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G. E. MARTELL
APPARATUS FOR CUTTING FLEXIBLE STRIP
MATERIAL INTO MEASURED LENGTHS

2,734,571

Filed March 9, 1953

3 Sheets-Sheet 1

Fig. 1

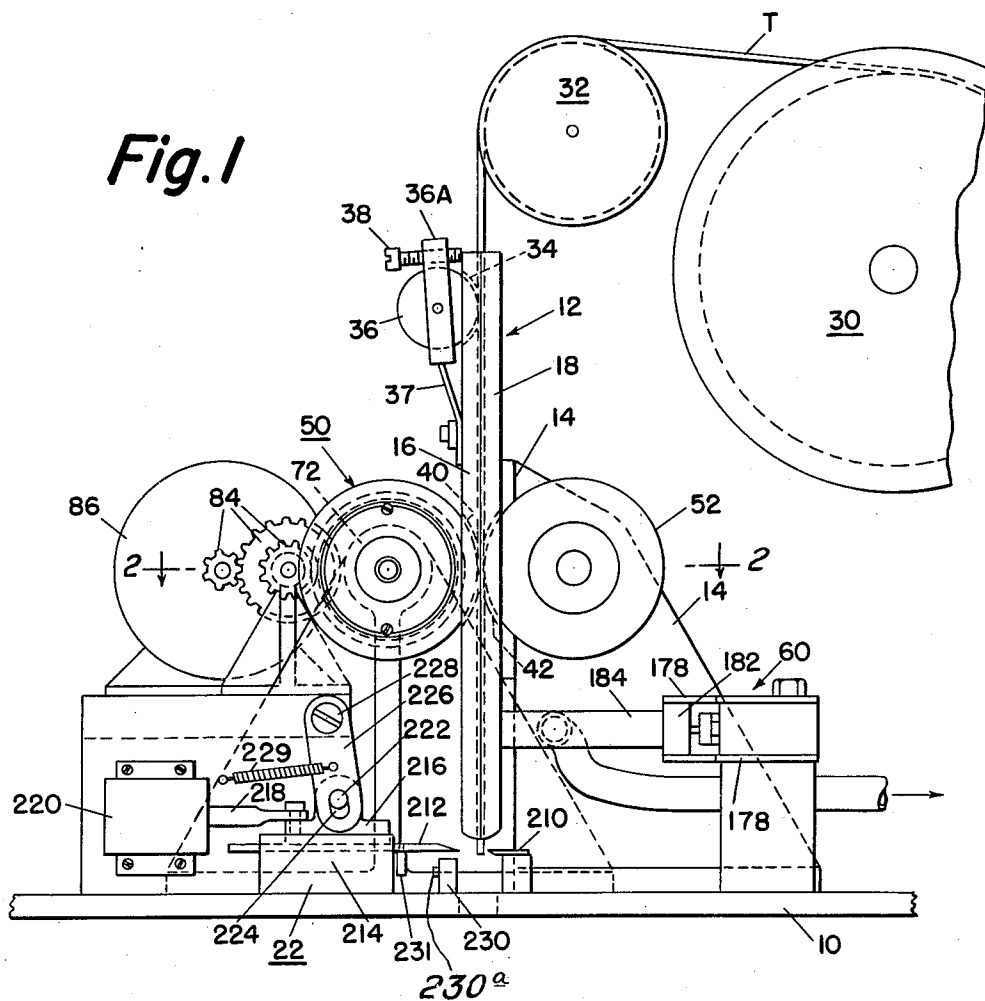
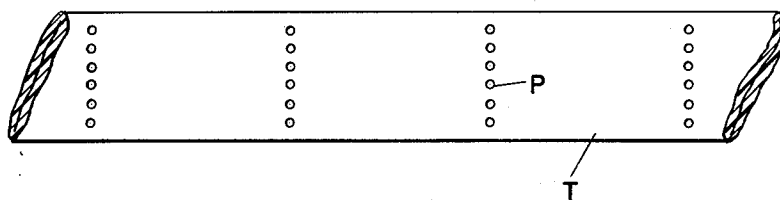


