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Sheffield

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[54] **EMBOSSER HAVING COOPERATING ENDLESS INDICIA CARRIERS DISPLACEABLE RELATIVE TO ONE ANOTHER**

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[52] **U.S. Cl.** **101/18,** 101/111, 197/6.2

[51] **Int. Cl.** **B41j 5/30**

[58] **Field of Search** 101/18, 111, 287; 197/6.2, 197/6.7

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[57] **ABSTRACT**

Method and apparatus for the multiple, simultaneous embossment of flexible materials using complementary, character-forming inner and outer bands for each character to be embossed. There is one pair of bands per stage, including an outer, control band and a relatively flexible inner, follower band. Within each stage, the bands are brought into registration with each other in advance of an embossing position but are permitted to move in unregistered contact towards the registration position as the bands are advanced. Beyond the registration position, the bands are separated to accomodate the material to be embossed. In one embodiment, the bands are formed by blocks with respective raised and recessed characters for the inner and outer bands. The blocks are linked together and are hinged in the case of the inner bands.

17 Claims, 5 Drawing Figures

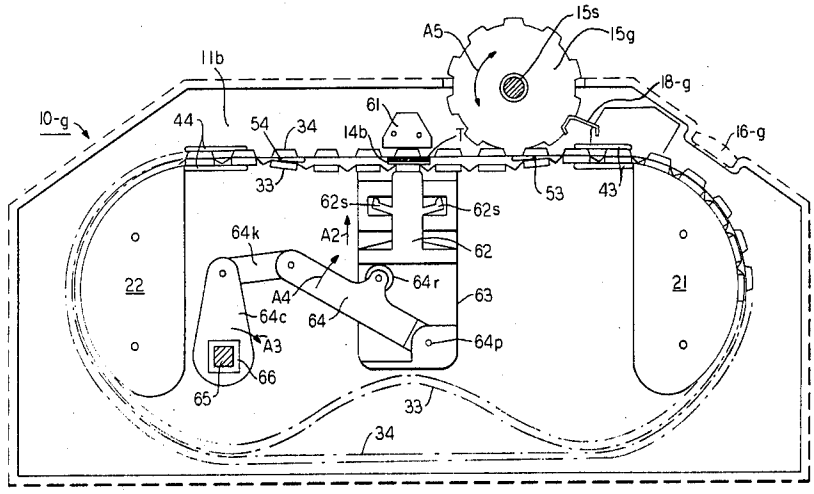


FIG. 1A

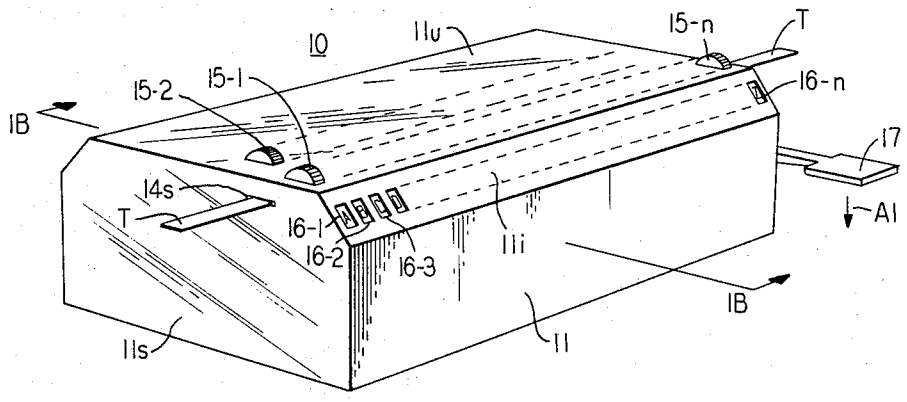
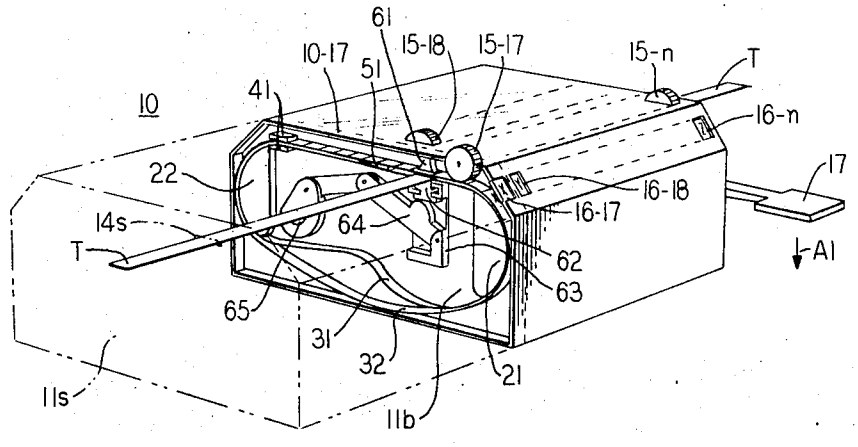


