Jan. 2, 1962 R. A. BRIDWELL 3,015,292

HEATED DRAW DIE

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Fig. 1

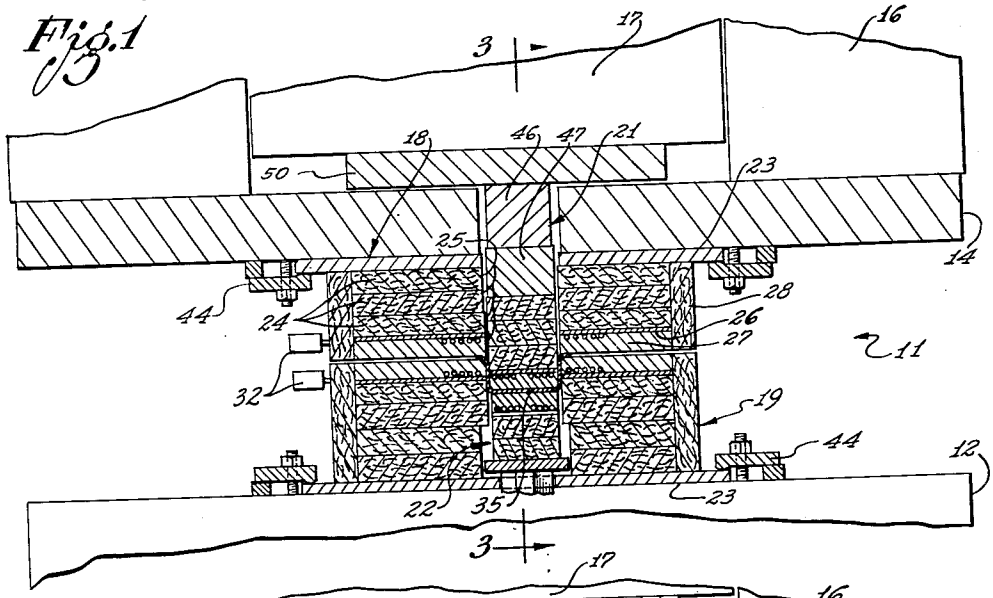


Fig. 2

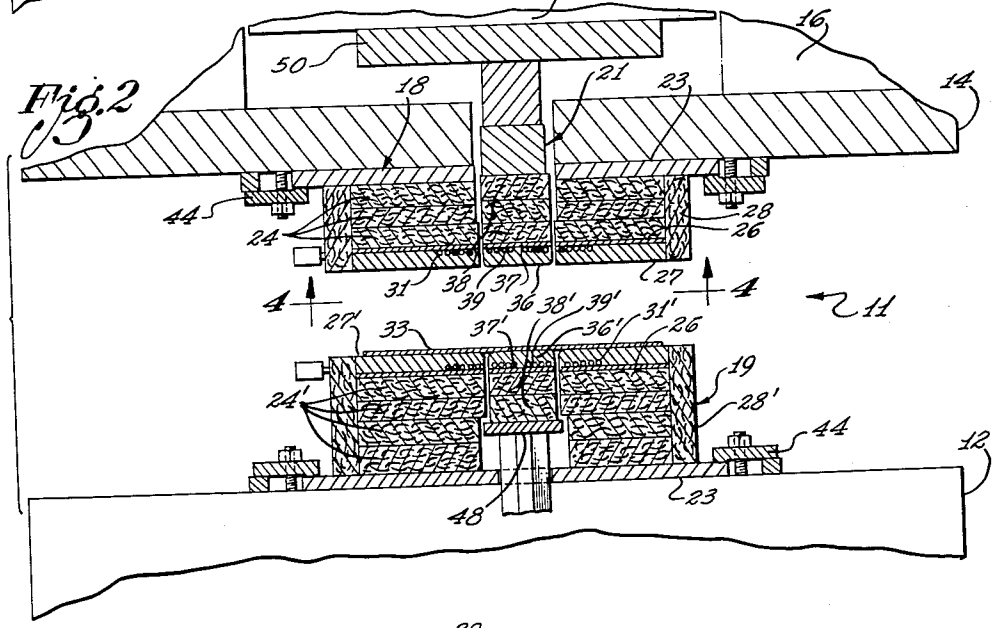
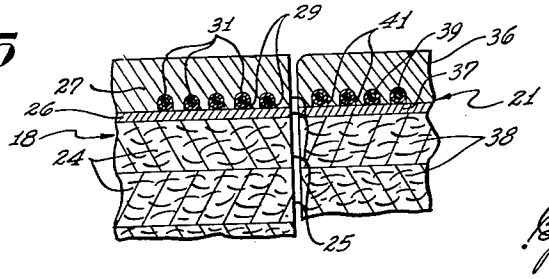


