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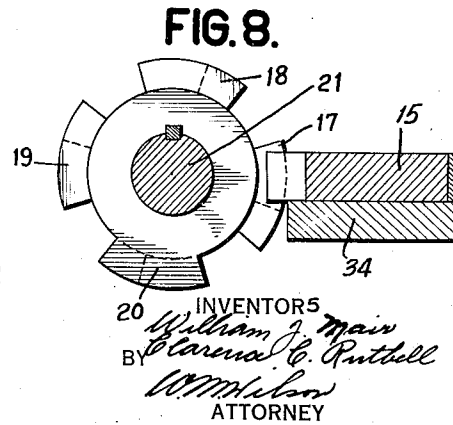
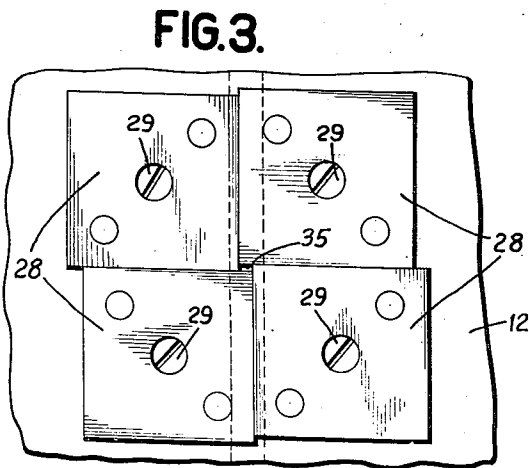
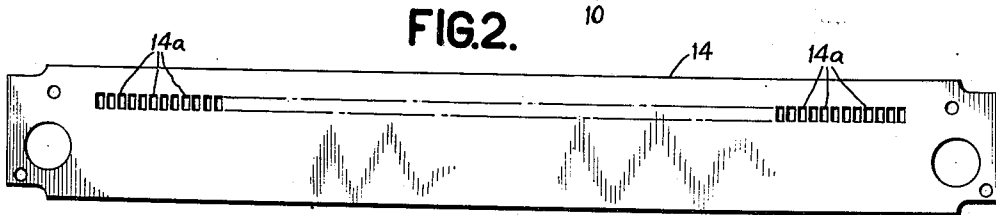
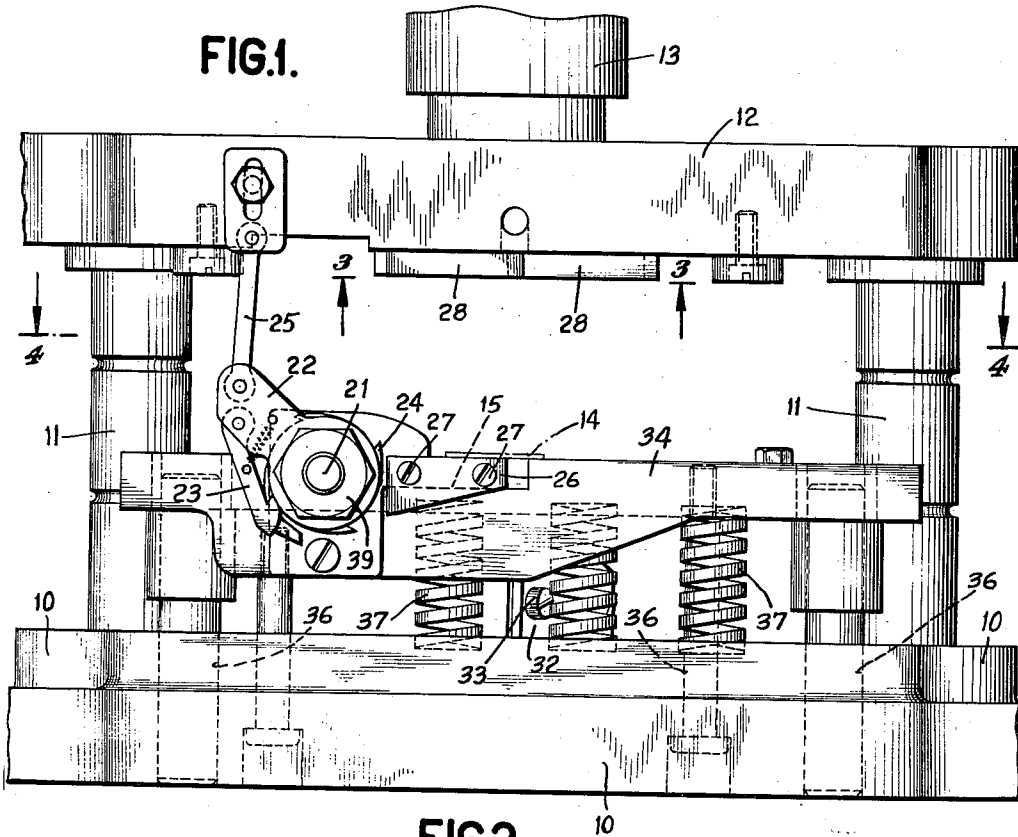
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2,213,566

APPARATUS FOR PERFORATING METAL PLATES OR THE LIKE

Filed Dec. 28, 1938

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 4.

