Dec. 22, 1931. M. F. BOLLAERT 1,837,522

PUNCHING MACHINE

Filed April 17, 1929 3 Sheets-Sheet 1

Fig. 1

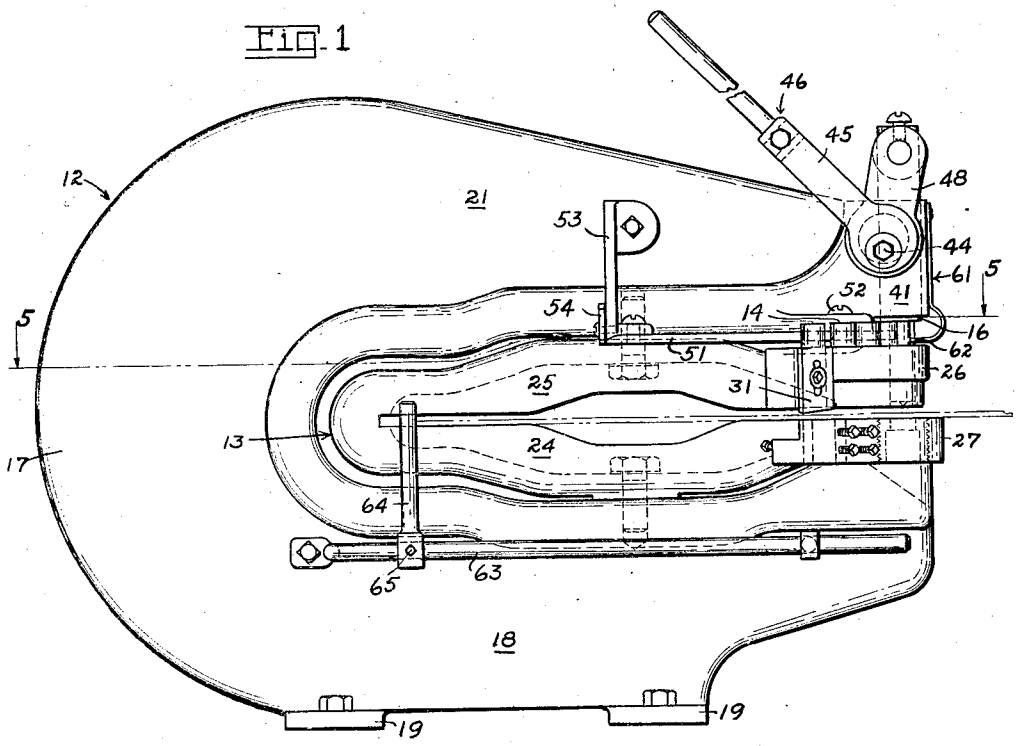


Fig. 3