Fig. 4



INVENTOR.
GEORGE E. MARTELL

BY
Roberts Cushman & Groun

ATTORNEYS

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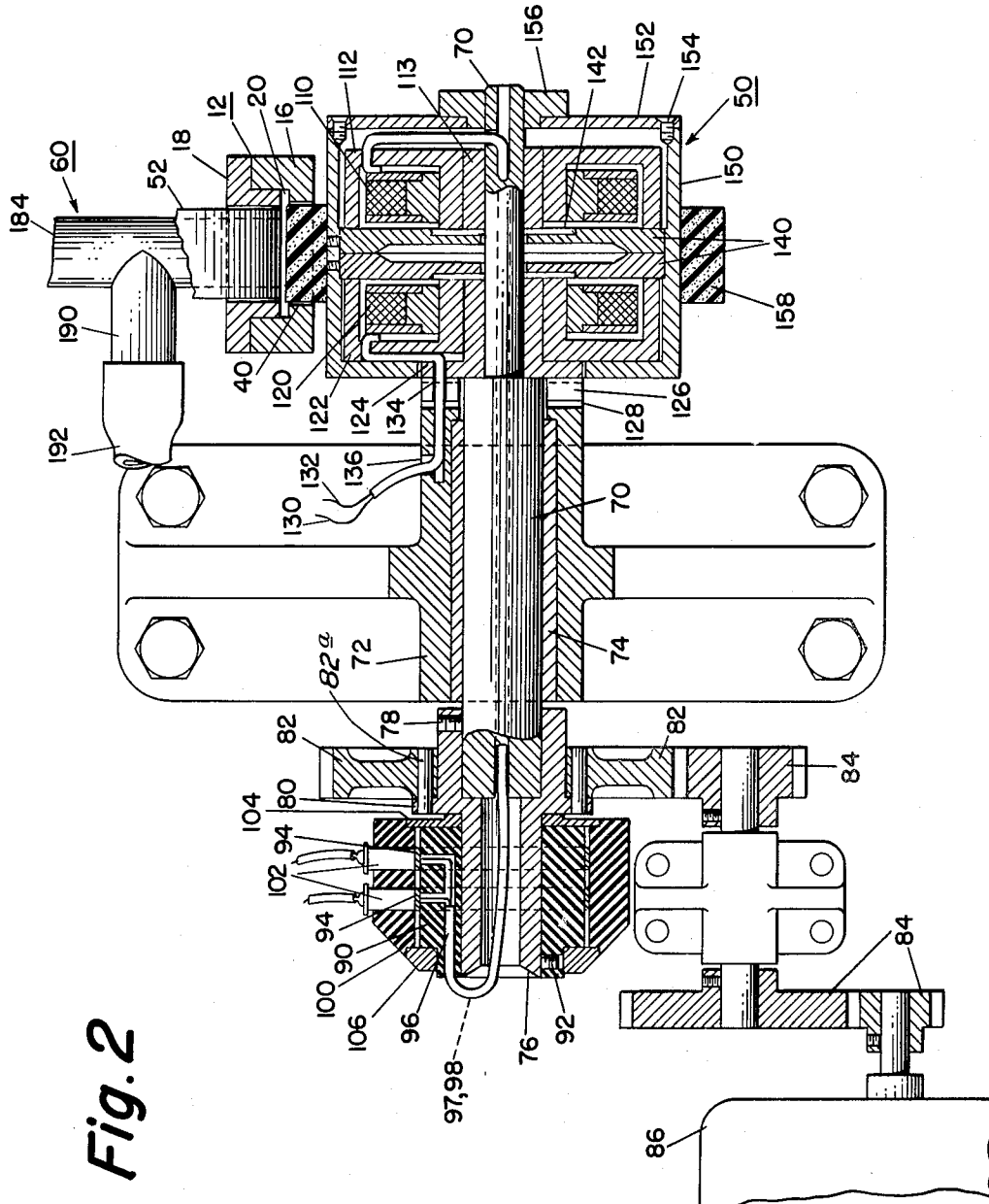


