Dec. 28, 1965 C. V. ALLEN 3,226,279

BUTT SPLICER CONTROL

Filed Dec. 14, 1962 2 Sheets-Sheet 1

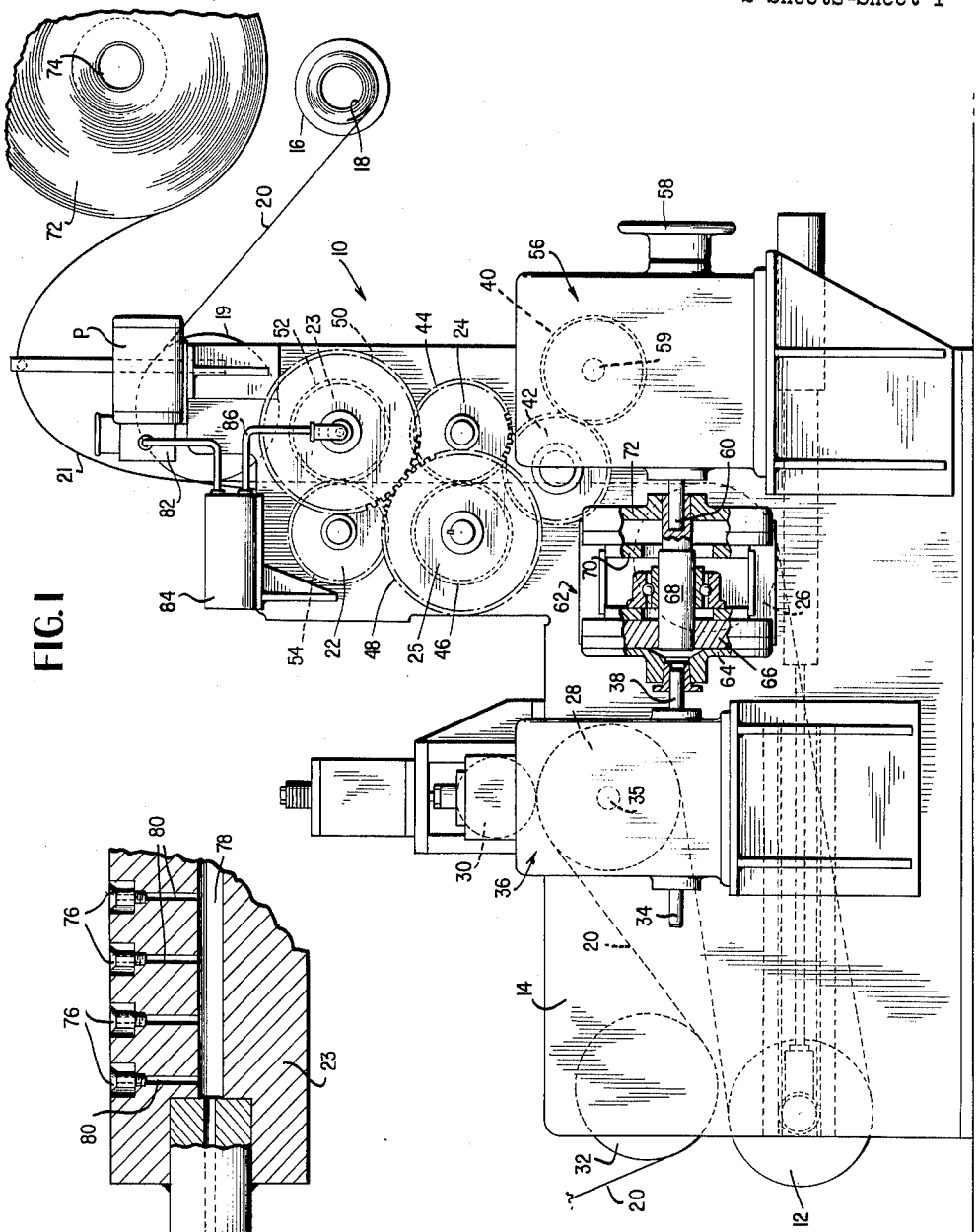


FIG. 1

FIG. 2

INVENTOR.
CLAUDE V. ALLEN

BY

ATTORNEYS.

