APPARATUS FOR PERFORATING A WEB OF FLEXIBLE FILM

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ABSTRACT
Apparatus for perforating a web of flexible film on transverse lines spaced longitudinally of the web, in which the web is fed at substantially constant speed over a back-up roll and perforated at sheet length intervals by a rotary perforator as it travels over the back-up roll. The perforator is adapted to carry one or a plurality of perforating blades at different radii for forming lines of perforations at different sheet length intervals. For perforating position-printed webs, provision is made for maintaining registration of the lines of perforations in respect to registration marks on the web by increasing or decreasing the speed of the perforator. The web may be slit into a plurality of webs. Provision is made for winding up one web into a roll or a plurality of webs into individual rolls in contact with the back-up roll.

7 Claims, 11 Drawing Figures
APPARATUS FOR PERFORATING A WEB OF FLEXIBLE FILM

BACKGROUND OF THE INVENTION

This invention relates to apparatus for perforating a web of flexible sheet material, and particularly a plastic film (polyvinylidene chloride film or the like) on transverse lines spaced longitudinally of the web to provide for tearing off sheets from the web at the lines of perforations.

The invention is particularly useful for providing rolls of perforated shrink film such as are widely used in supermarkets and other establishments for tearing off individual sheets of the film for wrapping various products.

It is particularly concerned with apparatus for perforating what may be referred to as "position printed" film, i.e., film which is printed with a recurrent block of printing at sheet length intervals, the block comprising market or product identification, etc., as distinguished from unprinted or what may be referred to a random printed film (as to which there is recurrent repeated printed indicia, but without relation to sheet length).

In perforating position printed, it is desirable that the lines of perforations be formed between the recurrent blocks or "frames" of the preprinted matter, avoiding forming the lines of perforations out of register with respect to the blocks or frames, and this has involved problems occasioned by the tendency of film such as widely used for wrapping purposes to stretch, and also by variation in the spacing of the positions or frames. It will be understood that if the formation of the lines of perforations becomes out of synchronism with respect to the frames of printed matter passing through the perforating means, the lines of perforations will be formed across the frames instead of between the frames. Another problem is that of providing for forming lines of perforations at different intervals to define sheets of different length for frames of printed matter of different length.

Reference may be made to U.S. Pat. No. 3,283,636 showing apparatus in the same general field as this invention.

SUMMARY OF THE INVENTION

Among the several objects of this invention may be noted the provision of improved apparatus for perforating a web on transverse lines spaced at sheet length intervals longitudinally of the web in which the spacing may be readily varied over a wide range to define sheets of different length; the provision of such apparatus having a perforating blade or blades which may be readily changed; the provision of such apparatus for perforating position-printed webs and maintaining registration of the lines of perforations relative to the printing on the webs; the provision of such apparatus in which a relatively wide web may be slit into a plurality of narrower webs, if so desired; and the provision of such apparatus having means for efficiently winding the perforated web into a roll, or the perforated webs into individual rolls.

In general, apparatus of this invention comprises means for feeding the web through the apparatus at a substantially constant speed comprising a rotary back-up roll, and a rotary perforator having at least one perforating blade for forming transverse lines of perforations in the web as it travels over the back-up roll. The perforator is mounted for rotation on an axis parallel to the axis of the back-up roll and for movement toward and away from the backup roll for positioning of the perforating blade to perforate through the web on the back-up roll.

Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of apparatus of this invention for forming transverse lines of perforations in a flexible web;

FIG. 2 is a left side elevation of the perforating apparatus, showing the path of the web as it passes through the apparatus;

FIG. 3 is a section on line 3--3 of FIG. 2 showing means for driving a back-up roll and a rotary perforator of the apparatus;

FIG. 4 is a vertical section on line 4--4 of FIG. 3 showing means for differentially varying the speed of rotation of the rotary perforator relative to the speed of rotation of the back-up roll;

FIG. 5 is an enlarged vertical section on line 5--5 of FIG. 1 showing the rotary perforator and how it is mounted for movement toward and away from the back-up roll;

FIG. 6 is an enlarged view on line 6--6 of FIG. 2 showing means for winding the web into a web roll or "product roll" after it has been perforated;

