

March 22, 1938.

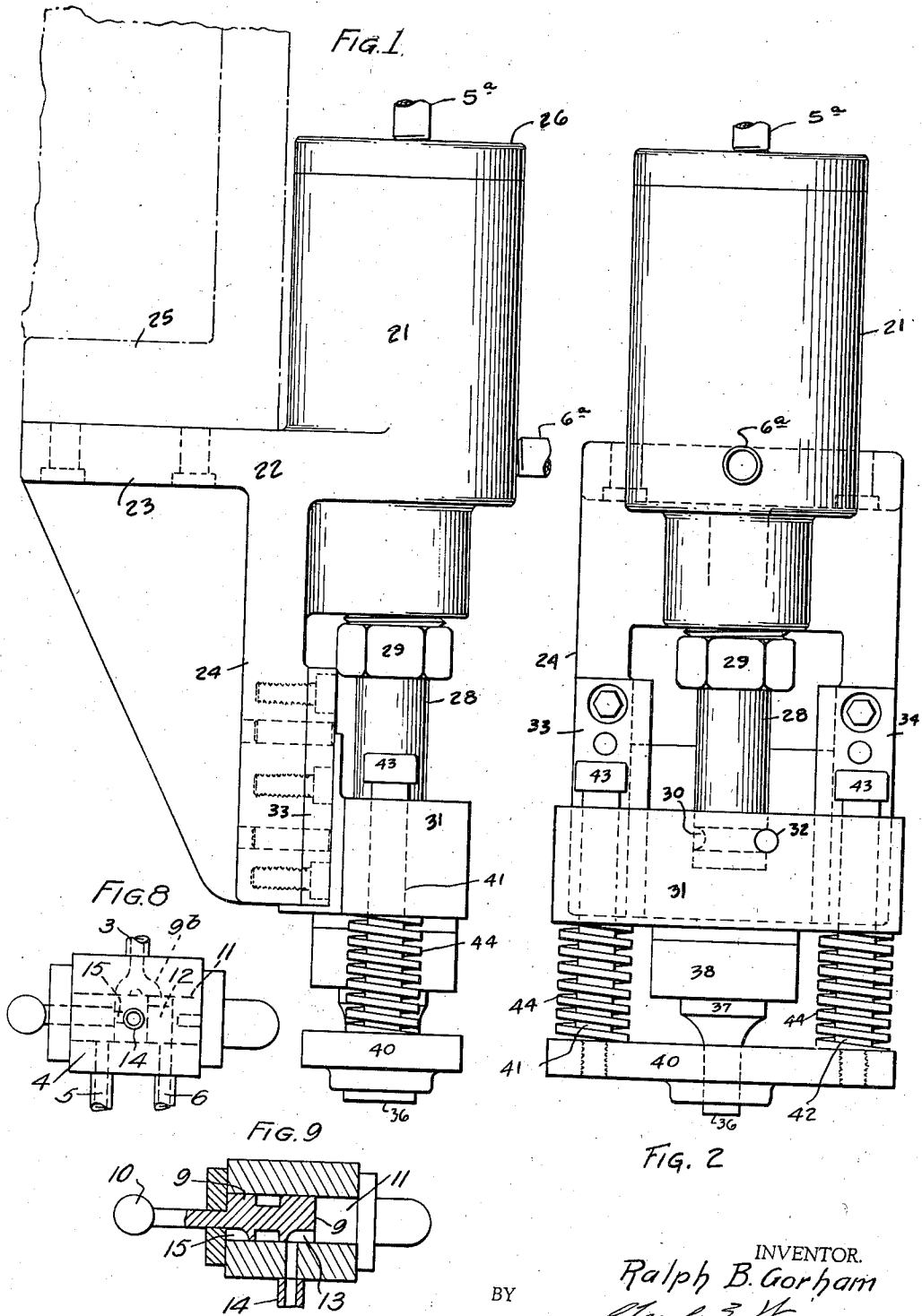
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2,112,153

HYDRAULIC PUNCH AND DIE UNIT

Filed May 25, 1936

3 Sheets-Sheet 1



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HYDRAULIC PUNCH AND DIE UNIT

