July 28, 1964 J. J. BRAND 3,142,427

GLASS SNAPPING APPARATUS

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FIG. 1

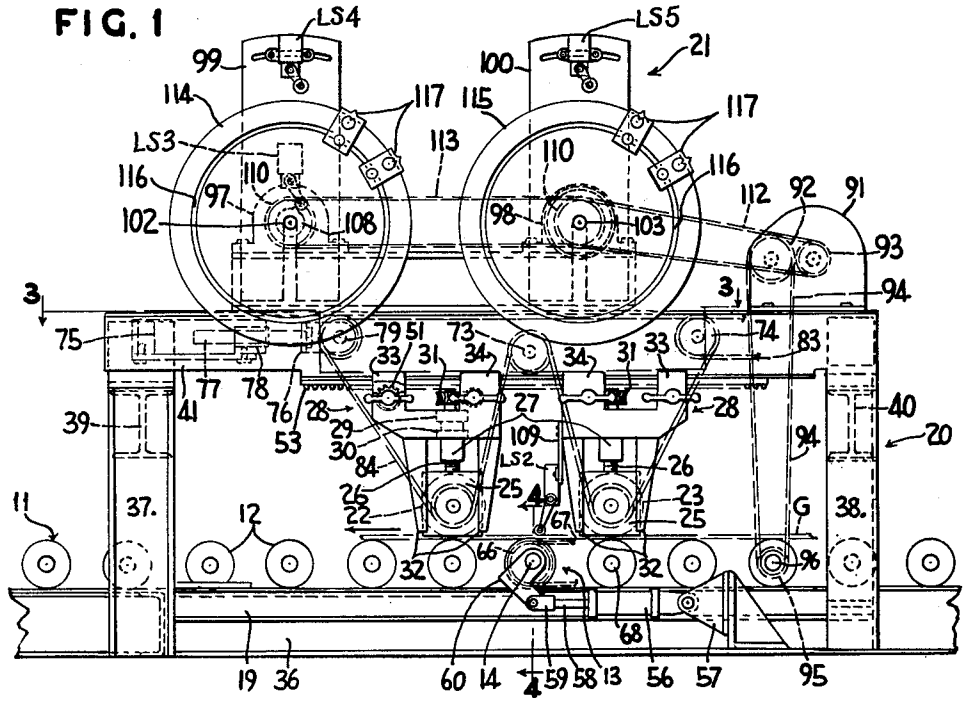

FIG. 2

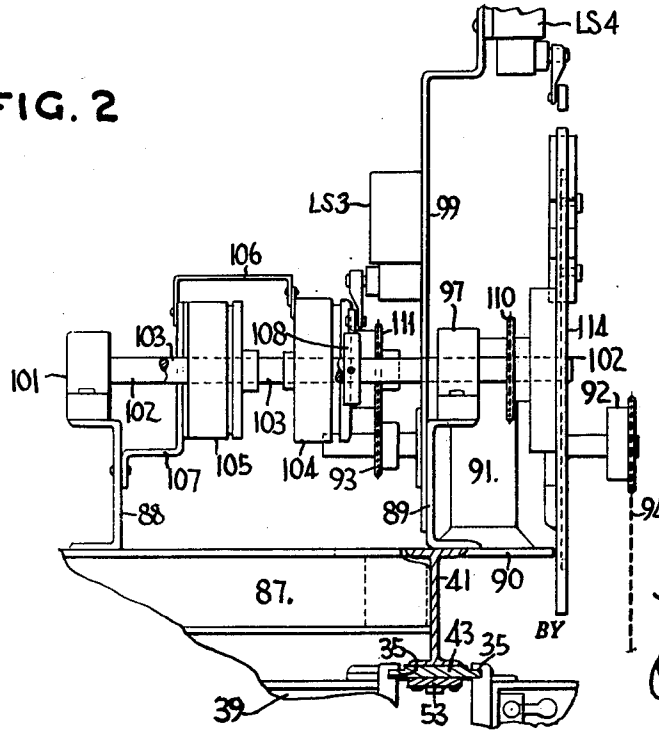

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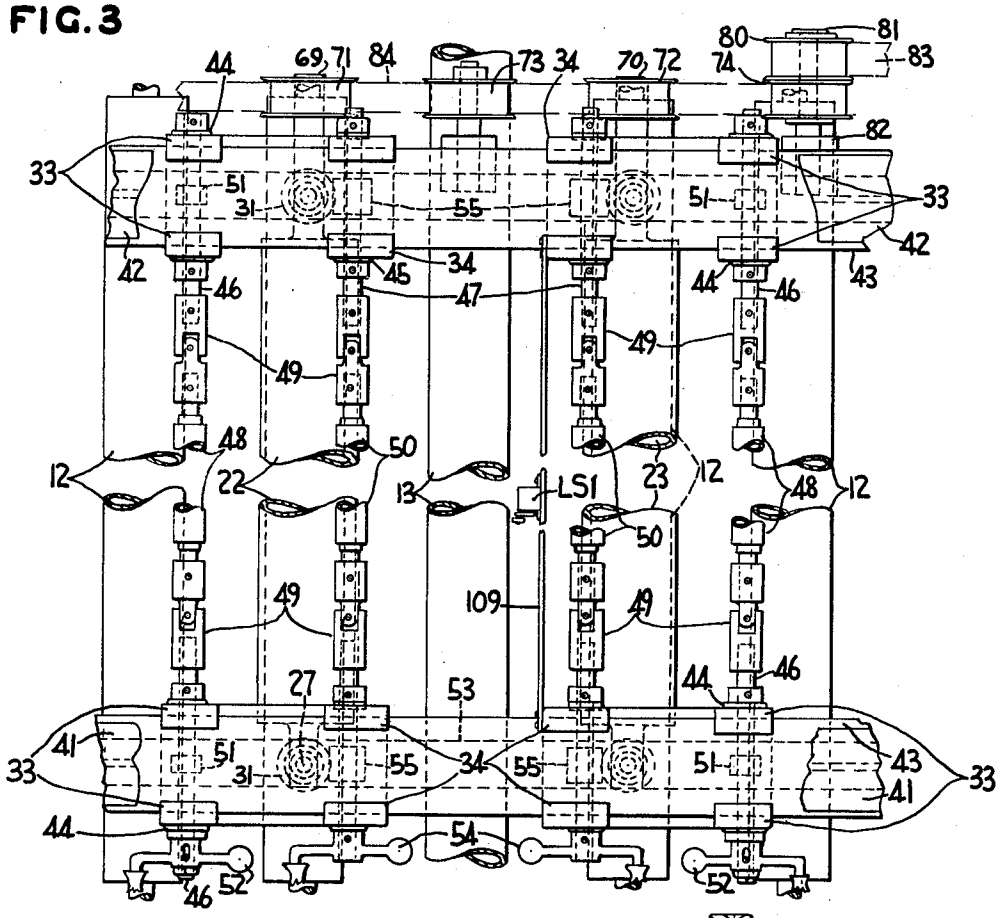
FIG. 3