Dec. 28, 1965 C. V. ALLEN 3,226,279

BUTT SPLICER CONTROL

Filed Dec. 14, 1962 2 Sheets-Sheet 2

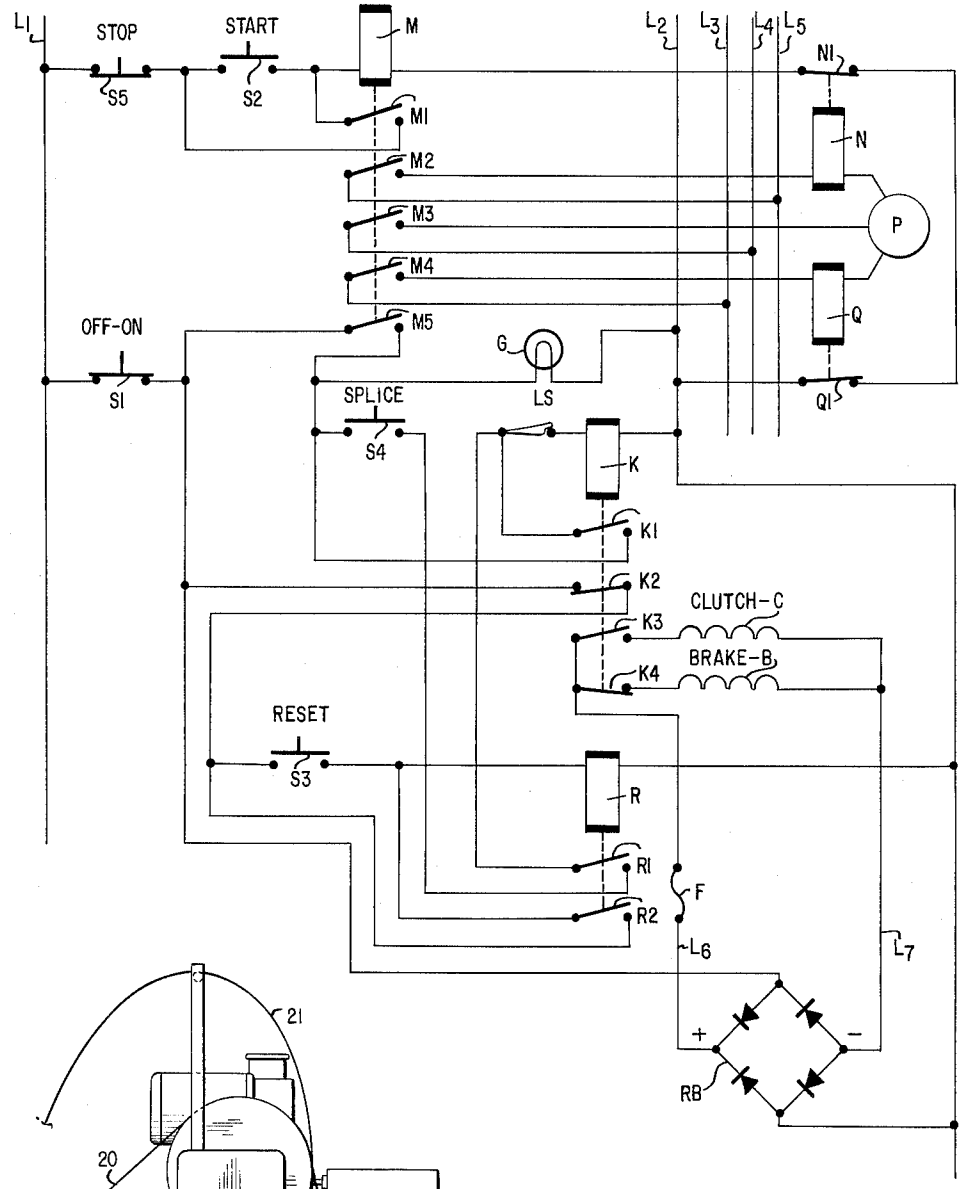


FIG. 4

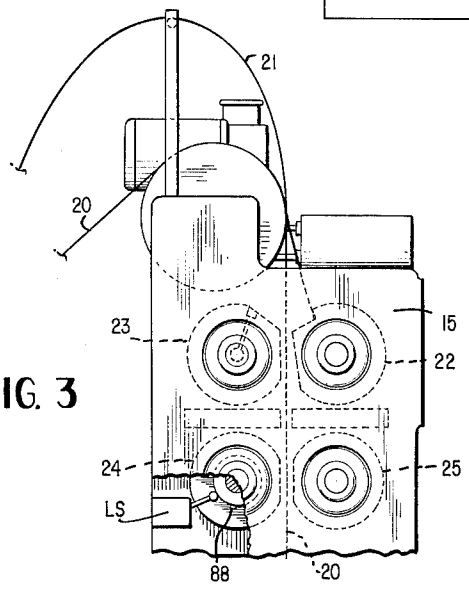


FIG. 3

INVENTOR.
CLAUDE V. ALLEN

BY Merriam & Smiley
ATTORNEYS.

United States Patent Office

3,226,279

Patented Dec. 28, 1965

3,226,279

BUTT SPLICER CONTROL

Claude V. Allen, Newburgh, N.Y., assignor to The Inta-Roto Machine Company, Inc., Richmond, Va., a corporation of Virginia

Filed Dec. 14, 1962, Ser. No. 244,671

8 Claims. (Cl. 156—505)

This invention relates to new and useful improvements in web feeding machines, and more particularly to improvements in the electrical control for machines which automatically butt splice the lead end of a fresh roll to the trailing end of an exhausted roll of paperboard.

In the production of paperboard containers such as milk and other food cartons, a web is withdrawn from a supply roll and fed into printing, punching and other operation performing machines to fabricate the individual container blanks in printed and cut out form. Machines for performing these functions operate at a web speed of approximately 300 feet per minute.

Butt splicers are in existence which perform the splice automatically without stopping the machine or the flow of the web, cutting the old roll and splicing the lead end of the new roll in butt fashion to the cut end of the web without reducing the speed of the machine. One example of such machine is fully described in Patent No. 2,706,515 granted to A. J. Evers on April 19, 1955. The patented machine employs a pair of draw rolls and a supply roll for drawing the web from the supply roll and advancing the