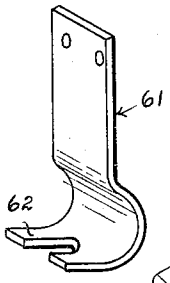


Fig. 2

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Fig. 4

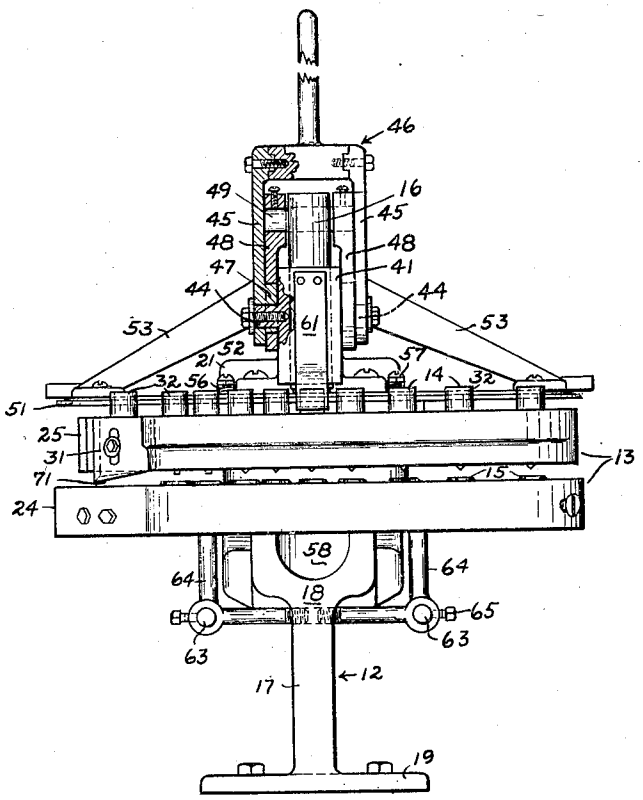
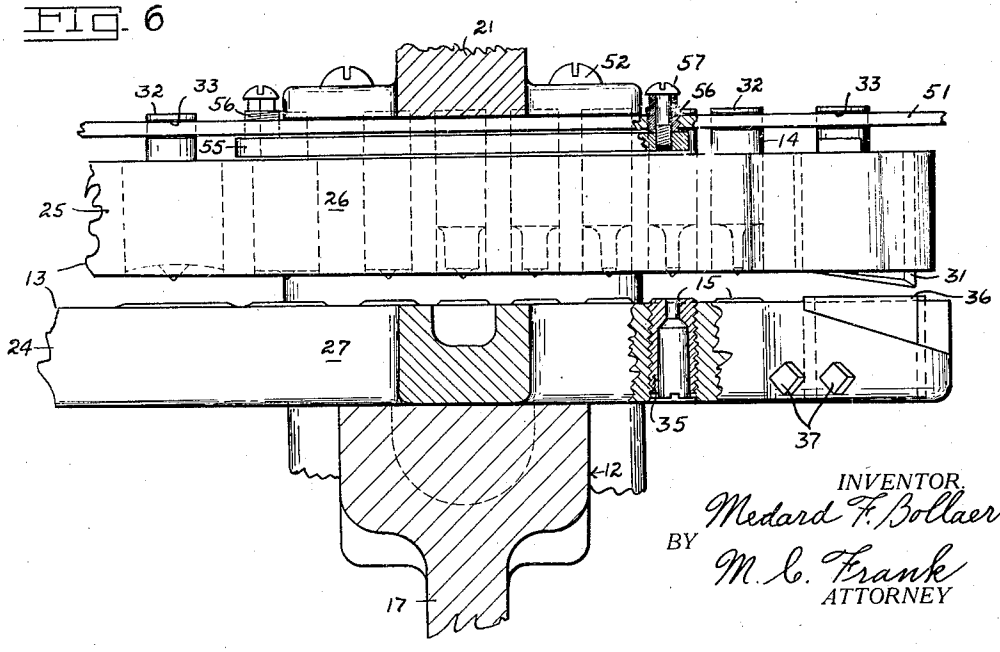