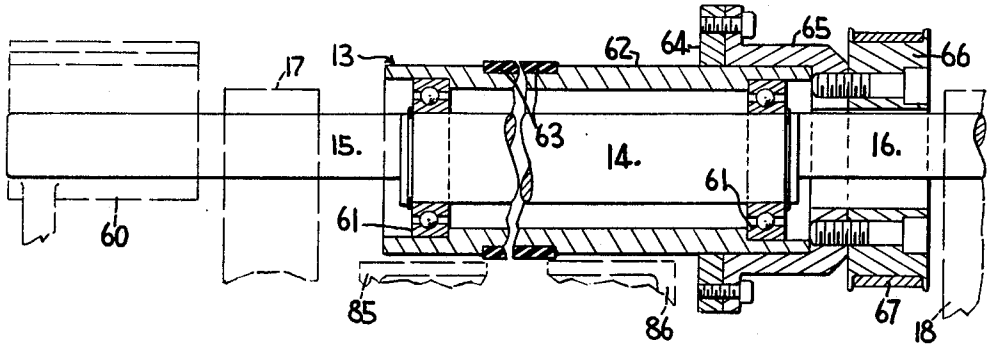


FIG. 4

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FIG. 5

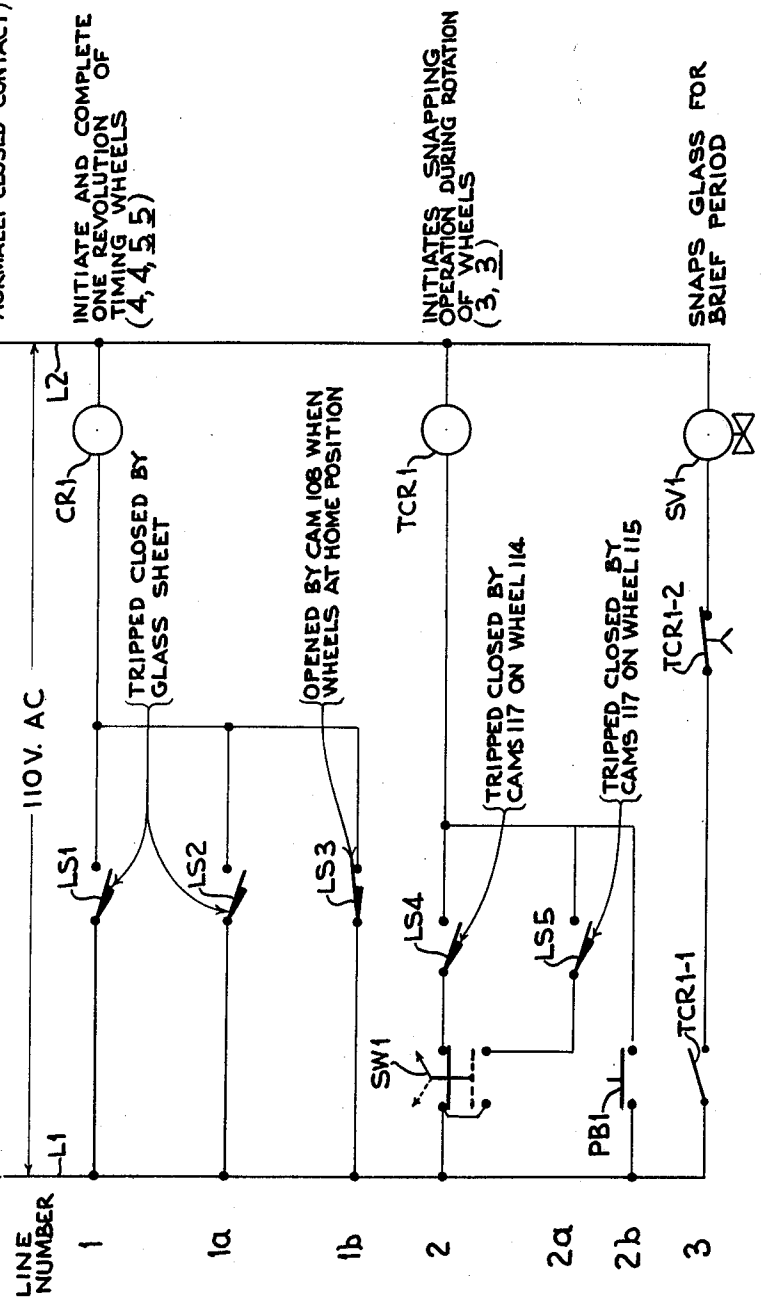

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FIG. 6

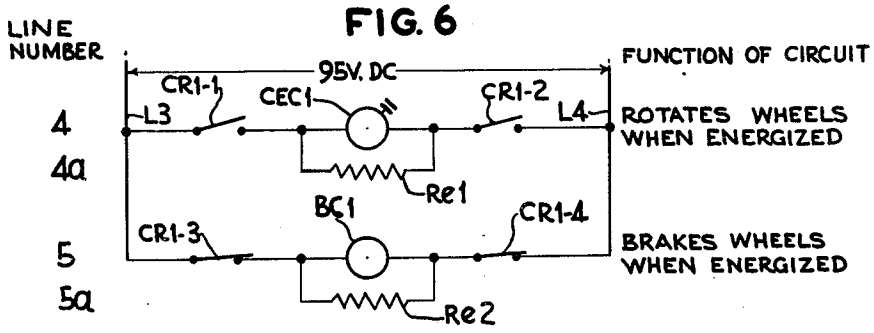

FIG. 7

LEGEND

ILLUSTRATIVE REFERENCE CHARACTER	SYMBOL	TYPE OF UNITS
CR1		COIL OF RELAY
TCR1		COIL OF TIMER RELAY
BC1		COIL OF ELECTRIC BRAKE
CR1-1		NORMALLY OPEN CONTACT OF RELAY
TCR1-1		NORMALLY OPEN CONTACT OF A TIMER RELAY INSTANTANEOUSLY CLOSING UPON ENERGIZATION OF COIL OF TIMER RELAY
CR1-1		NORMALLY CLOSED CONTACT OF RELAY
TCR1-1		NORMALLY CLOSED CONTACT OF TIMER RELAY, BUT TIME OPENING UPON ENERGIZATION OF COIL OF TIMER RELAY
LS1		NORMALLY OPEN, TRIPPED CLOSED, LIMIT SWITCH
LS1		NORMALLY CLOSED, TRIPPED OPEN, LIMIT SWITCH
PB1		NORMALLY OPEN PUSH-BUTTON SWITCH
SW1		PUSH-BUTTON TYPE OF SELECTOR SWITCH WITH TWO CONTACTS IN DIFFERENT CIRCUITS AND WITH ONE CONTACT CLOSED WHEN THE OTHER IS OPEN (SWITCH IN TWO POSITIONS SHOWN)
SV1		SOLENOID OF SOLENOID-OPERATED VALVE
CEC1		COIL OF ELECTRIC CLUTCH
Re1		RESISTOR

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United States Patent Office 3,142,427 Patented July 28, 1964

3,142,427

GLASS SNAPPING APPARATUS

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Filed Mar. 1, 1960, Ser. No. 12,223
9 Claims. (Cl. 225—104)

This invention relates to a glass snapping apparatus and more specifically relates to an apparatus for running cuts in sequence along a number of parallel score lines which are parallel to the leading edge of a moving glass sheet.

In the cutting of a glass sheet to sheets of smaller size various apparatuses have been developed to score the glass sheet along parallel lines by glass cutting tools or cutter wheels. An apparatus for providing these parallel score lines on a glass sheet is disclosed and claimed in my copending patent application Serial No. 11,261, entitled "Glass Cutting Apparatus," and filed on February 26, 1960. With use of that apparatus there can be obtained two sets of parallel score lines in which the parallel score lines in the first set are transverse or normal to the parallel score lines of the second set. When using conventional scoring tools or cutter wheels the glass sheet is merely scored by such apparatus, so that it is necessary to run the cuts along these score lines.

In the apparatus of said copending application the one set of parallel score lines is parallel to the direction of travel provided by the belt conveyor on which the scoring operation takes place. The other set of parallel score lines is transverse to this direction afforded by the belt conveyor which operates to remove the glass sheet from the scoring station. The scored glass sheet is fed to a receiving conveyor. The sheet is moved by the receiving conveyor with one set of parallel score lines transverse to the path of movement and parallel to the leading edge of the moving glass sheet.

It is an object of the present invention to provide an apparatus for the application of an upward force against the moving glass sheet each time that a score line of the sheet is substantially directly above the snapping force.

It is a further object of this invention to provide an apparatus for snapping a glass sheet along parallel score lines by the application of an upward snapping force below the sheet substantially at the moment that each score line passes over the snapping station while the apparatus on the top side of the sheet restrains upward movement of the sheet on opposite sides of the score line.

