United States Patent [19]

Maroschak

[11] **3,870,774**

[45] **Mar. 11, 1975**

[54] **PIPE DOFFING AND BUNDLING METHOD**

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[22] Filed: **Sept. 1, 1972**

[21] Appl. No.: **285,928**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 278,003, Aug. 4, 1972.

[52] **U.S. Cl.** ..... **264/40,** 83/160, 100/6, 100/7, 214/6 D, 264/99, 264/151, 264/209, 264/238, 264/DIG. 052, 425/135, 425/296, 425/DIG. 206, 425/DIG. 231

[51] **Int. Cl.** .. **B29c 17/07,** B29c 17/16, B65b 13/02

[58] **Field of Search** ..... 264/89, 90, 92, 93, 94, 264/95, 98, 99, 148, 150, 159, 151, 209, 40, DIG. 052, 238; 425/142, 296, 302, 303, 326, 342, 343, 396, 139, 135, DIG. 206, DIG. 231; 214/6 D; 100/6, 7; 83/158–160

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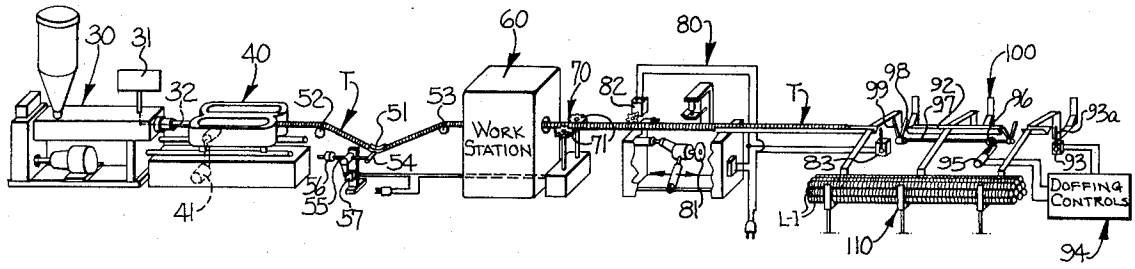
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[57] **ABSTRACT**

Concurrently with, or after the molding of a tube, such as a corrugated plastic tube, cut lengths thereof are formed into bundles of a predetermined number of cut lengths wherein successive cut lengths of a tube are continuously fed into a doffing station and according to a preselected routine are ejected into either of two hoppers located on opposite sides of the doffing station. As selected, successive cut lengths may be ejected alternately into the first and second hoppers or, alternatively, a predetermined number of successive cut lengths may be ejected first into the first hopper and then into the second hopper. The ejected cut lengths of tubes are stacked in nesting relation and secured together with bundling elements to form bundle.

13 Claims, 10 Drawing Figures



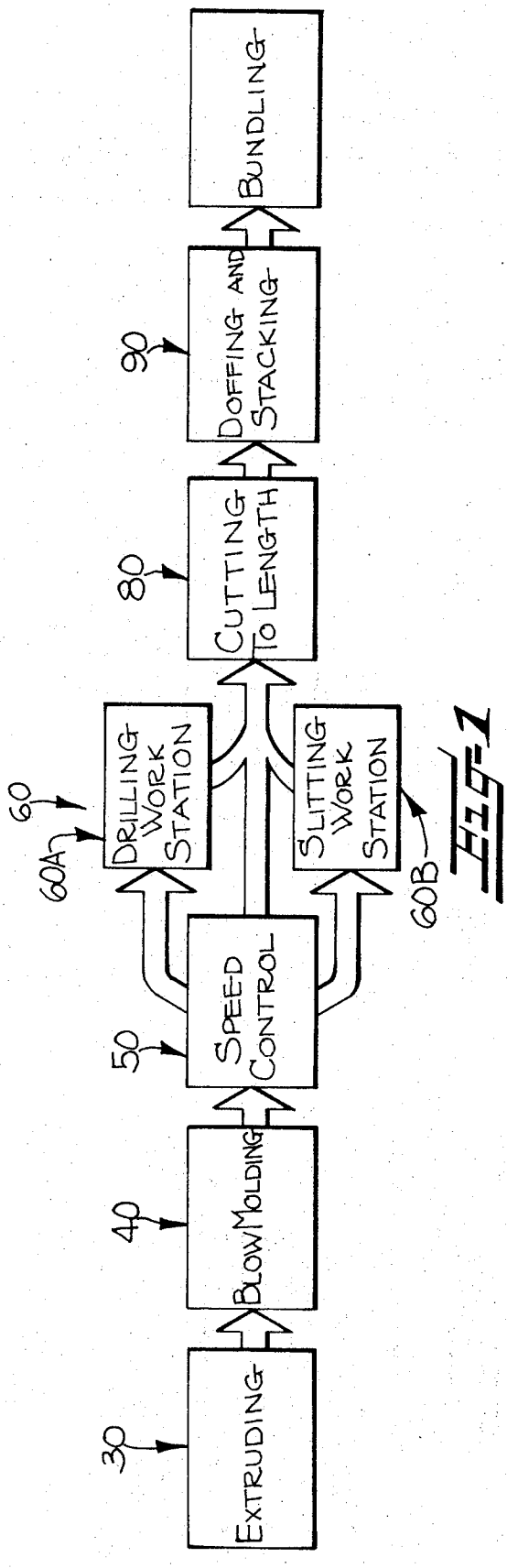

EXTRUDING
30
BLOW MOLDING
40
SPEED CONTROL
50
DRILLING WORK STATION
60A
60
SLITTING WORK STATION
60B
CUTTING TO LENGTH
80
DOFFING AND STACKING
90
BUNDLING