web toward in line machine for further operations. Between the supply roll and the draw rolls are a pair of cutting rolls and a pair of tape applying rolls, both pairs normally being stationary but being driven in unison when the splice is being made. While the cutting and taping rolls are stationary, the web passes between flats on the pairs of said rolls. When the splice is being made, the cutting and taping rolls are each rotated one revolution only. The cutting rolls sever the old web, retaining the severed portion by suction, drive the new web forward with the edge abutting the line of severance on the old web to the taping rolls which apply adhesive tape to both sides of the web adjacent the line of severance.

In the Evers patented structure and similar conventional machines, rather light paperboard is worked and the cutting and taping rolls are started with a manually operated mechanical clutch and stopped also mechanically by pins which fall into locking recesses upon reclutching of the rolls. Obviously with such a structure the relatively heavy cutting and taping rolls provide a severe shock to the mechanism both in starting from a dead stand-still to obtain a rapid rate of travel necessary to maintain the web moving at 300 feet per minute and in suddenly stopping when the splice is made in one revolution of the cutting and taping rolls. Any excessive turning of the cutting rolls beyond one revolution will sever the spliced web a second time and since there is no more tape on the taping rolls, the web separates and it is necessary to stop the machine. The mechanical drive described is inadequate for larger machines feeding heavier and wider paperboard web.

