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PUNCH AND DIE UNIT
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2,373,962

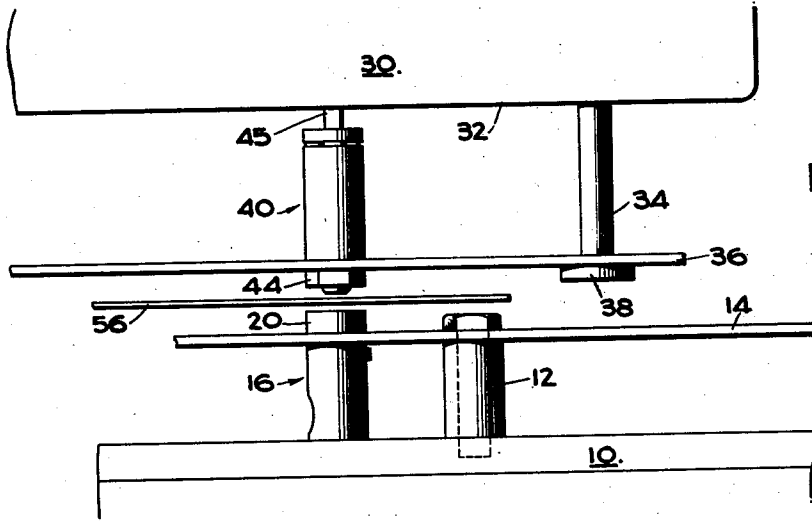


Fig. 1.

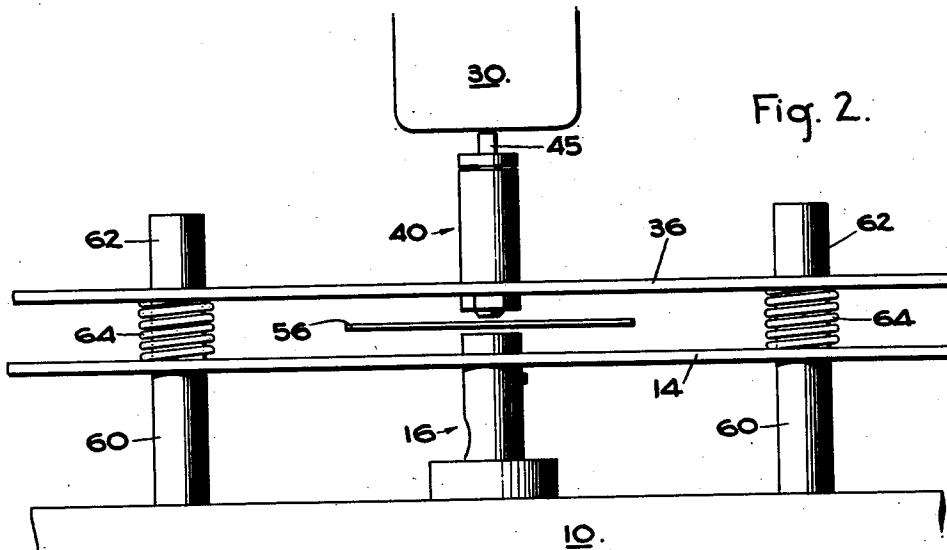


Fig. 2.

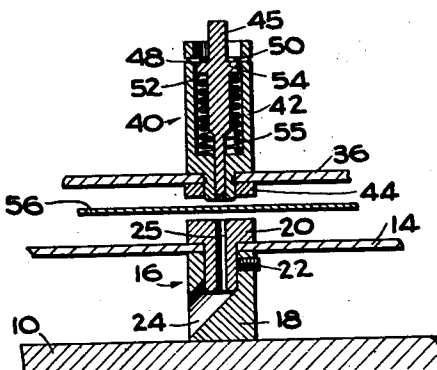


Fig. 3.

