Jan. 8, 1952 R. C. INGERSOLL 2,581,663

BLANK HOLDER CUSHION

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Fig. 1

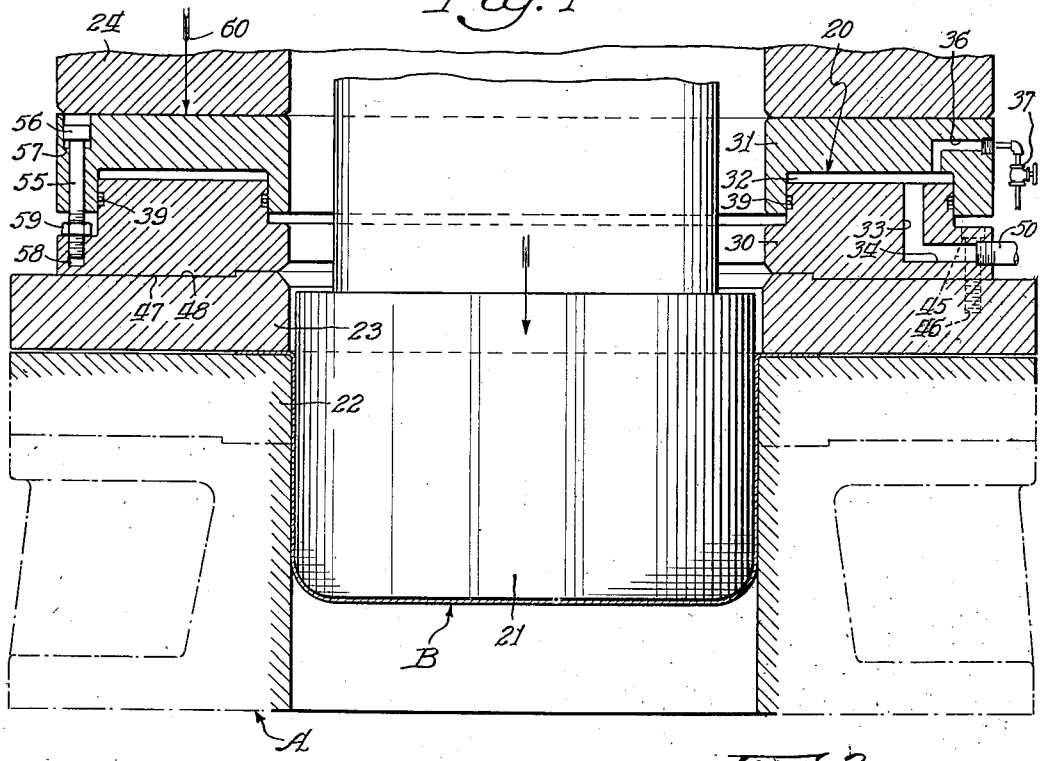


Fig. 3

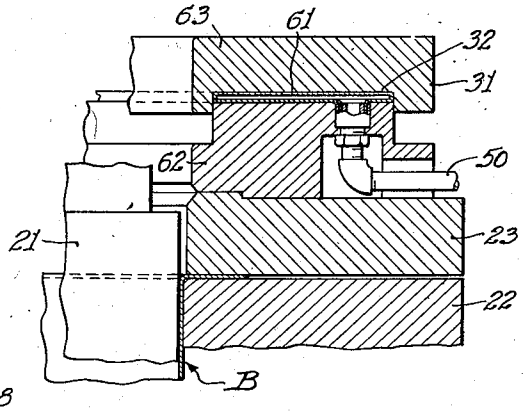
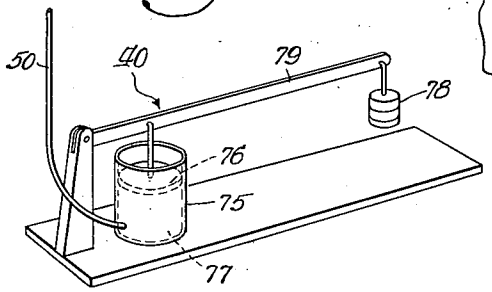


Fig. 2



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BLANK HOLDER CUSHION

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2 Claims. (Cl. 113—46)

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This invention relates in general to double action presses for drawing metal, and is more particularly concerned with and directed to an equalizing cushion arrangement for controlling the draw ring in such double action presses to provide adjustment of pressure between two dies employed simultaneously in the same press.