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3 Sheets-Sheet 2

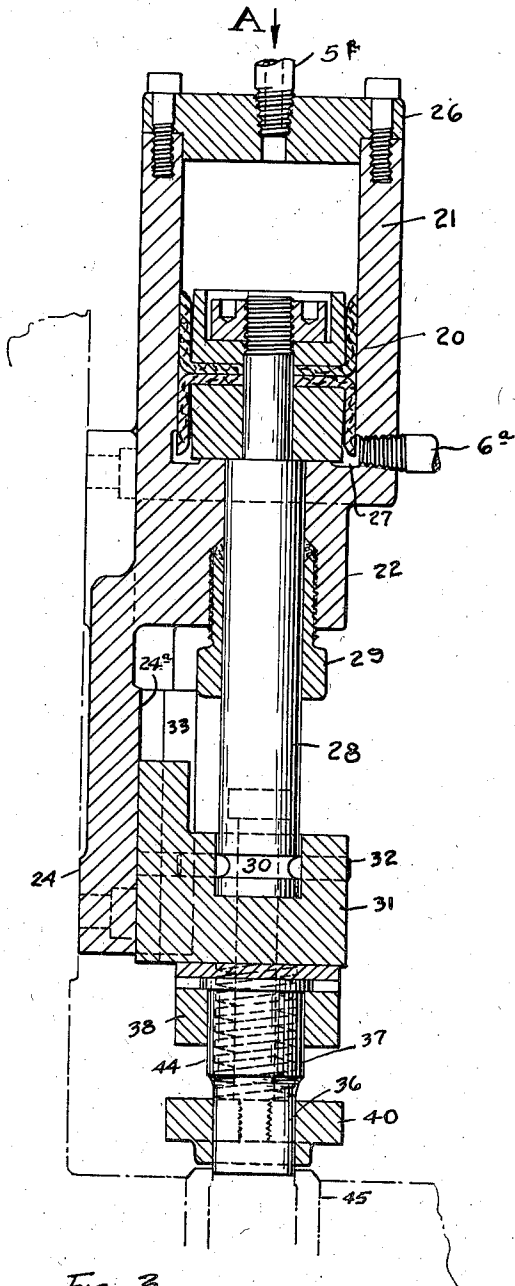


Fig. 3

B

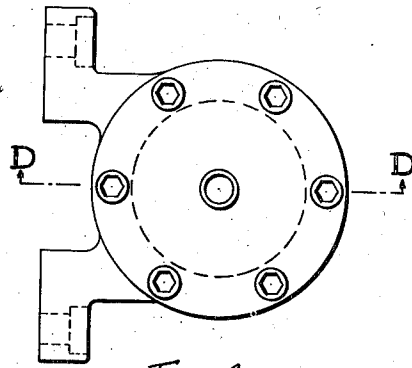


Fig. 4

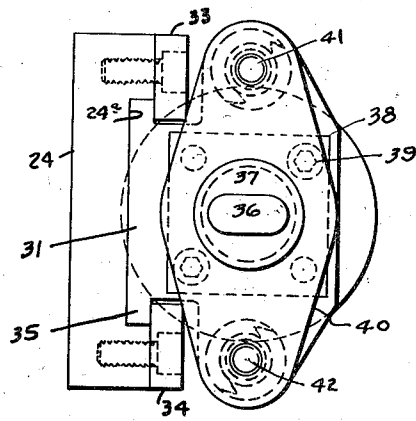


Fig. 5

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3 Sheets-Sheet 3

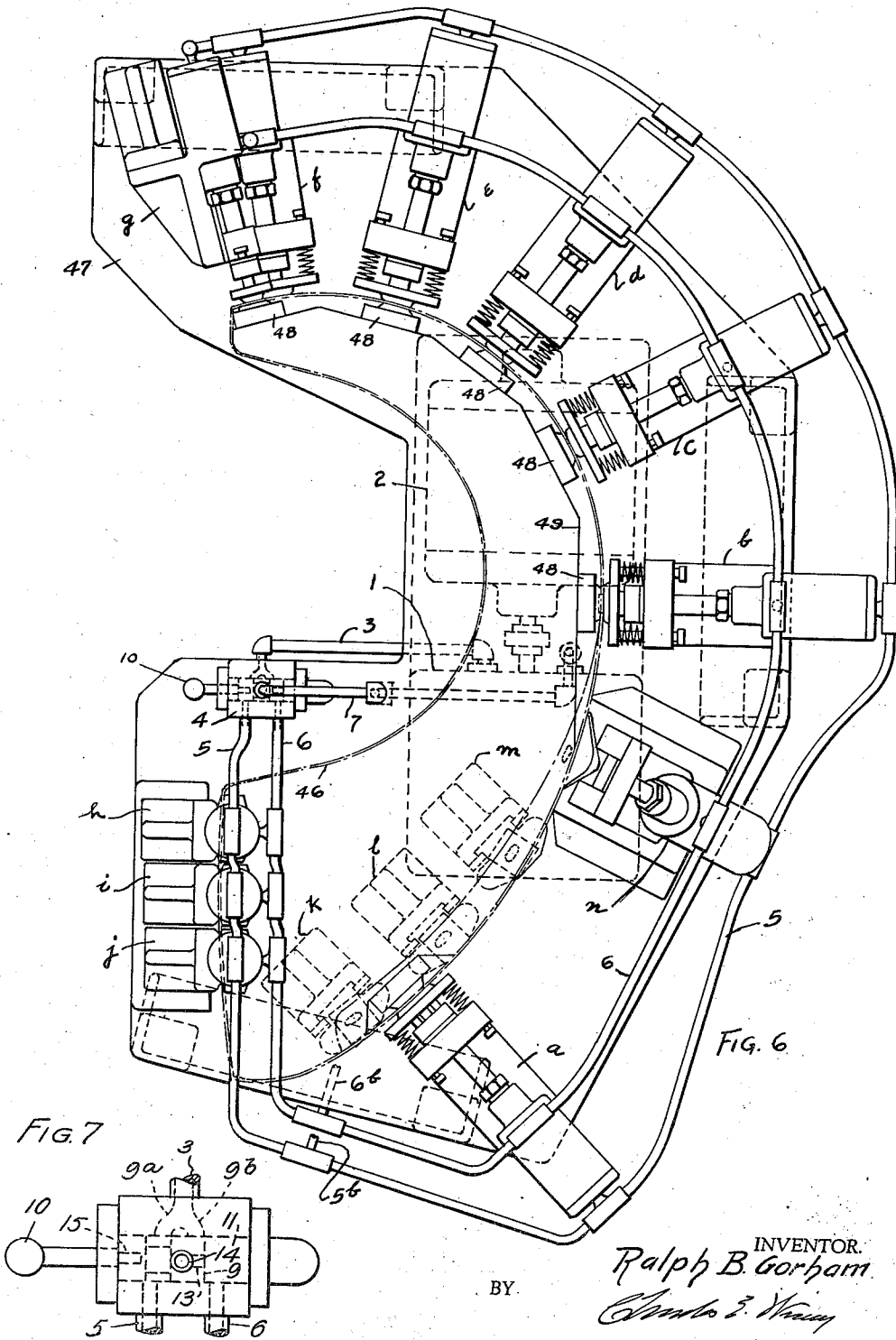


FIG. 6

FIG. 7

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HYDRAULIC PUNCH AND DIE UNIT

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4 Claims. (Cl. 164—95)

This invention relates to hydraulic punch and die units, the object being to provide a new and unique arrangement of punch parts for cooperation with a die in which the punch is actuated hydraulically to perform the piercing operation and a control means therefor whereby the punch is caused to be withdrawn from the die likewise by hydraulic pressure.

The invention further seeks to provide a frame for the assembly of a series of piercing units in the desired relationship for forming a series of holes in predetermined relation in a sheet metal part and wherein the punches of the units thus assembled on the framework are simultaneously actuated to perform the piercing step and through control means are simultaneously withdrawn for a succeeding operation.

A further feature and object of the invention is to provide a punch element actuatable by hydraulic pressure to perform a piercing operation or be withdrawn therefrom and wherein the punch proper is carried by a slide block in its reciprocable movement and thus maintained constantly in alignment with the die and held from rotation in respect thereto.