Fig. 2

INVENTOR.
 GEORGE E. MARTELL

BY
Roberts Cushman & Francis
 ATTORNEYS

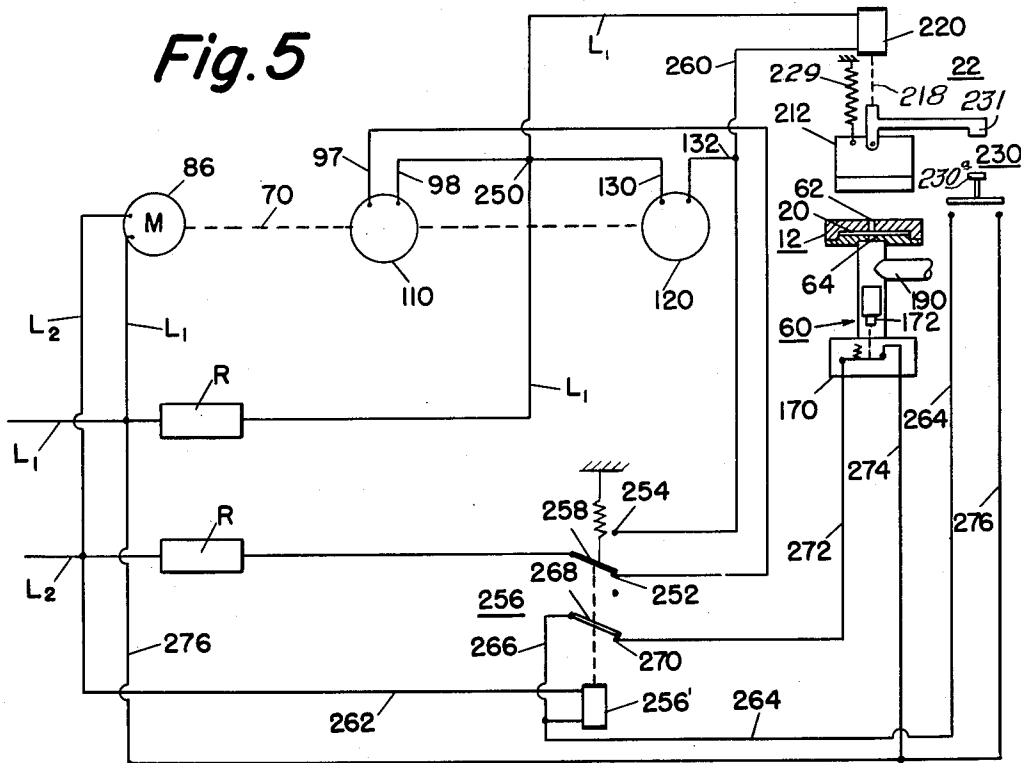
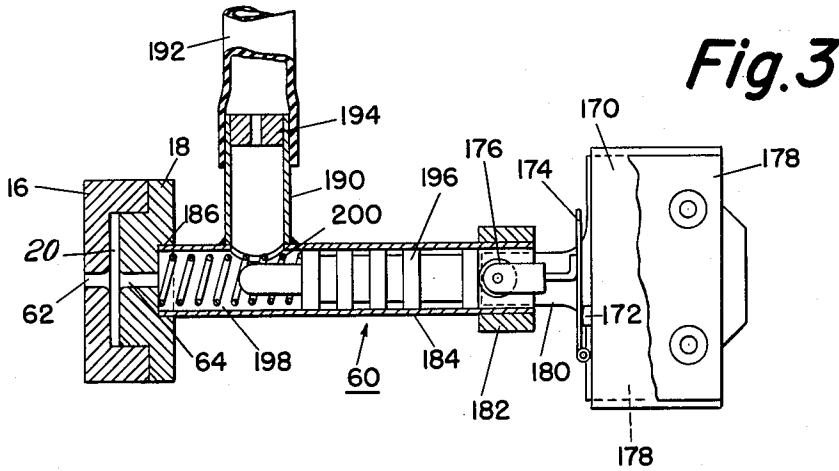
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3 Sheets-Sheet 3