It is another object of the invention to provide an apparatus for snapping a moving glass sheet along a score line without imposing substantial strain at other areas of the sheet other than that of the score line.

These and other objects of this invention will be apparent to one skilled in the art from the description which follows of a preferred embodiment of the apparatus taken along with the drawings in which similar parts are generally designated by the same numeral and in which:

FIG. 1 is a front elevation of the preferred embodiment of the apparatus;

FIG. 2 is a fragmentary side elevation of the preferred embodiment as viewed from the left-hand side of FIG. 1;

FIG. 3 is a fragmentary cross section taken substantially along line 3—3 of FIG. 1 with parts broken away;

FIG. 4 is a fragmentary vertical cross section taken along the line 4—4 of FIG. 1;

FIGS. 5 and 6 are schematic drawings of electrical circuitry used in the apparatus; and

FIG. 7 is a list of symbols used in FIGS. 5 and 6 along with illustrative reference characters used with the symbols and a description of the types of electrical components for which the symbols are used.

The apparatus of the preferred embodiment, as seen in FIG. 1, has a conveyor generally indicated at 11 which includes a number of conveyor rolls 12 which are journaled by bearings (not shown) so that the top surfaces of conveyor rolls 12 are in horizontal alignment. The conveyor 11 constitutes a feeding conveyor means to move a glass sheet in a horizontal path and a receiving conveyor means to continue movement of the sheet in the horizontal path. The conveyor 11 is of a conventional type except that one of conveyor rolls 12 is replaced by an eccentric snapping roll 13. The detailed construction of eccentric roll 13 is shown in FIG. 4. The conveyor rolls 12 are driven by a motor (not shown) through a chain and sprocket arrangement (not shown) which, of course, includes a sprocket fixed on one end of the shaft of each of conveyor rolls 12.

The shaft 14 of eccentric roll 13 has cylindrical end ports 15 and 16 (FIG. 4) which are of the same diameter but which have a smaller diameter than the main central cylindrical portion. The longitudinal axes of the end cylindrical portions 15 and 16 are in coincidence with each other but are not in coincidence with the longitudinal axis of the main central cylindrical portion. The end cylindrical portions 15 and 16 are journaled in bearings 17 and 18 which are mounted on channel irons 19 of a supporting structure generally indicated at 20. The rotation of the end cylindrical portions 15 and 16 of shaft 14 results in a raising and lowering of the central main cylindrical portion of shaft 14. Thus there is an eccentric mounting of the central main portion of shaft 14.

The apparatus includes a mechanism whose mechanical components are generally indicated at 21 in FIGS. 1 and 2. This mechanism rotates shaft 14 to move snapping roll 13 upwardly and then downwardly with a slight arcuate motion as a sequence of operation which is repeated in a programmed manner.

The apparatus further includes backup rolls 22 and 23. On the ends of shafts 24 of each of packup rolls 22 and 23 is mounted a bearing (not shown) which is mounted in a bearing housing 25 that has an integral upstanding threaded shaft 26. Each of threaded shafts 26 is screwed into a bottom threaded opening of a shaft 27 which extends through a vertical opening in a support member generally indicated at 28 having larger diameter top and bottom portions of the opening for receiving bearings 29 and 30 which are on shaft 27. A gear 31 is keyed on the top end of shaft 27.