These and other objects and various novel features of the invention are hereinafter more fully described and claimed and the preferred form of a hydraulic piercing unit embodying my invention and the assembly of such units upon a common frame are shown in the accompanying drawing in which—

Fig. 1 is a side elevation showing my improved punch.

Fig. 2 is an elevation taken from the right side of Fig. 1.

Fig. 3 is a vertical longitudinal section of the punch.

Fig. 4 is a top plan view thereof.

Fig. 5 is a view from the bottom end showing the face of the punch and the guide block carrying the same.

Fig. 6 is a view of a series of units carried by a frame to be utilized in piercing the fender of an automobile body.

Fig. 7 is a plan view of a control unit showing a ported manually controlled valve for causing fluid to flow to actuate the punch in its piercing operation.

Fig. 8 is a similar view showing the valve set to cause flow of fluid under pressure to withdraw the punch.

Fig. 9 is a cross section of the control valve.

It is firstly to be understood that in any installation of a single or a series of punches involving

my invention, a pump 1 of any approved character is provided and operated by a motor indicated by the dotted lines 2. The discharge fluid from the pump passes through the conduit 3 to the control valve element indicated generally at 4 and in the setting of the valve unit 4 shown in Fig. 6, the conduit 6 for actuation of the punches is closed and the conduit 7 open to receive fluid displaced by movement of the punches as hereinafter more fully described.

In its unitary form as shown in section in Fig. 3, the conduit 5^a opens to the top and the conduit 6^a opens to the bottom of the cylinder 20. These two conduits correspond to the conduits 5 and 6 of Figs. 6, 7 and 8 in which the control valve is shown. This valve is here diagrammatically shown partially in dotted lines and includes a piston valve 9 controlled by a handle 10 and slides in a cylinder 11 in the body.

The discharge conduit 3 from the pump opens into the side of the valve body 4 and opens into the cylinder 11 therein at two points 9^a and 9^b shown in dotted lines in Figs. 7 and 8 at spaced points longitudinally of the cylinder wall. The piston valve 9 has an aperture 12 transversely thereof and opens through the valve 9 on opposite sides and in the position of the valve shown in Fig. 7 the discharge line 3 is in communication with the line 5 through the branch 9^a and cross aperture 12. The valve also has an aperture 13 in its end which extends longitudinally thereof for a short distance and terminates in the surface of the valve at the opening 14 as shown in Fig. 9. In the position of the valve shown in Fig. 8 this opening 14 registers with the recess 15 in the other end of the valve 9. Fluid therefore passes through the pressure conduit 3 to the line 5 of Fig. 8 or 6^a of Fig. 3.

In order to move the piston 20 upwardly in the cylinder 21 from the position shown in Fig. 3 and to cause like movement of the pistons in the units shown in Fig. 6, the valve 9 is shifted from the position shown in Fig. 7 to the position shown in Fig. 8. In so doing, the passageway 12 extending transversely of the valve body is aligned with the outlet 9^b of the pressure conduit 3 and with the outlet of the valve body to which the conduit 6 or 6^a of Figs. 6 and 3 is connected which applies pressure through the line 6 or 6^a to the under side of the piston, and the fluid in the upper part of the cylinders is discharged through the conduit 5 or 5^a of the respective views passes into the opposite end of the cylinder 11 and opposite end of the valve from that to which the conduit 6 or 6^a discharged as aforesaid. This piston valve has

an L shaped conduit in its end wall 15 which in the position of the piston shown in Fig. 8 opens to the port 14 in the wall of the valve cylinder to which the return line 7 is connected. Thus, by manual movement of the piston valve, fluid under pressure may be discharged to the conduit 5 or 5^a and then through the conduit 6 or 6^a to reverse the movement of the pistons. With this explanation of the hydraulic control, it will be realized that the piston 20 in the cylinder 21 shown more clearly in Fig. 3 may be reciprocated by fluid pressure developed by the pump in the casing 1 which may apply fluid under pressure to one line 5 or 6 and then to the other line 5^a or 6^a depending upon the direction it is desired to move the piston.

