United States Patent

[11] 3,634,170

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[54] **TAPE SPLICER**
8 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **156/504,** 156/502
[51] **Int. Cl.** **B65h19/18,** B65h 69/06
[50] **Field of Search** 156/502, 504, 505, 506, 507, 508

[56] **References Cited**
UNITED STATES PATENTS

2,613,042	10/1952	Dice, Jr.	156/504
2,745,464	5/1956	Auerbacher et al.	156/504
2,752,984	7/1956	Casey	156/504
2,752,985	7/1956	Aldrich	156/504
2,940,507	6/1960	Butler, Jr.	156/504
3,061,220	10/1962	Gagg et al.	156/504
3,089,661	5/1963	Phillips, Jr. et al.	156/504
3,467,334	9/1969	Chesnut et al.	156/504

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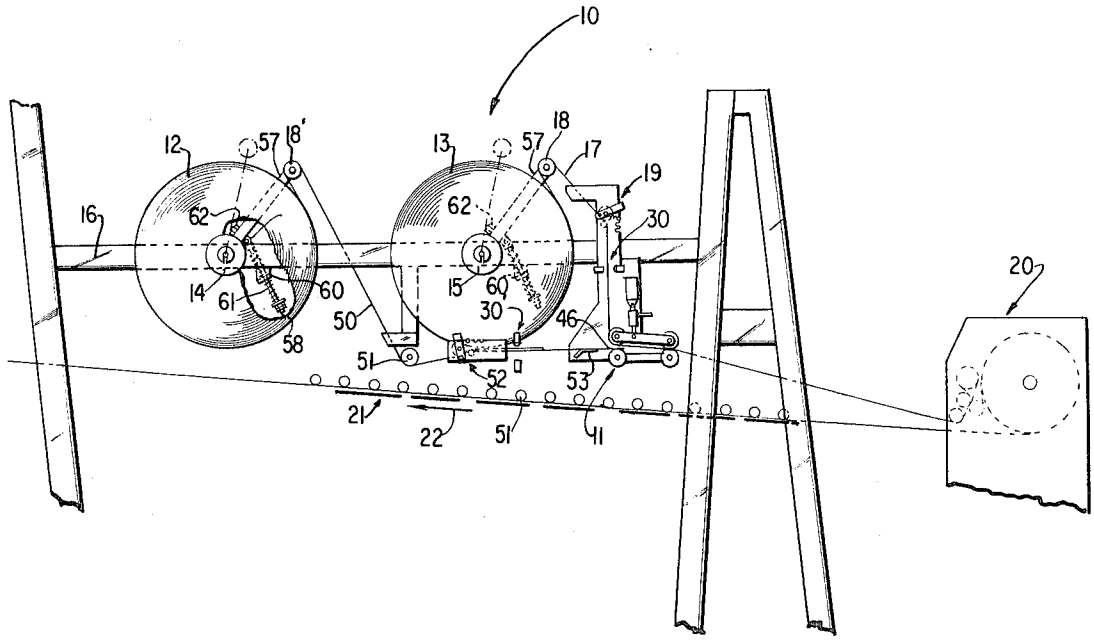
ABSTRACT: A tape-splicing apparatus is provided with a pair of tape supply rolls with the tape being advanced from one roll through spaced clamping rolls to a point of use. The tape end from the other supply roll before a splicing operation is positioned against the other of the clamping rolls with the rolls being moved into clamping relationship in response to a tape end coming off an empty supply roll. A photoelectric cell senses the tape end and actuates a fluid motor to move the clamping rolls together and thus splice the tapes.