Each of the four bearing housings 25 has convex vertical sides with central vertical grooves. Each support member 28 has a pair of downwardly extending arms 32 whose opposing vertical faces are concave in horizontal section. These opposing faces of arms 32 of each support member 28 provide sliding contact for the convex vertical sides of each bearing housing 25. The arms 32 of each housing 25 have horizontal apertures in which dowels (not shown) are positioned. Each dowel extends into one of the vertical grooves of bearing housing 25. With this construction bearing housing 25 can be moved vertically relative to arms 32 of support member 28 without pivotal movement about a vertical axis. The rotation of shaft 27 results in the rotation or lowering of bearing housing 25.

Each support member 27 also has a pair of upstanding arms 33 and a pair of upstanding arms 34. Each arm 33 is disposed relative to an arm 34 in a direction parallel to the path of travel provided by conveyor 11. Each one of arms 33 or arms 34 is disposed transversely of the other arm 33 or 34 respectively, of the same support member 27. The arms 33 of each support member 27 have horizontal grooves 35 (FIG. 2) in their opposing

faces. The arms 34 of each support member 27 have horizontal grooves 35 in their opposing faces.

The supporting structure 20 has a pair of horizontal channel irons 36 which are connected to a pair of upright channel irons 37 and a pair of upright channel irons 38. The upright channel irons 37 support a horizontal transverse I-beam 39. The upright channel irons 38 support a horizontal transverse I-beam 40. A horizontal I-beam 41 is mounted on one end of I-beam 39 and one end of I-beam 40. A horizontal I-beam 42 is mounted on the other ends of I-beams 39 and 40. The bottom portion of the ends of I-beams 41 and 42 are cut away as shown in FIG. 1. The channel irons 19 are supported by channel irons 36.

Guide plates 43 (FIGS. 1 and 2) are bolted to the undersurface of I-beams 41 and 42. The guide plates 43 extend into grooves 35 of arms 33 and 34 of support members 28. Thus support members 28 are supported by slidable engagement with guide plates 43.

The arms 33 of each support member 28 have aligned horizontal apertures in which are mounted bearings 44. The arms 34 of each support member 28 has horizontally aligned apertures in which are mounted bearings 45. A shaft 46 is rotatably mounted on arms 33 of each support member 28 by bearings 44. A shaft 47 is rotatably mounted on arms 34 of each support member 28 by bearings 45. A shaft 48 is connected by U-joints 49 to shafts 46 mounted on support member 28 supported by I-beam 41 and mounted on support member 28 supported by I-beam 42. A shaft 48 is similarly connected to other shafts 46 journaled in the other two support members 28. A shaft 50 is connected by U-joints 49 to shafts 47 mounted on support member 28 supported by I-beam 41 and mounted on support member 28 supported by I-beam 42. A shaft 50 is similarly connected to other shafts 47 journaled in the other two support members 28.

Gears 51 are keyed on shafts 46 between the arms 33 of each support member 28. The shafts 46 on the front support members 28 have handles 52 fixed on them. The I-beams 41 and 42 have racks 53 mounted on the undersurface of guide plates 43. The gears 51 mesh with racks 53.

An operator can rotate handle 52 on support member 28 thereby rotating gears 51. This rotation results in horizontal movement to left or right (as viewed in FIG. 1) of both ends of backup roll 22 or 23 depending upon which handle 52 is rotated because of this left or right movement.

The shafts 47 journaled in arms 34 of front support members 28 have handles 54. Gears 55 are mounted on shafts 47 between arms 34 of front and rear support members 28. The gears 55 mesh with gears 31 mounted on shaft 27 so that the rotation of one of handles 54 results in the raising of both ends of backup roll 22 or 23 depending on which handle 54 is rotated.

In view of the construction which has been described above, each of the backup rolls 22 and 23 is rotatably mounted, but is adjustable vertically and horizontally at both ends. The rolls 22 and 23 can be properly positioned to be in rolling engagement with the top surface of a glass sheet G moving through the apparatus. The horizontal adjustment provides for variation of spacing of the backup rolls 22 and 23 from the vertical transverse plane extending through the axis of rotation of end portions 15 and 16 of eccentric roll 13.

The shaft 14 is turned by the operation of an air cylinder 56 pivotally mounted on a bracket 57 mounted on one of channel irons 19. The piston rod 58 of air cylinder 56 is connected by a clevis 59 to a crank arm 60 keyed on the end portion 15 of shaft 14. The turning of shaft 14 by the extension of piston rod 58 results in the lifting of eccentric roll 13 in a motion which is almost entirely vertical but which has a slight arcuate motion. This motion is because, in this preferred embodiment, the axis of the cylindrical ends 15 and 16 of shaft 14 is offset only slightly from the longitudinal axis of the main cylindrical portion of shaft 14.

The conveyor rolls 12, the eccentric roll 13 and the backup rolls 22 and 23 are provided with a covering of a resilient material, such as rubber.

Bearings 61 are mounted on the central main cylindrical portion of shaft 14 of snapping roll 13. The bearings 61 support a cylindrical tube 62 on which is mounted the covering 63 of resilient material. A peripheral flange 64 is integral with one end of tube 62. A cover member 65 is bolted to flange 64. A belt pulley 66 is bolted to cover member 65. The end cylindrical portion extends through cover member 65 and pulley 66. The pulley 66 is driven by a belt 67 (FIG. 1) which is driven by a pulley (not shown) mounted on shaft 68 of adjacent conveyor roll 12 or by a pulley on a motor (not shown). By this construction cylindrical tube 62 is always rotating. The tube 62 is raised with a slight arcuate motion when piston rod 58 is extended.

The air cylinder 59 is connected to a pressurized air source (not shown) through a solenoid-operated, spring-biased, 4-way valve (not shown) having solenoid SV1 which is not normally energized. Thus the spring of the valve maintains the spool of the latter normally in the first position in which one of the chambers of cylinder 56 communicates with the pressurized air source and the other chamber communicates with an exhaust line so that piston rod 58 is in its retracted position. When solenoid SV1 is energized, the spool moves to a second position to communicate the second air chamber with the pressurized air source and the first chamber with the exhaust line so that piston rod 58 moves outwardly.

The shafts 69 and 70 (FIG. 3) of backup rolls 22 and 23 have pulleys 71 and 72 keyed on them. The I-beam 42 rotatably supports pulleys 73 and 74.

The I-beam 42 supports an air cylinder 75 which has its piston rod connected to a pulley support 76. A bar 77 is mounted on a transversely extending flange of pulley support 76 and bar 77 extends through a guide 78 mounted on air cylinder 75. The support 76 has journaled on it a pulley 79. A pulley 80 is keyed on a shaft 81 journaled by a bearing 82 mounted on I-beam 42. The pulley 74 is keyed on shaft 81. The pulley 80 is driven by a belt 83 which is driven by a pulley (not shown) operated by a motor (not shown). Thus pulley 74 is a driving pulley for a belt 84 which extends around pulleys 71, 72, 73, 74 and 79 so that backup rolls 22 and 23 are continuously rotated.