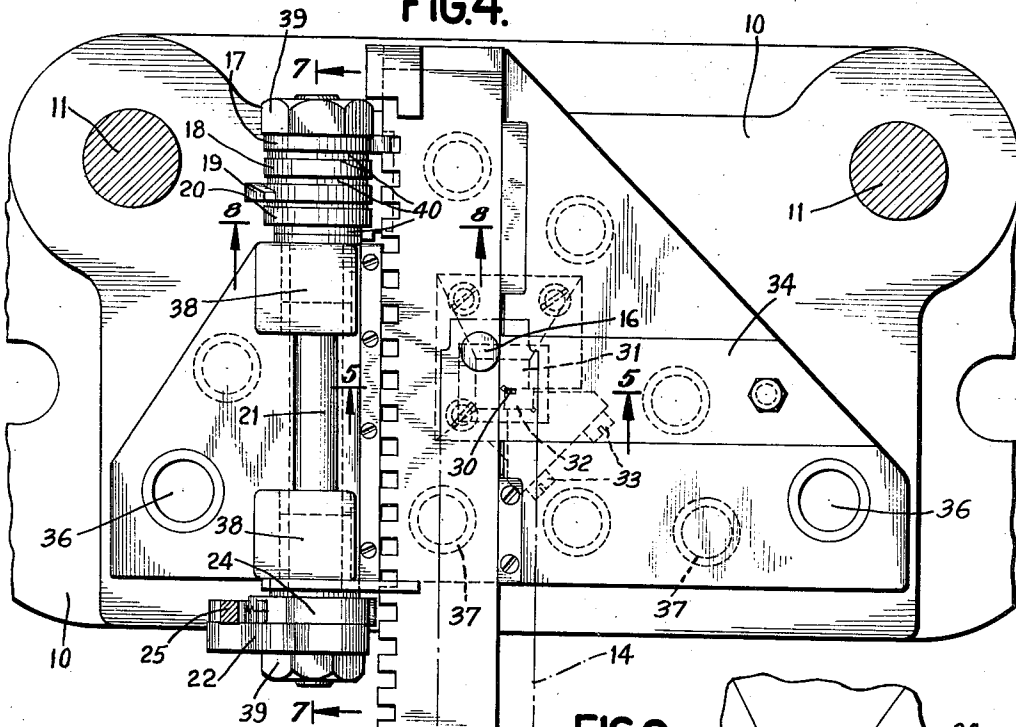


FIG. 6.

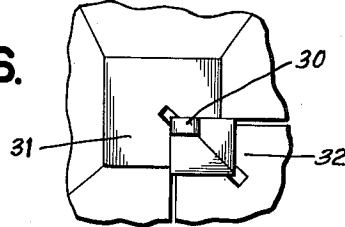


FIG. 5.

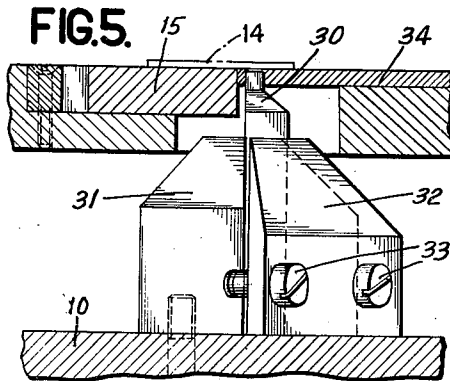
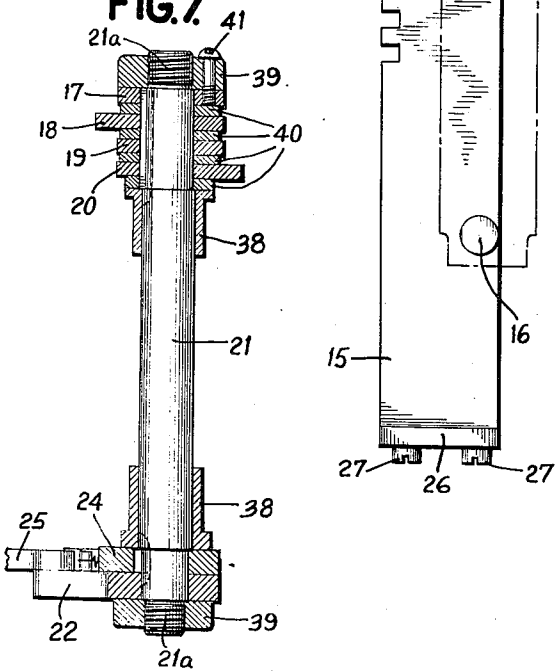


FIG. 7.