INVENTOR.
GEORGE E. MARTELL

BY
Roberts, Cushman & Gross

ATTORNEYS

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APPARATUS FOR CUTTING FLEXIBLE STRIP MATERIAL INTO MEASURED LENGTHS

George E. Martell, Bellmawr, N. J., assignor, by mesne assignments, to Geo. J. Meyer Manufacturing Co., a corporation of Wisconsin

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3 Claims. (Cl. 164—49)

This invention relates to means for advancing sheet material toward a station or zone at or within which it is subjected to some operation or treatment, and more particularly to means for advancing a flexible strip of such material to provide portions of measured length and for severing each portion as it is measured from the supply. The measurement of the length so advanced and severed is determined by indicator elements carried by the strip material itself. Such indicator elements may be of any desired type, using appropriate detector means to cooperate therewith. For example, the indicator elements may be distinctly colored spaced spots, lines, or the like formed in or printed upon or otherwise applied to the sheet material, or as here illustrated by way of example, but without limitation, as equally spaced perforations formed in the strip material in anticipation of its severance into predetermined lengths by the apparatus of the present invention. While a single perforation may be sufficient to constitute each indicator element, it is preferred to form each indicator element as a plurality of perforations, for example, a transversely extending row of perforations. Such rows would usually be spaced equal distances apart, lengthwise of the strip, assuming that the parts to be severed are to be of equal length.

The invention has been found to be of particular utility for advancing or feeding wet cellulosic banding material, such as is customarily used in forming sealing bands which are slipped over bottle necks and which, in drying, shrink and tightly embrace the bottle neck. When employed for this purpose, the apparatus of the present invention will advance the strip material rapidly and cut it off in accurately measured lengths.

Such neck-banding material is commonly formed with longitudinally spaced rows of perforations, each row being designed to be located, when the band has been placed on the bottle neck, at the junction of the top of the bottle neck and the top of the cork, thereby to facilitate the breaking of the band and the removal of the cork. One object of the present invention is to provide mechanism which, in response to the presence of such spaced rows of perforations, will advance accurately predetermined, band-forming lengths of the material and sever each such length from the supply.

A further object is to provide mechanism for advancing and measuring-off predetermined lengths of strip material, which is capable of starting and stopping the advance movement of the material in a very short interval of time, thereby to measure accuracy of measurement.

A further object is to provide mechanism which, in response to spaced rows of perforations in neck-banding material, will advance the material step-by-step to provide neck-banding lengths and will then sever each such length from the supply at the completion of the advance movement.

A further object is to provide mechanism of the above type which is capable of measuring off a succession of band-forming lengths from the supply at a rate of speed as great as they can be used by a neck-banding machine.

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A further object is to provide measuring and severing means which is simple, relatively inexpensive, accurate and durable.

While, as above noted, the invention is of especial value in the preparation of bottle neck bands, its utility is not necessarily confined to such employment. For instance, it may be used for automatically removing portions of strip material containing defects such as holes or perforations, to whose presence the mechanism of the present invention will respond.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings in which

Fig. 1 is a diagrammatic front elevation of a machine embodying the present invention;

Fig. 2 is a fragmentary horizontal sectional view in a plane indicated by the line 2—2 of Fig. 1, showing details of construction of the drive for the strip advance rolls;

Fig. 3 is a fragmentary horizontal sectional view, showing details of construction of a switch device employed in the machine;

Fig. 4 is a plan view of a length of cellulosic neck-banding tubing, the tubing being flattened and having transversely extending spaced rows of perforations which extend through its opposite walls; and

Fig. 5 is a wiring diagram illustrative of the electrical control elements of the apparatus.

The numeral 10 (Fig. 1) designates a table or surface on which the various elements of the feed and cut-off mechanism are mounted. While it forms the base of the complete device, it should be understood that it may be a part of another machine for instance, a machine for stacking cut bands or even applying them to bottles.