FIG-1

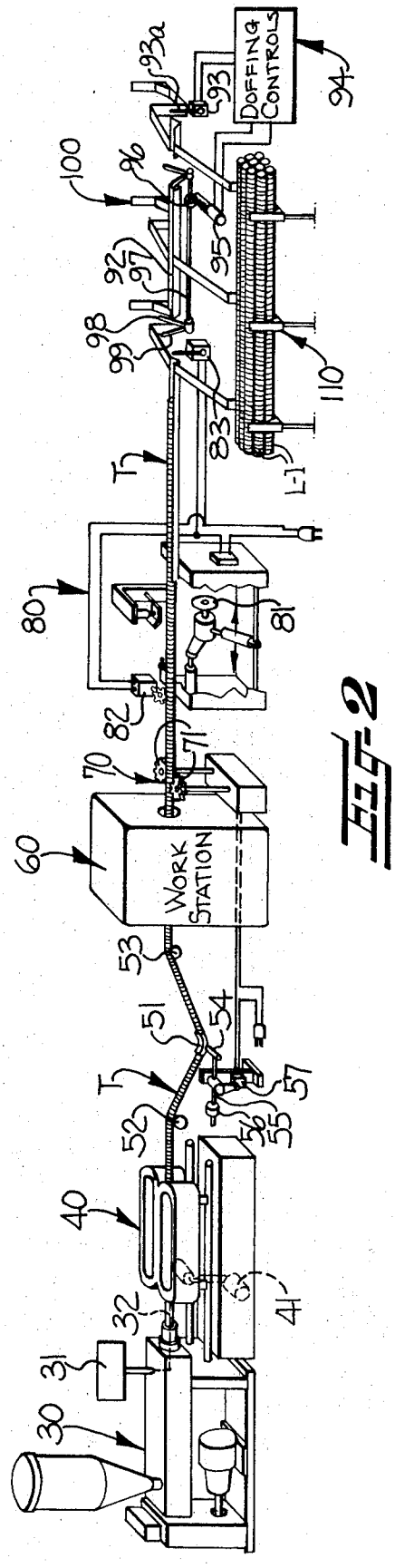

30
31
32
40
41
WORK STATION
60
70
71
80
81
82
T
L-1
83
110
DOFFING CONTROLS
94
93a
93
96
97
98
99
100
92
95
51
52
53
54
55
56
57

