically, this invention provides an apparatus for orienting, aligning and packaging lengths of flexible wire as they issue from a conventional wire cutting machine.

Electrical assembling and installing operations, in particular, employ bundles incorporating a number of insulated wires which have the end portions thereof stripped of insulation. Machines are available that will automatically measure, cut and strip one or both of the ends of the insulated wire. Such machines also include a counter mechanism for counting the number of wires cut and stripped. As the cut and stripped wires issue from these machines, they pile up in an unoriented mass in the bottom of the exhaust chute. If a counter is also utilized, the machine will stop after a predetermined number of wires have been cut and stripped as a result of a signal from the counter.

In order to facilitate the selection of individual wires by an assembler, the wires should preferably be presented to the assembler in bundle-form, with the ends of the lengths comprising the bundle in substantial alignment. Present practice requires manual manipulation of the wires until they are oriented with their lengths substantially parallel and their ends aligned. Rubber bands are thereafter placed around the ends of the bundle in order to hold the length of wire together.

Sorting and bundling problems arise under present practice when the operator tries to convert the mass of cut wires into bundle-form. The problems of untying, orienting and aligning the wires are quite bothersome, particularly when the mass consists of a considerable number of flexible lengths. In practice, the operator spreads out the wires on a flat surface and then physically moves each misaligned wire until the ends thereof is aligned with the ends of other wires. The operator must then bundle the lengths so that they can be secured together by rubber bands. As will be evident, such a process requires considerable time-consuming attention by the operator.

It is an object of this invention to provide an automatic packaging system which will replace the above-described manual sorting and bundling operation.

Another object of this invention is to provide an automatic packaging apparatus in accordance with the above object for use with conventional wire cutting machines without essentially modifying or changing the structure of the latter.

More specifically, it is an object of this invention to provide an apparatus for receiving cut lengths from a cutting machine and which orients the lengths so received in longitudinal directions, collects the lengths into bundles, aligns the ends of the bundle, and thereafter packages the bundle.

Another object of this invention is to provide a packaging apparatus in accordance with the foregoing object that additionally counts and controls the number of lengths so that the packaged bundle contains only a predetermined number of lengths.

Still another object of the invention is to provide a relatively simple mechanism for periodically indexing a packaging mechanism to a position where a container carried by the packaging mechanism can receive a predetermined number of lengths.

According to this invention, a vibrating chute receives cut lengths of material and is formed with a constricted end portion. The vibration of the chute and the constricted end portion cooperate to respectively orient and compact the lengths into bundle form. A packaging mechanism is positioned to receive bundles of lengths issuing from the constricted end of the chute. A control mechanism is provided to control the number of lengths deposited in the chute, and a closure member is interposed between the constricted end of the chute and the packaging mechanism. The closure member supports and releases bundles in response to signals from the control mechanism so that each bundle contains only a predetermined number of lengths.

Other objects, advantages and novel aspects of the invention will become apparent upon consideration of the following detailed description, in conjunction with the accompanying drawings, in which:

FIG. 1 illustrates the complete packaging apparatus constructed in accordance with this invention;

FIG. 2 is an end view of a collector for receiving lengths issuing from a length cutting machine and transferring the lengths received thereby to a vibrating chute positioned therebeneath;

FIG. 3 is a detailed plan view, taken on the line 3—3 of FIG. 1, of the blocking plate which alternately supports and releases a bundle in response to a signal from a control mechanism;

FIG. 4 is a partial side view of the control mechanism for effecting sequential operation of the various stages of the packaging apparatus;

FIG. 5 is a detailed plan view of a mechanism for actuating a package carrying turret; and

FIG. 6 is a sectional end view of FIG. 5 taken through section lines 6—6.

Referring now to FIGS. 1 and 2, there is illustrated the packaging apparatus 10 in combination with a conventional length cutting machine 11 for severing successive sections of insulated wire, stripping the insulation from the ends thereof and discharging the wire sections in a substantially horizontal position. The system 10 includes a rotatable length collector or accumulating device indicated generally by the numeral 12, which is supported for rotative movement on supports 13 and consists of a pair of end plates 14 and a central core 15 having four substantially U-shaped portions 16a, 16b, 16c and 16d which form axially directed recesses or pockets for receiving the lengths therein. Lengths issuing from the machine 11 are received by one of these portions. The collector 12 is supported by a shaft 17 revoluble in suitable bearings in the supports 13. Affixed to one extremity of the shaft 17 is a ratchet 18, which is revoluble in a clockwise direction, FIG. 2, by means of a pawl 19 under the control of a conventional air cylinder 20. It will be evident that actuation of the pawl 19 effects rotation of the ratchet 18 through 90°, causing any lengths deposited in the depressed portion 16a to be thrown or fed therefrom onto a slide plate 21. A pair of springs 22 and 23 are connected to the pawl 19 and to the support 13. The spring 22 biases the pawl against the teeth of the ratchet and the spring 23 returns the pawl to the position shown in the figures after actuation thereof. The pawl is guided for movement by a linkage 24 pivotally mounted by a pin 25 to the support 13. A semi-circular inclined chute 26 is placed at the bottom of the plate 21 to receive the lengths and is mounted on a table 27 in such a manner that it may be vibrated in the directions indicated by arrows A—A by a commercial vibrator indicated generally by the numeral 28.
The vibrator can be driven electrically, hydraulically, or otherwise. As may be seen in FIG. 1, the chute 26 is positioned at an angle with respect to the table 27 and when vibrated by the vibrator 28 causes the lengths deposited therein to move toward the right or down the chute. An L-shaped rod 33 is secured at an angle to the plate 31 and serves to pivot the lengths so that the ends thereof enter the chute 26.

