United States Patent [19]

Lowe et al.

[11] **3,926,713**

[45] **Dec. 16, 1975**

[54] **APPARATUS FOR PRODUCING AND ASSEMBLING TABBED CARDS**

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[73] Assignee: **E-Z Machine Corporation,** Plainview, N.Y.

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[21] Appl. No.: **392,994**

[52] **U.S. Cl.** ..... **156/510;** 156/461; 156/521; 156/566; 156/583; 93/1 E

[51] **Int. Cl.². B32B 31/20;** B65C 9/06; B30B 15/34

[58] **Field of Search** ..... 156/250, 510, 297, 566, 156/196, 216, 227, 267, 464, 484, 571, 479, 156/556, 521, 475, 461, 583, 459, 517; 93/1 E, 93/1 R, 88

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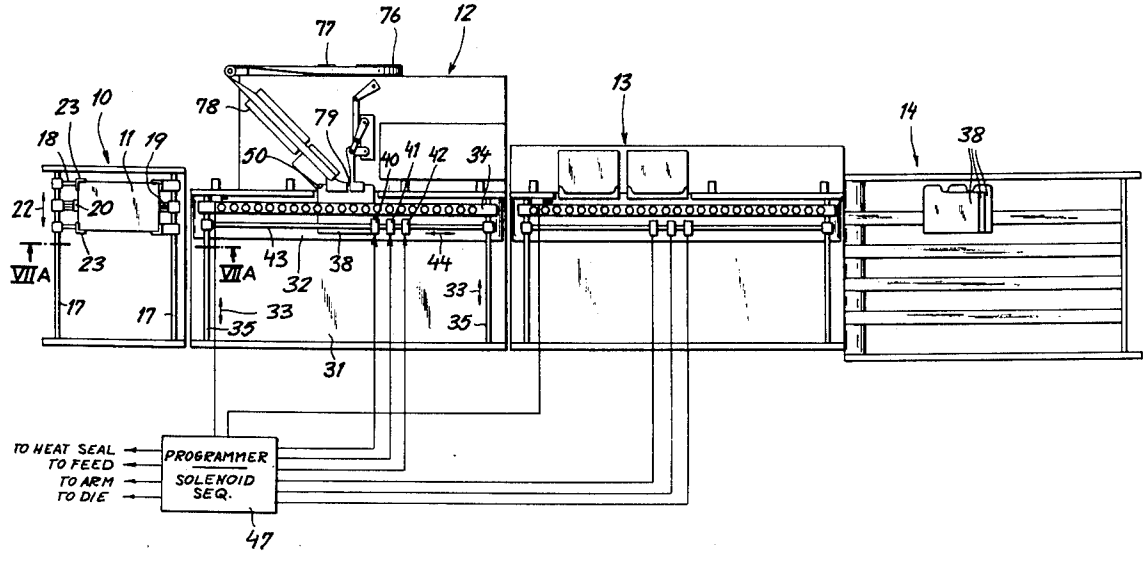
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Primary Examiner—Douglas J. Drummond
Assistant Examiner—M. G. Wityshyn
Attorney, Agent, or Firm—Karl F. Ross; Herbert Dubno

[57] **ABSTRACT**

A tab applicator for applying tabs to a substrate sheet for indexing or tabulating sheets is provided with forming means for folding, shaping and subdividing a thermally bondable synthetic-resin foil to form a succession of tabs applicable to sheet stock, e.g. file, index, tabulator or programming card or sheet stocks. The apparatus includes a swingable arm receiving the shaped tab and advancing same to meet the card stock in a direction generally transverse to the edge of the stock to which the tab is to be applied at a controlled distance so that a formed portion or bight of the tab lies against or in spaced relation to this edge. The meeting location is preferably provided between a pair of heated platens at which the thermoplastic, thermally bondable foil may be heat sealed at the portions of the tab overlapping the opposite faces of the stock or substrate which thereupon may be advanced parallel to the edge for die-cutting and/or assembly (collation). A guide rail engageable with the projecting portion of the tab may be retractable to enable another guide rail to be effective when the tab in alternative mode of operation has its formed portion engaging the edge of the substrate. Preferably, the stock is die-cut downstream of the tab-applying station to form a tab-carrying formation along the aforementioned edge of the sheet. Means is provided for selectively stopping the substrate at the die-cutting station and/or the tab-applying station to iteratively form the projecting index formations at different locations along the edge of the sheet so that when the sheets are gathered into a stack, the index formation of each sheet is offset from that of the preceding and the following sheet.