FIG-2

Fig-3

Fig-4

Fig-6

Fig-5

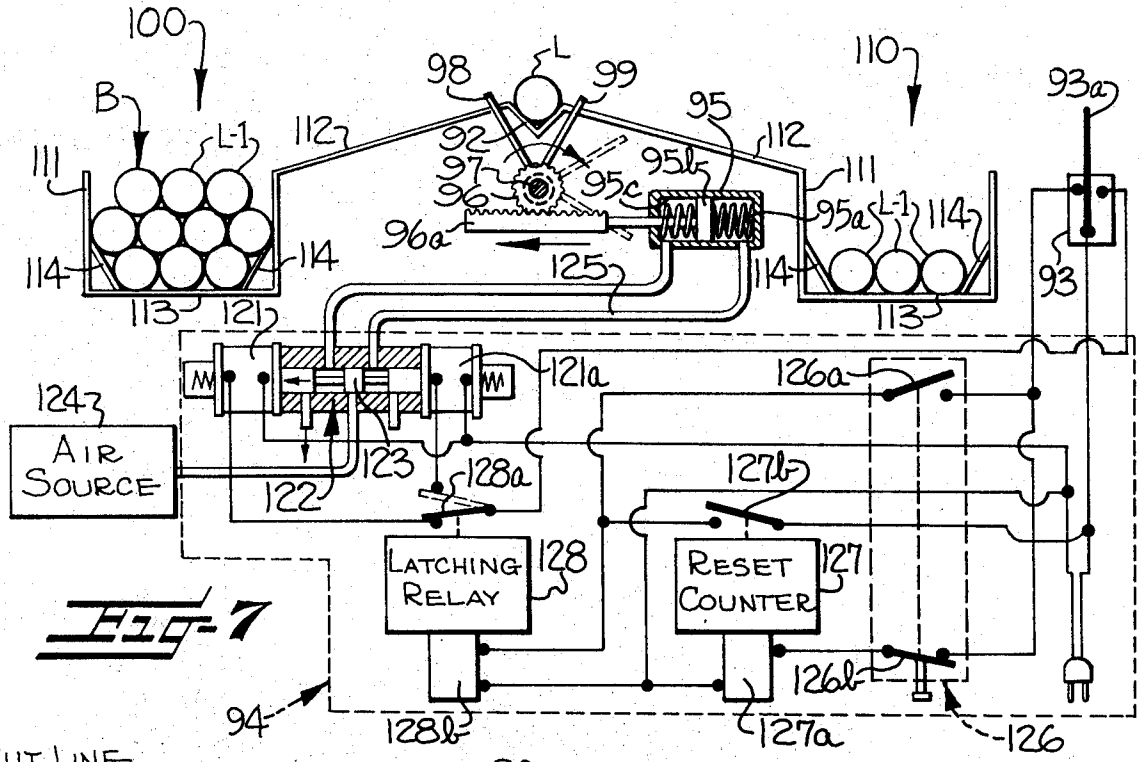


Fig-7

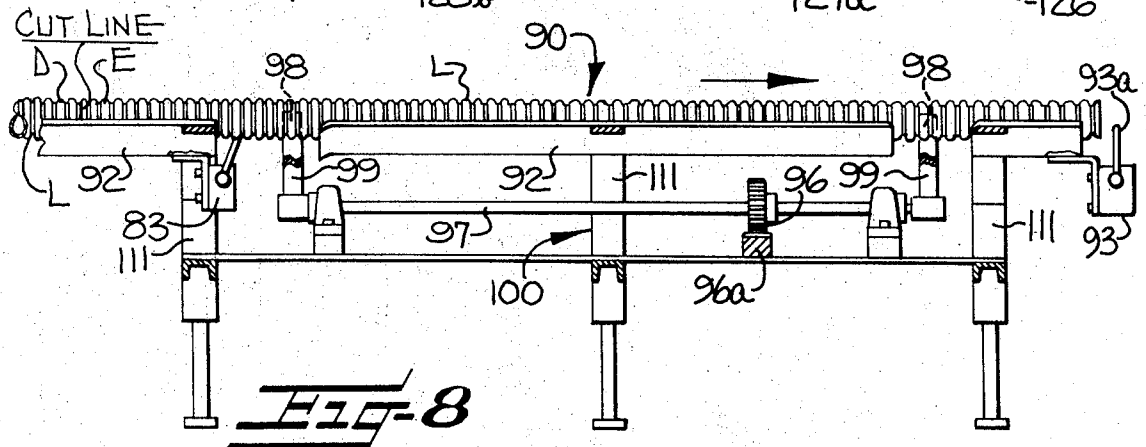


Fig-8

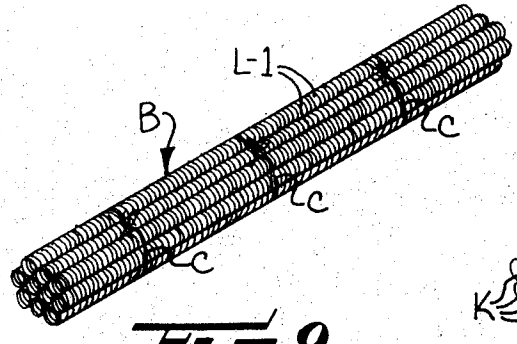


Fig-9

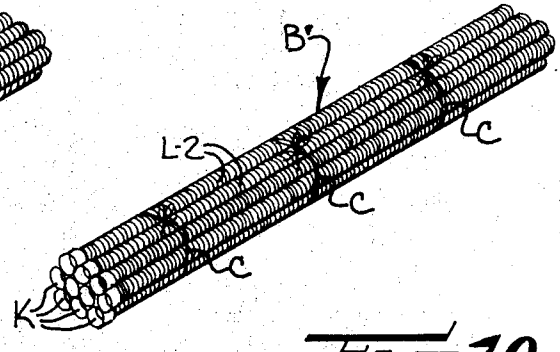


Fig-10

PIPE DOFFING AND BUNDLING METHOD

This application is a continuation-in-part of my copending application Ser. No. 278,003, filed Aug. 4, 1972, and entitled METHOD AND APPARATUS FOR RESHAPING TUBES TO FORM COUPLERS THEREON.

This invention relates to a method for continuously stacking cut lengths of a tube, especially corrugated plastic tube, in nesting relation into bundles containing a predetermined number of cut lengths. While corrugated plastic tube is conventionally formed in continuous lengths, it is generally shipped to the consumer either in rolls of a predetermined number of linear feet or in bundles of cut lengths of tubes containing a predetermined linear footage. For facility in shipping and in order to form a stable package, it is desirable to have the cut lengths forming the bundles nested against each other in a closely packed relationship. Where the cut lengths are formed with integral coupler collars on one end, it may be desirable, for ease of installation in the field, to have the coupler collars at a common end of the bundle. Thus, the cut lengths may be removed from the bundle and installed in position without the necessity of arranging the cut lengths to have the coupler collars at the desired end.

It is therefore the primary object of this invention to provide an improved method for continuously receiving cut lengths of a tube, especially corrugated plastic tube, stacking the same in nesting relation, and forming bundles thereof.

It is another object of this invention to provide a method of forming a bundle of plastic tubes having a corrugated wall structure of alternating ribs and valleys stacked in nesting relationship and secured together to form a bundle by a plurality of pliable binding elements.

It is a more specific object of this invention to provide a method of forming bundles of cut lengths of a flexible plastic tube by feeding the successive cut lengths to a doffing station, sensing the position of the cut lengths in the doffing station and in response thereto ejecting each successive cut length out of the path of feed of the cut lengths and into either one of a pair of hoppers located adjacent the path of travel of the cut lengths, accumulating and stacking in nesting relationship a plurality of the ejected cut lengths, and upon the accumulation of a predetermined number of cut lengths, securing pliable binding elements around the stacked cut lengths to form a bundle thereof.

It is still another object of this invention to provide a method utilizing an apparatus for forming cut lengths of an elongate flexible plastic tube into stacks facilitating the forming of bundles thereof, which apparatus comprises a doffing station including support means arranged to receive successive cut lengths of the flexible tube and further including means to sense the arrival of each successive cut lengths in the doffing station and ejecting the same from the support means, and hopper means for accumulating and stacking in nesting relationship therein a predetermined number of the cut lengths as they are ejected from the support means preparatory to binding the stacked cut lengths together with pliable binding elements to form bundles thereof.