FIG. 1B



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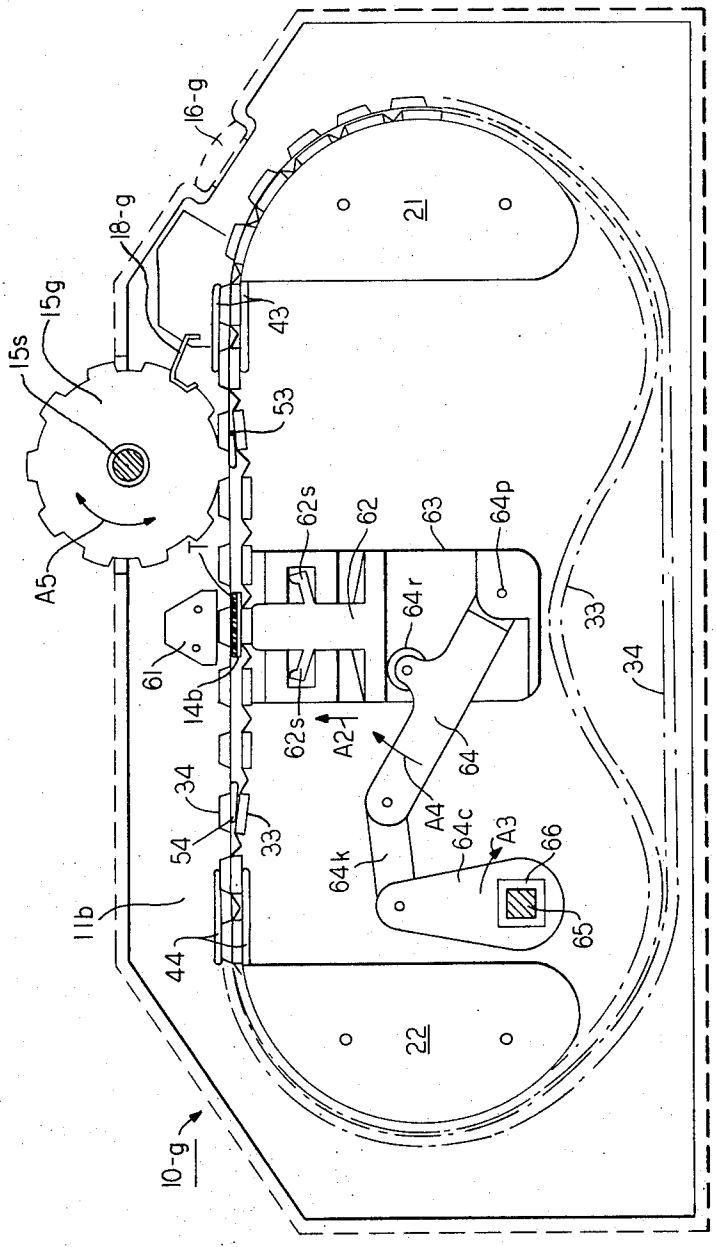
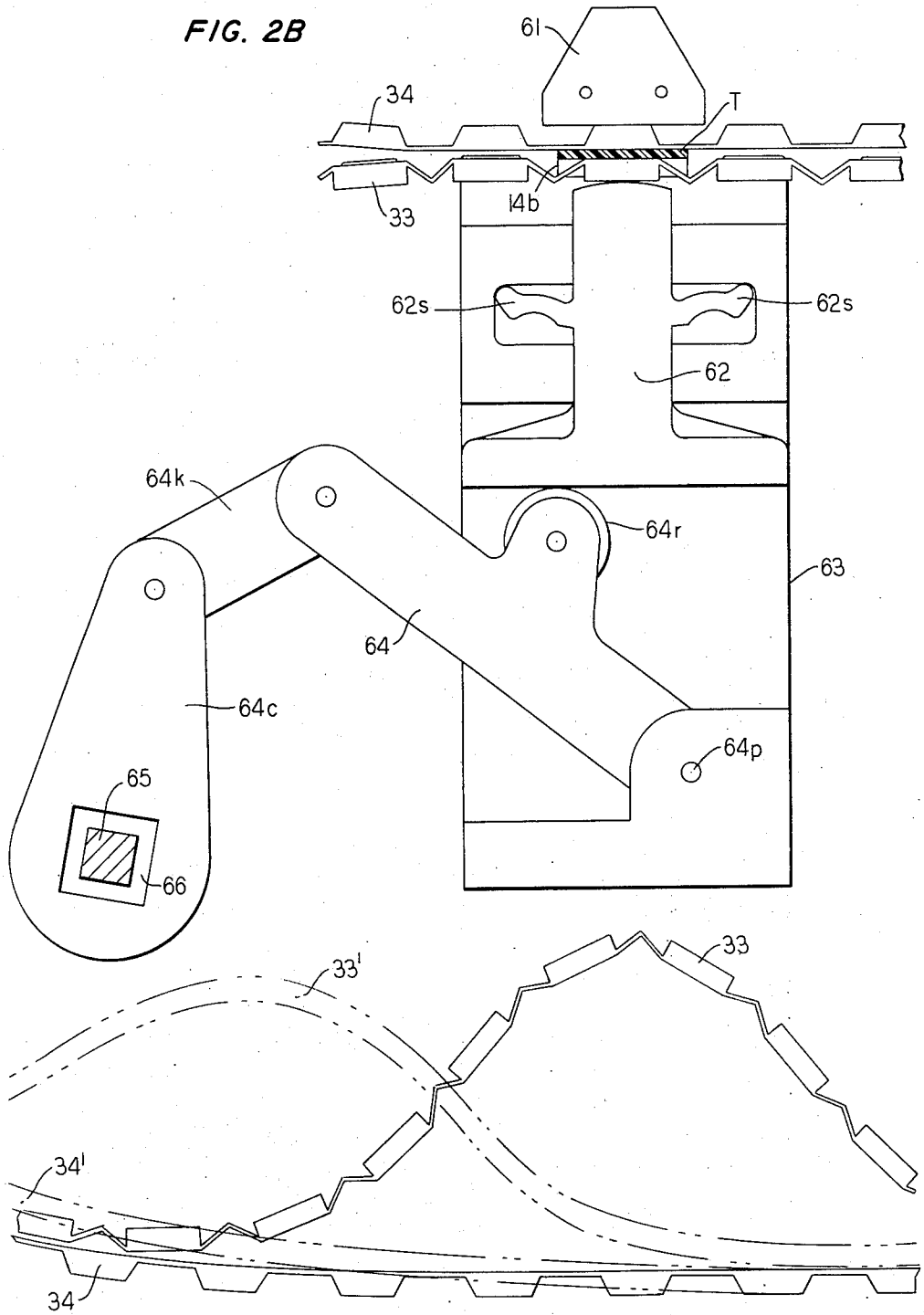

16-g
18-g
15g
15s
43
53
21
62s
62
63
64p
64r
A5
61
14b
62s
A2
64
33
34
A4
64c
A3
66
64k
65
54
34
33
11b
44
22
10-g

FIG. 2A

FIG. 2B



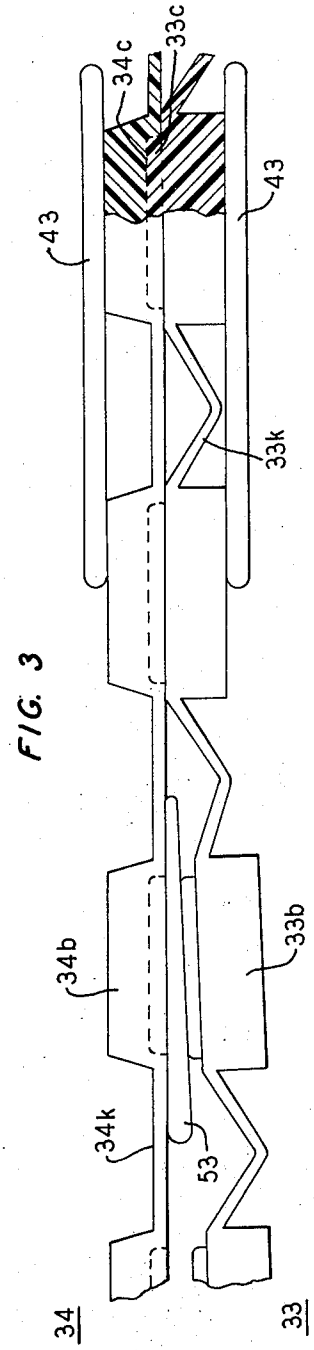


FIG. 3

EMBOSSER HAVING COOPERATING ENDLESS INDICIA CARRIERS DISPLACEABLE RELATIVE TO ONE ANOTHER

BACKGROUND OF THE INVENTION

This invention relates to the embossment of flexible materials, and more particularly to the simultaneous production of a selected multiplicity of raised characters on strips of flexible plastic tape.

Flexible materials are typically embossed by devices which make use of a punch and die arrangement, provided, for example, by the tynes and complementary recesses of a dialable embossing wheel. Such an arrangement generally produces a single character at a time and has the disadvantage that the number and size of the characters is constrained by the physical limitations of the device.

Another punch and die arrangement is provided by a band of raised, punch characters operating with a platen or in conjunction with a band having complementary die characters. This type of arrangement also generally produces a single character at a time. Further, in the case of a platen, there is the disadvantage that the resulting characters are often indistinct because the same counter-surface is used regardless of punch configuration. In the case of punch and die bands, the resulting characters will be disfigured if there is a failure of registration between the bands, such as occurs when one of the bands is advanced more than the other. Although desirable, mechanisms to provide registration are often omitted because of their complexity. Even when used, registration mechanisms can be cumbersome and a source of difficulty. For example, they can reduce the efficiency of operation of an embossing device by introducing a drag effect which interferes with the selective setting of the bands.

Accordingly, it is an object of the invention to facilitate the embossment of flexible materials. A further object is to achieve flexibility with respect to the number and size of characters that can be produced. A still further object is to produce distinct and non-disfigured characters.

Another object of the invention is to achieve suitable registration between the punch and die members of an embossing device. A related object is to achieve registration using a simple and reliable mechanism. A further object is to limit the drag that attends the registration of punch and die bands. Still another object of the invention is to facilitate the multiple, simultaneous embossment of flexible materials.

SUMMARY OF THE INVENTION

In accomplishing the foregoing and related objects, the invention provides for the simultaneous multistage embossment of prescribed characters on a flexible material, such as a strip of embossing tape. For each stage of embossment inner and outer members are provided that are movable over rectilinear and curvilinear paths and bear character-forming indicia. The members, which are desirably driven to an embossing position by a detented indexing wheel in engagement with the outer member, are first brought into registered contact over a region of their rectilinear paths of travel after being permitted to move in curvilinear, unregistered contact. Beyond the registration position, the members

are separated to accomodate embossable material and forced together to produce the desired embossment.

The inner and outer members advantageously are punch and die, i.e., male and female, bands with complementary character-forming indicia. The punch or male band, which is desirably the inner member, bears a plurality of raised indicia, while the die, or female band has a corresponding plurality of recessed indicia. The two bands are brought into registered contact with each other over at least a two-character interval along their linear paths of travel. Registration is illustratively achieved by forcing raised characters of the outer band into the corresponding recesses of the inner band by, for example, the sandwiching action of parallel plates. Advantageously there are two positions of registration along the rectilinear paths of travel of the bands for both forward and reverse directions of motions.

In accordance with one aspect of the invention, the inner and outer bands from closed loops and the exterior of each outer band bears markings which indicate, for any position, the corresponding character at the embossing position.

In accordance with another aspect of the invention, the inner band, which is a follower, is longitudinally flexible with respect to the outer or control band. The inner and outer bands are formed by respective sets of blocks, bearing complementary character-forming indicia. They are linked together and, in the case of the inner band, are hinged to provide the desired longitudinal flexibility. Where the inner band carries blocks of male embossing characters, the hinge effect provides desired displacement flexibility of the male characters relative to the female band.

In accordance with still another aspect of the invention, each inner band is guided over a curvilinear path, such as provided by a curved shoulder, to a registration position and is in contact with an outer band over at least a portion of its path of travel.

In accordance with still a further aspect of the invention, the bands are separated in advance of their embossing position by one or more wedge members and are forced together with a strip of embossing tape between them. For that purpose there is an anvil against the outer band at the embossing position and a hammer that is able to act against the inner member. The hammer is driven by, for example, a toggle linkage which is controlled with respect to a flexible bushing. The latter permits an adjustment in the toggle force applied per stage during the simultaneous actuation of all of the stages.

BRIEF DESCRIPTION OF THE DRAWINGS

Other aspects of the invention will become apparent after considering several illustrative embodiments taken in conjunction with the drawings in which:

FIG. 1A is a perspective view of a multistage embossing device in accordance with the invention;

FIG. 1B is a cross-sectional view of the device of FIG. 1A showing one of its intermediate stages;

FIG. 2A is a plan view of a representative single stage for a multistage embossing device of the kind shown in FIG. 1A;

FIG. 2B is a partial plan view of the stage of FIG. 2A during the embossment of a strip of plastic tape; and

FIG. 3 is a fragmentary view illustrating details of the

inner and outer bands of the stage shown in FIG. 2A.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

Turning to the drawings, an embossing device **10** in accordance with the invention for the multiple, simultaneous embossment of materials, such as a strip of embossing tape T, has a plurality of stages within an enclosure **11.** The number *n* of stages determines the number of characters that can be simultaneously embossed on the tape T, which enters the device **10** through an aperture **14***s* of a side panel **11***s* and emerges through an opposite side panel. The characters are set in the constituent stages of the device **10** by associated indexing wheels **15–1** through **15**–n in the upper panel **11***u* of the enclosure **11.** To facilitate access to the indexing wheels **15–1** through **15** -*n*, they are staggered for alternate stages. As the wheels are rotated, indications of the characters being set are visible through corresponding viewing windows **16–1** through **16**–*n* in the inclined face panel **11***i*. When all of the indexing wheels **15–1** through **15**–*n* have been set as desired, and the tape T is in embossing position, a lever **17** is operated in the direction indicated by the arrow A1 to bring about the multiple embossment of the tape T.

For simplicity, the multistage device **10** is shown without a source of supply for the tape T or a mechanism for severing the tape after it has been embossed. The device **10** is readily adapted to accomodate both or either of a source of tape and a cut-off mechanism.

A cross-sectional view of the device **10** is shown in FIG. 1B with a representative stage, for example the 17th stage **10–17** exposed to view. This stage, like the others of device **10** is formed by constituents that are mounted on a backing plate **11***b*. In the assembly of the stages within the enclosure **11,** the backing plate of each preceding stage forms the frontal plate of the suceeding stage. This limits the distance of separation between stages.

As illustrated for the seventeenth stage **10–17,** the backing plate **11**b mounts supports **21** and **22** for inner and outer embossing bands **31** and **32.** The latter move jointly over curved shoulders of the supports **21** and **22** in response to rotation of the indexing wheel **15–17.** To prevent undesirable frictional effects such as would occur if there were a separator between the bands **31** and **32,** or if they were to be in mesh with each other during travel over a curved path, the bands are disposed to make unregistered contact in a manner illustrated in greater detail in FIG. 2A. However, to provide the desired alignment of the bands **31** and **32** at the embossing position beneath an anvil **61,** registration is effected by plates **41** which extend over more than one character position of the bands. In addition, the bands **31** and **32** are separated to accomodate the tape T by a member **51.** The character that is set at the embossing position is identified through a viewing window **16–17.** When embossing is to take place, the bands **31** and **32** are brought together against the anvil **61** by a hammer **62** that slidably moves in a housing **63.** The hammer **62** is acted upon by a toggle linkage **64** which is, in turn, operated by the lever **17** through a rod **65.**

Because of the modular design of the various stages of the device **10,** the anvil **61** extends only for the interstage distance between adjoining backing plates and thus has a rigidity that would be absent if the anvil were continuous from one side panel to another of the overall enclosure.

Constructional details of a representative general stage **10**–*g* for the device **10** are set forth in FIG. 2A. To achieve the desired modularity of the stage **10**–*g*, it carries various constituents on the backing plate **11**b. Thus the supports **21** and **22** are illustratively riveted to the backing plate **11***b*, together with the anvil **61** and the hammer housing **63.**

As with the illustrated stage **10–17** of FIG. 1B, the supports **21** and **22** serve as guides for inner and outer embossing bands **33** and **34.** The latter are controllably advanced with respect to an embossing position beneath the anvil **61** by the clockwise or counterclockwise rotation (indicated by a double-headed arrow A5) of an indexing wheel **15**–*g* about a shaft **15***s*. The indexing wheel **15**–*g* has detent teeth which engage the outer band **34** between its constituent blocks. Step-by-step, i.e., character-by-character, movement of the bands **33** and **34** is assured by a detent spring **18**–*g*. The particular character that is set at the embossing position is indicated on the upper surface of the block of the outer band **34** opposite the viewing window **16**–*g*.

Between the embossing position and the respective supports **21** and **22,** the bands **33** and **34** have substantially rectilinear paths of travel, except for the separation of the bands effected by wedges **53** and **54** to allow the tape T to be received between them.

However, over the shoulders of the supports **21** and **22** the paths of travel are curved with the result that the distance traversed by the inner band is less than that of the outer band. Consequently, as depicted for the right-hand support **21,** there is an increasing degree over the shoulder of unregistered contact between the two bands.

To bring the bands **33** and **34** into registration before they reach the embossing position, two pairs of registration plates **43** and **44,** both mounted on the backing plate **11***b*, are included. The first pair of plates **43** is at the exit position of the support **21** as the bands **33** and **34** travel towards the embossing position as a result of clockwise rotation of the indexing wheel **15**–*g*. Correspondingly, the second pair of plates **44** is at the exit position of the support **22** as the bands **33** and **34** travel towards the embossing position as a result of the counterclockwise rotation of the indexing wheel **15**–*g*. Each pair of registration plates **43** and **44** bring the two bands together over at least a two-character interval in a manner shown with greater particularity in FIG. **3.**

It is to be noted that the bands **33** and **34** in FIG. 2A form closed loops, but they may also be inner and outer strips which hang freely over the respective shoulders of the supports **21** and **22.** It is the disposition of the inner and outer bands **33** and **34** relative to each other over the shoulder, without requiring registration over a considerable number of positions, that reduces the amount of drag that is encountered during rotation of the indexing wheel **15**–*g*.

When the bands **33** and **34** are closed loops, the difference in path lengths, because of the curvature of the supports **21** and **22,** results in slack in the inner band **33,** as indicated beneath the housing **63.**

As shown in FIG. 2A the tape T extends into the stage **10**–*g* through an aperture **14***b* in the backing plate **11***b* and between the two bands **33** and **34** before there has been any upward movement of the hammer **62** in the direction indicated by the arrow A2. The hammer

62 is maintained in its non-embossing position by the action of the spring members 625. When embossing is to take place, a crank 64*c* of the toggle linkage is rotated in the direction indicated by the clockwise arrow A3 by the shaft 65 acting through a flexible bushing 66. Torque is then transmitted by an intervening link 64*k* to the main toggle member 64 to bring about the clockwise rotation indicated by the arrow A4 with respect to a pivot 64*p* of the housing 63. A roller 64*r* on the main toggle 64 produces the desired upward movement of the hammer against the inner band 33.

The result of the movement of the toggle 64 initiated in FIG. 2A is indicated in FIG. 2B, showing the hammer 62 moved upwardly in the housing 63, compressing the springs 62*s* and bringing the head of the hammer 62 directly against the inner band 33. This forces the bands 33 and 34, with the tape T in between, against the anvil 61 and brings about the desired embossment.

The toggle linkage 64 permits ready attainment of the mulitiplication of the force applied to the actuator lever 17 (FIG. 1B) that is needed to bring out the embossment, and does with less friction, as compared for example with an eccentric mechanism, and consequently has less wear of parts. Illustratively, a force of approximately sixty pounds is required at the hammer 62, so that if the force at the lever is ten pounds the toggle linkage must provide a multiplication of 6*n*, where *n* is the number of stages.

Moreover, in a multistage embossing device the embossing force applied to the individual hammers of the different stages will vary depending upon the tolerances of its parts. In order to bring about a uniform embossment of the Tape T for all of the stages, the flexible bushing 66 is provided. This kind of bushing equalizes the forces applied to the various stages.

Also depicted in FIG. 2B is the configuration of the bands 33 and 34 below the housing 63. As the bands 33 and 34 are rotated, their relative positions will shift about, one such position being indicated by the bands 33′ and 34′ shown in phantom.

A detailed fragment of the bands 33 and 34 of FIGS. 2A and 2B is given in FIG. 3. The inner follower band 33 is formed by character blocks 33*b* which are hinged together by flexible members 33*k*. The outer control band 34 is formed by blocks 34*b* that are linked by members 34*k*. The inner blocks 33*b* have raised characters 33*c*, while the corresponding outer blocks 34*b* have recessed characters 34*c*. Because of the way the blocks are linked together, the bands 33 and 34 can be used with a wide variety of embossing tape widths. In addition the relative thinness of the linking members 33*k* and 34*k* of the bands 33 and 34 helps prevent fatigue. In the case of the inner band 33, the hinged members 33*k* provide displacement, i.e., longitudinal, flexibility for the male embossing characters relative to the female embossing characters of the outer band 34.

As shown in FIG. 3 the bands 33 and 34 are brought into registration as they pass between plates 43 by having the raised characters of at least two inner blocks forced into the corresponding recess of the oppositely positioned outer blocks.

The bands 33 and 34 are desirably molded as single pieces from a material such as an acetyl resin plastic of the type sold and marketed by E. I. du Pont de Nemours and Co. of Wilmington, Delaware, under the trade name of "Delrin." The bands 33 and 34 can also be die cast or made of powdered metal or stampings.

While various aspects of the invention have been set forth by the drawings and the specification, it is to be understood that the foregoing detailed description is for illustration only and that various changes in parts, as well as the substitution of equivalent constituents for those shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. An embossing device having at least one stage and comprising, per stage:
   - an elongated outer control member and an inner follower member, disposed to move over a linear region of travel from a curvilinear region of travel with said control member presenting a smooth inner face to said follower member and said follower member being constituted by blocks which are displaceable relative to one another, whereby the control and follower members are able to slide in contact and relative to one another into registration, one member having raised embossing characters and the other having complementary recessed characters;
   - means in said curvilinear region of travel for permitting the outer and inner members to move in unregistered contact with each other towards registration;
   - registering means at the position of registration for forcing at least two raised characters of one member into corresponding recessed characters of the other member during the movement of said outer control member to an embossing position;
   - means in said linear region between said registration position and said embossing position for separating the registered members to accommodate embossable material therebetween at said embossing position; and
   - means at said embossing position for controllably forcing the separated members against the embossable material.

2. An embossing device as defined in claim 1 wherein said stage includes a backing plate that is able to serve as a cover for a succeeding stage and the forcing means at said embossing position comprises an anvil mounted on said backing plate on one side of said control and follower members, a hammer slidably mounted on said backing plate on an opposite side of said control and follower members and means pivotally mounted on said backing plate to act against said hammer for pressing said members, with said material therebetween, against said anvil.

3. An embossing device as defined in claim 1 wherein the pressing means comprises a toggle linkage.

4. An embossing device as defined in claim 3 wherein said toggle linkage is pivotally mounted in a flexible bushing.

5. An embossing device as defined in claim 1 wherein said control and follower members are disposed to move over a linear region of travel between two curvilinear regions of travel, said control member forms a first closed loop, and said follower member forms a second closed loop nested within said first loop.

6. An embossing device as defined in claim 5 wherein said first closed loop is elliptical and said second closed loop is in contact with said first loop over a major portion of the curvilinear regions of travel thereof.

7. An embossing device as defined in claim 5 wherein the closed loop of said follower member is of a length which produces a region of slack with respect to the closed loop of said control member.

8. An embossing device as defined in claim 7 wherein said control and follower members are positioned to cause the region of slack of said follower member to shift position during the movement of said control member.

9. An embossing device as defined in claim 1 wherein the control member is formed by blocks, including one block for each embossing character, joined together by a continuous band which faces the blocks of said follower member, with the outer surface of the control member blocks bearing character indicating indicia.

10. An embossing device as defined in claim 9 further including a manually rotatable indexing wheel which engages the blocks of said control member for moving a desired raised and recessed character set to said embossing position.

11. An embossing device as defined in claim 1 wherein the blocks of said follower member are joined together by flexible hinges.

12. An embossing device as defined in claim 11 wherein said hinges are V-shaped members, each extending between the surfaces of adjoining blocks of the follower member.

13. An embossing device as defined in claim 1 wherein said registering means comprises at least one pair of plates between which said members are sandwiched over a two block interval of said follower member.

14. An embossing device as defined in claim 1 wherein the separating means comprises means positioned between said members and located between the registering means and said embossing position.

15. An embossing device as defined in claim 14 wherein the registering means is in two parts on opposite sides of said embossing position, and said separating means comprises respective wedges between said members on opposite sides of said embossing location.

16. An embossing device as defined in claim 1 wherein said registering means comprises a first pair of plates for registering said members during travel in one direction of motion and a second pair of plates for registering said members during travel in the opposite direction of motion.

17. An embossing device as defined in claim 1 for the multiple simultaneous embossment of flexible material which comprises a plurality of successive modular stages, each in accordance with claim 21, connected in tandem and means for operating the forcing means of the individual stages simultaneously.

* * * * *