Heretofore, in drawing metal to form a hollow article such as a laundry tub or the like, it has been the general practice to position the blank between the draw ring and the hold down ring whereby the blank is clamped in position by the outer ram which usually has been adjusted so that it exerts what is calculated to be the pressure required on the marginal region of the blank, thereby to permit the punch on the inner ram to draw the blank to the intended shape or form desired. This method possesses inherent objections which have been found to be due chiefly to variations in the gauge of the sheet metal blank from one side to another side of the blank, or variations in the gauge of successive pieces which may be fed into the machine. Test tabulations have shown that scrap loss has ranged between 25% and 50%. Also, it has been the practice, when two dies are operated simultaneously in the same press, to perform complicated shimming operations to insure an even distribution of pressures on the two dies, but this has seldom produced completely satisfactory results, nor has it eliminated the losses resulting from malformation of the sheet metal.

In drawing metal with a double action press the die incorporated therein may consist of a punch, a draw ring and a hold down ring. The metal blank which is desired to be drawn is placed between the draw ring and the hold down ring, and suitably clamped in this position by an outer ram of the press which is adjusted to exert the necessary pressure to permit the punch to draw the metal blank to shape without either breaking the bottom or wrinkling the sides. It is notable that too great a pressure will prohibit the proper flow of metal and cause breakage during the drawing operation, whereas too little a pressure will permit too easy a flow of the metal, thereby permitting wrinkles to form.

In a conventional double action press heretofore employed in such hereinbefore described drawing operation, the hold down pressure has been adjusted to a given thickness of blank; however, because of gauge variations and variations in the thickness and characteristics of the metal stock, this pressure has been known to vary from piece to piece, thereby causing excessive scrap and waste in such drawing operations because of the non-adjustability of such present day double action mechanical presses with respect to variations in gauge of the metal blanks.

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Moreover, when two dies are operated simultaneously in the same press complicated shimming operations must be performed in order to insure proper distribution of pressures on the two dies without ever obtaining completely satisfactory results.

In the embodiment disclosed herein the present arrangement has successfully overcome, to a considerable extent, the above-mentioned inherent disadvantages and objections of prior art double action presses, and the structure disclosed herein effects a material reduction in the waste incident to the prior practice.

Accordingly, an object and accomplishment of the present invention is to provide a blank holder cushion means readily adaptable for incorporation in a double action press and providing a constant predetermined equalizing pressure on the blank positioned between the draw ring and the hold down ring of such presses, regardless of the gauge variation of the metal blank, and will permit the adjusting of pressures on two dies employed simultaneously in the same press without complicated shimming.

The invention seeks as a further object and accomplishment to provide a blank holder cushion means as contemplated herein and characterized by an arrangement of parts to more advantageously and satisfactorily perform the function required of it, and adapted to provide a compact assembled unit which will successfully combine the factors of structural simplicity and durability, and yet be economical to manufacture.

Another object and accomplishment of the invention is to improve the construction of double action presses by the incorporation therein of a blank holder cushion means as contemplated herein to increase the efficiency and versatility of such double action presses, and to this end an important feature of the invention is to incorporate into a double action press a blank holder cushion means as contemplated herein employing principles and structure between the outside ram and die of such double action press comprising a hydraulic cushion which will maintain constant pressure regardless of gauge variations, the pressure to the hydraulic cushion being maintained by an accumulator means or some other like means whereby the pressure within the cushion is maintained constant regardless of the travel of the cushion.

Additional objects, features and advantages of the invention disclosed herein will be apparent to persons skilled in the art after the construction and operation are understood from the within description.

It is preferred to accomplish the various objects of this invention and to practice the same in substantially the manner hereinafter fully described and as more particularly pointed out in the appended claims, reference being had to the accompanying drawing, which forms a part of this specification, wherein:

Fig. 1 is a side elevational view, partially in section, of a double action press having incorporated therein a blank holder cushion means embodying the features of the present invention;

Fig. 2 is a perspective view of an accumulator which may be advantageously adjunctively employed with the blank holder cushion depicted in Fig. 1; and

Fig. 3 is a fragmentary sectional view of a blank holder cushion means employed as a modification of the blank holder cushion means depicted in Fig. 1.

The drawing is to be understood as being more or less of a schematic character for the purpose of illustrating and disclosing a typical or preferred form of the improvements contemplated herein, and in the drawing like reference characters identify the same parts in the several views.

Referring to the drawing, particularly Fig. 1, wherein the blank holder cushion means with which the invention is particularly concerned and designated in its entirety by the numeral **20**, is illustrated as being adjunctively employed, for example, to a conventional double action press designated in its entirety by the letter A and comprising, in general, a punch **21** of any particular shape, a draw ring **22** complementary to the punch and adaptable to cooperate with said punch to form, for example, the metal blank B which is advantageously held in position by a hold-down ring **23**.

According to the construction of the invention, the metal blank B may be placed between the draw ring **22** and the hold down ring **23**, and suitably clamped in this position by an outer ram **24** of the press A which is adjustable to exert the necessary predetermined pressure to permit the punch **21** to draw the metal blank B without either breaking the bottom or wrinkling the sides thereof. It is notable that too great a pressure will prohibit the proper flow of metal and cause breakage or tearing during drawing operations, whereas too little pressure will permit too easy flow of the metal, thereby permitting objectionable wrinkles to form.