It is still a further object of this invention to provide a method for stacking and forming bundles of cut lengths of a flexible plastic tube, downstream of, and concurrently with the continuous extrusion and molding of the plastic tube and the cutting thereof into cut lengths.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which

FIG. **1** is a block diagram of the method of making a corrugated plastic tube and forming cut lengths thereof into bundles;

FIG. **2** is a schematic perspective view of an arrangement of apparatus for carrying out the method of this invention;

FIG. **3** is a schematic plan view of the extruder and blow molding machine showing one arrangement of the die blocks for producing a molded corrugated plastic tube and showing lines along which it is preferred that the molded tube be severed to form nominal 10 foot lengths therefrom;

FIG. **4** is a schematic plan view similar to FIG. **3** wherein the die blocks are designed to mold a series of closely spaced corrugated body-forming lengths with interconnecting sleeves between the body-forming lengths and also showing lines along which it is preferred that the molded tube be severed to form nominal 10 foot lengths therefrom with each length having an integral coupler collar on one end thereof;

FIGS. **5** and **6** are enlarged perspective views of the doffing, stacking and bundling portions of the apparatus showing two methods of sorting and stacking according to the invention;

FIG. **7** is a schematic cross-section of the doffing and stacking apparatus also showing schematically the doffing control system;

FIG. **8** is a vertical sectional view of the doffing, stacking and bundling portions of the apparatus taken along the line **8—8** in FIG. **5** and wherein a cut length of the corrugated tube is resting in the supporting trough of the doffing station;

FIG. **9** is a schematic view showing one embodiment of the bundle of tubes according to the invention; and

FIG. **10** is a schematic view showing a second embodiment of the bundle of tubes according to the invention wherein each tube has an integral coupler collar on a common end of the bundles.

Referring more specifically to the drawings, as shown in FIG. **2,** an extruding machine **30** is arranged to continuously extrude and feed a tube of hot plastic material into a blow molding machine or corrugator broadly designated at **40.** The blow molding machine is of a well known type which successively forms annular corrugations on the tube being extruded from machine **30** as the tube is received in an elongate blow molding zone formed by a plurality of pairs of cooperating substantially semitubular mold sections or die blocks arranged in end-to-end relation in each of two opposing series. Conventional drive means, shown schematically at **41** in FIG. **2,** is provided for moving the two series of die blocks along respective endless paths with the proximal runs or reaches of such paths extending in and moving forwardly along a substantially straight path aligned with the nozzle of extruding machine **30** and forming a first blow molding zone in machine **40.**

As is well known, the die blocks move forwardly together along the molding zone where they are formed into said cooperating pairs with each cooperating pair forming a single mold cavity and with the cavities of all the die blocks in the molding zone forming an elongate

composite mold cavity having annular corrugations of alternating ribs and valleys therealong for forming respective valleys and ribs defining the wall of the corrugated tube being formed. In this regard, the corrugated tube being formed by molding machine **40** is broadly designated at T. Since conventional corrugated die blocks such as are used in molding machine **40** are well known, a further detailed description thereof is deemed unnecessary. As is conventional, extruder **30** is provided with suitable pressure means for introducing compressed air or other fluid under pressure from source **31** through outlet **32** and into the tube being extruded to expand and mold the same against the corrugated wall of the composite mold cavity formed by the die blocks at the molding zone defined thereby.

The term "annular corrugations" as used herein not only means corrugations in the form of individual circular ribs and valleys around the plastic tube, but also means spiral or helical ribs and valleys extending around and along the length of the corrugated tube. Also, some of the ribs of the corrugations may be interrupted at certain intervals, such as for the purpose of providing recesses in the corresponding ribs for the drilling of drainage holes through the recesses of the tube at spaced intervals along the length of the corrugated tube.

As indicated heretofore, the forwardly moving die blocks of molding machine **40** deliver corrugated tube T forwardly at a predetermined speed. As indicated in FIGS. **1** and **2**, the corrugated tube T being delivered from blow molding machine **40**, successively passes through a speed control or tension sensing device **50**, a work station **60**, a positive feeding mechanism **70**, a cutting station **80**, a doffing station **90**, and stacking and bundling apparatus **100, 110** which is employed to form uniform cut lengths of the tube T, such as 10 foot lengths, for example, into stacks to ultimately be formed into bundles B or B' tied with a plurality of tie strings or other pliable binding elements C therearound as shown in FIGS. **9** and **10**.

The positive feeding mechanism **70**, under control of speed control **50**, may, as indicated in FIG. **1**, feed corrugated tube T directly through cutting station **80** while by-passing work station **60**, or the feeding mechanism **70** may feed tube T through work station **60** in its course from molding machine **40** to cutting station **80**. Work station **60** may take the form of a drilling work station **60A** or it may take the form of a slitting work station **60B** as shown in FIG. **1**. If work station **60** is in the form of a drilling work station **60A**, it may include any suitable means for drilling drainage holes at spaced intervals along and around tube T being fed therethrough by feeding mechanism **70**. By way of example, drilling work station **60A** may be of the general type disclosed in my copending application Ser. No. 262,192, filed June 13, 1972, and entitled METHOD OF MAKING AND PROCESSING CORRUGATED PLASTIC PIPE.