Supported above the table 10 by means of the rigid bracket 14 is a vertical guide 12. This guide comprises two complementary members 16 and 18, which, when fitted together, define a vertical guide passage 20 (Fig. 3) of rectangular transverse section. The strip material enters this passage at the upper end of the guide and is advanced downwardly step-by-step to the zone of action of the cutting-off mechanism 22 (Fig. 1) which is mounted on the table 10 below the lower end of the guide 12. The strip material T, which may, for example, be a flattened tube of neck-banding material, leads from a supply reel 30 (Fig. 1), over an idler pulley 32 and into the upper end of the passage 20. A slot 34 (Fig. 1) is provided near the upper end of the guide member 16. This slot opens into the passage 20 to admit a spring biased brake wheel 36 whose periphery enters the passage 20 and bears upon the strip material thereby to prevent clogging of the passage with loose material because of any over-travel of the reel 30 due to inertia. This brake wheel 36 is mounted for rotation in a block 36^a which is supported by a spring 37 which, in turn, is secured to the guide member 16. A set screw 38 provides for adjustment of the pressure applied by the wheel 36.

The guide members 16 and 18 have slots 40 and 42 about midway the length of the guide 12, arranged at opposite sides, respectively, of the passage 20 to receive a feed drum 50 and an abutment roll 52, respectively. Near the lower end of the guide 12 two small, axially aligned ports 62 and 64 (Fig. 3) are provided in members 16 and 18, respectively.

Air at atmospheric pressure may flow from port 62 into port 64, unless the passage 20 between the ports 62 and 64 is obstructed.

Referring to Fig. 2, the feed drum 50 is rotatably mounted on the end of a hollow shaft 70 which, in turn, is rotatably supported in a fixed journal bracket 72. A sleeve bushing 74 of lubricated type is carried by the

bracket 72 and provides a smooth bearing for the shaft 70.

A stepped sleeve 76 is secured to the left-hand end (Fig. 2) of the hollow shaft 70 by means of a set screw 78, and a gear 82, mounted on the larger end portion of the sleeve 76, is fixed to the sleeve by a dowel pin 82^a. The gear 82 is driven continuously by means of a suitable train of gears 84 which are driven by a motor 86 (Fig. 1).

A sleeve 90 (Fig. 2) of non-conducting material, for example, fiber impregnated with a synthetic resin, is secured by means of a set screw 92 to the sleeve 76, so as to rotate with the latter. Two electric collector rings 94 are tightly fitted to the outer surface of the sleeve 90. This sleeve has a passage at 96 to receive two wires 97 and 98, one of which is connected to the inner surface of each of the collector rings 94, respectively. The two wires 97 and 98 extend through the stepped sleeve 76 and through the hollow shaft 70 to the feed drum 50.

An outer stationary fiber sleeve 100 (Fig. 2) constitutes a housing for the collector ring and supports brushes 102 which contact the collector rings 94. A backing plate 104 and a collar 106 cooperate to hold the housing 100 in place.

The conductors 97 and 98 extend through the hollow shaft 70 to an electromagnetic coil 110 which is housed in an annular cup 112 whose open side is directed toward the left, as viewed in Fig. 2. This cup 112, which is within the hollow feed drum 50, is fixed to a housing 113, which is keyed or otherwise secured to the shaft 70 so as to rotate with the latter.

A second electromagnetic coil 120, similar to the coil 110, is housed within a second annular cup 122 (also within the hollow feed drum 50) which is keyed or otherwise secured to a fixed bushing 124. This bushing 124 is keyed to the journal bracket 72 by means of projections 126 which fit into slots 128 in the end of the journal bracket 72 so that the bushing 124 can not rotate. Thus the bushing 124, the cup 122, and the coil 120 are stationary and do not partake of the rotation of the shaft 70. The open end of the cup 122 is at its right side, as viewed in Fig. 2, the cups 112 and 122 being coaxial and of the same diameter. Two electrical conductors 130 and 132, leading from the coil 120, extend out through openings 134 in the bushing 124 and an opening 136 in bracket 72.

