VERY HIGH SPEED CAM ACTUATED PUNCH WITH INTERPOSER BETWEEN PUNCH AND CAM
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6 Claims. (Cl. 83—572)

The present invention relates to punches, and pertains more particularly to a very high speed punch actuating mechanism.

Punches used for punching data indicating holes in business machine cards and tapes must operate with absolute accuracy and precision, and also at extremely high speeds. Since it is also necessary to be able to punch the holes for such use in close proximity to each other, it is also highly desirable that the punch actuating mechanism be extremely compact.

The present invention provides punch actuating mechanism which is simple, fast, positive, compact and relatively inexpensive. The invention also provides punch actuating mechanism which requires only a very short movement of a light weight actuating element to operate it, and which positively prevents accidental double actuation of the punch.

A further object of the invention is to provide an improved and simplified high speed, single stroke, punch actuating mechanism.

The foregoing, and other objects, features and advantages of the invention, will be apparent from the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings, wherein:

FIG. 1 is a fragmentary, perspective view showing the upper end portion of a single punch and the actuating mechanism therefor, the parts being shown in punch actuating condition.

FIG. 2 is a transverse sectional view through the shaft of the punch actuating cam of FIG. 1, the punch being shown as it appears at the completion of a stripping operation, portions of the die with a punch card inserted therein being included.

FIG. 3 is a side elevational view of the cam and punch with the parts in their unactuated or normal condition of FIG. 2, portions being broken away.

FIG. 4 is a sectional view generally similar to FIG. 2, but with the parts shown as they appear at the completion of a punching stroke.

FIG. 5 is a side elevational view generally similar to FIG. 3 but with the parts in the positions thereof shown in FIG. 1, the interposer being shown in broken lines in its inoperative position.

FIG. 6 is a sectional view taken as along line 6—6 of FIG. 4, additional portions being included, the interposer and a portion of its support rod being shown in solid lines in punch actuating position, and in broken lines in retracted, inoperative position.

Referring briefly to the illustrative embodiment A of the invention shown in the drawings, a punch 10 is mounted for lengthwise movement in a guide hole provided therefor in a die 11 adapted to receive a work piece, or card as a card box of suitable sheet material, in a slotted opening 12 therein. A punch actuating cam 13 is mounted on a rotary cam shaft 14 endwise beyond the punch 10, and has a rise-fall cam face 15 formed thereon which is aligned with, but even at its maximum degree of eccentricity, is beyond operative engagement with the punch 10.

An interposer 17, which in the present instance is a small, light weight block, is mounted on the free end of a light weight rod 18, the other end of which is supported for universal pivotal movement on pivot pins 19 and 19a (FIG. 11). Rod actuating means such as a conventional solenoid 20 permits swinging the rod 18 and the interposer 17 thereon from their broken to their solid line positions of FIG. 6.

In its solid line, punch actuating position of FIG. 6 the interposer 17 is positioned between the punch actuating cam face 15 and the punch 10, while in its retracted, broken line position of FIG. 6 the interposer 17 is positioned laterally beyond the cam face 15 and clear of the punch 10. As used in the present specification and the appended claims the term "laterally" as applied to the inoperative position of the interposer relative to the cam face, and to the direction of movement of the interposer between operative and inoperative positions means "transversely of the direction of movement of the cam face past the interposer."

An axially inclined restore cam face 21 is provided on an annular side flange 22 of the cam 13, and returns the interposer 17 laterally in the opposite direction to its inoperative position of FIG. 2 upon the completion of each punching operation.

Punch stripping means comprises a bell crank lever 23 mounted on a fixed pivot and with one end thereof riding on the side flange 22 in the path of a raised striping cam 24 thereon. The bell crank lever 23 is swung by the striping cam 24 to retract the punch 10 to its normal, inoperative position of FIG. 2 upon the completion of each punching operation.