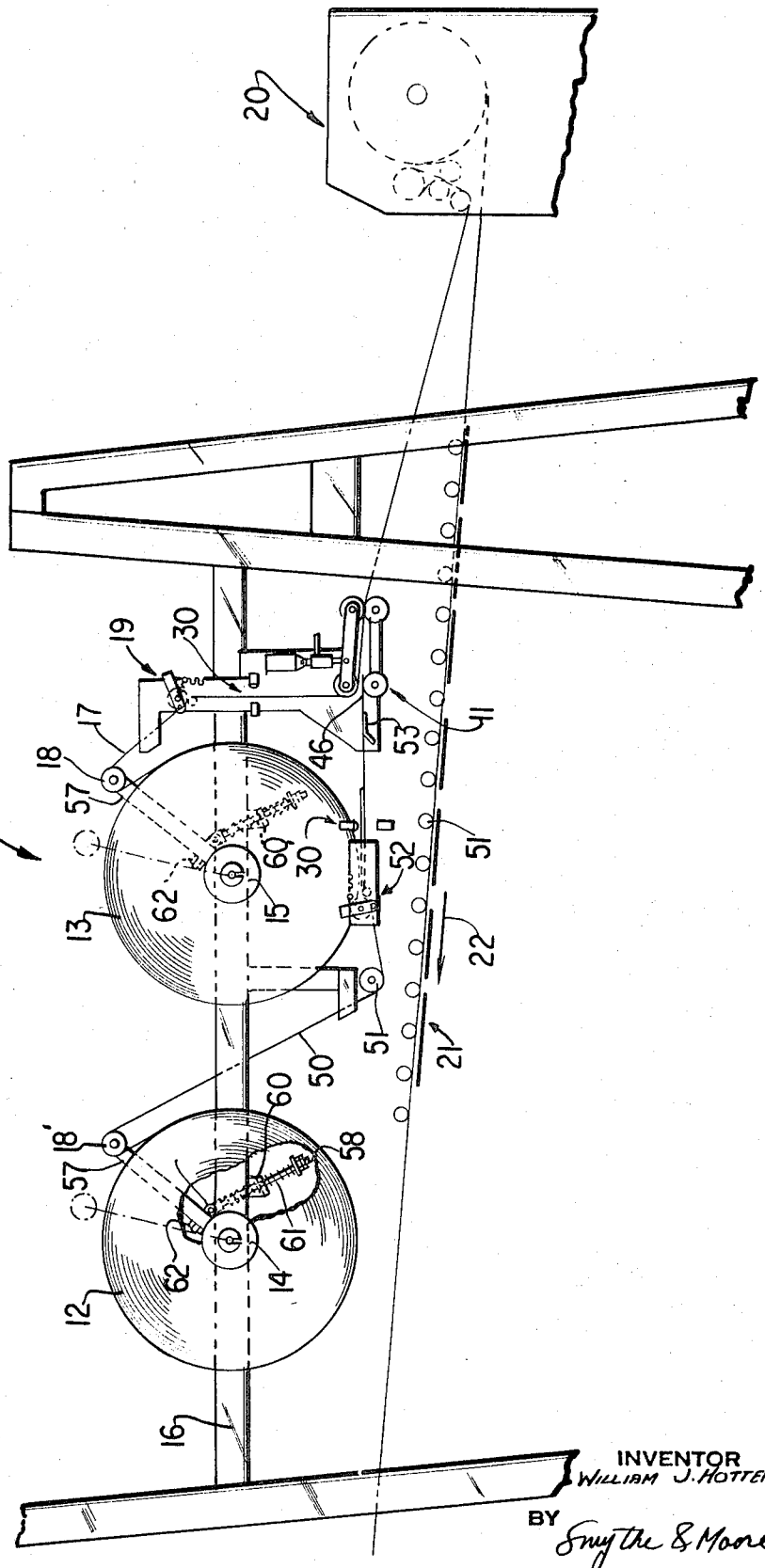


FIG. 1

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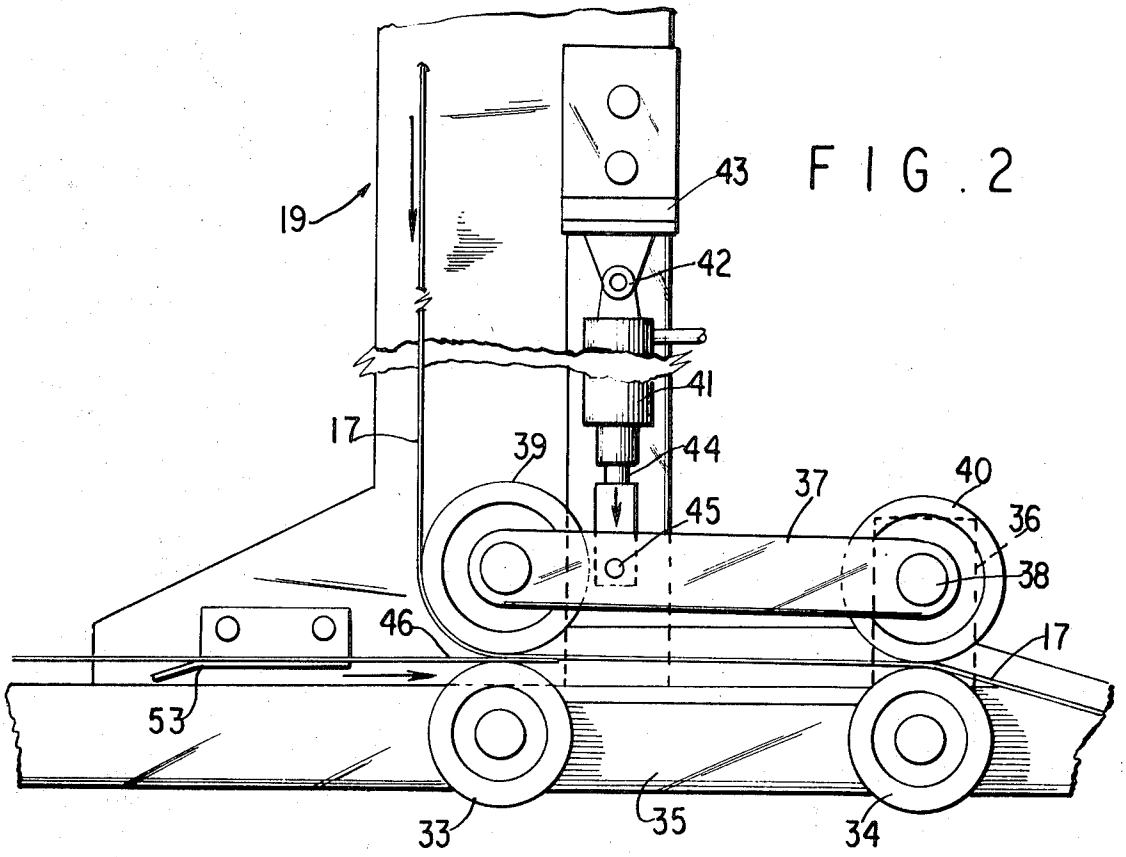