In such conventional machines as use an electrically controlled drive for the cutting and taping rolls, the controls are such that the operator in the excitement of making the splice may hold the splice switch engaged too long causing a second and involuntary severing of the web.

When a splice is initiated before vacuum is applied to the cutting rolls, the cut portion of the old web is not retained, but is fed forward along with the new web and snarls to such an extent that it may be necessary to stop the machine.

It is a primary object of the present invention to provide an improved control for butt splicers which will obviate the above recited disadvantages of conventional machines.

Another important object of the invention is to provide an improved control for butt splicers which is foolproof in operation and ensures against cutting the web more than once to unintentionally make more than one splice at a time.

A further object of the invention is to provide an electrical control for a butt splicer which will not start the splice operation until the appropriate cutting roll is connected to an operating vacuum pump so as to ensure that the cut tail of the web will adhere to the cutting roll and not proceed forward through the taping rolls and other parts of the machine.

Still another object of the invention is to provide an improved electrical control for a butt splicer wherein is provided a plurality of switches for operating the butt splicer to make a splice and which splice will not be made unless said switches are closed in a predetermined sequence.

Still another object of the invention is to provide an improved electrical control for a butt splicer of the above described characteristics in which said plurality of switches and the associated control circuit elements are so arranged that the holding closed of any of said switches for too long a period will not prevent the splice from being performed and will not induce the start of a second splice.

Yet another object of the invention is to provide an improved electrical control for a butt splicer which is simple, rugged and inexpensive to produce and operate.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, wherein like reference characters indicate like parts throughout the several figures and in which:

FIG. 1 is a side elevation of a butt splicer provided with improved electric controls according to the invention wherein parts are broken away to reveal internal sectional details;

FIG. 2 is a fragmentary sectional view taken through the axis of one of the cutting rolls;

FIG. 3 is a fragmentary side elevation looking in the opposite direction at the other side of FIG. 1; and

FIG. 4 is a schematic circuit diagram showing the electrical controls for the butt splicer.

Referring now more particularly to the drawings, there is shown in FIG. 1 a butt splicer machine **10**, of more or less conventional construction, to which has been added the improved electric controls of the present invention. The machine **10** comprises a frame having a pair

of side walls 14, 15 which support and mount the splicing apparatus. A paperboard supply roll is shown diagrammatically at 16 as having a core or spindle 18 from which the paper web 20 is constantly fed into and through the butt splicer at a high rate of speed, approximately 300 feet per minute.

The web 20 is passed over a guide roll 19 to and between a pair of normally stationary cutter rolls 22, 23, to and between a pair of normally stationary splicing rolls 24, 25, under an idler roll 26, under an accumulator roll 12 and between the draw rolls 28 and 30 to another idler roll 32. From thence the paper web may be fed over additional rolls such as dancer and shock rolls to further machines which process the paper by printing, punching or similar operations.

The structure, function and mode of operation of the accumulator roll 12 and its connected operating parts are fully set forth in the application for patent Serial No. 231,373 filed October 18, 1962 by Claude V. Allen. Since the accumulator roll and its operation form no part of the present invention, no further description of this element is considered to be necessary.

The draw rolls 28 and 30 which feed the web at high speed, are continuously driven by an electric motor, not shown, which is coupled to the input shaft 34 of a speed reduction device 36 whose output shaft 35 is coupled to the shaft draw roll 28. Any suitable conventional speed reduction gearing may be used, the device illustrated being a Winsmith type CB unit 10, with its input shaft extended through both ends, see 34 and 38, and having a speed reduction ratio of approximately 12½ to 1. The shaft 38 constantly rotates as long as the butt splicer is feeding web 20 through the machine.

The splicing rolls 22–25 are intermittently driven in unison when required to perform a splice by means of the gear train comprising meshing spur gears 40, 42, 44 and 46, the last two being fixed to the shafts of the taping rolls 24 and 25 respectively. The latter shaft also has fixed to it a larger gear 48 which meshes with gear 50 of the same size fixed to the shaft of the cutting roll 23. Two equal and meshing gears 52 and 54 are secured to the shafts of the cutting rolls 22 and 23. The described gear train drives the cutting and taping rolls at the same speed and for one rotation only each time a splice is to be made.

