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PUNCHING MECHANISM

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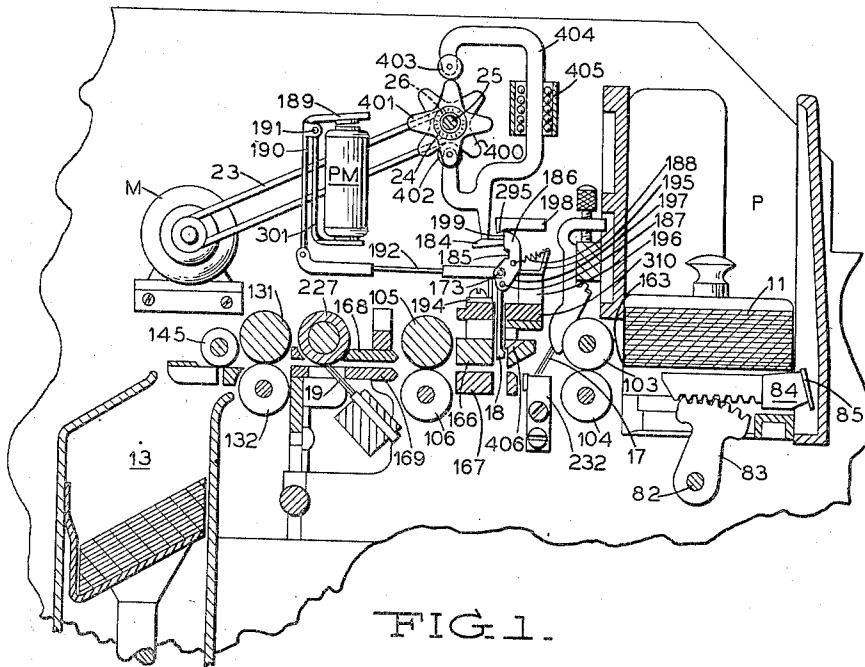


FIG. 1.

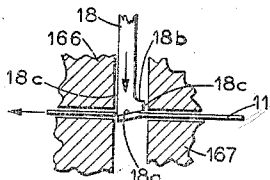


FIG. 2a.

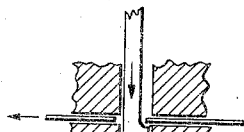


FIG. 2b.

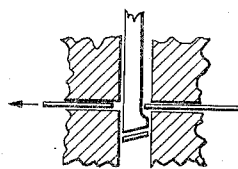


FIG. 2c.

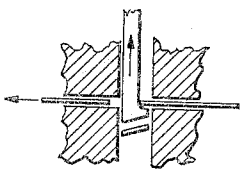


FIG. 2d.

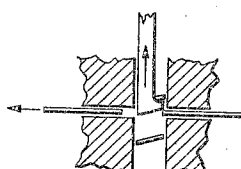


FIG. 2e.

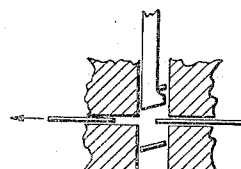


FIG. 2f.

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## PUNCHING MECHANISM

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1 Claim. (Cl. 164—124)

This invention relates to paper punching mechanism for paper or card stock or the like and the main object is to provide a construction capable of rapid operation wherein rapid punching of continuously moving stock can be accomplished with a stationary die.

The present invention relates more particularly to a punching mechanism which punches a hole in continuously moving stock by shearing the ends of the hole on both the downward and upward strokes of the punch.

While not limited thereto, the construction has found a particular and successful application in the production of record cards for use in record card controlled accounting machines where the record cards are provided with holes in certain index positions to represent certain numerical and/or alphabetical information. A standard size for such holes is  $\frac{1}{8}$ " by  $\frac{1}{16}$ ".

Other objects of the invention will be pointed out in the following description and claim and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a partial sectional elevation view of a record card perforating machine showing the present invention applied thereto.

Figs. 2a-2f are a series of diagrammatic views showing the operation of the punching element of the present invention.

In Fig. 1 there are shown, by way of example, the essential elements of the punch side of the well-known IBM reproducing punch, modified as to its punching mechanism in accordance with the present invention. Record cards generally designated 11 are placed in a hopper P, from where they are advanced singly from the bottom of the stack by a pair of picker slides 84 actuated by sector arms 83 attached to the shaft 32. Knife edges 85 on the slides push the cards through the throat 163 and between feed rollers 103 and 104 which feed the cards along between the punch master card brush 17 and contact bar 232. After leaving the master card sensing station, the cards are fed between a stripper plate 166 and a die plate 167, where punches 18 operate to punch out selected positions. Then the cards enter between feed rollers 105 and 106 which feed them between guide plates 168 and 169 in the punch sensing station. When the cards leave the sensing brushes 19 and contact roller 227 they are engaged by the rollers 131 and 132 which eject them. As the cards are ejected they are deflected by the roller 145 so that they are directed into the card stacker 13. This briefly is the sequence of operations and reference may be had to Patent No. 2,032,805 for a more detailed explanation.

The present invention is concerned with the manner in which the configuration and operation of the punches 18 have been modified so that punching may be rapidly and accurately carried out while the cards are in motion. First, it may be mentioned in connection with the driving

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connections of the machine that a motor M is mounted above the base of the machine. The motor is connected by a driving belt 23 to a pulley 24 on a shaft 25 mounted on bearings in the frame of the machine. Fixed to the shaft 25 is a gear 26 which serves to drive the continuously running devices of the machine and speed reduction gearing, disclosed in the above-cited patent, is placed between the gear 26 and the various feed rollers of the card feeding mechanism. The drive between the shaft 25 and the punches 18 has been modified for the present invention in a manner that will be presently described.

In accordance with the present invention, each punch 18 is provided with a hook-head portion and a shank portion, the hook-head portion having a greater cross-sectional area than the shank portion as shown in the drawings. The hook-head portion is actually defined by an inclined edge 18a, a substantially horizontal opposing edge 18b and the vertical sides 18c. By so configuring said hook-head portion of each punch element, the cutting or shearing surfaces 18a and 18b are provided which will shear the ends of a hole in a continuously moving record card on both the downward and upward strokes of the punch in the following manner.

Referring to Fig. 1, there may be a plurality of punch elements 18 arranged in a row across the machine and these punches operate between the fixed stripper plate 166 and die plate 167. For selective operation of the punches it will be noted that the continuously running shaft 25 has attached thereon a pair of complementary jumping cams 400 and 401. These cams operate between a pair of follower rollers 402, 403 on a bail member 404. The bail is supported for reciprocation by a suitable bearing block 405 attached to the frame of the machine and it can be seen that as long as shaft 25 is revolving the jumping cams will cause the bail to reciprocate rapidly up and down.

The bail 404 has formed thereon a punch actuating bar 184 which is adapted to cooperate with notches 185 in any of a plurality of selected interposer pawls 186. Each of the punch elements 18 has an interposer pawl 186 which is pivotally connected thereto by a pin 187. Normally the pawl is held out of the path of the bar 184 and the punch is held above the die by a spring 188 attached to the pawl. However, when a magnet PM is energized, the associated pawl is drawn into cooperation with bar 184 and the related punch is depressed to perforate the record card.

A punch controlling magnet PM is provided for each punch element 18 and the armature 189 of each magnet is mounted on a lever 190 pivoted at 191. The lower end of lever 190 is pivotally connected to a call wire 192 the other end of which is pivoted at 173 on pawl 186. A plurality of such connections are made, one to each pawl, the magnets PM being arranged in staggered rows and columns. The brackets 301 carry the magnets of one row as a unit.

When attracted, the armature 189 swings the lever 190 in a clockwise direction and draws the wire 192 to the left, urging pawl 186 into cooperation with bar 184. The wires 192 are guided by a slotted plate 194, and the pawls 186 are aligned by slots in a plate 195 fastened on a supporting bar 196, the plate being used also to secure one end of springs 188. The edge of bar 196 cooperates with a cam face 197 on pawls 186 to hold the selected pawls into cooperation with bar 184 as the bar is lowered.

An extension 295 on a fixed bar 198 cooperates with the upper ends of the pawls to cam them in a clockwise direction out of engagement with the ascending bar 184 on the return stroke of the bail. In order to positively hold the pawls in disengaged position, the end of bar 184 cooperates with a cam face 199 on each pawl. The punch

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elements 18 are guided above the holes in the die 167 by sliding in a fixed bar 310 and the stripper plate 166.

The operation of punching occurs without any pause in card feeding. The jumping cams 400, 401 on shaft 25 are juxtaposed relative to each other so that the bail 404 is rapidly reciprocated. As the bail and bar 184 are reciprocated, any of the pawls may be moved over by the call wires until notches 185 engage the end of bar 184. Then the connected pawls and punch plungers are depressed to shear away the leading portions of selected index positions of the card and quickly withdraw to shear the remaining portions of said selected index positions during continued movement of the card. As was previously mentioned, speed reduction gearing is placed between the gear 26 and the card feeding mechanism and consequently the cams impart a high velocity to the punches relative to speed of the card stock.

Referring to Fig. 2a, on the downward stroke of the punch the inclined cutting surface 18a of the punch engages the stock first and starts shearing away a portion as the stock feeds from right to left. In Fig. 2b the punch has descended far enough to have completely punched out a hole and as the punch reaches the bottom of its stroke, Fig. 2c, the resulting stock chip can be seen falling through the die plate. In Fig. 2d the punch is shown starting its upstroke and it can be seen that a portion of the stock adjacent the rear edge of the partially punched hole has now moved into the path of the cutting edge 18b. As the punch completes its upstroke, Figs. 2e and 2f, the cutting edge 18b shears off this portion of the stock to complete the punching of the desired hole in the moving stock. As shown in Fig. 1, there may be provided in the stripper plate 166 a chute 406 to facilitate the removal of the chips formed on the upstroke of the punch.

In most cases where record cards are being provided with holes in certain index positions to represent numerical and/or alphabetical information, the speed of reciprocation of the punches relative to the rate of feed of the

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record card would be such that successive punched holes measuring  $\frac{1}{8}$ " by  $\frac{1}{16}$ " would be approximately  $\frac{1}{8}$ " apart. It should be understood though that various other relative speeds could be chosen to give varying distances between punchings as well as different size punchings.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claim.

15 What is claimed is:

A punching mechanism for moving paper stock and the like comprising a female die and a male punch movable into and out of said die, said punch successively comprising an inclined cutting surface at its distal end adapted to form one end of a rectangular opening in the paper upon entry of the punch into the die, a second cutting surface above said first surface and oppositely inclined with relation to said first surface and adapted to form the remainder of said opening upon movement of said punch out of the die, and a shank portion above said second cutting surface the rearward edge of which is disposed forwardly in the direction of paper feed from the rearward edges of said cutting surfaces to allow free movement of the paper between reciprocations of said punch.

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