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APPARATUS FOR PERFORATING METAL PLATES OR THE LIKE

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9 Claims. (Cl. 164—88)

This invention relates to punching apparatus for punching metal plates or the like with a high degree of accuracy.

In certain classes of work it is necessary that the perforations made in the metal plates be spaced very accurately and be clean-cut in order to assure the proper functioning of the plates in their various applications. Such is the case, for example, in the making of dies for record card punching machines such as described in the U. S. Patent 2,032,805 to C. D. Lake where close tolerances are essential. Accordingly, it is the general object of the present invention to provide a punching apparatus having novel means for feeding the material to be pierced a predetermined accurate distance between punching operations and locking the same against movement during said punching operations.

More specifically, it is the object of the present invention to provide a novel screw type feed for the rack of a punching machine comprising a rotatable shaft having a plurality of cams thereon cooperating in succession with a plurality of notches in the rack in the course of rotation of the shaft, so as to lock the rack during the punching operation and feed the same a predetermined accurate distance between punching operations.

Further objects of the instant invention reside in any novel feature of construction or operation or novel combination of parts present in the embodiment of the invention described and shown in the accompanying drawings whether within or without the scope of the appended claims and irrespective of other specific statements as to the scope of the invention contained herein.

In the drawings:

Fig. 1 is a front elevation view of the machine showing the various operating parts.

Fig. 2 is a view of the stock showing the location of the holes to be punched therein.

Fig. 3 is a plan view of the die plates of the punching apparatus shown in Fig. 1 taken in the direction 3—3.

Fig. 4 is a sectional view of the machine taken at 4—4 of Fig. 1 in the direction indicated by the arrows.

Fig. 5 is a sectional view taken generally at 5—5 of Fig. 4.

Fig. 6 is a detail view of the punch mechanism shown in Fig. 5.

Fig. 7 is a sectional view taken in the direction 7—7 of Fig. 4 showing the feed shaft and the various parts mounted thereon.

Fig. 8 is a sectional view taken at 8—8 of Fig. 4 showing the shape of the feed cams and their spacing around the periphery of the feed shaft.

It is apparent that the subject matter of the present invention may find applications in machines other than punching machines. However, for purposes of illustration and in order to forego too much detail, the description which follows is confined to a preferred embodiment of the invention as applied to a metal punching machine.

Referring now to the drawings the frame structure as shown in Fig. 1 includes base 10 and upright members 11. A crosshead 12 is supported by and is integral with a connecting member 13 to which a reciprocating motion is imparted by any suitable means (not shown). The crosshead is guided in its movement by the members 11, the down stroke being a punching stroke and the up stroke being a feeding stroke.

Assuming, for example, that a piece of stock such as 14 (Fig. 2) is to receive a plurality of perforations 14a in predetermined accurately spaced relationship with one another, the stock is placed on a rack 15 and firmly positioned by locating pins 16 (Fig. 4). The rack is provided on one side with a plurality of notches which cooperate with a plurality of cams such as 17, 18, 19, and 20 to impart the necessary longitudinal feed movement of the rack after each punching stroke. The feed cams are mounted on a shaft 21 and have engaging portions or high points spaced equally around the periphery of the shaft 21, as best shown in Fig. 8. The high point of one of the cams is normally in engagement with the rack 15, locking the latter against movement in either direction. Upon rotation of shaft 21 a predetermined amount, in a manner to be described later, the high point of the cam in engagement with the rack is moved away and the high point of another cam is moved into engagement with the following notch in the rack. Each of the high points is provided with a beveled leading surface so that in moving into engagement with the rack the beveled surface engages a wall of one notch in the rack and cams the latter forward a predetermined distance.

At the beginning of operations, the first cam 17 is engaged in the first notch in rack 15 as shown in Fig. 4. On the downstroke of crosshead 12, a lever 22 turns about the shaft 21 carrying a ratchet pawl 23 downward to engage in a succeeding notch of ratchet wheel 24. The ratchet wheel is provided with four teeth equally spaced around its periphery so that it requires

four feed strokes by the pawl 23 to rotate shaft 21, and hence cams 17 to 20, one revolution. Feeding occurs on the up-stroke of the crosshead 12, the lever 22 being connected to the crosshead by a link 25, and during the upstroke the pawl 23 advances the ratchet 24 ninety degrees in a clockwise direction as viewed in Fig. 1.

