Dec. 4, 1973

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3,776,795

METHOD OF JOINING THE ENDS OF MULTI-LAYER PRINTING FORMS

Filed April 9, 1971

3 Sheets-Sheet 1

FIG. 1

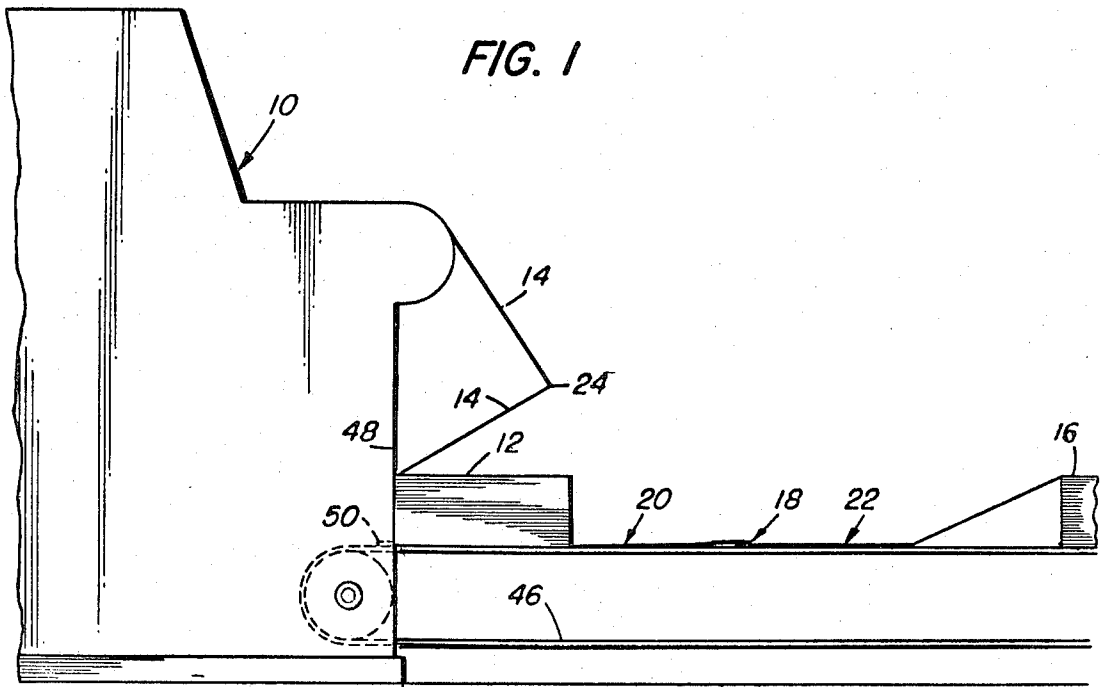


FIG. 2

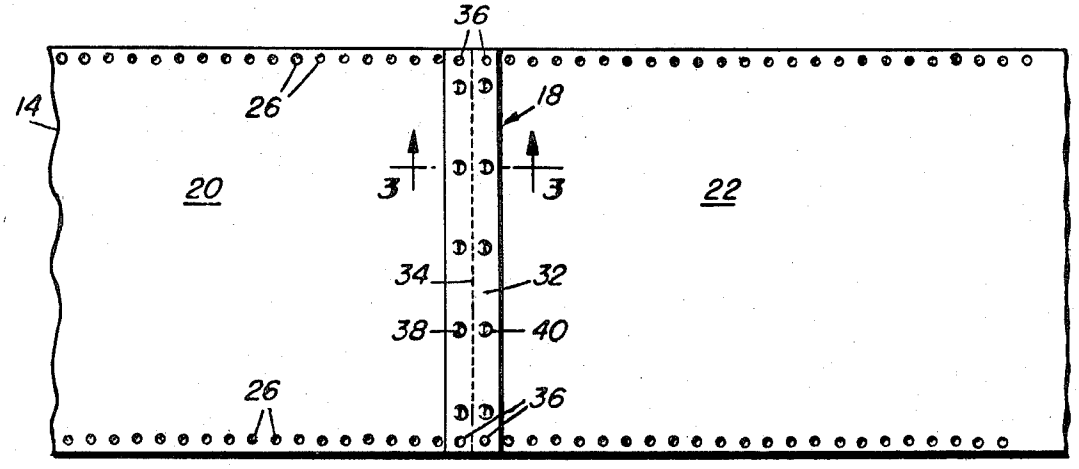
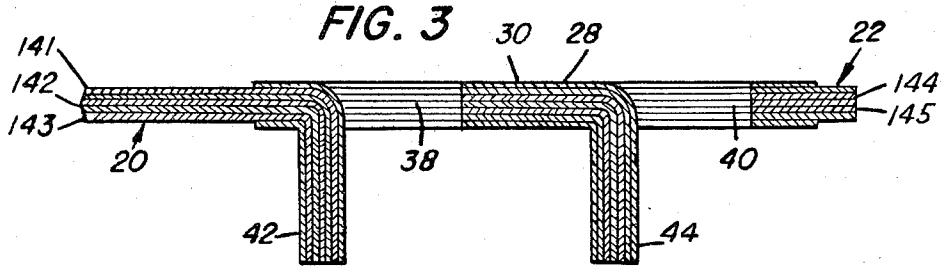


FIG. 3



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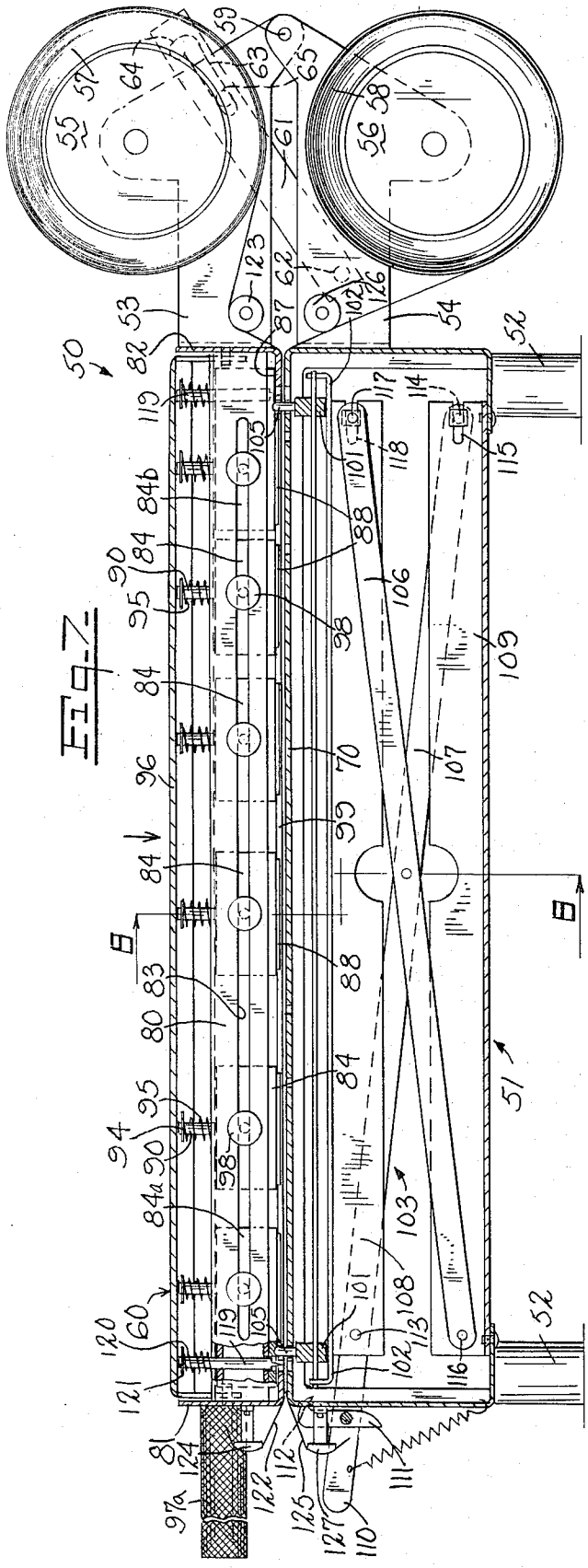


Fig. 7

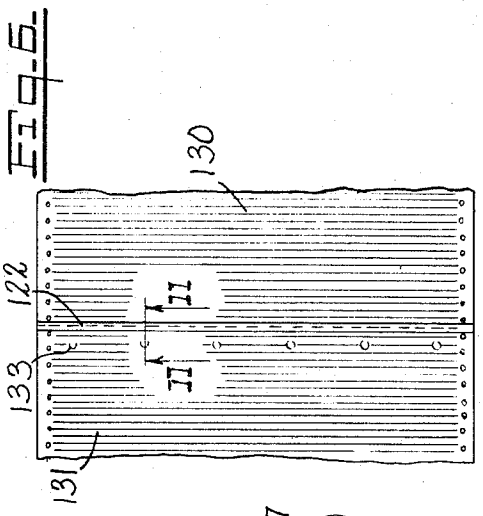


Fig. 6

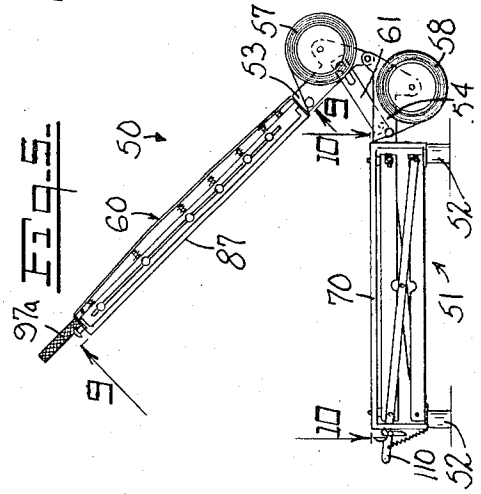


Fig. 5

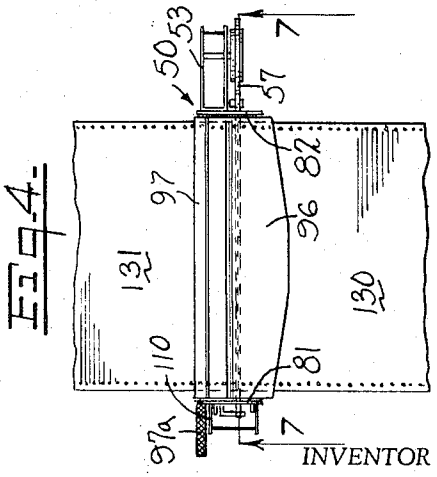


Fig. 4

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Fig. 8.

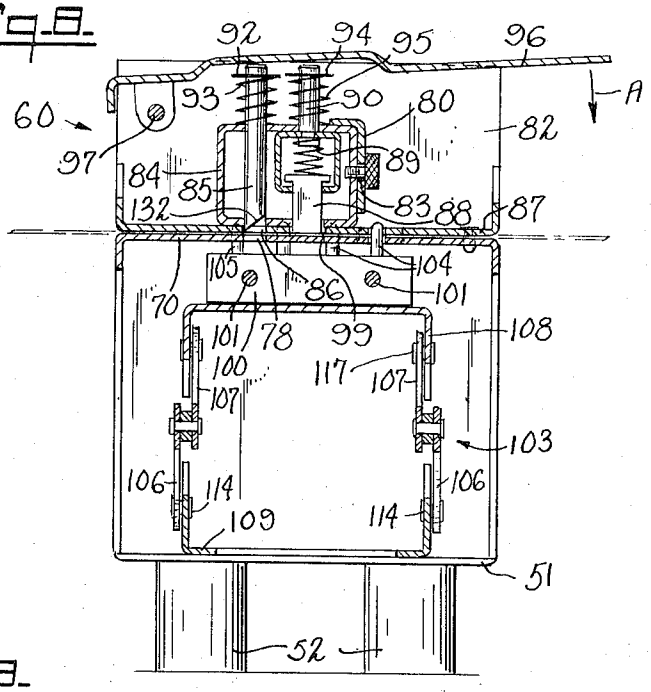


Fig. 9.

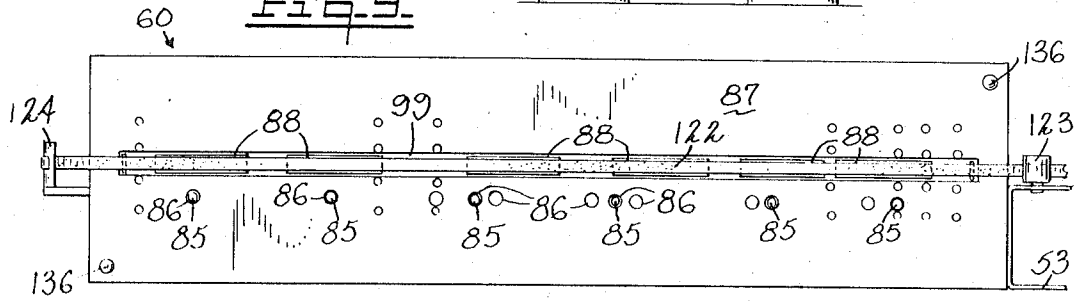


Fig. 10.

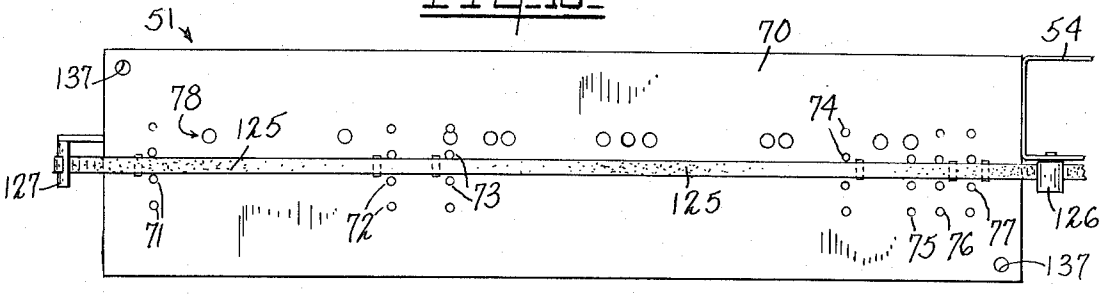
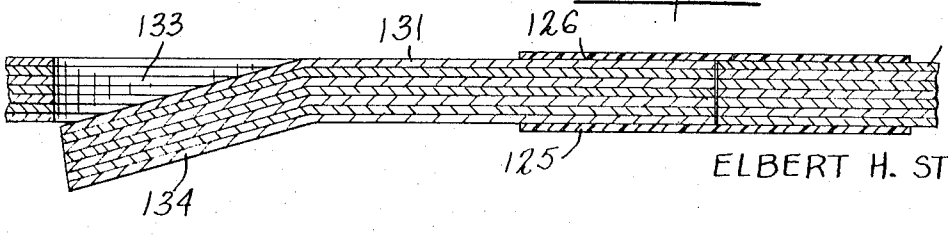


Fig. 11.



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METHOD OF JOINING THE ENDS OF MULTI-LAYER PRINTING FORMS

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Continuation-in-part of abandoned application Ser. No. 824,776, May 15, 1969. This application Apr. 9, 1971, Ser. No. 132,656

Int. Cl. B31f *5/06;* B41j *13/00, 5/04*

U.S. Cl. 156—157 10 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a method and means for joining the ends of multi-layer printing forms so as to provide a continuous supply of printing media to high speed printing machines. The end of one strip of multilayer forms is positioned with the front edge of the next strip in aligned abutting relation. Then a strip of adhesive material is applied across an outer sheet or layer of each strip. Then one or both forms are partially perforated leaving a partially folded over tab which holds the under layers in aligned relation to the outer sheet.

This application is a continuation-in-part of copending application Ser. No. 824,776 filed May 15, 1969 now abandoned.

This invention relates to the joining of multi-layer sheet material in strip form, and more particularly relates to the joining of multiple layer or copy printing forms to provide a continuous supply of printing media to high speed printing machines.

The invention is particularly adapted for use in conjunction with high speed printing devices where printing forms folded in a so-called fan-fold and having a multiplicity of copies are utilized to supply a printing device, such as may be associated with a computer. In the high speed printing machines utilized to print out information from computers, stacks of folded paper having a multiplicity of copies are rapidly consumed, and a new stack must periodically be supplied to the printing device. When a first stack of printing forms is consumed the readout of the computer must be interrupted and thereafter two or three minutes expended to connect a new pack of printing forms to the feed mechanism of the printer. This causes a serious loss of time in relation to the overall operating time of the printing machine.

Where the rental of such computers is very high and perhaps on the order of about one-hundred dollars per hour, the loss in resupplying the printing media becomes quite substantial.

This invention eliminates such interruptions by providing a technique of positively joining a fresh supply of printing media to media in the printer without discontinuing the printout. A new stack of folded multicopy forms is abutted to and joined to the previous pack, and the several stacks fed to the printing machine continuously without loss of time for resupplying the printing media.

Briefly stated, the invention in one form thereof comprises a method of joining the ends of strips of sheet material such as multi-layer printing forms while one strip is being utilized. The trailing transverse edge of the first strip is abutted to the leading transverse edge of the succeeding strip. In aligning these stacks, the forms may include aligning a pilot pin perforation along the edges thereof for guide indexing purposes, and such pilot pin perforations may be utilized in aligning the aforementioned edges in essentially abutting relationship. Outer layers of each form are then joined as, for example, by

use of an adhesive tape extending along the abutting edges thereof. Then, one or more perforations is made in at least one of the strips intermediate the edges thereof to provide a depending tab which comprises a portion of each layer displaced from its normal plane. Such tab effectively locks the layers or copies of each strip in longitudinal and lateral alignment and prevents any slipping thereof while only the outer layers on one or both strips are joined to each other.

An object of this invention is to provide a new and improved method and apparatus for joining the trailing and leading edges of first and second multi-layer strips of sheet material.

Another object of this invention is to provide a new and improved method for providing multi-layer printing forms of continuous and indefinite length to high speed printing apparatus.

A further object of this invention is to provide a new and improved apparatus for aligning, abutting and joining the trailing and leading edges of multi-layer strips of printing forms.

The features of the invention which are believed to be novel are particularly pointed out and definitely claimed in the concluding portion of this specification. However, the invention both as to its organization, operation and order of procedure, together with further objects and advantages thereof, may best be appreciated by reference to the following detailed description taken in conjunction with the drawings, wherein:

FIG. 1 is a diagrammatic view of the series of packs of multi-layer printing forms having the abutting edges of successive packs joined together for feeding the strips successively to a printing machine without interrupting the operation of the printing machine;

FIG. 2 is a top plan view of two of the pack of stacks of printing forms of FIG. 1 joined together;

FIG. 3 is a view seen in the plane of lines **3**—**3** of FIG. 2;

FIG. 4 is a view of a mechanism embodying the invention in a position to join two stacks of strips;

FIG. 5 is an elevation of the device of FIG. 4;

FIG. 6 is a plan view of a section of the forms which have been joined;

FIG. 7 is a view seen in the plane of lines **7**—**7** of FIG. 4;

FIG. 8 is a view seen in the plane of lines **8**—**8** of FIG. 7;

FIG. 9 is a view of the upper platen of the device of FIG. 2 seen in the plane of lines **9**—**9** of FIG. 5;

FIG. 10 is a view of the body platen of the apparatus of FIG. 2 seen in the plane of lines **10**—**10** of FIG. 5; and

FIG. 11 is a sectional view seen in the plane of lines **11**—**11** of FIG. 6.

There is shown at **10** a diagrammatic representation of any type of high speed printing machine, usually associated with a computer for printing out the data from the computer. A stack **12** of folded multicopy superimposed strips of printing forms **14** is shown feeding through the printing machine **10**. At **16** is shown a successive pack where the end fold **20** of stack **12** from the bottom thereof has been joined at **18** to the beginning fold **22** of stack **16** from the top thereof.

It is the method and means of providing this joint **18**, as well as the indefinite length strip of printing forms resulting from the method and means, that constitutes the essence of this invention.

The forms **14**, both as to format and number of copies or layers, vary according to the particular type of printing machine, and also according to the particular use for which they are intended. However, the forms **14** are folded at **24** in packs **12**, **16** of convenient size, and generally

have a row of aligning or pilot pin perforations **26** extending along the opposite longitudinal edges, whereby the print machine **10** controls the passage of the forms through the machine **10**. While the packs may contain only one or two layers of forms, they usually consist of several superimposed strips, **141, 142, 143**, as shown in cross-section in FIG. 3, and usually have interleaved carbon paper strips **144, 145**, between the strips of printing forms **14**. The joint **18** of this invention is provided by abutting the transverse trailing edge **28** of the end form **20** folded out from the bottom of stack **12** with the transverse leading edge **30** of the beginning form **22** from the top of successive stack **16**. While thus abutted on any convenient surface, a tape **32** having an adhesive coating thereon is adhered to surfaces of an outer layer or copy bridging the leading and trailing edges **28** and **30**. This tape **32** may have a preformed midline of folding and tear perforations **34**, similar to the conventional folding and tear perforations already present at **24** in the strips of forms **14**. Also, at the transverse ends of the tape **32** there may be provided a line of at least two aligning pin apertures **36** coinciding in spacing and location with the aligning pin apertures **26** in the strip of forms **14**. Obviously, the tape **32** may be of a width to have four, six or more aligning pin apertures **36** as desired. When abutting the edges **28, 30** of forms **20** and **22** together, a suitable template (not shown) with aligning pins, similar to that on the printing machine **10**, is used to hold the abutted edges **28** and **30** together and to insure that the tape **32** has its aligning pin perforations **36** coincide with aligning pin perforations **26** of the forms **20** and **22**. Such template may be part of a suitable apparatus hereinafter described which may be used for making partial holes or perforations **38** and **40** adjacent the leading and trailing edges **28** and **30**. The punch making the incomplete holes or perforations **38** and **40** forms tabs **42** and **44** which depend through the superimposed strips of forms adjacent to but spaced from the abutting edges **28** and **30**. The depending tabs **42** lock the superimposed strips (**141, 142, 143**) of forms **20** and interleaved carbon paper strips **144, 145** to the tape **32**, and the depending tabs **44** likewise lock the superimposed forms **22** and interleaved carbon paper strips **144, 145** to the tape **32**, thus locking the superimposed strips **141–145** of forms **20** and **22** together against their abutted edges **28** and **30** and thus provide a secure joint **18**. If desired, a second similar tape **32** is adhered to the bottom surface of the bottommost strips **143** and forms **20** and **22**, before the top tape **32** is adhered, so that the punch pushes the tabs **42** and **44** down the bottom tape **32** at the same time. The tape or tapes **32** are adhered in any convenient manner, self-adhering adhesive being one convenient type. The surface on which the joint **18** is made may be an endless belt **46** movable over a flat surface, to the printing machine **10**. A motor (not shown) slowly moves the stack **12** up to a wall of printing machine **10**, where the stack **12** touches a microswitch button **50**, deactivating the belt motor until stack **12** is consumed, whereupon the belt **46** is reactivated to move the stack **16** into contact with the wall **48** and switch **50** again stopping the belt motor and providing time for making a joint **18** with a successive pack of printing forms. Obviously, the belt **46** may be made as slow as desired, so that several joints **18** may be made in quick succession. In such case, the last or next to last stack **16** may be in the path of an electric eye delayed operation alarm, so that when the electric eye path is left uninterrupted for longer than it takes for the successive pack to move into the electric eye path, the alarm will alert an attendant to join up a new series of successive stacks **16**.

An apparatus **50** for practicing the invention is shown in one form thereof in FIGS. 4–11. The apparatus **50** generally comprises a base member **51** which may be supported on legs **52** and has spaced apart arms defining brackets **53** and **54** extending from one end thereof. The brackets **53** and **54** mount reels or spools **55** and **56** of tapes **57** and **58** having an adhesive or pressure-sensitive adhesive thereon. Bracket **53** is pivotally mounted to bracket **54** by a pin **59** in order that an upper assembly, generally indicated at **60** in FIG. 5, may be pivoted upwardly with respect to base **51**. A support link **61** is pivotally mounted at one end thereof to bracket **54** at **62**. Defined in link **61** adjacent the other end thereof is a slot **63** including a holding notch **64** therein. Slot **63** receives therein a pin **65** carried on one arm of bracket **53**. With this arranmgement when the upper assembly **60** is raised, the notch **64** will receive pin **65** therein and hold member **60** in the position shown in FIG. 5.

Base member **51** defines a table **70**, FIG. 10, having a plurality of rows of pilot holes **71, 72, 73, 74, 75, 76** and **77**, adapted to receive pins therethrough as hereinafter described, to locate the guide perforations in the edges of the strips of forms passing therethrough.

Also defined in table **70** is a plurality of apertures **78** spaced transversely across the table, with respect to the leading and trailing edges of the strips and adapted to receive punches therethrough as hereinafter described.