Fig. 6



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PUNCHING MACHINE

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Fig. 5

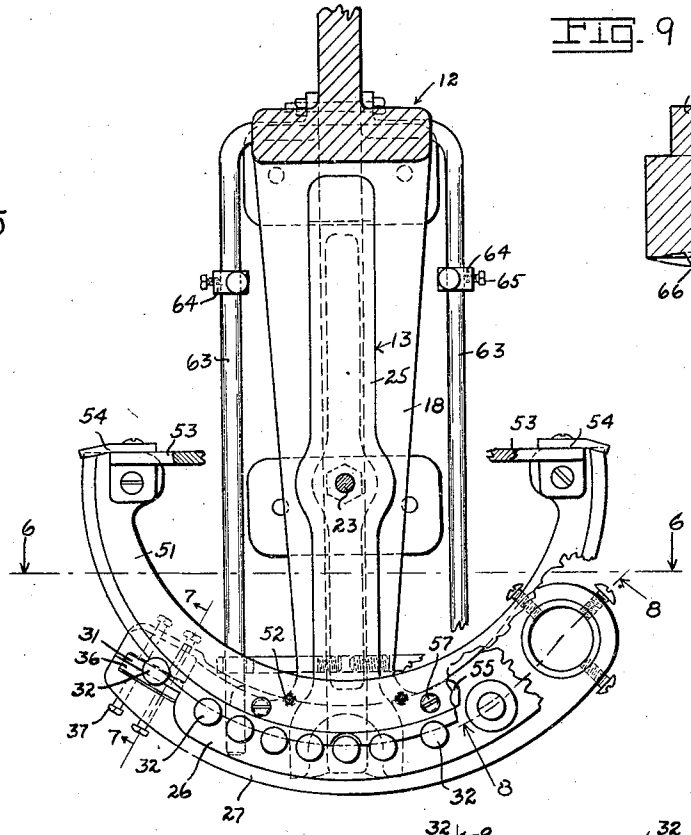


Fig. 9

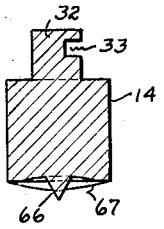
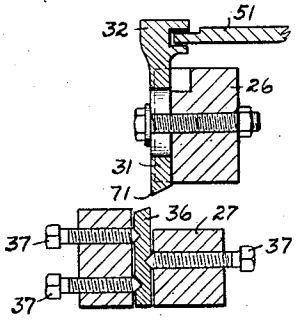


Fig. 7



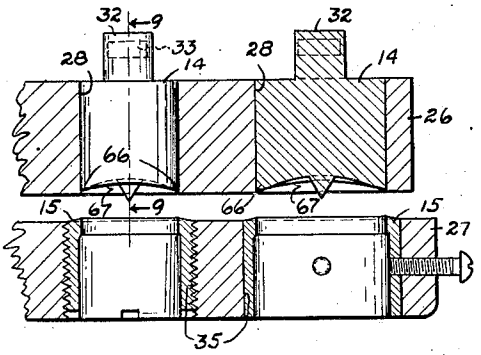


Fig. 8

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Patented Dec. 22, 1931 1,837,522

UNITED STATES PATENT OFFICE

MEDARD F. BOLLAERT, OF OAKLAND, CALIFORNIA

PUNCHING MACHINE

Application filed April 17, 1929. Serial No. 355,928.

The invention relates to a punching machine providing a plurality of punches for selective use.

A general object of the invention is to provide a generally improved punch over that disclosed in my United States Patent No. 1,704,962, issued March 12, 1929.

A more specific object is to provide an improved and particularly compact device for perforating relatively large sheets of material at points thereof appreciably spaced from the sheet edges.

Another object of the invention is to provide in a machine of the class described and having a plurality of movable tools for selective use, an improved means for securing the tools not in use in an inoperative position; said means permitting a particularly ready replacement of a tool when and as required.

A further object of the invention is to provide a machine of the class described in which the movable tools are held against rotation at all times.

Still another object of the invention is to provide a particularly simple, positive, and releasable means for securing a holder in position to operatively dispose a selected tool.

An added object of the invention is to provide in the machine a shear having a straight cutting edge for forming slits in sheet material.

A still further object of the invention is to provide a particularly effective punch for use in the machine.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of a preferred form of the invention which is illustrated in the accompanying drawings, in which,

Figure 1 is a side elevation of a machine embodying the invention, the sheet perforating elements thereof being all inoperatively disposed.

Figure 2 is a fragmentary vertical section through the machine, a punch member at said section being disposed at the end of a working stroke thereof.

Figure 3 is a perspective view of a spring detent member of the structure.

Figure 4 is a front elevation of the machine, a portion of a tool actuating device thereof being disclosed in section.

Figure 5 is a plan view taken generally at the broken line 5—5 in Figure 1.

