Dec. 5, 1961 H. L. BAUMBACH ET AL 3,011,936

STRIP SPLICING MACHINE

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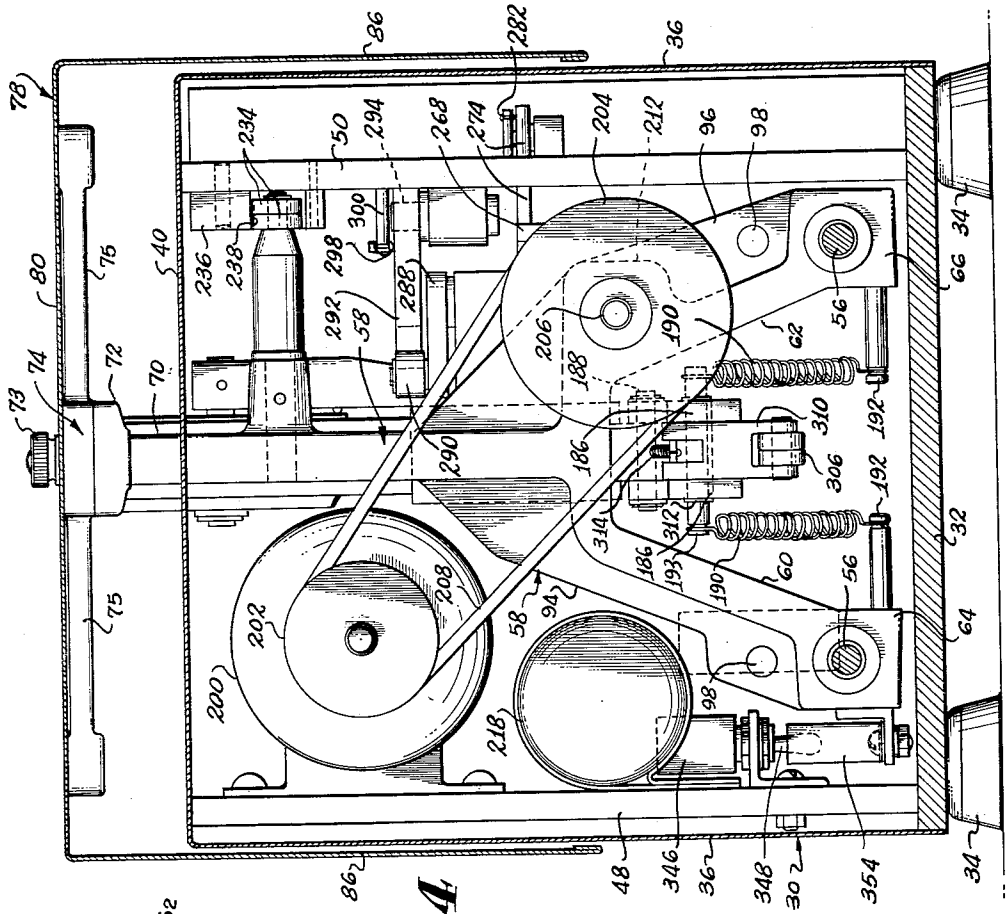


Fig. 4

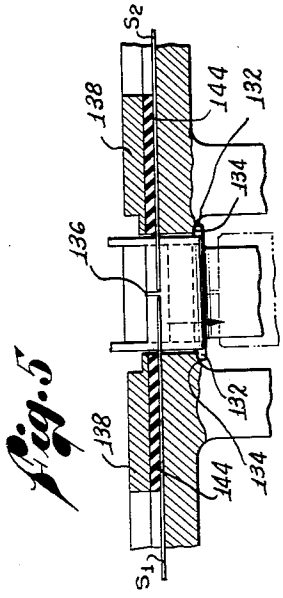


Fig. 5

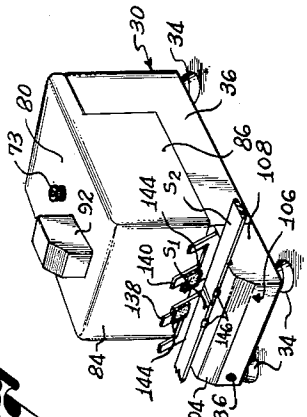


Fig. 1

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STRIP SPLICING MACHINE

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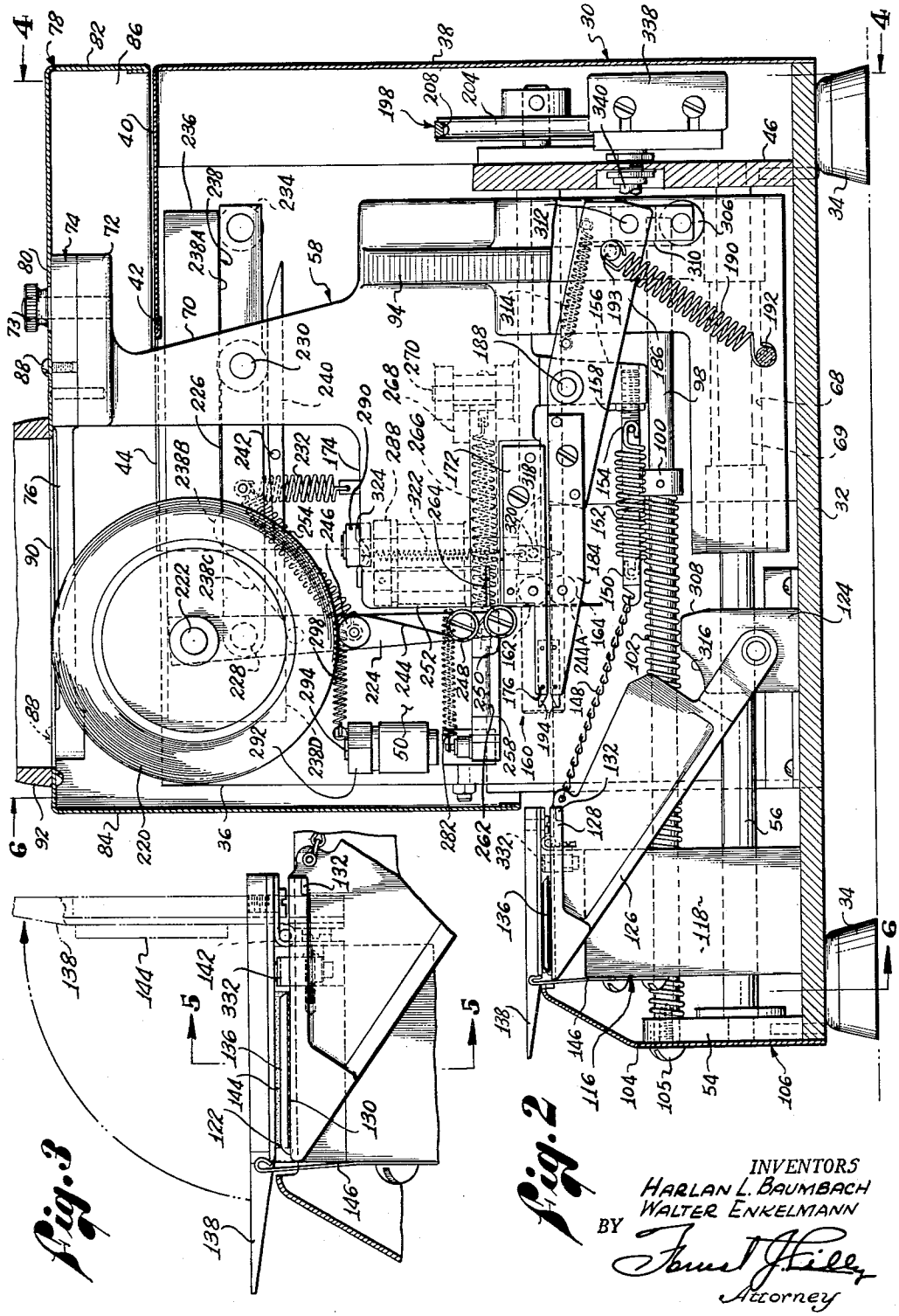


Fig. 3

Fig. 2

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STRIP SPLICING MACHINE

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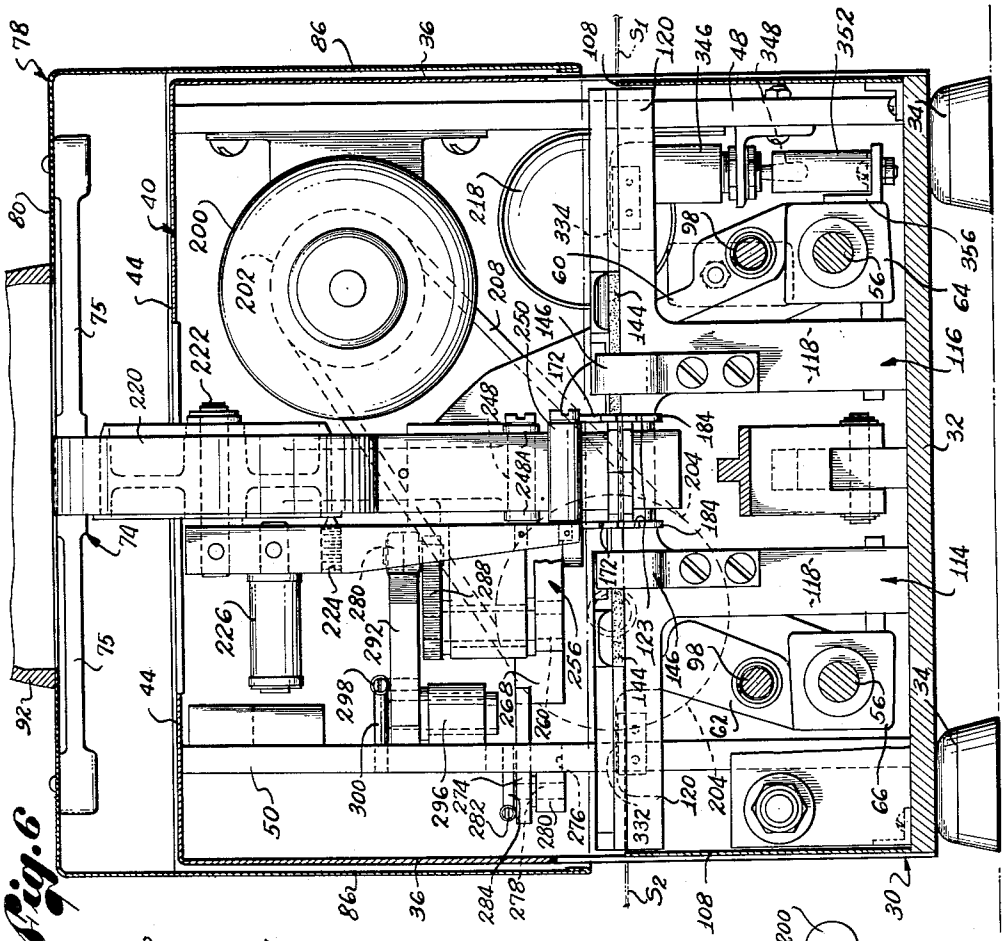