The walls of the chute 26 taper inwardly and finally terminate as a funnel-shaped end 29. The lower opening of the end 29 is normally blocked by a pair of plates 30 mounted therebeneath. The vibrating motion of the chute 26 serves to longitudinally orient the lengths during travel thereof towards the end 29.

A turret 31 is rotatably mounted under the plates 30 on a shaft 32 and is so positioned that a plurality of apertures 34 (FIG. 1) equi-spaced in a circle near the periphery thereof may be presented successively below the opening in the end 29. A standard 32a supports the shaft 32 for rotative movement. Secured to the shaft 32 is a ratchet 35 (FIGS. 1, 5 and 6) having a predetermined number of teeth, four of the teeth being designated by the numerals 36a, 36b, 36c and 36d. These teeth are spaced adjacent the periphery thereof and are equal in number to a number of equispaced holes 37 (FIG. 5). The holes 37 are equal in number to the number of apertures 34, and are spaced in a circle concentric with the axis of the ratchet 35. The ratchet 35 indexes the turret 31 by means of a pawl 36 under the control of an air cylinder 39 of conventional type.

Referring now to FIG. 1, a plurality of tubes, indicated generally by the numeral 40, are provided, one in each of the apertures 34. The tubes 40 have an open upper end, a closed lower end, and an enlarged portion along the length thereof which serves to overlay the turret 31 and support the metal beads 36. The tubes may be of the type disclosed in U.S. Patent No. 2,881,947 issued to W. M. Hancock and assigned to Western Electric Company, Inc.

The operation of the apparatus 10 is such that after a predetermined number of cut lengths are collected in depression 16a in the collector 12, the collector will be rotated clockwise 90° to throw the lengths onto the plate 21 down which they fall by gravity into the enlarged end of the chute 26. The vibrator 28, acting against the chute 26 will vibrate and thereby advance and orient the lengths until the lenses fall into the chute 26 where they are ultimately supported by the plates 30 in compacted bundle-form. Upon separation of the plates 30, the bundle is released and falls from the end 29 into one of the tubes 40. Thereafter, the plates 30 will close and the turret 31 will be stepped or indexed to present a succeeding tube 40 below the end 29.

In order to achieve the above sequential operations, a control mechanism or timing device, indicated generally by the numeral 42 in FIG. 4, is provided. The mechanism 42 consists of a counting gear 43 mounted on a shaft 44 for rotation by a pawl 45. The pawl 45 is inter-connected with an arm 46 which in turn is connected to one end of a lever 47 pivotally connected to the machine 11 by a pivot pin 48. The other end of the lever 47 is connected to one of the material cutting blades (not shown) of the machine 11 so that every time the machine 11 cuts a length, the lever 47 will be pivoted. The lever 47 acts through the arm 46 and the gear 43 to rotate the distance of one tooth in a clockwise direction, the gear 43 being indexed the distance of one tooth as each length exhausts from the machine 11.

The gear 43 has a contact operating arm 50 secured for movement therewith and upon rotation thereof the extremity acting through either an arm 51 or an arm 52 actuates switches 53 or 54, respectively. The switch 53 is connected in circuit with an air solenoid (FIG. 1), generally referred to by the numeral 56, the solenoid acting to switch air from a pressurized air source 57 into the cylinder 20 (FIG. 1) every time the contact operating arm 50 depresses and thereby closes the switch 53 (FIG. 4). Actuation of a piston (not shown) in the air cylinder 20 causes the pawl 19, FIG. 1, to rotate the ratchet 18 clockwise 90° to the limits of the lengths deposited in the portion 16e to the plate 21.

The lengths fall initially into the widest portion of the chute 26 and are oriented and caused to travel the length of the chute 26 until they slide in compacted bundle-form into the end 29 with their lower ends abutting the plates 30 which are closed. As more lengths are brought from the machine 11, the counterclockwise 43 will be rotated in step-by-step manner. Succeeding cut lengths are exhausted into the succeeding depression 16b now presented to the exhaust of the machine 11.