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PUNCH AND DIE UNIT

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4 Claims. (Cl. 164—124)

This invention relates to machine tools, and more particularly to improvements in die set devices for punching identically patterned holes through series of sheet metal stock pieces and the like; and more particularly to improvements in punch and die units such as are adapted to be interchangeably used in variously patterned setups. Thus, the invention is applicable to punch and die devices such as are presently used in large quantities for example in connection with punching of rivet holes or the like through metal sheets which are to be subsequently riveted into aircraft assemblies or the like. More specifically, the present invention relates to improvements in the art concerning the tool devices of U. S. Patents Nos. 2,296,136 and 2,350,436; and is designed to provide an improved punch and die unit for use in connection with punching operations such as the types of operations disclosed in the prior patents aforesaid.

In the drawing:

Fig. 1 is a fragmentary elevation of a punch and die set of the invention mounted for operation upon a work sheet;

Fig. 2 is a similar view showing another form of mounting for the punch and die sets of the invention; and

Fig. 3 is a vertical section through one of the punch and die sets of the invention.

The invention is shown in the drawing to comprise an improved punch and die unit which is adapted to be mounted for operation between die blocks and rams in a variety of arrangements. For example, in Fig. 1 the die block is indicated at 10 to comprise any suitable stationary block preferably mounting a plurality of anchoring posts 12 to which is bolted a die holder plate 14 so that the latter extends substantially parallelly to the face of the block 10 and in suitably spaced relation therefrom so as to be adapted to receive therebetween a plurality of the die members of the invention.

One of such die members is illustrated at 16, and as shown in Fig. 3 the die member 16 comprises a generally cylindrical body 18 and a telescopically inserted die head 20. The die body 18 is bored at its upper end to receive in slip-fitted relation therein the shank portion of the die head 20; and thus it will be understood that the larger head portion of the die element 20 will clamp down upon the die holder plate 14 to clamp the die element upon the plate when the unit is in assembled relation. A set screw 22 is provided to lock the die elements together in a clamping relation upon the plate 14. Thus,

it will be understood that a plurality of such die elements may be readily mounted upon the die holder plate 14 in accord with any predetermined plan view arrangement by simply providing the die holder plate 14 to be suitably perforated to receive and properly position the shank portions of the corresponding die elements. Such perforations in the die holder plate are centered upon points corresponding to the centers of the perforations to be punched through the stock to be operated upon. The die bodies 18 are diagonally counterbored as indicated at 24 into communication with the die shank receiving bore portions thereof; and the die heads 20 are vertically bored as indicated at 25 concentrically of the die head shank portions so as to coincide exactly with the prescribed centers for the punching operation upon the stock sheets to be processed.

The ram of Fig. 1 is designated at 30 to comprise any suitable movable ram device having its working surface 32 disposed parallel to the bed plate 10 and carrying a plurality of suspension pins 34. A punch holder plate 36 is suitably apertured to slidably fit upon the shank portions of the pins 34 and to be thereby laterally positioned relative to the ram 30. The guide pins 34 are headed as at 38 so as to provide stirrups upon which the holder plate 36 is adapted to rest and to be stopped against accidental disassembly from the ram. The holder plate 36 mounts a plurality of punch devices which are indicated generally at 40. Each comprises a cylindrical barrel 42 (Fig. 3) having a reduced shank portion at its lower end adapted to slip-fit through a suitably apertured portion of the holder plate 36 so as to laterally position the punch unit 40 in proper punching alignment with the corresponding die unit 16 therebelow. A lock nut 44 is provided to lock each punch unit barrel upon the guide plate 36.

The punch cylinder 42 is vertically centrally bored to receive in free sliding relation therein a punch element 45; the lower end of the punch element 45 being adapted to protrude when the punch is hit from the cylinder 42 and to register with the bore 25 of the corresponding die head 20 for punching stock material disposed therebetween. Adjacent its upper end the cylinder 42 is slotted at opposite side portions as indicated at 48—48 to permit a U-shaped clip 50 to be slidably inserted to partially block the interior bore portion 52 of the cylinder. The punch 45 is provided with a shoulder portion 54 which accurately slip-fits within the cylinder bore and