Fig. 6

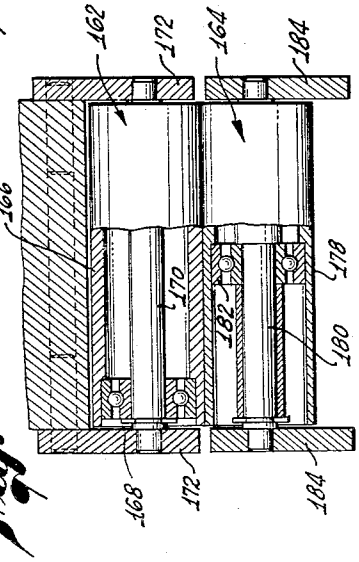


Fig. 7

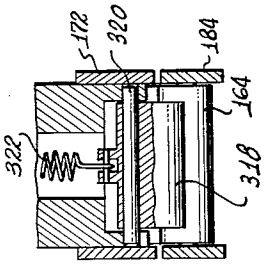


Fig. 8

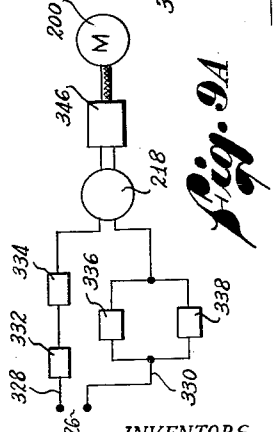


Fig. 9A

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STRIP SPLICING MACHINE

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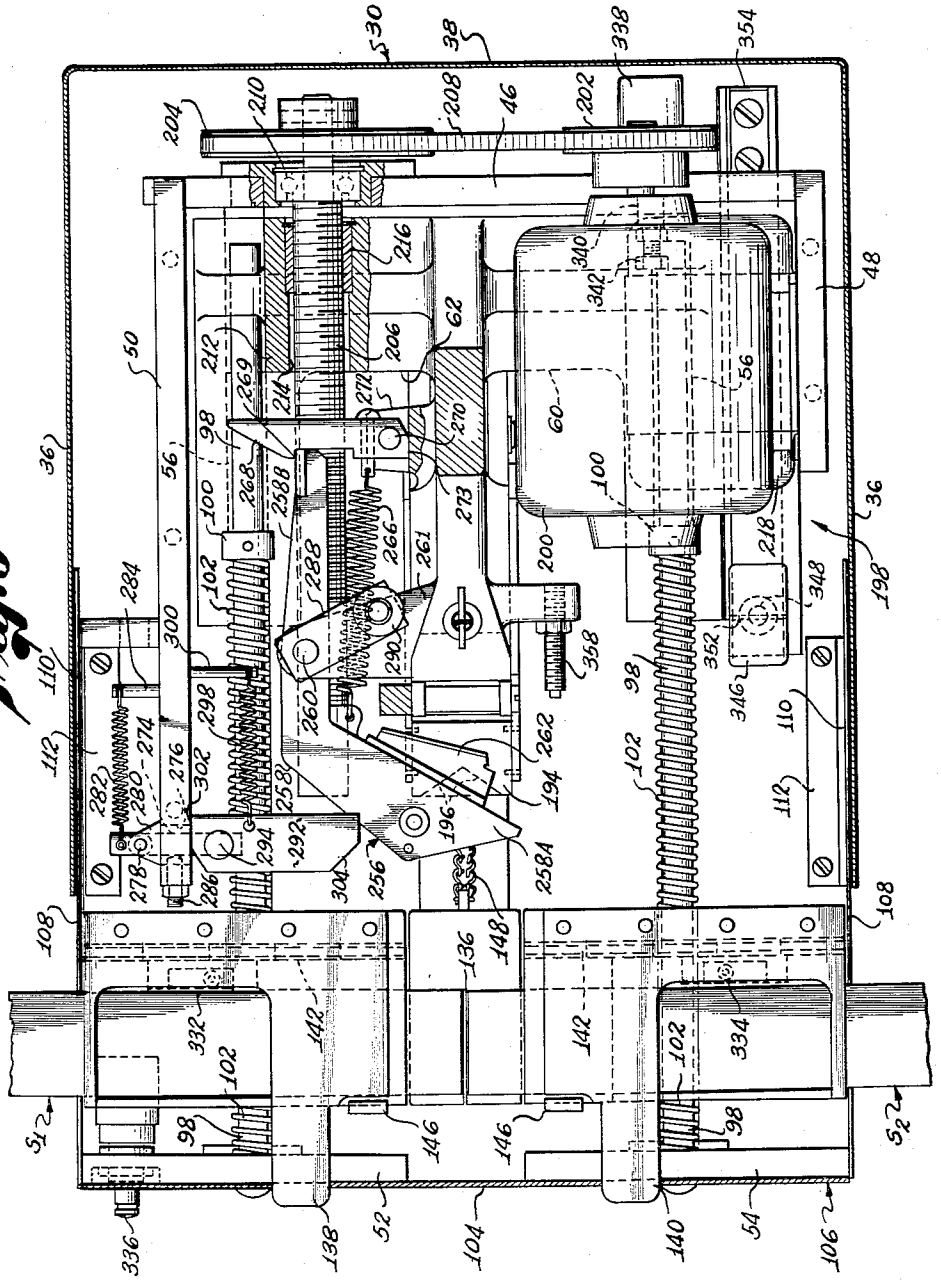


Fig. 9

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STRIP SPLICING MACHINE

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Fig. 10

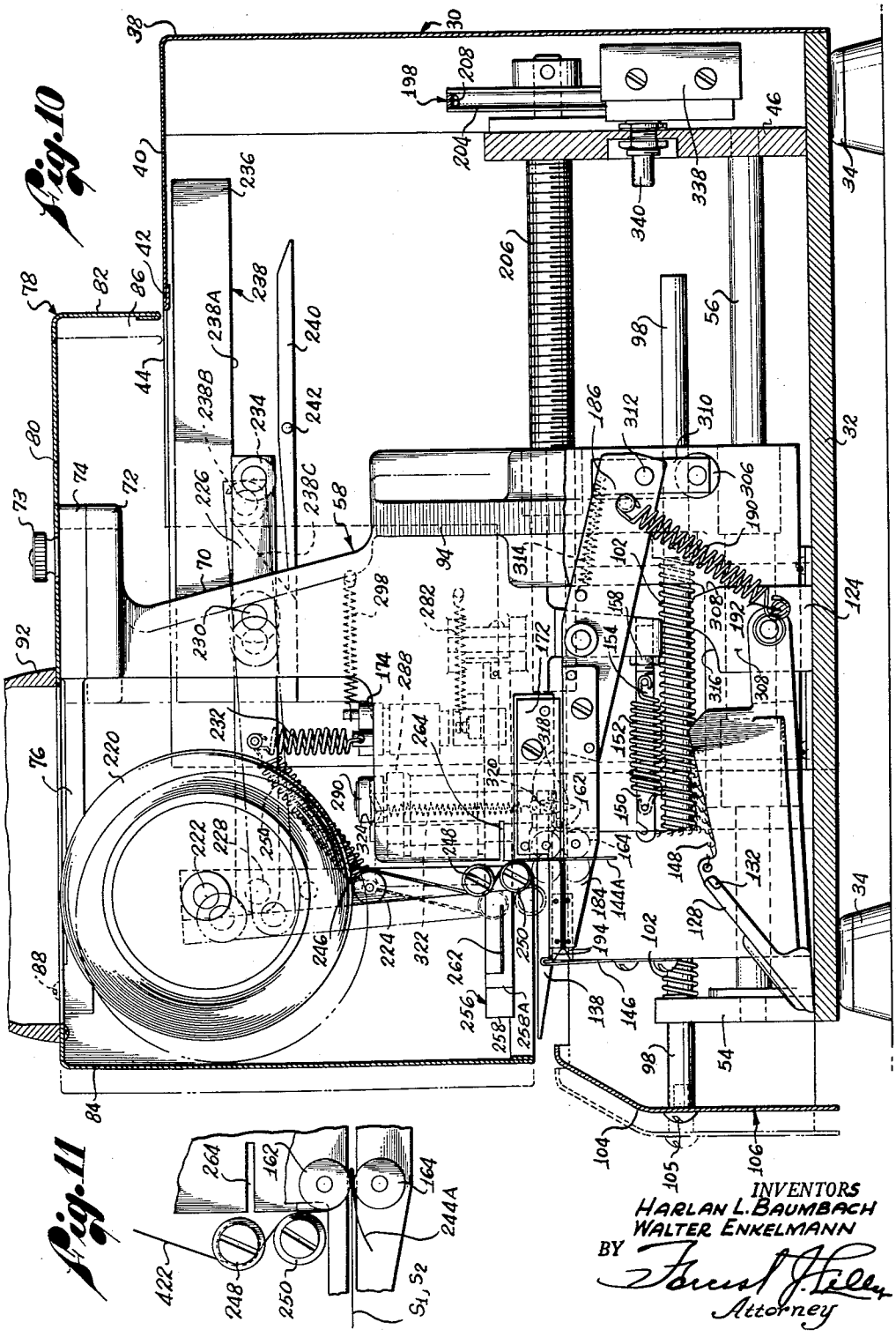


Fig. 11

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Fig. 12

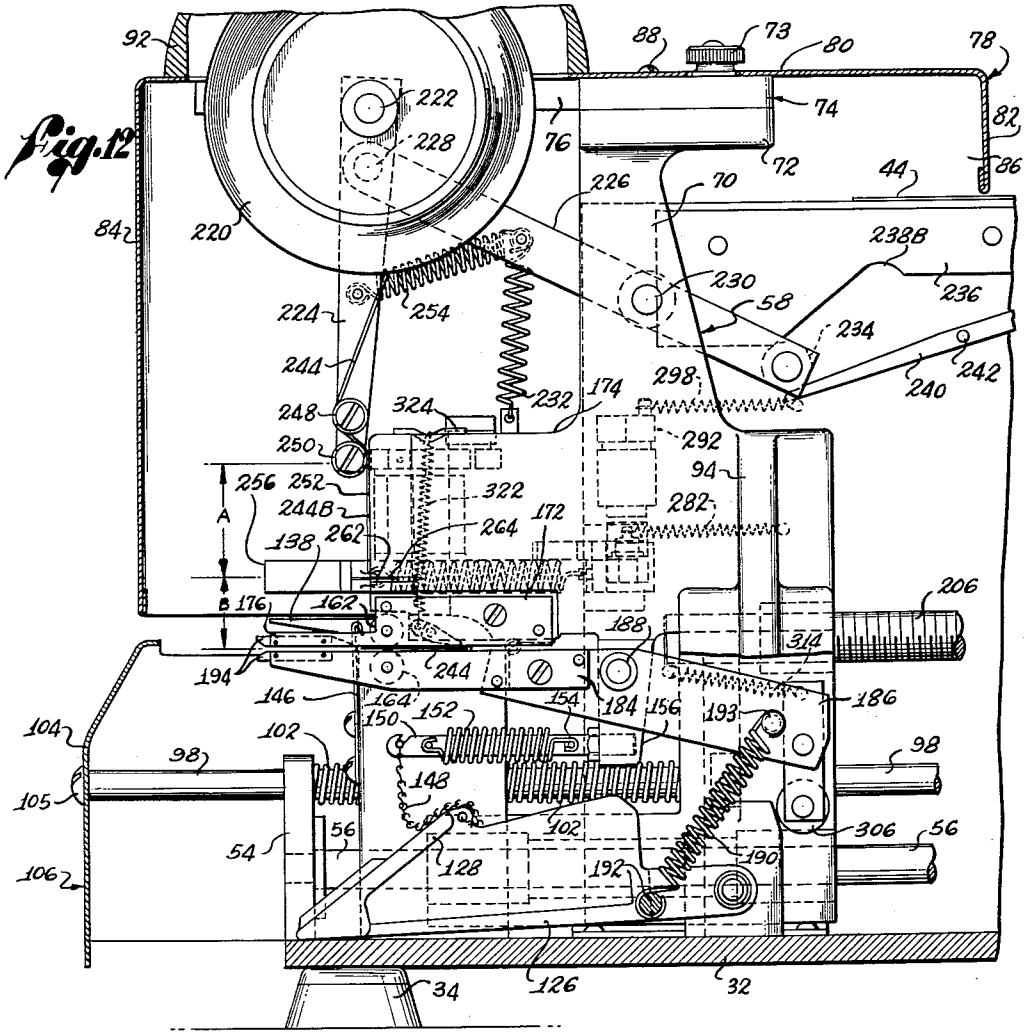
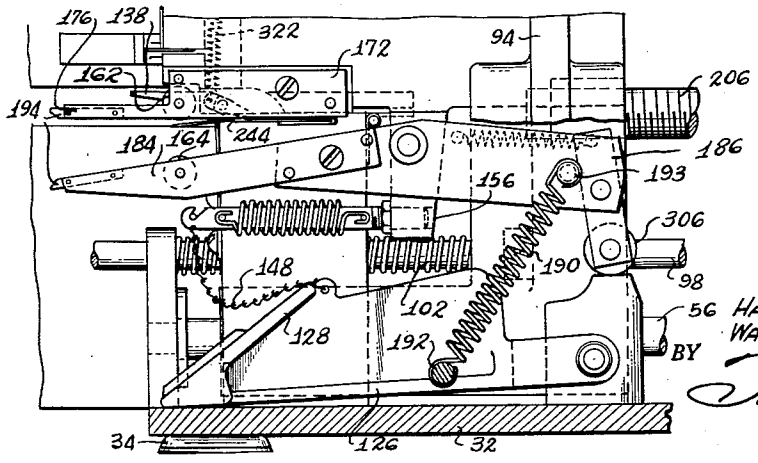


