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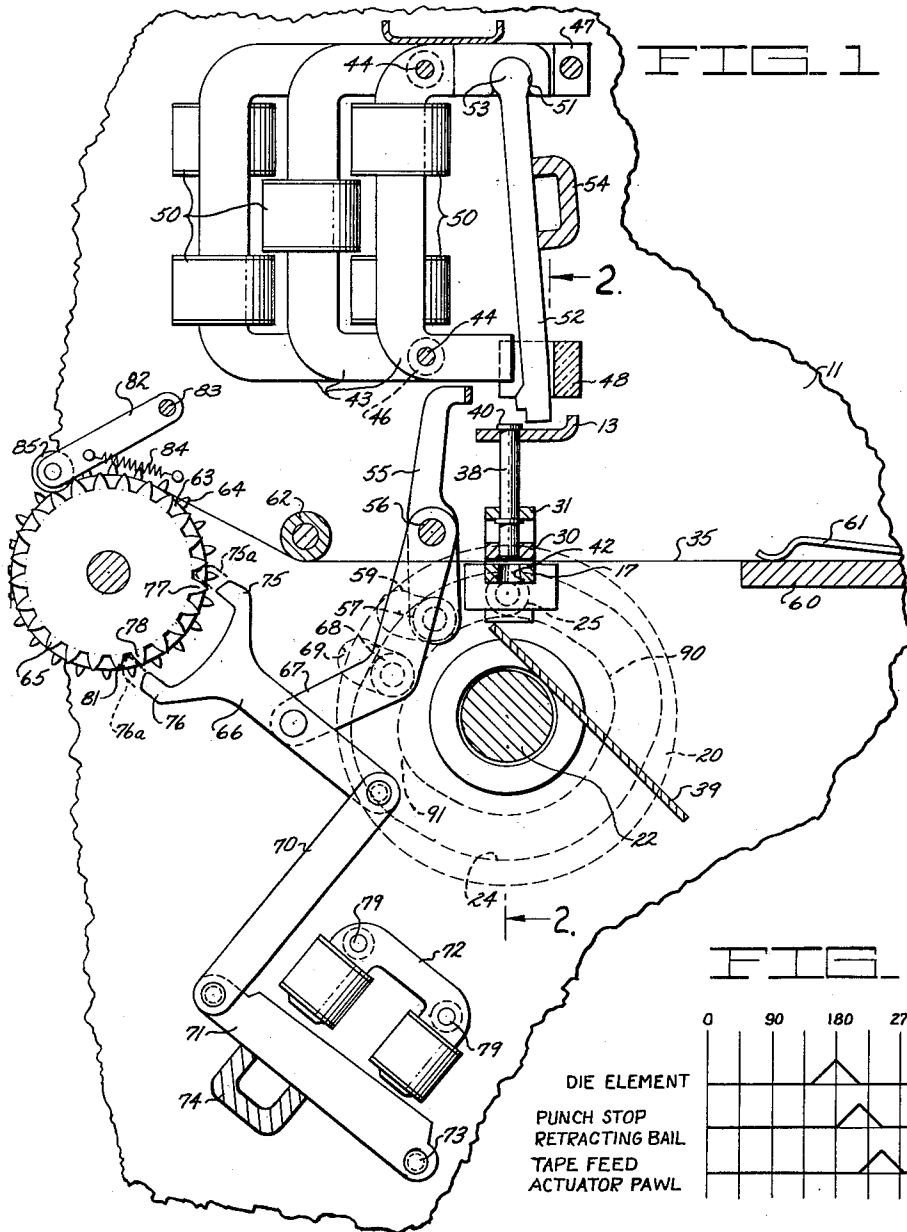
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3,051,376