The tension on belt 84 is provided by the mounting of pulley 79 because air cylinder 75 is connected to a pressurized air source so that the piston rod of air cylinder 75 pulls pulley 79 to the left (as viewed in FIG. 1).

The bearings for rotatably supporting conveyor rolls 12 are mounted on angle irons 85 and 86 which are mounted on channel irons 19.

The supporting structure also has a pair of transverse horizontal channel irons 87 mounted on I-beams 41 and 42. The channel irons 87 support channel iron 88. The I-beam 41 supports a channel iron 89. A plate 90 is also supported by I-beam 41.

The plate 90 supports a gear reducer 91 which has sprockets 92 and 93. The sprocket 92 is driven by a chain 94 which is driven by a sprocket 95 mounted on shaft 96 of one of conveyor rolls 12.

The channel iron 89 supports bearings 97 and 98 and brackets 99 and 100. The channel iron 88 supports bearings 101. A shaft 102 is journaled by bearing 97 and one of bearings 101. A shaft 103 is journaled by bearing 98 and the other bearing 101. An electric clutch 104 and an electric brake 105 are mounted on shaft 103. The clutch 104 and brake 105 are supported by brackets 106 and 107 that are connected to each other and bracket 107 is mounted on channel iron 88. A cam 108 is fixed on shaft 102.

A plate 109 is mounted on the right (as viewed in FIG.

1) of support members 28. The plate 109 supports limit switches LS1 (FIGS. 3 and 5) and LS2 (FIGS. 1 and 5) which are of the normally open type and are transversely spaced above conveyor 11 to be tripped closed by glass sheet G traveling on conveyor 11. These switches are preferably mounted so that this tripping occurs when the leading edge of glass sheet G is substantially directly over the axis of rotation of end cylindrical portions 15 and 16 of eccentric snapping roll 13.

The bracket 99 supports a limit switch LS3 which is tripped by cam 108. The switch LS3 is of the normally closed type but when cam 108 is at its home position it opens switch LS3.

The brackets 99 and 100 support normally open limit switches LS4 and LS5, respectively. Mounting bolts of these limit switches extend through arcuate slots in brackets 99 and 100 thereby permitting adjustment of position of these limit switches by movement in an arcuate path of each that has a center of curvature at the axis of rotation of either shaft 102 or shaft 103.

Each of shafts 102 and 103 has a sprocket 110 (FIG. 1) keyed on it. In addition shaft 103 has a sprocket 111 rotatably mounted on it. The sprocket 111 is associated with electric clutch 104 and is driven continuously by chain 112 which is driven by sprocket 93. The sprocket 110 on shaft 103 drives sprocket 110 on shaft 102 by chain 113. The shafts 103 and 102 are driven only when sprocket 111 through clutch 104 drives shaft 103.

When a coil CEC1 (FIG. 6) of electric clutch 104 is energized, clutch 104 engages shaft 103 so that the latter rotates. The coil CEC1 is normally deenergized, as described later. The electric brake 105 has a coil BC1 which is normally energized by the circuit in which it is located so that brake 105 maintains shaft 103 in a fixed location. The deenergization of coil BC1 permits the rotation of shaft 103. When coil CEC1 is energized, coil BC1 is deenergized and vice versa, as described later.

The mechanism 21 further includes a circular disc or a wheel 114 and a wheel 115 fixed on shafts 102 and 103, respectively. The wheels 114 and 115 have a circular groove 116 in their front faces. Dogs or cams 117 are mounted on wheels 114 and 115. Each of cams 117 is U-shaped so that it has two flanges on the front and rear sides of wheel 114 or wheel 115. The cams 117 have a pointed portion that trips either switch LS4 or switch LS5 depending on which wheel that dog 117 is mounted.

The front flange of cam 117 has a bolt threaded through it and extending into circular groove 116 to fix cam 117 in position. By loosening the bolt temporarily dog 117 can be moved around the periphery of either wheel 114 or wheel 115 to position cam 117 so that it will trip switch LS4 or switch LS5 at the proper moment during the single rotation of wheels 114 and 115. The bolt is then tightened. Each of the front flanges of cams 117 also has an aperture which is generally circular in nature but has a little pointed portion which is opposite radial indicia lines (not shown) on wheels 114 and 115 to indicate that the distances from the leading edge of glass sheet G at which roll 13 will be raised for a snapping operation if cam 117 is positioned with the pointer directly in line with the indicia lines.

When wheels 114 and 115 are in their home positions, cam 108 opens switch LS3. The cam 108 is constructed so that as soon as it is given a slight degree of rotation switch LS3 can close and remain closed until a complete revolution of shaft 103 is made.

The number of cams 117 on wheel 114 will equal the number of score lines on a glass sheet to be snapped in sequence by the closings of switch LS4. The positions of these cams 117 on wheel 114 is determined by the distances between the leading edge of glass sheet G and the score lines of sheet G. When another glass sheet having score lines that are in a different pattern of distances from the leading edge of the glass sheet is to be snapped, switch LS5 is used and the positions of cams 117 on wheel 115 is determined by these distances between the leading edge of this glass sheet and the score lines of this sheet. Thus the apparatus can be rapidly changed from the program of snapping of one glass sheet to a different program of snapping for another glass sheet that has a different pattern of score lines by rendering switch LS4 ineffective in the electrical circuitry and rendering switch LS5 effective through a 2-position selector switch SW1 (as shown in FIG. 5). In other words, to change from one program of snapping to a second program of snapping, it is not necessary to change the positions of cams 117 on wheel 114. Instead the wheel 115 and its cams 117 are utilized for the second program.

Referring to FIG. 5 electric lines L1 and L2 are connected to a 110-volt alternating current source (not shown). A coil CR1 (line number 1) of a relay is in series with normally open limit switch LS1 (line number 1), normally open limit switch LS2 (line number 1*a*), and normally closed limit switch LS3 (line number 1*b*). The three limit switches are in parallel with one another. Thus any one of the three limit switches can provide a circuit for coil CR1 between lines L1 and L2.

Each of switches LS1 and LS2 is a sensing means actuated by the leading edge of the glass sheet G moving on conveyor 11.