Between the two cups 112 and 122 is a pair of annular, flexible clutch disks 140 of magnetic material fixedly connected to the interior of the drum barrel 150 but freely rotatable with respect to the annular cups 112 and 122, except when the coils 110 and 120 are energized. These disks 140 are also free to turn relatively to the shaft 70. The coil 110 and the adjacent clutch disk 140 form an electromagnetic clutch for connecting the drum 50 to the shaft 70 so as to turn with the latter, while the coil 120 and the adjacent clutch disk 140 constitute a brake for connecting the drum 50 to the fixed bushing 124. When the coils are energized, the disks 140 flex toward and against cups 112 or 122, respectively, but spring back when the coils are deenergized, so as to insure complete separation of the disks and cups.

The drum barrel 150 has a cover plate 152 secured to it by screws 154 and is provided with a bushing 156 which turns freely on the shaft 70. A rubber traction rim 158 is secured to the outer periphery of the drum barrel 150 and it is this rim which projects through the slot 40 in the guide member 16 and contacts the strip material T.

The automatic control device for the feed and brake mechanism comprises an electrical switch 60 (Figs. 1 and 3). This switch is here illustrated, by way of example, as an ordinary commercial type of switch of the snap type, such as that known by the trade name "Micro-switch." It comprises a casing 170 (Fig. 3) which houses contacts which normally engage, thereby to close a circuit, but which may be separated by pressure ap-

plied to a push button 172. Pressure is so applied through the intermediary of a lever arm 174 which is pivoted to the switch casing and which carries a bracket in which an anti-friction roller 176 is mounted.

The switch casing 170 is interposed between spaced, parallel side plates 178 which have parallel, projecting arms 180 between whose free ends a rigid annulus 182 is welded. This annulus supports one end of an elongate, rigid tube 184. The other end of the tube 184 fits tightly into a counterbore 186 coaxial with the port 64 in the member 18 of the guide 12. Near its left-hand end, as viewed in Fig. 3, the tube 184 has a laterally projecting nipple portion 190, providing means for connecting a flexible tube 192, which leads from a vacuum pump or the like (not shown) whereby subatmospheric pressure may be created in the tube 184. An orifice plug 194 is arranged within the nipple 190, thus providing a restriction in the passage between the tube 184 and the vacuum pump. Within the tube 184 is a longitudinally slidable multi-ringed piston 196 which is urged toward the right, as viewed in Fig. 3, and against the anti-friction roller 176, by a compression spring 200, located within the space 198 at the left end portion of the tube 184.

So long as free entrance of air through the ports 62 and 64 into the space 198 is prevented by the presence of imperforate strip material in the passage 20 between the ports 62 and 64, the low pressure in the space 198, caused by the action of the vacuum pump, causes the piston 196 to be held to the left (as viewed in Fig. 3) in opposition to the spring 200. Thus, the arm 174 does not exert pressure on pin 172 and the contacts of the switch remain in engagement.

The strip-severing mechanism 22 (Fig. 1) comprises a pair of flat knife blades 210 and 212, respectively, which cooperate to effect a shear cut. The blade 210 is fixed, being mounted on a block attached to the base plate 10, while the blade 212 is slidably mounted in guides in a block 214 also fixed to the base plate 10. Attached to the top of the blade 212 (Fig. 1) is a bracket 216 to which is connected a push-rod 218 attached to or forming the core of a solenoid 220. A horizontal pin 222, carried by the bracket 216, engages a slot 224 in the lower end of a lever 226 which is pivoted at 228 on a fixed part of the machine frame. A tension spring 229 biases the lever 226 in a direction such as to retract the knife blade 212, that is to say, to move it to the left, as viewed in Fig. 1, when the solenoid 220 is not energized. A starter switch 230 is mounted on the plate 10. The contacts of this starter switch are normally separated but may be engaged by pressure on an actuating button 230^a. The blade 212 carries a projection 231 which, as the blade 212 nears the termination of its cutting stroke, engages the button 230^a and thus closes the switch 230, thereby to close an electrical circuit, as hereafter described, and, by such action, starting the machine on a new cycle of operation.