Figure 6 is an enlarged fragmentary view taken at the line 6—6 in Figure 5, parts of the showing being broken away to show the construction thereat.

Figure 7 is an enlarged fragmentary section taken at 7—7 in Figure 5.

Figure 8 is a fragmentary section on the line 8—8 in Figure 5.

Figure 9 is a section of a punch of the device taken at the line 9—9 in Figure 8.

By reference to the drawings, the elements of the present invention are seen to be incorporated in the structure of a punching machine having a one-piece U-shaped frame 12 carrying within it a one-piece U-shaped holder 13 which in turn supports a plurality of punches 14 and their dies 15. The punches are arranged to be actuated selectively by means of a mandrel 16 mounted for reciprocation in the frame 12, said holder being movable in the frame for disposing a selected punch for operation by the mandrel 16. The frame structure is seen to be of T section, with the stem of the T provided by a web portion 17 defining the plane of the frame and giving a required amount of rigidity thereto in said plane whereby a forcing apart of the legs of the frame is resisted. One leg 18 of the frame is provided along its outer edge with feet 19 to provide a base for the frame, while the other leg 21 of the frame carries the aforesaid mandrel 16 and an operating means therefor. As particularly disclosed, though not necessarily so, the machine is disposed with the frame legs horizontal whereby the plane of the frame is vertical.

The plane of the holder 13 is also vertical and said holder is mounted for rotation about a fixed axis with respect to the frame 12. Pivot bolts 22 and 23 are utilized for mounting the holder in the frame, the bolt 22 extending downwardly through the lower leg 24 of the holder and being threadedly

engaged in the lower frame leg 18 while the bolt 23 extends through the upper holder leg 25 and is threadedly engaged in the upper frame leg 21; accordingly, the pivotal axis of the holder is in the plane of the frame and is vertical. The pivot bolts 22 and 23, it is noted, engage the respective legs at intermediate points thereof, which points, in the case of the holder, are seen to be substantially at the middles of its legs. In this manner, the space defined between the holder legs is seen to be entirely unobstructed even though the pivotal axis of the holder passes through said space, it being noted that this space is arranged to receive metal sheets to be interiorly punched, as is indicated in Figures 1 and 2.

The holder legs 25 and 24 are seen to terminate in mutually opposed and arcuately curved members 26 and 27 respectively, said members extending generally transversely of said legs. The member 26 is provided with a plurality of vertically extending bores 28 of varying diameters which are adapted to receive a plurality of the punches 14 corresponding in diameter to their respective bores, said punches being adapted for limited reciprocation through said bores as hereinafter described. The member 26 is also vertically slotted from the outer face thereof to provide a guideway for a vertically reciprocable shearing blade 31, said blade providing a cutting edge which is oblique to the horizontal. The punches 14 and blade 31 are seen to be provided at the top thereof with like cylindrical heads 32, each of said heads being provided with a lateral segmental notch 33 at the side thereof toward the pivotal axis of the holder, the utility of said notches being hereinafter set forth. It is particularly noted that the heads 32 are aligned in an arc having its axis of curvature coincident with the pivotal axis of the holder whereby the various heads move in a common path when the holder is displaced.

The dies 15 are mounted on the member 27 opposite the punches 29, said dies being secured in place by means of their threaded, or other, engagement in openings 35 extending vertically through the member, the structure and relations being particularly shown in Figures 2 and 8 of the drawings. The dies 15 are, of course, cooperative with the opposed punches for perforating a plate disposed between the members 26 and 27 thereat. A shear blade 36 is also mounted on the member 27 for cooperation with the blade 31. Preferably, and as particularly shown in Figures 5, 6 and 7, the blade 36 is carried by and between cooperating screws 37 threadedly engaging the member 27 whereby to effect the adjustment of its shearing edge with respect to the working edge of the blade 31.