A coil TCR1 (line number 2) of a time delay relay is in other circuits between lines L1 and L2. The normally open limit switches LS4 (line number 2) and LS5 (line number 2*a*) are in parallel with each other and are in series with coil TCR1. The 2-position selector switch SW1 (line number 2) has one position in which selector switch SW1 connects limit switch LS4 to line L1 and in the other position selector switch SW1 connects limit switch LS5 to line L1. In FIG. 3 selector switch SW1 is in the position in which switch LS4 is connected to line L1. In parallel with switch SW1 and switches LS4 and LS5 and in series with coil TCR1 is a normally open push-button switch PB1 (line number 2*b*).

The relay having coil TCR1 has a normally open contact TCR1–1 (line number 3) of the instantaneous type and a normally closed contact TCR1–2 (line number 3) of the time opening type which, upon the energization of coil TCR1, opens after a delay. The contacts TCR1–1 and TCR1–2 are in series with solenoid SV1 (line number 3).

The relay having coil CR1 has two normally open contacts CR1–1 and CR1–2 (both at line number 4) and two normally closed contacts CR1–3 and CR1–4. The contacts CR1–1 and CR1–2 are in series with coil CEC1 (line number 4) of electric clutch 104 in a circuit connected to lines L3 and L4 (FIG. 6) which are connected to a 95-volt direct current source (not shown). Another circuit, which is connected to lines L3 and L4, contains in series contacts CR1–3 and CR1–4 (both at line number 5) and coil BC1 (line number 5) of electric brake 105. In parallel with coil CEC1 and in series with contacts CR1–1 and CR1–2 is a resistor Re1 (line number 4*a*). Similarly a resistor Re2 (line number 5*a*) is in parallel with coil BC1 and in series with contacts CR1–3 and CR1–4. The resistors Re1 and Re2 are present to protect contacts CR1–1 through CR1–4 when either coil CEC1 or coil BC1 is deenergized. A well-known resistor for this purpose is a Thyrite resistor in which the current varies as a power of the applied voltage.

When the leading edge of the glass sheet G trips either switch LS1 or switch LS2 to close it, coil CR1 is energized. This results in the closing of contacts CR1–1 and CR1–2 for the energization of coil CEC1 to operate or engage electric clutch 104. At the same time contacts CR1–3 and CR1–4 open to deenergize coil BC1 to disengage electric brake 105. As a result shaft 103 starts its rotation to operate timing wheels 114 and 115.

In the home position of timing wheels 114 and 115,

cam 108 maintained switch LS3 open. Upon the initial rotation of shafts 102 and 103 and thus upon the initial rotation of cam 108 switch LS3 closes to maintain coil CR1 energized until after sheet G passes switches LS1 and LS2.

When timing wheels 114 and 115 return to the home position, cam 108 opens switch LS3. This results in the deenergization of coil CR1 to open contacts CR1–1 and CR1–2 for the deenergization of coil CEC1 of electric clutch 104. This deenergization of coil CR1 results also in the closing of contacts CR1–3 and CR1–4 to energize coil BC1 of electric brake 105 which stops rotation of shaft 103 at its home position as determined by cam 108.

With switch SW1 in the position shown in FIG. 3 each time one of cams 117 on timing wheel 114 trips switch LS4 the latter is closed to energize coil TCR1 momentarily. With switch SW1 in this position the tripping of switch LS5 by cams 117 on wheel 115 for the closing of switch LS5 for short periods of time does not provide energizations of coil TCR1. However, with switch SW1 in its other position the cams 117 on wheel 114 do not result in energizations of coil TCR1 but each timing cam 117 on wheel 115 trips switch LS5 there is an energization of coil TCR1 for a short period of time.

Each time coil TCR1 is energized contact TCR1–1 closes immediately so that coil SV1 is energized to raise rotating tube 62 of roll 13. After a delay contact TCR1–2 opens, thereby deenergizing coil SV1 before coil TCR1 is deenergized, by the opening of switch LS4 or LS5, to open contact TCR1–1.

At any time an operator wishes to operate air cylinder 56 he can close switch PB1 to energize coil TCR1 so that coil SV1 is energized until contact TCR1–2 opens.

Operation

The top surfaces of rolls 12 are at the same horizontal plane to support glass sheet in a horizontal path. A glass sheet G is moved from right to left by rolls 12 that are to the right of roll 13 (as viewed in FIG. 1). Thus this group of rolls 12 constitutes in effect a feeding conveyor that feeds glass sheet G in a horizontal path to roll 13 which is at its normal lowered or first position at which its top surface is in horizontal alignment with the top surfaces of rolls 12 feeding sheet G to it. The sheet G passes from roll 13 onto rolls 12 to its left. These rolls constitute in effect a receiving conveyor. The moving sheet G thus passes over rolls 12 of the feeding conveyor, over roll 15 and then onto rolls 12 of the receiving conveyor. The rolls 12 and 13 are rotating continuously. The roll 13 is in the lowered position.

The leading edge of sheet G trips and closes switches LS1 and LS2. The closing of either switch LS1 or switch LS2 energizes coil CR1 to close contacts CR1–1 and CR1–2 for the energization of coil CEC1 and to open contacts CR1–3 and CR1–4 for the deenergization of coil BC1. The electric brake 105 disengages and the electric clutch 104 engages so that the continuous drive of sprocket 111 results in the rotation of shafts 102 and 103.

In this description of operation it is assumed that switch SW1 is in the position shown in FIG. 3. Thus each time that a cam 117 on wheel 114 trips switch LS4, coil TCR1 is energized to immediately close contact TCR1–1 for the energization of coil SV1. This occurs when the first score line is above roll 13. The air cylinder 56 operates to raise tube 62 of roll 13 with a slight arcuate motion rapidly to a second position where the top surface of covering 63 is above the top surface of rolls 12. The raising of roll 13 lifts sheet G to provide an upward snapping force against sheet G while rolls 22 and 23 hold-down glass sheet G on opposite sides of the score line. The rolls 22 and 23 are rotating continuously and are adjustably positioned vertically so that when roll 13 is at its normal lowered position rolls 22 and 23 touch sheet G with rolling contact. As a result the cut runs along this score line.

As soon as the delay period of contact TCR1–2 has run, it opens so that solenoid SV1 is deenergized and roll 13 is lowered, even though switch LS4 might still be closed by cam 117. This completes the first cycle of the snapping operation.