The invention here disclosed is a hydraulically controlled piercing punch and the construction thereof is best illustrated in Figs. 1, 2 and 3. The structure consists of a casting 22 having a base part 23 and 24 and the portion 23 may be bolted to the frame indicated in dotted lines at 25 in Fig. 1. The upper end of the casting is bored to provide the cylinder 21 and is provided with a removable end cap 26 through which the conduit 5^a extends to the interior of the cylinder.

The piston may be of any approved form here shown as of the double cupped leather type. The bottom of the cylinder is recessed as at 27 and the conduit 6^a is threaded into an aperture leading to the recess so that oil under pressure passing through the conduit 6^a is introduced to the open side of the lower cupped element and forces the piston upwardly in the position shown in Fig. 3. The bottom of the cylinder is apertured to receive the piston rod 28 which is provided with a packing compressible by the adjusting nut 29. The lower end of the rod 28 is circumferentially grooved at 30 and is seated in a recess formed in the guide block 31, the pin 32 extending into the block and the groove 30 to prevent removal.

The guide block 31 as shown in Fig. 5, has its finished face riding on the finished surface 24^a of the bracket portion 24 and strips 33 and 34 are secured on opposite sides of the edge portions of the bracket 24 providing ways overlying the flanged end portions 35 of the guide block 31 as will be seen more clearly in Fig. 5. This guide block 31, due to the reciprocation of the piston, rides vertically in these ways. The punch 36 is oval in form in end view as shown in Fig. 5 and has a circular shank 37 secured in a block 38 which in turn is secured as by means of screws 39 to the guide block 31. The usual stripper plate 40 has an aperture to receive the punch as will be understood from Fig. 2 and this plate 40 has pins 41 and 42 at its opposite end which extend upwardly through the guide block and is there provided with a head 43 which limits the distance to which the stripper plate may be positioned below the guide block. Springs 44 are provided on these pins 42 which in the punching operation wherein the punch enters the die 45, indicated diagrammatically in Fig. 3, raise the plate 40 from lowermost position and as the punch is withdrawn the springs force it outwardly and strips the punched metal from the punch end. This is the usual stripper plate now used with the ordinary punch and die set.

When the punch is in the position shown in Fig. 3, manipulation of the piston valve 9 by the handle 10 to the position shown in Fig. 8 applies pressure through the conduit 6^a raising the piston from the position shown in Fig. 3 and thereafter when another piece of material to be pierced is

positioned over the die the valve is changed to the position shown in Fig. 7 and pressure is applied to the line 5^a to the head of the piston forcing the same on the piercing movement as will be understood from the previous description of the hydraulic circuit.

The punch is also well adapted to be used in groups for special purposes only one of which is illustrated in Fig. 6 showing the several punches arranged for piercing the edge of an automobile fender 46 indicated by dotted lines. For this purpose, I utilize a frame element 47 for supporting the units, which may be of any convenient form for any special purpose. In this particular use some of the punches are positioned in one plane as for instance the punch units *a, b, c, d, e* and *f*. Others may be positioned at a right angle thereto as for instance the unit *g* at the top of Fig. 6 or the three units positioned vertically as at *h, i* and *j* at the bottom left side of Fig. 6. Others may be turned practically at a right angle to these *h, i* and *j* units as shown by dotted lines *k, l* and *m* or at other angular relationship as indicated at *n* in Fig. 6.

With a group of punches as described, the conduit 5 is connected to the top of each of the cylinders of the group there being a branch conduit 5^b for the group *k, l* and *m*. Likewise the other conduit 6 connects with the bottoms of the cylinders of the group as indicated and the branch 6^b is to be understood as extending to the bottoms of the cylinders *k, l* and *m*. These conduits may be flexible to permit change in the spacing or position of the respective units. Thus, with the valve set as shown in Fig. 6, pressure is applied through the conduit 6 and 6^b to the bottom of the cylinders of the group and oil in the tops of the pistons of the group is returned through the conduit 5 or 5^a to the return line 7. By reversing the position of the piston valve to correspond to that shown in Fig. 7, pressure will be discharged through the conduit 5 or 5^a to the tops of all the cylinders while the oil from the under side of the pistons is discharged through the conduits 6 and 6^b to the return line 7. Thus, in the use of this group arrangement of piercing units, the work is first placed between the dies 48 indicated at the upper part of Fig. 6 which are to be understood as being supported by the element indicated by the line 49. The edge of the work to be pierced being introduced over these dies in the proper place, the valve is moved from the position in which the punches are retracted as in Fig. 8 to the position shown in Fig. 7 and pressure applied simultaneously upon the tops of the pistons of each of the punch units of the group. The punch is thus forced on its piercing stroke and then returned by shifting the valve again to the position shown in Fig. 8 retracting the punch whereupon a succeeding piece of work may be introduced upon the element or anvil 49.

