May 16, 1944. V. H. PAVLECKA 2,348,921

DRAW PRESS

Filed Aug. 16, 1941 2 Sheets-Sheet 1

Fig. 1.

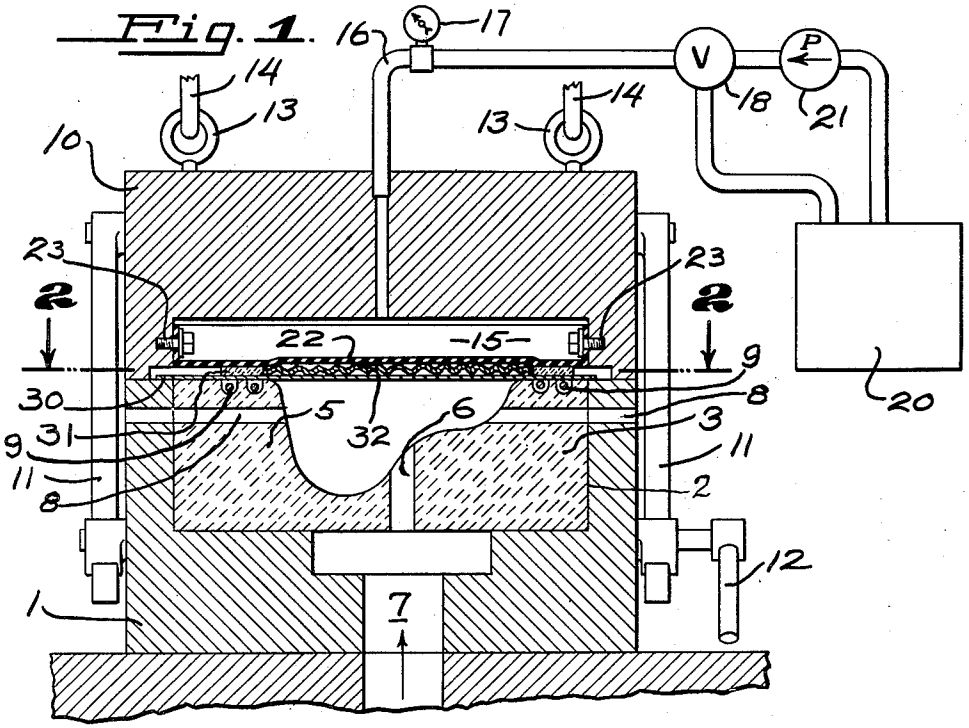

Fig. 2.

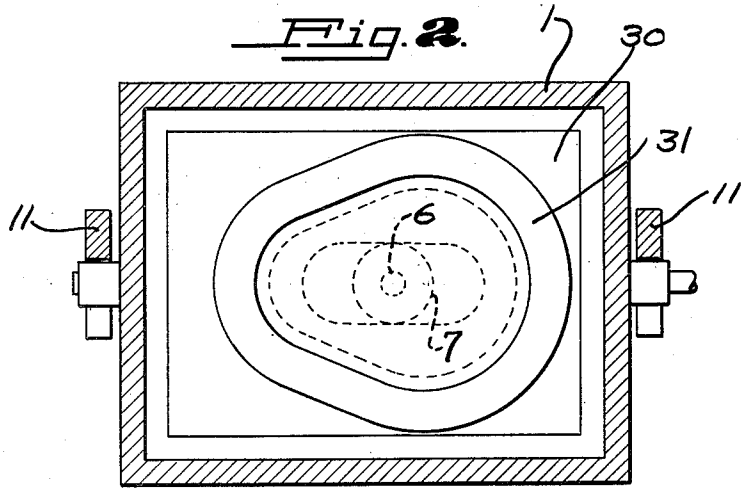

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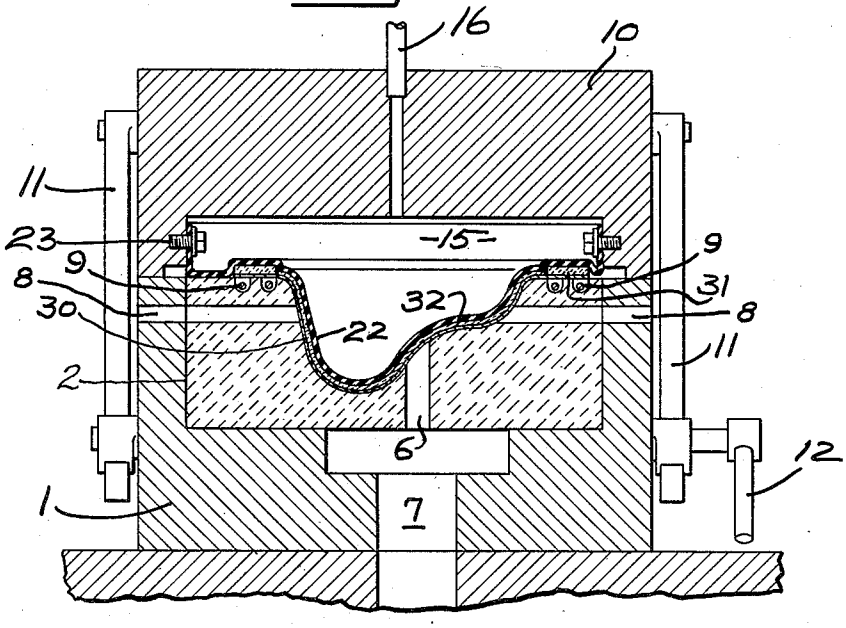
Fig. 3.



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Patented May 16, 1944 2,348,921

UNITED STATES PATENT OFFICE

2,348,921

DRAW PRESS

Vladimir H. Pavlecka, Pacific Palisades, Calif., assignor to Northrop Aircraft, Inc., Hawthorne, Calif., a corporation of California

Application August 16, 1941, Serial No. 407,194

2 Claims. (Cl. 113—44)

My invention relates to draw presses and more particularly to a means and method of forming sheet material having a relatively low melting point such as, for example, sheets of magnesium and aluminum, or alloys thereof.

My invention is valuable for use in manufacture of aircraft parts, as large and relatively complicated draws can be made with the relatively simple and inexpensive draw press of my invention.

In making parts for metal aircraft, relatively thin sheet material has to be formed, and some of this material has to be provided with rather deep draws. Conventional draw presses for such work are large, heavy, cumbersome and expensive. It is the main object of my present invention to provide a means and method of producing formed sheet material by the use of a relatively simple and inexpensive press, which can be duplicated without extensive use of precision machine tools.

Another object of my invention is to provide a means and method of hot forming thin metal sheets by the use of hydraulic pressure.

My invention possesses numerous objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is therefore to be understood that my method is applicable to other apparatus, and that I do not limit myself, in any way, to the apparatus of the present application, as I may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

In the drawings:

Fig. 1 is a diagrammatic view, partly in section and partly in elevation, showing one form of press of my invention, together with a hydraulic operating circuit therefor.

Fig. 2 is a view partly in section and partly in elevation taken as indicated by the line 2—2 in Fig. 1.

Fig. 3 is a diagrammatic view similar to the view of Fig. 1, showing the relationship of press parts after the draw has taken place.

My invention may be more readily understood by direct reference to the drawings. A base block 1 of heavy construction is provided. This base block may be, for example, of cast iron or it may be of reenforced concrete and boiler plate, and is provided with a central die chamber 2 in which a female die 3 is mounted. As no impact is used in the operation of the press, the female die may be made of inexpensive materials capable of being molded or cast, such as plaster of paris, for example, shaped to provide the contour of the finished part it is desired to draw from a flat sheet.

The female die 3 is provided with one or more inlet air channels 6 extending upwardly therethrough, these air channels connecting with a main air conduit 7 in block 1. In case of hot forming the conduit 7 is supplied with hot air from a source not shown. Lateral air outlet channels 8 are provided in the side walls of the female die. It may also be desirable to heat the top of die 3, and electric heating coils 9 may be inserted for that purpose.

An upper block 10 is provided, mating with the lower block 1 and locked thereto by locking bars 11 on each side thereof, the lock being under control of handle 12. Upper block 10 is provided with eye bolts 13 to which hoist cables 14 may be attached for lifting the upper block away from its mating position with lower block 1.

Upper block 10 may be entirely of iron, for example, or may be partly iron and partly concrete. In any event both blocks 10 and 11 should be of relatively heavy construction, and will in many cases be quite large, as formed parts of five and six foot extent are often desired.

The lower surface of upper block 10 is provided with an inset oil chamber 15, this oil chamber being connected to oil conduit 16 having a pressure gage 17 connected thereto, with a valve 18 controlling the flow of oil to and from a sump 20, the oil pressure being supplied by pump 21. Oil is maintained in the oil chamber 15 by a facing sheet 22, this sheet being of a resilient material having elastic characteristics similar to rubber, but preferably being more heat resistant than rubber. I have found that several of the so-called synthetic rubbers, or organic elastic materials are suitable for closure of oil space 15. A number of these rubber materials are able to withstand temperatures of from 350° to 400° F. without losing their elastic properties and without damage. The resilient sheet 22 is maintained in position to seal space 15, by the means of bolts 23 around the periphery thereof. The chamber 15 is therefore a sealed chamber having the resilient sheet 22 as the lower closure thereof.

In operation the die blocks are unlocked and the upper block 10 is raised so that a work blank 30 of material to be drawn, may be placed on top of the female die 3. Blank 30 will be, of course, so cut as to include edge metal in the proper places to be drawn into the die, or, if desired, proportioned so that draw may take place

in the metal itself. In order that the draw may be accurately controlled I next place over the blank 30 a pressure pad 31. The pressure pad may be uniform in width as shown or it may vary in width in accordance as to whether or not it is desired to have metal drawn from the blank edges into the die or whether it is desired to have the draw take place in the metal itself, or both, as will be explained later.