FIG. 7 is an enlarged vertical section on line 7--7 of FIG. 1 showing how a web roll or "product" roll (or rolls) is driven by contact with the back-up roll;

FIG. 8 is an enlarged view on line 8--8 of FIG. 1 showing means for holding the product rolls in a retracted position for removal of completely wound product rolls and for mounting new product roll cores thereon;

FIG. 9 (sheet 7) is a section on line 9--9 of FIG. 2;

FIG. 10 (sheet 6) is a view on line 10--10 of FIG. 1 showing a photoelectric scanner for sensing registration marks preprinted on the web; and

FIG. 11 (sheet 6) is a view on line 11--11 of FIG. 10.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, there is generally indicated at 1 apparatus of this invention for perforating a web W of flexible sheet material, such as polyvinylidene chloride plastic film, on transverse lines spaced longitudinally of the web. As shown, the apparatus comprises a frame generally indicated at 3 having a base 5 secured to the floor and side plates extending upwardly therefrom, the left side plate (as viewed in FIG. 3) being indicated at 7 and the right side plate being indicated at 9. A chucking assembly generally indicated at 11 is mounted on the side plates at the entrance or front end of the apparatus for rotatably holding a mill roll R of unperforated web W for being fed through the apparatus. As shown in FIGS. 2 and 4, the web is unwound from the mill roll R and passes under...
a pair of stabilizer rolls 13A and 13B, around a spreader roll 15, between a nip roll 17 and a back-up roll 19, and is then wound up on a core, forming a so-called product roll P. The back-up roll 19 is positively driven, and with the web W gripped between the nip roll and the back-up roll, the web is pulled and fed through the apparatus at a substantially constant speed determined by the speed of the back-up roll.

A rotary perforator generally designated 21 is provided for forming transverse lines of perforations in the web as it travels over the back-up roll 19. The perforator has at least one perforator blade assembly 23 and is positively driven for rotation on an axis parallel to the axis of the back-up roll. The perforator is carried by a pair of arms 25A and 25B (see FIG. 3) pivotally supported by side plates 7 and 9 in a manner as will appear for movement of the perforator toward and away from back-up roll 19 for positioning the perforator blade of assembly 23 to perforate through the web on the back-up roll.

A motor 27 for driving both the back-up roll 19 and the perforator 21 is mounted on a platform 29 which extends between side plates 7 and 9. More particularly, motor 27 via a timing belt 31 (see FIG. 3) drives a pulley 33 keyed on a countershaft 35 which extends between side plates 7 and 9. The left end portion of the countershaft is journaled in a bearing 37 at plate 7, and a pulley 39 is keyed on the left end of the countershaft for driving the back-up roll 19 as will appear. The right end portion of the countershaft is connected to the input of a differential drive assembly generally indicated at 41 mounted on side plate 9. The output of differential drive assembly 41 includes conventional differential gearing including a ring gear whereby rotation of the ring gear in one direction causes the speed of rotation of the differential output and hence the speed of the perforator to be differentially increased relative to the speed of rotation of countershaft 35; and rotation of the ring gear in the opposite direction causes the speed of rotation of the perforator to differentially decrease relative to the speed of the countershaft.

Back-up roll 19 is mounted on a shaft 45 extending horizontally between side plates 7 and 9 and journaled in bearings 47 carried by the latter. A pulley 49 is keyed on the left end of shaft 45 (as viewed in FIG. 3), and a belt 51 is trained around pulley 39 on counter-shaft 35 and pulley 49 for driving the back-up roll. The back-up roll is somewhat wider than the maximum width of web W which is to be perforated, and is shown as constituted by a drum 51 secured as by welding to shaft 45. The drum has a cover 53 of a material (e.g., a relatively hard rubber) which is relatively hard but sufficiently elastic to be deformable as the teeth of the perforating blade or blades of perforator 21 punch through the web W (see FIG. 5). The right end of shaft 45 extends out beyond the right side plate 9 and has a hand wheel 55 keyed thereon for manually turning the back-up roll to facilitate threading the web through the apparatus.

As shown in FIGS. 3 and 9, arms 25A and 25B carrying the rotary perforator 21 are disposed adjacent the inner faces of side plates 7 and 9, being inclined upwardly over the back-up roll 19 from the ends of a sleeve 57, the arms and the sleeve together constituting a rigid welded subassembly. A shaft 59 extends through the sleeve 57 between side plates 7 and 9 mounting the arms for pivotal movement about the shaft axis, which extends parallel to the axis of shaft 45 which carries back-up roll 19.