5 Claims, 15 Drawing Figures



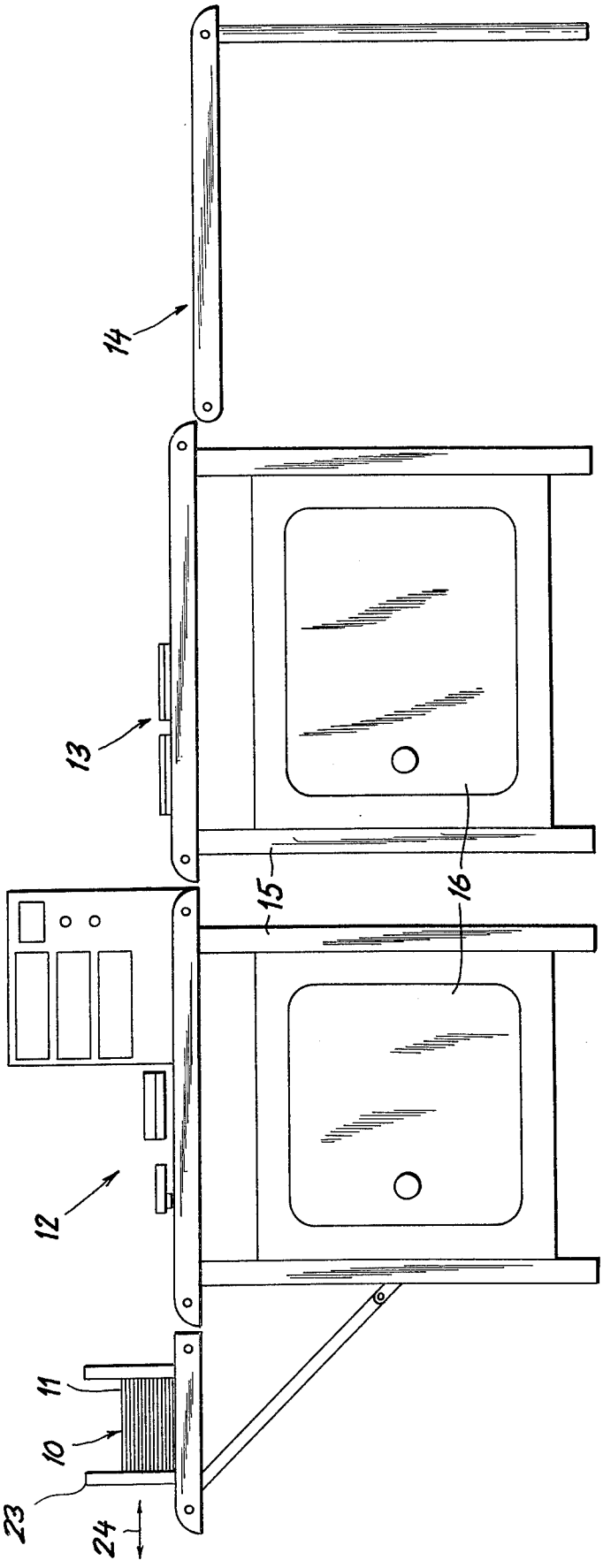


FIG. 1

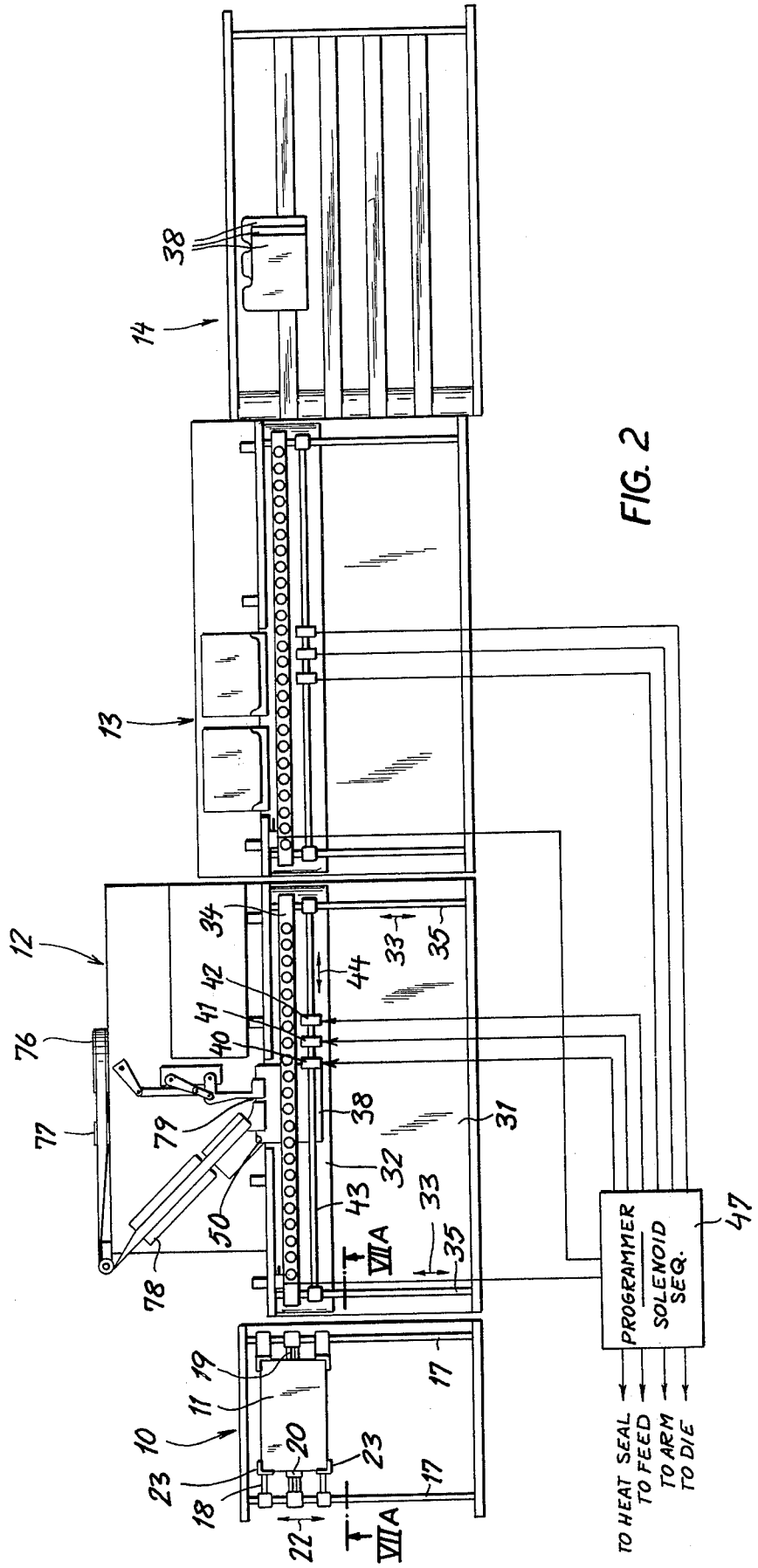

38
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12
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31
32
43
33
50
VIII A
35
78
19
11
17
10
20
23
23
17
18
22
VIII A
PROGRAMMER
SOLENOID
SEQ.
47
TO HEAT SEAL
TO FEED
TO ARM
TO DIE

FIG. 2

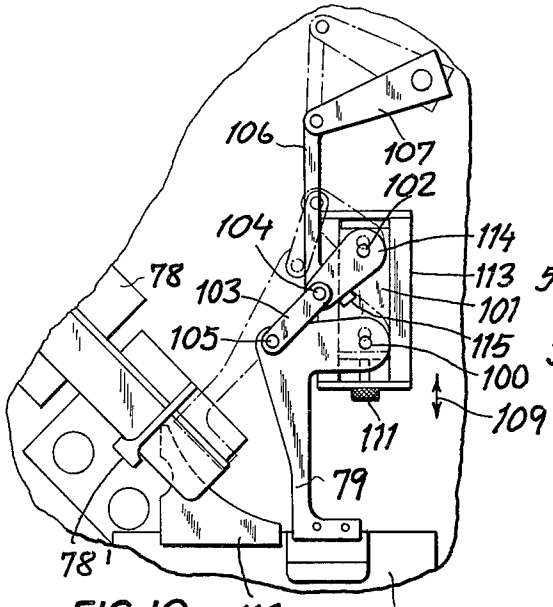


FIG. 10

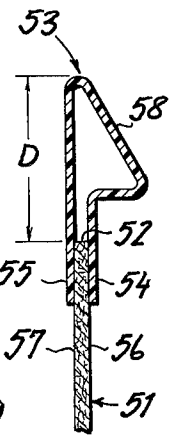


FIG. 3

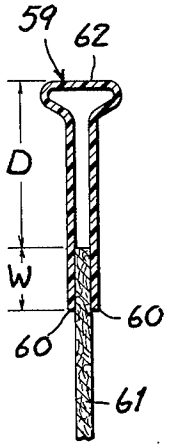


FIG. 4

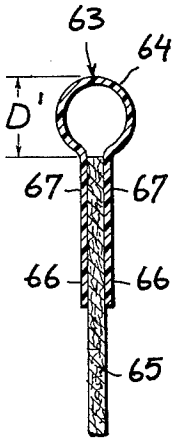


FIG. 5

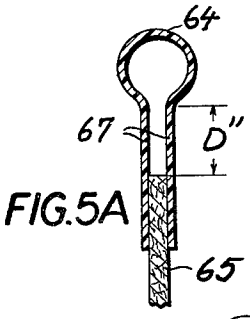


FIG. 5A

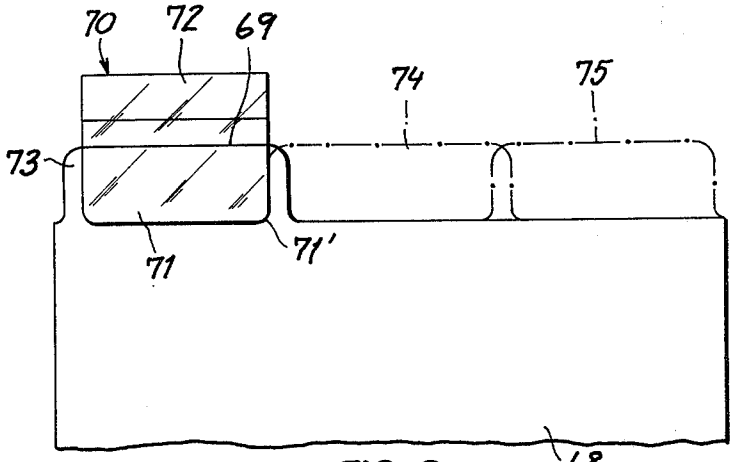


FIG. 6

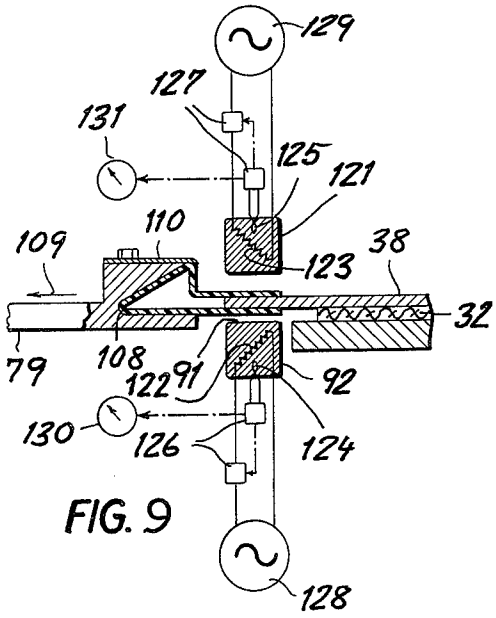


FIG. 9

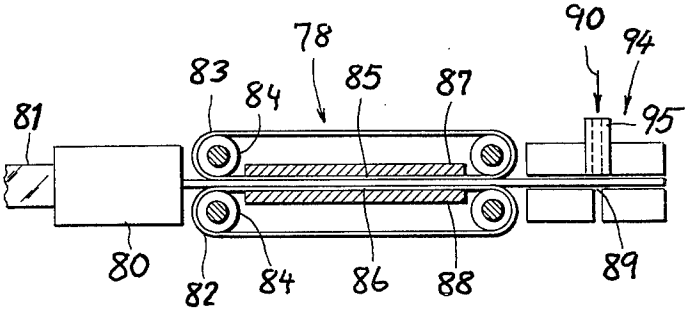


FIG. 12

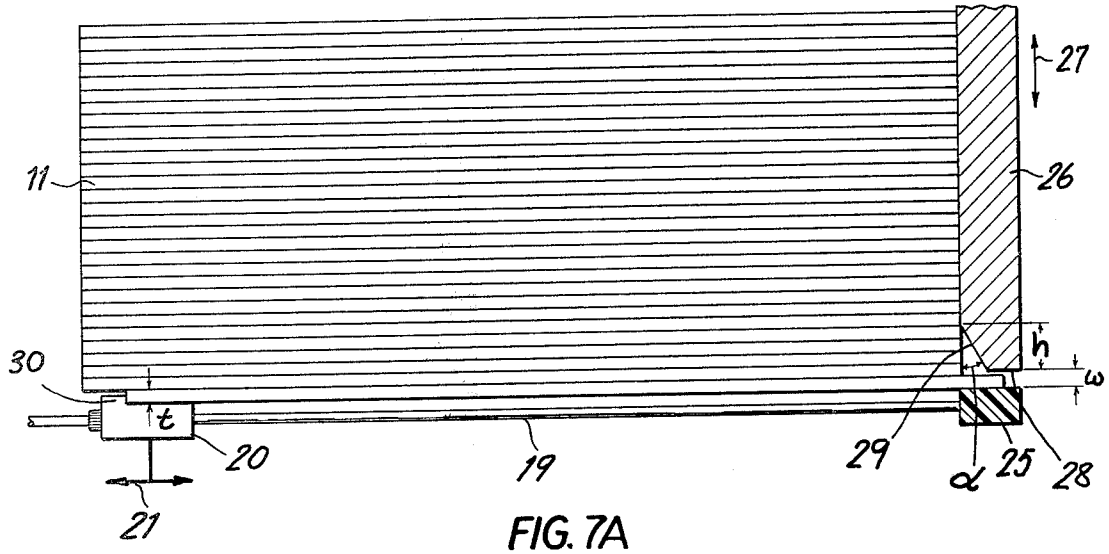


FIG. 7A

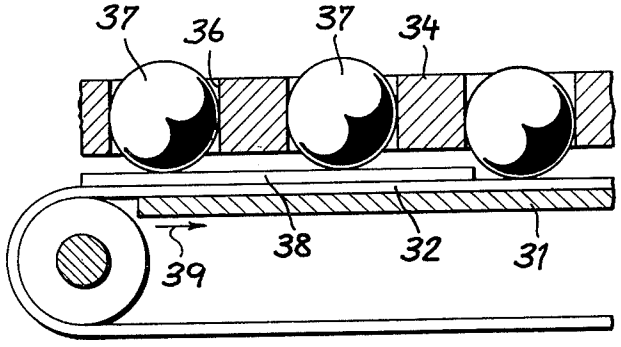


FIG. 7B

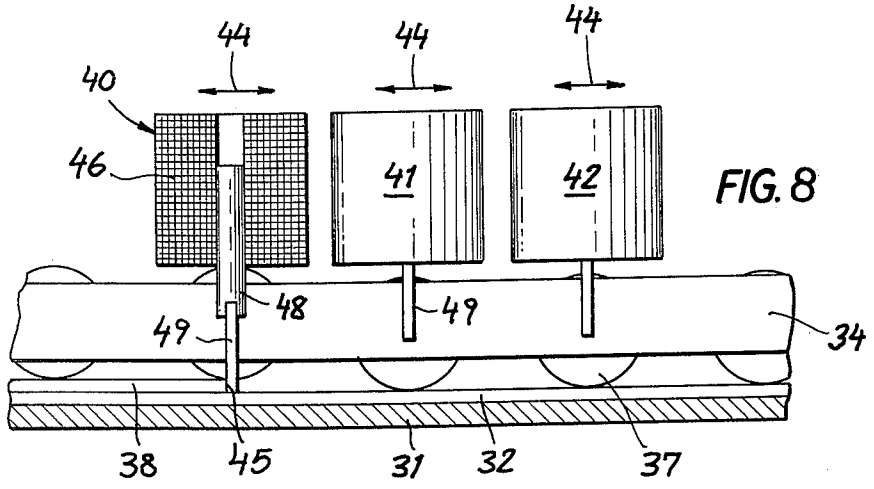


FIG. 8

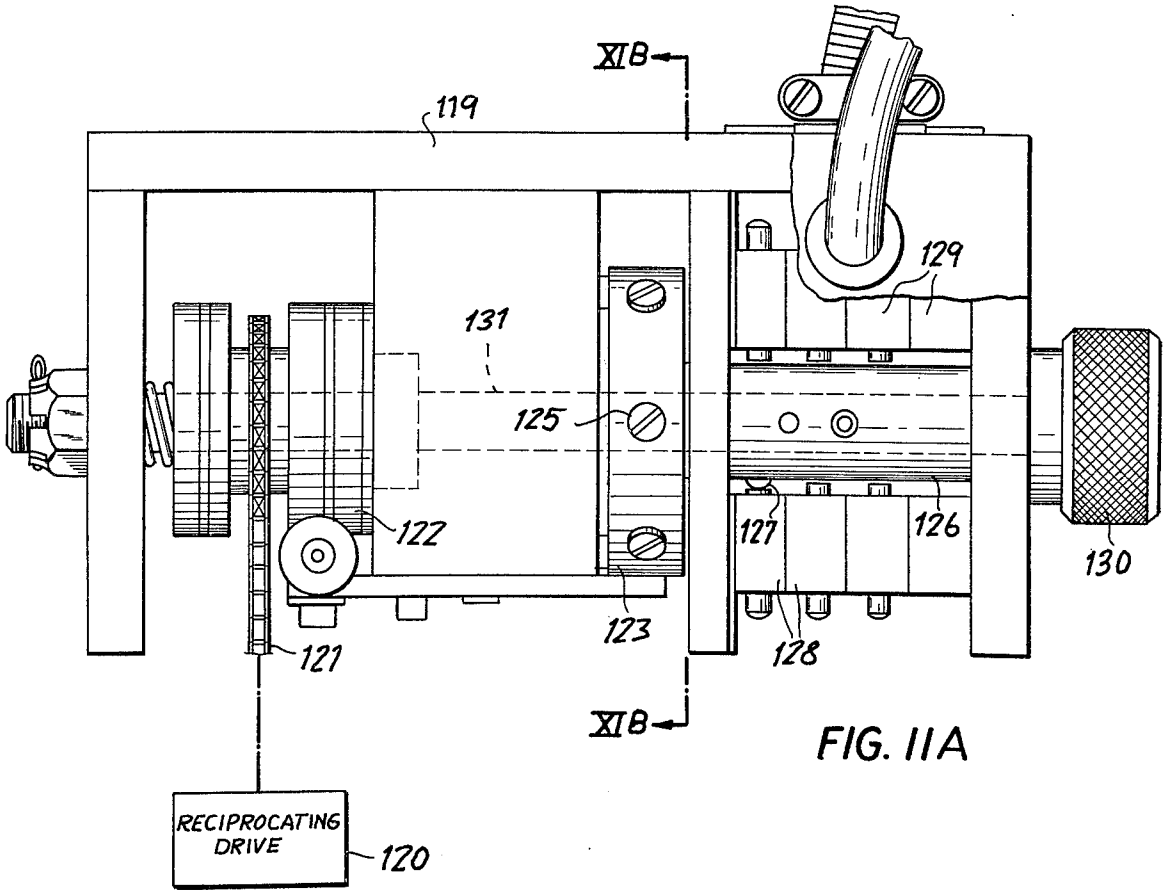


FIG. IIA

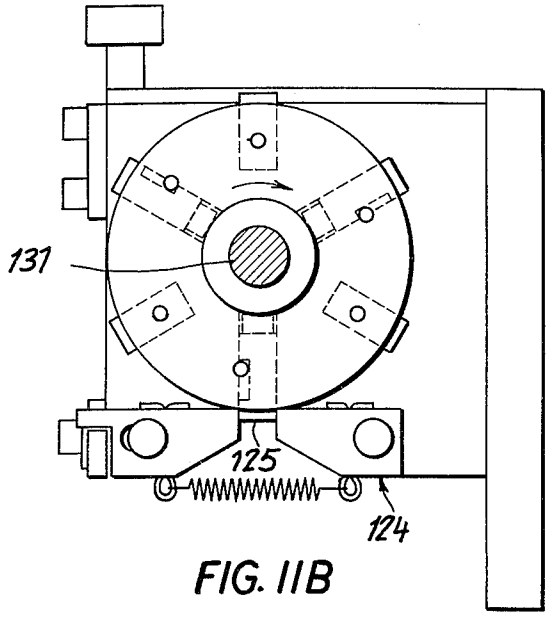


FIG. IIB

APPARATUS FOR PRODUCING AND ASSEMBLING TABBED CARDS

FIELD OF THE INVENTION

The present invention relates to the application of tabs (index or tabulator tabs), preferably of a synthetic-resin foil, to generally rectangular substrate sheets (e.g. card stock) at selected locations along an edge thereof to accommodate indicia or filing or identification; the tabulator sheets may be index cards principally used as separators for card, letter or like files and generally being collated so that the tabs of successive sheets are disposed at different locations along the edge. More particularly the inventon relates to a system for forming such sheets at selected locations with synthetic-resin foil tabs haaving a selected profile in which a portion of the formed tab may project beyond the edge to which the tab is secured and to an apparatus for the production of tabbed sheets of the aforementioned character wherein the bight of the synthetic-resin foil strip may be in contact with the edge of the sheet and/or the edge of the sheet may be die-cut to provide a projection carrying the tab.

BACKGROUND OF THE INVENTION

In card, letter and other files, it is common practice to provide separators between compartments receiving the sheetlike members to be filed which have upstanding formations, hereinafter referred to generally as index tabs, which may carry indicia representing the material stored behind or ahead of the separators. Such separators are generally marketed in packs with the tabs of successive separators offset along the upper edge from one another, thereby facilitating selection of a particular compartment. The tabs also facilitate withdrawing and inserting of the cards into a horizontal stack, cabinet or drawer and may be formed with synthetic-resin foil pockets into which a strip carrying the identifying indicia may be slid through a lateral opening.

In prior-art manufacturing techniques, it has been the practice to feed a succession of synthetic-resin foil channels to a station between a pair of heated platens and to insert the substrate into the throat of the channel-like or U-section member constituted by the foil tab, to actuate the platens to compress a limited strip of each shank of the foil channel or U against the respective faces of the substrate and thermally bond the synthetic-resin foil to the substrate. Thereafter, or prior to this operation, the generally rectangular sheet may be die-cut to provide an elongated lobe along the edge bearing the synthetic resin tab so that the tabs project from a horizontal stack of the cards.

These operations were generally followed by a tedious assembly or collation of such tabbed sheets having their tabs at different locaations along a corresponding edge so that, for example, the successive tabbed sheets of the stack have their tabs stepped along the aforementioned edge and a number of tabs of the stack are exposed at once, rather than being obstructed by one another as is the case where each tab is disposed immediately behind the other of the stack.

Both the tab-applying and collating operations have generally been carried out by hand and there has been little success with altering the process. The hand operations, especially in the application of the synthetic-resin foil, are complicated and have not hitherto been successfully increased in speed or output, even where automatic means has been provided for feeding a precut synthetic resin strip to the thermal bonding station.

OBJECT OF THE INVENTION

The principal object of the present invention is to provide an apparatus adapted to obviate the aforementioned disadvantages and increase the speed of production of tabbed sheets of the character described with improved flexibility as to configuration and positioning of the tab.

Another object of this invention is to provide a system for automatically producing separators or like members having indicia-receiving tabs in a collated state so as to eliminate the need for manual collation.

Yet another object of this invention is to provide an improved system for producing tabbed cards, with or without projections at an edge carrying the tab, wherein the profile of the applied synthetic-resin foil may be variable.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained in accordance with our present invention in an apparatus for producing tabbed sheet elements which comprises means for forming a succession of tabs, each having an inner edge adapted to overlie a respective sheet element and an outer edge spaced from the inner edge, means for feeding these tabs to a tab-applying station, means at the tab-applying station for affixing each of the tabs to at least one face of a sheet element disposed at the station with the inner edge overlying the face of the sheet element, and means for controlling the position of each outer edge of each tab relative to the aforementioned edge of the respective sheet element.

The term "sheet element" or "substrate" as used herein is intended to refer to any sheet stock, e.g. of paper, card stock, synthetic resin, synthetic-resin coated paper or card stock, and the tab may be flat but preferably is of channel shape so that portions of the tab both overlie and underlie the sheet element. While we prefer to thermally bond the tab, which can be formed from any strip material, to the sheet element or substrate, as noted below, any other pressure affixation may be used. For example, the tab or sheet may be formed with a pressure adhesive, a foil of pressure-activated or thermally-activated adhesive may be interposed between the tab and the substrate, or some other means may be provided to effect bonding. In the preferred case, the tab is channel-shaped synthetic-resin foil of a polyester such as Mylar or another material bondable to the substrate under heat and pressure.

We thus may provide at the tab-applying station, a pair of heated platens defining a space between them, at least in an open position of a movable one of these platens, a swingable arm adapted to receive sections of a preformed channel-shaped tab of generally U-section and provided with means for yieldably gripping a bight portion of such tabs, and actuating means for angularly displacing this arm to swing the tab between the platens to meet and overlap the substrate which may be inserted automatically parallel to the receiving edge or manually transversely thereto. Means is provided for advancing the arm and the tab carried thereby so that at least a strip of each shank of the tab overlies the substrate but the bight of the tab may be spaced therefrom. The platens may then close to thermally bond the

aforementioned bands to the juxtaposed surfaces of the card along strips parallel to the edge of the card, while leaving the bight portions and the remainder of the portion of the U free from engagement with the cards and projecting outwardly from this edge. In the closed position of the device, the arm may be linearly withdrawn, preferably along a radius of its arcuate path to disengage the thermally bonded tab from the spring-loaded gripper carried by the arm, whereupon the card having the tab bonded thereto is advanced parallel to the aforementioned edge for stacking or collation.

While the system is applicable to manual-feed machines as described above, we prefer to make use of an automtic feeder and for this purpose the machine is provided with a transport system or conveyor defining a transport path parallel to the aforementioned edge, e.g. between an array of gravity loaded freely rotating balls and a conveyor belt underlying the card stock but spaced inwardly of the aforementioned edge a distance equal at least to the width of the thermally bonded bands transverse to this edge. At the upstream end of this transport path there is provided a destacking or feed arrangement, according to the present invention, which receives between upstanding guides a stack of cards from which the bottom card is withdrawn by a pusher or slide-type reciprocating feeder to pass successively onto and along the transport path.

According to an important feature of this invention, the destacking arrangement comprises a bottom member and an adjustable upper member with parallel faces of a spacing slightly greater than the thickness of the sheet stock used, but less than twice this thickness, the upper member being formed with a beveled flank turned toward the sheets but inclined to the path thereof in the direction of the slot formed by the space members. Surprisingly, when these beveled faces are highly polished and include an angle of $35° \pm 5$ with the vertical, the lowest sheet element is guided into this slot but the next higher sheet element is retained and engagement of the lower sheet element by the pusher, e.g. which may have a ledge engaging the trailing edge of the card, advances it onto the transport path.

Downstream of the destacking means, according to the present invention, there is provided a pair of heated platens having juxtaposed elongated portions of a width corresponding to the width of the bands of the synthetic-resin foil tabs to be secured to the substrate, the welding faces of the platens being parallel to the direction of the substrate feed and being fixed in the transverse direction. At least one of the platens is vertically displaceable to compress the foil tab and the substrate against the other platen, e.g. by a pneumatic cylinder, controlled by the timing system of the apparatus.

In the region of this station, we provide a slide which is horizontally shiftable in a direction perpendicular to the direction of travel of the transport means and carrying a multiple lever linkage to which the tab-carrying arm is articulated for movement in the horizontal direction and pneumatically operated actuating members connecting this linkage so that, in the absence of a blockage of the angular displacement of the arm, the latter swings about its pivot but, with continued operation of this actuating means and blockage of the angular displacement of the arm, the latter is advanced perpendicularly to the tab-receiving edge between the platens of the heat-sealing device. Advantageously, the angular displacement of the arm is so dimensioned with respect to the path of the substrate, running parallel to the tab-receiving edge, that the latter edge lies along a secant of the arcuate orbit of the outwardly extending strips or arms of the channel-shaped tab which is open in the direction of the substrate path. Preferably, at least in the region in which the path of the cards intersect this orbit, the supporting surface of the transport table is recessed below its normal horizontal plane so that, while the major portion of the substrate is supported in this plane, a strip along the edge of the substrate of a width corresponding to the width of overlap of the tab and the cards, is set below this plane and the lower flange or shank of the tab can be accommodated below the substrate. Of course, the upper shank or flange of the tab is disposed above the upper face of the substrate.

According to another feature of this invention, selective abutment means is provided along the path of the substrate for temporarily immobilizing same, preferably by engagement with its leading edge, so that the desired segment of the edge strip of the substrate, overlapped above and below by this synthetic-resin foil tab, registers with the heat-sealing surfaces of the platens and operation thereof is enabled. As soon as the platens release the tabbed substrate, the latter may be again entrained by the continuously operating transport means, preferably to a collating station.

According to an important feature of this invention, the transverse advance of the arm is controlled so that at least a portion of the bight region of the tab remains spaced away from the edge of the substrate to which the tab is thermally welded. Stop means is provided for the stroke of the slide, the stroke of the actuating member or stroke of the arm for this purpose. An important feature resides in the linkage of the arm which decelerates it to zero movement when it cooperates with the substrate edge.

According to another important feature of the invention, the tabs are formed immediately prior to insertion between jaws of the pivotal arm, at least one of these jaws being spring loaded to retain the tab with sufficient force as to prevent dislodgement by centrifugal force or by shifting upon engagement of the arm with an abutment limiting its angular travel so that it is moved perpendicularly to the edge of the cards to which the tab is affixed.

The tab-forming means, according to the invention, comprises a roller arrangement for scoring a strip of thermally bondable synthetic foil, e.g. a Mylar polyethene terephthlate resin, along the longitudinal edges thereof to form offset bands of the strip from the central portion, these bands having a width equal to the width of overlap of the tab when the latter is fed into the path of the substrate. Furthermore, the strip. provided with the offset bands, is then passed through a forming die in which the generally U-shaped configuration is applied to the strip, either in the form of a bead of rounded profile or in the form of an angular (e.g. generally triangular or trapezoidal) profile, this shaped portion being referred hereinafter as the bight portion of the tab. The tab-forming means may then include means, e.g. a pair of endless bands of rubber or like high-friction material, backed between the rollers about which the bands pass by low-friction strips, e.g. of Teflon, which advance the formed tab strips through a predetermined adjustable distance (setting the tab length) and are cut from this trip. The path of the strip, prior to cutting, preferably includes the jaws of the swingable arm which may be open in the direction of

the strip-forming means so that the latter is slid into the jaws in a longitudinal direction but is withdrawn transversely when the arm is retracted.

According to still another feature of this invention, the stop means at the thermal welder comprises a plurality of solenoid-operated plates which are selectively vertically shiftable into the path of the substrate, the solenoid operation being programmed so that the selected solenoids are deenergized to permit advance of the substrate into engagement with the respective plates. When the solenoids are spaced along the path, actuation of all of the solenoids except the first upstream solenoid will cause a portion of the substrate approximately at its leading edge to be positioned between the platens to receive a tab; energization of all the solenoids except the next most upstream solenoid will permit the substrate to pass the first solenoid and be immobolized so that an intermediate portion of the substrate upstream of the first position is positioned between the platens to receive a tab, etc.

The invention also resides in a unique system for operating the solenoids according to the invention in the proper sequence, this arrangement comprising a rotable drum provided with a plurality of angularly spaced formations engageable by a finger-stop indexing means, the drum carrying a plurality of cams which operate sensitive switches connected in circuit with the cylinders. Advantageously a slip clutch is provided between the drum and a device for converting a linear motion of a pneumatic piston into rotary motion of the drum, the transmission mechanism insuring a rotation through at least 180° for each stroke of the piston and preferably a greater rotation. The transmission, for this purpose, may include a sprocket wheel or sector displaced by the pneumatic piston and coupled by a chain to the drum ahead of the slip clutch.

Downstream of the heat-sealing means, there is provided a further index-type stop arrangement, preferably with respective solenoids for temporarily mobilizing the substrate within a stamping die; the latter may consist of two die portions defining between them a space corresponding to the length of the substrate formation accommodating the tab. The latter solenoids are, accordingly paired with the first-mentioned solenoids so that the edge strip of the card is cut away except in the region accommodating the foil tab. Of course, the die-cutting system may be disconnected, by circuit means provided for this purpose, when the advance of the arm is increased to permit the bight of the foil strip to seat against the edge of the substrate.

Downstream of the die-cutting device, we provide means for accumulating the cards, thereby automatically collating them when the solenoid stops are in operation. By disabling the solenoid stops at the strip-applying portion of the machine and rendering the tab feed inoperative, it is possible to conduct the substrate completely through the tab-applying portion of the transport path and into the die-cutting portion thereof when it is desired to form tab-like projections on the substrates without the plastic foil overlays. Similarly, when it is desired to use the system for producing a large number of substrates with the tabs at one location, both sets of stops are disabled and removed from the path of the cards except for the one stop which remains effective to stop the substrates with the aforementioned location in alignment with the platens and in the space between the cutting portions of the dies.

From the foregoing, it will be apparent that the system of the present invention affords versatility as to the nature of the product produced and allows the manufacture of various tab systems which have not been produced heretofore by mass production or convenient semiautomatic operations, or which have not been economically attainable with prior-art apparatus.

The sheet elements are preferably planar substrates or sheets, preferably of rectangular configuration, which are displaced parallel to an edge of the substrate adapted to receive the tab. Of course, any width of substrate may be accommodated, simply by providing a sufficient wide transport table and adjusting the guides accordingly, and any length may be accommodated by varying the position of the card-entraining member of the feed means in its extreme retracted position. The system has been found to be suitable for stock of paper weight, and such thinner materials are not be excluded by the use of the term "card."

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. **1** is a diagrammatic front-elevational view of an apparatus embodying the present invention;

FIG. **2** is a plan view thereof with parts removed for clarity and also in diagrammatic form;

FIG. **3** is a cross-sectional view through a tab which may be applied to the edge of a substrate according to the invention;

FIGS. **4**, **5** and **5A** are similar views of tab structures according to other embodiments of the invention;

FIG. **6** is a plan view of a tab as applied to the substrate after the diecutting thereof;

FIGS. **7A** and **7B** are diagrammatic vertical sections through a portion of the feed system of the present invention taken along the line VIIA—VIIA of FIG. **2**;

FIG. **8** is a diagrammatic detail view of a stop arrangement for the die-cutting or tab-applying stations of FIGS. **1** and **2**;

FIG. **9** is a vertical section through a heat-sealing arrangement for the apparatus;

FIG. **10** is aa diagrammatic plan view of a mechanism for feeding the cut tabs to the heat-sealing arrangement;

FIG. **11A** is an elevational view of a mechanical programmer for the stop arrangement of FIG. **8**;

FIG. **11B** is a section taken along line XIB—XIB of FIG. **11A**; and

FIG. **12** is a diagrammatic detail view of a portion of the device for forming the tabs according to the present invention.

SPECIFIC DESCRIPTION

In FIGS. **1** and **2**, we show a tab-forming apparatus for index-card, file and like separators and, generally, tabulating and programming sheets, which comprises a feed station **10** from which individual cards (representing any of the substrates described) are drawn from a stack **11** and are advanced to a tab-supplying station **12**. Downstream of the tab-supplying station, there is provided a diecutting station **13** and a collating table **14**.

As illustrated in FIGS. **1**, **2**, **7A** and **7B**, the apparatus may comprise a housing **15** having doors **16** which may be opened to afford access to the pneumatic cylinders

operating the various movable parts of the apparatus in accordance with the desired program. At the upstream end of the housing **15**, there is provided the card-feed arrangement **10** which may comprise a pair of traverses **17** along which support rails **18** extending in the direction of the card feed may be moved. Between these rails there is mounted a track **19** for a pusher **20** which is coupled, as shown by arrows **21**, to a pneumatic cylinder received within the housing **15** and connected to the pusher by a hinged tie rod (not shown).