The advancement of ratchet 24 in the above manner causes the high point of the second cam 18 to move into engagement with the second notch of rack 15 and, as it does so, to feed the rack a predetermined distance as previously described. During the next downstroke, punching occurs in a new location on the stock 14 and the rack and stock are held firmly locked against movement by the engagement of cam 18 with rack 15.

The following upstroke brings the third cam 19 into engagement with the third notch of rack 15 moving the rack and the stock ahead to present a new portion of the surface of the stock for a punching operation. Likewise, on the next upstroke, the fourth cam 20 engages in the fourth notch of rack 15 and again advances the rack and the stock in the same manner. It will be noted that when ratchet 24 is turned one more step that cam 17 is again moved into engagement with rack 15, since one revolution will have been completed. This time, however, cam 17 engages in the second notch of the rack. Correspondingly, as the other cams are brought into engagement with the rack, they will engage a notch one removed from the notch which they engaged on the preceding revolution of shaft 21.

By the above feeding method, the number of notches may be considerably less than the number of holes to be punched in the stock. Suppose, for example, that the number of holes to be cut in the stock is 80, then the number of notches in the rack need be only 22. It is understood that more sets of cams may be secured to shaft 21, so that two or three cams are engaged with the rack simultaneously. This would assure a more perfect alignment over a greater period of time due to less wear and a greater rigidity. A bracket 26 is fastened at one end of rack 15 by means of screws 27 and, upon the completion of the last punching operation, this bracket moves into the path of pawl 23 so as to prevent it from further engagement with ratchet 24, thus discontinuing any further advancement of the rack 15.

As for the punching mechanism, a punch 30 (Fig. 5) is mounted in a holder comprising the two members 31 and 32 held in a clamping position on punch 30 by means of screws 33, the punch and its holder being stationary. A set of four die plates 28 are arranged as shown in Fig. 3 and fastened to the bottom surface of the crosshead 12 by screws 29. When the crosshead moves down, the die plates 28 bear upon the stock 14, and in turn upon the rack 15 and a stripper 34 moving all of them down. During this downward motion the punch 30 pierces the stock and enters hole 35 formed by the die plate 28. The stripper 34 is guided by rigid pins 36 in its vertical motion and is returned to its normal position by means of coil springs 37.

Immediately following the punching of the last hole in the stock, the rack may be returned to the starting point by rotating shaft 21 a slight amount to a point where any two of the engaging surfaces of the cams will straddle rather than engage the rack. Then, as will be best understood from Fig. 8, the rack may be moved freely back to the starting point. This presents a time

saving advantage over an ordinary worm drive construction where the worm shaft corresponding to shaft 21 would have to be rotated in the reverse direction to feed the rack back to the starting point.

The shaft 21, although quite free to rotate under the pawl and ratchet drive, is mounted in bearings 38 with very little end play so that it does not turn under vibration caused by the impact of the punching elements during a punching operation. The structure is best shown in Fig. 7 which reveals threaded portions 21a at each end of the shaft adapted to receive nuts 39. At the upper portion of the shaft as viewed in this figure, the cams 17 to 20 are mounted with spacers 40 therebetween, both the cams and the spacers being keyed to the shaft. Nut 39 for the upper portion is held in position by a screw 41 provided for this purpose. The pawl and ratchet assembly already described are also keyed to shaft 21 and secured in position by a nut 39 cooperating with threaded portion 21a at the lower end of the shaft as viewed in Fig. 7.

While there has 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 claims.

What is claimed is:

1. A machine to punch a series of holes in succession in work such as a die plate or the like, comprising a work support, a fixture having an opening therein and provided with guide means for mounting the work support for slidable movement along the fixture in the direction of the spacing of the holes, the work extending past the work support and resting on the fixture which helps to support the work, drive means acting on the support to move the support positively step by step and to lock the support positively against movement in either the direction of the spacing of the holes or in the opposite direction between said steps of movement, and punching means comprising a punch element and a die, the punch moving through the opening in the fixture to perforate the work in cooperation with the die in the course of a punching operation.

2. A machine for punching a series of successive holes in work such as a die plate or the like, comprising a work support adapted for movement along a given plane in the direction of the spacing of the holes, drive means acting on the support to move the support positively step by step and lock the support positively against movement in either direction along said plane between said steps of movement, punching means for punching a hole in the work on the support between each said step of movement, the work support being also mounted to move in the direction of movement of the punching means to yield to the impact of the punching means, and means to resist the latter movement.