Fig. 5



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Fig. 3

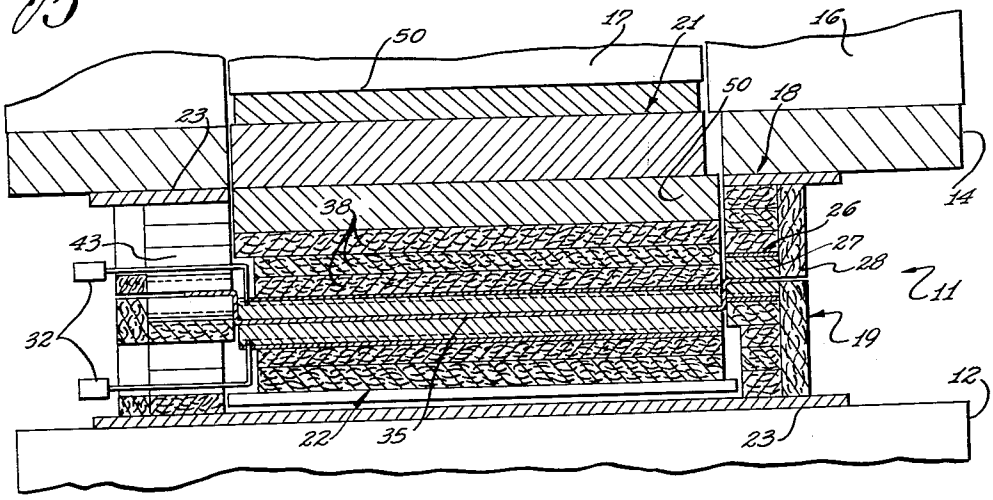
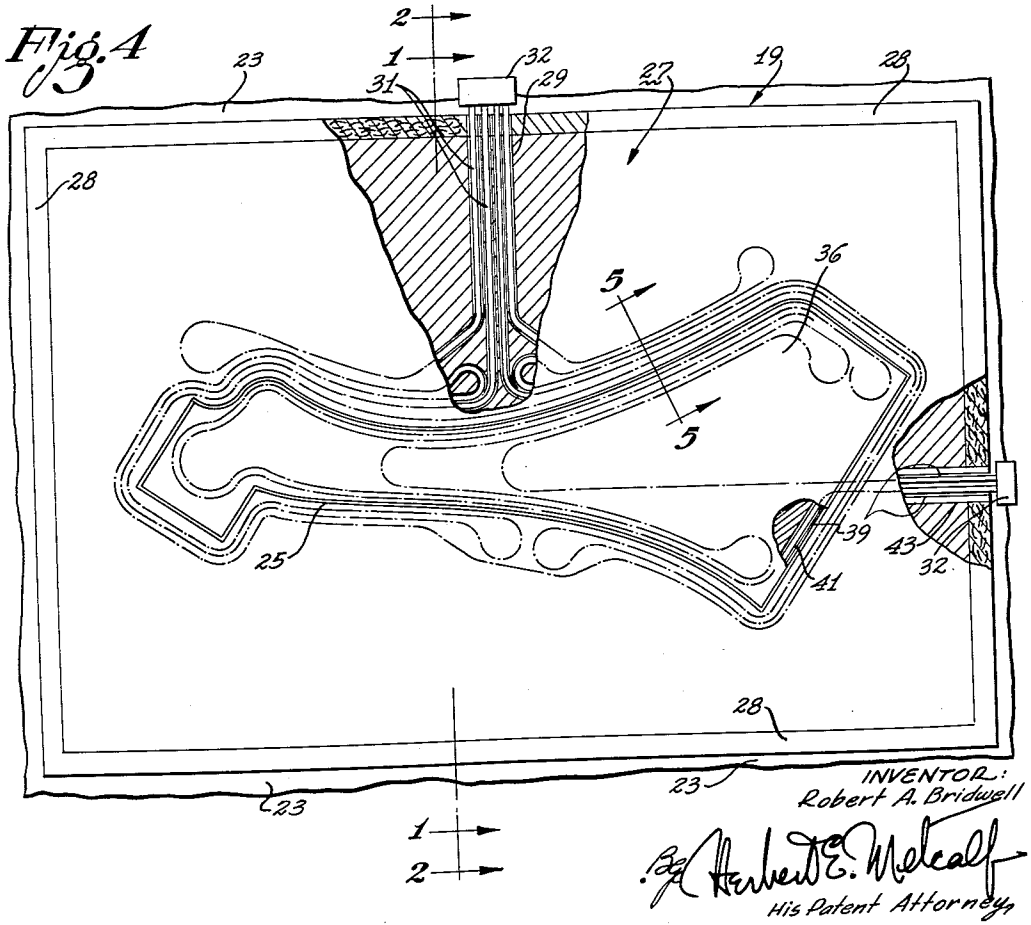