FIG. 2

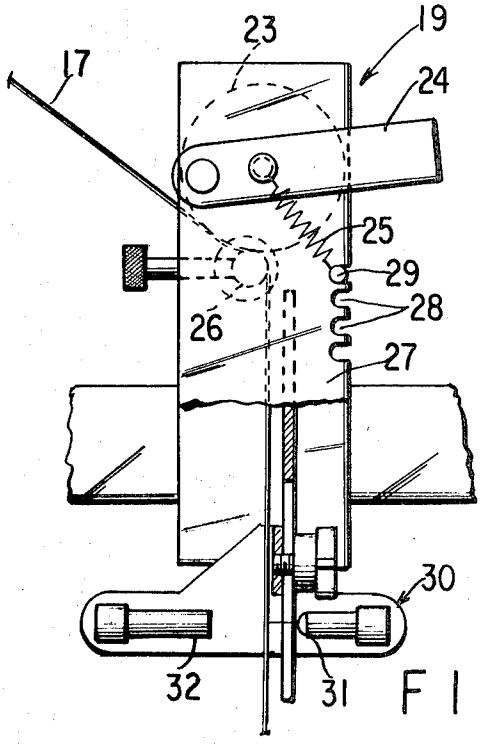

FIG. 3

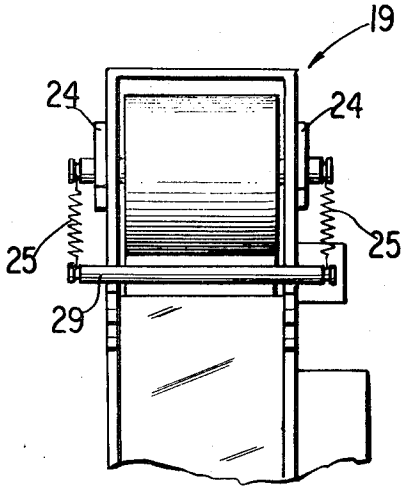

FIG. 4

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FIG.7

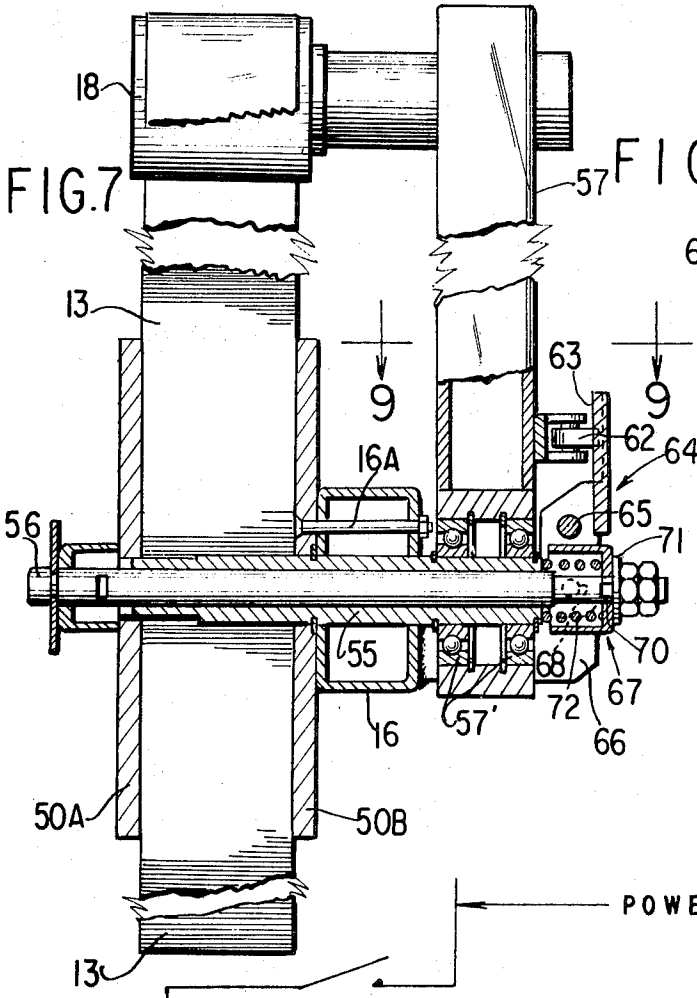
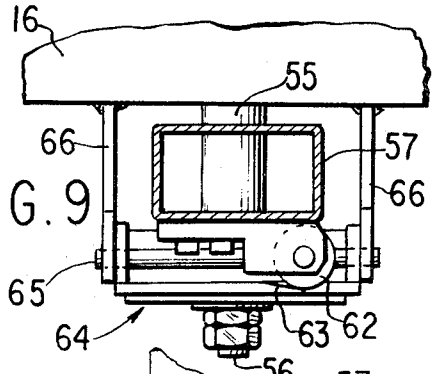