Perforator 21 comprises a shaft 61 of square cross section with cylindric ends 61A journaled in arms 25A and 25B by means of bearings 63 and 65 (see FIG. 9). The ends of the shaft 61 extend laterally outward through notches such as indicated at 67 in FIG. 5 in the side plates 7 and 9, allowing for pivotal movement of the arms 25A and 25B on shaft 59.

More particularly, perforator 21 includes four pairs of mounting blocks, each indicated at 69, a pair being secured to each of the four faces of shaft 61 for removably mounting one, two or four blade assemblies 23 at equal angular intervals around shaft 61. Each blade assembly includes a holder 71 for holding a perforator blade 72. The two mounting blocks of each pair are mounted one adjacent each end of the shaft (see FIG. 9). As appears in FIG. 5, each mounting block has a dovetail groove 73 extending parallel to the axis of shaft 61. Each holder 71 is constituted by a bar having a dovetail along one edge as indicated at 75 slidable endwise into the dovetail grooves in a pair of the mounting blocks. The latter are undercut, as indicated at 77, and have locking screws 79 which may be tightened to firmly clamp each blade holder in its respective mounting blocks. Arm 25B has a cut-out 81 adjacent shaft 61 enabling the blade holders to be readily inserted endwise in the dovetail grooves or removed endwise therefrom. This permits installation and removal of the blade holders without removing shaft 61 from the arms. Each perforator blade 72 is removably secured in a slot 83 in the outer end of each blade holder 71 as by means of set screws 84. The perforator blade is an elongate blade having a series of pointed teeth 87 (see FIG. 3) forming a serrated perforating edge which projects out beyond the outer end of its blade holder 71 when it is installed in slot 83. As shown in FIG. 5, the radii of the teeth of all the perforator blades 72 with respect to the axis of shaft 61 are substantially equal and thus the teeth of the blades lie on a common pitch circle P.C.

The spacing between lines of perforations formed in web W may be varied over a wide range (e.g., between 4 and 34 inches, with 25 different spacings therebetween, for example) by installing one, two or four perforating blade assemblies 23 on shaft 61 and/or by using blade holders 71 of different height (width) (thereby changing the pitch diameter of the pitch circle of the perforator), sets of blade holders 71 of different heights being provided with apparatus 1 for changing the pitch diameter of the perforator pitch circle. As above noted, the holders may readily be installed and removed from shaft 61 by backing off screws 79 and sliding the holders endwise in or out of dovetail grooves 73 in blocks 69 via cut-out 81 in arm 25B.

For example, nine sets of four blade holders 71 each may be provided ranging from about 1.100 inches to 3.965 inches high in increments of about 0.318 inch. Use of four of the smallest of these on the shaft 61 (which may measure 2¼ inches, for example, on a side) provides for a spacing of four inches between the four perforating blades around the pitch circle PC for a four-inch sheet length. Use of two on opposite faces of shaft 61 provides for a spacing of 8 inches for an 8 inch
sheet length, and use of one provides for a spacing of sixteen inches (the circumference of the pitch circle) for a 16-inch sheet length. Use of four of the largest of the holders on the shaft provides for a spacing of 8.5 inches for an 8.5 inch sheet length, the use of two of these longest holders provides for a spacing of 17 inches for a 17 inch sheet length, and the use of one of these longest holders provides for a spacing of 34 inches for a sheet length of 34 inches.

When a set of holders 71 of one height is replaced with a set of holders of a different height, arms 25A and 25B must be pivoted on shaft 59 to move the perforator toward or away from back-up roll 19 to position the perforator 21 for proper contact of the perforator blades 72 with the back-up roll 19 for perforating the web. Accordingly, arms 25A and 25B are swingable on shaft 59 to anyone of a series of angularly spaced positions of adjustment related to the height of the particular blade holder or holders 71 mounted on shaft 61, for locating the edges of the blades 72 in the holders for the perforating operation. The positions of adjustment are determined by means comprising two arcuate series of holes 85a and 85b in the arms adjacent their ends adapted to register with holes 86a and 86b in the side plates 7 and 9, a pin 87 being inserted in the registering holes 86a, 85a or 86b, 85b (as the case may be). Each arm carries a bolt 89 which extends through an arcuate slot 91 in the adjacent side plate, these bolts and slots limiting the pivotal movement of the arms. Bolts 89 may be tightened fractionally to hold the arms at any position of adjustment to facilitate the insertion of lock pin 87.