3. A machine for punching a series of successive holes in work such as a die plate or the like, comprising a work support, means mounting the work support for slidable movement along a given plane in the direction of the spacing of the holes, drive means acting on the support to move said support positively step by step and to lock the support positively against movement in either

direction between said steps of movement, and punching means comprising a stationary punch at one side of the work and a movable die at the other side of the work for impacting said work and holding it firmly against movement with respect to the work support and then, while holding it, forcing it together with the work support against the punch to cause the latter to perforate the work.

4. In a machine of the character described having punching elements adapted to be moved relatively toward each other during a punching operation for punching a series of successive holes in work such as a die plate or the like, a movable rack supporting the work and having a plurality of spaced notches therein, a rotatable shaft having cam surfaces arranged to cooperate with the notches in the rack, intermittent means for rotating the shaft a predetermined amount at a time for bringing the cam surfaces successively into engagement with said rack to step the rack and the work forward a predetermined distance upon each engagement in accordance with the spacing of the holes, and means whereby the cam surface engaged in the rack upon interruption of the rotation of the shaft locks said rack against movement either forward or backward but permits yielding movement of the rack along the line of movement of the punching elements during a punching operation.

5. In a machine of the character described having punching elements adapted to be moved relatively toward each other during a punching operation for punching a series of successive holes in work such as a die plate or the like, a movable rack supporting the work and having a plurality of spaced notches therein, a rotatable shaft having a plurality of cams with engaging surfaces spaced equally around the periphery of said shaft, arranged to cooperate with the notches in the rack, intermittent means for rotating the shaft a predetermined amount at a time to bring the cams into engagement with the rack in succession, said rack together with the work being moved forward in a direction transverse to that taken by the punching elements during a punching operation a predetermined distance upon each engagement in accordance with the spacing of the holes, and means whereby a cam engaged with a notch in the rack upon interruption of the rotation of the shaft locks said rack against forward or backward movement in said direction but permits yielding movement of the rack and the work along the line of movement of the punching elements during a punching operation.

6. In a machine of the character described including punching elements and means providing relative movement between said elements during a punching operation for punching a series of successive holes in work such as a die plate or the like, a rotatable shaft, a plurality of cams having engaging surfaces spaced equally around the periphery of said shaft, said engaging surfaces being provided with beveled leading edges, pawl and ratchet means for rotating the shaft a predetermined amount on each feed stroke of said pawl and ratchet means, and a

feed rack supporting the work and having spaced notches therein cooperating with the said cams during the rotation of the shaft to feed the rack forward a predetermined distance in a direction transverse to the line of movement of the punching elements during a punching operation upon engagement of the beveled edges of each of the cams with related notches in the rack in accordance with the spacing of the holes, the engaging surface of the cam locking the rack against forward or backward movement in said transverse direction but permitting yielding movement of the rack and the work along the line of movement of the punching elements during the return stroke of the pawl of the aforementioned pawl and ratchet means accompanying a punching operation.

7. In a punching machine, a die and a punching element, means to move the die relatively with respect to the punching element to perform a punching operation in a piece of material, a rotatable shaft having a plurality of cam surfaces, a feed rack forming a mounting for the material and adapted to cooperate with said cam surfaces to lock the rack against movement during the punching operation, and means automatically set up by the die during said punching operation and effective upon the return stroke to rotate the shaft and the cam surfaces a predetermined amount so as to feed the rack together with the material a predetermined distance.

8. In a punching machine, a stationary punching element and a movable die, means for moving the die toward the punch element to effect a punching operation in a piece of material, a feed rack adapted to carry said material and having a plurality of spaced notches therein, a rotatable shaft provided with cam surfaces thereon arranged to cooperate with the notches in the rack, and means conditioned upon movement of the die toward the punch element and effective upon the return stroke of the die to rotate the shaft a predetermined amount, the aforesaid cam surfaces in the course of the rotation of the shaft causing the rack and the material to be fed a predetermined distance.

9. In a punching machine of the character described, a die and a punching element, means to move the die relatively toward said element to effect a punching operation, a rotatable shaft having a plurality of cam surfaces, a feed rack provided with spaced notches therein, one of which is adapted to engage with one of the notches in the rack to lock the rack against movement during the punching operation, and means prepared for operation during the punching movement of the die with respect to the punching element and operated on the return movement to rotate the shaft a predetermined amount to move the engaged cam surface away from its notch in the rack and another cam surface into engagement with another notch of the rack, the latter engagement causing the rack to be fed a predetermined distance.

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