Fig. 13



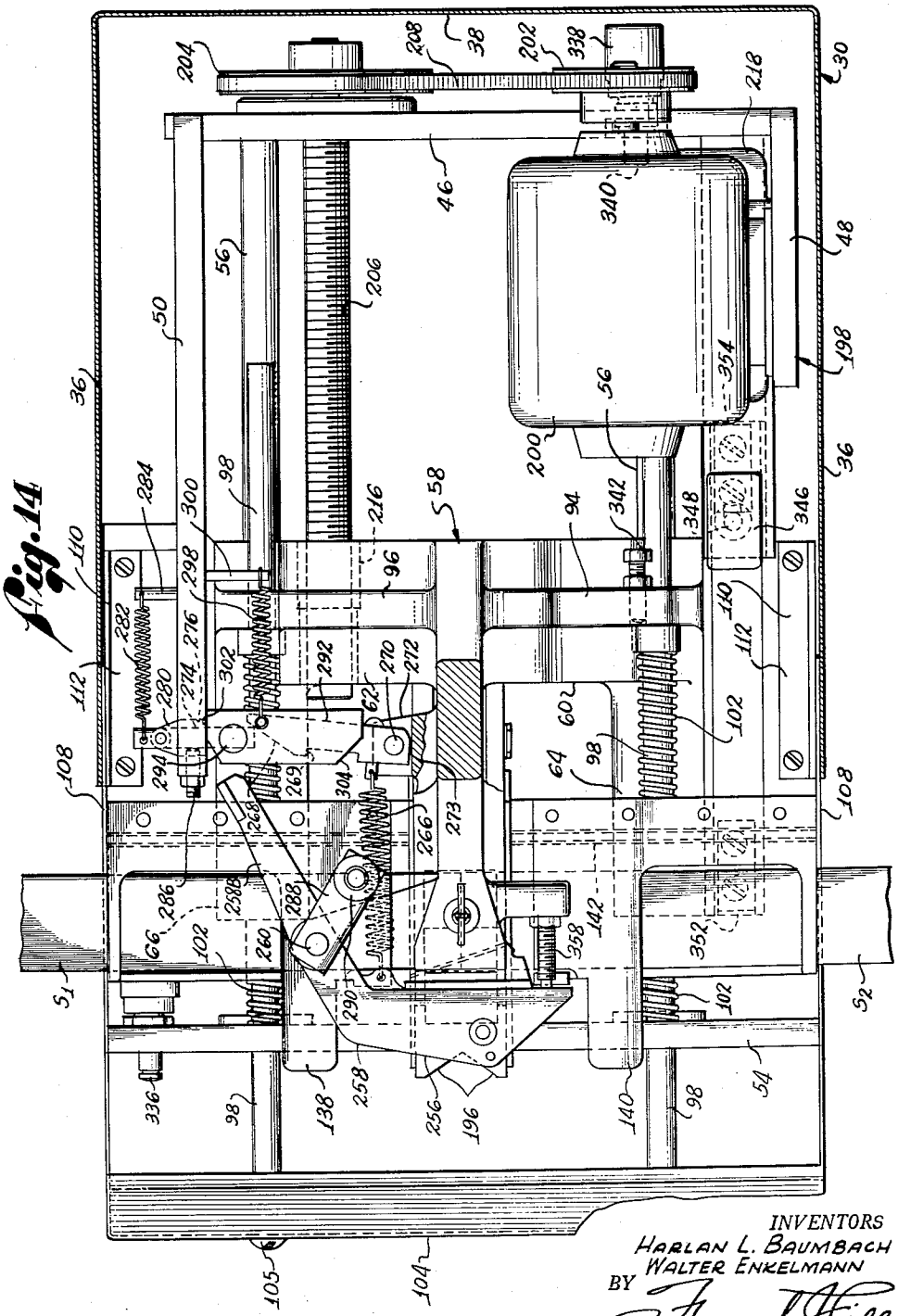
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STRIP SPLICING MACHINE

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Fig. 14



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STRIP SPLICING MACHINE

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Fig. 15

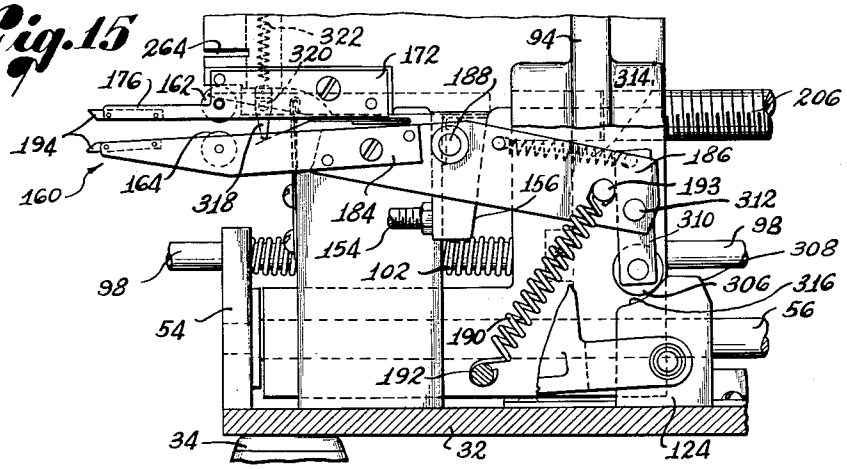


Fig. 16

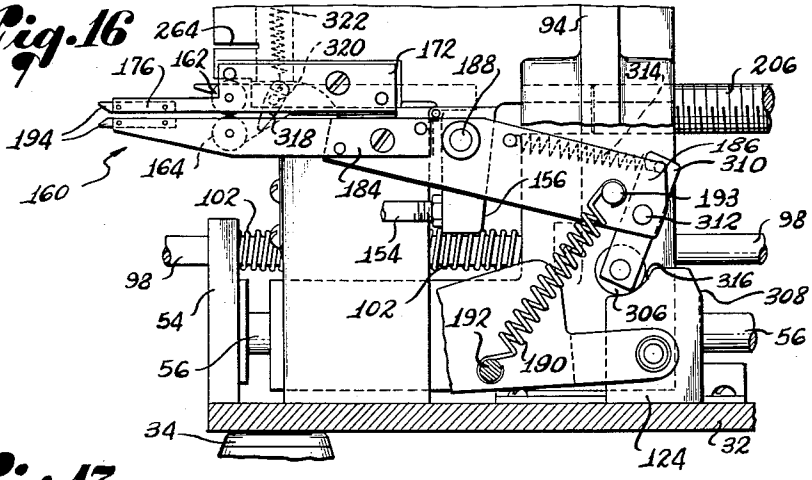
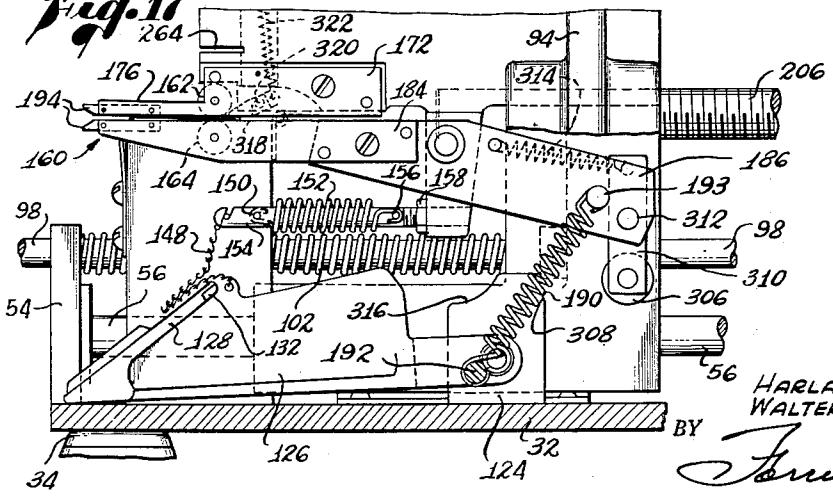


Fig. 17



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STRIP SPLICING MACHINE

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Fig. 18

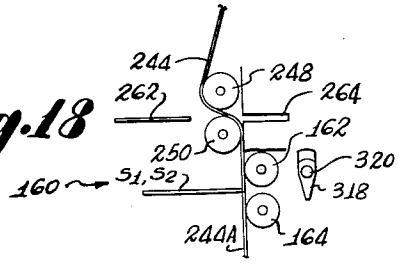


Fig. 19

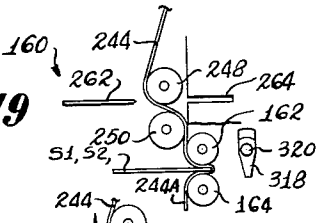


Fig. 20

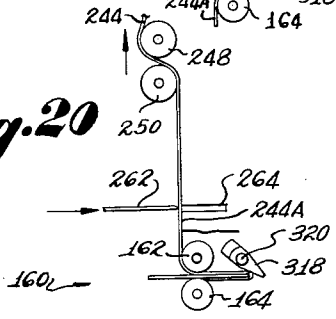


Fig. 21

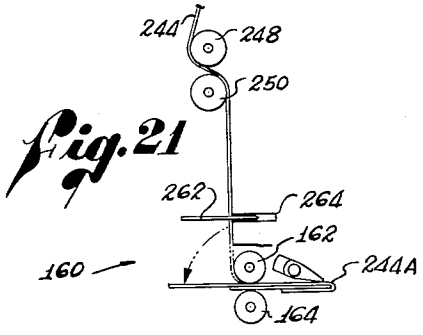


Fig. 22

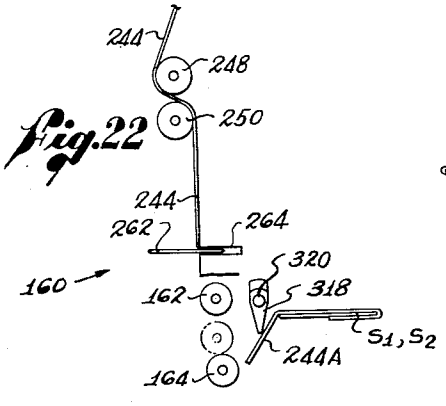


Fig. 23

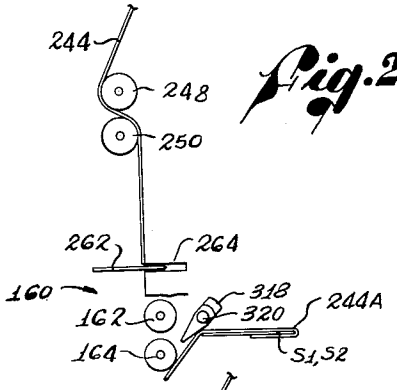


Fig. 24

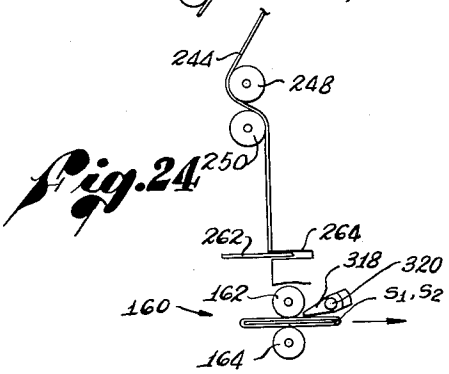


Fig. 25

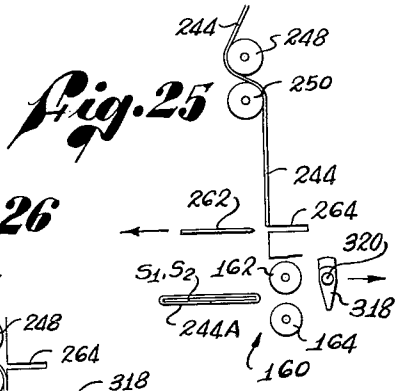
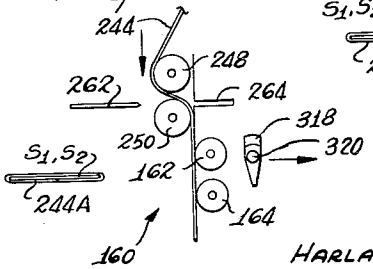


Fig. 26



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United States Patent Office 3,011,936 Patented Dec. 5, 1961

3,011,936
STRIP SPLICING MACHINE

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Filed Mar. 4, 1957, Ser. No. 643,562
16 Claims. (Cl. 156—482)

This invention relates broadly to a splicing machine, and particularly to an automatic machine for splicing two strips together.

Among the numerous applications for the present machine is that of splicing sections of motion picture film.

The illustrative embodiment of the invention is concerned with such a film splicing application. It will become apparent, as the description proceeds, however, that the present machine is susceptible of broad application and should not be thought of as limited in use to film splicing.

Various types of splices are employed in the film industry. Thus, for example, permanent splices are generally accomplished by cementing overlapping ends of adjacent film strips together. Frequently, however, it is desired to merely temporarily join adjacent film strips to permit feeding thereof through film handling machines such as film printers, developing machines, and the like. After processing of the films has been completed, they are again separated and subsequently permanently spliced in a desired order or to other film strips to form a length of film for projection purposes.

In the past, temporary splices have been made by cementing or stapling the film strips together and in various other ways. Some of the machines for making these prior splices have been entirely or partially manual in operation or completely automatic in operation.

Owing to the frequency with which splices must be made during the processing stage of motion picture film, it is essential that the splicing operations be capable of rapid performance. It is, of course, necessary that the splice firmly join the adjacent film strips and be capable of withstanding a certain amount of tension in the film without parting or causing tearing of the film.

Stapling has been a commonly accepted method of splicing because of the rapidity with which it may be accomplished. Cemented splices, while being more satisfactory than stapled splices, are generally not employed as temporary splices, owing to the excessive amount of time required for setting and the difficulties involved in handling of the cement. Stapled splices, on the other hand, are deficient in that they present projections which are prone to catching on squeegees and other film contacting parts of the processing machines through which the spliced film is fed. Also, stapled splices are prone to tearing under relatively light film tension.

The illustrative embodiment of the present invention comprises a machine for wrapping a section of pressure sensitive tape about adjacent aligned ends of a pair of film strips to firmly splice or join the latter. The pressure sensitive tape is relatively thin so that no projections, prone to catching on the squeegees or other film engaging elements of film processing machines, are presented at the splice.

In the finished splice made by the present machine, the intermediate portion of the section of tape which splices the strips extends across one side of the strips, the opposite ends of the tape section being folded against the other sides of the strips to approximately their center line. Loose ends on the tape are thereby avoided and tension in the film is distributed evenly over the entire width of the latter, at the splice. This even distribution of the tension and the inherent strength of pressure sensitive tape provide in the splice, formed by the present machine, a strength greatly exceeding the maximum film tension encountered in film handling machines. In fact, it has been found that the splice made by the present machine is substantially stronger than the film itself, with the result that the film parts under excessive tension before the splice separates.