PERFORATING APPARATUS

Filed Nov. 17, 1960

2 Sheets-Sheet 1



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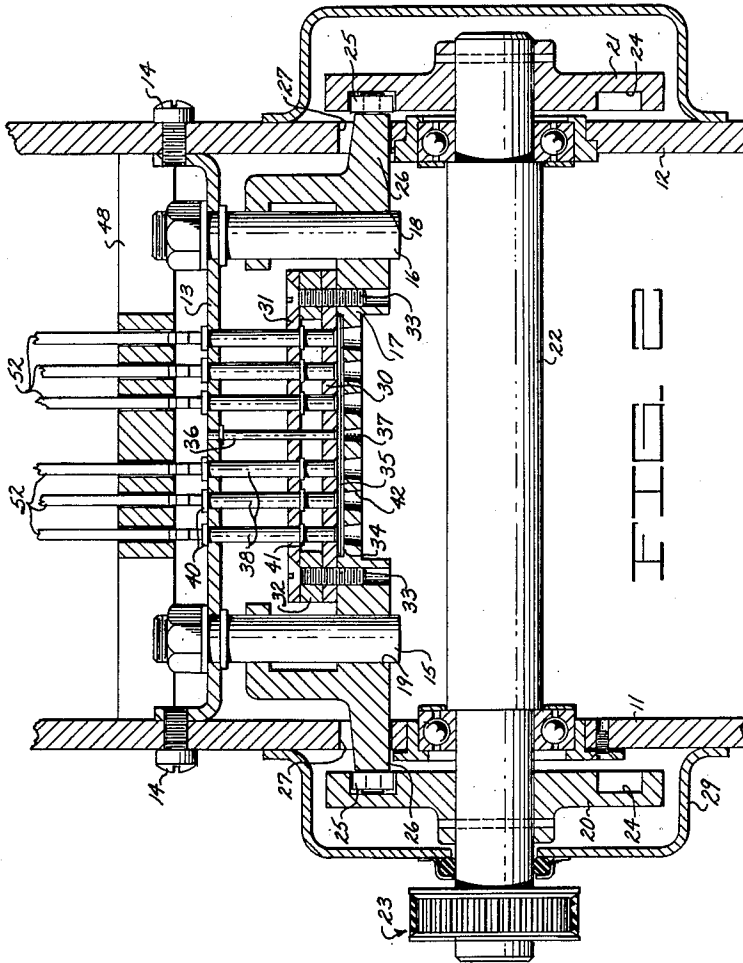
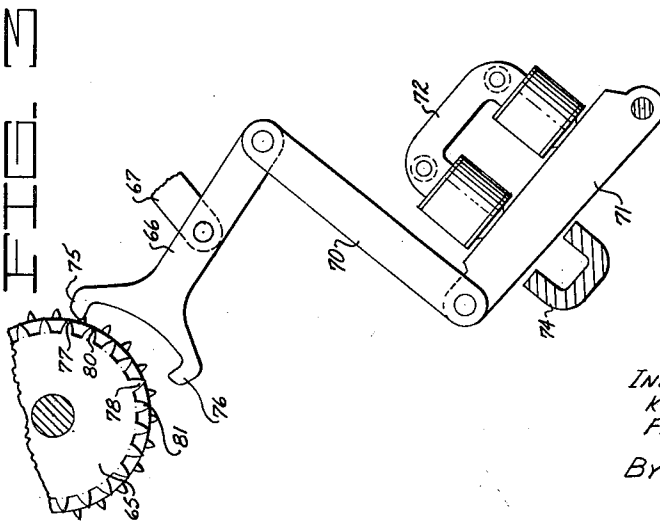
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1

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PERFORATING APPARATUS

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This invention relates to perforators and has particular reference to high speed perforators adapted to record data by perforating record media, such as paper tape.

Heretofore, perforators of the above type have generally embodied relatively complicated cam-driven linkages or trains or elements for operating the punches. Because of the number of parts which must be reciprocated, and because of the design of the moving mechanism, such perforators involve considerable reciprocating mass which restrict the overall speed of operation. Also, such perforators generally incorporate springs which are effective to return moving linkage or parts to normal positions. For this reason, the drive means has to be massive and strong enough to drive such linkages and parts against the spring load when initially moving the same. This also contributes to relatively large reciprocating masses and consequent limiting of the speed of operation.

Further, it has been found that springs are limited in speed of operation in that they tend to set up resonant vibrations at certain high speeds of operation which also limit their effectiveness.

It therefore becomes a principal object of the present invention to provide a perforator of the above type capable of relatively high speeds of operation.