In Fig. 4 there is illustrated, more or less diagrammatically, a type of strip material T such as it is contemplated may be used in the machine of this invention. This strip material is a flattened tube which may, for example, be wet cellulosic material designed to form neck bands for bottles, and which is provided, at uniformly spaced intervals lengthwise, with transversely extending rows of perforations P. Ordinarily each row would extend completely around the tube, and the tube is so flattened that the perforations of the opposed plies of the flattened tube register with each other, thereby to provide free passage of air through the perforations of each row from one side of the tube to the other.

The operation of the mechanism can best be described by reference to the wiring diagram of Fig. 5.

Referring to the diagram of Fig. 5, the leads L¹ and L² supply current to the machine. These leads are connected directly to the motor 86, and so long as current is supplied through these leads the motor operates. The

leads L¹ and L² have branches extending beyond the motor circuit which preferably lead to rectifiers R which are desirably employed to reduce chatter in the clutch and brake coils 110 and 120, respectively. Wires 98 and 130, leading to the clutch coil 110 and the brake coil 120, respectively, are connected to the lead L¹ at 250. The lead L¹ is continued beyond this point 250 to one terminal of the core of the knife-actuating solenoid 220. Wires 97 and 132 lead from the clutch coil 110 and the brake coil 120, respectively, to contacts 252 and 254, respectively, of a relay 256. A switch arm 258 is connected to the lead L² and may at times engage either the contact 252 or the contact 254 so that either the clutch or the brake coil may be energized. The other terminal of the knife-actuating solenoid 220 is connected by a conductor 260 to the conductor 132 which lead from the coil 120 of the brake to the contact 254 so that the coil of solenoid 220 is energized whenever the brake coil 120 is energized. The switch 60 controls the circuit through the coil 256' of relay 256. One terminus of this coil 256' is connected directly to lead L² by a wire 262. The wire from the other terminal of relay coil 256' has branches, the branch 264 extending to one pole of the starting switch 230 while the other branch extends to a second switch arm 268 of the relay 256 for the purpose of providing a holding circuit. The contact 270 of the relay 256 is connected to one pole of the control switch 60 by the wire 272. The other pole of the switch 60 is connected to the lead L¹ by the wire 274. The second pole of the starting switch 230 is connected to the lead L¹ by the wire 276.

In describing the operation it will be assumed that the current is being supplied to the leads L¹ and L² by the closing of a manually operated switch (not shown) and that the vacuum pump or equivalent means is in operation.

As illustrated in this diagram, the circuit for the clutch roll 110 is closed, which may be considered to be the normal condition, so that the clutch is energized and the strip is being fed downwardly by the action of the feed drum 150.

It will be understood that when the machine was first started the starting switch 230 was momentarily closed by hand. The result of so closing the starting switch is that current is supplied to the relay coil 256', thereby simultaneously moving the arm 268 into engagement with contact 270, and arm 258 into engagement with contact 252. Although the starting switch 230 is closed only momentarily, the relay coil 256' remains energized, because of the engagement of switch arm 268 with contact 270, and holds the arm 258 in the position shown in Fig. 5. The engagement of arm 258 with contact 252 closes the circuit through the clutch coil 110, thus pulling the right-hand ring 140 (Fig. 2) into engagement with the cup 112 so that the ring rotates with the cup and thereby turns the feed drum 150. The strip material is thus fed downwardly through the passage 20 until its lower end projects below the plane of operation of the cutter blades 210 and 212. The normally closed control switch 60 is in circuit with the relay coil 256 and, so long as imperforate strip material occupies that portion of the passage 20 which is between the ports 62 and 64, low pressure subsists in the space 198 and the piston 196 is held to the left by suction, as shown in Fig. 3, thus allowing the contacts of the switch 60 to remain closed.