A vertical bore 40 is provided through the forward end 41 of the upper frame leg 21, and the tool operating mandrel 16 is reciprocably fitted therein, said end 41 thus constituting a mandrel head. Preferably, and as shown, the axis of the bore 40 intersects the line of movement of the tool heads 32. The lower end of the mandrel 16 is arranged to overlie a head 32 and is provided with a depending L-shaped extension, having a forwardly directed portion 43 thereof disposable in a tool head notch 33 whereby the tool engaged thereby may be reciprocated with the mandrel.

The mandrel is arranged to be reciprocated through but a relatively short distance, preferably by a means having a high mechanical advantage. As particularly disclosed, lever means are provided for actuating the mandrel and are mounted in the head 41. Pivot shafts 44 extend laterally oppositely from the head 41 and have journalled thereon the extremities of the legs 45 of a forked lever 46, said lever legs spanning the head. The inner sides of the lever legs 45 are provided with eccentrics 47 and links 48 are provided having bores at one end for receiving said eccentrics. The other link ends are connected by a rock shaft 49 which extends through and is journalled in the upper end of the mandrel 16, it being noted that the arrangement of parts is such that when the lever 46 is extending upwardly and rearwardly, as is shown in Figure 1, the mandrel is in its normally raised position, while a forward swinging of the lever depresses the mandrel, as is shown in Figure 2.

Normally, all the tools are disposed in inoperatively raised positions with their head notches 33 coplanar, and under these conditions the notch engaging mandrel extension 43 is arranged to lie in the plane of the notches. In this manner, the holder 13 may be swung to dispose and engage a selected tool beneath the mandrel for reciprocation therewith. Since the tools not engaged by the mandrel are to be inoperatively disposed, and yet must be depressible when engaged by the mandrel, a track 51 is provided for engaging the head notches 33 of said tools to hold them in the aforesaid planar relation. As particularly shown in Figures 1 and 5, the track 51 comprises an arcuate plate mounted on and beneath the upper frame leg 21 and having its outer edge simultaneously engageable in the various tool head notches, said plate edge being cut away however beneath the mandrel to permit the mandrel extension 43 to replace the plate edge thereat. In this manner, a continuous supporting track and guideway is provided for the tool heads as the holder is variably adjusted. The track 51 is seen to be secured to the upper frame leg 21 by means of screws 52, and the extremities thereof are carried by brackets 53 mounted on and extending transversely from the said frame leg.

It will now be noted that the arc of the track 51 is substantially one hundred eighty degrees and that said arc is preferably about twice that of the tool heads whereby any tool may be engaged by the mandrel while the remaining tools engage the track. The track 51 is preferably no longer than necessary, whereby a swinging of the holder 13 to dispose all the tools to the same side of the mandrel will release the tools from the track; in this manner any tool may be removed by swinging the holder to disengage it from the track. Since a tool releasing positioning of the holder will not ordinarily be desired, displaceable stops 54 are preferably provided at the ends of the track 51; as particularly shown in Figures 1 and 5 the stops 54 comprise turn buttons loosely pivoted at the ends of the brackets 53 to gravitationally maintain their operative disposition at the track end, said stops being engageable by the tool heads at the ends of the line thereof.

In forming the various members now described, a certain amount of clearance is provided between the opposed faces of the extremities of the upper frame and holder legs 21 and 25 respectively, part of said clearance being taken up by the track 51. The opposed faces of the lower frame and holder legs 18 and 24 respectively are finished plane and are arranged to lightly and slidably engage, whereby, when the machine is used, said lower frame leg may serve as a supporting anvil for the die carrying member of the holder. Since the withdrawal of a punch from a perforation of a plate will tend to lift the holder thereat, means are preferably provided in the aforesaid clearance space above the holder for preventing an appreciable upward displacement, or springing, of the holder, and as shown, such means comprises the mounting of a plate 55 on and beneath the track 51, said plate providing a lower bearing face for engaging the opposed upper face of the holder portion 26 if such displacement occurs, the normal clearance of the plate and portion being very slight. Since the frame and holder members are cast and their dimensions may vary slightly, the plate 55 is mounted on sleeves 56 threadedly engaging the track for adjustment therein and is secured to the sleeves by means of screws 57 extending axially through the sleeves. In this manner, a minimum of machining is required in fitting the parts of the machine together. This feature is particularly brought out in Figures 2 and 6. To permit the escape of punched out portions of the sheet to be perforated, the lower leg of the frame is obliquely cut away at the forward side thereof and in the line of the mandrel 42 to provide a chute 58 for the gravity escape of said sheet portions from below the dies.