Another object is to reduce the number of reciprocating parts in a perforator of the above type.

Another object is to eliminate springs in the moving parts of a perforator, particularly in those parts which must reciprocate at relatively high speeds.

Another object is to provide a perforator which is reliable and yet economical to manufacture.

A further object is to provide a compact perforator having a minimum number of parts.

The manner in which the above and other objects of the invention are accomplished will be understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a sectional view through a tape perforating apparatus, with parts broken away, illustrating a preferred form of the present invention.

FIG. 2 is a transverse sectional view through the perforating apparatus and is taken substantially along the line 2-2 of FIG. 1.

FIG. 3 is a fragmentary view illustrating the tape advancing mechanism in condition to advance the tape.

FIG. 4 is a graph illustrating the phase relationship of different components of the perforating apparatus.

Referring to the drawings, the perforator comprises a frame including side frames 11 and 12 held in spaced relation by cross braces, one of which is shown at 13, secured to the side frames by screws 14. The brace 13 supports a pair of spaced vertically extending guide posts 15 and 16 depending therefrom.

A die element 17 is provided having spaced bearings 18 and 19 at opposite ends thereof which are slideable along the posts 15 and 16. The die element is reciprocated vertically by a pair of cams 20 and 21 securely mounted on a drive shaft 22. The latter is continuously rotated in a counterclockwise direction (FIG. 1) by a suitable motor (not shown) through a belt and pulley arrangement partially indicated at 23.

2

The cams 20 and 21 are located outside of the perforator side frames 11 and 12 to protect the same from chad, etc., formed during the punching operation and have camways 24 therein which engage rollers 25 mounted on extensions 26 on opposite ends of the die element, which extensions project through openings 27 in the side frames. End caps 29 are suitably attached to the side frames and enclose the cams.

Mounted on the die element are a stripper plate 30 and a retractor plate 31, the latter being spaced from the stripper plate by spacers 32. Screws 33 hold the stripper and retractor plates in fixed relation to the die element.

A channel or groove 34 is formed in the die element 17 directly below the stripper plate to slideably receive a tape 35 of paper, or the like, to be perforated.

A sprocket perforation punch 36 is suitably attached at its upper end to the brace 13 and extends through aligned guide openings in the plates 30 and 31. When the die element is in its lowermost position, as shown in FIG. 2, the bottom shearing edge of the punch 36 lies directly over the tape. The punch 36 is aligned with a die opening 37 in the die element so that when the latter is raised by the cams 20 and 21, the die opening will invariably move over the punch 36 to perforate the tape.

A plurality of data perforating punches 38 are located in line with the punch 36 on opposite sides thereof. Each of the data punches is slideably mounted in aligned bearing holes formed in the brace 13 and the plates 30 and 31. A head 40 is formed on the upper end of each punch 38 and normally, when the die element is in its lowermost position, rests on top of the brace 13. A collar 41 is also formed on each punch and is located between the plates 30 and 31. Normally, the collar rests against the lower surface of plate 31, thereby holding the punch in a position wherein the bottom shearing edge thereof lies directly above the tape.

Each punch is aligned with a die opening 42 in the die element 17 so that when the punch is blocked, as will be described presently, the die opening will pass over the block to perforate the tape. However, when a punch is not blocked, the tape, upon being raised by the die element, will be effective to raise the punch idly and thus no perforation will occur.

An angularly disposed deflector plate 39 is located under the die openings and is suitably attached to the side frames 11 and 12 to deflect the chad into a suitable receptacle (not shown).

In order to aid the tape in raising the data punches when no perforation is to take place, the plate 31 is preferably magnetized as a permanent magnet, causing the data punches to be yieldably raised and lowered along with the die element. This is of particular value at extremely high speeds where even the relatively light mass of the freely mounted or floating punches tends to otherwise cut through the tape when the die element is rising.