Another advantage of splices made by wrapping pressure sensitive tape about the film is that the film itself is not perforated or otherwise marred. Accordingly, if desired, the tape can be unwrapped after processing is completed and the film will be unmarred. Also, since no metallic parts are used in the splice, no corrosion or other chemical reactions occur as often happens in the case of stapled joints.

Splicing film and other strip material with pressure sensitive tape, of course, is known in the art. No machines, at least fully automatic machines, for making such splices, however, are presently in existence insofar as we know. This invention provides a machine for making splices of the type under discussion which is fully automatic in its operation, the only manual steps required being those of initially positioning the film strips to be spliced in film holders on the machine, closing pressure pads to retain the film in position in the holders, and actuating of a starting button to initiate the wrapping operation of the machine.

The machine is relatively small in size, light in weight and rapid in operation so as to be uniquely adapted to film splicing operations. As preliminarily indicated, however, splicing of film is only one of the many uses to which the machine may be put. It should be understood, therefore, that such use is merely illustrative in nature and that the machine may be designed to splice other types of strip material, and, in fact, to wrap various types of flexible strips or filaments about different forms of articles.

With the foregoing discussion in mind, a broad object of the invention may be stated as being the provision of a fully automatic machine for wrapping flexible strips and the like about articles.

A more specific object of the invention is the provision of a machine for wrapping pressure sensitive tape about articles.

Another object of the invention is the provision of an automatic wrapping machine of the character described for wrapping pressure sensitive tape about adjacent ends of a pair of aligned strips to splice the same.

A further object of the invention is the provision of an automatic tape wrapping machine of the character described which is uniquely adapted to the splicing of motion picture film.

Yet a further object of the invention is the provision of a film splicing machine which is rapid and fully automatic in operation and wherein the splice produced possesses high strength and is extremely smooth so as to be capable of passage through film processing machines without catching on any of the film contacting parts thereof.

A still further object of the invention is the provision of a new and improved method for splicing motion picture film.

Briefly, the foregoing and other objects and advantages are achieved in the illustrative embodiment of the invention by the provision of a pair of stationary film supports for holding a pair of film strips to be spliced in longitudinally aligned relation with their butt ends proximately positioned. These butt ends of the strips extend beyond their supports to permit adhesive tape to be wrapped therearound.

Also embodied in the machine is a tape wrapping mechanism including a movable carriage supporting a supply

roll of pressure sensitive tape. A free end section of this tape is initially held in a predetermined position on the carriage aligned with and having its adhesive surface facing the butt ends of the film strips.

During a splicing operation of the machine, the carriage, tape supply roll, and tape section are advanced as a unit toward the film supports in a manner such that the section of tape is translated, along a direction line normal to its plane and parallel to the plane of the film strips, into initial contact with the adjacent, or rear, edges of the strips. A light adhesive bond is established between the film and tape by this initial contact.

The section of tape is so located that in its position of initial contact with the film, the free end portion of the tape section extends beyond the under sides of the film strips a distance approximately equal to one half the width of the latter. The other end portion of the section, of course, extends a distance beyond the upper sides of the film strips to the supply roll.

Located on the carriage immediately behind the tape, at opposite sides of the plane of the film strips, are a pair of pressure rollers. During continued travel of the carriage beyond the position of initial contact of the tape with the film, these pressure rollers ride across, and thereby fold and press the section of tape against, opposite sides of the film strips. The supply roll is dropped slightly upon initial contact of the tape and film to provide a limited amount of slack in the tape between the film and tape roll. Upward drawing of the tape section about the rear edges of the film strips during initial travel of the rollers across the film is thereby avoided. It is desirable to avoid such upward drawing of the tape section about the film in order to maintain at the under side of the latter a length of tape which, when folded, will extend to approximately the center line of the film strips.

After sufficient adhesive bond has been established between the tape and film to prevent this upward drawing of the tape section, the tape supply roll is raised as the pressure rollers travel across the film. A predetermined length of tape is thereby unwound from the supply roll.

During forward movement of the pressure rollers across the film, to limiting positions beyond the forward edges thereof, the upper end of the tape section is rolled across the entire width of the film by the upper pressure roller and is severed from the supply roll by a blade mechanism. The sheared end of the tape section is then folded downwardly about the forward edges of the film strips to a position rearwardly of the lower pressure roller and is thereafter folded against the forward under sides of the strips by the latter roller during the return stroke of the carriage.

The section of tape is thereby wrapped substantially completely about the film strips, the ends of the section being located at the under sides of strips approximately at the center line of the latter. Shortly before the carriage reaches its normal rear position, the tape supply roll is dropped to its normal position to locate the new section of tape, which was withdrawn from the roll by the aforesaid raising of the latter, in position for the next wrapping operation.

The illustrative apparatus embodies various other structural elements, such as a vertical movable film support for initially supporting the butt ends of the film strips, which cooperate with those elements briefly discussed above to provide a film splicing machine that is fully capable of attaining the preliminarily mentioned and other objects and advantages.

The invention will now be described in greater detail by reference to the attached drawings, wherein:

FIGURE 1 is a view in perspective of a motion picture film splicing machine embodying the present invention;

FIGURE 2 is an enlarged side elevation, partly in section, of the splicing machine of FIGURE 1;

FIGURE 3 is an enlarged detail view, in side elevation, illustrating the film supports and film clamps of the machine for holding film strips in position to be spliced;

FIGURE 4 is a rear elevation, partly in section, of the present splicing machine;

FIGURE 5 is a section taken along line 5—5 of FIGURE 3;

FIGURE 6 is a front elevation, partly in section, of the present splicing machine;

FIGURE 7 is an enlarged detail, partially sectioned, of a pair of tape folding, pressure rollers embodied on the machine;

FIGURE 8 is an enlarged detail, partially sectioned, of a tape folding pressure plate embodied in the machine;

FIGURE 9 is a top plan view, partly in section, of the present splicing machine;

FIGURE 9A is a schematic diagram of the electrical control circuit of the machine;

FIGURE 10 is a view similar to FIGURE 2 but showing the parts of the machine in an initial position they occupy during a splicing operation;

FIGURE 11 is an enlarged detail illustrating the manner in which pressure sensitive tape is initially wrapped about a pair of film strips during a splicing operation of the machine;

FIGURE 12 is a partial view, similar to FIGURES 2 and 10, illustrating a further stage in the splicing operation;

FIGURE 13 is an enlarged detail of certain parts of FIGURE 12, illustrating the same in a still further stage of the splicing operation;

FIGURE 14 is a view similar to FIGURE 9 illustrating the parts of the machine when the latter is in the condition of FIGURE 12;

FIGURES 15, 16 and 17 are enlarged details similar to FIGURE 13, illustrating further stages of the splicing operation; and

FIGURES 18–26 diagrammatically illustrate the splicing operation of the present machine.

Referring now to the drawings, and particularly to FIGURES 1 through 9 thereof, showing the machine in its normal inoperative condition, the numeral **30** denotes a stationary casing of the machine. This casing comprises a base part or plate **32** to the underside of which are fixed supporting legs **34**.

Fixed to and rising from the side and rear edges of the base plate **32** are side panels **36** and a rear panel **38**, respectively. The side and rear panels are bridged at their upper end by an integral top panel portion **40**. The side panels **36** extend from the rear edge of the base for approximately three quarters of the length of the latter in a fore and aft direction. The top panel **40** of the stationary casing extends about one quarter of this distance and has its forward edge crimped at **42**. Forwardly of the crimp **42**, the top panel is continued in laterally spaced flange portions **44**, defining a slot therebetween.

From the descriptioin thus far, it will be seen the stationary casing **30** is closed on its sides by the side panels **36**, at its rear by the rear panel **38**, and has a portion of its top closed by the top panel **40**. The forward portion of the stationary casing is open at its top and front.

Rigidly fixed to the base plate **32**, a distance from the rear edge thereof, and extending transversely of the base plate, is a rear upstanding wall **46**. As shown most clearly in FIGURES 4 and 9, a vertical supporting side wall **48** is rigidly fixed to the base plate **32** at one end of the rear wall **46** and extends forwardly a distance from the rear wall in a plane paralleling the right hand edge of the base plate **32**, as the machine is viewed from the front. A left hand, vertical supporting side wall **50** is rigidly fixed to the base plate **32** at the other end of the rear wall **46** and extends forwardly therefrom in a plane parallel to the left hand side edge of the base plate **32**, as the machine is viewed from the front. The side

supporting walls 48 and 50 are spaced inwardly a distance from the adjacent side edges of the base plate 32, as shown.

Fixed to the forward edge of the base plate 32 are a pair of vertical supporting walls 52 and 54 which may be seen most clearly in FIGURES 2 and 9. The forward walls 52 and 54 are appreciably shorter in the vertical direction than the other abovementioned walls.

Extending in a fore and aft direction between and fixed at opposite ends to each of the forward supporting walls 52 and 54 and the rear supporting wall 46 are a pair of guide rails or rods 56 which are spaced a distance above the supporting plate 32. These guide rails 56 slideably support a carriage part, generally indicated at 58, for forward and rearward movement in the stationary housing 30.

To this end, the carriage 58, which may, for example, comprise a casting, is formed with a pair of lower, divergent legs 60 and 62 which may be seen most clearly in FIGURE 4. Legs 60 and 62 of the carriage terminate at their lower ends in forwardly elongated bearing blocks 64 and 66. The blocks 64 and 66 are axially bored and counter-bored as indicated at 68 in FIGURE 2 for receiving ball bushings or sleeve bearings 69. Bearings 69 receive the guide rails 56 slideably therethrough so that the carriage 58 is supported on the guide rails for the aforesaid forward and rearward movement in the stationary casing 30.

Carriage 58 includes a relatively slender vertical rib 70 which rises from the upper ends of the divergent carriage legs 60 and 62 and terminates at its upper end in a flat plate portion 72. Removably fixed to this plate portion 72, by a knurled nut 73, is a supporting bracket 74, including a pair of arms 75 (FIGURE 4) which extend a distance beyond opposite sides of the rib 70. Extending forwardly from the ends of the arms 75 are a pair of arms 76 (only one shown). The ends of the arms 75 and 76 have enlarged bosses, as illustrated, formed with coplanar upper surfaces for supporting an upper movable casing 78.

The movable casing 78 comprises an upper panel 80 which, in the normal inoperative position of the parts illustrated in FIGURE 2, extends forwardly from the plane of the rear panel 38 of the stationary casing 30 to a position somewhat forwardly of the forward edge of the side panels 36 of the stationary casing.

As shown, the upper panel 80 of the movable casing 78 is located a distance above the upper panel 40 of the stationary casing 30 and has its rear edge downwardly flanged to form a rear panel 82. The lower edge of the rear panel 82 of the movable casing terminates just above the upper panel 40 of the stationary casing and is crimped, as shown. A forward panel 84 of the movable casing extends downwardly, in a vertical plane, from the forward edge of the top panel 80 and terminates a distance above the base plate 32 of the machine.

The movable casing 78 is completed by a pair of side panels 86 (FIGURE 4) which extend downwardly from side edges of the top panel 80. Approximately the rear two thirds of the side panels 86 terminate in the plane of the lower edge of the rear panel 82 of the movable casing, as shown in FIGURE 2. The forward one-third portion of the side panels 86 extend downwardly and terminate in the plane of the lower edge of the front panel 84 of the movable casing, so that the side panels of the movable casing have a generally L-shaped configuration.

The movable casing 78 is secured to the bracket 74 by means of screws 88. Fixed to the upper surface of the top panel 80, adjacent the forward edge thereof, and overlying an opening 90 therein is a generally dome-shaped cover 92.

As will be seen, the movable casing 78 moves forwardly and rearwardly with the carriage 58, during operation of the machine, the rear panel 82 of the movable casing being located just rearwardly of the forward edge

of the top panel 40 of the stationary casing when the carriage 58 is in its forward limiting position.

Legs 60 and 62 of the carriage 58 are formed on their outer surfaces with vertical reinforcing webs 94 and 96. Extending slideably through aligned openings in these webs 94 and 96 and the forward vertical supporting walls 52 and 54, in vertically spaced, parallel relationship to the guide rails 56, are a pair of rods 98. Rods 98 have collars 100 fixed thereon between their respective carriage legs 60 and 62 and the forward supporting walls 52 and 54. Encircling the rods 98 between, and abutting at opposite ends the respective forward walls 52 and 54 and the fixed collars 100, are a pair of coil compression springs 102 which bias the rods 98 rearwardly. Rearward movement of the rods 98 is limited by abutment of a panel 104, fixed to the forward ends of the rods, with the forward faces of the stationary supporting walls 52 and 54.

Panel 104 forms the front panel of a lower movable casing 106 which may be best seen in FIGURES 1 and 9 to additionally comprise a pair of vertical, rearwardly extending side panels 108. Side panels 108 of the lower movable casing extend slideably between the inner surfaces of the side panels 36 of the stationary casing 30 and vertical flanges 110 on a pair of L-shaped brackets 112 fixed to the base plate 32 of the machine within the stationary casing.