FIG.9



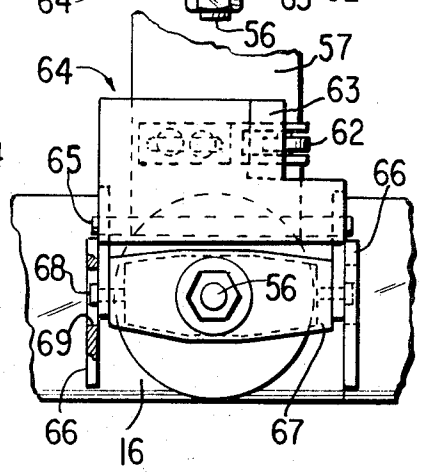


FIG.8

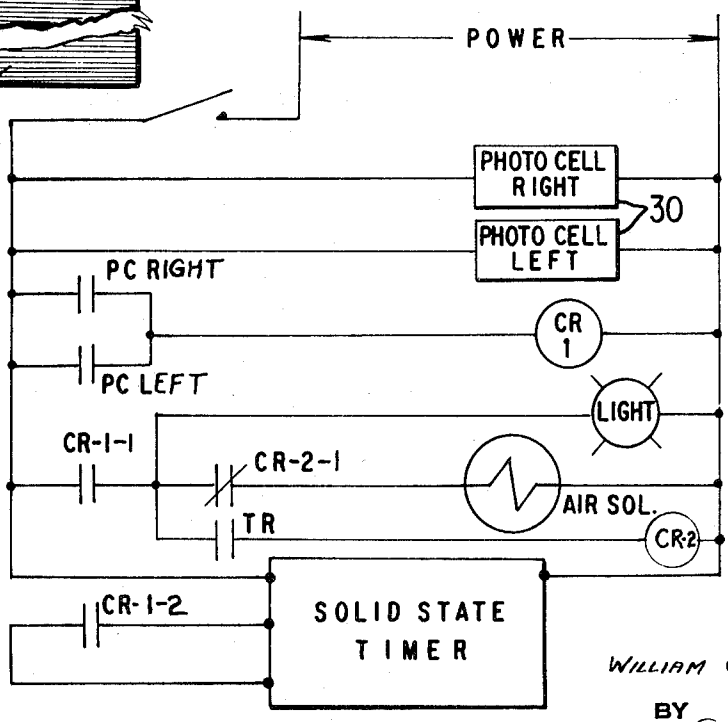


FIG.11

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FIG. 6

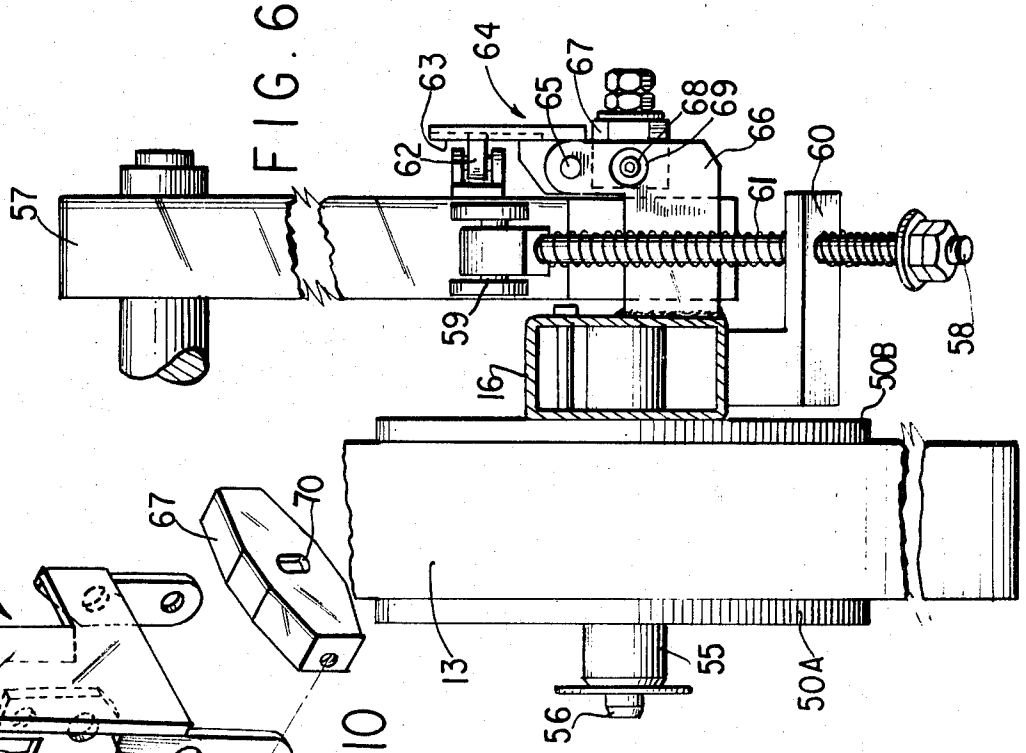

FIG. 10

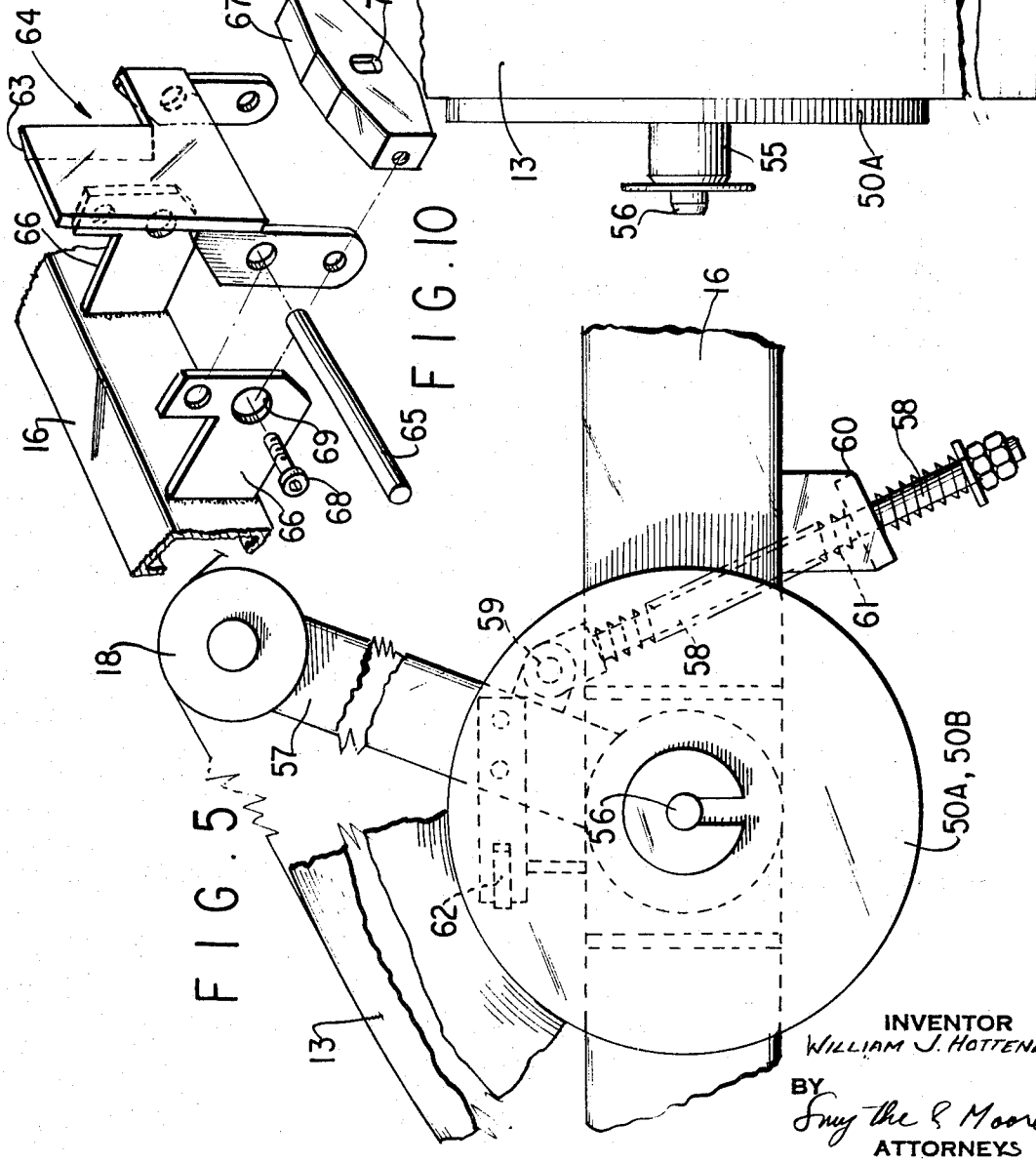

FIG. 5

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TAPE SPLICER

In many operations it is desired to provide a continuous length of adhesive tape or other forms of adhesive-backed web material. A continuous supply of tape is particularly desirable in the assembling of cardboard boxes where the blanks are folded into position and an adhesive tape applied along the folds or joined edges of the blank. The adhesive tape is generally provided from a supply roll which carries a finite length of tape thereon. When all of the tape from a supply roll is used, it is either necessary to stop the entire operation and to insert a full supply roll or to provide a mechanism whereby the end of the tape coming off of the empty roll is spliced to the end of the tape from the full roll without interrupting the operation. Known tape-splicing mechanisms required continuous attention by an operator particularly when the end of a supply roll was reached. At that time, the operator would have to pay close attention and manipulate suitable switches or other mechanism so that a new supply roll would be switched into an operative position.

One of the objects of the present invention is to provide an improved tape splicing apparatus.