Referring to the drawings in greater detail, in the illustrative embodiment A of the invention, the punch 10 may be a rectangular rod of suitable punch material such as steel, and is mounted for guided, lengthwise movement in a hole 25a provided therefor in an upper portion of the die 11. The portion of the die surrounding the lower end of the hole 25a comprises a stripper for stripping a punched card from the punch when the latter is withdrawn upwardly after punching a hole in a card. Actuation of the punch moves it downwardly into a die opening 25 of corresponding size and shape provided in the lower portion of the die 11. Suitable guide means, such as the slot 12, is provided to guide the work piece, such as a conventional punch card B of a well known type, into desired position relative to the punch 10. Since this and other work pieces and the means for positioning them for punching are well known, and since they do not form a part of the present invention, it will be unnecessary to further illustrate or describe them herein.

Each punch 10 is mounted with an actuating face 27, which, in the illustrated form of the invention is the upper end thereof, located opposite the rise-fall cam face 15. This punch actuating cam face 27 is spaced slightly from the high point of the punch actuating cam face 15, and from the low point thereof by a distance slightly greater than the thickness of the interposer 17. Each cam face 15 of which is preferably provided for each punch to be actuated, is secured to the rotary cam shaft 14 to rotate therewith.

A guide face or hub 28 for the interposer 17 in its laterally offset, inoperative position of FIGS. 2 and 3, preferably is provided on the punch actuating cam face 15 thereon, and the punch actuating cam face 15 thereof. At the leading and trailing ends of the punch actuating cam face 15 in its desired direction of rotation, portions 26 and 26a of the cam faces 15 and 28 respectively are continuous so as to provide a smooth surface along which the interposer 17 can move easily between its operative and inoperative positions.

The annular side flange 22 is provided on the axially opposite side of the punch actuating cam face 15 from
the guide face 28, and is of a height to operatively engage a side of the interposer 17 and prevent the latter from over-acting. This action continues as the striping punch is moved from retracted to operative position. Except for the raised stripping cam 24 thereon, the periphery of the side flange 22 is preferably concentric with the cam shaft 14.

The side flange 22 has a thin portion 22a which is circumferentially co-extensive with, and extends circumferentially slightly beyond both ends of, the punch actuating cam face 15. A thicker portion 22b of this annular side flange 22 is located on the opposite side of the cam 13 from the punch actuating cam face 15.

The interposer restores cam face 21, for laterally deflecting the interposer back onto the guide face 28 after each punch actuation, is formed on the leading end of this thickened side flange portion 22b and extends axially entirely across the width of the punch actuating cam face 15. Thus, upon the completion of each operative stroke of the punch 10 by actuation of the interposer 17 by the cam face 15, the interposer encounters the laterally deflecting cam face 21 and is deflectedly laterally thereby, back onto the guide face 28.

A stop 18a preferably is positioned to limit the movement of the interposer 17 back onto the guide face 28 by the restore cam face 21, and thus to prevent the interposer from striking the side flange 22 when the latter is positioned closely adjacent thereto. In its retracted condition shown in Figs. 2, 3 and, and in broken lines in Figs. 5 and 6, the interposer 17 is preferably clear of frictional contact with all parts of the the rotating cam.

The bell crank lever 23 is pivoted on a fixed pin 29, and the upright arm 30 thereof has a lateral offset 30a formed therein so that the free end 31 of this upright arm 30 will ride on the periphery of the side flange 22 when the free end 32 of the generally horizontal arm 33, riding in a notch 34 provided therefor in the side of the punch 10, is at its downward limit of movement, as shown, for example, in Figs. 1 and 4.

The lever upper end portion 31 is in the path of movement of the stripping cam 24, and the latter is so located, circumferentially of the cam 13, as to operatively engage the upper lever end portion 31 after the punch actuating cam face 15 has passed rotationally beyond its associated punch 10 during each revolution of the cam 13, and after the laterally deflecting cam face 21 has moved the interposer 17 clear of the punch 10 and onto the guide face 28 as shown in broken lines in Figs. 5 and 6. In actuation by the stripping cam 24, the bell crank lever 23 is comparatively and then withdraws the punch 10 from the guide face 25 and into its guide hole 25a thereby to strip the punch from a work piece B.

A coil spring 35 is mounted in compression between the horizontal arm 33 of the bell crank lever and the fixed member 37, and urges said arm 33 upwardward toward a fixed stop member 38, in which position the stripping cam 24 will clear the upper end portion 31 of the upright lever arm 30.

The operation of the illustrated embodiment A of the invention is as follows: With the cam shaft 14 and cam 13 thereon rotating at a desired speed, and with the solenoid 20 unactuated, the interposer 17 will ride normally on the guide face 28 axially beyond the punch actuating eccentric cam face 15, and the bell crank lever 23 will be biased by its spring 35 in a clockwise direction against the stop 38 as shown in Fig. 2.

Upon an actuation of the solenoid 20 the latter urges the arm from their broken 17 from their broken line position of Fig. 6 toward their solid line positions of said figure. As the interposer 17 clears the thickened portion 22b of the annular side flange 22 the interposer will slide laterally along the smooth cam surface 26 (Figs. 1 and 5) toward the side flange portion 22a, and is thus interposed between the punch actuating eccentric cam face 15 and the punch 10.

As the cam 13 rotates to the position thereof shown in Figs. 1 and 4, and in solid lines in Figs. 5 and 6, the punch 10 with the rise-fall cam face 15 and interposer 17 into the die 25 as shown in Fig. 4, thereby plunging a hole in the work piece B. Further rotation of the cam 13 carries the rise-fall cam face 15 beyond the interposer 17 and brings the laterally deflecting, restore cam face 21 into engagement with the interposer 17, the latter said interposer laterally to a position over the guide face 28 and clear of the punch 10. The stop 18a limits the movement of the interposer support rod 18 to arrest the interposer centrally over the guide face 16. Since the solenoid 20 is operated only momentarily for each actuation of the punch, the interposer 17 continues to ride in its normal, inoperative condition over the guide face 28 until the solenoid is again energized.

As the interposer 17 is deflected laterally onto the guide face 28 by the lateral cam face 21 at the completion of each punching operation, the upper end 31 of the upright lever arm 30 rides onto the stripping cam 24, which swings the bell crank lever 23 clockwise from its actuated position of Figs. 1 and 4 to its stripping or inoperative position of Fig. 2, thereby raising the horizontal lever arm 33 into engagement with its stop member 38, and restoring punch actuating mechanism which is extremely compact, and which is adapted to extremely high speed operation. The parts are rugged and long wearing and require very little servicing or other attention.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a punch mechanism wherein a punch element is movable into a die; punch actuating mechanism comprising a rotating cam having a rise-fall cam face thereon opposite to and spaced endwise clear of the punch element, an interposer guide surface rotating with the cam and laterally deflectable to a side of the punch face, and an interposer movable from the guide surface laterally transversely of the direction of movement of the rise-fall cam face past the interposer onto the rise-fall cam face to a position between the punch element and the rise-fall cam face, the interposer being of a height radially of the cam, when on the high point of the rise-fall cam face, to move the punch element into the die.

2. In a punch mechanism wherein a punch element is movable into a die; punch actuating mechanism comprising a rotating cam having a rise-fall cam face thereon opposite to and spaced endwise clear of the punch element, an interposer guide surface laterally adjacent a side of the rise-fall cam face, an interposer movable transversely of the direction of movement of the rise-fall cam face past the interposer, from the guide surface laterally onto a low portion of the rise-fall cam face to a position between the punch element and the eccentric cam face, the interposer being of height radially of the cam, when on the high point of the rise-fall cam face, to move the punch element into the die, and means for moving the interposer between a position on the guide surface a position between the punch element and the rise-fall cam face.

3. In a punch mechanism wherein a punch element is movable into a die; punch actuating mechanism comprising a rotating cam having a rise-fall cam face thereon opposite to and spaced endwise clear of the punch ele-
an interposer guide surface laterally adjacent a side of the rise-fall cam face, an interposer movable transversely of the direction of movement of the rise-fall cam face past the interposer, from the guide surface laterally onto a low portion of the rise-fall cam face to a position between the punch element and the rise-fall cam face, the interposer being of a height radially of the cam, when on the high point of the rise-fall cam face, to move the punch element into the die, means for moving the interposer from the guide surface laterally onto a low portion of the rise-fall cam face to a position between the rise-fall cam face and the punch element, and a lateral restore face on said cam circumferentially beyond the high point of the rise-fall cam face in the direction of cam rotation for moving the interposer laterally from such position between the rise-fall cam face and the punch element back onto the guide surface.

4. In a punch mechanism wherein a punch element is movable past a stripper and into a die, and the stripper is spaced from the die to receive a work piece therebetween; punch actuating mechanism comprising a rotating cam having a punch actuating cam face thereon opposite to and spaced endwise clear of the punch element, an interposer guide surface laterally adjacent the punch actuating cam face, an interposer movable from the guide surface laterally, transversely of the direction of movement of the cam face past the interposer, onto the punch actuating cam face to a position between the latter and the punch element, the interposer being of a height, radially of the cam, when on the high point of the punch actuating cam face, to drive the punch element into the die, a stripper cam element on said cam in laterally offset relation to the punch actuating cam face, and a punch retractor mounted for actuation by the stripper cam element after the interposer has been passed by the high point of the punch, said retractor engaging the punch element for retracting the latter from the die thereby to strip a punched work piece therefrom upon each actuation of the retractor by the stripper cam element.

5. In a punch mechanism wherein a punch element is movable past a stripper and into a die, and the stripper is spaced from the die to receive a work piece therebetween; punch actuating mechanism comprising a rotating cam having a punch actuating cam face thereon opposite to and spaced endwise clear of the punch element, an interposer guide surface laterally adjacent the punch actuating cam face, a portion of the guide surface and a low portion of the cam face being continuous, an interposer movable laterally, transversely of the direction of movement of the cam face past the interposer, from the guide surface along such continuous surface onto a low portion of the punch actuating cam face to a position between the latter and the punch element, the interposer being of a height, radially of the cam, when on the high point of the punch actuating cam to drive the punch element into the die, a restore cam face on said cam beyond the high point of the punch actuating cam in the direction of cam rotation and positioned to deflect the interposer laterally in the opposite direction back onto the guide surface, a stripper cam element on said cam in laterally offset relation to the punch actuating cam face, and a pivotally mounted bell crank lever with one end thereof operatively engaging the punch element and the other end thereof in the path of the stripper cam element for engagement thereby upon the completion of each punching operation of the punch element to swing the bell crank lever in a direction to withdraw the punch element from the die and past the stripper to strip a work piece from the punch element.

6. In a punch mechanism, a die, a punch element movable into said die, means for actuating said punch element comprising; a continuously rotating cam, an interposer idle surface on said cam, a punch actuating cam face on said cam opposite said punch element, and laterally immediately adjacent the idle surface, an interposer movable laterally from a position over and riding on said idle surface to a position over and riding on the punch actuating cam face and between the latter and the punch element, and electromagnetic means for moving said interposer laterally between said idle surface and said punch actuating cam face, whereby the displacement of said interposer by said punch actuating cam face is communicated to said punch element to move the latter into the die.

References Cited in the file of this patent

UNITED STATES PATENTS

1,074,900  Sears Oct. 7, 1931
2,857,968  Cousino Oct. 28, 1958
2,951,534  Woodbury Sept. 6, 1960
3,054,368  Bono Sept. 18, 1962