If work station **60** is in the form of slitting work station **60B** of FIG. **1**, it may include a plurality of slitting saws or rotary cutting blades arranged around the tube and periodically moved into engagement with the tube for cutting slits in the valleys thereof. Slitting work station **60B** may be of the general type disclosed and claimed in my copending application Ser. No. 271,379, filed July 13, 1972, and entitled METHOD AND APPARATUS FOR FORMING SLITS IN TUBES. As is well known, it is customary to provide round drainage holes in corrugated plastic tubes used for septic tanks fields or other drainage systems, and it is customary to provide circularly arranged series of arcuate slits, usually in alternate valleys, in a corrugated tube used for an underground irrigation system. Accordingly, a detailed illustration of the work station **60** or either of its embodiments **60A** or **60B**, and an illustration of the drilled holes or slits in the tube is deemed unnecessary for the purposes of this disclosure.

In any event, it is apparent that it is highly desirable that the corrugated tube, generally designated at T, is fed in a positive manner at a predetermined speed through the work station **60** in accordance with the rate at which the tube is delivered from the corrugator or molding machine **40**. Accordingly, referring to the positive feeding mechanism **70** and its speed control **50** (FIG. **2**), it will be observed that the positive feeding mechanism is illustrated in the form of a pair of spaced feed gears **71** diametrically opposed relative to tube T and preferably meshingly engaging the corrugations along opposite sides of tube T. An electric motor, not shown, preferably of the DC type, is provided for imparting rotation to the tube feed gears **71**.

In view of the fact that tube T normally is in heated condition as it passes through work station **60** and not entirely cool at this point in the process, it is desirable to avoid stretching the tube lengthwise as well as to avoid compressive shortening of the tube. To avoid these conditions, it is desirable to synchronize the speed of feed gears **71** with the delivery rate of corrugated tube T emerging from the blow molding machine **40**. This permits obtaining a final tube product having a substantially uniform number of ribs and valleys per unit length thereof. Accordingly, referring now to the speed control or tension sensing device **50**, as illustrated in FIG. **2**, it comprises a tension sensing arm **51** engaging tube T at a point between molding machine **40** and work station **60**. Sensing arm **51** rests on tube T between a pair of spaced supporting rollers or members **52, 53** and permits the tube to slide freely thereunder. Shaft **54** is carried by one end of a pivotally mounted counterbalance arm **55** having adjustably mounted counterbalance weight **56** on the other end thereof. A potentiometer or rheostat **57** is electrically connected to the feeding mechanism **70** and is operatively connected to counterbalance arm **55** so as to be driven thereby such that potentiometer **57** is varied in accordance with the position of the counterbalance arm **55**. In other words, in the event that the tension in tube T increases, this results in lifting of idler arm **51** to decrease the speed of the tube feed gears **71**.

Referring now to tube cutting station **80**, the motorized saw **81** thereof is actuated under control of either a linear counter **82** or, preferably, a sensing switch **83**. Linear counter **82** is positioned upstream of the motorized saw **81** and is operatively engaged with the tube moving thereby. Counter **82** is arranged to actuate saw **81** each time a predetermined linear footage has passed by the counter. Sensing switch **83** is positioned a predetermined distance downstream from cutting station **80** and has a switch sensing arm **84** (FIGS. **2, 5–6**) which normally protrudes upwardly through tube guide trough **91** whose rear end is also spaced a substantial distance downstream or forwardly of cutting station **80**. Upon the leading end of tube T engaging and pushing switch sensing arm **84** forwardly, switch **83** is closed to

actuate motorized saw **81.** It follows, therefore, that saw **81** severs each successive portion of corrugated tube T moving therethrough into a predetermined length. In order to enable the cutting station and doffing station to be located in close proximity to each other, sensing switch **83** is located downstream of cutting station **80** within the confines of doffing station **90.** As shown in FIG. **8,** sensing switch **83** is positioned downstream of the location of the trailing end E of each successive cut length L of the tube T as the cut length is fully received in the doffing station preparatory to being doffed. Thus upon each successive cut length L of the tube T being doffed from the doffing station, leading end D of the uncut tube will move downstream a predetermined distance before engaging sensing arm **84** of switch **83** to actuate motorized saw **81** (FIG. **2**). As is conventional, motorized saw **81** is reciprocated to automatically move forward with tube T during the cutting operation and, upon the cutting being completed, saw **81** returns upstream to its original position ready for the next cutting operation. Since the operation and structure of such cutting saws are well known in the art, a further more detailed description thereof is deemed unnecessary.

As each successive cut length of the tube is advanced forwardly of saw **81** following the cutting operation, it is advanced onto a supporting trough means **92** of the doffing station **90.** As shown in FIG. **8,** each successive cut length of tube L is fed along trough means **92** and into doffing station **90** by the leading end D of the uncut tube pushing against the trailing end E of the previously cut length of tube L. Again referring to FIG. **2,** the supporting trough means **92** is located in substantial alignment with the path of travel of corrugated tube T throughout its movement from molding machine **40** through cutting station **80.** As each successive cut length L approaches the end of supporting trough means **92,** it engages a finger **93a** of a doffing switch **93.** Doffing switch **93** is connected through suitable doffing control means **94,** to be described later, to a double-acting cylinder or ram **95.**