Fig. 4



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HEATED DRAW DIE

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3 Claims. (Cl. 113—49)

This invention relates to metal working equipment and more particularly to a draw type die assembly adapted to facilitate the forming of titanium blanks and the like.

Although the forming facility as disclosed herein is especially useful in the drawing of titanium alloy blanks it may have equal or greater utility in draw operations of other blanks constructed of other materials.

Titanium alloy blanks have well known inherent characteristics rendering them especially difficult and in some cases impossible to shape by a drawing operation unless the blanks are preheated to a very specific temperature. Accordingly titanium alloy blanks are normally heated in a furnace, oven, or some type of open flame, the latter being integrated into the die assembly. If the open flame type of heating is employed a workman is necessarily subject to hazardous and to say the least unpleasant working conditions.

Titanium blanks as used throughout this disclosure refers to titanium sheet material from which sheet metal parts are to be fabricated by a drawing operation or other processing requiring close heat control.

Accordingly it is an object of the present invention to provide a draw-type die facility including means which enable titanium alloy blanks to be preheated to a very exacting temperature prior to a drawing operation.

Another object is to provide a draw-type die facility in which titanium alloy blanks may be preheated to a predetermined temperature prior to the time a drawing operation is performed in the facility without danger or discomfort to the operator thereof.

Another object is to provide a draw-type die facility including heating means and incorporating novel means directing major portions of the heat which is given off by the heating means in the direction of a blank which has been previously positioned in and is to be shaped by the facility.

Another object is to provide a self-heating draw-type die facility which is simple in design, economical to manufacture, and which is safe and efficient in its operation.

Although the characteristic features of the present invention are particularly pointed out in the appended claims, the invention itself, also the manner in which it may be carried out, will be better understood by referring to the following description taken in connection with the accompanying drawings forming a part of this application and in which:

FIGURES 1 and 2 are sectional views of the die facility as disclosed herein in the closed and open positions thereof, respectively, the sections being taken along the common line **1—1**, **2—2** of FIGURE 4.

FIGURE 3 is a sectional view of the die facility similar to the section as shown in FIGURE 1 with respect to the section of FIGURE 1.

FIGURE 4 is a partial bottom view of the upper die of the facility as shown in FIGURES 1–3 as indicated by the arrows **4—4** in FIGURE 2, the view being rotated 90°.

FIGURE 5 is a fragmentary sectional view in detail of the instant die facility as indicated by the line **5—5** of FIGURE 4.

Referring to the drawings, the draw-type die facility of the present invention is shown in FIGURES 1–3 in its mounted and assembled attitude in a conventional press and is identified in its entirety by the numeral **11**. Portions of the press on which the die facility is mounted are shown in FIGURES 1–3 and include a bed plate **12**, a die cushion **48**, an upper clamp plate **14** secured to the holding ram **16**, and a main ram **17**. Power to actuate the holding and main rams is applied by conventional means (not shown).