The following described apparatus is provided to couple the gear train to the input drive shaft 34. Gear 40 is coupled to the output shaft 59 of gear reduction device 56, which may be a Winsmith type CB unit 12 having a gear ratio of approximately 8¼ to 1, and a hand wheel 58 by means of which the ratio may be varied. The input shaft 60 of the device 56 is coupled to the shaft 38 of the reduction device 36 by an electromagnetic clutch and brake assembly 62. Any suitable conventional clutch and brake assembly may be utilized for this purpose, that illustrated being a Warner clutch and brake, type 1525 comprising the electromagnetically operated clutch plates 64, 66 respectively keyed to the shafts 38 and 68, and the fixed and rotatable brake plates 70 and 72 respectively, the latter being keyed to the shaft 60 of the gear reduction device 56.

The supply roll 16 is shown as having diminished to a point where virtually only the core 18 remains. A second, or new, supply roll 72 on core or spindle 74, has a paper web 21 diagrammatically shown in FIG. 3 with its leading end attached to the stationary cutter roll 22.

The detailed construction and mode of operation of the cutter rolls 22, 23 and the taping rolls 24, 25 are fully set forth in the patent granted to A. J. Evers, No. 2,706,515. These details will not be repeated in this application except in the following brief remarks to clarify the mode of operation. Referring to FIGS. 1, 2 and 3 particularly, it should be clear that clamp means are provided on roll 22 to hold the fresh end of the new web 21 until such time as a splice is required to be made. The rolls 22 and 23 are also provided with a knife and a cooperating anvil, turning of said rolls severing the old web 20 and the new web 21 along a line parallel to the axis of the rolls, the cut tag end of web 20 being retained by suction apertures 76, FIG. 2, each communicating by a the roll 23 is provided in its surface with a plurality of suction apertures 76, FIG. 2, each communicating by a channel 80 with an axial bore 78 of the roll. A motor driven vacuum pump P is mounted on the frame side 14 near the top of the machine and connected by a suction conduit 82 to a vacuum receptacle 84 which is in turn connected by suction conduit 86 to the axial passage 78 of the roll 23. Thus, when the vacuum pump is operated a continuous suction is applied to the surface of the roll 23. The cutter rolls as well as the taping rolls 24 and 25 are each provided with flats extending substantially vertically as shown in FIG. 3 and providing space between said flat surfaces for passage of the web 20 before the splice is made. Adhesive tape is positioned on rolls 24, 25 before a splice is made. Upon rotation of the rolls the tape is applied to both sides of the new and old webs adjacent the butt seam between them at the line of severance made by the cutting rolls 22, 23. Thus, as more fully explained in the Evers patent, a single rotation of the rolls 22–25 can be performed at any time it is necessary to splice a new web onto the old web without stopping the machine or slowing the passage of the web.

To restrict these rolls to one revolution during a splice, a limit switch LS is secured on the machine frame near one of the rolls, the actuating arm of the limit switch being shown adjacent the shaft of the taping roll 24, FIG. 3. A small protuberance 88 on the shaft engages the actuating arm and opens the limit switch once each revolution of the roll 24. At all other times, the protuberance 88 is not in contact with the switch arm and the switch is closed.

A plurality of push button switches on a panel, not shown, mounted on frame wall 15 are provided for use by an operator in starting a splice. The placement of such switches is optional and may be at a distance from the machine if so desired.