Double-acting cylinder **95** is connected, by a suitable rack and pinion arrangement **96,** to a rocker shaft **97.** Rocker shaft **97** is suitably journaled in the desired position and has a pair of outwardly diverging doffer arms **98, 99** projecting upwardly from each end portion of the shaft. Switch **93** and doffing control means **94** are so arranged that, as the leading ends of the cut lengths L of tube engage finger **93a** and actuate switch **93,** rocker shaft **97** is rotated in a predetermined direction to eject the corresponding cut lengths of tube L laterally from the doffing station into either a first substantially U-shaped hopper **100** located on one side of the path of travel of the successive cut lengths of tube onto supporting trough means **92** or into a second substantially U-shaped hopper **110** located on the other side of the path of travel of the successive cut lengths of tube and opposite the first hopper **100.**

As shown in FIG. **5,** each substantially U-shaped hopper **100, 110** comprising the stacking and bundling apparatus is preferably formed of a group of three spaced-apart generally U-shaped frame members **111** whose proximal portions **112** adjacent supporting trough means **92,** serve as guide tracks for guiding respective successive cut lengths L into the U-shaped frame members **111** which are so arranged as to nestingly receive approximately ten, ten-foot cut lengths of the tube therein. The opposing upright portions of the U-shaped frame members **111** are spaced apart from each other a distance sufficient to accommodate four cut lengths in side-by-side relation, while the distance along the bottoms **113** of the frame members is restricted to accommodate only three cut lengths in side-by-side relation. Gusset plates **114** are conveniently employed in the bottom corners of the U-shaped frame members **111** to restrict the distance along the bottom of the frame member **113.** As seen in hopper **100** in FIGS. **5** and **7,** when ten cut lengths of tube are doffed from the doffing station **90** into either of hoppers **100** and **110,** the cut lengths will form a three-layered stack having a bottom layer of three cut lengths in side-by-side relation, an intermediate layer of four cut lengths in side-by-side relation nestingly stacked on the bottom layer, and a top layer of three cut lengths also in side-by-side relation and nesting in the arcuate recesses formed by the intermediate layer of cut lengths. As each successive stack is formed, the spacing between the frame members **111** permits manual tieing of the cords C around the bundles B thus formed as shown in FIG. **5.** Following the tieing of each stack to form a bundle B, the corresponding bundle (FIG. **9**) is removed from the respective hopper and stored at any suitable location preparatory to shipment thereof to a customer.

Referring now to FIG. **3,** the extruding and blow molding machines and the tube produced thereby is shown, as employed in one embodiment of the invention wherein all of the cooperating pairs of die blocks are corrugated and the tube produced thereby is continuously corrugated. Also shown in FIG. **3** are the lines upon which it is preferred that the molded tube be severed to form nominal **10** foot lengths L-**1** thereof.

FIG. **4** shows the extruding and blow molding machines as employed in another embodiment of the invention in which coupler collars are integrally formed on the tube. This arrangement of extruding and blow molding machines is fully disclosed and claimed in my copending application Ser. No. 271,225, filed July 13, 1972, and entitled METHOD AND APPARATUS FOR MAKING CORRUGATED PLASTIC PIPE WITH INTEGRAL COUPLER COLLARS. As shown in the latter copending application, at least one, and preferably two adjacent pairs of cooperating die blocks indicated at **42** in FIG. **4** of this application, have portions thereof which define a non-corrugated relatively smooth substantially circular wall defining a mold cavity therein of substantially greater axial length than that of a plurality of ribs in the remaining pairs of cooperating die blocks, with the cylindrical wall being of a substantially greater diameter than that of the valleys of the corrugations in the remaining pairs of cooperating die blocks. Thus, when the molded tube T emerges from the molding zone of FIG. **4,** it will comprise successive closely spaced elongate corrugated lengths L-**2,** L-**3** with enlarged relatively short noncorrugated sleeves **43** between and interconnecting the proximal ends of adjacent corrugated lengths, and the distance between the medial longitudinal centers of the adjacent sleeves will be about 20½ feet which, as preferred, somewhat exceeds the length of tube required in order to form nominal ten-foot lengths of pipe therefrom having an enlarged integral coupler collar K (FIG. **6**) on one end thereof. When the thus molded tube is cut along the lines indicated in FIG. **4,** which include a line about halfway between opposite ends of each succes-

sive sleeve, forming each sleeve into a pair of separate collars, and also include a line cutting each successive body-forming length about halfway between opposite ends thereof, the cut lengths thus produced will have the integrally formed coupler collar on leading ends of alternate cut lengths L-3 and on trailing ends of intervening cut lengths L-2.

The doffing control means **94** and associated circuitry, which will be more fully described later, may be manually selected so as to deposit ten cut lengths in succession in one of the hoppers **100** or **110,** and then deposit ten cut lengths in the other of the hoppers so that, while one hopper is receiving a stack of cut lengths, an operator may be tieing the cords C around the stack previously deposited in the other of the hoppers. Alternatively, the doffing control means **94** and associated circuitry may be manually selected so as to deposit alternate successive cut lengths into one of the hoppers **100** or **110** and intervening cut lengths into the other hopper.