engages beneath the wire 50 when the unit is in assembled condition; and a compression spring 55 is mounted within the cylinder to bear upwardly against the shoulder 54 of the punch so as to normally bias the punch upwardly relative to the cylinder 42 in retracted position. Thus, it will be appreciated that subsequently to mounting a stock piece such as a metal sheet 56 between the punch and die set units, upon operation of the ram 30 so as to press it downwardly into stock sheet punching position, the lower ends of the punch cylinders 42 will initially ram the stock sheet against the corresponding top surfaces of the die heads. Further travel of the holder plate 36 will thereupon be blocked, but the ram 30 will be free to continue to move toward the die block due to the slip-fit connections between the holder plate 36 and the guide pins 34. Such continued motion of the ram 30 will cause the punch devices 45 to be depressed relative to their corresponding cylinders 42 against the forces of their springs 55 so as to drive the lower punching end portions of the punch devices through the stock in directions accurately aligned with the bored portions 25 of the corresponding die heads.

Thus, the plugs or pellets or stock material punched out of the stock sheets will be driven into the bored portions 25 of the die heads so as to ultimately fall through the inclined enlarged bored portions 24 thereof for final disposal thereof; and upon retraction of the ram 30 the spring devices 55 of the punch units will initially retract the punch devices 45 and the stirrups 38 will thereupon pick up the guide plate 36 so as to lift the entire punch-set away from the punched stock so that another stock piece can be placed thereunder for repetition of the punching operation.

In Fig. 2 the punch and die units of the invention are illustrated in mounted connection upon corresponding holder plates 14-36; the upper holder plate 36 being mounted in a somewhat different manner from the mounting thereof as shown in Fig. 1. Posts 60-66 are connected to extend upwardly from the die block 10 and to support thereon the holder plate 14, as in the manner of the support of the die holder 14 in Fig. 1. However, the support posts 60 are extended further upwardly to engage at suitably apertured portions thereof the upper holder plate 36 in slide fitting relation thereon, and compression springs 64 are disposed between the holder plates 14-36 so as to bias the upper holder plate 36 upwardly to normally maintain an adequate stock sheet transfer space between the lower end of the punch units 40 and the upper ends of the corresponding die heads 16. However, it will be appreciated that subsequent to mounting the stock sheet in operative position downward movement of the ram 30 will initially displace the punch set and holder plate 36 against the action of the spring 64 until such time as the stock sheet is firmly clamped between the punch and die units. Further travel of the ram 30 will thereupon press the punch devices 45 against the action of their coil springs in such manner as to project the punch elements from their corresponding cylinders into stock sheet punching relation in direct alignment with the corresponding die units. Upon release of the ram pressure the punch elements will initially retract, and then the lift springs 64 are freed to operate to raise the holder plate 36 whereby to lift the entire

punch set away from the work so as to permit easy exchange of stock pieces.

The annular shoulder portion 54 of the punch element 45 is so dimensioned as to accurately slip-fit within the interior of the counterbored portion 52 of the punch cylinder, whereby the shoulder 54 is adapted to function simultaneously as a bearing for one end of the spring 55 and as a stop device when abutting against the locking clip 50 and as a punch guide device to laterally stabilize the upper end of the punch element 45 relative to the punch cylinder. Thus, the lower stock perforating end portion of the punch element 45 may be safely formed to relatively slim stem-like dimensions, such as is required in connection with the punching of small size holes, because the shoulder 54 and relatively rugged upper end portion of the punch stem relieves the lower stem portion of lateral bending stresses and the like. Thus, the relatively delicately dimensioned stock perforating end portion of the punch element is protected in improved manner against stresses such as ordinarily cause excessive breakages of punching elements of similar devices of the prior art.

Also, it will be appreciated that a particular feature and advantage of the invention resides in the fact that it is the reduced end portion of the punch cylinder per se that slip-fits into the apertured holding plate 36 for locking thereon by means of the lock nut 44; and that a single integral cylinder device carries in its lower end the relatively delicately dimensioned stock perforating end portion of the punch element 45 and guides at its upper end the more ruggedly dimensioned upper end portion of the same punch element 45. Hence, both ends of the punch element are carried by a single rigid cylinder in lieu of by an assembly of multiple parts as in the prior art; whereby in the invention any possibility of misalignment of the punch element relative to its carrying cylinder is obviated, and whereby improved punching alignment and punch life are assured.