The improvements in and operation of the controls for the butt splicer will now be explained with particular reference to the circuit diagram of FIG. 4. At the top of the diagram appear power lines L1 and L2 which are preferably connected to a source of alternating current such as 115 volts, 60 cycles. Lines L3, L4 and L5 connect to a three phase power source. A start circuit is shown at the top of FIG. 4 connecting the Stop Switch S5, the Start Switch S2, relay M and normally closed contacts N1 and Q1, of the overload relays N and Q, in series across lines L1 and L2. When the Start Switch push button S2 is depressed, relay M will be energized to close all of the relay contacts M1–M5. The closing of contacts M1 establishes a hold circuit across switch S2 which retains relay M energized even though the switch S2 is released. The closing of contacts M2–M4 connects the vacuum pump P to the three phase power source represented by lines L3, L4 and L5 through the circuit breakers N and Q disposed in two of the power lines. As soon as the motor driven pump is energized, vacuum is established in the bore 78 and surface apertures 76 of the cutting roll 23 as previously described. The presence of this vacuum is essential to prevent the cut tag end of the old web from passing through the cutting and taping rolls when the splice is made. The closure of relay contacts M5 also energizes the lamp G which indicates to the operator that the vacuum has been established and that the machine is ready to start the splice. Closed contacts M5 also establish a connection from one side of the Splice Switch S4 to line L1 through the Off-On Switch S1 so that subsequent depression of the Splice Switch button will start the splicing operation.

The operator next pushes the Reset Switch button S3

which energizes the Reset Relay R in the Reset Circuit from line L1 through switch S1, normally closed relay contacts K2, the Reset Switch S3, and the winding of Relay R to line L2. Energization of relay R closes the contacts R2 establishing a hold circuit about the Reset Switch S3, and contacts R1 disposed in the Splice Circuit, to be described.

The operator then depresses the Splice Switch button S4 energizing relay K in the Splice Circuit from line L1 through switch S1, relay contacts M5, Splice Switch S4, relay contacts R1, limit switch LS, and the winding of relay K to line L2. Operation of relay K closes contacts K1 establishing a hold circuit around the Splice Switch S4 and relay contacts R1, and opens contacts K2 to the Reset Circuit, closes contacts K3 and opens contacts K4.

It will be noted that a rectifier bridge RB is provided having opposite diametrical terminals connected to lines L1 and L2 through the switch S1 so as to obtain a D.C. potential across the alternate pair of bridge terminals. The positive terminal is connected through line L6 and fuse F to the relay contacts K3 and K4, and the negative terminal is connected through line L7 to one end of each of the clutch and brake windings C and B, respectively. The other ends of these windings are connected to the relay contacts K3 and K4. Therefore, operation of Splice Relay K connects the clutch C through K3 and opens the circuit to the brake winding at contact K4. Energization of the clutch winding C operates clutch plates 64, 66 to couple the shafts 38 and 68 thus connecting input shaft 34 to the gear train 40, 42, 44, 46, 48, 50, 52 and 54 to turn the cutting and taping rolls.

The operation of Splice Relay K and opening of the contacts K2 in the Reset Circuit deenergizes the relay R and relay contacts R1 open in the Splice Circuit. However, this circuit is still held closed through the limit switch and contacts K1.

Just before the splicing rolls 22–25 have completed one revolution, the projection 88 on one side of the roll shafts actuates the limit switch LS momentarily to open the Splice Circuit and deenergize relay K. This opens the circuit to the clutch C at contacts K3 and closes the circuit to the electromagnetic brake B at contacts K4, stopping all of the rolls. The brake operates very quickly to stop the rolls substantially exactly at the end of one revolution so that the rolls are positioned as pictured in FIG. 3 to permit the spliced new web to pass between them until the next splice is made.

Having completed the splice, the operator will depress the Stop Switch button S5 opening the circuit to relay M which breaks the power connection to the vacuum pump P.

