

April 12, 1949.

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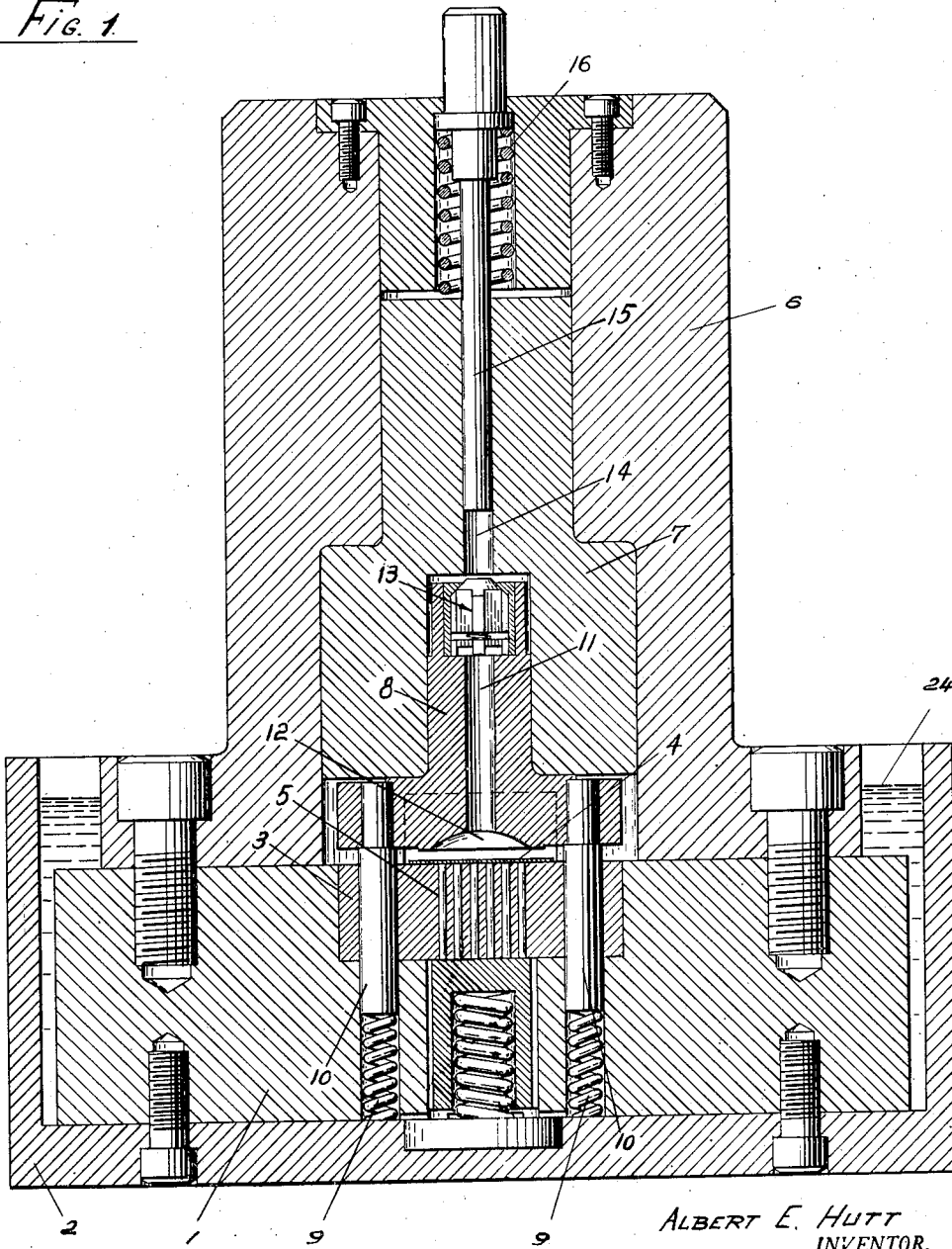
2,467,034

SHEET METAL PIERCING

Filed Nov. 20, 1945

2 Sheets-Sheet 1

Fig. 1



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2 Sheets-Sheet 2

Fig. 3.