The relays having coils CR1 and TCR1 and their contacts, sprocket 111, electric clutch 104 and its coil CEC1, shafts 102 and 103, wheel 114 or wheel 115, cams 117, and switch LS4 or LS5 comprise with solenoid SV1 means responsive to the sensing means to actuate after a predetermined delay air cylinder 56 constituting part of the power means to raise snapping roll 13. The contact TCR1–1 and the valve having solenoid SV1 comprise part of means responsive to the sensing means after a further delay to actuate air cylinder 56 to lower roll 13.

The forward movement of the remaining portion of sheet G continues. When its next score line is directly above roll 13, a cam 117 on wheel 114, because of its predetermined positioning, trips switch LS4 to repeat the cycle of raising and lowering of roll 13 described above.

After the last score line in sheet G has been run by the raising of roll 13 in cooperation with hold-down rolls 22 and 23 through the tripping of switch LS4 by the last cam 117 on wheel 114 in its single revolution, the drive of wheel 114 continues until cam 108 opens switch LS3. Before this event sheet G has passed beyond switches LS1 and LS2 so that they are now open. With coil CR1 deenergized by the opening of switch LS3 contacts CR1–1 and CR1–2 open to deenergize coil CEC1 and contacts CR1–3 and CR1–4 close to energize coil BC1. Thus electric clutch 104 disengages and electric brake 105 immediately stops shaft 103 so that it, shaft 102 and cam 108 are at their home positions. If the next glass sheet has a different pattern of distances of score lines from the leading edge and if this pattern of distances is represented by the positioning of cams 117 on wheel 115, an operator changes switch SW1 to the second position, which is the second of the two positions shown in FIG. 7 so that switch LS5 when closed by cams 117 will energize coil TCR1. However, if the next glass sheet has the same positioning of score lines as the sheet described above, switch SW1 is kept in the first position for the automatic snapping of the glass sheet along these score lines through the tripping of switch LS5 by cams 117 on wheel 114.

It is apparent from the foregoing that the apparatus of the preferred embodiment has feeding and receiving conveyors with conveyor rolls, a snapping or eccentric roll which in its normal position has its top surface in a horizontal plane to support the glass sheet moving over it from the feeding conveyor to the receiving conveyor, and hold-down or backup rolls which are above the path of travel of the glass sheet on the conveyor rolls. It is apparent also that it is preferred that all of these rolls rotate continuously. The snapping roll 13 is referred to as an eccentric type because its tube 62 is rotatably mounted by bearings 61 on shaft 14 which is mounted eccentric to the axis of rotation of tube 62 so that turning of shaft 14 raises tube 62. The motion is almost entirely a vertical component of direction. There is a slight horizontal component. The overall motion is upward with a slight arc so that the top of roll 13 is above the top of rolls 12 and can be above the bottom of rolls 22 and 23. The rolls 22 and 23 are movable laterally to properly position for the best hold-down action.

The conveyor rolls 12 that are to the left (as viewed in FIG. 1) of snapping roll 13 are rolls of a receiving conveyor whereas rolls 12 to the right of snapping rolls 13 are rolls of a feeding conveyor. The rolls 12 of the receiving conveyor are rotated at a faster peripheral speed than rolls 12 of the feeding conveyor so that when glass sheet G is snapped into smaller glass sheets the leading smaller sheet is moved rapidly away from the newly formed edge of the trailing smaller glass sheet. The rolls 12 of the receiving conveyor are preferably at a lower ele-

vation than that of rolls 12 of the feeding conveyor. A difference in elevation is about one-eighth of an inch, for example.

Various modifications of the apparatus will be apparent to one skilled in the art from the description of the preferred embodiment presented above and in the drawings. Thus the invention is not to be limited by this description but only by the claims that follow.

I claim:

1. An apparatus for snapping a moving glass sheet to run a cut along a score line on the sheet parallel to the leading edge of the sheet which comprises a supporting structure, a feeding conveyor means to move a glass sheet in a horizontal path, a receiving conveyor means to continue movement of the sheet in the horizontal path, a snapping roll, mens to support said snapping roll for rotation about a horizontal axis normal to the path of travel of the sheet provided by said feeding and receiving conveyor means, power means to rotate said snapping roll, first and second backup rolls rotatably mounted to said supporting structure above the path of travel of the glass sheet, said first and second backup rolls being in vertical planes on opposite sides of a vertical plane parallel to and through the axis of rotation of said snapping roll, power means to rotate said backup rolls, means connecting one of said backup rolls to said supporting structure for horizontal movement of each end of said one backup roll, and power means to move said support means for said snapping roll vertically for movement of said snapping roll between lowered and raised positions whereby a part of said snapping roll in the raised position is in the path of travel of the sheet to force the sheet upwardly while backup rolls abut the top surface of the sheet.

2. The apparatus of claim 1 wherein said means to move said snapping roll between lowered and raised positions is actuated power means and said apparatus includes sensing means mounted on the supporting structure in a position to be actuated by the leading edge of the glass sheet moving on said feeding conveyor means, actuating means responsive to the sensing means to actuate after each of a number of three predetermined delays said power means to raise said snapping roll from the lowered position to the raised position, and means responsive to said actuating means to actuate said power means to lower the snapping roll from the raised position to the lowered position shortly after each operation of said power means that raises said snapping roll.

3. An apparatus for snapping a moving glass sheet to run a cut along a score line on the sheet parallel to leading edge of the sheet which comprises a supporting structure; a feeding conveyor means to move a glass sheet in a horizontal path; a receiving conveyor means to continue movement of the sheet in the horizontal path; a snapping roll including a tube; means, including a shaft having end portions mounted to said supporting structure for rotation about an axis and a main portion having an axis eccentric to the axis of rotation of said end portions, to support said snapping roll for rotation about a horizontal axis normal to the path of travel of the sheet provided by said feeding and receiving conveyor means; first and second backup rolls rotatably mounted to said supporting structure above the path of travel of the glass sheet, said first and second backup rolls being in vertical planes on opposite sides of a vertical plane parallel to and through the axis of rotation of said snapping roll; and power means, including a crank arm fixed on one of said end portions of said shaft and an air cylinder connected to said crank arm and mounted on said supporting structure, to move said support means vertically for movement of said snapping roll between lowered and raised positions, whereby said snapping roll is raised and lowered in an arcuate direction and a part of said snapping roll in the raised position is in the path of travel of the sheet to force the sheet upwardly while backup rolls abut the top surface of the sheet.

4. The apparatus of claim 3 including power means to rotate said tube of said snapping roll about the axis of the main portion of said shaft and power means to rotate said backup rolls.