The closure of the switch 53 by the operating arm 50 will simultaneously effect actuation of the air solenoid 60 (FIG. 1) since the solenoids 56 and 60 are connected in parallel with the switch 53. A battery 61 provides a power source for energizing both solenoids which are of a commercial type. Upon energization of the solenoid 60, pressurized air is received by the air cylinder 39.

Referring now to FIG. 5, the air cylinder 56 shown mounted is the standard 32a by means of a plate 62. A rod 63 driven by a piston (not shown) in the cylinder 39 is pivotally connected by a pin 64 to a pawl 65. The pawl 65 (FIG. 6) comprises a pair of spaced-apart rectangular plates 64a and 64b connected together by pins 64 and 73, respectively. A cam 66 having an inclined surface 66a tapering from right to left as shown in FIG. 5 is affixed to the plate 65a and is designed to move under and engage an end 67 of an L-shaped lever 68 pivotally mounted to the plate 62 at 69 (FIG. 6). A spring 70 biases the lever 68 counterclockwise, as viewed in FIG. 6. A blocking pin 71 hoạted in the cam 66, particularly with the circle formed by the centers of the holes 37 and is pivotally connected to the end of the lever 68. The distance between successive holes is substantially equal to the distance between successive teeth on the ratchet 35. The spring 70 urges one end of the pin 71 into a hole 37 presented above the pin. A bore 72 in the plate 62 accepts the opposite end of the pin 71 for sliding movement therein. When the pin is inserted into a hole 37, the end portion remaining in the bore 72 serves to connect the ratchet 35 to the stationary plate 62 thereby locking the ratchet against further rotation.

In order to release the ratchet 35, the cam surface 66a must move under the groove end 67 of the lever 68 to wedge and thereby pivot the lever clockwise to the dotted line position shown in FIG. 6. Since the cam 66 tapers to a pointed edge and since the end 67 is spaced from the plate 65a, the pointed edge thereof will not be blocked by the end 67. The inclined surface 66a will drive the end 67 clockwise upon further movement of the pawl 65 to the left, FIG. 5. Rotation of the ratchet 35 is achieved by the portion of the pin 73 that extends between the plates 65a and 66b. Coil springs 74 and 75 are respectively affixed to the ends of the pins 73 and 64 and to the ends of the pins 76 and 77 fixed to, and extending from, the plate 62. The springs 74 and 75 guide the pawl 65 during movement thereof and also serve to retract the pawl to the position shown in FIG. 5.

When the air cylinder 56 is actuated by the solenoid 60, the rod 63 drives the pawl 65 to the left, as viewed in FIG. 5, thereby causing the pin 73 to ride along the edge of the tooth 36c. As the pin 73 reaches the apex of the tooth 36c, the cam 66 has moved sufficiently under the lever end 67 to tilt the lever until the pin 73 is almost completely withdrawn from the hole 37. Complete withdrawal of the pin 71 occurs after the pin 73 has moved between the teeth 36c and 36d and against the face of the tooth 36c.

Since the ratchet 35 is now released for rotation, upon subsequent deenergization of the solenoid 60 by the switch
53, the springs 74 and 75 will retract the pawl 65 and the pin 73 causing the ratchet to be indexed the distance of one tooth. Upon retraction of the pawl 65, the cam 66 will also be retracted to its initial position substantially as shown in FIG. 5 releasing the end 67 of the lever 68 so that the spring 70 (FIG. 6) can drive the pin 71 into a succeeding hole 37 in the ratchet 35.

As the counting gear 43 is further rotated to the position where the contact operating arm 59 through the arm 52 closes the switch 54, an air solenoid 30, FIG. 1, will be energized by the source 57 to switch pressurized air into an air cylinder 82. The air cylinder 82 is secured to a flange 83 extending from a table support 84. The plates 30 (FIG. 3) are pivotally connected by pins 86 and 87 to the flange 83. A piston rod 90 of the air cylinder 82 has a pair of arms 88 and 89 pivotally mounted to the end thereof. Opposite extremities of the arms 88 and 89 are secured to the plates 30 and the plates can be separated against the compression of a connecting spring 85 upon movement of the rod 90 to the right by a piston (not shown) in the cylinder 82. The plates 30 therupon separate, to the dotted line positions, and release the bundle in the end 29 so that it can be packaged by a tube 40 presented beneath the plates 30. Upon deenergization of the solenoid 80 by the switch 54, the spring 85 contracts and closes the plates 30.