Referring to FIG. 3, perforator gear train 43 is shown to include a gear 93 keyed on the output shaft 95 of differential gear assembly 41. Gear 93 meshes with an idler gear 97 rotatably carried on shaft 45 by means of a bearing 99 for rotation independent of the rotation of the shaft. Idler gear 97 meshes with a gear 101 removably mounted on the perforator shaft 61 for driving the latter. The diameters of gears 97 and 101 are sized relative to one another for driving the perforator at such speed of rotation that its surface speed is (0.707 X the pitch diameter of the perforator X the speed of rotation of the perforator) substantially equal to the surface speed of the back-up roll. Differential drive assembly 41 rotates output shaft 95 in the opposite sense of countershaft 35 thus causing perforator 21 and back-up roll 19 to be rotated in opposite senses as shown by the arrows in FIG. 3. Thus when a perforator blade contacts the back-up roll for perforating the web, there is substantially no relative movement between the back-up roll and the perforator blade.

Gear 101 is keyed to shaft 61 by a key 103 and is removable retained on the shaft by a nut 105 threaded on the end of the shaft. Gear 101 is one of a set of change gears furnished with the apparatus, the gears in this set being of different diameters for meshing with idler gear 97 when arms 25A and 25B are moved to their various fixed positions of adjustment to accommodate different pitch diameters of the rotary perforator. Thus, gear 101 is changed each time the arms are moved to a different position relative to back-up roll 19 for accommodating the different sets of perforator blade holders 71.

The web W, being position-printed film, has registration marks printed thereon at sheet length intervals, and, in accordance with this invention, the apparatus includes registration means generally indicated at 107 in FIG. 1 for maintaining the formation of the lines of perforations in registration relative to the registration marks with the lines of perforations being formed between successive frames of printed matter on the web. This means functions, in response to any out-of-registration condition of the perforating blades with respect to the registration marks on the web to vary the speed of the perforator 21 relative to the surface speed of the back-up roll 19 to bring the perforator blades back into registration with respect to the marks. It includes the aforesaid differential unit 41 and a reversible motor 109 for driving the ring gear of the differential unit 41 in one direction or the other thereby to vary the speed of rotation of the differential output shaft 95 relative to the speed of countershaft 35 connected to the differential input. It further includes photoelectric scanning means generally indicated at 111 (see FIGS. 1 and 10) for sensing the registration marks 113 (see FIG. 11) preprinted on the web at predetermined sheet length intervals (corresponding to the desired spacing between the lines of perforations which are to be formed) and perforator position sensing means 115 (FIG. 2). At 117 (FIG. 2) is indicated a control which receives signals from the registration mark scanning means 111 and from the perforator position sensor 115, compares these input signals, and generates an output signal for energizing motor 109 to drive it in one direction or the other to advance or retard the speed of rotation of output shaft 95 of differential 41. More particularly, the ring gear of differential 41 is rotated by a worm gear, the shaft of which is indicated at 119 in FIG. 4. One end of a drive shaft 121 is connected to the outer end of the worm gear shaft 119 and the other end of the shaft 121 is journaled in a bearing 123 and carries a pulley 125. A belt 127 is trained around a pulley 128 fixed on the output shaft of motor 109 and around pulley 125 for driving shaft 121 from the motor.