It is apparent from the above description of the circuits, FIG. 4, that the use of a Splice relay K and a Reset Relay R, each arranged with a set of contacts in the energizing circuit of the other provides an interlocking feature which prevents operation of the splicer rolls to perform a splice except when the Start Switch S2, the Reset Switch S3 and the Splice Switch S4 are depressed in that sequence. If these switches are closed in any other sequence the Splice Circuit will be open at M5 or R1 and the Splice Relay K cannot operate to energize the clutch to start revolving the splicing rolls. In addition, the utilization of a Start Switch S2, which must be depressed first, ensures that the vacuum pump is started and that the machine is in readiness to make the splice and hold the tag end of the web cut during the splice. Consequently, with the described electrical controls the operation of the machine to make a splice is foolproof, a splice not being able to be performed except when the machine is in readiness and when the appropriate switches are depressed in the proper sequence. It is further impossible by holding any one or several of the switch buttons depressed to accidentally perform two splices in sequence. That is to say, even holding the Splice Switch closed too long will not cause more than one revolution and one cutting of the web by the splicer rolls, because the limit switch opens the Splice Circuit and this cannot be reclosed until the Reset Relay operates to close contacts R1.

Although a certain specific embodiment of the invention has been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed is:

1. A machine for automatically butt splicing moving webs comprising a pair of draw rolls for continuously advancing a web, a pair of cutting rolls positioned ahead of said draw rolls for supporting the lead end of a new web for transversely severing an old web while simultaneously advancing the new web in butting relation to the line of severance, vacuum means for retaining the severed web portion against one of said cutting rolls and preventing its advancement, said vacuum means including a vacuum pump and conduits connecting said pump to said one of said pair of cutting rolls, a pair of taping rolls interposed between said draw rolls and cutting rolls for applying tape over the butt joint between said webs as said webs are being continuously advanced, means for driving said cutting and taping rolls in unison, said driving means including an electromagnetically operated clutch and brake, and an electric control circuit for said driving means, said control circuit including means for energizing said vacuum pump in series with a start switch, means for energizing said clutch and denergizing said brake in series with a splice switch, means for energizing said brake and deenergizing said clutch including a switch operated by one of said cutting and taping rolls, and interlocking means including a reset switch connected to said means for energizing the vacuum pump and clutch for actuating said cutting rolls only when said vacuum means is energized first and said start, splice and reset switches are closed in a predetermined sequence.

2. A machine according to claim 1 wherein said interlocking means includes a splice relay in series with said splice switch and a reset relay in series with said reset switch, each relay having switching contacts so disposed in the energizing circuit of the other that energizing of the splice relay opens the reset relay and energization of the reset relay closes the splice relay.

3. A machine according to claim 2 wherein said means for energizing said vacuum pump includes a start relay, said start relay having a switching contact so arranged in series with said splice switch and splice relay as to prevent energization of said splice relay to operate said clutch until vacuum has been applied to said cutting roll.

4. A machine according to claim 2 wherein a reset relay is provided in series with said reset switch, said reset relay having a switch contact so arranged in series with said splice switch and splice relay as to prevent operation of the splice relay unless the reset relay is energized.

5. A machine according to claim 2 wherein said switch operated by one of said cutting and taping rolls comprises a normally closed microswitch and means is provided on one of said cutting and taping rolls for momentarily opening said microswitch once during each revolution so as to sever an old web and tape the new web to the old web during one rotation of said one cutting and taping roll.

6. A machine according to claim 1 wherein said interlocking means comprises a plurality of relays having contacts arranged to open each other's energizing circuit so as to prevent unintentional operation of said cutting rolls to cut said web more than once during a splicing operation.

7. A machine according to claim 1 wherein is provided an input shaft continuously driven, a gear reduction

device coupling said input shaft to one of said draw rolls, said input being extended through said device, said means for driving said cutting and taping rolls including a second gear reduction device having an input shaft which is coupled to said extended shaft on the first device by said clutch and brake.

8. A machine according to claim 2 wherein said Splice Relay includes switching contacts connecting said clutch and brake alternately in series with a source of rectified power.

References Cited by the Examiner

UNITED STATES PATENTS

2,606,136	8/1952	Garrett et al.	156—505
2,706,515	4/1955	Evers	156—505
3,024,157	3/1962	Beerli	156—506
3,092,532	3/1963	Swick et al.	156—505

EARL M. BERGERT, *Primary Examiner.*

DOUGLAS J. DRUMMOND, *Examiner.*