Extending along the length of upper assembly **60** is a member **80** which is carried between sidewalls **81** and **82**. Member **80** has a longitudinally extending slot **83** thereacross which acts as a guide and a clamp for a plurality of members **84**. Each of the members **84** carries a punch **85**, FIG. 8, arranged to extend through apertures **86** in an upper table or platen **87** and into apertures **78** in table **70**. Also carried by each of members **84** is a pressing member **88**, FIG. 8, which is acted upon by a spring **89** through a plunger **90** to move pressing member **88** downwardly into engagement with table **70**. Punch **85** has a washer or other member defining a head **92** thereon and a return spring **93** thereabout.

Plunger **90** also has a washer or other means defining a head **94** thereon and a return spring **95** is disposed between head **94** and member **84**.

An actuating member **96** is pivotally mounted between sidewalls **81** and **82** about pins or a rod **97** extending between sidewalls **81** and **82**. A lifting handle **97*a*** is positioned on an extension of rod **97**. When actuating member **96** is moved downwardly as shown by the arrow A, it will engage the punches **85** and plungers **90** and depress them moving member **88** into contact with table **70** and anything thereon while punch **85** will extend through apertures **86** in assembly **60**, and apertures **78** in table **70** to perforate material thereon. The members **84** are movable along member **80** and may be aligned with any of the apertures **78** and **86**. This may be accomplished by loosening bolts or screws **98** which are threadably received in each of members **84** and sliding the numbers **84** to any given position with respect to member **80**. Thereafter, screws **98** may be tightened against member **80** to clamp the members **84** in the given position to member **82**. A slot **99**, FIG. 9, is defined across table **87** through which extend the pressing members **88** when they are depressed into engagement with table **70**.

Disposed below table **50** are pilot pin carriers **100** which may be movable across table **50** on guides **101**. The guides **101** are affixed at either end thereof to a member **102** which are carried on an elevator structure generally indicated by the reference numeral **103** disposed within base **51**. When actuated, the elevator structure **103** will raise carriers **100** with a plurality of pins **104** and **105** thereon through the pilot perforations **71–77** at either end of the forms. This is accomplished through a scissors-like mechanism comprising links **106** and **107** which raise carrier member **108** with respect to a stationary base member **109**. Links **107** are extended to provide handle portions **110**, one of which carries a pivotal latch **111** which engages an aperture **112** in base member **51** to latch the elevator structure **103** in the position shown in FIG. 7. Links **107** are pivoted to carrier member **108** at **113** and have extending pins **114** in the other ends thereof which

may move in slots **115** in base member **109**. Links **106** are pivoted to base member **109** at **116** and carry pins **117** at the other end thereof received in slots **118** of carrier member **108**. The links **106** and **107** are also pivoted to each other.

In the construction disclosed, when latch **111** is disconnected from base member **51** the elevator structure **103** will fall and pins **104** and **105** will move downwardly with respect to table **70**. At this time, the carriers **100** may be positioned transversely of the table **70** on guide rods **101** to extend through any of the sets of pilot holes **71–77**. Thereafter, handles **110** may be raised to reposition carrier members **100** and the pins **104** and **105**.

Blocks **84***a* and **84***b* guidably mounted to member **80**, besides containing punch **85** and pressing block **88** may also have mounted therein cutting tools **119**, together with a return spring **120** acting on head **121** of tool **118** to sever a length of tape as hereinafter made apparent.

Considering the operation of the device, the trailing edge of one stack of forms is received on table **70** after the upper assembly has been pivoted to a position as shown in FIG. 5 through handle **97***a* on rod **97**. The last two aligning perforations on the side thereof are received on pins **104**. The leading edge of the next stack of forms is similarly positioned so that the edges are in essentially abutting relationship and pilot pins **105** extend through the edge perforations. At this time, the assembly **60** is in the position shown in FIG. 5. A length **122** of the tape **57** is drawn from reel **55** first over a roller **123** on bracket **53** to a guide **124** extending from sidewall **82**. Prior to this, a length **125** of tape **58** is drawn over a roller **126** on bracket **54** to a guide **127** extending from base **51** such that a length of tape is on base **70** prior to positioning of the strips **130** and **131** as shown in FIG. 6. The strips are thus positioned so as to overlie opposite side edges of tape length **125**. Then, the upper assembly is pivoted downwardly to the position shown in FIGS. 4 and 7, and actuating member **96** is depressed. Pressing members **88** will press the adhesive strips into engagement with the upper and lower outer sheets of the multilayer forms **130** and **131** as shown in FIG. 11. Simultaneously, punches **85** which have the cutting edges **132** residing in an angled plane with respect to a perpendicular section thereof will provide a plurality of perforations **133** through the multiplicity of layers and leave an integral depending tab **134** through the trailing form **131**. The layers in the tab **134** reside outside of the normal plane of their layers. This tab **134** locks and secures all of the layers together in longitudinal and lateral alignment so that when a pulling force is exerted thereon through the tapes **122** and/or **125** such force is transmitted to the intermediate layers through tab **134** and there will be no tendency for the inner layers and carbons, if present, to slip with respect to the outer. To aid in proper positioning of the upper tape length **122** and the perforation positions, pins **136** may be provided on upper assembly **60** to register with holes **137** in table **70**.

It will be apparent that the perforations **133** may be formed either within the boundaries of the tapes **122** and **125** or outside thereof, and may be formed in both forms **130** and **131** of the printing forms or, alternatively, in only one strip, in which case it is preferably the trailing strip **131**. Moreover, the perforations may be formed from either side of the strip. For example, the punches could be carried by either an upper or a lower member.

The alignment means, namely, the pins **104** and **105** may be adjusted for any width printing form or, alternatively, vertically guiding sidewalls might be utilized to guide the edges of the paper. After the junction between the two strips of printing forms is made, the mechanism may be left in the position shown in FIG. 5 with the pilot pins **104** in a lowered position and the newly attached form **131**, FIGS. 6 and 11, pulled across table **70** by the feed mechanism of the printer.

It is to be understood that it may only be necessary to utilize one of the tapes **122** or **125**, and either or both may be utilized depending upon the number of layers or copy sheets in the strip.

It is further to be understood that the apparatus disclosed is only illustrative of a mechanism for practicing the steps embodying the invention, and is illustrated as a totally manually operated device. Moreover, the invention may be utilized to join various types of multilayer material in sheet or strip form and is not limited to printing forms.

In practice, it will be understood that a device having the functions illustrated could be automated or mechanized, and thus reduce the manual steps necessary to practice the invention.

It will thus be seen that the objects of the invention set forth above, as well as those made apparent from the preceding description, are efficiently attained. Since changes may be made in the constructions set forth without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A method of joining the leading edge of a first strip of plural-layer sheet material to the trailing edge of a second strip of plural-layer sheet material comprising the steps of aligning the leading and trailing edges in essentially abutting relationship, applying a tape to an outer layer of said strips along the leading and trailing ends thereof to join the edges of said outer layers, and perforating all of the layers of at least the first of said strips adjacent said leading edges and between the sides thereof to leave integral tabs comprising a portion of each layer of one of said strips disposed outside of the normal plane of each layer.

2. The method of claim **1** comprising the further step of applying the tape to the outer layers on both sides of said strips.

3. The method of claim **1** wherein a plurality of said perforations are made in said first strip transverse to the length thereof to provide a plurality of tabs.

4. The method of claim **1** wherein said at least one perforation is made at least partially within the bounds of said tape.

5. A method of joining a strip of multi-layer printing media to the leading edge of a second strip of printing media wherein the first strip has a trailing edge and the second strip has a leading edge comprising the steps of aligning the leading and trailing edges in essentially abutting relationship, applying a joining strip across said edges to an outer layer of both of said strips along the leading and trailing ends thereof, and making a plurality of aligned perforations in said second strip adjacent the leading edge thereof and between the sides thereof to leave a plurality of integral tabs each comprising a portion of each layer disposed outside of the normal plane of each layer.

6. The method of claim **5** wherein said second strip is perforated beyond the edge of said joining strip.

7. The method of claim **5** wherein said perforations are formed in both of said strips, and a plurality of perforations are formed in both strips.

8. The method of claim **5** wherein said strips have aligning holes extending along the edges thereof, and said aligning holes are utilized to initially align the leading and trailing edges in essentially abutting relationship.

9. The method of claim **5** comprising the further step of providing said joining strip with a line of tear perforations along the length thereof adapted to coincide with the line between said leading and trailing edges.

10. The method of claim **5** comprising the further step of providing a tape having an adhesive coating to provide said joining strip.

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PHILIP DIER, Primary Examiner

U.S. Cl. X.R.

156—505, 513; 161—110; 197—126; 280—20