As shown in FIGS. 10 and 11, the registration mark scanning means 111 includes a photoelectric cell 129 and an exciter lamp 131 spaced vertically apart from one another with the margin of web W bearing registration marks 113 passing therebetween. The exciter lamp emits a beam of light B which passes through the web W, which is generally transparent, and registers with the photoelectric cell. When a registration mark 113, which is opaque, passes between the photoelectric cell and the lamp, the beam of light is interrupted thereby effecting a change in the output signal of the photoelectric cell to indicate the position of the registration mark. The photoelectric cell and the exciter lamp are mounted on an L-shaped bracket 133 which is carried on a pair of spaced-apart channel members each designated 135 extending between side plates 7 and 9. This bracket is releasably secured in position on the channel members by means of bolts 137 extending between the channel members and a clamping plate 138 at the bottom of the channel members. When bolts 127 are loosened, the bracket with the photoelectric cell and exciter lamp thereon may be moved along the channels for handling webs of various widths with the margin passing between the photoelectric cell and the exciter lamp. Bracket 133 may be turned 180° so that registration marks on opposite margins of the web may be scanned.
Referring to FIGS. 3 and 9, the perforator position sensor 115 is shown to include a disk 139 releasably secured on the left end of perforator shaft 61 for rotation with the shaft. This disk is secured to a sleeve 141 on the outer end of the perforator shaft, the sleeve having a set screw 143 for engagement with the perforator shaft releasably to secure the perforator disk at any desired angular position on the shaft relative to the rotary perforator 21. Disk 139 has an index mark 145 (see FIG. 2) of reflective tape or the like on its outer face. The perforator position sensor further comprises a photoelectric sensor head 147 having a photocell (not shown) and an excitier lamp (not shown), this head being mounted on a bracket 149 carried by arm 25A. The excitier lamp emits a beam of light which is directed toward disk 139 and which is reflected therefrom when the reflective index mark rotates through the light beam. The photoelectric cell is positioned in the sensor head 147 to receive the light beam which is reflected by index mark 145. Thus, each time the index mark passes the light beam, it reflects the light to the photocell, causing the output of the photoelectric cell to change, thus indicating the position of the perforating blades.

Motor 109 is preferably a stepping motor such as that sold under the trade name SLO-SYN by The Superior Electric Company, of Bristol, Connecticut. The control 117 is a suitable commercially available control (preferably one having solid-state switching components) adapted to receive input signals from the photocell 129 of the registration mark scanner 111 and from the photoelectric sensor position scanner 115, and to provide voltages for energizing windings of motor 109 to cause stepwise rotation of its output shaft in one direction or the other in response to a difference in phase between the input signals and the sequence of the output signals. Thus, if the registration mark signals should lead the perforator position signals, control 117 provides voltage to motor 109 to effect rotation of its output shaft in the direction for rotating the ring gear of the differential 41 to increase the speed of rotation of perforator 21 to bring the perforator back into phase with respect to the registration marks so that the perforator blades 72 strike the back-up roll at the proper point between the printing frames on the web. Conversely, if the perforator position signals lead the registration mark signals, meaning that the perforating blades are perforating too soon, control 117 provides voltage to motor 109 to effect rotation of its output shaft in the opposite direction for rotating the ring gear in the opposite direction to slow down the perforator and bring it back into phase with the registration marks so that the blades strike the back-up roll at the proper point between the printing frames on the web. The system is adapted closely to maintain registration of the lines of perforations relative to the printed matter within one-quarter inch, for example. If web W is stretched as it is unwound from mill roll R, motor 109 may be continuously energized to drive differential 41 for advancing the speed of the perforator relative to the back-up roll, there being no limit to the amount of correction the registration system of this invention may effect. Thus, the position of the lines of perforations may be maintained relative to the registration marks regardless of the amount of stretch which occurs between successive registration marks and regardless of the length of the web which is to be perforated.

At 117 in FIG. 1 is indicated a control panel 151 including an on-off switch 153, a manual-automatic switch 155, a forward-reverse switch 157, an automatic synchronizing indicator lamp 159, and a correct-alignment indicating lamp 161. The on-off switch is connected to turn the registration system on and off. The manual-automatic switch is connected for operation of the apparatus without energization of the registration system in the event an unprinted or randomly printed web is to be perforated. The forward-reverse switch permits perforator 21 to be intermittently moved or jogged relative to back-up roll 19 to aid in threading the web through the apparatus and to aid in synchronizing perforator position sensor 115 and the registration mark scanner 111 in a manner as will appear. Indicator lamp 159 is provided to show that the registration system is automatically maintaining synchronization between the perforator and the registration marks while the apparatus is in operation, and lamp 161 shows when the perforator is in correct alignment with the registration marks as web W is being threaded through the apparatus.