Pressure pad 31 being in position, a shield sheet 32 is then positioned over the blank 30 inside of the pressure pad. This shield sheet may be a thin sheet of asbestos, for example, and its main purpose is to protect sheet 22 from the heat of the blank if the blank is to be heated during the draw. It is made to fit the completed part, and is ruffled to fit inside of the pressure pad.

After the blank 30 is in place with the pressure pad thereon, and the shield sheet 32 in place, the upper block 10 is lowered to mate with the lower block 1. The two blocks are then locked together by means of rods 11 and handle 12. If it is desired to heat the blank 30 in order that it may be softened, hot air is passed into the female die 3 through conduits 6 and 7 and the temperature of this air may be, for example, raised to 500° F. Furthermore, if desired the oil itself from sump 20 may be heated, for example, to 150° F. Thus, the blank 30 so can be raised, if desired, to the neighborhood of 400° F. during the drawing operation, and at these temperatures both aluminum and magnesium or alloy sheets thereof are softened sufficiently to greatly facilitate drawing and forming.

When it is ready to start the draw, oil under pressure from pump 21 is admitted to the oil space 15 under the control of valve 18. This pressure expands the resilient sheet 22, forcing the metal of blank 30 into the empty space of female die 3. Pressure is continued until the blank 30 is drawn and formed to fit the contoured surface 5 of the female die, as shown in Fig. 3. In this latter position, of course, the asbestos pad 32 will not be of sufficient extent to fully cover the extent of the expanded resilient sheet 22, and it will have protected the resilient sheet to a large degree from the direct heat of the blank during the draw.

However, there are many cases where the temperatures will be such that the shield sheet may be dispensed with, as it is only desirable in the case of the use of extreme temperatures.

After the forming of the blank has been attained, as shown in Fig. 3, the valve 18 is operated to drain the oil from chamber 15, and the resilient sheet 22 will return to its original planar condition. The blocks 10 and 1 may then be separated and the completed, formed sheet removed and the cycle repeated.

It will be noted that the pressure pad 31 is also in contact with the resilient sheet 22, which means that the pad pressure on the blank 30 may be accurately regulated by changing the width of the pressure pad 31. If, for example, pressure pad 31 is made wide at any particular area around the periphery of the blank then at this point there will be greater pressure exerted against the blank and the draw will tend, by reduction of thickness, to take place in the metal itself. If, however, the pressure pad is made narrow at any area, pressure on the edges of the blank is reduced. Under these circumstances the edge metal may then be drawn into the die at that point. By regulating the width of the pressure pad around the die, the pull of the metal from the edges of the blank into the die may be accurately regulated as desired and the draw can be adjusted to take place either in the metal, from the edges or both, as may be desirable under the circumstances. For lower temperatures, real rubber may be used for sheet 22.

Inasmuch as the temperatures within the female die space are relatively high at the maximum desired heating of the blank 30, it is advantageous when the press is to be used at such temperatures to provide an oil for use in the hydraulic system which has a relatively high flash point, in order to reduce the danger of fire in case the resilient sheet 22 should burst and allow the oil to pass through and come in contact with the heated blank. Such oils are, however, well known to those skilled in the art and may be selected in accordance with the requirements of the press. In many cases water may be safer and more satisfactory.

I have found that for certain thicknesses of sheet, the press just above described can also be used at room temperature. Satisfactory drawing is produced with draw taking place either in the metal or being pulled into the die from the edges of the blank. I have also found that metal such as magnesium and aluminum in thicker sizes, which cannot ordinarily be drawn into deep dies without heating can be heated in the press just above described, at least to 400°. At such a temperature the blank will become sufficiently softened to permit the accurate and quick drawing, with irregular shapes and deep draws.

Furthermore it will be obvious from inspection of the device as described, that the press of my invention is extremely simple and can be made of inexpensive materials without the necessity for accurate machining. Thus my invention is ideally adapted for use in producing parts for metal airplanes as a battery of presses may be produced at relatively low cost.

I claim:

1. The method of forming a work sheet in a cavity die which comprises placing said work sheet across and beyond the cavity of said die applying a pressure pad of varying width around the cavity of said die in pressure transmitting relationship to said work sheet, expanding a resilient material against said sheet to force said sheet to take the contour of said die, and simultaneously applying pressure of the expanding resilient material in varying values along the edges of the sheet extending beyond said cavity to differentially control the movement of sheet material into said cavity.

2. A press for forming a work sheet comprising a cavity die having surfaces around the cavity thereof for supporting said work sheet bridging said cavity, a pressure pad positioned on supported portions of said work sheet, a sheet of resilient material positioned over said work sheet and said pressure pad, and means for applying a fluid pressure to said resilient sheet to force the work sheet into said cavity and simultaneously against said pressure pad to control the draw of metal from the supported portions of said work sheet, said pressure pad being of varying width around said cavity to control the movement of sheet material into said cavity.

VLADIMIR H. PAVLECKA.