However, when a row of perforations P of the strip material comes opposite to the ports 62 and 64, air is allowed to enter the space 198; thereupon the spring 200 pushes the piston 196 to the right, thereby swinging arm 174 so as to press on the pin 172 and thus opening the circuit at switch 60. The relay coil 256 is thereby immediately deenergized, allowing the arms 258 and 268 to separate from the contacts 252 and 270, respectively, and at the same time allowing arm 258 to engage the contact 254, such movement of the arm 258 being oc-

casioned by a spring forming an element of the relay device.

The separation of arm 258 from contact 252 deenergizes clutch coil 110 so that the drum 150 is no longer driven, while the closure of the circuit between the arm 258 and the contact 254 energizes the brake coil 120, thus drawing the left-hand ring 140 (Fig. 2) toward the stationary cup 122 and so positively stopping the rotation of the feed drum 150. At the same time current is supplied to the coil of the solenoid 220 which ejects the rod 218 and so moves the cutter blade 212 to the right (Fig. 1), thus severing the downwardly depending length of strip material from the supply at the plane of action of the cutter blades 210 and 212. Since a single forward stroke of the cutter is sufficient to sever the material, and since the action of the brake is to stop the feed of the material instantly, it is not necessary to maintain the circuit between the arm 258 and the contact 254 closed for more than a very short time.

As the cutter 212 completes its advance stroke, the pin 231 engages the button of the starter switch 230, thus again closing the circuit through the coil 256' of the relay and thus starting a new cycle of operations provided that, at the same time, an imperforate portion of the strip material, in the passage 20, prevents entry of air through the ports 62 and 64 into the chamber 198.

The machine thus continues to operate until the current is cut off from the leads L¹ and L². It will be apparent that the arrangement thus above described operates to advance the strip material intermittently, the length of the material so advancing depending upon the spacing of the rows of perforations P, and that the advance movement is stopped very suddenly and accompanied by an actuation of the cutter to sever the measured length of material from the supply, and that immediately after the length has been severed the feed motion is resumed without delay. The machine is thus capable of measuring and cutting off predetermined lengths of the strip material with great accuracy and at very high speed and without attention on the part of the operator once the machine has been started into operation.

The pressure motor, comprising the cylinder 184, piston 196, spring 200 and the spaced ports 62 and 64, constitutes one desirable form of detector, responsive to indicator elements carried by the strip material, but obviously other detector devices—mechanical, electrical or optical—may be substituted for the pressure motor here described.

While one desirable embodiment of the invention has herein been disclosed by way of example, all modifications thereof which fall within the terms of the appended claims are to be considered as within the scope of the invention.

I claim:

1. In combination, in apparatus for cutting off pieces of uniform length from a strip of elastic material provided with openings so spaced apart lengthwise of the strip that the distance between each pair of successive opening equals the length of the piece to be cut off, wall means forming a substantially vertical guide passage for the strip, strip advancing means passing through openings in said wall means and adapted to engage the strip in said guide passage, strip severing means adjacent the discharge end of said guide passage, said wall means having a pair of opposed ports between said strip advancing means and said strip severing means, one of said ports communicating with the atmosphere, pneumatic detector means connected to the other port and operative in response to the arrival of one of said openings in the strip opposite said ports to terminate the operation of the strip advancing means and actuate the strip severing means.

2. Apparatus according to claim 1, wherein the strip-

advancing means comprises a rotary, strip-engaging drum coaxial with a constantly moving shaft, an electromagnetic clutch normally connecting the drum to the shaft, an electromagnetic brake, and a switch actuable by the movement of said detector means to break the clutch circuit and close the brake circuit and thereby suddenly to stop the advance of the strip material.

3. Apparatus according to claim 2, wherein the strip severing means has a reciprocable blade and the movement of the detector means to stop the advance of the strip material concomitantly initiates advance of the reciprocable blade to sever the strip, and means whereby, as the reciprocable blade completes its cutting stroke, the clutch circuit is again closed and the brake circuit is broken.

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