Motor 29 is energized via a conventional motor speed control (not shown) housed in a box 163 (see FIG. 1) on one side of the apparatus. An on-off switch 165 on control panel 151 energizes and deenergizes the speed control; turning this switch on effects energization of motor 29 in a manner to permit back-up roll 19 and perforator 21 to be gradually brought up to their operating speed, and turning it back to its off position gradually slows the back-up roll and the perforator to a stop. The desired operating speed of the apparatus is controlled by a potentiometer 167 mounted on control panel 151. Switches 169 and 171 on box 163 control the power supplied to the speed control and to motor 29.

One or more slitters, as indicated at 173 in FIG. 4, carried by a bar 175 extending between side plates 7 and 9 may be provided for slitting web W into two or more webs of various widths, as desired, as the web is fed through the apparatus. The bar is rotatably mounted between the side plates for pivotal movement of the slitter (or slitters) between a lowered slitting position (as shown in FIG. 4) and a raised retracted position in which the slitting blade is clear of the web. The slitter comprises a rod 177 secured to the bar and a blade holder 179 mounted on the free end of the rod, with a slitter blade 181 removably held in the holder. Suitable provision may be made for adjusting the slitter or slitters to different positions on the bar to vary the width of the webs slit from web W.

At 182 in FIGS. 6 and 7 is generally indicated means for winding up a web W after it has been perforated into a so-called product roll P, and for winding up a plurality of webs into which web W may be slit after they have been perforated into a plurality of product rolls. This web winding or take-up means utilizes the back-up roll 19 as a driver for the product roll (or rolls), by tangential contact of the product roll with the back-up roll, and thus automatically compensates for the increasing diameter of the product roll (or rolls) in the winding thereof. It comprises means generally indicated at 183 for chucking one or more cores 185 (see FIGS. 6-8) for winding thereon of the web W (or webs) after the lines of perforation have been formed. A core with the web wound thereon constitutes the product roll P. More particularly, this chucking means com-
prises a mounting bar 187 extending between side plates 7 and 9 adjacent back-up roll 19 as shown in FIGS. 1 and 6. This mounting bar carries a plurality of pairs rotatably to hold a core or cores in position against back-up roll 19 so as to be frictionally driven by the back-up roll for winding a web on the core (or webs on the cores). Each pair of arms comprises an arm 189A with an offset and a straight arm 189B. Each arm is pivotally mounted for swinging movement in a vertical plane to rotate and away from the back-up roll by means of a pin 191 in lug 192 on a collar 193 slidable axially on mounting bar 187. A coil tension spring 195 connected between each arm 189A and its respective collar biases the arm toward a horizontal position against a stop pin 197 provided on the respective collar. Bar 187 has a set of diametrical positioning holes 199 along its length, and each collar 193 carries a locating pin 201 adapted to be inserted in one of the positioning holes for locating the arm carried by the respective collar in a predetermined position of adjustment along the bar. As shown in FIG. 1, three pairs of chucking arms 189 are provided for simultaneously supporting three cores 185 so that up to three separate relatively narrow web slits from web W by two slitters 173 may be wound into product rolls. Referring to FIG. 6, it will be noted that if a plurality of webs are wound into product rolls, cores may be centered with respect to the webs due to the offsets in arms 189A.

Each arm 189A has a core chuck 203 at its outer end for rotatably chucking one end of a core 185, and arm 189B has a core chuck 205 at its outer end for rotatably chucking the other end of the core. Each of the chucks is held in a stub shaft by a bolt 211, the chuck being journaled on bolt 211 by a ball bearing 213. Bolt 211 in chuck 203 is threaded endwise in a stub shaft 214 in a recess 215 slidable at the outer end of arm 189A for movement of chuck 203 toward and away from the adjacent end of core 185. Chuck 203 is biased by a coil compression spring 217 toward engagement with the adjacent end of the core, and is held in engagement therewith by a locking pin 219 which is movable in an L-shaped slot 221 in the outer end of arm 189A. By moving pin 219 in the L-shaped slot, chuck 203 may be axially moved for removal of a full product roll P from the chucking arms and chucking of a new core 185. Bolt 211 of chuck 205 is threaded endwise in a stub shaft 222 which is slidable in a recess 223 in the outer end of arm 189B. Chucks 203 and 205 may be readily removed from their respective chucking arms by sliding shafts 211 and 222 from their respective recesses 215 and 223 to permit a pair of chucks of one size to be exchanged for a pair of chucks of a different size for handling of cores 185 of various diameters.