FIG. **5** shows the doffing and stacking apparatus operating according to the former mentioned alternative. As can be seen in FIG. **5,** ten successive cut lengths of the tube have been deposited into hopper **100** where they have been secured together in nesting relationship by pliable binding elements, such as cords C, into a bundle B. As directed by the doffing control, ten successive cut lengths will be deposited into hopper **110,** whereupon the doffing control will again eject ten successive cut lengths into hopper **100.**

FIG. **6** shows the doffing and stacking apparatus as used for sorting and stacking cut lengths of plastic tube which have an integrally formed coupler collar K on one end thereof. As shown in FIG. **6,** successive cut lengths are delivered to the doffing station with the integral coupler collars K on the leading end of alternate cut lengths and on the trailing end of intervening cut lengths. According to this variation, the doffing control may be selected to eject alternate successive cut lengths into hopper **110** while ejecting intervening cut lengths into hopper **100.** Thus, the cut lengths are sorted so as to provide the integral coupler collar at a single common end of each stack. When ten cut lengths are accumulated in hopper **100** the operator will secure the stack into a bundle by means of pliable binding elements such as cords. FIG. **10** shows a bundle of tubes produced according to this embodiment of the invention wherein the coupler collar on each tube is located at a common end of the bundle.

it is to be understood that the successive cut lengths with integral coupler collars thereon, produced as above described, may, if desired, be deposited into the hoppers according to the earlier described alternative, wherein ten successive cut lengths are deposited into the first hopper **100** and then ten successive cut lengths are deposited into the second hopper **110.** Each bundle thus produced has some of the cut lengths of tubes therein with the integral coupler collars located at one end of the bundle while the remainder of the cut lengths in that bundle have the integral coupler collars located at the opposite end of the bundle.

FIG. **7** schematically shows the operation of doffing station **90** as controlled by doffing controls **94.** Advancing cut lengths arriving at the doffing station deflect wand **93***a* of doffing switch **93** and thereby activate coil **121** of a two-way fluid valve **122** causing a valve core **123** to be moved to the left, thereby permitting compressed fluid from a source **124** to flow through the valve, along fluid line **125** and into chamber **95***a* of a double-acting cylinder or ram **95.** Thus, piston **95***b* and toothed rack **96***a* of rack and pinion assembly **96** are moved to the left from their normal neutral position, to which they are urged by springs **95***c*. Accordingly, outwardly diverging doffer arms **98** and **99** are caused to rotate clockwise to the position indicated by the dashed lines. The cut length L resting in trough **92** is accordingly struck by doffer arm **98** and ejected into hopper **110.**

When doffing control **94** is in the mode illustrated in FIG. **7,** as selected by selector switch **126,** the reset counter **127** is operatively included in the circuit. Reset counter **127** is of a well known type wherein contact **127***b* is closed momentarily after coil **127***a* has been activated and then interrupted a predetermined number of times. As employed in the circuit shown, reset counter **127** causes contact **127***b* to close momentarily after ten successive cut lengths have been doffed into the respective hopper **110.** The closing of contact **127***b* activates latching relay **128,** which is of a well-known type wherein single-pole double-throw contact **128***a* is alternately thrown from one position to another position each time coil **128***b* is activated. When coil **128***b* of latching relay **128** is activated, contact **128***a* is thrown to the position indicated by the dashed lines, whereupon coil **121***a* of two-way valve **122** is substituted in the circuit for coil **121,** causing fluid pressure to enter the left-hand end of cylinder **95** in FIG. **7.** Accordingly, the above sequence is repeated with ten successive cut lengths being ejected into the other hopper **100.**

Where integral coupler collars are formed on the ends of cut lengths in the manner described above, such that successive cut lengths arrive at the doffing station with the coupler collar located at the leading end of alternate cut lengths and at the trailing end of intervening cut lengths, it may be desired to doff alternate cut lengths to a first hopper and intervening cut lengths to a second hopper so that all of the coupler collars in each stack of cut lengths will be at a common end as shown in FIG. **6.** This function may be obtained by manually throwing selector switch **126** (FIG. **7**) such that contact **126***a* is closed and contact **126***b* is opened. In so doing, the reset counter **127** is removed from the circuit and the latching relay **128** alternately causes coil **121** and coil **121***a* of valve **122** to be energized. Thus, piston **95***b* of cylinder **95** is driven alternately to the right and to the left, thereby causing successive cut lengths of the tube to be ejected alternately into hoppers **100** and **110.**

It will be appreciated that the method and apparatus of stacking and forming bundles according to this invention is suitable for use not only where elongate members are being continuously produced and cut to length, but wherever it is desired to form bundles of stacked and nested lengths of an elongate member.

In the drawings and specification, there have been set forth preferred embodiments of the invention and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

I claim:

1. A method of forming bundles of cut lengths of an elongate flexible plastic tube, said method comprising continuously extruding a tube of plastic material into a

molding zone while molding annular corrugations of alternating ribs and valleys on the tube during the forward movement thereof through the molding zone, delivering the corrugated tube from the molding zone and advancing the tube through a cutting station while successively cutting the tube into predetermined cut lengths, feeding each successive individual cut length along a path of travel forwardly of the cutting station a predetermined distance and in response thereto quickly ejecting each successive cut length out of the path of travel by engaging each cut length intermediate its ends and moving the same laterally out of the path of travel, accumulating and stacking a plurality of cut lengths in nesting relation, and securing pliable binding elements around the stacked cut lengths to form a bundle thereof after a predetermined number of the cut lengths have been accumulated.

2. A method according to claim **1** wherein the step of ejecting each successive cut length includes, at times, ejecting certain cut lengths in one direction into a first hopper positioned adjacent one side of the path of travel of the cut lengths and at other times ejecting other cut lengths in the opposite direction into a second hopper positioned adjacent the opposite side of the path of travel of the cut lengths.