Means are provided for retaining a selected tool in engagement with the tool operating mandrel 42, and as particularly shown, said means comprises a leaf-spring member 61 mounted on the mandrel carrying head 41 at the forward face thereof. A lower and free end of portion 62 of the spring 61 is turned inwardly to lie in the path of movement of the tool heads 32 and is notched at its extremity to engage a tool head at opposite sides thereof whereby the head and its holder are held against displacement in the path of adjustment thereof. The spring portion 62 is arranged to resiliently and slidably engage a tool head, and the head may readily be released by manually pulling the spring end forwardly to disengage it.

The present device, it is noted, is particularly designed for perforating relatively large sheets without requiring a machine of undue size, such being accomplished by leaving the clear interior space in the pivotal line of the holder. Since the tools are operated at a fixed point of the machine, stop means are provided for adjustably limiting the insertion of a sheet within the holder space. As shown, rods 63 are mounted at opposite sides of the lower frame leg 18 to extend therealong, and perforated stop arms 64 are slidably mounted on the rods 63, said arms being disposable to intersect the plane of the holder space. Set screws 65 are provided in the arms 64 for fixing them in set position.

Certain of the punches, and particularly the larger ones, are provided with leading points 66 rather than having all parts of the cutting edge in a common plane as is usual. For forming the cutting edges 67 of these punches, to provide the points 66, a tool blank is first spherically cupped at its leading end and then cylindrically cupped across said end with the axis of the cylinder of cupping perpendicular to the punch axis; the spherical cupping may, on occasion, be omitted. A punch thus made is seen to provide for a sawing, or slicing, cut of the material thereat rather than a straight shear, whereby the application of the cutting force applied through the mandrel is more effective. The punch structure is particularly disclosed in Figures 8 and 9. Generally, and particularly with such a punch as that now described, rotation of the punch while cutting is not desired, and such is seen to be prevented by reason of the provision of segmental, rather than annular, tool head notches 33 for receiving the mandrel extension 43. The track 51 is seen to similarly engage the tools not in use, so that said tools are held for proper engagement with the mandrel when the holder 13 is moved to dispose them thereat.

With respect to the cooperative shearing blades 31 and 36, it is noted by reference to Figures 6 and 7 that the movable blade 31 is provided with a cutting edge 71 which

is oblique to the cutting edge of the lower blade whereby slits of varying lengths may be made in sheet material. Obviously a number of said slits may be combined with each other or an opening differently formed, to provide a perforation of some special shape having one or more straight sides. The provision of a shear means as part of the present machine is therefore seen to be highly useful.

The operation and application of the machine now described is deemed to be amply covered in the foregoing description. It is particularly noted that, for the work to be done thereby, the present machine is particularly compact, involves a minimum of parts and provides for the fullest possible visibility and accessibility to the work at the tools being used.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States the following:

1. In a machine of the class described, a frame, a one-piece tool holder pivotally mounted in said frame and arranged for oscillation about a fixed axis, a set of arcuately aligned movable tools carried by said tool holder, a set of fixed dies mounted on said holder to cooperate with said tools, the arc of the line of said tools being coaxial with said axis, and said holder being formed to receive therein and between the sets of tools and dies a sheet of material to be operated on by a selected tool at a specified point thereof, the axis of said tool holder being so positioned that the distance between said point of the sheet and the nearest edge of the sheet may exceed the radius of said arc.