As shown in FIG. 6, each end of the mounting bar 187 is removably connected to a slider 224 by pins 225. The sliders are slidable on horizontal guides 227 secured to side plates 7 and 9. Each slider is movable toward and away from back-up roll 19 by a pneumatic cylinder unit 229 (see FIGS. 2 and 7) secured to the adjacent side plate for effecting movement of the mounting bar and chucking arms thereon between an advanced winding position (see FIG. 7) in which the mounting bar is most closely adjacent back-up roll 19 for engagement of cores 185 held between the pair of chucking arms generally designated 900 arranged in the chucking arms. Guides 227 include opposed upper and lower guide rails as indicated in 231 and 233, respectively, these guide rails being spaced apart from one another and engaging in grooves 235 provided in sliders 224 (see FIG. 6). End plate 237 are secured to the front and rear ends of the guide rails to prevent the slider from becoming disengaged from the guides.

Each air cylinder unit 229 includes a cylinder 239 mounted on the respective side plate 7 or 9, a piston (not shown) axially movable within the cylinder and a piston rod 241 having its free end secured to an ear 243 on slider 224 for movement of the slider along guide 227 as the piston rod is extended and retracted relative to the cylinder. Air under pressure is supplied to cylinder units 229 via lines 245 and 247 (see FIG. 2) for extending and retracting their respective piston rods, and the operation of the cylinders is controlled by a valve 249 mounted at a convenient operating position at the front of the apparatus.

With mounting bar 187 in its retracted unloading position (see FIG. 8) and with chucking arms 189A and 189B supporting cores 185, the arms are biased by springs 195 to assume a generally horizontal position with the cores being held for engagement with back-up roll 19 when the mounting bar is moved from its retracted position to its winding position (see FIG. 7). Piston rods 241 of air cylinder units 229 at each side of the apparatus may be simultaneously extended to move the mounting bar to its winding position by actuating valve 249. With the mounting bar in its winding position, cores 185 are in engagement with back-up roll 19 so that, with web W wrapped on the core, the core is frictionally driven by the back-up roll to wind the web on the core. As the web is wound on the core, the diameters of the product roll increases and the chucking arms pivot on pins 191 away from their horizontal position. Springs 195 maintain frictional contact between the product roll and the back-up roll so that the product roll is peripherally driven at the speed of the back-up roll, whereby the web is wound under generally uniform tension as the diameter of the product roll increases.

As shown in FIG. 1, mill roll R includes a mandrel or core 251 on which web W is wound. Chucking means 11 includes chucks 253 and 255 for engaging in the ends of core 251 rotatably to hold the mill rod for unwinding the web. The chuck 253 is movable toward and away from one end of the mill roll by a pneumatic cylinder unit 257 to facilitate changing of mill rolls. The chucks are axially movable between a plurality of fixed positions for accommodating mill rolls of various widths. Air is supplied to pneumatic cylinder unit 257 via lines 258 and is controlled by a valve 259 mounted on the front of the machine at a convenient operating location. A magnetic particle clutch 261 is connected to shaft 263 for chuck 255 by a belt and pulley drive 265 to apply a tensioning force on the web for maintaining proper tension on the web as it is fed through the apparatus, and to apply a braking force on the mill roll to prevent overrun of the mill roll upon stopping operation of the apparatus.
A power frame saw including a bench frame on which a workpiece to be cut is mounted between a set of adjustable clamping braces. A saw frame which holds a saw blade is positioned within a housing and is displaceably mounted therein so as to be capable of being moved in a reciprocating stroke direction. The housing, in turn, is pivotally articulated to a machine frame arranged on the bench frame. A drive system is mounted within the housing and includes a crank disc, which is operatively coupled to the back portion of the saw frame. This back portion of the saw frame extends in the direction of reciprocating stroke movement of the saw frame and is provided with two widened portions which form web sections, both of which extend transverse to the longitudinal axis of the back portion. An arrangement is provided for displaceably guiding the web sections within the housing so as to be moved along the reciprocating stroke direction.

10 Claims, 7 Drawing Figures