3. A method according to claim **2** wherein the step of ejecting each successive cut length includes ejecting a predetermined number of successive cut lengths into the first hopper and then ejecting another predetermined number of successive cut lengths into the second hopper.

4. A method according to claim **2** wherein the step of ejecting each successive cut length includes ejecting alternate ones of the successive cut lengths into the first hopper and ejecting intervening ones of the successive cut lengths into the second hopper.

5. A method according to claim **1** wherein the steps of ejecting, accumulating and stacking a plurality of the cut lengths are performed in continuous sequence as the elongate plastic tube is molded and cut to length.

6. A method of sorting, stacking and bundling cut lengths of a flexible plastic tube, said method comprising continuously extruding a tube of plastic material into a blow molding zone while molding the tube into a series of closely spaced body-forming lengths of annularly corrugated tube with integral relatively enlarged annular sleeves between and intersecting adjacent body-forming lengths, delivering the thus molded tube from the molding zone and advancing the tube through a cutting station, cutting the tube along a line about halfway between opposite ends of each successive sleeve to form each sleeve into a pair of separate collars, and also cutting each successive body-forming length along a line about halfway between opposite ends thereof, thereby producing a plurality of successive cut lengths each having an integral coupler collar on one end thereof, alternate ones of the successive cut lengths having the collar on the leading end thereof, and intervening ones of the cut lengths having the collar on the trailing end thereof, directing each successive individual cut length a predetermined distance forwardly of the cutting station to a doffing station, and in response thereto laterally doffing each successive cut length from the doffing station by engaging each successive cut length intermediate its ends and quickly ejecting the same laterally from the doffing station, accumulating and stacking in nesting relation a plurality of the doffed cut lengths, and securing pliable binding elements around the stacked cut lengths after a predetermined number of cut lengths have been accumulated to thereby form a bundle of a predetermined number of cut lengths.

7. A method according to claim **6** wherein the step of doffing each successive cut length from the doffing station includes doffing certain ones of the cut lengths into a first hopper positioned adjacent one side of the doffing station and doffing other ones of the cut lengths into a second hopper positioned adjacent the opposite side of the doffing station.

8. A method according to claim **7** wherein the step of doffing certain ones of the cut lengths into a first hopper positioned adjacent one side of the doffing station and doffing other ones of the cut lengths into a second hopper positioned adjacent the opposite side of the doffing station includes doffing alternate ones of the successive cut lengths into the first hopper and intervening ones of the cut lengths into the second hopper, so that all of the cut lengths in the stack of tubes thus produced have the intergral coupler collar at a common end of the stack.

9. A method according to claim **7** wherein the step of doffing certain ones of the cut lengths into a first hopper positioned adjacent one side of the doffing station and doffing other ones of the cut lengths into a second hopper positioned adjacent the opposite side of the doffing station includes doffing a predetermined number of successive cut lengths into the first hopper and then doffing another predetermined number of cut lengths into the second hopper, so that some of the cut lengths forming each stack have the integral coupler collar at one end of the stack and the remainder of the cut lengths forming each stack have the integral coupler collar at the opposite end of the stack.

10. A method according to claim **6** wherein the step of directing each successive cut length a predetermined distance forwardly of the cutting station includes pushing the leading end of the uncut tube being fed against the trailing cut end of the previously cut length to push the previously cut length said predetermined distance.

11. A method according to claim **6** wherein the step of accumulating and stacking in nesting relation a plurality of the doffed cut lengths including forming a three-layered stack of nested cut lengths including a bottom layer of three cut lengths, an intermediate layer of four cut lengths, and a top layer of three cut lengths.

12. A method of forming bundles of cut lengths of an elongate flexible plastic tube, said method comprising continuously extruding a tube of plastic material into a molding zone while molding annular corrugations of alternating ribs and valleys or the tube during the forward movement thereof through the molding zone, delivering the corrugated tube from the molding zone and advancing the tube through a cutting station while successively cutting the tube into predetermined cut lengths, feeding each successive cut length along a path of travel forwardly of the cutting station to a doffing station, sensing the arrival of each cut length at a predetermined location in the doffing station and in response thereto doffing each successive cut length from the doffing station by engaging the cut length intermediate its ends and quickly ejecting the same laterally out of the path of travel, accumulating and stacking a plurality of cut lengths in nesting relation, and securing pliable binding elements around the stacked cut lengths

to form a bundle thereof after a predetermined number of the cut lengths have been accumulated.

13. A method of forming bundles of cut lengths of an elongate flexible plastic tube, said method comprising continuously extruding a tube of plastic material into a molding zone while molding annular corrugations of alternating ribs and valleys on the tube during the forward movement thereof through the molding zone, delivering the corrugated tube from the molding zone and advancing the tube through a cutting station while successively cutting the tube into predetermined cut lengths, feeding each successive cut length along a path of travel forwardly of the cutting station to a doffing station by pushing the leading end of the advancing uncut tube against the trailing end of the previously cut length, and in response to the arrival of each cut length at the doffing station doffing each successive cut length from the doffing station by quickly ejecting the cut length laterally out of the path of travel, accumulating and stacking a plurality of cut lengths in nesting relation, and securing pliable binding elements around the stacked cut lengths to form a bundle thereof after a predetermined number of the cut lengths have been accumulated.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,870,774

DATED : March 11, 1975

INVENTOR(S) : Ernest J. Maroschak

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 10, Line 53, CLAIM 12, change "or" to --on--

Signed and sealed this 6th day of May 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks