

[54] **WEB FEEDING APPARATUS FOR BLANK MAKING MACHINE**[75] Inventor: **Ralph H. Eggert**, Cinnaminson, N.J.[73] Assignee: **FMC Corporation**, San Jose, Calif.[22] Filed: **May 15, 1973**[21] Appl. No.: **360,520**[52] U.S. Cl. **226/42, 226/118, 226/97, 226/111, 226/117, 242/183**[51] Int. Cl. **B65h 23/22**[58] Field of Search **226/97, 113, 42, 118, 111, 226/117; 242/183, 184**[56] **References Cited****UNITED STATES PATENTS**

3,177,749	4/1965	Best et al.	226/118
3,240,411	3/1966	Zarlang	226/118 X
3,236,429	2/1966	Klein	226/118 X
2,907,565	10/1959	Sauter	226/118 X
3,203,635	8/1965	Rayfield et al.	226/118 X

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[57] **ABSTRACT**

A machine for making box blanks or the like from a

continuous strip or web of sheet material includes an unwind stand having a large diameter parent roll of the material from which a web or strip is cut and delivered to power unwind rolls. The unwind rolls feed material into a cylindrical vacuum box having adjustable side sealing plates, in which a loop of the material is formed with the assistance of a suction blower. Index or oscillating draw rolls intermittently remove the web material from the vacuum box for action by a reciprocating die set that forms the blanks when the web is not moving. The vacuum box is provided with a bank of photo resistant cells on one side of the loop and a bank of lamps on the other side, sensing the height of the loop and for controlling a variable DC speed motor that drives the unwind rolls, using an S.C.R. type control. The photocell control maintains the loop in the vacuum box at a nominal length and the inertia of the unwind drive system and the mechanism that feeds web to the loop is such that the feed motor does not respond to the rapid intermittent variations in loop length resulting from indexing of the draw rolls. A loop size sensing switch controls the initial size of the loop when starting up the machine. In one form of the apparatus a flexible opaque shade rides inside the loop so that the photocell control can operate on transparent web material.

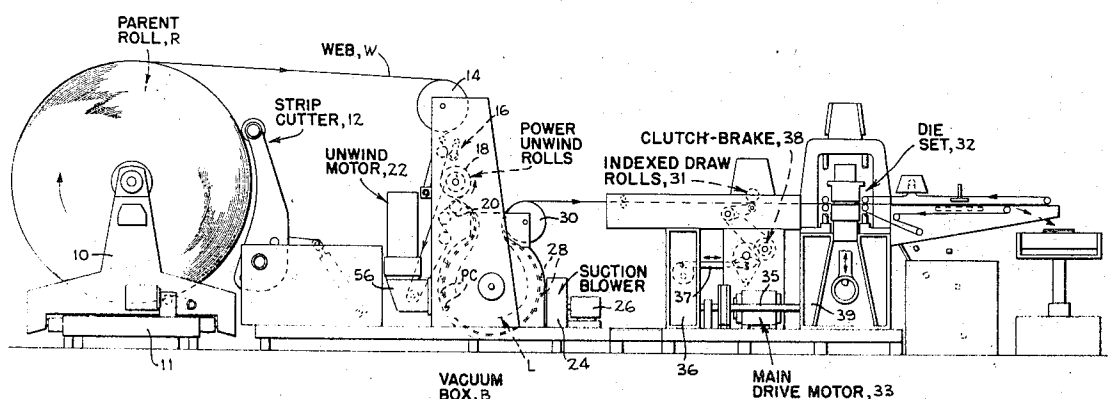
9 Claims, 6 Drawing Figures

FIG. 1

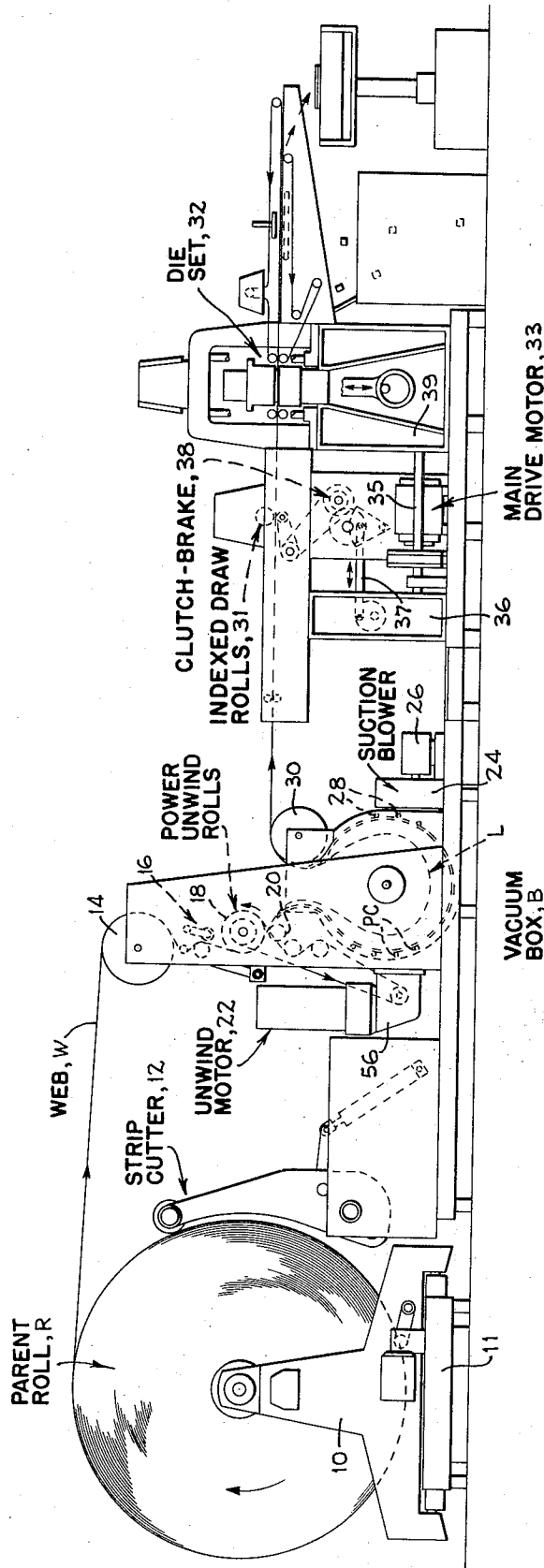


FIG. 2

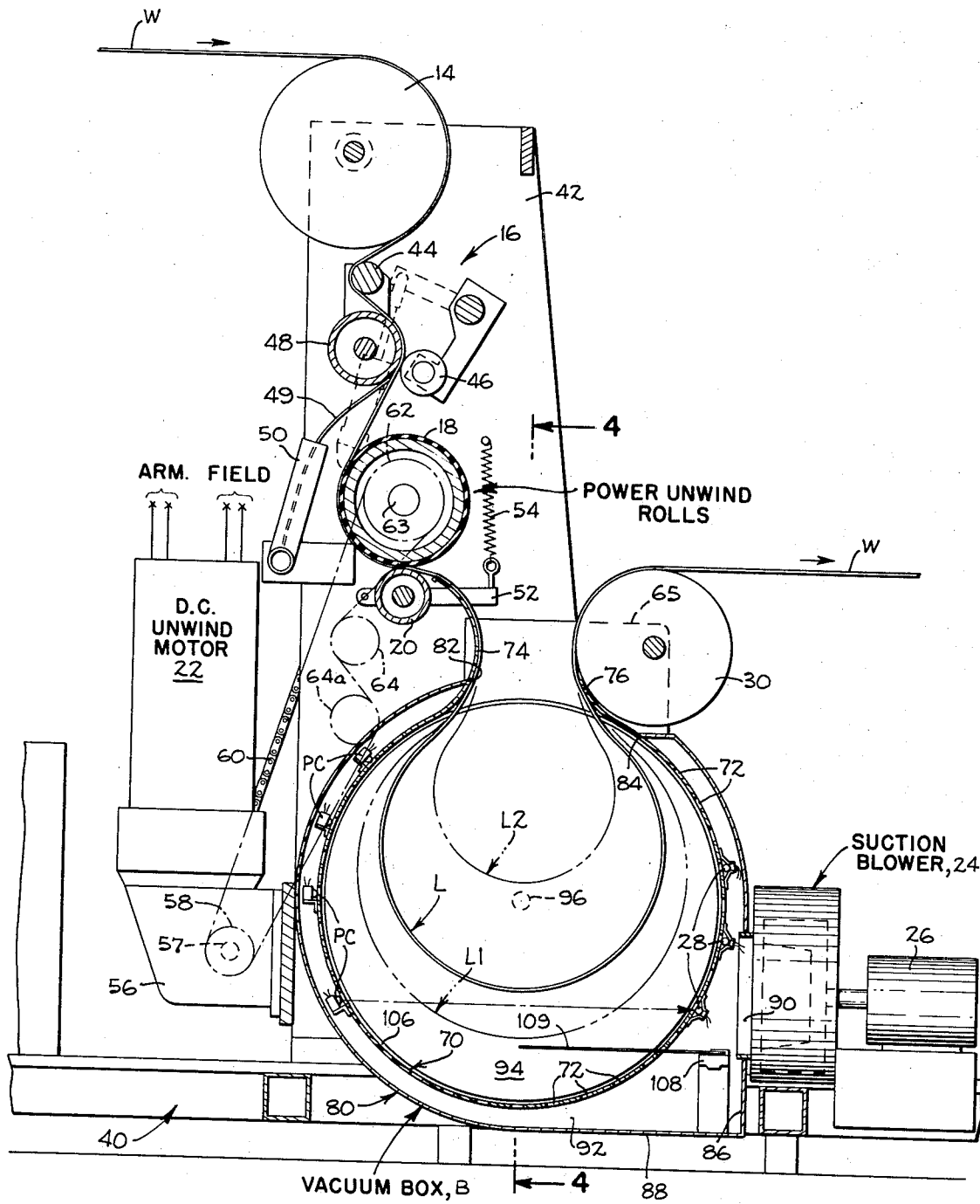


FIG. 3

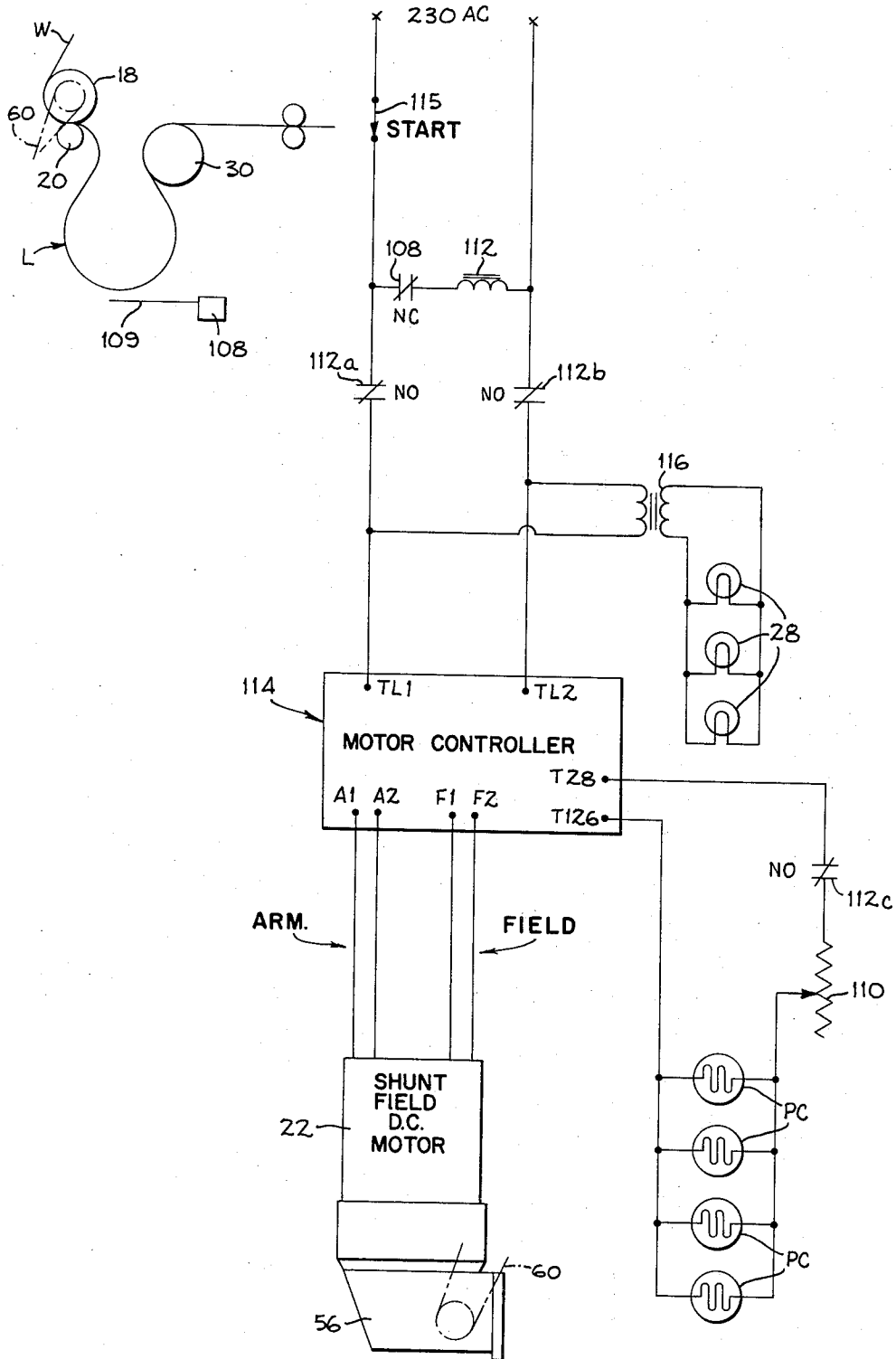


FIG. 4

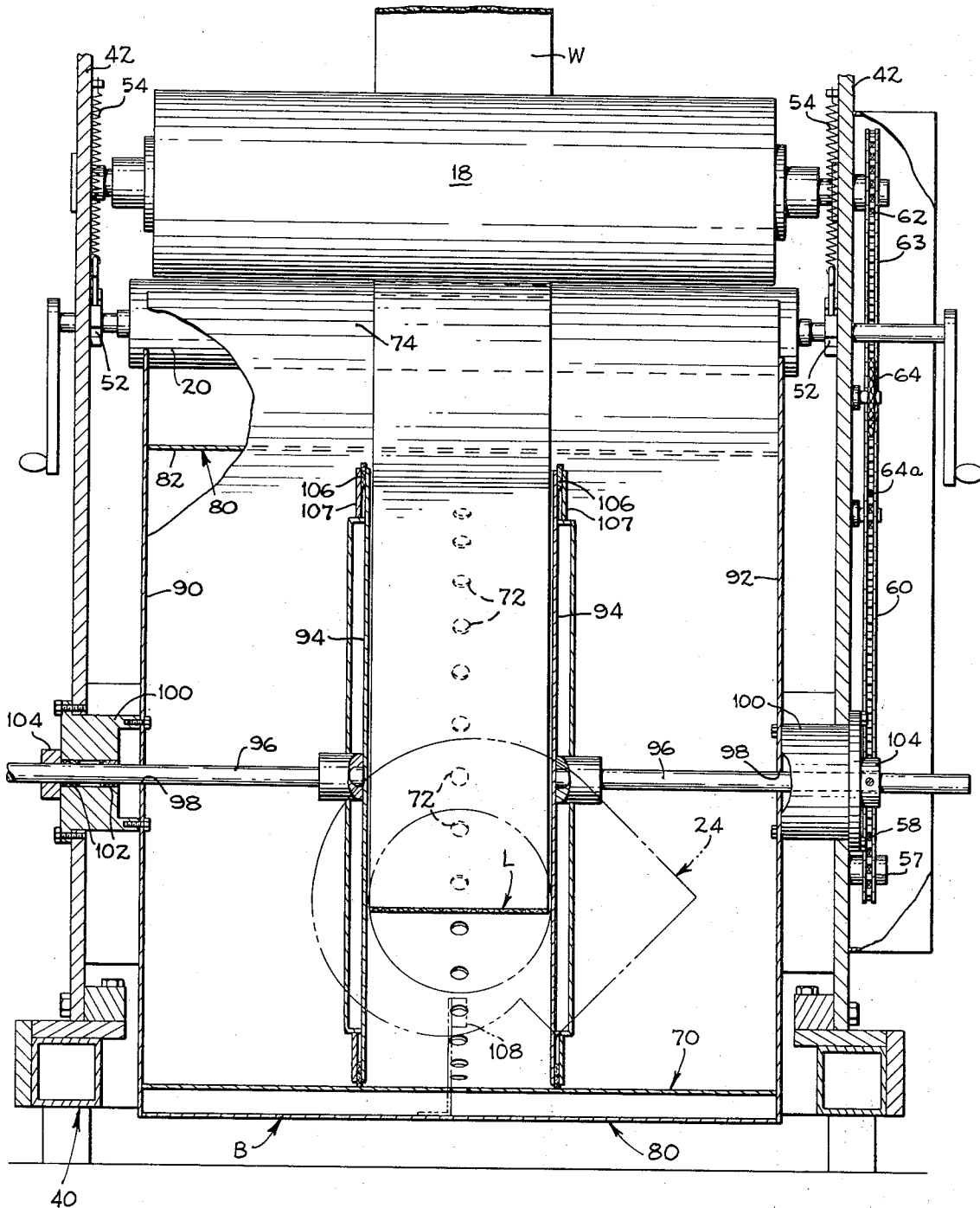


FIG. 6

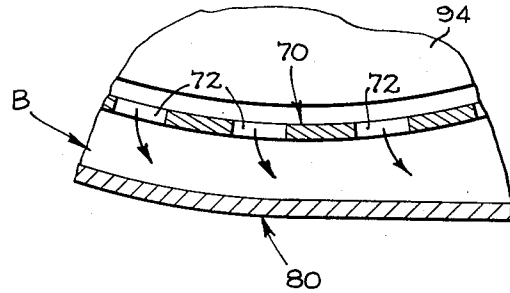
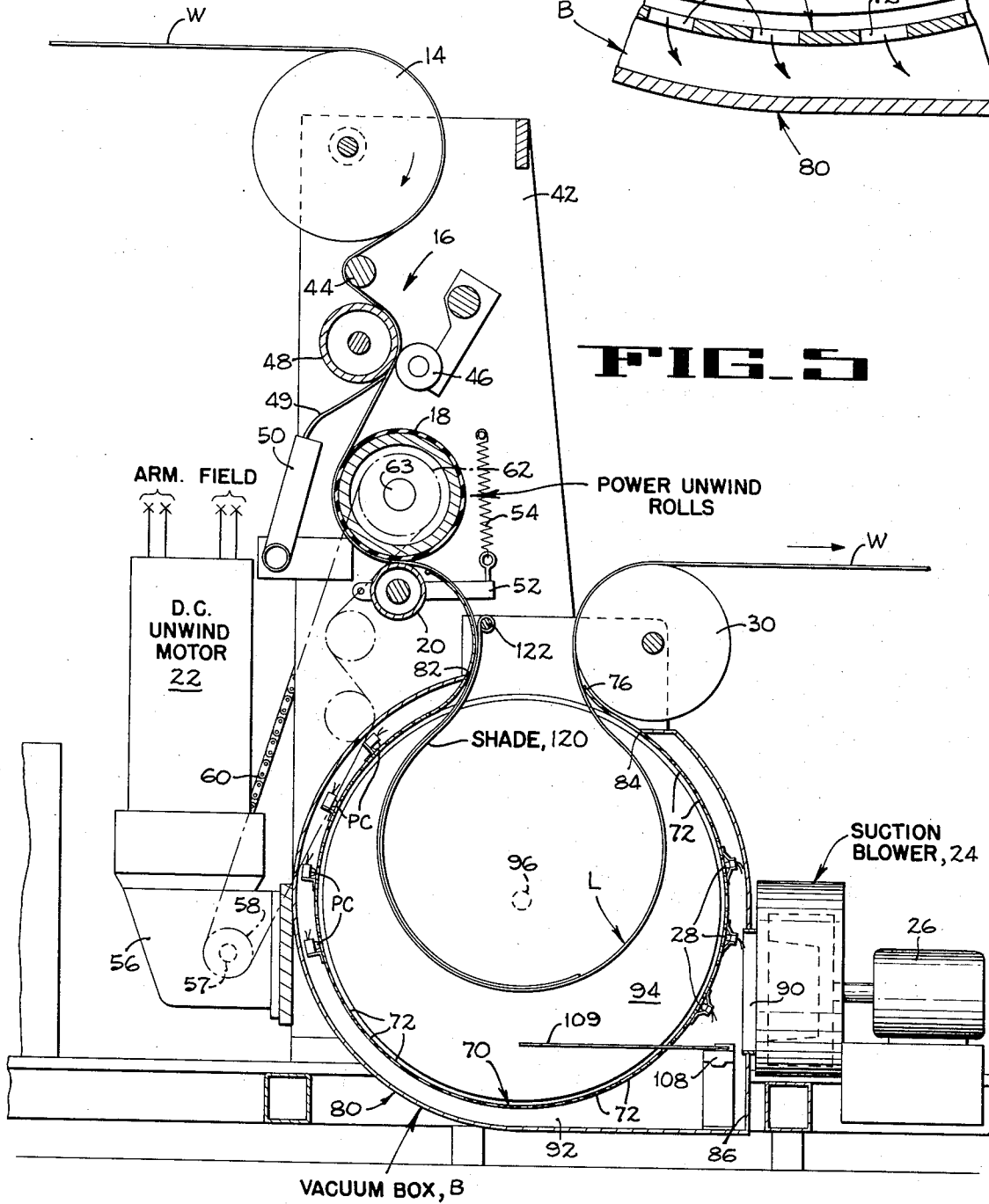


FIG. 5



WEB FEEDING APPARATUS FOR BLANK MAKING MACHINE

FIELD OF THE INVENTION

This invention relates to a machine for cutting blanks from an indexed continuous web and more particularly to a web feeding apparatus for such a machine involving a vacuum box loop device and photocell control for the web unwinding motor.

DESCRIPTION OF PRIOR ART

The use of a double loop, vacuum box with photocell loop control in a tape recorded feed is shown in the U. S. Pat. to Ferrier Jr. No. 3,563,492, Feb. 16, 1971. The signals from the photocells, the nature of which are not disclosed, are in effect, neutralized when the loops are at their mid positions.

The U.S. Pat. To Zarlang No. 3,240,411, March 15, 1966 shows a loop control system employing photo-voltaic "solar" cells in parallel and controlling a magnetic amplifier. This photo-voltaic system requires a compensating low impedance amplifier to correct for the shunting effect of the cells that are not strongly illuminated during operation of the system. Photo-resistance cells do not present this problem.

The U.S. Pat. to Klein No. 3,236,429, Feb. 22, 1966, employs a double loop control for a tape recorder using solar or photo-voltaic cells to provide a DC voltage when illuminated. These cells control logic circuits and two SCR firing circuits in double bridge circuits for operating the reel motors in conjunction with a motor speed sensing tachometer connected to each reel drive motor.

The U. S. Pat. to Thomas No. 3,129,719, Apr. 21, 1964, shows an acid scaling device for metal bands employing banks of photocells and lights for controlling the loop lengths. The nature of the photocells and of the control circuit is not specifically disclosed.

The U. S. Pat. to Best et al. No. 3,177,749, Apr. 13, 1965, discloses a loop formation device wherein strip steel is withdrawn from the loop at a constantly varying rate and the photocells that sense loop position control switches in the variable speed drive motor circuit.

The U. S. Pat. to Christian No. 3,721,376, Mar. 20, 1973, shows a strip feed system wherein a loop is formed and its length is determined by an elongated lamp and a single photocell behind a side angle lens.

Other and less pertinent patents that show loop control systems are the U. S. Pats. to Long No. 3,047,198, July 31, 1962 and Anderman Jr. U.S. Pat. No. 3,277,305, Oct. 4, 1966.

SUMMARY OF THE INVENTION

The work feeding apparatus of the present invention is employed in a machine for cutting blanks from a strip or web, which machine includes indexed draw rolls for intermittently withdrawing the web from a loop formed in a vacuum box. Photo-resistance photocell devices are spaced along one side of the vacuum box and lamps are disposed along the other side thereof for sensing the size or length of the loop. The photocells trigger a control device of the silicon controlled rectifier (SCR) type connected to a variable speed DC motor. A change in the signal from the photocell devices caused by a prolonged change in the length of the loop during operation of the blank machine triggers the motor con-

troller to change the speed of the motor and restore the length of the loop to a predetermined nominal value. However, under the present invention the inertia of the parent roll and of the unwinding roll drive means and other elements feeding the loop is great enough so that the unwind motor does not respond to the effects of intermittent web withdrawal by the indexed draw rolls downstream of the loop and just ahead of the blank forming dies. As mentioned, in order to avoid interaction among the photocell devices the photocells are of the photo-resistance type and are connected in parallel to the SCR type control.

In order to minimize the effectiveness of the vacuum blower for the vacuum box, adjustable side sealing plates confine the edges of the loop.

A loop size sensing device prevents the formation of an oversize loop when first threading the feed apparatus for start up.

In order to make it possible to control the loop when the web material is transparent or substantially transparent, a flexible shade is suspended from the upper portion of the vacuum box. This shade is substantially opaque to light and is disposed inside of the loop. The shade is formed of thin, flexible material for accommodating itself to the loop configuration and is long enough to always extend to at least the bottom of the loop. In this matter the aforesaid photocell control system can be employed for transparent web or strip materials.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic side elevation of a machine forming blanks from a continuous web of material and embodying the web feeding apparatus of the present invention.

FIG. 2 is an enlarged side view of the vacuum box and associated apparatus.

FIG. 3 is a schematic diagram of the control system.

FIG. 4 is a section taken on line 4-4 of FIG. 2.

FIG. 5 is a modified form of a vacuum box embodying the opaque shade for use for transparent material.

FIG. 6 is an enlarged fragmentary view of the lower portion of the vacuum box.

BRIEF DESCRIPTION OF THE BLANK FORMING MACHINE

The blank forming machine of FIG. 1, which embodies the web feeding apparatus of the present invention, has an unwind stand that mounts the parent roll of thin material, such as cardboard, paper, plastic or the like. A continuous web of material is cut from the parent roll by a strip cutter and is delivered to powered unwind rolls driven by a variable speed, DC unwind motor. A loop of material is formed and maintained in a vacuum box at a nominal length under the control of photoelectric cells and a control system to be described presently. The vacuum box also mounts a suction blower to maintain the vacuum therein and thus form the loop into a symmetrical configuration. The machine includes a set of indexed draw rolls which are intermittently rotated or oscillated by a main drive motor to intermittently feed predetermined lengths of the web to a reciprocating die set that includes knives which cut the web into blanks. The machine also includes trimming, scoring and creasing knives. Except for the vac-

uum box and other equipment associated with the web feed apparatus, the details of the blank making machine of FIG. 1 are not critical to the present invention. The machine may be of the type shown in copending application of Eggert et al., Ser. No. 149,302 filed June 2, 1971 and assigned to the FMC Corporation, which application is incorporated herein by reference for a more complete disclosure of various details of the blank making machine shown completely but diagrammatically in FIG. 1.

Referring more specifically to FIG. 1, the blank forming machine includes a laterally adjustable unwind stand 10 the shaft of which mounts a large parent roll R of thin cardboard, paper or plastic material. The unwind stand is laterally positionable on a track structure 11. A web or strip W of material is cut from the parent roll by a strip cutter 12 and fed through the machine. The roll R may have a diameter of 5 feet and a length of 42", and hence a full roll has a high rotational inertia. The web W passes over an idler roll 14 and through uncurling and edge trimming devices indicated generally at 16, the details of these not being critical to the present invention. The web is unwound from the parent roll by a pair of power driven unwind rolls 18, 20 driven by a DC, variable speed unwind motor 22. A loop L of the web material is formed in a vacuum box B to which is connected a suction fan or blower 24 driven by a motor 26 for maintaining a partial vacuum in the box and thus arranging the loop in a symmetrical form. In accordance with the present invention, a bank of photocells PC is disposed along one side of the vacuum box and illumination lamps 28 are disposed along the other side of the box.

After leaving the vacuum box, the web is trained around an idler roll 30 and is intermittently advanced by indexed draw rolls 31 which present the web to a vertically reciprocating die set 32, the web feed being interrupted sufficiently along for the dies to close and form the blanks. As described in the aforesaid Eggert application, a main drive motor 33 operates the draw rolls 31, the die set 32 and other points of the blank forming apparatus, most details of which are not critical to the invention and which need not be described in order that the invention be understood. Briefly, however, the motor 33 drives a jackshaft 35 which operates a gear box 36. The latter operates an oscillating mechanism 37 that indexes the draw rolls 31 through a clutch-brake 38, the clutch-brake being controlled by a cam operated switch (not shown) driven by the gear box 36. Thus when the clutch-brake 38 is on "clutch" the draw rolls are indexed through a cog belt and pulley drive whereas when the clutch-brake is on "brake" the draw rolls are held by the brake and the clutch is disengaged, which permits free retraction or oscillation of the mechanism 37. The jackshaft 35 also drives a gear box 39 through a clutch-brake (not shown) to cause reciprocation of the upper die of the die set 32. Control for starting and stopping operation of the draw rolls 31 and the die set 32 is separate and independent of the control for the web unwind motor 22.

As previously mentioned the aforesaid application of Eggert et al., Ser. No. 149,302 discloses a suitable strip cutter 12, the mechanism 36, 37 for operating the draw rolls 31 and the die set 32 from the main drive motor 33, the clutch-brakes and their controls, as well as details of other portions of the blank forming apparatus

which need not be described herein in order that the present invention be clearly understood.

VACUUM BOX ASSEMBLY

FIGS. 2 and 4 illustrate details of the preferred construction of the vacuum box assembly B and associated elements.

The assembly is mounted on a frame structure for the apparatus illustrated generally at 40, and includes two upstanding side plates 42, between which various rolls and the vacuum box are disposed. The direction changing roll 14, previously mentioned, is mounted at the upper portion of the side plates 42, as seen in FIG. 2. As is also seen in FIG. 2 the decurling and trimming knife units referred to generally at 16, include a decurling or straightening roller 44 and an edge trimming cutter 46 that cooperates with the back up roll 48 for trimming a narrow strip 49 from one edge of the web W, which strip discharges into a tube 50, it being understood that this trimming apparatus is not critical to the present invention. The upper power unwind roll 18, which is rubber covered, is also mounted between the side plates 42 as is the lower unwind pinch roller 20, this roller being spring urged against the upper roller 18 by two arms 52 pivoted to the side plates 42 and raised by springs 54, only one arm 52 appearing in FIG. 2.

The DC unwind motor 22, previously described, drives into a gear reduction box 56, the details of which are not critical to the present invention. The output shaft 57 of the gear reduction box 56 drives a small sprocket 58, a chain 60 and a sprocket 62 for the shaft 63 of the upper power unwind roll 18, all as seen in FIG. 2. The chain 60 passes over idlers 64, 64a, one of which may be adjustable in accordance with the conventional practice.

The direction changing roller 30, previously described, is mounted between brackets 65 associated with the side plates 42, it being recalled that the web W is intermittently withdrawn over the roller 30 from the loop L of web material by the indexed draw rolls 31 shown in FIG. 1.

The vacuum box is characterized, in its preferred embodiment, as a double wall, generally cylindrical box having inner and outer shells 70, 80 closed by fixed side plates and having a throat or opening at the upper portion thereof for receiving and paying out web material from the loop L. At least the inner wall or shell 70 of the vacuum box is cylindrical to nicely accommodate an expanded or ballooned loop L, which loop is shaped by drawing a vacuum through a row of apertures formed in the inner shell and disposed at the midportion or midplane of the vacuum box. In order to augment the vacuum action, opposed circular side sealing plates are slidably mounted to laterally confine the loop L and to seal against the inner shell, it being understood that the width of the loop L is usually considerably less than the axial length or width of the vacuum box B. The photocells PC and their illuminating lamps 28, previously described, are mounted on opposed walls of the inner shell of the vacuum box.

The details of the vacuum box will be described more specifically in connection with FIGS. 2 and 4. An entrance throat for the loop of web material is formed by extending the upper web receiving end of the inner shell 70 to form a curved guide 74 which terminates at the delivery side of the unwind rolls 18, 20. The other edge of the inner shell 70 terminates in a shorter lip 76

which delivers the web from the loop L smoothly to the direction changing roller 30, previously described.

The inner shell 70 of the vacuum box is surrounded by the outer shell 80, and in order to save space and reduce the clearance volume and outer shell 80 generally conforms to the inner shell 70, as seen in FIG. 2. The two upper ends or edges 82, 84 of the outer shell 80 are welded to the inner shell 70 adjacent the inlet and exit throat of the latter. In order to mount the suction blower 24 the outer shell 80 has a vertical wall 86 (FIG. 2) which merges with a lower, tangential wall 88 and the inlet duct 90 of the blower 24 fits snugly in an opening formed in the vertical wall 86 of the outer shell.

As seen in FIG. 4, in order to provide an air-tight chamber between the outer shell and the perforated inner shell 70, side plates 90, 92 are welded to the end edges of both shells and also enclose the space within the inner shell 70.

Mention has been made of side sealing plates within the inner shell 70 which loosely confine the loop L and maximize the effect of the vacuum drawn by the blower 24 in forming or arranging the loop L. The sealing plates just mentioned are of identical construction and hence are given identical reference characters 94. Each sealing plate 94 is supported, cantilever fashion, on a rod 96 which extends through opposed apertures 98 in the side plates 90, 92. Each of the rods 96 is slidably supported in a large bushing 100 bolted to the side plates 92 previously described. In order to exclude the entry of air around the rods 96, felt seals 102 are provided in each bushing 100 as seen at the left of FIG. 4. The differential pressure on the side sealing plates 94 caused by pulling a vacuum through the apertures 72 in the inner shell 70 by the suction blower 24 urges the plates 94 toward the midportion of the vacuum box. Thus the sealing plates 94 must be firmly positioned in their adjusted relation to the loop L, and this is accomplished by means of collar 104 on each of the rods 96 which collars can be secured to the rods by set screws or the like at the adjusted positions of the plates 94.

In order to further improve the efficiency of the suction action of the blower 24 on the loop L, each of the side sealing plates 94 mounts a peripheral felt washer 106 which is mounted or clamped on the plate 94 by an annulus 107, the details of the clamp structure not being critical to the present invention. The felt washers 106 make sliding, sealing engagement with the inner wall of the inner shell 70 which augments the ballooning action of the differential pressure of the loop L, which pressure is the difference between sub-atmospheric pressure on the outside of the loop, caused by the suction blower 24, and the atmospheric pressure on the inside of the loop. This causes the loop to assume a generally smooth, circular configuration as shown, for example, in FIG. 2.

In accordance with the present invention the speed of the DC unwind motor 22 is controlled by the photocells PC under illumination of the lamps 28 (FIG. 2) previously described. In the present embodiment, there are four photocells PC mounted behind apertures formed in the inner shell 70. Of course, access plates (not shown) can be provided on the outer shell 80 at the photocells to facilitate wiring, mounting and replacement, this being a mere mechanical detail not critical to the present invention.

It has been found that three of the lamps 28 which are also mounted behind apertures formed in the inner

shell 70 are adequate with the size apparatus under description. The lamps 28 are normally 12 volt lamps rated at 0.15 amperes. The manner in which the photocell-lamp assembly just described controls the DC unwind motor 22 will be described presently.

LOOP SWITCH

In order to insure that a full loop is in the vacuum box B before the draw rolls 31 and the die set 32 are started up to withdraw web and make blanks, a mechanically actuated loop switch 108 is provided. In the illustrated embodiment, this is a normally closed switch that is opened by depression of a blade 109 that projects into the vacuum box B through an opening in the inner shell 70. During normal blank making operation with a loop L present in the vacuum box, the loop control system controls the speed of the unwind motor 22 so that the loop does not engage the blade 109 and the switch 108 remains closed, which places control of the unwind motor 22 under the automatic photocell and controller system.

The loop switch 108 functions primarily when first threading and starting up the web feed apparatus, and before the draw rolls and die set are started up. When the web W is first threaded through the unwind rolls 18, 20, down into the vacuum box B and out over the roll 30, the loop L will ordinarily be too short to reach the switch blade 109. When the unwind motor 22 is turned on, since the loop is short, the photocell control mechanism will cause web feeding by the unwind motor 22 to increase the length of the loop. However, even when the loop reaches the position shown at L1 in FIG. 2, thereby eclipsing the lowermost photocell PC, the nature of the motor controller employed is such that the unwind motor 22 is not brought to a dead stop. Thus the unwind motor continues to "creep" slowly, and hence will feed and enlarge the loop until it engages the blade 109 and opens the switch 108. This turns off all power to the motor controller and hence to the unwind motor 22, and no more web material will be fed into the vacuum box B until the draw rolls 31 (FIG. 1) and the die set 32 are started up. The first indexing of the draw rolls withdraws enough of the material from the vacuum box so that the loop L clears the switch blade 109, which reopens the switch 108 and restores control of the unwind motor to the photocell circuit. Of course, during blank machine operation the average rate of web withdrawal by the draw rolls greatly exceeds the "creep" speed of the unwind motor when all photocells in the control system are eclipsed, so that loop control is provided by the photocell system.

LOOP CONTROL CIRCUIT

The control circuit employed in the present invention for maintaining the loop at its normal length during normal operation of the machine is illustrated diagrammatically in FIG. 3. Each of the photocells PC is of the photoresistance type (also referred to in the art as the photoconductive type) in that the resistance (the inverse of the conductance) of the light sensitive material in the cell changes as the intensity of the light impinging upon the material changes. In the embodiment of the invention being described, the resistance of the photocells is at a maximum when they are dark and decreases as they are illuminated or stated differently, the conductance of the photocells is at a minimum when they are dark, and increases when they are illuminated.

The cells employed in the embodiment being described are Clairex cells of the CL-5M series and specifically are type CL-5M4L. These cells are manufactured by Clairex Electronics, a division of Clairex Corporation at 560 South Third Avenue, Mt. Vernon, N.Y., and they are described in data sheets 104/ITO8-70 issued by the aforesaid supplier.

These cells include Type 4CdSe sensitive material and have a resistance at two foot candle illumination of about 0.25K ohms and a minimum dark resistance in the order of 167K ohms.

As seen in FIG. 3, the four photocells PC are wired in parallel across lines leading to terminals T 126 and T 28 of a motor controller 114. This controller operates on small variations of an internally supplied DC voltage caused by changes in the effective resistance of the bank of photocells, thus providing signal voltages that are a function of the combined resistance of all photocells PC, illuminated or dark.

The controller 114 is of the type wherein these signal voltages are applied to internal operational amplifiers which in turn operate solid state trigger transistors which gate solid state power devices of the silicon controlled rectifier (SCR) type. These, in turn, control the current directed to the armature of the DC motor 22 by outputs from controller terminals A1, A2 on the motor controller.

In the embodiment being described the motor 22 is of the shunt field type and its field terminals are connected to the terminals F1, F2 of the controller for providing a feedback type speed control.

The motor controller 114 is powered from a 230 volt AC line through remote control relay contacts 112a, 112b entering terminals TL1, TL2 of the controller. The basic or nominal speed level of the unwind motor 22 is adjusted by rheostat 110, which corresponds to and replaces a speed control potentiometer supplied with the controller. The line leading to the terminal T 28 of the controller and including the rheostat 110 also includes a set of remote control relay contacts 112c for turning the unit on and off in a conventional manner. The lamps 28 are fed from the power line through a transformer 116 which reduces the voltage to the nominal lamp rating of the twelve volts AC.

It is not necessary to describe the circuitry of the motor controller 114 in detail, inasmuch as devices of this general nature are available to the trade. The device described above is a "MinPak V*S Drive" for 3 Hp motor. These devices are supplied by the Reliance Electric Company, 24701 Euclid Avenue, Cleveland, Ohio 44117. The circuit for the device under description is found in the MinPak Instruction Manual D-3696-2 published Nov. 1972 by Reliance Electric and appears on page 11 of that publication. It is to be understood that under the broader aspects of the invention, a permanent magnet type DC motor could be employed in place of the shunt field DC motor which is illustrated in the circuit diagram of FIG. 3.

OPERATION OF THE LOOP CONTROL CIRCUIT

It will be assumed that the normal length of the loop L is that shown in solid lines in FIG. 2, which length can be set by adjusting the rheostat 110 shown in FIG. 3. Under these conditions, the lower photocell PC is directly illuminated by a lamp 28 and the rest of the photocells are eclipsed by the loop. The unwind motor 22

will now run at its predetermined or "standard" speed.

With circuit and controller just described, if the average rate of web withdrawal by the indexed draw rolls 31 (FIG. 1) is less than the preset speed of the unwind motor 22 (FIG. 2) the loop L will slowly "grow" or increase in length until at position L1, direct illumination of all photocells PC by the lamps 28 is at a minimum, the photocells are relatively "dark," their net resistance is at a maximum, and the proportion of the internal DC control voltages applied to the internal amplifiers in the controller 114 is at a minimum. This causes the unwind motor to run at a reduced speed from that determined by the setting of the rheostat 110, until the loop length is restored to position L. The rate of operation of the unwind roll 18 by the unwind motor should now match the rate of loop withdrawal by the draw rolls 31.

If the loop becomes short enough for more of the photocells to be directly illuminated by a lamp, as at position L2, a second photocell PC is directly illuminated, thereby decreasing the net resistance of the bank of parallel wired cells. This decreases the net resistance of the photocell bank, which increases the speed of the unwind motor sufficiently to restore the loop to its normal L position of FIG. 2, thereby permitting the unwind motor to "catch up" with the increased rate of web withdrawal by the draw rolls 31 which caused this loop condition.

It will be noted that the above description of how the loop control system matches (in effect) the speed of the unwind motor 22 with the average rate of web withdrawal by the draw rolls 31 has ignored the fact that in reality, the loop L is being momentarily shortened at a rate that corresponds to the formation of about 60 - 215 blanks per minute by the blank machine. This is explained by the fact that the frequency of web withdrawal by the indexed draw rolls 31 is much higher than the response frequency of the over all web feed apparatus. In other words, although the controller 114 may apply an instantaneous speed up signal to the unwind motor 22 with each indexing of the draw rolls 31, the inertia of the motor 22, that of the associated gearing 56 and that of the parent roll of material R is great enough to inhibit instantaneous response of the web unwinding system to the rapid, cyclical loop shortening produced by the indexed draw rolls 31. Thus, although the web feed and loop control system is precisely sensitive to a prolonged mismatch between the effective speed of the unwind motor 22 and the average rate of web withdrawal from the loop by the draw roll, it is not responsive to the above mentioned rapid cyclical decreases in loop length. Stated differently, when operating at its normal or set conditions, over a given period of time the unwind motor 22 and the unwind rolls 18, 20 will supply exactly the amount of web material to the loop L that is withdrawn by a corresponding number of indexing cycles of the draw rolls 31, and any effective variations in the speed of the unwind motor will only be those required to correct prolonged differences between the rate of unwind and the average rate of web withdrawal by the draw rolls.

LOOP SWITCH CIRCUIT

As previously mentioned, the blade operated switch 108 is disposed near the bottom of the vacuum box for providing an auxiliary control, assuring that a full loop

will be fed into the box before the blank machine proper is started up and without providing initial over feeding, folding up, creasing, etc. of the loop itself. This blade switch arrangement also makes it unnecessary to provide windows of other means for observing the condition of the loop inside the vacuum box when first threading or starting up the machine. It also insures that an oversized loop will not be developed. Of course, the photocell circuit and the motor controller of 114 previously described maintain a nominal sized loop in the vacuum box during normal operation of the draw rolls and die set of the machine.

The circuit for the blade actuated switch 108 also appears in FIG. 3. In the embodiment of the invention being described this is a normally closed switch across the 230 volt line in series with a relay coil 112 which operates the normally open contacts 112a, 112b in the power line to the controller as well as the normally open contact 112c in one of the control lines from the photocells. A manually operated start-stop switch 115 is also positioned in the 230 volt power line ahead of all of the circuit elements of the web control system. The circuit conditions illustrated in FIG. 3 are those wherein the loop L clears the blade 109 of the switch 108 and since the switch 108, in the present embodiment, is a normally closed switch, the relay coil 112 will then be energized. This means that the normally open contacts 112a, 112b and 112c are all closed and hence the unwind motor 22 is under control of the photocell, lamp and controller system.

As previously mentioned, when initially threading the web material through the machine and into the vacuum box to form the loop, the loop will be short and the regular automatic control system with the contacts 112a, b and c closed as illustrated in FIG. 3, will energize the unwind motor 22 and cause development of a loop. As previously explained, since there is a small "creep" of the unwind motor 22 under control of an SCR type control 114 previously described, even when all of the photocells PC become eclipsed by the loop, the unwind motor is not completely deenergized, but slowly continues to feed material into the vacuum box and hence enlarge the loop, so long as no web material is being withdrawn from the loop by the indexed draw rolls 31. Thus, even though the photocells PC are all eclipsed, the loop will gradually enlarge due to the aforesaid creep of the unwind motor, until the loop engages the switch blade 109 thereby opening the normally closed loop sensing switch 108. This deenergizes the coil of relay 112 (which was holding controls 112a, 112b and 112c closed) and thereby permits the normally open contacts 112a, 112b and 112c to open. Opening of the contacts 112a and 112b shuts off all power to the motor controller and hence brings the unwind motor 22 from its slow or "creep" operation to a dead stop. The loop, which is fully developed but is not developed enough to cause creeping and folding, is now ready for withdrawal of web material upon subsequent starting up of the blank forming machine elements, including the operation of the indexed draw rolls 31. Upon the first indexing of the draw rolls 31, enough web material is withdrawn from the vacuum box to shorten the loop L sufficiently to clear the switch blade 109. This recloses the switch 108, re-energizes the relay 112 and recloses the contacts 112a, 112b and 112c. The automatic control system is now energized for automatic operation, which condition is shown in the diagram of FIG. 3.

TRANSPARENT MATERIAL CONTROL

FIG. 5 is a view like FIG. 2 showing a modified form of the invention employed for controlling the loop length when the web W is formed of a transparent material such as a plastic or the like. When the material of the web W is substantially transparent or even translucent to a certain degree, the loop control system embodying the lamps 28 and the photocells PC is rendered either inefficient, imprecise or ineffective. In order to correct this condition, an opaque shade 120 of thin flexible material is suspended inside of the loop L. The shade is secured to and suspended from a rod 122 which extends between the side brackets of the machine. However, the width of the shade 120 is considerably less than the complete axial extent of the vacuum box. The shade need only be wide enough the eclipse the photocells PC from the lamps 28 and hence can have a maximum width that is only somewhat less than the narrowest strip of web material W that is drawn through the vacuum box. The length of the shade 120 is adequate to reach the bottom of the loop and hence eclipse the lowermost photocell PC when the loop is enlarged enough to receive light reaching the lowermost photocell. The differential air pressure across the loop previously described, causes the shade 120 to substantially conform to the interior surface of the loop, and being formed of thin, flexible material the shade 120 does not interfere with the provision of a smooth, substantially symmetrical loop configuration.

In both modifications of the invention previously described, it is to be understood that the unwind stand 10 (FIG. 1) is, in accordance with conventional practice, moveable axially or laterally across the blank forming machine. Thus in operation, the unwind stand 10 is positioned relative to the remainder of the machine so that the web or strip W of material removed by the strip cutter 12 from the parent roll R is centered or at least substantially centered relative to the vacuum box B. Thus, the lamps 28 and the photocells PC are also axially centered along the inner shell 70 of the vacuum box which means that they will, in effect, be substantially aligned with the row of vacuum aperture 72 (FIG. 4) formed in the inner shell. With this construction, the loop L, shaded or unshaded will always be interposed between the lamps and the photocells.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

What is claimed is:

1. Web feeding apparatus of the type comprising an unwind reel, roll means for unwinding the web from said reel, variable speed D.C. motor means for continuously driving said roll means, a vacuum box connected to a vacuum source for accommodating a take-up loop in said web, web feed means for withdrawing the web from said vacuum box, a bank of photocell devices spaced along one side of said vacuum box and lamps along the other side for sensing the size of said loop, and automatic control means connected to said photocell devices and to said variable speed motor means for maintaining the length of said loop at substantially a predetermined value; the improvement wherein said feeding apparatus is employed in a machine for cutting blanks from the web and the blank machine includes

indexed draw rolls for intermittently withdrawing the web from said vacuum box, said control means comprising a silicon controlled rectifier type D.C. motor controller that is triggered in accordance with the total illumination of said bank of photocell devices, a change in the signal from said bank of photocell devices caused by a prolonged change in the length of said loop triggering said motor controller to change the speed of said motor means and restore the length of the loop to said predetermined value, the inertia of said unwinding roll drive means being such that said motor means does not substantially respond to the effects of intermittent web withdrawal.

2. The web feeding apparatus of claim 1, wherein said photocell devices are of the photoresistance type and are connected in parallel.

3. The web feeding apparatus of claim 1, wherein the dark resistance of each of said photocell devices exceeds its resistance when illuminated by a lamp.

4. Web feeding apparatus of the type comprising an unwind reel, roll means for unwinding the web from said reel, variable speed motor means for driving said roll means, a vacuum box connected to a vacuum source for accommodating a take up loop in said web, intermittent web feed means for withdrawing the web from said vacuum box, a bank of photocell devices spaced along one side of said vacuum bank and lamps along the other side for sensing the size of said loop, and automatic control means connected to said photocell devices and to said variable speed motor means for maintaining the length of said loop at substantially a predetermined value; the improvement for use when the web is substantially transparent to light comprising a substantially opaque shade disposed within said loop, said shade being formed of thin, flexible material for accommodating itself to the loop configuration, and means for suspending said shade within said loop from an upper portion of said vacuum box.

5. Web feeding apparatus of the type comprising an unwind reel, roll means for unwinding the web from said reel, variable speed motor means for driving said roll means, a vacuum box connected to a vacuum source for accommodating a take up loop in said web, web feed means for withdrawing the web from said vacuum box, photocell means spaced along one side of said vacuum box and lamp means along the other side for sensing the size of said loop, and automatic control means connected to said photocell means and to said variable speed motor for maintaining the length of said

loop at substantially a predetermined value; the improvement wherein said vacuum box comprises an outer shell, a tubular inner shell having an upper loop receiving throat, side plates joining said shells, axially adjustable, loop confining sealing plates slidably mounted within said inner shell, a row of apertures formed substantially at the mid portion of said inner shell, and a vacuum blower connection to substantially a mid portion of said outer shell.

6. The apparatus of claim 5, wherein said inner shell is substantially cylindrical, said sealing plates are generally circular, and peripheral sealing means on said sealing plates engaging said inner shell.

7. The apparatus of claim 6, comprising a central rod projecting laterally outwardly from each sealing plate and through an aperture in the associated vacuum box side plate for facilitating lateral adjustment of the sealing plates to confine the loop of material.

8. Web feeding apparatus of the type comprising an unwind reel, roll means for unwinding the web from said reel, variable speed motor means for driving said roll means, a vacuum box connected to a vacuum source for accommodating a take up loop in said web, intermittent web feed means for withdrawing the web from said vacuum box, a bank of photocell devices spaced along one side of said vacuum box and lamps along the other side for sensing the size of said loop, and automatic control means connected to said photocell devices and to said variable speed motor means for maintaining the length of said loop at substantially a predetermined value; the improvement comprising loop sensing means for detecting a loop size larger than that which eclipses all of the photocells, and auxiliary control means connected to said loop sensing means for deenergizing said motor when said large size loop is detected, said auxiliary control means restoring control of said motor to said automatic control means upon withdrawal of a length of web from said vacuum box by said intermittent web feed means.

9. The apparatus of claim 8, wherein said auxiliary control means comprises a switch for causing deenergization of said motor and said loop size sensing means comprises an actuator for said switch projecting into the vacuum box, actuation of said switch actuator by a large size loop operating said switch to deenergizing said motor until the loop is withdrawn from said actuator by the intermittent web feed means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,807,612
DATED : April 30, 1974
INVENTOR(S) : RALPH H. EGGERT

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

- Column 1, line 14, "recorded" should be --recorder--.
- Column 1, line 19, "To" should be --to--.
- Column 1, line 48, "side" should be --wide--.
- Column 2, line 13, "minimize" should be --maximize--.
- Column 3, line 42, "points" should be --portions--.
- Column 4, line 9, "illustratd" should be --illustrated--.
- Column 5, line 11, "all" should be --wall--.
- Column 7, line 45, delete "the".
- Column 8, line 51, "average" should be underlined.
- Column 9, line 31, "mentiond" should be --mentioned--.
- Column 9, line 57, "creeping" should be --creasing--.
- Column 10, line 17, "the" (second occurrence) should be --to--.
- Column 11, line 27, "bank" should be --box--.
- Column 11, line 49, after "motor" add --means--.
- Column 12, line 46, "deenergizing" should be --deenergize

Signed and Sealed this

eighteenth Day of November 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks