May 18, 1948. H. G. KENDALL 2,441,821

MACHINE FOR REENFORCING AND PUNCHING SHEETS

Filed March 31, 1942

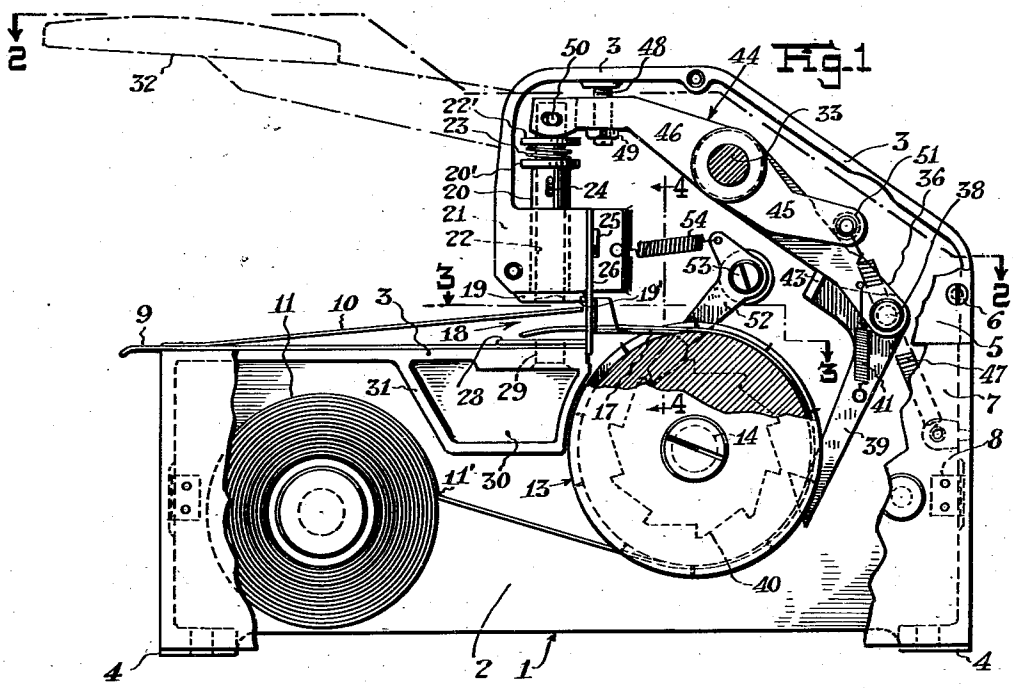


Fig. 1

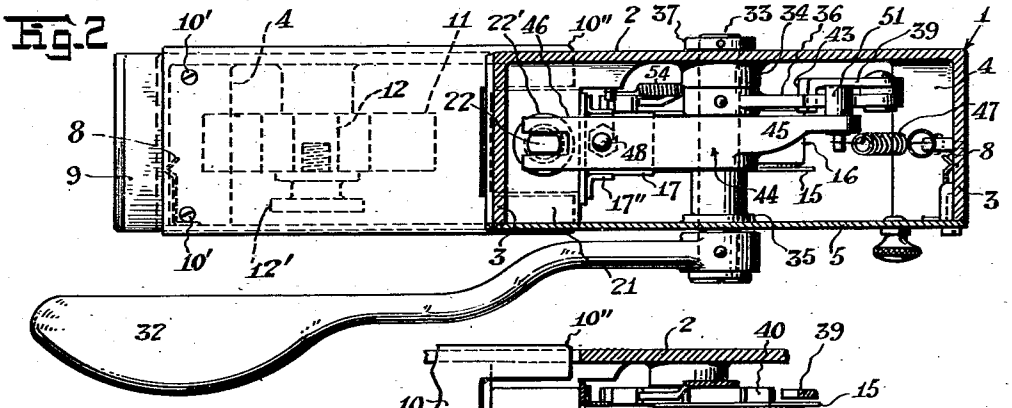


Fig. 2

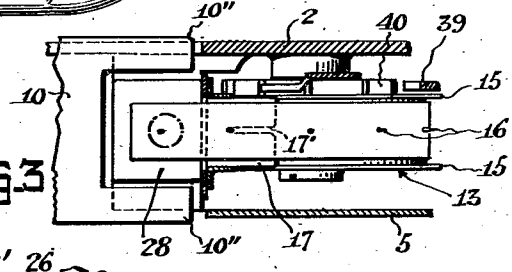


Fig. 3

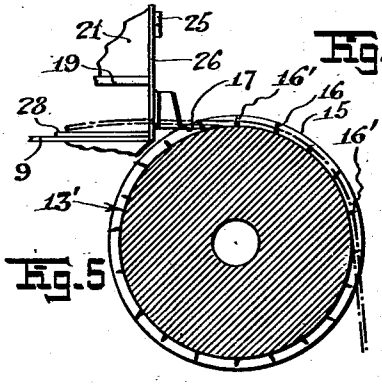


Fig. 5

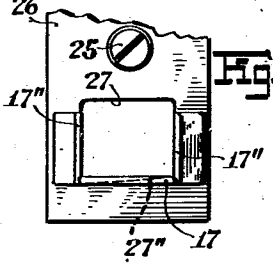


Fig. 4

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MACHINE FOR REENFORCING AND PUNCHING SHEETS

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4 Claims. (Cl. 93—1)

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This invention relates to machines for reenforcing and punching sheets of material such as paper sheets, cards, tags, cloth strips, etc., and more particularly relates to such unitary machines of the character mentioned as are adapted for applying reenforcing patches or strips of adhesive tape to such sheets and for punching the reenforced portions of the sheets, all in one operation. The invention has especial utility, and is herein illustrated and described, in connection with a machine for reenforcing and punching paper sheets for loose-leaf binders, but it will be understood that I intend no unnecessary limitation of my invention to machines of this type.

My invention is concerned generally with improvements in machines of the character above-mentioned which are adapted to simplify the construction and operation of such machines and to render them more practical and dependable. In these respects, a particularly special feature of my invention lies in the provision of an improved and simple feed mechanism for the reenforcing material which is operable dependably with single-coated adhesive tapes of the non-drying type, these tapes being known in the trade as pressure sensitive adhesive tape or Scotch tapes.

There is a wide selection of Scotch tapes on the market which are strong and tough and ideally suited for reenforcing paper sheets for loose-leaf binders. While these tapes have the distinct advantage of being capable of being applied directly to the sheets without any auxiliary or preliminary operations such as are required with the dry and thermoplastic tapes, yet the Scotch tapes have not been used successfully because of the difficulty in feeding the tape to the work. In machines of the character concerned, the tape is to be fed out in a single layer for direct application to the work. Because of the small ridigity of the tape and its characteristic of adhering tenaciously to whatever comes in contact with its adhesive or gummed side, it is necessary that the feed mechanism be able to feed the tape to the work without making any substantial contact with the gummed side of the tape. In accordance with my invention, I am so able to feed out a single layer of Scotch tape from a continuous supply roll, for direct application to a paper sheet or other article, and to do this in a highly simple and reliable manner. However, I do not intend my invention to be restricted for use in connection with only Scotch tapes as it may have also advantageous and practical application with other kinds of tapes.

It is accordingly an object of my invention to

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provide a machine of the character above-mentioned which is adapted for efficient and reliable operation with single-coated non-drying adhesive tapes as the reenforcing media.

It is another object to provide a simple and reliable means for pulling a non-drying adhesive tape from a supply roll and dispensing it in a free state.

It is another object to provide a simple and reliable means for feeding a non-drying adhesive tape from a supply roll without incurring any substantial contact with the gummed side of the tape.

It is a further object to provide an improved feed mechanism which is operable dependably in connection with any of various kinds of adhesive tapes.

It is a further object, in a machine of the character above-mentioned, to dispense a reenforcing tape to a paper sheet by means of a pin wheel which takes hold of the tape by piercing or puncturing the tape at regular space intervals, and then to punch the sheet and tape, when the two are applied together, at a place where the tape has been pierced by the pin wheel.

It is another object, in machines of the character mentioned, to dispense an adhesive tape by a pin wheel and to shear reenforcing patches from the tape by cutting the tape on a line substantially at a place where the tape has been pierced by the pin wheel.

A further object of my invention is to provide an improved machine for the purposes above stated which may be readily actuated either to punch a sheet only or both to reenforce and punch a sheet, as the operator may desire.