The above-described cycle repeats as the counting gear 43 continues to rotate the operating arm 59 in response to length cutting by the machine 11. The number of lengths packaged in each tube 40 is thus equal to the number of teeth on the gear 43. In the event that a different number of lengths might be desired to be collected at one time, either the gear 43 could be interchanged with another gear having a different number of teeth, or the entire control mechanism 42 may be removed from the machine 11 and another suitable control mechanism substituted therefor.

After the lengths are packaged in the tubes, the tubes may be removed and placed in a rack, similar to that disclosed in the above-identified patent, which is located at the working station where the electrical assembly is being done. The removed tubes can be replaced by unfilled tubes.

Although the apparatus 10 has been specifically disclosed as an automatic packaging apparatus for use with wire cutting and stripping machines, it should be evident to those skilled in the art that the apparatus may also be employed to package automatically predetermined numbers of plastic tubing lengths, lengths of synthetic or glass filaments, and like lengths.

It should also be evident to those skilled in the art that the collector 12, the plates 30 and the turrets 31 can be actuated at any time in the operating cycle by merely providing another microswitch in the control mechanism 42 and connecting it in circuit with the source 61, the air solenoid 60, and the air cylinder 39. The positions of the microswitches relative to the operating arm 59 will determine the operating sequence of the collector, plates and turrets.

If the apparatus 10 is to be used in combination with a material cutting machine of the type that incorporates a device for stopping the machine after a predetermined number of lengths are cut, the collector 12 can be eliminated and the chute 26 positioned to receive the cut lengths directly from the cutting machine.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for packaging lengths of material which comprises, a vibratory sloping chute for receiving and advancing such lengths of material and having an end provided with a restricted opening and wall portions converging toward said opening for directing the lengths of material into a bundle, means for feeding a predetermined number of such lengths of material into said chute, means for supporting a container in a loading position in alignment with said end of said chute for receiving the bundle, stop means interposed between the container in the loading position and said end of said chute and cooperate with said chute for supporting and orienting the lengths of material into a bundle, and means for actuating said stop means to permit the movement of the bundle into the container.

2. An apparatus for packaging lengths of material which comprises, a sloping chute for receiving such lengths of material and having an end provided with a restricted opening and wall portions converging toward said opening for directing the lengths of material laterally together, means for vibrating said chute to advance the lengths of material toward said end and into said opening, means for periodically feeding a predetermined number of such lengths of material into said chute, a stop member located adjacent to said end of said chute and cooperable therewith for supporting and orienting the lengths of material into a bundle in timed relation to said feeding means for actuating said stop member to release a bundle from said chute, carrier means for supporting a plurality of containers successively in a loading position for receiving the bundles released from said chute, and means operable in timed relation to said feeding means for indexing said carrier means to advance successive containers into the loading position.

3. In combination with a machine for severing successive sections from an elongated element of indefinite length and discharging the sections in a substantially horizontal position, means mounted in the path of such sections for receiving and accumulating the sections, means for periodically actuating said accumulating means to effect the ejection of the accumulated sections, a chute having a portion disposed in inclined relation to the horizontal in a position to receive the sections as they are ejected from said accumulating means and having a downwardly directed conical portion provided with a restricted opening, means for vibrating said chute to orient the sections in parallel relation to each other and to effect the longitudinal movement of the sections into the downwardly directed conical portion of the chute and the lateral movement of the sections together in said chute, stop means below said opening of said chute for supporting the sections thereon, means for supporting a tubular container in vertical alignment with said opening and below said stop means, and means for withdrawing said stop means to permit the movement of the elements from said chute into said container.

4. In combination with a machine for severing successive sections from a wire of indefinite length and discharging the wire sections in a substantially horizontal position, a rotary accumulating device having a plurality of axially directed peripheral recesses for receiving the wire sections, means for supporting said accumulating device for rotary movement about the horizontal axis with one of said recesses in position to receive the wire sections as they are discharged from said machine, a counting device actuated by the machine in timed relation to the discharge of wire sections therefrom, means operable under control of said counting device for indexing said accumulating device at predetermined interval to effect the ejection of the wire sections from a recess of said device and the positioning of another recess for receiving the wire sections from the machine, a chute having a portion disposed in inclined relation to the horizontal in a position for receiving the wire sections discharged from the accumulating device and having a downwardly directed funnel-shaped portion provided with a restricted opening, means for vibrating said chute to effect the orientation of said wire sections into parallel relation.
with one another and the longitudinal movement of said wire sections into said downwardly directed portion and into the opening thereof and the movement of the wires thereby into a bundle, stop means mounted for movement below and in close proximity to said opening of said chute for arresting the downward movement of the bundle of wire sections therein, a carrier for supporting tubular containers for receiving the bundles of wire sections, means operable under control of said counting device for indexing said carrier to advance successive containers to a loading position below and in registration with said opening in said chute, and means operable under control of said counting device for actuating said stop means to release the bundle of wire sections for movement into the container.