2. In a machine of the class described, a frame, a tool holder pivotally mounted in said frame and arranged for a horizontal oscillation about a fixed axis, a plurality of radially positioned headed tools carried by said tool holder and a plurality of cooperating dies mounted therein to receive the tools, said tools and dies defining arcuate lines coaxial with said axis, each of said tools having a notch formed in one side of the head thereof, a reciprocable mandrel mounted on said frame and providing means normally disposed to engage said notch in the head of a selected one of said tools for reciprocation therewith, and a track member engaging the notches in the heads of the remaining tools for holding them in inoperative position with respect to their dies, said member lying entirely at the radially inward side of said tools.

3. In a machine of the class described, a frame, a tool holder pivotally mounted in said frame and arranged for a horizontal oscillation about a fixed axis, a plurality of radially positioned headed tools carried by said tool holder and a plurality of cooperating dies mounted therein to receive the tools, said tools and dies defining arcuate lines coaxial with said axis, a reciprocable mandrel mounted on said frame and providing means normally disposed to receive the head of a selected one of said tools for reciprocation therewith, and track segments fixedly mounted on said frame and normally engaging the heads of tools not engaged by the mandrel to hold them against rotation and in inoperative position with respect to their dies, said segments extending only radially inwardly of said tools and said holder being arranged to be swung to release the tool heads from the track segments to permit the dismounting of the tools from the holder.

4. In a machine of the class described, a frame, a tool holder pivotally mounted in said frame and arranged for a horizontal oscillation about a fixed axis, a plurality of radially positioned headed tools carried by said tool holder and a plurality of cooperating dies mounted therein to receive the tools, said tools and dies defining arcuate lines coaxial with said axis, a reciprocable mandrel mounted on said frame and providing means normally disposed to receive the head of a selected one of said tools for reciprocation therewith, track segments fixedly mounted on said frame and normally engaging the heads of tools not engaged by the mandrel to hold the said tools against rotation and in inoperative position with respect to their dies, and displaceable stop means on said track members normally operative against said tool holder to prevent the disposal thereof to release the tool heads therefrom.

5. In a device of the class described, a rigid support, a tool holder movable therein, a plurality of differing punches carried by said tool holder, a mandrel mounted in said support and having means for engaging said tools individually, means for positioning a selected said punch in axial alignment with said mandrel, and a notched spring means mounted on said support and releasably engaging the said selected punch for releasably locking the tool holder against movement when the said selected tool has been positioned.

6. In a device of the class described, a rigid support, a tool holder movable there-

in, a plurality of differing punches carried by said tool holder, a mandrel mounted in said support and having means for engaging said tools individually, means for positioning a selected said punch in axial alignment with said mandrel, and spring means fixedly mounted on said support and engaging a tool for releasably locking the tool holder against movement when the said selected tool has been positioned.

7. In a punch of the class described, a U-shaped frame having a leg serving as a base, and a U-shaped tool holder of integral construction disposed between the legs of said frame and pivoted thereto for rotation about an axis intersecting the legs of said frame and holder at intermediate points thereof, the space between the holder legs being unobstructed.

8. In a device of the character described, a frame, a substantially U-shaped tool holder, a tool carried by the holder, a die member carried by the holder, means on the frame for causing cooperative movement between said tool and die member, and a pivotal support disposed between the connected and open ends of said U-shaped tool holder, whereby the tool and die may be swung into alignment with said means on the frame.

9. In a device of the character described, a frame having a pair of spaced arms, a tool holder having a pair of spaced arms, tools carried by one arm of the holder, cooperating dies carried by the other arm of the holder, and axially aligned pivotal connections between the arms of the frame and the arms of the tool holder at points intermediate the ends of the arms of the tool holder.

In testimony whereof, I affix my signature.

MEDARD F. BOLLAERT.