It will be appreciated that by reason of the specific formation and arrangement of operative parts of the punch and die elements of the mechanism, a particularly rugged and mechanically simple and fool-proof and accurately aligned punch and die set is provided; and that the elements of the invention are adapted to be economically manufactured and to be easily assembled and serviced with improved facility.

Although only two forms of the invention have been shown and described in detail it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A stock punching apparatus comprising a punch holding plate provided with an opening, a punch unit mounted upon said punch holding plate and comprising a cylinder member having a body and a reduced end portion integral with said body and slip-fitted into said opening of said punch holding plate, means locking said reduced end cylinder portion upon said punch holding plate, said body portion of said cylinder having a relatively large bore and said cylinder reduced end portion having a central bore of relatively reduced dimension, a punch stem of relatively small sectional dimension at its lower end slip-fitted into the bore of said cylinder reduced end

portion, said punch stem having a sectionally enlarged body portion disposed within the bore of said cylinder body portion, a coil spring disposed within said cylinder body and encompassing said enlarged stem body portion, said punch stem being formed with an enlarged shoulder accurately slip-fitting into said cylinder body bored portion and providing a bearing for said coil spring, and detachable stop means carried by said cylinder body exteriorly of said punch stem shoulder for limiting movements thereof in one direction relative to said cylinder.

2. A stock punching apparatus comprising a punch unit including a cylinder member having a relatively large body and a reduced end portion integral with said body, said cylinder body having a relatively large bore and said reduced end portion having a relatively small bore, a punch stem of relatively small diameter at its lower end slip-fitted into the bore of said cylinder reduced end portion, said punch stem having an enlarged diameter body portion disposed within the larger bore of said cylinder and a shoulder slip-fitting into said cylinder body bored portion for laterally guiding the upper end of said stem relative to said cylinder.

3. A stock punching apparatus comprising a holder plate provided with an opening, a punch unit mounted upon said holder plate and comprising a cylinder member having an integral reduced end portion thereof slip-fitted into said opening of said holder plate, means locking said cylinder member upon said holder plate, said cylinder having a relatively large bore at one of its ends and a relatively small bore at its reduced end, a punch stem of relatively small sectional dimension at one end slip-fitted into said small bore and a sectionally enlarged body portion disposed within said large bore, a coil spring disposed within said cylinder and encompassing said enlarged stem body portion, said punch stem being formed with a shoulder accurately slip-fitting

into said cylinder large bore portion and providing a bearing for said coil spring, and detachable stop means carried by said cylinder exteriorly of said punch stem shoulder for coaction therewith to limit movements thereof in one direction relative to said cylinder, and a second holder plate provided with a second opening directionally aligned with said first opening, a die unit mounted upon said second holder plate and comprising a cylinder and a headed die block slip-fitted into said cylinder and bored in alignment with said punch stem.

4. A stock punching apparatus comprising a punch holder plate provided with an opening, a punch unit mounted upon said punch holder plate and comprising a cylinder member having a reduced end portion integral with the body of said cylinder slip-fitted into said opening of said punch holder plate, means locking said reduced end cylinder portion upon said punch holder plate, the body of said cylinder being centrally bored to relatively large diameter and said reduced cylinder end portion being centrally bored to relatively small diameter, a punch element comprising a stem-like device of relatively small diameter at its lower end accurately slip-fitted into the small bore of said cylinder reduced end portion and having a sectionally enlarged stem portion disposed within the large bore of said cylinder body, a spring disposed within said cylinder bored portion and bearing against said reduced end portion thereof, said punching element being formed with a shoulder accurately slip-fitting into said cylinder large bore portion and providing a bearing for said spring and a guide for said punching element relative to said cylinder, and detachable stop means carried by said cylinder exteriorly of said punching element shoulder for limiting movements thereof in one direction relative to said cylinder.

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