It is obvious that these punch piercing units may be placed altogether differently from what is disclosed herein as may be required by the shape of the piece to be pierced but, in any case, the punches of the general structure described are connected up with the conduits after the manner herein disclosed to secure a reciprocation of the punch hydraulically. I have here shown a manual control for causing pressure to be applied to one side and then to the other of the piston handling the punches but the invention is not restricted to manual control as in some characters of punching operation a single

or a number of piercing units may be so set that material is automatically fed to the same under which condition the valve control may be timed with the movement of the work piece subsequent to each piercing stroke and withdrawal of the punch from the work.

From the foregoing description it is believed evident that my improved piercing punch is simple in its general construction and is readily operated by use of the hydraulic pressure to reciprocate the punch in respect to die or anvil element and that the various objects of the invention are attained by the structure described.

Having thus briefly described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is—

1. A punch and die set for piercing a series of holes in a work piece comprising a series of punches and a complementary series of dies, a frame member having seats for each punch and die unit arranged in various angles and in various planes and permitting the mounting of the respective punch and die units in position on the frame for the piercing of holes as may be required in various portions of the work, each punch unit including a cylinder, a piston reciprocable therein, a piston rod extending from the end of the cylinder, and a punch movable by the rod, means for applying fluid under pressure to the several punch units, comprising a conduit having branches extending to the upper end of the cylinder of each unit, and a second conduit having branches extending to the lower end of the cylinder of each unit, a pump having a discharge conduit for supplying fluid under pressure, valve means operable to connect the said discharge conduit of the pump alternately to the first named conduit and then to the other, and a return line to the pump opening to the valve means, movement of the valve to open the first named conduit to the pump discharge conduit opening the other conduit to the return line.

2. A punch and die set for piercing a piece of work having portions thereof arranged in different planes, comprising a series of punch elements and a series of die elements complementary thereto, a frame member having seats for supporting each punch and die element, said seats being arranged to position the respective punch and die

elements in the required plane for punching the work portions, said punch elements being adapted for operation by hydraulic pressure, means for supplying fluid under pressure to alternately move the punches in the piercing stroke and then to withdraw the same, said means including flexible conduits common to the several punch units and permitting within the length of the conduits between the successive punch units a practically universal variation in angular relationship to thereby permit the punch units to be positioned in the different planes as may be required for the piercing of the work.

3. A punch and die set for use in piercing a piece of work having portions thereof requiring piercing arranged in different planes and in different angular relationships, comprising a series of punch elements and a series of die elements complementary thereto, means for applying hydraulic pressure to the punch and die elements to cause the piercing of the work and the withdrawal of the punches therebetween, said means including flexible conduits common to the several punches permitting within the length of the conduits between successive units a practically universal variation in angular relationship of the respective units to thereby permit the flexibly connected punch and die units to be variously positioned upon a frame having seats therefor and to be removed therefrom and positioned upon another frame having seats differently arranged from that of the first frame.

4. A punch and die set for piercing a series of holes in a work piece, comprising a series of punches and a complementary series of dies, a frame member having seats for each punch and die unit arranged at various angles and in various planes permitting the mounting of the punch and die units in position on the frame for the piercing of holes as may be required in various portions of the work, means for applying fluid under pressure to the several punch units, comprising a pressure supply conduit and a return conduit with which the punch units are commonly connected, said conduits being flexible and permitting the punch units to be variably positioned as may be required in adapting the same for the piercing of a particular piece of work.

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