Means are provided for selectively blocking different ones or all of the data punches to effect perforating. For this purpose, a plurality of U-shaped magnet frames 43 of iron or similar magnetic material having low magnetic retentivity are mounted side by side on cross rods 44 and 45 extending between the side frames 12 and 13. The frames 43 are held in spaced relation to each other and in alignment with respective punches 38 by spacers 46 and by notched comb bars 47 and 48 suitably secured at their opposite ends to the side frames 12 and 13. Electromagnetic coils 50 are mounted on respective ones of the frames 43. It will be noted that the legs of the frames are of progressively greater length to allow for mounting of the coils even though the lateral spacing

3

between adjacent frames is too close to otherwise mount such coils.

Each of the frames 43 is formed with a circular socket 51 located directly above the aligned punch 38. A punch blocking element 52 is provided for each frame, the latter having a circular head 53 pivotally mounted in the socket to form a knuckle joint. The lower end of the blocking element lies directly adjacent the head 40 of the aligned punch 38, but is normally held out of blocking relation thereof, as shown in FIG. 1, by a U-shaped permanent magnet 54 suitably supported between the side frames 12 and 13. The various blocking elements are guided by the comb bars 47 and 48.

Upon energization of a coil 50, the magnetic flux induced in its respective frame 43 will rock the associated blocking element 52 clockwise slightly to a position wherein it will block the aligned punch 38 from being moved upward along with the die element 17. Accordingly, such punch will affect perforating of the tape when the die element is raised.

Means are provided for positively returning the blocking element 52 following a punching operation to permit a new punching set-up to be made by energizing newly selected coils 50. For this purpose, a retracting bail 55 is pivotally mounted on a cross rod 56 extending between the side frames 12 and 13. The bail extends across all of the blocking elements 52 and the opposite legs of the bail are provided with rollers, one of which is shown at 57. The latter extend through openings 59 in the side frames 11 and 12 and are engaged by the camways 24 of the cams 20 and 21.

As seen in FIG. 4, the cams are effective to actuate the retracting bail directly after the die element 17 has reached the top of its stroke.

As soon as the die element 17 returns to its lowermost position shown in FIGS. 1 and 2, wherein the stripper plate 30 becomes effective to strip the tape 35 from any or all of the punches, the tape is advanced preparatory to a new perforating operation. For this purpose, the tape, which is fed from a suitable supply roll (not shown) and over a table 60 against which it is yieldably held by a suitable spring element 61, passes through the aforementioned channel 34 in the die element 17, under a guide roller 62 and over a feed sprocket 63. The latter has sprocket pins 64 which engage the sprocket perforations in the tape to positively advance the tape to the left in FIG. 1. Suitably attached to the sprocket 63 is a toothed wheel 65 arranged to be intermittently advanced in a counterclockwise direction by an actuating pawl 66. The latter is pivotally supported intermediate its ends by a cam follower 67 pivotally supported on the rod 56 and provided with a roller 68. The roller extends through an opening 69 in the side frame 12 and is engaged by the camway 24 in the cam 20.

The pawl 66 is connected through a link 70 to an armature 71 of an electromagnet 72. The armature is pivoted at 73 and is normally held in a lowered position by a U-shaped permanent magnet 74 suitably supported between the side frames to thereby normally hold the pawl 66 in its idle position shown in FIG. 1. The electromagnet 72 is fixedly supported relative to the perforator frame by cross rods 79 extending between the side frames 11 and 12.

The pawl 66 is provided with spaced teeth 75 and 76. When the armature 71 is held in its lower position shown in FIG. 1, the cam 20 will be effective, after actuating the retracting bail 55, to force the cam follower 67 and actuator pawl 66 to the left, in which case the teeth 75 and 76 will idly pass adjacent teeth 77 and 78 on the wheel 65 without interference. Accordingly, the pawl will be ineffective to advance the wheel. However, upon energization of the electromagnet 72, which would occur concurrently with or shortly after energization of one or more of the magnets 50, the actuator pawl 66 is rocked by the armature 71 to its position shown in FIG. 3

4

wherein the upper pawl tooth 75 is located directly in line with the tooth 77 of the wheel 65. Thus, as the actuator pawl is driven to the left, the tooth 75 will engage the tooth 77 to advance the wheel 65 one increment in a counterclockwise direction. During such movement, a succeeding tooth 80 on the wheel engages the lower surface of the pawl tooth 75 to rock the actuator pawl clockwise toward its normal position of FIG. 1 wherein the teeth 75 and 76 assume their dotted line positions 75a and 76a. Accordingly, as the pawl 66 reaches the end of its stroke, it will assume the same position it otherwise assumes at the end of an idle stroke. Therefore, the pawl tooth 76 moves into the path of a succeeding tooth 81 on the wheel 65 to prevent overthrow of the wheel and sprocket. This movement will also retract the armature 71 into its lower position where it will be held by magnet 74.