A yet further object of my invention is to provide a simple and improved means for sequentially dispensing an adhesive tape across a sheet at a clearing distance therefrom, and then applying the tape to the sheet.

Still other objects and features of my invention will be apparent from the following description and the appended claims.

In the description of my invention reference is had to the accompanying drawings, of which:

Figure 1 is a side elevational view of a machine into which my invention is incorporated, the side plates of the machine being partially broken away to permit a better showing of the interior parts of the machine;

Figure 2 is a horizontal plan and sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a fractional view taken substantially on the line 3—3 of Figure 1;

Figure 4 is a partial sectional view to enlarged scale taken substantially on the line 4—4 of Figure 1; and

Figure 5 is a view showing a modified form of feed wheel for the machine.

In Figures 1 and 2 there is shown a machine constructed in accordance with one embodiment of my invention, which constitutes a unit adapted for applying a reenforcing strip of Scotch tape to a paper sheet, severing the strip from its supply roll along the edge of the sheet and punching the part of the sheet which is so reenforced, the function of the machine being to provide the sheet with a reenforced apertured portion by which it may be firmly held in a loose-leaf binder. While I herein show only one such unit in order to simplify the description of my invention, it will be understood that a plurality of such units may be provided in one unitary machine for unitary operation as may be desired.

The unit herein shown has a frame or housing comprising a section 1 formed suitably by die casting which includes a vertical side wall 2 provided with flanges 3 along its rim and with two depending legs 4 which are adapted for fastening the unit to a suitable base not shown. The housing may be considered as constituting a lower rectangular part and an upper rearward part of which the latter is enclosed by a side plate 5 held to the flanges 3 by screws 6 and the lower part is enclosed by a rectangular side plate 7 which is detachably held to the lower flanges 3 by spring clips 8. This lower part of the housing forms a support for a table 9 at the front of the unit. It is on this table that a paper sheet is to be placed when the same is to be operated upon by the unit. Overlying the table, however, is a flat upwardly inclined spring 10 which is adapted to space the sheet initially from the adhesive tape as will hereinafter appear, this spring being riveted to the forward part of the table 9 as at 10'.

A supply roll 11 of Scotch tape is carried in the housing below the table 9 on a short post 12 secured to the housing section 1, the roll being held onto the post by a thumb screw 12'. Access into the housing for installing the roll is had by detaching the side plate 7. For pulling the tape from the roll, and feeding it to the paper sheet, I provide simply a pin wheel 13 which is journalled to the housing, rearwardly of the supply roll, on a shaft 14. This pin wheel has flanged rims 15 and a series of circumferentially-aligned projecting pins 16 which are spaced about the periphery of the wheel at intervals equal to the length of each strip of adhesive tape, or patch, that is to be applied to the paper sheet, the pins being suitably ordinary store pins which are anchored into the body of the wheel. The adhesive tape is pulled free from the supply roll and onto the wheel at the bottom thereof, with its gummed or adhesive side away from the wheel, and is carried about the wheel to the top thereof, the tape being punctured and held to the wheel by the pins 16. Since the pins are sharp, a rotation of the wheel will cause them to pierce the tape consecutively and maintain a continuous connection of the tape to the wheel so long as there is a small resisting force of the tape such as is provided by the adherence of the Scotch tape to its supply roll. At the top of the pin wheel there is provided a short horizontal plate 17, which is placed preferably in engagement with the periphery of the wheel. This plate is extended substantially tangentially from the wheel at a level slightly above the table 9, and is provided with a central narrow slit 17' through which the pins 16 pass. By means of this plate the tape is stripped from the pin wheel and guided forwardly below the level of the rearward part of the spring 10, with its adhesive side facing upward for application to the paper sheet.