Another of the objects of the present invention is to provide an apparatus for automatically splicing tape ends to assure a continuous supply of tape.

Another object of the present invention is to provide a tape-splicing apparatus which is simple in construction, reliable in operation, and requires a minimum of attention from operating personnel.

According to one aspect of the present invention, the apparatus for splicing adhesive tape to provide a continuous supply of tape may comprise a pair of rotatably mounted tape supply rolls. Means continuously advance tape from one of the supply rolls with the means including a pair of clamping rolls normally spaced apart and movable into clamping relationship. The tape end from a full supply roll prior to the splicing operation rests on one of said spaced rolls. In response to the end of a tape coming off an empty supply roll, means are actuated to move the clamping rolls together into clamping relationship whereby the empty roll tape end is adhered to the tape end of a full supply roll and a continuous supply of tape is provided.

The tape-splicing apparatus also comprises a braking arrangement whereby a supply roll is quickly braked to a stop when tension of the tape coming off the roll is reduced either through breakage of the tape or the end of the tape is reached.

Other objects, advantages and features of the present invention will be apparent from the accompanying description and drawings, which are merely exemplary.

In the drawings:

FIG. 1 is a side elevational view of the tape-splicing apparatus according to the present invention;

FIG. 2 is a side elevational view in enlarged scale of the clamping roll arrangement shown in FIG. 1;

FIG. 3 is a side elevational view in enlarged scale of the upper guide and tape straightener shown in FIG. 1;

FIG. 4 is a partial front elevational view of the guide and straightener of FIG. 3;

FIG. 5 is a side elevational view in enlarged scale of a tension arm for a supply roll of FIG. 1;

FIG. 6 is a front elevational view of the structure of FIG. 5 with the frame member being shown in sections;

FIG. 7 is a transverse sectional view taken through the rotational axis of a supply roll of FIG. 1 and in enlarged scale;

FIG. 8 is a side elevational view of the structure shown in FIG. 7;

FIG. 9 is a sectional view taken along the line 9—9 of FIG. 7;

FIG. 10 is an exploded perspective view of the structure shown in FIGS. 8 and 9; and

FIG. 11 is a schematic diagram showing the electrical control circuit for the apparatus of the present invention.

Proceeding next to the drawings wherein like reference symbols indicate the same parts throughout the various views, a specific embodiment of the present invention will be described in detail.

In FIG. 1, there is indicated generally at 10 the tape storage unit of a slotter-folder-taper apparatus for assembling cardboard boxes. The tape splicer, according to the present invention, is indicated generally at 11 and is incorporated in the tape storage unit 10. In the tape storage unit, tape supply rolls 12 and 13 are rotatably mounted at 14 and 15, respectively, on a hollow beam 16.