5. An apparatus for snapping a moving glass sheet to run a cut along a score line on the sheet parallel to the leading edge of the sheet which comprises a supporting structure; a feeding conveyor means to move a glass sheet in a horizontal path; a receiving conveyor means to continue movement of the sheet in a horizontal path; a snapping roll; means to support said snapping roll for rotation about a horizontal axis normal to the path of travel of the sheet provided by said feeding and receiving conveyor means; first and second backup rolls rotatably mounted to said supporting structure above the path of travel of the glass sheet, said first and second backup rolls being in vertical planes on opposite sides of a vertical plane parallel to and through the axis of rotation of said snapping roll, one of said backup rolls being mounted to said supporting structure by support members each rotatably mounting one end of said backup roll; a horizontal shaft rotatably mounted on both of said support members and extending and spaced above one of said feeding and receiving conveyor means; first gears fixed on said horizontal shaft; racks mounted on said supporting structure and extending horizontally in a direction parallel to the direction of travel of the sheet on feeding and receiving conveyor means and engaging said first gears; means for rotating said horizontal shaft; guide means mounted on said supporting structure for both of said support members to maintain rectilinear movement of each of said support members during rotation of said gears engaging said racks; and power means to move said support means vertically for movement of said snapping roll between lowered and raised positions whereby a part of said snapping roll in the raised position is in the path of travel of the sheets to force the sheet upwardly while backup rolls abut the top surface of the sheet.

6. An apparatus for snapping a moving glass sheet to run a cut along a score line on the sheet parallel to the leading edge of the sheet which comprises a supporting structure; a feeding conveyor means to move a glass sheet in a horizontal path; a receiving conveyor means to continue movement of the sheet in the horizontal path; a snapping roll; means to support said snapping roll for rotation about a horizontal axis normal to the path of travel of the sheet by said feeding and receiving conveyor means; first and second backup rolls rotatably mounted to said supporting structure above the path of travel of the glass sheet, said first and second backup rolls being in vertical planes on opposite sides of a vertical plane parallel to and through the axis of rotation of said snapping roll, one of said backup rolls being mounted to said supporting structure by bearing housings, each bearing housing supporting an end of said one backup roll and each bearing housing including a vertically extending threaded rod, support members having downwardly extending arms with opposing vertical grooves, said bearing housings having vertical edges abutting and extending in said vertical grooves of said arms, and a vertical shaft mounted in each of said support members and having in its lower end an internally threaded vertical hollow portion, said threaded rods of said bearing housings extending into said internally threaded portion of said vertical shafts; a first horizontal shaft rotatably mounted on said support members for rotation about a horizontal axis, first gears mounted on said vertical shafts, second gears mounted on said first horizontal shaft and engaging said first gears, whereby rotation of said first horizontal shaft results in rotation of said vertical shafts to move vertically said rods of said bearing housings for movement vertically of both ends of said one backup roll; a second horizontal shaft rotatably mounted on both of said support members and extending and spaced above one of said feeding and receiving conveyor means; third gears mounted on said second hori-

zontal shaft; racks mounted on said supporting structure and extending horizontally in a direction parallel to the direction of travel of the sheet on said feeding and receiving conveyor means and engaging said third gears; means for rotating said second horizontal shaft; guide means mounted on said supporting structure for both of said support members to maintain rectilinear movement of each of said support members during rotation of said third gears engaging said racks; and power means to move said support means vertically for movement of said snapping roll between lowered and raised positions whereby a part of said snapping roll in the raised position is in the path of travel of the sheet to force the sheet upwardly while backup rolls about the top surface of the sheet.

7. The apparatus of claim 6 wherein both of said backup rolls are mounted as recited for said one backup roll and wherein said apparatus includes power means to rotate said snapping roll and power means to rotate said backup rolls including pulleys fixed on one end of said backup rolls, a belt to drive said pulleys, means to adjust automatically tension of said belt upon relative horizontal movement of said support members.

8. An apparatus for snapping a moving glass sheet to run a cut along a score line on the sheet parallel to the leading edge of the sheet which comprises a supporting structure; a feeding conveyor means to move a glass sheet in a horizontal path; a receiving conveyor means to continue movement of the sheet in the horizontal path; a snapping roll; means to support said snapping roll for rotation about a horizontal axis normal to the path of travel of the sheet provided by said feeding and receiving conveyor means; first and second backup rolls rotatably mounted to said supporting structure above the path of travel of the glass sheet, said first and second backup rolls being in vertical planes on opposite sides of a vertical plane parallel to and through the axis of rotation of said snapping roll; actuated power means to move said support means vertically for movement of said snapping roll between lowered and raised positions whereby a part of said snapping roll in the raised position is in the path of travel of the sheet to force the sheet upwardly while backup rolls abut the top surface of the sheet; sensing means mounted on the supporting structure in a position to be actuated by the leading edge of the glass sheet moving on said feeding conveyor means; a wheel mounted for rotation from a home position about an axis; actuated motor means to rotate said wheel about said axis; cams mounted on said wheel about a circle concentric with said axis, the limit switch mounted to be tripped by said cams during rotation of said wheel; means responsive to tripping of said limit switch to actuate said power means for movement of said snapping roll from the lowered position to the raised position; means responsive to tripping of said limit switch to actuate after a delay said power means for moving said snapping roll from the raised position to the lowered position; means responsive to said sensing means to actuate said motor means, and means responsive to each single revolution of said wheel to deactuate motor means and to stop rotation of said wheel at said home position.

9. The apparatus of claim 8 wherein said snapping roll includes a tube, wherein said support means for said snapping roll includes a shaft having end portions mounted to said supporting structure for rotation about an axis and a main portion having an axis eccentric to the axis of rotation of said end portions, and wherein said means to move said snapping roll between lowered and raised positions includes a crank arm fixed on one of said end portions of said shaft and an air cylinder connected to said crank arm and mounted on said supporting structure, whereby said snapping roll is raised and lowered in an arcuate direction.

References Cited in the file of this patent

UNITED STATES PATENTS

1,895,779	Aurien et al.	Jan. 31, 1933
1,959,545	Paxton	May 22, 1934
2,236,011	Shock	Mar. 25, 1941
2,265,028	De Croce	Dec. 2, 1941
2,756,545	Atkeson	July 31, 1956
2,834,156	Oberlin	May 13, 1958
2,942,796	Gurney et al.	June 28, 1960
2,948,991	Walters et al.	Aug. 16, 1960
2,979,186	Shen et al.	Apr. 11, 1961
3,011,375	Muller	Dec. 5, 1961
3,044,216	Billinger	July 17, 1962