A centralizer 82 is provided to centralize the wheel 65 and sprocket 63 when the actuator pawl 66 is withdrawn. The centralizer is pivoted at 83 and is urged counterclockwise by a tension spring 84 to hold a roller 85 against two adjacent teeth of the gear wheel.

The spring element 61 exerts a slight drag on the tape to maintain the tape relatively taut as it passes over the die element 17. Also, the distance between the punches and the spring element 61 on one side and the roller 62 on the other is relatively greater than the vertical movement of the die element so that only a slight endwise movement of the tape results from such vertical travel of the die element.

It will be noted in FIG. 1 that the camways on cams 21 and 22 each have two diametrically opposed cam lobes 90 and 91 thereon effectively to successively actuate the die element 17, the retracting bail 55 and the tape advancing actuator pawl 66. Accordingly, the punch will operate through two cycles during each revolution of the shaft 22.

Although we have described our invention in detail in its preferred embodiment and have therefore used certain specific terms and languages herein, it is to be understood that the present disclosure is illustrative rather than restrictive and that certain changes and modifications may be made without departing from the spirit or scope of the claims appended hereto.

Having thus described the invention, what we desire to secure by United States Letters Patent is:

1. Perforating apparatus for a record medium comprising at least one elongate punch of magnetic material, means for guiding said punch for endwise movement, a die element, means for advancing and retracting said die element in the direction of movement of said punch, means for guiding said record medium between said die element and said punch, a punch retractor carried by said die element and effective to move said punch with said die element but out of punching relation with said die element during retraction of said die element, said retractor being magnetized to yieldably maintain said punch out of punching relation with said die element, and means for selectively blocking said punch from endwise movement during advancement of said die element whereby to cause said die element to perforate said record medium over said punch.

2. Perforating apparatus for a record medium comprising at least one elongate punch of magnetic material, means for guiding said punch for endwise movement, a die element, means for advancing and retracting said die element in the direction of movement of said punch, a stripper plate carried by said die element, said stripper plate being spaced from said die element to guide said record medium between said plate and said die element, a punch retractor carried by said die element and effective to move said punch with said die element but out of punching relation with said die element during retraction of said die element, said retractor being magnetized to yieldably maintain said punch out of punching relation with

5

said die element, means for limiting movement of said punch upon retracting movement of said die element, and means for selectively blocking said punch from endwise movement during advancement of said die element whereby to cause said die element to perforate said record medium over said punch.

3. Perforating apparatus for a record medium comprising at least one elongate punch, means for guiding said punch for endwise movement, a die block, means comprising a cam having a camway and a cam follower controlled by said camway for advancing and retracting said die block, in the direction of movement of said punch; means for feeding a record medium between said die block and said punch, means comprising a second cam follower controlled by said camway for actuating said feeding means; a blocking device movable into and out of the path of said punch, means for selectively moving said blocking device into the path of said punch whereby to enable said die block to perforate said record medium over said punch during advancement of said die block, and means comprising a third cam follower controlled by said camway for moving said blocking device out of the path of said punch.

4. Perforating apparatus for a record medium compris-

6

ing at least one elongate punch, means for guiding said punch for endwise movement, a die block, means comprising a rotatable cam having a camway and a cam follower controlled by said camway for advancing and retracting said die block in the direction of movement of said punch; means for feeding a record medium between said die block and said punch, means comprising a second cam follower controlled by said camway for actuating said feeding means; a blocking device movable into and out of the path of said punch, means for selectively moving said blocking device into the path of said punch whereby to enable said die block to perforate said record medium over said punch during advancement of said die block, means comprising a third cam follower controlled by said camway for moving said blocking device out of the path of said punch, and means for continuously rotating said cam.

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