As illustrated in FIG. 1, an adhesive tape 17 is drawn from supply roll 13 over an idler roller 18 through an upper guide mechanism 19, the splicing unit 11, and to a taping unit 20. For comprehension of the present invention, it is not necessary to describe in detail the manner in which the adhesive tape is employed in the taping unit. From the taping unit 20, boxes move along a conveyor 21 in the direction of movement as indicated by the arrow 22.

The upper guide mechanism, as illustrated in greater detail in FIG. 3, comprises a roller 23 journaled on a pivotally mounted beam 24 and biased by a spring 25 against the tape 17 just before the tape passes over a roller 26. The pivotally mounted beam and roller 23, 24 function as a tape straightener. The guide section 19 is provided with a vertical standard 27 having a plurality of notches 28 therein within which a pin 29, to which springs 25 are attached, may be positioned to vary the tension on the roll 23.

As tape 17 passes downwardly over roll 26, the tape passes through a photoelectric sensing unit 30 which includes a beam of light 31 and a photoelectric-responsive cell 32. Other types of sensing units can be used.

The tape 17 then enters the splicing apparatus, which is shown in greater detail in FIG. 2, and comprises a first pair of rolls 33 and 34 which are journaled in a fixed frame member 35. There is a vertical standard 36 upstanding from frame member 35 and a lever arm 37 is pivotally mounted to the upright standard 36 at 38. Lever arm 37 is provided with a pair of rolls 39 and 40 which cooperate, respectively, with rolls 33 and 34. The rolls 34 and 40 are fixedly positioned a spaced distance apart to guide the passage of the tape 17 therethrough. The roll 39 is normally spaced apart from roll 33 as shown in FIG. 1. Thus, the tape 17 from the supply roll 13 passes around roll 39 and between rolls 34 and 40 on its way to the taping unit. The tape 17 will proceed along this path until the end of the tape comes off of the empty roll 13. As the tape end passes the photoelectric unit 30, the unit will be energized and will actuate solenoids to admit air under pressure to a pneumatic motor 41 pivotally mounted at 42 to a vertical standard 43 and having its piston rod 44 connected at 45 to the pivotally mounted lever arm 37. Actuation of the air motor 41 will move the arm 37 downwardly and thus, bring the rolls 39 and 33 into clamping relation. Electrically actuated means also could be used.

Prior to the splicing operation, a tape end 46 from the full supply roll 12 has been positioned to rest upon the roll 33. Tape end 46 or the under surface of tape 17 may have a suitable adhesive or gripping means thereon. Thus, as roll 39 is moved downwardly into the clamping position, the tape 17 is clamped against tape end 46 to clamp these tapes together to present a continuous tape passing through the taping unit.

The tape from the full supply roll 12 is indicated at 50 and similarly passes over an idler roll 18', a further idler roll 51, and a further idler roll 52 which is a component of a tape straightener similar to that illustrated in FIG. 3. The tape 50 then passes through a photoelectric unit 30', over a stationary guide 53 to the splicer unit where the tape end 46 rests upon the stationary roll 33.

The mechanism for braking a tape supply roll to a halt when all the tape has been removed therefrom or when the tape breaks is illustrated in FIGS. 5 through 10, inclusive. The rotational axis of a tape supply roll 13 as shown in FIG. 7 is formed by a hollow tubular supporting shaft 55 fixedly mounted on the beam 16. Slidably mounted within the hollow shaft 55 is a solid shaft 56.

The idler roll **18** is mounted on the end of a tension arm **57** which in turn is rotatably mounted by means of antifriction bearings **57'** on the end of shaft **55**. During normal operation, tension arm **57** is held in the position as shown in FIG. **1** and is moved in a counterclockwise direction to effect braking of the supply roll under the action of an actuating rod **58** having one end connected at **59** and slidably mounted within a bracket **60** depending from the beam **16**. A spring **61** surrounds actuating rod **58** to urge the tension arm **57** into the counterclockwise direction.

Mounted on the lower portion of tension arm **57** is a cam roller **62** which bears against a cam surface **63** mounted on the inner face of a member **64** pivotally mounted by a beam **65** to brackets **66** extending outwardly from frame member **16** and welded thereto.

Pivotally mounted at the lower end of member **64**, as may be seen in FIG. **10**, is a bar **67** which is secured to member **64** by bolts **68** passing through enlarged openings **69** in brackets **60**. Bar **67** is provided with a center opening **70** through which is inserted an end of shaft **56** and retained therein by a nut and washer assembly **71**.