It will be seen that the pin-wheel type of feed which I provide for the tape is a particularly simple yet reliable means for pulling a single-coated non-drying adhesive tape from a supply roll and feeding it, in a single layer and in a free state, to a sheet or other article for direct application thereto. The reliability of operation of this feed mechanism follows largely from the fact that it involves no substantial contact with the adhesive side of the tape. Yet the pin wheel is positively acting for it firmly takes hold of the tape so long as a suitable number of pins, as of four or more, is maintained in engagement with the tape. Although the tape has little rigidity, it can be readily stripped from the pin wheel and projected forwardly across the plate 17 in sufficient free lengths for the purpose desired. Also, the free tape stripped from the pin wheel has a downward bias which causes it to lay flat into the plate 17 and to be thus easily controlled, this biasing of the tape being caused by the sharp bend which the tape receives at 11' as it is pulled from the supply roll. While the feed mechanism involves piercing the tape at regular intervals, this does not materially weaken the tape since the pins 16 may be quite short to produce only short tears. In any case, in accordance with the present invention, I preferably blank out the punctured part of each reenforcing patch in the punching of the paper sheet, thus leaving the tape which is applied to the sheet in a wholly undamaged state, as will hereinafter appear.

For applying the tape to the paper sheet and performing the shearing and punching operations, there is provided a punch and die unit 18 of the double-action type, that is, the type wherein the punch element is movable relative to the respective die plates. This unit has an upper flat die plate 19 which is staked to a vertical tube 20 that is guided slidably in an apertured block 21 provided suitably as an integral part of the housing section 1. Slidable within the tube 20 is a cylindrical punch 22. This punch extends upwardly beyond the tube and is held retracted in relation to the die plate 19 by a compression spring 23 which is interposed between a shoulder 20' on the end of the tube and a shoulder 22' on the end of the punch. Between the tube and punch there is a pin and slot arrangement, generally referred to as 24, which defines the retracted position of the punch and permits a downward movement of the punch relative to the die plate.

Secured by a screw 25 to the rearward side of the block 21 is a flat depending spring 26 which is biased forwardly to bear slidably against a rearward bevelled edge 19' of the die plate 19. This flat spring is provided with a central window 27, and has the stripping plate 17 secured thereto in position to guide the tape from the pin wheel through the window, the plate being at the level of the lower edge 27'' of the window and provided with upturned wings 17'' at the sides for confining the tape laterally and preventing it from catching on the side edges of the window. The lower edge 27'' of the window is inclined relative to the horizontal (see Fig. 4) and is adapted to cooperate with the rearward edge 19' of the die plate 19 to form a scissors for shearing the tape

as the upper die plate is pressed downwardly; these edges are accordingly made sharp, and the die plate 19 and spring 26 are made of hard stock. Because of the inclination of the lower edge of the window, the stripping plate 17 is given a twist so that its front and back edges will be in line respectively with the cutting edge 27'' and with the periphery of the pin wheel.

Below the level of the cutting edge 27'', as at a distance of about $\frac{1}{16}$ inch, there is a rectangular stationary die plate 28. This die plate is mounted on the rearward part of the table 9 directly below the upper die plate 19, and is made of hardened stock and provided with a circular opening 29 to receive the punch 22. Below the die plate 28 there is provided a compartment 30, formed by one of the flanges 3 and by an interior web 31 of the housing section 1, for catching the disks which are blanked out by the punch and die unit. This compartment is openable at the side merely by detaching the side plate 7 of the housing.

The spring 10 aforementioned extends rearwardly short of the lower die plate 28 but has two rearwardly extending fingers 10'', one to each side of the die plate 28, which underlie the opposite end portions of the die plate 19 (see Figs. 1 and 3). When a paper sheet is to be reenforced and punched, it is inserted between the spring 10 and the upper die plate and pushed rearwardly until its rearward edge contacts the spring 26. The feed wheel is then turned to feed a strip of adhesive tape below the sheet across the lower die plate, and the upper die plate 19 is then pressed down. As the die plate 19 is so pressed, the spring 10 yields to the downward pressure thereof and the paper sheet is moved down into contact with the tape, the spring 10 clearing the lower die plate and coming into a position substantially flat with the table 9; also, the movement of the die plate 19 past the cutting edge 27'' of the spring 26 operates to shear the tape on a line with the edge of the sheet, but no part of the adhesive side of the tape, other than the very cutting edge 19' of the die plate, comes into contact with any part of the punch and die unit. Furthermore, upon applying a suitable pressure to the punch 22 as the dies are closed, the punch will enter the opening 29 in the lower die and blank out a disk from the reenforced part of the sheet, leaving the sheet with a reenforced apertured part by which it may be firmly held in a loose-leaf binder.

The pin wheel and the punch and die unit are operated by a hand lever 32. This lever is secured to a shaft 33 which is pivoted to the upper part of the housing in bearings 34 and 35 provided on the side walls 2 and 5. Pinned to the shaft within the housing is a rearwardly depending arm 36; this arm abuts against the inner face of the bearing 34 to hold the shaft from lengthwise play in one direction, the shaft being held from play in the other direction by an abutment collar 37 which is provided on the outer end thereof. Pivoted at 38 to the end of the arm 36 is a depending pawl 39 which operates in conjunction with a ratchet wheel 40 that is secured to the side of the pin wheel, the ratchet wheel being provided with as many teeth as is the pin wheel with pins 16. This pawl is biased forwardly, by a tension spring 41 connected between the pawl and the arm 36, into a position defined by the abutment of an arm 43 of the pawl against the underside of the arm 36. Pivoted to the shaft 33 adjacent to the arm 36 is a rock lever 44 having rearwardly and forwardly extending arms 45 and 46. This rock lever is biased clockwise by a tension spring 47 connected between the lever and the housing, and is held in a limiting position defined by the abutment of a screw 48 in the arm 46 against the underside of the top flange 3 of the housing section 1, the screw 48 being held in adjusted position by a lock nut 49. This arm 46 has a pin and slot connection 50 to the punch 22. In the rearward arm 45 there is provided a short lateral pin 51 which overlies the arm 36 and which, in response to the bias of the rock lever 44, serves yieldably to retain the hand lever against the downward force of its own weight in a raised intermediate position, which is the position it occupies normally as is shown in Fig. 1.

A detent 52 is provided for holding the pin wheel from travel in a reverse direction. This detent is pivoted at 53 to the side wall 2 and is held in engagement with the ratchet wheel 40 under the influence of a tension spring 54 connected between the detent and this side wall.

When the hand lever is raised from its normal or intermediate position, the pawl 39 is first impinged against the ratchet wheel and then cammed down over a tooth thereof, the pawl being turned about the pivot 38 and pressed against the ratchet wheel by spring 41 as the hand lever is raised. As the hand lever is next returned to normal position, the ratchet wheel is advanced by an amount of the angular distance between adjacent teeth and then the arm 36 impinges against the arm 43 of the pawl and turns the pawl unitarily therewith about the shaft 33 and out from engagement with the ratchet wheel, the ratchet wheel becoming again latched against reverse travel by the detent 52 as the pawl is disengaged. This step of advance of the ratchet wheel causes a strip of tape to be fed between the dies equal in length to the arcuate distance between adjacent ones of the pins 16.

Upon next continuing the downward travel of the hand lever below its normal position, a downward pressure will be applied to the punch 22 through the arm 36 and lever 44, and this downward pressure will be transmitted by the spring 23 to the upper die plate 19. The spring 23 is preferably made sufficiently strong so as not to yield substantially by the force on the punch required to overcome the resistance of the spring 10 and to press the die plate 19 past the cutting edge 27'' to shear the tape. Thus, the punch will remain retracted relative to the die plate 19 until this die plate engages the lower die plate 28, but will be pressed down into the opening 29 of the lower die plate upon the application of a small additional pressure to the hand lever at the end of its stroke.

It is thus seen that upon first raising the hand lever above normal position and then lowering it below that position, a sheet which is held on the spring 10 between the dies will be applied to a strip of the adhesive tape, this strip of tape will be severed from its supply roll and a hole will be punched through the sheet and reenforcement. When the hand lever is released from down position, it will be returned to normal position by the spring 47 and the punch will be stripped from the sheet by its retraction under the influence of the spring 23.

As typical values, the length of tape fed out between the dies by one stroke of the hand lever may be $\frac{2}{16}$ inch, which will also be the distance of spacing between adjacent pins 16. Also, the tape may be ½ inch in width, and the punch 22 may be ¼ inch in diameter and be located

with its axis at $\frac{5}{16}$ inch from the cutting edge 27. Under these conditions, each reenforcement applied to the sheet will be ½ inch wide and $\frac{9}{16}$ inch long and will be provided with an aperture ¼ inch in diameter at a minimum distance of $\frac{3}{16}$ inch from the edge of the sheet, the reenforcement at the inner side of the aperture being ⅛ inch wide. This size of aperture, and spacing of the aperture from the edge of the sheet, is in accord with standard practice for loose-leaf sheets.

Since the punching operation is effected by moving the hand lever down from normal position, and the tape feeding operation is effected by the travel of the handle above normal position, the machine may be used readily for punching only or for both reenforcing and punching, as the operator may desire. While I preferably complete the tape feeding operation before starting the punching operation, it will be understood that these operations may overlap so long as the feeding of the tape is stopped substantially before the paper sheet is applied thereto.

As has been hereinbefore mentioned, I preferably space the feed wheel in relation to the punch and die unit so that the puncture made in each length of tape fed between the dies will become located directly below the punch 22, this condition being illustrated for instance in Figure 3. Thus, the puncture in the tape is blanked out and the tape which is applied to the sheet is left in a wholly undamaged state.

To install a new roll of tape in the machine, the side plate 7 is detached to expose both the thumb screw 12' and the pin wheel. The roll is then placed on the post 12 and a strip of tape is pulled free from the roll and applied to such fractional part of the periphery of the pin wheel as will bring two or three consecutive pins 16 into engagement with the tape. The pin wheel is then turned to feed the tape up over the stripping or plate 17.

Should it be desired to employ a design of the machine wherein the application of the tape to the feed wheel is limited to a small fraction of the periphery thereof, or if it be desired to take the tape off from the wheel at the bottom thereof, an additional holding force of the tape to the wheel may be required. In such cases my invention contemplates the use of a modified pin wheel 13' having an additional set of intermediate pins 16', such as is shown in Figure 5. These additional pins are preferably made quite short and placed on the pin wheel in relation to the punch and die unit so that each puncture made thereby in the tape will come at the line where the tape is sheared. By this method, whatever weakening effect on the tape the additional set of pins may cause, is substantially nullified. Also, I incline the major set of pins 16 forwardly in the direction of advance of the pin wheel, as is shown in Figure 5. In so doing, these pins will not have any substantial tearing action as they pierce the tape, and will thus have a strong firm grip on the tape to hold it securely to the pin wheel. Although they will now have greater tearing action on the tape as the tape is stripped from the pin wheel, this is unimportant since, as before, the part of the tape which is pierced by these pins is blanked out by the punch and die unit.

The preferred embodiments of my invention herein shown and described are to be considered as illustrative and not necessarily limitative of my invention, as these embodiments are

subject to many changes and modifications without departure from the scope of my invention, which I endeavour to express according to the following claims.

I claim:

1. In a machine of the character described: the combination of a pair of punching dies; means to feed adhesive tape between said dies comprising a wheel having projecting pins spaced equidistantly along the periphery of the wheel, said pins being adapted to pierce said tape and pull it from a supply roll as the wheel is turned; means to remove the tape from said wheel as the latter is turned and to guide the tape between said dies; and means operable to actuate said feed wheel to feed a length of tape between said dies equal to the spacing between successive predeterminately selected pins and thereupon to close said dies, said actuating means being adapted to locate a pierced hole in each length of tape within the area of punching of said dies.

2. In a machine of the character described: the combination of a pair of shearing dies; a pin wheel for feeding adhesive tape from a supply roll between said dies, said pin wheel having its pin elements spaced equidistantly about the periphery thereof; and means operable to actuate said pin wheel to feed a strip of tape between said dies of a length equal to the distance of spacing between predeterminately selected pin elements and thereupon to close said dies, said actuating means being constructed and arranged to locate a hole pierced in each strip by said pin wheel substantially at the line of shearing of said dies.

3. The method of applying adhesive tape to a sheet and punching the sheet, comprising piercing the tape for taking hold of it and feeding it across said sheet, pressing the tape and sheet into contact with each other, and punching a hole in the sheet and tape at a place where the tape has been pierced in the feeding thereof.

4. In a machine for applying adhesive tape to sheets and punching the sheets: the combination of a closeable die mechanism including a punch; and tape feeding means associated with said die mechanism, said feeding means including advanceable tape-perforating drive pins for propelling the tape, and drive-pin advancing means recurrently actuatable for feeding successive predetermined lengths of tape into said die mechanism, said feeding means being predeterminately positioned in relation to said punch to cause a perforated portion of each length to be aligned within the shearing edge of said punch.

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