The main parts of the die facility **11** includes upper, lower, male, and auxiliary die members **18**, **19**, **21** and **22**, respectively. The upper and lower die members **18** and **19** each include a mounting plate **23**, the latter plates providing means for securing the die members to the bed plate **12** and holding ram **16** and on which other components of the dies **18** and **19** are respectively mounted.

In the embodiment as shown the upper die member **18** includes three horizontally positioned plate-like backing blanks **24**, a stainless steel sheet **26**, a holding plate **27**, and vertically positioned plate-like side blanks **28**. The blanks **24**, plate **27**, and sheet **26** are formed with suitable aligned apertures **25** through which the die member **21** passes during a forming operation of the facility **11**. Also the blanks **24**, plate **27**, and sheet **26** are secured together by bolts (not shown) or the like with the side surfaces of the plates **24** in complete contact and in juxtaposed relation, with the sheet **26** secured to an outermost major side surface of the blanks **24**, and with the plate **27** secured to the outer side surface of the sheet **26** substantially as shown in FIGURES 1–3. Secured to the edges of the blanks **24**, sheet **26**, and plate **27**, as by bolts (not shown) or the like, are the side blanks **28** which completely cover the edges of the members **24**, **26** and **27** except for openings for electric leads as described presently.

The blanks **24** and **28** are constructed of a material consisting of asbestos fibers and suitable aggregate which are bonded together with cement or the like. Such a material is manufactured and marketed under the trade name of "Transite" by Johns Manville Co. Material of this character has a very high ultimate compressive strength in the range of 12,000–15,000 p.s.i. at 500° F. and also embodies exceptionally good heat insulating characteristics for heating means, located within the die member **18**, and which will be described in detail as the disclosure progresses.

The innermost side surface of the holding plate **27** is recessed, or a plurality of grooves may be formed therein as indicated by the numeral **29** as best seen in FIGURE 5. The above mentioned recess or grooves may constitute a single unitary recess or a plurality of individual grooves **29** formed in the plate **27** adjacent the periphery of the aperture **25** in a pattern substantially as indicated in FIGURES 4 and 5. The grooves **29** are of sufficient size to receive conventional tubular electrical resistor heating elements **31** so that the outermost peripheries of the heating elements are in substantially flush relation with the inner surface of the plate **27**. Also in the embodiment shown two heating elements **31** are employed which are supplied with electrical current through leads (not

shown) which terminate in an outlet receptacle **32**. The side of the stainless steel plate **26** adjacent the plate **27** is highly polished and, therefore, reflects heat given off by the heating elements **31** into the plate **27** and in the direction of a blank **33** when positioned in its forming attitude in the facility **11**, as shown in FIGURE 2, or of a finished part **35** as shown in FIGURES 1 and 3.

The male die **21** is similar in construction to the upper die member **18** as just described and has a cross-sectional shape allowing it to pass through the aperture **25** in the plate **27** with proper forming clearance provided therebetween. Major component parts of the die **21** include a punch plate **36**, stainless steel sheet **37**, and backing blanks **38**.

A single electrical heating element **39** is utilized which is positioned in a continuous groove **41** formed adjacent the outer periphery of the punch plates **36** substantially as shown in FIGURES 4 and 5. The leads (not shown) which extend from the heating element **39** pass through the stainless steel plate **37** and then through the die member **18** via a passageway **43**, the latter being formed by removing portions of the blanks **24** as best seen in FIGURES 3 and 4 and terminates in an outlet receptacle **32**. The passageway **43** supplies sufficient clearance for the leads **42** at such times as relative movement occurs between the die members **18** and **21**.

The construction of the lower die member **19** is quite similar to the die member **18**, the same is true of the auxiliary die member **22** with respect to the male die member **21** and, therefore, a detailed description of the members **19** and **22** is not believed necessary. Component parts of the members **19** and **22**, corresponding to similar parts of the members **18** and **21**, are identified by the same reference numeral with the addition of a prime.

The upper die member **18** and the lower die member **19** are secured to the upper clamp plate **14** and the bed plate **12**, respectively, by means of hold down clamps **44**. The male die **21** is secured to the ram **17** and spaced therefrom by spaced blocks **46** and **47** and punch plate **50**, similarly the auxiliary die member **22** rests on the hydraulically or pneumatically actuated die cushion **48** which allows movement thereof with respect to the die member **19** in a conventional manner. As mounted in the press all of the die members are properly aligned to effect a drawing operation.

In operation it is assumed that an 8% Mn titanium alloy blank **33** is positioned in the die facility **11** substantially as shown in FIGURE 2. It is well recognized the blank should be drawn as nearly as possible to its maximum allowable temperature which in the case of an 8% Mn titanium alloy blank is 1025° F. The importance of forming (drawing) titanium blanks at their maximum allowable temperature, or as close to this temperature as possible, can readily be appreciated when it is considered an elongation loss of approximately 66% occurs therein with a temperature drop of 200° F.

With electrical current flowing through the resistor elements **31**, **31'**, **39** and **39'**, located at positions both above and below the blank **33**, the temperature of the blank is soon raised to its maximum allowable temperature. A temperature sensing device (not shown) may be utilized to determine the exact time at which the blank **33** reaches the aforementioned desired temperature.

The blank **33** having been raised to the desired temperature the resistor elements **31**, **31'**, **39** and **39'** may or may not be rendered inactive. Inasmuch as the blank is in its forming attitude at this time the drawing operation may be effected with a minimum of delay and, therefore, only a minimum temperature change will occur prior to and during the actual drawing operation. This would not be the case if the blank **33** had been heated in a furnace, oven, or the like. In the latter instance an extended time delay would necessarily occur (at least 15 seconds) between the time the blank was removed from the oven and the drawing operation is effected, this delay would result in a temperature drop of approximately 200° F. The instant facility also provides additional advantages. Inasmuch as the facility is well insulated, particularly the plates **27**, **27'**, **36** and **36'**, it is possible to maintain the temperature of the plates and the blank **33** at or very close to the maximum allowable temperature of the latter. Also the insulating blanks **24**, **24'**, **28** and **28'** provide a workman with good protection against heat radiation. It will therefore be apparent that a die facility providing the numerous advantages and objects as set forth above has been disclosed.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise a preferred form of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed:

1. In a metal forming press having open and closed positions and including holding and main rams aligned respectively with a bed plate and a die cushion, the combination comprising: upper and lower die members each including a metallic holding plate having opposed side surfaces and outer edge surfaces and having a die receiving opening formed therein; said die members including insulating material mounted on said holding plates, on a side surface thereof and covering the outer edge surfaces of each of said holding plates; said insulating material being further characterized by having openings formed therein which are aligned with the die receiving openings in said holding plates when mounted on said holding plates; means mounting said upper and lower die members on said holding ram and bed plate, respectively, with the exposed side surfaces of said holding plates in spaced, opposed and aligned relation; male and auxiliary die members each including a metallic punch plate each having opposed side surfaces; insulating material mounted on a side surface of each of said punch plates; means mounting and positioning said male and auxiliary die members in said die receiving openings and on said main ram and die cushion, respectively; said male and auxiliary die members as mounted on said main ram and die cushion being further characterized in that the exposed side surfaces of said punch plates have an opposed relation with respect to each other and a coplanar relation with respect to the exposed surface of said holding plate with which they are associated at such time as said press is in said open position; and said upper, lower, male and auxiliary die members including heating units having heating elements which are completely surrounded by said insulating material, holding and punch plates and are equally spaced from the exposed side surfaces of said holding and punch plates.

2. In a metal forming press the combination set forth in claim 1: further characterized in that the heating elements in said upper and male die members are positioned in the holding and punch plates, constituting components of said upper and male die members, in adjacent contiguous portions of the latter holding and punch plates and the heating elements in said lower and auxiliary die members are positioned in the holding and punch plates, constituting components of said lower and auxiliary die members, in adjacent contiguous portions of the latter holding and punch plates.

3. In a metal forming press the combination as set forth in claim 1: further characterized in that said upper, lower, male and auxiliary die members each include a heat reflecting sheet positioned between the unexposed side surfaces of said holding and punch plates and the in-

sulating material mounted on said upper, lower, male and auxiliary die member.

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