The bar **67** has a U-shaped cross section, as may be seen in FIG. **7**, and supports a spring **72** therein which bears against the end of tubular shaft **55**.

When the tension of tape **17** decreases either by breakage of the tape or the complete supply of tape is exhausted from the roll, the tension arm **57** will be moved in a counterclockwise direction as seen in FIG. **1**. This movement of the tension arm will cause cam roller **62** to move to the right as shown in FIG. **9** and will cause cam surface **63** to move inwardly, thereby pivoting member **64** in a counterclockwise direction as shown in FIG. **7**. This pivoting movement of member **64** will slide the shaft **56** axially to the right as seen in FIG. **7** to move plate **50A** to the right (FIG. **7**), move roll **13** against fixed plate **50B**, and thereby bring the supply roll to a rapid stop. Plate **50B** is held to frame **16** by bolt **60A**.

Thus, it can be seen that the present invention has disclosed an automatic tape splicer which assures a continuous supply of adhesive tape from a plurality of supply rolls. When the tape is exhausted from one roll, the end of the tape from the empty roll is automatically spliced or adhered to the leading end of the tape from a full supply roll so that a continuous tape is advanced to the station where it is being used. Immediately upon exhausting of a supply roll, the empty roll is braked to a stop so that it may be quickly replaced with a full supply roll. The braking mechanism is also responsive to any brakes in the tape which may occur during operation.

In one form of circuit shown schematically in FIG. **11**, energization of one of the photocells because the tape runs out will energize CR–1 by closing of PC right or PC left which closes CR–1–1 and energizes the air solenoid and the solid-state timer by closing CR–1–2. The solid state timer at the end of a predetermined time will close TR which energizes CR–2 and opens CR–2–1 to deenergize the air solenoid. As an alternative, and instead of the solid-state timer, CR–2–1 can be replaced by a time-delay switch (not shown) which opens at the end of a predetermined time to deenergize the air solenoid.

It will be understood that various details of construction and arrangement of parts may be made without departing from the spirit of the invention.

What is claimed is:

1. In an apparatus for use in boxboard assembling for splicing adhesive tape to provide a continuous supply of the tape, the combination of a pair of rotatably mounted tape supply rolls means for continuously advancing a tape from one of said supply rolls, said means including a pair of clamping rolls normally spaced apart and movable into clamping relationship, the tape end of a full supply roll prior to splicing resting on one of said clamping rolls, and tape end responsive means located adjacent the path of each of the tapes between its roll and said clamping means and actuated by the end of a tape passing thereby and coming from an empty supply roll for moving said clamping rolls together into clamping relationship whereby the empty roll tape end is spliced to the tape end of a full supply roll.

2. In an apparatus as claimed in claim **1** with said clamping roll moving means comprising photoelectric cell means adjacent the paths of both of the tapes between the supply rolls thereof and the clamping rolls.

3. In an apparatus as claimed in claim **2** and comprising a fluid motor connected to said clamping rolls and actuated in response to the energization of one of said photoelectric cell means to move said clamping rolls together.

4. In an apparatus as claimed in claim **1** and comprising tensioning means responsive to a decrease in tension of either tape coming off of a supply roll for braking that supply roll.

5. In an apparatus as claimed in claim **4** with said braking means comprising a pivotally mounted tension arm for each supply roll and having an idler roller on the end thereof with the tape from that supply roll passing over said idler roller.

6. In an apparatus as claimed in claim **1** with said clamping rolls comprising a first pair of spaced rolls mounted in a fixed frame, a second pair of spaced rolls cooperating with said first pair of rolls, said second pair of rolls mounted in a frame having one end pivotally mounted so that the cooperating rolls at the pivotal end are in rolling engagement when a tape is passing therebetween, and means connected to said pivotally mounted frame for moving said frame into the clamping position in response to a tape end.

7. In an apparatus for splicing adhesive tape to provide a continuous supply of the tape, the combination of a pair of rotatably mounted tape supply rolls, means for continuously advancing a tape from one of said supply rolls, said means including a pair of clamping rolls normally spaced apart and movable into clamping relationship, the tape end of a full supply roll prior to splicing resting on one of said clamping rolls, means responsive to the end of a tape coming off an empty supply roll for moving said clamping rolls together into clamping relationship whereby the empty roll tape end is spliced to the tape end of a full supply roll, braking means for said supply rolls including a tensioning arm means, and means responsive to a decrease in tension of a tape coming off of a supply roll for braking that supply roll.

8. In an apparatus as claimed in claim **7** and wherein said clamping rolls are moved in response to activation of photoelectrical means adjacent the paths of both of the tapes and located between the supply rolls thereof and said clamping rolls.

* * * * *