Each longitudinal guide **18** which, like track **19**, can be shifted transversely (arrow **22**) to accomodate card stock of various widths is provided with a pair of upstanding guides **23** one of which may be adjusted as represented by arrow **24** along the rectangular guide **18** to accommodate card stock of varied length.

As illustrated in FIG. **7A**, the feeder comprises a fixed bar **25** of a low-friction material such as polytetrafluoroethylene, a vertical member **26** capable of vertical adjustment (arrow **27**) by a screw (not shown) to vary the gap width *w* between the bottom edge **28** and the upper surface of bar **25**. The gap width *w* should be slightly greater than the thickness *t* of the card but less than twice this thickness.

The member **26** has, facing in the upstream direction at the lower edge **28**, a beveled face **29** which may include an angle of about 35°±5° with the vertical. This beveled flank **29** has a height *h* at least equal to several times the thickness *t* of the card.

The pusher **20** may have a ledge **30** whose height is equal to or slightly less than the card thickness *t* so that, as seen in FIG. **7A**, it engages behind the lowermost card of the stack **11** and entrains it to the right when the card is to be fed to the tab-forming apparatus. Surprisingly, the beveled flank **29**, when highly polished and dimensioned as indicated, retains all of the cards but the lowermost card in proper position so that only a single card can be fed to the tab-applying station at each stroke. The result is indeed unexpected since systems operating with guide surfaces for feeding cards and paper stock through a slot have hitherto been characterized by unreliability of feed (i.e., a card is not advanced at each and every stroke of the pusher) and by a tendency to feed more than one card at a time into the slot, thereby jamming the latter.

Downstream of the feeding device (FIG. **7B**), the table **31** may be provided with an endless belt **32**, preferably of fabric, which may be shifted transversely (arrow **33**) when larger cards or smaller cards are to be processed. Only the upper pass of the belt overlies the table. To retain the cards against the belt over substantially their entire transport path, there is provided a holddown device which comprises a bar **34** mounted for adjustment in the direction of arrows **33** upon a pair of rods **35** at each end of the table, and formed with a multiplicity of horizontally spaced vertically throughgoing bores **36** at least some of which receive freely rotating balls **37**. Dependent upon the force which is to be applied to the cards, the number of balls and their spacing may be increased or decreased and/or balls of greater or lesser weight may be used. For example, when heavy card stock is to be processed, the balls may be composed of steel and may be located in each bore **36**, with lighter card stock, a ball **37** may be provided in every other bore. When extremely light stock is employed, glass balls may be introduced in bores **36** spaced apart by more than one empty bore. In FIG. **7B**, the balls **37** are shown to hold a card **38** against the upper pass of conveyor belt **32**. The card is thus displaced in the direction of arrow **39**.

In FIG. **8** the stop means according to the present invention has been illustrated diagrammatically. When three index tabs are to be provided along an edge of the card (so-called "one-third cut"), three solenoids **40, 41** and **42** are provided, the solenoids being adjustably mounted along a bar **43** as represented by the arrow **44** for setting the position of the leading edge **45** of the card for each cut. The bar **43** may also be adjustably positioned as represented by the arrows **33** on rods **35**. Each of the solenoids **40, 41, 42** may thus be set (e.g. via a set screw not shown) to engage the leading edge of the card to apply the tab at the lelft-hand side, right-hand side or an intermediate location when three tabs are to be used in the "one-third cut" arrangement for the purposes of illustration here. When two tabs are to be provided (so-called "one-half cut"), of course, only two solenoids need be employed, the third being continuously energized or removed. Of course, when four tabs are to be employed in the so-called "one-quarter cut," for example, an additional solenoid appropriately positioned along the bar **43** may be used.

As illustrated in FIG. **8**, each of the solenoids comprises a coil **46** which may be energized by a programmer of stepping device shown diagrammatically in FIG. **2** at **47** but preferably of the mechanical type shown in FIGS. **11A** and **11B** and an armature **48** to which is secured a blade **49**. When each solenoid is energized (e.g. as shown for the solenoids **41** and **42** of FIG. **8**), its armature **48** is retracted to lift the blade **49** above the path of a card **38**. On the other hand, when each solenoid is deenergized, its armature **48** may drop by gravity until its blade **49** enters the path of card **38** and, as the card is carried along by the continuously operating conveyor, abuts the leading edge **45** of this card.

The conveyor **32**, the bar **34** and the stops **40 – 42** are disposed inwardly of the longitudinal edge **50** of the cards to which the tabs, are to be applied. In FIG. **3**, for example, there has been shown a card **51** whose longitudinal upper edge **52** is to receive a tab **53** of the angularly bent type. This tab comprises a pair of strips **54, 55** respectively overlying the upper face **56** and underlying the lower face **57** of the card **51** when the latter is disposed in a horizontal position on the tape. Furthermore, each tab straddles the edge **52** of the card to which it is applied and is heat sealed to the card along the strips **54** and **55**. It is an important feature of the present invention, that the upper edge, flank or bight of the tab **53**, as represented at **58**, be spaced by a distance D from the upper edge **52**, i.e., that the upper edge does not engage the inner surface of the bight.

In FIG. **4**, there has been shown another profile of a tab **59** whose shanks **60** straddle the card **61** and whose bight **62** is spaced by the distance D, preferably between **0.1** W and **5** W where W is the width of the strip of the tab heat sealed to the card. While the profiles of the tabs of FIGS. **3** and **4** are angular, the profile of the tab **63** (FIGS. **5** and **5A**) is generally flat, i.e., the rounded bight **64** is spaced at a distance D′ or D″ from the upper edge of card **65**. The strips **66** flanking the cards **65** and heat sealed thereto may have connecting portions **67** which are not thermally bonded to the card, but flank portions of the latter as they reach toward the bight **64**. Of course the distances D, D′ and D″ may be reduced to the thickness of the foil of the tab.

In FIG. 6, a die-cut card has been shown in plan view. The card can be seen to have a body 68 of card or paper board stock and initially of a rectangular configuration with a longitudinal edge 69. After a tab 70, preferably of one of the configurations shown in FIGS. 3 to 5A is applied to this longitudinal edge with strips 71 (having radiused corners 71') straddling the card 69 and heat sealed thereto and with a portion 72 projecting beyond the edge 69, the cards may be diecut to remove all of the longitudinal edge portions except for a tab formation 73 carrying the tab 70. The next card may likewise be provided with a tab 70 and thereafter die cut to remove all of the upper edge of the card but the tab-like formation 74 shown in dot/dash lines and carrying the synthetic -resin tab. The next card may likewise be fitted with a tab 70 of synthetic-resin material by heat sealing and thereafter diecut to produce the formation 75, shown in dot-dash lines, the remainder of the upper edge of the cards being cut away.

The tab-applying apparatus may comprise a supply coil 76 (FIG. 2) of a thermally bondable synthetic resin foil, e.g. a Mylar polyester, which is scored by conventional roll 77 to form the thermally bondable strips 54, 55, 60 or 66 thereon. The strip is then passed through a forming die 78 in which it is folded, cut to the desired length by a blade 78' shaped to form the radius corners 71', and fed to an arm 79 the function of which will be described in greater detail below.

From FIG. 12 it may be seen that the forming die may comprise a folding body 80 in which the synthetic resin band 81 is folded to form the aforementioned bight, a transport device comprising a pair of conveyor belts 82 and 83, and a cutting arrangement 94. The conveyor belt 82 and 83 pass about rollers 84 and may be driven by means not shown but preferably connected to a pneumatic cylinder by any conventional transmission for converting linear piston of the cylinder into rotation of the belts. The belts 82 and 83 have horizontal stretches 85 and 86 which engage heat sealing strips of the formed foil band and are backed by platens 87 and 88 of a low-friction material such as polytetrafluoroethylene. The conveyor band 82 and 83 are operated intermittently to advance the formed foil into the arm 79 previously described when the latter is disposed at the mouth 89 of the foil-forming device 78. The cutting blade 95 is shifted downwardly (arrow 90) once the desired length of tab, adjusted by setting the stroke of the last-mentioned piston, is established, thereby leaving within the arm the requisite length of foil strip.

As can be seen in FIG. 9, the card 38, when supported upon the cloth belt 32 is held slightly above the surface 91 of a lower platen 92 of a heat sealing arrangement comprising an upper platen 121 engageable through the card and tab with the lower platen 92. Each platen 92 and 121 has a respective resistive heating element 122 and 123 and thermocouple 124 and 125 which operated a control circuit 126 and 127 between a current source 128 and 129 and the respective heater to maintain a uniform temperature. Indicators 130 and 131 are provided to indicate the temperature of the platens 92 and 121.

The arm 79 is pivotally mounted at 100 on a slide 101 linearly guided in a slide housing 113 for movement in the direction of arrow 109, i.e., perpendicularly to the edge of the substrate to which the tab is to be applied. A link 103 is articulated to the arm 79 at 105 and to a further arm 114 at a pivot 104, the arm 114, in turn, being pivotally connected to the slide at 102. Arm 107, which is swung by a programmed pneumatic cylinder (not shown) is articulated to a connecting rod 106 which is pivotally joined to arm 114 at 104. At its free extremity, the arm 79 is provided with a channel 108 adapted to be aligned with the tab-forming means and to receive a formed tab (dot-dash lines in FIG. 10) under the slight spring pressure of a clip 110. Of course the channel 108 will generally conform to the shape of the tab used.

The mechanism for displacing the arm 79 is so constructed, in accordance with the principles of harmonic-motion mechanisms, to decelerate the arm 79 to standstill when it approaches its solid-line position in FIG. 10. This may be accomplished by providing that the pivots 102, 104 and 105 lie along a common line in the solid-line position of arm 79.

With the arm 79 in its dot-dash position (FIG. 10), the tab, severed from its strip, is releasably held while arm 107 swings in the counterclockwise sense to similarly pivot arms 114 and 79 in the counterclockwise sense until the arm 114 engages a stop 115. In this position, pivots 102, 104, 105 lie along a common line at an angle of 45° to the path of the slide and hence, by the laws of harmonic motion, the arm is decelerated to standstill in its solid-line position shown in FIG. 10. Furhter displacement of arm 107 in the clockwise sense advances the slide to feed the tab onto the substrate to the extent determined by the setting of, for example, a stop screw 111, thereby establishing the distances D, D' and D'' mentioned earlier. An arcuate guide plate 112 between the legs of the tab ensures that the substrate 38 will be straddled thereby.

FIGS. 11A and 11B show, in somewhat simplified form, a sequencing unit for operating the solenoids of the tab-applying and die-cutting stations, the unit comprising a housing 119 in which a shaft 131, rotatable by hand via a knob 130, is journaled. The shaft 131 is driven by a slip clutch 122 and carries an indexing drum 123 provided with angularly equispaced threaded bores each receiving a threaded pin 125 which can be backed out to project (see DIG. 11B) or inserted to or below the face of the drum. The projecting pins are engaged by a finger-stop arrangement 124 to immobilize the drum and the shaft by engagement with each protruding pin so that the cams 127 on the shaft operate the switches 128 and 129 connected to the respective banks of solenoids. A sprocket wheel driving the slip clutch is engaged by the chain 121 and is rotatable through at least 180° with each reciprocation of a drive 120 which can be a pneumatic cylinder as previously described.

The system described may, of course, be modified in many ways without deviating from the spirit and scope of the invention claimed. While a three-tab machine has been illustrated, the principles described are, of course, applicable to five-head machines and to machines capable of applying tabs of different colors with collation as required. Multiple arm machines, in which three or more tabs are applied simultaneously, are also included within the present precepts.

For example, downstream of the collating device or between the die-cutting device and the collating device, there may be provided a printing station for embossing or imprinting the tabulating or programming sheets after they have been provided with tabs. Also, the tabs may be provided with windows overlying the substrate instead of wholly beyond the tab-receiving edge. Suction grippers may be provided on the swing-

able arm in place of the resilient means described, etc.

We claim:

1. An apparatus for producing tabbed sheet elements comprising:

means for forming a succession of tabs, said tabs being generally channel-shaped with shanks adapted to straddle an edge of a respective sheet element

means for feeding said tabs to a tab-applying station;

means at said station for affixing each of said tabs to a respective sheet element disposed at said station;

means for controlling the position of the bight of each tab relative to said edge of the respective sheet element,

means for feeding a succession of sheet elements to said station, to enable said sheet elements to receive respective tabs; and

selectively operable stop means engageable with said sheet elements for locating the successive sheet elements at different positions with respect to said station whereby the tabs are applied to the successive sheet elements at locations along said edge thereof varying in accordance with the stopped positions of said sheet elements, said means for feeding said tabs to said station including an arm swingable substantially in the plane of said sheet elements and having a free end successively receiving said tabs, each tab carried by said arm describing an orbit, said edge of each sheet element extending along a secant of said orbit, and s slide carrying said arm and shiftable perpendicularly to said edge at said station, said means for controlling the relative position of the bight of each tab with respect to said edge of each sheet element including means for limiting the advance of said slide, said arm being provided with a slot open in the direction of said sheet elements and receiving the bight of said tabs.

2. The apparatus defined in claim 1 wherein said means for feeding said sheet elements includes conveyor means continuously operable to advance a succession of sheet elements through said station and said stop means including respective stop members actuatable for selective interposition in the path of said sheet elements for temporarily retaining a leading edge of a sheet element in a position determined by said stop member.

3. The apparatus defined in claim 1 wherein said tabs are composed of a thermoplastic, said means for fixing said tabs to said sheet elements including a heat-sealing platen engageable with each tab along a portion thereof overlying the face of the respective sheet element.

4. The apparatus defined in claim 1, further comprising die cutting means downstream of said station for imparting a predetermined configuration to said edge of each sheet element.

5. The apparatus defined in claim 4, further comprising selectively operable stop means engageable with said sheet elements downstream of said station and positioning respective portions of said edge of said sheet element in engagement with said die cutting means.

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