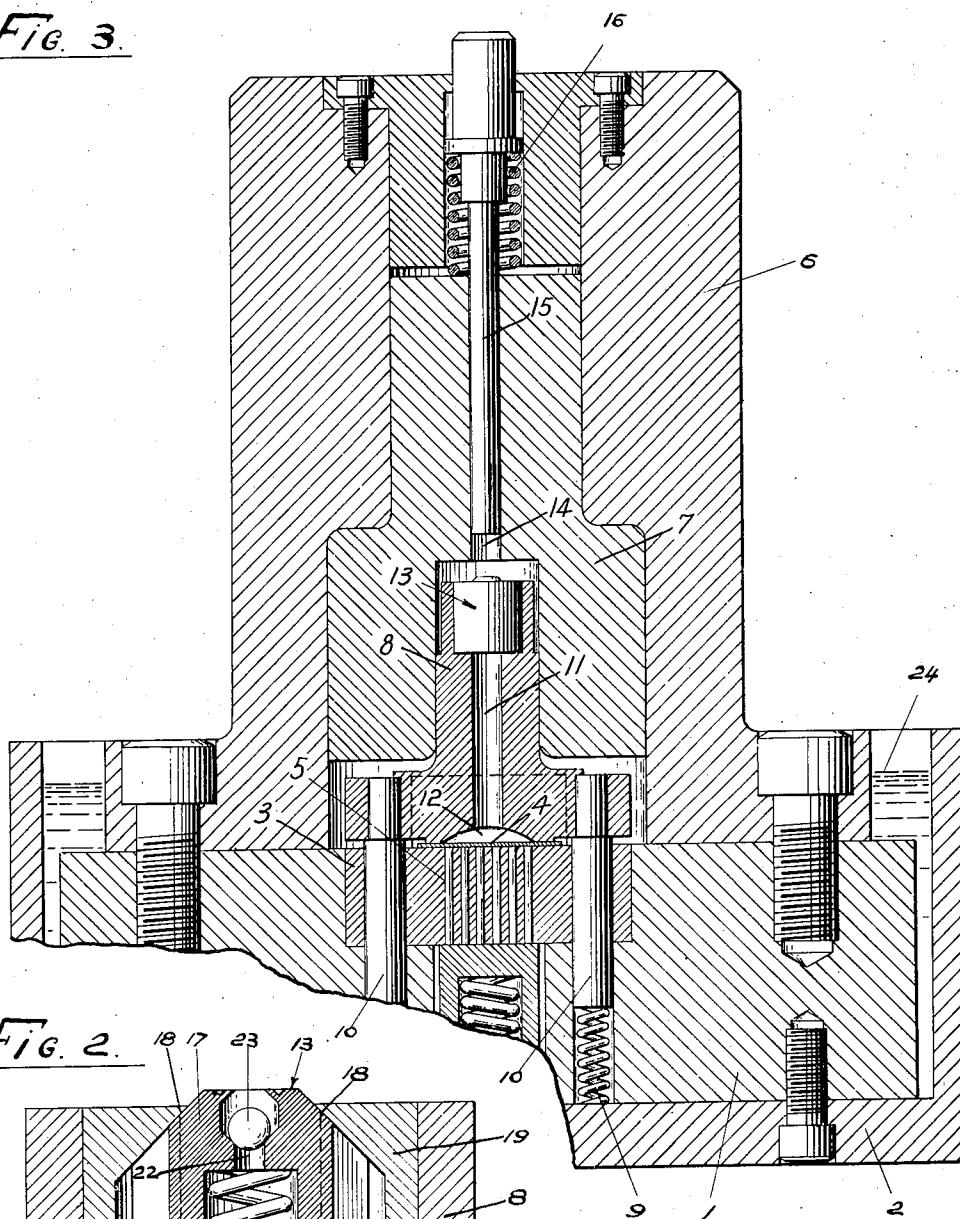
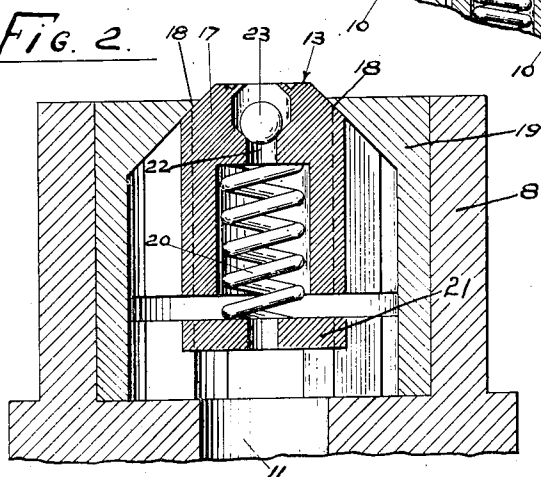


Fig. 2.



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UNITED STATES PATENT OFFICE

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SHEET METAL PIERCING

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Application November 20, 1945, Serial No. 629,735

3 Claims. (Cl. 164—95)

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This invention relates to an improved form of press suitable for carrying out the method of piercing sheet material disclosed in my application Serial No. 588,153, filed April 13, 1945, now Patent 2,395,123, granted February 19, 1946.

In that application there is disclosed a method of piercing sheet material, such as thin sheet metal, by means of hydraulic pressure. In general, such method contemplates the use of a rigid sheet support which is recessed or provided with apertures accurately shaped and located to define the precise areas to be pierced, the sheet being laid on the support and its upper surface then subjected to liquid pressure in an amount sufficient to rupture the unsupported areas of the sheet. The present invention provides a simplified form of press, as will be apparent from the following description.

In the accompanying drawings, in which a preferred form of the improved press is illustrated, Fig. 1 is a vertical section; Fig. 2 is an enlarged broken out view of the control valve; and Fig. 3 is a vertical section similar to Fig. 1 but showing certain of the parts in a different position.

In Figs. 1 and 2 the press is shown as consisting of a base or bed 1 rigidly supported in a trough 2, the base incorporating an insert or block 3 which serves as a support for the sheet 4 to be pierced. This support is pierced or provided with apertures to define, on the under surface of the sheet, the areas to be pierced; and for purposes of illustration, the block 3 is shown provided with six holes 5, the upper or entrance ends of which define the outline of six holes to be pierced in the sheet 4.

Secured to the base 1 is a main or outer cylinder 6 in which is secured an inner cylinder 7; and movably mounted in the latter is a piston 8 which, normally, or when the press is idle, is biased into the upper position indicated in Fig. 1. For this purpose, springs 9 are shown abutting the lower ends of studs 10, the upper ends of which are seated in the piston 8. The piston incorporates a cylinder 11 which, at its lower end, terminates in a cavity 12 which overlies all of the unsupported areas of the sheet 4.

In the head or upper end of piston 8 is mounted a valve, generally designated 13; and above the valve and piston head is a second cylinder section 14 in which operates a plunger 15. The latter is normally sustained in the position shown in Fig. 1 by spring 16, and is adapted to be depressed by any suitable power mechanism, not shown.

As shown more particularly in Fig. 2, valve 13

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consists of a body portion 17 having a conical upper end adapted to seat against the shoulders 18 of an insert 19 in the head of piston 8 to close off communication between cylinders 11 and 14.

The valve body is biased to its closed position, as by a spring 20, the lower end of which seats on a spider 21. A passage 22 extends upwardly through the valve body, but it, too, is normally closed, as by ball 23.

In the operation of the press, the trough 2 is filled with liquid, such as oil, to the level indicated at 24, and the space beneath and around the lower end of piston 8 is likewise filled with liquid, as are also the cavity 12 and cylinder sections 11 and 14.