From the description thus far, it will be seen that the casing, or housing, of the present machine is composed of three parts, namely, the lower stationary casing 30, the upper movable casing 78, and the lower movable casing 106. During operation of the machine, as will be hereinafter more fully described, the carriage 58 and upper movable casing 78 moves forwardly and rearwardly as a unit, as abovementioned. The lower movable casing 106, however, remains stationary until the forward surfaces of the webs 94 and 96 on the carriage legs 60 and 62 are brought into abutment with the collars 100 on the rods 98 by forward travel of the carriage. The rods 98 and the stationary casing 106 secured thereto are thereafter moved forwardly with the carriage against the action of the compression springs 102. During subsequent rearward travel of the carriage 58 from its forward limiting position to its normal rearward position, illustrated in FIGURE 2, the stationary casing 106 is moved rearwardly to its normal position of FIGURE 2, by the action of the coil springs 102.

Movable casing 106 is open at its top and, in FIGURE 2, will be seen to extend forwardly a distance of the front panel 84 of the upper movable casing 78. Indicated at 114 and 116 in FIGURES 2, 6 and 9 are a pair of generally L-shaped film supports having laterally spaced, vertical legs 118, rigidly fixed to the base plate 32 of the machine.

In use of the machine, the supports 114 and 116 hold the film strips in proper position to be spliced. To this end, the horizontal legs 120 of the supports are formed with aligned, upwardly opening channels 122 extending transversely of the machine. Legs 120 are located in the plane of the open top of the lower movable casing 106, forwardly of the front panel 84 of the upper movable casing 78 when the latter is in its rear position shown in FIGURE 2. The opposing ends of the film supporting legs 120 are spaced, as shown most clearly in FIGURE 6, to define a gap 123 between the film supports.

Fixed to the supporting base 32 of the machine, rearwardly of the film supports 114 and 116, is a block 124, located in the plane of the gap 123. Hinged at one end to block 124 for vertical pivotal movement in this plane is an arm 126 formed at its free end with an oblique plate 128. The width of this plate 128 is slightly less than the gap 123 between the film supports.

Prior to operation of the machine, the pivotal arm 126 occupies its upper position illustrated in FIGURE 2, wherein the plate 128 is located in the gap 123 with its flat upper surface coplanar with the bottoms of the chan-

nels **122** in the horizontal film support legs **120**. Upward pivotal movement of the arm **126** to this position is limited by abutment of shoulders **132** on the arm **126** with cooperating shoulders **134** on the channel plates **120**. Plate **128** has an upstanding rib **136** extending transversely of and located midway between the horizontal film support legs **120**.

In use of the machine, film strips S1 and S2, to be spliced, are positioned in the channels **122** of the film supports **114** and **116** and are located in proper splicing position by placing their butt ends in contact with the rib **136** on the film supporting arm **126**. As just mentioned, at this point the arm **126** will occupy its upper position of FIGURE 2 wherein its plate **128** supports the ends of the film strips which extend beyond the ends of the film support legs **120** into the gap **123** therebetween.

A pair of clamp plates **138** and **140** are hinged at **142** to the rear edges of the film support legs **120** for vertical pivotal movement between the dotted line open position of FIGURE 3 to the solid line closed position of that figure. In this closed position, resilient pads **144** on the clamp plates bear on the film strips S1 and S2 to press the latter firmly against the bottoms of the channels in the film supports. The clamp plates **138** and **140** are retained in closed position by resilient latch arms **146** which are secured to the forward faces of the film supports **114** and **116** and engage over forward edges of the clamp plates to retain the latter in closed position. It will be observed in FIGURE 2 that in the normal rear position of the upper movable casing **78**, the forward panel **84** thereof is positioned sufficiently rearwardly of the film supporting structure, just described, to permit opening of the clamp plates **138** and **140**. Moreover, in the closed position of the clamp plates, the upper surfaces of the latter are located below the lower edge of the panel **84** so as to not obstruct forward movement of the upper movable casing **78** with the carriage.

Film supporting arm **126** is retained in its upper limiting position of FIGURE 2, when the machine is in its inoperative condition of that figure, by means of a link chain **148** attached at one end to the free end of the arm and at the other end to a hook **150**. Hook **150** is secured to one end of a coil spring **152**, the opposite end of which is secured to a rod **154** threaded in a downwardly depending arm **156** on the carriage **58**. The tension in the spring **152**, acting to retain the arm in its upper position, may be adjusted by threading the rod **154** into and out of the depending carriage arm **156**, a lock nut **58** being provided to retain the rod **154** in adjusted position. During forward movement of the carriage, the film supporting arm **126** is allowed to drop under its own weight and is again raised to its upper limiting position by subsequent rearward travel of the carriage to its position of FIGURE 2.

The film supporting arm **126** is thus lowered from its operative position of FIGURE 2 to its inoperative position of FIGURE 10 during the splicing operation of the machine to permit entrance of tape wrapping means, generally indicated at **160**, into gap **123** between the film supports. Tape wrapping means **160** are mounted on the carriage **58**.

Tape wrapping means **160** comprise a pair of upper and lower pressure rollers **162** and **164**, hereinafter also referred to in places as folding or wrapping members, shown in detail in FIGURE 7. The upper pressure roller **162** comprises a thin cylindrical shell **166** which is journalled at opposite ends, by bearings **168**, on a central supporting shaft **170**. Opposite ends of shaft **170** are fixed in a pair of plates **172** which are rigidly attached, by the screws shown, to opposite side faces of a forwardly projecting portion **174** of the carriage **58**. The forward ends of the pressure roller supporting plates **172** are reduced in width to form relatively slender tongues **176** which extend a distance forwardly of the forward face of the carriage portion **174**.

The spacing between the outer surfaces of the tongues **176** is slightly less than the width of the gap **123** between the film supports to permit movement of the upper roller **162** into this gap. The lower edges of the pressure roller supporting plates **172** are located substantially in the plane of the upper surfaces of the film strips S1 and S2, the upper pressure roller **162** having its lower periphery projecting slightly below these lower edges of the supporting plates, as shown.

The lower pressure roller **164** comprises, as shown most clearly in FIGURE 7, an outer cylindrical sleeve **178** which is journalled on a central supporting shaft **180** by a single ballbearing **182**, located intermediate the ends of the sleeve **178**. This bearing arrangement accommodates slight rocking of the sleeve **178** on the shaft **180**.

Opposite ends of the central supporting shaft **180** are fixed in a pair of arms **184** which, in turn, are secured at their rear ends to a pair of angularly extending arms **186**. These angularly extending arms **186** are hinged at an intermediate point **188** to the downwardly depending carriage arm **156** for swinging of the arms **186** and the lower pressure roller **164** in a vertical plane toward and away from the relatively fixed upper pressure roller **162**.

The upper edges of the lower pressure roller supporting arms **184** are located substantially in the plane of the lower surfaces of the film strips S1 and S2 when the arms **184** are in their upper limiting position of FIGURE 2.

The lower pressure roller **164** has its upper periphery projecting slightly above the upper edges of its supporting arms **184**, upward swinging movement of the latter arms being limited to the position of FIGURE 2 by abutment of the lower roller **164** with the upper roller **162**, as shown. The lower pressure roller supporting arms **184** and the lower pressure roller **164** journalled thereon are resiliently biased to this upper limiting position of FIGURE 2 by a pair of coil tension springs **190**, secured at one end to the angular extending arms **186** and at their lower ends to a pair of pins **192** extending inwardly from the bearing blocks **64** and **66** at the lower ends of the carriage legs **60** and **62**.

In this upper limiting position, it will be observed that a slight gap exists between the upper edges of the arms **184** and the lower edges of the upper pressure roller supporting plates **172**, which gap receives the film strips S1 and S2 when the carriage is moved to its forward limiting position.

Fixed between the forward ends of the upper roller support plates **172** and the lower pressure roller support arms **184** are a pair of nylon film guides **194**. The forward edge surfaces of these guides are beveled, as shown, to facilitate leading in of the film strips into the gap between the plates **172** and the arms **184**. Guides **194** have V notches **196** (FIGURE 9) which also aid in leading the film strips into the gap.

In each operating cycle of the machine, as will be hereinafter more fully described, the pressure rollers **162** and **164** are moved across the upper and lower surfaces of the film strips, to fold a section of adhesive tape thereabout, by movement of carriage **58** from its normal rear position to a forward limiting position, and back to its normal position.

Forward and rearward movement is imparted to the carriage **58**, to thus move the pressure rollers across the film strips by drive means **198**. Drive means **198** comprises a reversible, capacitor type drive motor **200** which, as shown most clearly in FIGURE 4, is mounted on the inner vertical side wall **48**.

The shaft of this motor mounts a pulley **202** around which, and a driven pulley **204** fixed to a lead screw **206**, is trained a drive belt **208**. As shown in FIGURE 9, lead screw **206** extends in a fore and aft direction and has its rear end journalled in the rear supporting wall **46** by a ballbearing assembly **210**. The lead screw projects a distance rearwardly of the wall **46** for mounting the driven pulley **204**.

The upper carriage leg **62**, as viewed in FIGURE 9, is formed with an enlarged boss **212** which is elongated in the direction of carriage travel. A bore **214** extends axially through this boss. Fixed against both rotation and axial movement in the bore **214** is an internally threaded sleeve **216**. Lead screw **206** extends through the bore **214** and is threaded in the sleeve **216** so that opposite directions of rotation of the lead screw cause forward and rearward movement of the carriage.

Mounted on the left hand supporting wall **48**, as viewed in FIGURE 4, below the motor **202**, is a capacitor **218** which operates in the manner hereinafter described to reverse the direction of rotation of the motor, and, hence the direction of carriage movement.

The adhesive, or pressure sensitive tape, which is wrapped around the film strips S1 and S2 by the pressure rollers to effect a splice during the aforementioned movement of the pressure rollers **162** and **164** across the strips, is received from a supply roll **220**. In FIGURES 2, 4 and 6, this supply roll **220** will be seen to be located directly above the forward ends of the pressure roller supporting plates **172** and supporting arms **184**.

Roll **220** is journalled on a horizontal, laterally extending shaft **222**, the left hand end of which, as viewed in FIGURE 6, is fixed in the upper end of a generally vertical arm **224**. Arm **224**, in turn, is pivotally connected to the forward end of a generally horizontal arm **226** by a journal pin **228** located a short distance below and paralleling the supply roll shaft **222**.

During operation of the machine, it is necessary, for reasons to be seen, to move the supply roll **220** with the carriage **58** and to raise and lower the roll at predetermined positions of carriage travel. To this end, the generally horizontal arm **226** is hinged at intermediate point, by a bearing pin **230**, to the upstanding rib **70** of the carriage **58**. Arm **226** is thus swingable in a vertical plane to raise and lower the supply roll **220**.

The arm **226** is biased in a direction to lower the supply roll **220** by a coil tension spring **232** connected between the arm, forwardly of its pivot **230**, and the forward carriage portion **174**. Pivoting of the arm **226**, under the action of the spring **232**, is limited by contact of a pair of rollers **234**, journalled on the rear end of the arm **226**, with a stationary control cam **236**.

Control cam **236** is attached to the inner surface of the right hand, as viewed in FIGURE 4, support wall **50**, adjacent the upper edge of the latter. The lower edge surface of this control cam, which cam is elongated in a fore and aft direction, defines a cam surface **238** (FIGURE 2) along which the rollers **234** ride during forward and rearward travel of the carriage **58**.

The rear section **238A** of this cam surface is straight and horizontal as shown. Forwardly of the section **238A**, the cam surface **238** continues in a concave section **238B**, the forward end of which merges with a straight, downwardly inclined section **238C**. Cam surface **238** is completed by a straight section **238D** extending forwardly from the lower end of the inclined section **238C** in parallel relationship to the rear straight section **238A**.

From the description thus far, of the supply roll supporting structure, it will be seen that during initial forward travel of the carriage and supply roll, from their inoperative position of FIGURE 2, the cam follower rollers **234** traverse the straight section **238A** of the cam surface **238**. The vertical positioning of the supply roll, therefore, remains unchanged.

Engagement of the rollers **234** in the concave section **238B** permits slight downward swinging of the forward end of the supply roll support arm **226** and lowering of the supply roll. Immediately thereafter, the cam follower rollers **234** ride onto the inclined section **238C** of the cam surface with resultant downward camming of the rear end of the arm **226** and elevating of the supply roll. During the final increment of forward travel of the carriage, the supply roll is retained in its elevated position by engagement of the cam follower rollers with the forward straight section **238D** of the cam surface **238**. In its elevated position, the supply roll **220** projects through the opening **90** in the top panel of the upper movable casing **78** into the dome-shaped cover **92**.

Indicated at **240** is a pivotal ramp which is centrally hinged at **242** to the side wall **50** for vertical swinging movement. The ramp **240** is so proportioned that its center of gravity is located rearwardly of its pivot **242**. The platform tends, therefore, to normally occupy the position of FIGURE 2 wherein a forward bevelled edge surface of the platform abuts the lower end of the inclined section **238C** of the cam surface **238** to limit upward swinging of the forward end of the ramp. In this normal position of the ramp, its lower face is substantially coplanar with the forward section **238D** of the cam surface **238**.

Accordingly, during initial rearward travel of the carriage from its forward limiting position, to be described, wherein the cam follower rollers **234** engage the forward cam surface section **238D**, to an intermediate position wherein the rollers **234** are approximately directly below the ramp pivot **242**, the supply roll **220** is retained in its aforementioned elevated position.

Continued rearward movement of the carriage beyond this intermediate position results in the ramp tilting in a counterclockwise direction, as viewed in FIGURE 2, due to the force exerted thereon, through the cam follower rollers **234**, rearward of its pivot **242** by the biasing spring **232**. The supply roll **220**, therefore, is gradually lowered to its normal position of FIGURE 2 during this later portion of carriage travel to its normal position of FIGURE 2. Disengagement of the cam follower rollers from the ramp near the end of the carriage movement, of course, releases the ramp for swinging to its normal position of FIGURE 2 under the force of gravity.

As will become clear as the description proceeds, the supply roll is raised and lowered in this fashion to effect, during each splicing operation of the machine, unwinding of a length of tape **244** from the supply roll and predetermined positioning of the end section of the tape thus unwound to place the machine in readiness for the next splicing operation.

Carried on the vertical supply roll supporting arm **224** are a series of three horizontal tape guide rollers **246**, **248** and **250**. Roller **246** is located proximate to the supply roll while rollers **248** and **250** are located at the lower end of the arm **224**.

The two lower tape guide rollers **248** and **250** are located in front of the forwardly extending portion **174** of the carriage **58**, as may be seen most clearly in FIGURES 2, 6 and 9. This portion of the carriage has a forward, vertical face **252** located in a vertical plane tangent to the forward sides of the tape wrapping pressure rollers **162** and **164**. A coil tension spring **254**, connected between the pivotally connected, vertical and horizontal tape roll supporting arms **224** and **226**, respectively, acts to bias the lower tape guide roller **250** against the forward face **252** of the carriage.

When initially setting up the machine for operation, a length of tape **244** is unwrapped from the supply roll and is passed about the uppermost tape guide roller **246**. The tape leads from this latter roller, around the front side of the lower guide roller **248**, between the latter and the other lower guide roller **250**, and then about the rear side of the roller **250** between the latter and the forward carriage face **252**.

The lower, free end **244A** of the tape hangs vertically from the lower guide roller **250**, as shown in FIGURE 2, and extends downwardly betwen the pressure roller support plates **172** and support arms **184**, in contact with the forward sides of the pressure rollers **162** and **164**. The length of the tape which hangs below a horizontal plane of tangency passing betwen the pressure rollers **162** and **164** is made slightly less than one half the width of

the film strips S1 and S2 being spliced, for reasons to be seen. The adhesive side of the tape 244 is forward, as viewed in FIGURE 2.

As may be observed most clearly in FIGURE 6, the lower tape guide roller 250 is strictly cylindrical. The other lower tape roller 248, on the other hand, has annular end shoulders 248A which guide the tape 244.

Briefly, during operation of the machine, the carriage 58, pressure rollers 162, 164, tape roll 220, and the tape end 244A are driven in a forward direction toward the film strips S1 and S2 to bring the freely hanging section of tape 244A into initial contact with the rear edges of the film strips. The tape supply roll, cam follower rollers 234 ride into the concave cam surface section 238B simultaneously with this initial contact of the tape with the film strips.

Continued forward travel of the carriage after this initial contact results in movement of the pressure rollers 162 and 164 across the upper and lower surfaces, respectively, of the film strips. The section 244A of tape 244 is thereby doubled on itself and pressed against the upper and lower film strip surfaces by the pressure rollers 162 and 164, in the manner illustrated in FIGURE 11, and hereinafter more fully described.

As just mentioned, the cam follower rollers 234 engage in the concave cam surface section 238B upon initial contact of the tape and film. The tape supply roll 220, supply roll supporting arm 224, and the guide rollers 246, 248 and 250 are thereby lowered slightly to provide slack in the tape, between the upper pressure roller 162 and the lower tape guide roller 250, during initial folding of the tape about and rolling thereof against the upper and lower surfaces of the film strips. Upward drawing of the tape around the rear edges of the film strips, to shorten the length of tape at the underside of the film strips, is thereby avoided.

After sufficient adhesive bond between the film strips and tape has been established to preclude this upward drawing of the tape, the cam follower rollers 234 ride onto the inclined cam surface section 238C with resultant raising of the tape supply roll 220, supporting arm 224 therefor, and the tape guide rollers thereon. A length of the tape 244 is thereby unwound from the supply roll as the pressure rollers move across the film.

As will be hereinafter more fully described, after the pressure rollers have traversed the width of the film strips, the tape 244 is cut at such a point below the then elevated lower tape guide roller 250 as to furnish the proper length of tape for completion of the splicing operation, as well as a new freely hanging tape section 244A of the length previously mentioned.

This cutting of the tape is accomplished by a hinged cutter generally indicated at 256 in FIGURE 9. Cutter 256 comprises a generally L-shaped blade support 258. This blade support is pivoted at 260 to a lateral extension 261 on the carriage 58, for rocking in a horizontal plane spaced a distance above the pressure rollers 162 and 164, as may be seen best in FIGURE 2. One leg 258A of this blade support extends in front of the forwardly extending carriage portion 174, while the other leg 258B of the support extends rearwardly along the left hand side of the carriage, as the machine is viewed from the front.

Fixed in the blade support leg 258A and projecting rearwardly therefrom is a thin, horizontal cutting blade 262. Carriage portion 174 has a narrow horizontal slot 264 (FIGURE 2) in its forward face 252 for receiving the blade 262 when the blade support is rocked in a counterclockwise direction, as viewed in FIGURE 9, to shear the tape 244. The cutting edge of the blade is so inclined that it enters the slot at an angle to the forward carriage face 252, the lower end of the cutting blade, as the latter is viewed in FIGURE 9, entering the slot first. A progressive shearing effect is thereby achieved.

The blade support 258 is biased from its normal inoperative position of FIGURE 9 to its cutting position, FIGURE 14, wherein the blade 262 is received in the slot 264, by a coil tension spring 266 connected between the forward cutter support leg 258A and a latch 268 hinged at 270 to a lug 272 extending from the carriage 58. Latch 268 is stopped against swinging forward beyond its position of FIGURE 9 by abutment of an end face 273 thereon with the side of the carriage.

The blade support is normally releasably retained against rocking to its cutting position by the latch 268. To this end, the latch has a hook or lip 269 engageable over the rear end of the blade support leg 258B, as shown in FIGURE 9.

During forward travel of the carriage to accomplish a splicing operation, the tip of the latch 268 engages the inner end of a trip arm 274 (FIGURES 6 and 9). The latch 268 is rocked rearwardly by the arm 274, as viewed in FIGURE 9, to release the blade support for movement of the latter to its cutting position under the action of its spring 266.

The outer end of the trip arm 274 extends through an opening 276 in the left hand side support wall 50 and is vertically pivoted at 278 to a projecting lug 280 on the outer surface of that wall. Trip arm 274 is biased in a clockwise direction in FIGURE 9 by a coil spring 282 connected between its outer end and a pin 284 fixed in the wall 50. Rocking of the trip arm 274 by the spring 282 is limited by an adjustable stop screw 286.

Thus, when the latch 268 engages the trip arm 274 during forward travel of the carriage, the trip arm is held against forward rocking by the stop screw 286 and the latch 270 is released. During subsequent rearward travel of the carriage, the trip arm 274 rocks rearwardly when engaged by the latch so as to not obstruct rearward carriage travel.

Blade support 258 is rigid on its pivot pin 260, the latter being journalled in and projecting above the lateral carriage arm 261, as shown in FIGURE 6. Rigid on the upper end of the pin 260, so as to be rockable with the blade support, is an arm 288. Arm 288 extends toward the carriage 58, at an acute angle to the blade support leg 258B, and mounts a camming roller 290 at its end.

Roller 290 is located in the horizontal plane of a cam arm 292 which is hinged at 294, for swinging in this plane, to a boss 296 on the inner side of the left hand support wall 50. Cam arm 292 is biased rearwardly by a spring 298 connected between the arm and a pin 300 fixed in the wall 50. Rearward rocking of the cam arm 292 by its spring is limited to the position of FIGURE 9 by a flat inner edge surface 302 on the arm. The forward edge of the cam arm 292 is terminally beveled to form a cam face 304.

When the blade support 258 is in its inoperative position of FIGURE 9, the tip of the cam arm 292 lies slightly in the path of the camming roller 290 on the blade support. During forward travel of the carriage 58, therefore, the cam arm 292 will be rocked forwardly when engaged by the blade support camming roller 290 so as to not obstruct forward travel of the carriage.

It will be observed in FIGURE 9 that the latch 268 engages the trip arm 274 to effect release of the blade support 258 after the camming roller 290 on the support has been carried to a position forwardly of the cam arm 292. The camming roller 290 is thereby swung upwardly, as viewed in FIGURE 9.

During the return stroke of the carriage, the camming roller 290 engages the beveled cam face 304 of the cam arm 292. Since the cam arm 290 is restrained against rearward pivotal movement by abutment of its inner flat edge 302 with the support wall 50, the camming roller 290 will be cammed downwardly as viewed in FIGURE 9, by the cam face 304. Blade support 250 is thereby rocked from its cutting position (FIGURE 14) which it then occupies, to and slightly beyond its inoperative position of FIGURE 9.

The blade support is thus rocked slightly beyond its inoperative position, of course, due to the fact that in the latter position the tip of the cam arm **292** projects slightly into the path of the camming roller, as just mentioned. Accordingly, camming of the blade support roller **290** past the end of the cam arm during the return stroke of the carriage results in the rocking of the blade support slightly beyond its inoperative position. The reason for thus rocking the blade support beyond its normal position is to enable the lip **269** of the latch to engage over the blade support leg **258B** under the action of its biasing spring **266**. The tip of the latch is forwardly beveled, as shown, so as to enable the blade support to cam the latch rearwardly as the support rocks toward its latching position. After the idler roller is carried clear of the cam arm **292**, the blade support is rocked back slightly to its normal latched position of FIGURE 9 by its spring **266**.

As will be more fully explained in the description of the operation of the machine, release of the blade support to shear the tape **244** occurs near the limit of the forward stroke of the carriage **58**. The sheared end of the tape drops under its own weight and during the subsequent return stroke of the carriage is wrapped downwardly around the forward edges of the film strips **S1** and **S2** and then across the under surfaces of the strips. As will be seen, the sheared end of the tape is rolled onto the under surfaces of the film strips by the lower pressure roller **164** during the carriage return stroke.

To enable this rolling of the tape onto the lower surfaces of the film strips, it is necessary that the sheared end portion of the tape occupy a position rearwardly of the lower pressure roller **164** prior to rearward movement of the pressure rollers across the film strips. To this end, the lower pressure roller is swung downwardly, away from the upper pressure roller **162** immediately after shearing of the tape and the sheared end of the tape is bent downwardly around the forward edges of the film strips to a position behind the lower pressure roller.

Lowering of the lower pressure roller **164** is accomplished by engagement of a cam roller **306** (FIGURE 2), carried on the lower pressure roller support arms **186**, with an inclined cam face **308** on the bearing block **124** for the pivoted film support **124**. Cam roller **306** is journalled in the lower, bifurcated end (see FIGURE 4) of a generally vertical arm **310** which is hinged at **312** between the rear ends of the pivoted support arm **186** for the lower pressure roller.

Roller arm **310** is biased in a direction to swing its lower end toward the rear of the machine by a coil spring **314** connected between the upper end of the roller arm **310** and the pressure roller support arms **186**. Swinging of the roller arm in this direction is limited to the position of FIGURE 2 by abutment of the forward edge thereof with the pin **193** to which the lower pressure roller biasing springs **190** are attached. The lower end of roller arm **310** is free to swing in a forward direction against the action of the spring **314**.

As will be seen, the cam roller **306** engages its cam surface **308**, during forward travel of the carriage **58**, immediately after shearing of the tape **144**. The roller **306** is cammed upwardly by the cam face **308**, with resultant downward swinging of the lower pressure roller **164**. The lower pressure roller is returned to its normal position of FIGURE 2 by its spring **190**, after the cam roller **306** clears the bearing block **124**. The forward face of this block is cylindrically grooved at **316** to facilitate riding of the cam roller **306** over the block **124** during the return stroke of the carriage. During this return stroke the lower end of the cam roller support arm **310** rocks forwardly upon engagement with the block **124** to permit passage of the cam roller **306** over the block without lowering of the lower pressure roller **164**.

Indicated at **318** in FIGURES 2 and 8 is a pressure plate which is pivoted at **320** between the supporting plates **172** for the upper pressure roller **162**. The pressure plate **318** is located rearwardly of the upper pressure roller, and has a tapered lower end, as shown in FIGURE 2. Attached to the upper end of the pressure plate and serving to resiliently retain it in its vertical position of FIGURE 2, is a coil spring **322**. Spring **322** is received in a vertical bore in the forwardly extending carriage portion **174** and has its upper end fixed to a transverse pin **324**.

As will be seen, this pressure plate serves to bend the sheared end of the tape **244** downwardly around the forward edges of the film strips **S1** and **S2**, to a position behind the lower pressure roller **164**, for reasons briefly mentioned above and hereinafter more fully discussed.

The electrical control system of the machine is relatively simple and is schematically illustrated in FIGURE 9A. Electrical power for operating the machine is derived from a source **326** through a pair of lines **328** and **330**. Line **328** leads to the capacitor **218** for the drive motor **200** through a pair of series connected, normally open micro switches **332** and **334**. As may be seen most clearly in FIGURES 2, 3, 6 and 9, these microswitches are mounted on the film supports **120** and are arranged to be closed when the film clamps **138** and **140** are latched in film clamping position. Thus, line **328** will be open unless the clamps are latched in closed position.

Line **330** leads to the capacitor **218** through a pair of parallel connected microswitches **336** and **338**. Switch **336**, comprising a main starting switch, is of the normally open type and is mounted on the front, left hand support wall **52** of the machine, as shown in FIGURES 2 and 9. The button of the switch extends through an opening in the lower movable front panel **104** of the machine for actuation by the operator of the machine. Switch **338** is of the normally closed type and is mounted on the rear supporting wall **46** of the machine, as shown best in FIGURES 2, 9 and 14. The button **340** of this switch projects forwardly of the wall **46** for engagement by an adjustable stop screw **342** on the carriage **58**. The stop screw **342** contacts the switch button **340** to open the switch **338** upon movement of the carriage to its rear, limiting position of FIGURE 2. Motor **200** is connected to the capacitor **218** through the lines **344**.

Fixed to the right hand support wall **48**, as the machine is viewed in FIGURE 6, is a reversing switch **346**, including an operating stem **348**. Switch **346** is connected between the capacitor **218** and motor **200** and is effective to reverse the connections between the capacitor and motor to reverse the direction of rotation of the latter. The stem of switch **346** is movable in a fore and aft direction, and when moved to either its forward or rearward position will remain therein. When the stem of switch **346** is in its rear position, motor **200** is conditioned to drive in a direction to cause forward travel of the carriage. When the stem is moved to its forward position, the direction of the motor **200** is reversed and the carriage **58** is driven toward the rear of the machine.

Switch **346** is operated by a pair of somewhat flexible arms **352** and **354** (see FIGURES 4, 6 and 14), fixed to an angle **356**. Angle **356** is secured to the right hand, as viewed in FIGURE 6, carriage leg **60**. The forward switch actuating arm **352** engages the switch stem **348** to move the latter to its rear position upon movement of the carriage to its rear limiting position. Similarly, the rear switch actuating arm engages the switch stem **348**, to move the latter to its forward position, upon movement of the carriage to its forward limiting position.

Thus, if the film clamp switches **332** and **334** are closed due to the film clamps **138** and **140** being latched in closed position, the capacitor **218** and the motor **200** are energized by closure of the main starting switch **336**. Limit switch **338** will be open at this time, and the stem **348** of the reversing switch **346** will occupy its rear posi-

tion since the carriage is in its normal, rear position of FIGURE 2.

Carriage **58** is therefore driven forwardly. Immediately upon forward movement of the carriage, limit switch **338** closes so that motor **200** remains energized even though the main starting switch **336** is now released. The motor continues to drive in a forward direction until the carriage reaches its forward limiting position. The stem **348** of the reversing switch is now moved to its forward position, to reverse the motor and direction of carriage travel, by contact of the rear switch actuating arm **354** with the stem.

Rearward driving of the carriage continues until, upon reaching its rear limiting position, the stop screw **342** engages the button **340** of the limit switch **338** to open the latter and deenergize the motor. Reversing switch stem **348** is simultaneously moved to its rear position by the forward actuating arm **352** to condition the motor for subsequent driving of the carriage in a forward direction. An adjustable stop **358** (FIGURE 9) engageable with the right hand forward support wall **54**, serves to positively limit forward movement of the carriage.

This completes the structural description of the machine.

A complete operating cycle will now be described.

Operation

As mentioned, the parts of the machine occupy their positions illustrated in FIGURES 1–9 prior to operation of the machine. The hinged film support **126** now occupies its upper position of FIGURE 2 with its upper plate portion **128** located in the gap **123** between and flush with the bottoms of the channels **122** in the film supports **114** and **116**.

After placing the film strips S1 and S2 in the channels **122** of the film supports with their butt ends contacting the locating rib **136** on the hinged film support, the film clamps **138** and **140** are closed and latched to retain the film in proper splicing position. Latching of the film clamps in closed position conditions the machine for operation as previously explained.

The starting switch **336** is now depressed to cause driving of the carriage **58**, and parts carried thereon, from their normal rear position toward the front of the machine. The hinged film support is lowered to its position of FIGURE 10 under its own weight, during initial forward travel of the carriage, to clear the gap between the film supports for entrance thereinto of the tape wrapping means **160**.

Forward movement of the carriage **58** results first in entrance of the film guide inserts **194**, on the forward ends of the upper and lower pressure roller supports **172** and **184**, respectively, into the gap **123**. The beveled end faces **194** and V-shaped notches **196** on these inserts guide the now unsupported end portions of the film strips into the narrow space between the pressure roller support arms **172** and **184**. Shortly thereafter, the carriage reaches a position, shown in solid lines in FIGURE 10 and diagrammatically illustrated in FIGURE 18, wherein the adhesive side of the tape contacts the rear edges of the film strips.

During travel of the carriage to this position, the tape supply roll **220**, as well as the lower tape guide rollers **248** and **250**, are retained in their initial vertical position of FIGURE 2, owing to engagement of the supply roll cam follower roller **234** with horizontal cam surface section **238A**. As previously mentioned, therefore, the length of the freely hanging section **244A** of tape **244** below the plane of the film strips is just slightly less than the width of the film strips.

Continued forward travel of the carriage beyond this position of initial contact of the tape with the film strips results in engagement of the film strips between the upper and lower pressure rollers **162** and **164**. As shown in FIGURE 11, and diagrammatically illustrated in FIGURE 19, the tape section **244A** is thereby doubled on itself and is pressed against the upper and lower surfaces of the film strips by the upper and lower pressure rollers, respectively.

Immediately after initial contact of the adhesive side of the tape with the film edges, so that the tape adheres slightly to the film, the supply roll cam follower roller **234** rides onto the concave cam section **238B**. The supply roll **220** and the tape guide rollers **248** and **250** are thereby lowered, as the carriage moves forward, from their initial position of FIGURES 2, 10 and 18, to the position indicated in phantom lines in FIGURE 10 and diagrammatically shown in FIGURE 19.

This lowering of the supply roll and guide rollers is thus caused to occur after the section **244A** of tape is prevented from dropping with the supply roll by virtue of adherence of the tape to the edge of the film. The supply roll and guide rollers are thus lowered during initial rolling of the tape onto the upper and lower surfaces of the film strips to provide a degree of slack in the run of tape between the lower tape guide roller **250** and the upper pressure roller **162**. Upward drawing of the lower end of the tape about the rear edges of the film strips, due to rolling of tape on the upper surfaces of the film against the normal resistance to unwinding tape from the supply roll is thereby avoided. Such upward drawing of the film, of course, would result in shortening of the length of tape below the film strips which is undesirable for reasons to be presently seen.

After sufficient adhesive contact between the tape and film strips has been established to avoid this upward drawing of the tape section **244A**, by wrapping of the tape about a limited portion of the film strips (the positions of FIGURES 11 and 19), the supply roll **220** and tape guide rollers **248** and **250** are elevated during continued forward travel of the carriage and movement of pressure rollers acros the film strips. As previously discussed, the supply roll and guide rollers are thus elevated by riding of the supply roll cam rollers **234** onto the inclined cam surface section **238C**. During this elevating of these parts, the lower tape roller continues to be urged against the forward carriage face **252** by the spring **254**.

Continued forward travel of the carriage beyond the position of FIGURES 11 and 19 results in the length of tape below the film strips being rolled onto the lower surfaces thereof by the lower pressure roller **164** to approximately the center lines of the film strips. Simultaneously, the tape is rolled onto the upper surfaces of the film strips, for the entire width of the latter, by the upper pressure roller **162**. As a result of raising the tape supply roll **220** during this latter carriage travel, tape is unwound from the roll and the length of tape between the lower tape guide roller **250** and the upper pressure roller **162** is increased.

Upon the carriage reaching the position shown in FIGURE 12, and diagrammatically illustrated in FIGURE 20, the pressure rollers **162** and **164** will be located adjacent the forward edges of the film strips and the supply roll cam roller **234** will have moved downwardly to the lower end of the inclined cam surface section **238C**.

The tape supply roll **220** and the tape guide rollers **248** and **250** are thus elevated to their upper limiting positions of FIGURE 12 wherein the supply roll projects into the dome-shaped cover **92**. The parts are retained in these elevated positions for the remainder of forward carriage travel by riding of cam roller **234** onto horizontal cam surface section **238D**.

In these elevated positions of the parts, the distance A in FIGURE 12 between the lower tape guide roller **250** and the blade slot **264** is equal to the previously described length of tape section **244A**. The distance B in FIGURE 12, between the blade slot **164** and the plane of the film strips, is made such as to provide the lower sheared section of tape with a remaining length just suf-

ficient to be capable of being wrapped about the forward edges of the film strips and then across the undersides of the strips to approximately their center lines.

During the portion of carriage movement thus far described, the blade support **258** is retained in its inoperative position by its latch **268**. Upon the carriage reaching the position of FIGURE 12, the latch **268** contacts its trip arm **274**, with resultant rocking of the blade support to its cutting position of FIGURES 12, 13 and 14. The tape is thereby sheared in the plane of the blade notch **264** by the blade **262**.

Forward movement of the carriage to its forward limiting position continues during and following this cutting operation. The upper pressure roller **162** thereby continues to roll the now sheared portion of tape onto the upper surfaces of the film strips for the remaining width of the latter. As a result of shearing of the tape and continued rolling thereof onto the film, the sheared end of the tape, which is now unsupported, swings downwardly, as diagrammatically illustrated in FIGURE 21, and rests momentarily on the upper guide insert **194**.

Immediately after the pressure rollers **162** and **164** have been moved to a position slightly forwardly of the forward edges of the film strips, the lower pressure roller is rocked downwardly, as shown in FIGURES 13 and 22, away from the upper pressure roller by the afore-described camming action between the cam roller **306** on the lower pressure roller support arms and its cam face **308** on the upstanding bearing block **124**.

During its travel across the film strips, the hinged pressure plate **318**, following the upper pressure roller **162**, is rocked in a counterclockwise direction from its normally vertical position to the tilted position shown in FIGURES 12, 13 and 21. This rocking of the pressure plate, of course, occurs against the action of its spring **322**.

In the forward limiting position of the carriage, FIGURE 15, the pressure rollers are located a distance forwardly of the film strips, and the tip of the pressure plate **318** clears the forward edges of the strips. The pressure plate is, therefore, rocked to its normal vertical position, as shown in FIGURE 15, by the action of its spring **322**. The sheared end portion of the tape **244** which, at this point, extends beyond the film strips, as shown, drops slightly under its own weight, as well as being bent downwardly by the pressure plate (FIGURES 15 and 22). Also, the cam roller **306** on the lower pressure roller support arms engages in the relief **316** on the forward side of the bearing block **124**, and the lower pressure roller **164** is returned to its normal position by spring **190**.

Upon reaching this forward limiting position, the direction of carriage travel is reversed, in the manner previously described. As the carriage moves rearwardly from its forward limiting position of FIGURE 15, the pressure plate **318** acts to further bend the free or sheared end of the tape, which projects beyond the film strips, downwardly to a position behind the lower pressure roller, as shown in FIGURES 16 and 23. As the pressure plate rides onto the film strips, it is rocked in a clockwise direction, as shown in FIGURE 17.

The cam roller support arm **310** swings forwardly, as previously described and shown in FIGURE 16, during rearward movement over the bearing block **124**, so that during the return stroke of the carriage, the lower pressure roller remains in its upper, normal position under the action of its spring **190**. The free end of the tape is, therefore, rolled onto the underside of the film strips to approximately the center line of the latter by the lower pressure roller, as shown in FIGURE 17, and diagrammatically illustrated in FIGURE 24. Splicing of the film strips is now completed.

During this return stroke of the carriage, the blade support **258** is cammed to its latched, inoperative position of FIGURES 9 and 25 by engagement of the blade support cam roller **290**, with the inclined cam face **304** on the cam arm **292**, as previously described. The tape supply roll **220** and tape guide rollers **248** and **250** are retained in their elevated position of FIGURE 12 until the blade support has thus been latched, owing to the supply roll cam roller **234** riding onto the pivotal ramp **240**. The parts are retained in these elevated positions to enable the cutter blade **262** and its support to be moved out of the path of the tape guide rollers **248** and **250**, and the section of tape **114B** (FIGURE 12) which now hangs from the lower guide roller **250**, prior to lowering of the tape and guide rollers to their normal position of FIGURE 2.

As previously described, when the carriage moves rearwardly to a position wherein the supply roll cam roller **234** crosses the pivotal axis **242** of the ramp **240**, the rear end of the latter swings upwardly, as viewed in FIGURE 2, against the cam surface section **238A**. The cam roller **234** rides upwardly along the now rear inclined ramp surface and finally onto the cam surface section **238A**, with resultant lowering of the supply roll and tape guide rollers to their normal position of FIGURES 2 and 26. The section **114B** of tape now hangs in front of the pressure rollers **162** and **164** in the same manner as described with reference to the tape section **144A**, in readiness for the next splicing operation.

By this time the guide inserts **194** on the forward ends of the bearing roller supports will be clear of the gap **123** between the film supports **120**, and the pivotal film support **126** will be elevated back to its film supporting position of FIGURE 2. Upon reaching the rear limit of its stroke, the drive motor is deenergized and conditioned in the manner hereinbefore described for subsequent forward driving of the carriage in response to the next operation of the main switch **336**.

This completes one operating cycle of the machine.

It will be immediately apparent that the present machine is adapted to wrapping articles other than film strips, as herein described, and, therefore, should not be thought of as limited to such applications. Also, while a preferred embodiment of the invention has been disclosed for illustrative purposes, it will be obvious to those skilled in the art that numerous modifications in design, arrangement of parts and instrumentalities are possible within the scope of the following claims.

We claim:

1. A machine for splicing a pair of strips with adhesive tape, comprising a pair of relatively movable parts, a pair of spaced supports on one part for holding a pair of strips to be spliced in coplanar, longitudinally aligned splicing positions with butt ends of the strips proximately disposed in the space between the supports, a pair of tape folding members on the other part, means for effecting relative movement between said parts to shift the relative position of the members with respect to the supports from a normal position at one side of the supports to a limiting position at the other side of the supports, and back to said normal position in such manner that relative movement of the members occurs through the space between the supports and the members straddle and press against opposite sides of the strips during relative movement of the supports and members past one another, a section of adhesive tape having a length greater than the width of the strips to be spliced, means on said other part for releasably supporting said section in an initial position on said other part directly in front of said members with the adhesive side of the section facing the strips and the members spaced along the section and located relatively near to one end of the section, whereby the latter has a long end and a short end relative to said members and the section is folded about the strips during relative movement of said parts from said normal position to said limiting position of the members and supports, and additional folding means on said other part behind the member remote from the short end of

the section for folding the long end of the section behind said members upon relative movement of the members and supports to said limiting position whereby said long end of the section is folded about the strips during return of the parts to said normal position.

2. The subject matter of claim 1 wherein said additional folding means comprises a spring loaded pressure member.

3. The subject matter of claim 1 wherein said one part comprises a stationary base and said other part comprises a carriage on the base movable toward and away from said supports.

4. In a strip splicing machine, a base, a pair of spaced supports on said base for holding a pair of strips to be spliced in coplanar, longitudinally aligned splicing positions with butt ends of the strips in a horizontal plane and proximately disposed in the space between the supports, a horizontally movable carriage on the base including a pair of yieldably contacting pressure rollers tangent to opposite sides of said plane and parallel to the side edges of the strips, said rollers being aligned with and movable through said space in a transverse direction of the strips and across opposite sides of the butt ends of the strips, said carriage having a forward vertical surface approximately tangent to the forward side of said rollers, a roll of adhesive tape on the carriage above said rollers, tape positioning means on the carriage above said rollers to hold an end section of said tape flat against said surface with the lower end of the section hanging free and vertically in front of said rollers and the adhesive side of the tape facing the strips whereby the section is folded against opposite sides of the strips during movement of said rollers across the strips, and a cutter on the carriage opposite said surface for severing said section from the roll.

5. The subject matter of claim 4 including means supporting said roll on the carriage above said rollers for vertical movement toward and away from the rollers, said tape positioning means including spring biased roller means on the roll support means through which the tape is threaded and which hold the tape flat against said surface during vertical movement of the roll support, means to elevate said roll support means from a given normal position thereof after initial contact of said tape section with the strips to unwind a new section of tape from the roll and pull this new section through said roller means, said cutter being located to sever the tape between said roller means and pressure rollers when the roll support means is elevated, and means for thereafter lowering said roll support means to its normal position to locate the new section of tape in front of said pressure rollers.

6. A film splicing machine comprising a base, a pair of spaced film supports on the base including longitudinally aligned film strip receiving guideways having lower film supporting surfaces in a common horizontal plane for holding a pair of film strips to be spliced with their butt ends proximately disposed in the space between the supports, a carriage on the base horizontally movable in a direction normal to the guideways, a pair of yieldably contacting pressure rollers approximately tangent to opposite sides of said plane mounted on the carriage with their axes in a common vertical plane parallel to the guideways, a downwardly spring biased pressure member on the carriage directly behind the upper pressure roller spring urged to a position behind the rollers, said carriage being movable to move said rollers through said space between a normal position at one side of the supports and a limiting position at the other side of the supports wherein said pressure member is beyond the adjacent side edges of the strips to be spliced, means on the carriage above said rollers for holding a roll of adhesive tape, means on said roll holding means for positioning an end section of the tape of predetermined length in a vertical hanging position in front of said rollers with the lower end of the section hanging below said horizontal plane a distance approximating one half the width of the strips to be spliced, tape cutting means on the carriage for severing the tape a preset distance above said horizontal plane, power means for moving said carriage from said normal position to said limiting position, and back to said normal position, and means for elevating said roll holding means a preset distance above a given normal position thereof to a position wherein said tape positioning means is located above said cutting means a distance equal to said predetermined length, operating said tape cutting means while the roll holding means is thus elevated, and thereafter returning the roll holding means to normal position in synchronism with movement of the carriage all in such manner that the lower end of said tape section is folded against the undersides of the butt ends of the film strips and the intermediate portion of said section is folded against the upper sides of said butt ends during movement of the carriage from said normal position to said limiting position and the other end of the section is folded back under and against the undersides of the butt ends of the strips during return of the carriage to the normal position.

7. The subject matter of claim 6 including means mounting said lower pressure roller on the carriage for vertical movement toward and away from the upper roller, and means for moving the lower roller away from the upper roller and then returning the lower roller to yieldable contact with the upper roller upon movement of the carriage to its limiting position.

8. The subject matter of claim 6 wherein said means for vertically moving the roll holding means includes means for lowering the roll holding means slightly below its normal position prior to elevation of the roll holding means above its normal position.

9. The subject matter of claim 6 including a movable film support in the space between the first-mentioned film supports, and means for moving the movable support from said space during travel of the carriage to its limiting position and return the movable support to its normal film supporting position in said space during return of the carriage to its normal position.

10. In a strip splicing machine of the character described, the combination of a pair of relatively movable parts, a pair of spaced supports on one part for holding a pair of strips to be spliced with butt ends of the strips proximately and coplanarly disposed in the space between the supports, a pair of parallel, yieldably contacting pressure rollers on the other part, means for effecting relative movement between said parts between a first position wherein said rollers are located at one side of said supports and a second position wherein the rollers are located at the other side of the supports and then back to said first position in such manner that relative movement of the rollers is through the space between the supports and across opposite sides of butt ends of the strips to be spliced, a roll of adhesive tape, means on said other part rotatably supporting said roll for movement toward and away from said rollers, means on said roll supporting means to position an end section of the tape in front of the rollers with the adhesive side of the tape facing away from the rollers and toward said supports whereby said section of tape is folded against opposite sides of butt ends of the strips to be spliced during relative movement of the rollers from said first position to said second position, means for moving said roll supporting means away from said rollers after contact of the adhesive tape with the strips to be spliced whereby to unwind a new length of tape equal to the length of said section from the roll and pull said new length through said tape positioning means, cutter means on said other part for severing said section from the remainder of the tape between said rollers and tape positioning means during said relative movement of the parts from said first position to said second position, and means for returning said roll supporting means toward said rollers during return relative movement of said parts from said second position to said

first position to position the new length of tape in front of the rollers.

11. The subject matter of claim 10 wherein said supports have supporting surfaces for the strips to be spliced located in a common horizontal plane passing between and tangent to the pressure rollers, said roll of adhesive tape having a horizontal axis and said roll and tape positioning means being located over and vertically movable toward and away from said pressure rollers, and said positioning means locating said section of tape so that it hangs free in a vertical plane in front of the rollers.

12. A strip splicing machine, comprising a pair of relatively movable parts, a pair of spaced supports on one part for holding a pair of strips to be spliced with butt ends of the strips proximately and coplanarly disposed in the space between the supports, a pair of parallel, yieldably contacting pressure rollers on the other part having a normal position to one side of the supports, a strip of adhesive tape having a length approximating twice the width of the strips to be spliced, means supporting said tape on said other part in front of said rollers so that the length of the tape extends transversely of a plane of tangency passing between the rollers with the adhesive side facing away from the rollers and toward the strips to be spliced and with said plane intersecting the tape along a transverse line spaced from one end of the tape a distance approximating one quarter of the length of the tape, means for effecting relative movement of said parts to move said rollers and butt ends of the strips to be spliced toward and past one another in such manner that one side edge of the butt ends of the strips and said tape are brought into initial contact along said line of intersection on the tape with the tape bridging the butt ends and subsequent relative movement of said rollers occurs in one direction across opposite sides of the butt ends of the strips to a limiting position beyond the opposite side edges of the strips so as to fold one end portion against one side of the strips and an intermediate portion of the tape against the other side of the strips, folding means on said other part to fold the other end portion of the tape about said opposite side edges of the strips and behind said rollers upon relative movement of the latter to said limiting position, and means for effecting return relative movement of said parts to return said rollers to said normal position thereof in such manner that relative movement of said rollers occurs in the opposite direction across opposite sides of the butt ends of the strips to be spliced so as to fold said other end portion of the tape against said one side of the strips.

13. The subject matter of claim 12 wherein said folding means comprises a pivoted, spring-biased folding plate on said other part behind one of said rollers which is resiliently urged against the tape.

14. The subject matter of claim 12 including cam means on said parts to separate said rollers upon relative movement thereof to said limiting position to clear said other end portion of the tape as it is folded about said opposite side edges of the strips to be spliced.

15. A strip splicing machine comprising a base, a pair of spaced strip supports on the base having aligned, horizontal guideways for holding a pair of strips to be spliced in a horizontal plane with butt ends of the strips proximately disposed in the space between the supports, a horizontally movable carriage on the base at one side of said supports and movable toward and away from the latter along a transverse direction line of said guideways, said carriage including a part which is movable forwardly into and rearwardly out of the space between said supports during movement of the carriage, a pair of yieldably contacting pressure rollers on said carriage part tangent to opposite sides of said plane and extending transversely of said direction line, means yieldably supporting the lower pressure roller for vertical movement toward and away from the upper pressure roller, a horizontally pivoted, spring loaded pressure plate on said carriage behind the upper pressure roller which is spring biased to a vertical position behind the rollers, said carriage having a vertical forward surface facing the supports and located in a plane tangent to the forward sides of the pressure rollers, a roll of adhesive tape located above said pressure rollers with its axis horizontal, a horizontally hinged support on the carriage pivotally supporting said roll for vertical movement toward and away from the pressure rollers, a horizontally hinged arm on said roll support depending below and vertically movable with the roll, horizontal guide rollers on the lower end of the arm, one end of the tape on the roll being threaded through said guide rollers, between one roller and said forward carriage surface, and hanging vertically from said one guide roller in front of said pressure rollers with the adhesive side of the tape facing forwardly away from the rollers so that said plane intersects the tape along a transverse line spaced from the lower end of the tape a distance approximately one quarter of the width of the strips to be spliced when said roll support and guide rollers occupy a given normal position, spring means to urge said arm toward said forward carriage surface to hold said tape flat against the surface, power means on the base for moving said carriage forwardly from a normal position thereof wherein said carriage part and pressure rollers are located to said one side of the strip supports to move said pressure rollers through said space between the strip supports and across opposite sides of the strips to be spliced to a limiting position wherein the pressure rollers and pivoted pressure plate are beyond the other side of the strip supports whereby the adhesive tape is brought into initial contact with one side edge of the butt ends of the strips to be spliced along said line of intersection on the tape and is then folded against the upper and lower sides of the strips, and then returning the carriage to its normal position, cooperating means on said base and said means yieldably supporting the lower pressure roller for moving the latter away from the upper pressure roller upon movement of the pressure rollers beyond the strip supports to said limiting position and returning the lower pressure roller to yieldable contact with the upper pressure roller upon return movement of the carriage, cooperating means on said base and tape roll support for lowering the latter and guide rollers slightly below said normal position thereof upon said initial contact of the tape and strips to be spliced and shortly thereafter elevating said roll support and guide rollers above said normal position thereof during movement of the pressure rollers forwardly across the strips to be spliced, a cutter on the carriage for severing the tape between said pressure rollers and guide rollers when the latter and roll support are elevated, cooperating means on the carriage and base for operating said cutter during forward movement of the pressure rollers across the strips to be spliced and while said lower pressure roller is lowered away from the upper pressure roller whereby the cut end of the tape is folded downwardly about the other side edge of the butt ends of the strips by said pressure plate upon movement of the pressure rollers to said limiting position and is subsequently folded against the undersides of the strips by the pressure rollers during return of the carriage to its normal position, elevation of said roll support and guide rollers above said normal position thereof unwinding a new length of tape from the roll and pulling the new length through the guide rollers, whereby after operation of said cutter, said new length hangs free below the guide rollers, and said cooperating means for vertically moving the roll support and guide rollers including means to return the roll support and guide rollers to their normal position during return movement of the carriage to position said new length of tape in front of the pressure rollers whereby to condition the machine for the next splicing operation.

16. The subject matter of claim 15 wherein each of

said cooperating means comprises cooperating cam and cam follower means.

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