With a sheet such as 4 in position to be pierced, pressure is applied to plunger 15 and thereby to the liquid in cylinder 14, and the head of piston 8. The springs 9 and the valve spring 20 are so related that the former yield before the latter with the result that, as plunger 15 is depressed, the pressure developed in the liquid in cylinder 14 serves first to depress piston 8 bodily to the position indicated in Fig. 3 where it is in clamping engagement with sheet 4. Under increasing pressure of the liquid in cylinder 14, valve 13 is depressed and opens and the compressive force of plunger 15 is transmitted to the liquid column in cylinder 11 and to the upper surface of sheet 4. Under increasing pressure, and in due course, the sheet is ruptured at each of its unsupported areas.

Thereafter, and as plunger 15 is relieved of the pressure applied to it, it rises under the influence of spring 16, valve 13 closes and piston 8 also moves back to the position of Fig. 1. The suction created by the upward movement of plunger 15 raises ball 23 and cylinder 14 is, accordingly, replenished by the suction-induced, upward flow of liquid from cylinder 11. When plunger 15 reaches the upper limit of its stroke and comes to rest, ball 23 again falls into its passage-closing position, and all of the parts are then restored to the position indicated in Fig. 1 with the several passages wholly filled with liquid in readiness for the next operation.

While the illustrated and described form of apparatus is preferred, its principles may obviously be applied in a variety of ways and the scope of the invention will be understood to be defined by the following claims.

I claim:

1. In a press having a bed forming a support for a sheet to be pierced, the surface of the bed having an aperture serving to deprive of support the area of the sheet to be pierced, a cylinder mounted on the bed, a piston movable in the

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cylinder into engagement with the sheet to clamp the same against the bed, said piston incorporating a liquid-containing cylinder terminating in a cavity overlying the unsupported area of the sheet and adapted to be closed by the sheet when the piston is in engagement therewith, the combination therewith of an upper liquid-containing cylinder section closed at its lower end by the head of the piston and at its upper end by a plunger, whereby depression of the plunger moves the piston into sheet-clamping position, a downwardly-opening, spring-supported valve mounted in the head of the piston and adapted to be opened in response to further depression of the plunger to admit the pressure of the liquid above the valve to said first-mentioned liquid-containing cylinder, and a normally-closed ball valve carried by the spring-supported valve, said ball valve being adapted to open in response to upward movement of the plunger and permit the suction-replenishment of said upper, liquid-containing cylinder section.

2. In a press having a bed forming a support for a sheet to be pierced, the surface of the bed having an aperture serving to deprive of support the area of the sheet to be pierced, a cylinder mounted on the bed, a piston movable in the cylinder into engagement with the sheet to clamp the same against the bed, said piston incorporating a liquid-containing cylinder terminating in a cavity overlying the unsupported area of the sheet and adapted to be closed by the sheet when the piston is in engagement therewith, the combination therewith of an upper, liquid-containing cylinder section closed at its lower end by the head of the piston and at its upper end by a plunger, whereby depression of the plunger moves the piston into sheet-clamping position, a downwardly-opening, spring-supported valve mounted in the head of the piston and adapted to be opened in response to further depression of the

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plunger to admit the pressure of the liquid above the valve to said first-mentioned liquid-containing cylinder, and a normally-closed valve adapted to open in response to upward movement of the plunger, said last-mentioned valve controlling liquid flow from the first-mentioned liquid-containing cylinder to said upper, liquid-containing cylinder.

3. In a press having a bed forming a support for a sheet to be pierced, the surface of the bed having an aperture serving to deprive of support the area of the sheet to be pierced, a cylinder mounted on the bed, a piston movable in the cylinder into engagement with the sheet to clamp the same against the bed, said piston incorporating a liquid-containing cylinder terminating in a cavity overlying the unsupported area of the sheet and adapted to be closed by the sheet when the piston is in engagement therewith, the combination therewith of an upper liquid-containing cylinder section closed at its lower end by the head of the piston and at its upper end by a plunger, whereby depression of the plunger moves the piston into sheet-clamping position, valve means adapted to open in response to further depression of the plunger to admit the pressure of the liquid in said upper, liquid-containing cylinder section to said first-mentioned liquid-containing cylinder, and means for replenishing said upper, liquid-containing cylinder following closure of said valve means.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
2,395,123	Hutt	Feb. 19, 1946