Since the invention is not particularly concerned with the precise construction of the illustrated double action press or its associated parts, they will not be further described in detail, and it is deemed sufficient for all intents and purposes herein contained to show only portions thereof adjacent to and cooperating with the blank holder cushion means contemplated herein. It is to be understood that details of construction of such double action presses and their associated parts may be modified to suit particular conditions, and the construction of the present invention is not to be limited to the construction of these elements as set forth except where such construction particularly concerns the invention contemplated herein.

Having thus described by way of example, a possible adaptation of the blank holder cushion means as contemplated herein and having described the general environment surrounding said adaptation, the specific construction and cooperating functions of the parts of said blank holder cushion means with which the present invention is particularly concerned, will now be described in detail.

In the exemplary embodiment of the invention depicted in Fig. 1, the blank holder cushion means **20** is shown as being adjunctively employed, for example, to the double action press A, said blank holder cushion means comprising, in general, a blank holder bottom member **30** of any particular shape and being removably secured to the hold-down ring **23** as shown, a blank holder top member **31** operatively associated with said blank holder bottom member **30** to define a suitable chamber **32** defined by surfaces of the blank holder top member **31** and the blank holder bottom member **30** and adaptable to receive and retain a suitable hydraulic fluid to provide a hydraulic cushion between said blank holder top member and said holder bottom member, thereby to maintain a constant predetermined equalizing pressure on the blank A which is being held between the hold down ring **23** and the draw ring **22** as shown, whereby equal pressure upon the blank B will be maintained regardless of gauge variations and variations in the thickness and characteristics of the metal stock. An accumulator means designated in its entirety by the numeral **40** (Fig. 2) is operatively connected to said chamber **32**, said accumulator means comprising a cylinder and piston arrangement adaptable to maintain a constant hydraulic pressure within the chamber **32**. Although I have illustrated one form of accumulator means, it is readily apparent that other forms having the same characteristics may be employed, such as, for example, a constant pressure pump with a relief valve (not shown), such pumps being sometimes termed as a pressure unloading pump, or any other means may be employed which will allow the selection of a variable constant predetermined pressure.

In accordance with the construction of the present invention the blank holder bottom member **30** is fixedly secured to the hold down ring **23** by means of securing means such as, for example, the bolts **45** having threaded ends adaptable to be received into suitably threaded apertures **46** in the hold down ring **23**. Preferably, the blank holder bottom member **30** is a casting having a suitable surface **47** complementary to a related surface **48** of the hold down ring **23**. It is notable that suitable recesses have been employed between the complementary surfaces **47** and **48** so that proper alignment between the blank holder bottom member **30** and the hold down ring **23** may be maintained.

Suitable pipe connections as at **50** are employed to operatively connect the chamber **32** with the accumulator means **40** or the pressure unloading pump hereinbefore mentioned, depending on which is employed. These pipe connections may be of any suitable construction preferably of a flexible type.

In order to prevent the hydraulic fluid from leaking from the chamber **32**, there is provided a suitable packing ring **39** operatively disposed between complementary surfaces of the blank holder top member and the blank holder bottom member and adapted to retain the hydraulic fluid in the chamber **32**. It can be seen that the

hydraulic fluid enters the chamber 32 through suitable interconnected passages 33 and 34 having suitable threaded formations adaptable to receive threaded end portions of the pipe connection 50 which is connected to the accumulator means 40.

In order to provide an air bleed for the hydraulic system hereinbefore described, there is provided a passageway 36 in the blank holder top member 31 and in open communication with the chamber 32. A suitable valve means is provided as at 37 to provide a means for permitting air in the system to be bled therefrom.

The blank holder top member 31 may be made of a casting formed to define surfaces complementary to top surfaces of the blank holder bottom member 30. From Fig. 1 it may be seen that the blank holder top member 31 is disposed in its operative position in a manner so that it may be moved upwardly or downwardly due to the functional reaction of the hydraulic fluid in the chamber 32. It is notable that the movement of the blank holder top member 31 in the upward direction is restricted as to amount by means of the bolts 55 which are provided with a suitable cap 56 adaptable to engage a seat 57, which engagement is adaptable to restrict any further upward movement with respect to the blank holder bottom member 30. Moreover, the degree of upward movement may be adjusted by regulation of the distance the bolts 55 are received into the suitably threaded apertures 58 in the blank holder bottom member 30, such adjustment being maintained in locked position by means of a suitable jamb nut 59.

In accordance with the construction of the present invention, downward pressure upon the blank holder top member 31 is exerted by an outside ram member 24 in the direction of the arrow 60 in Fig. 1. Since the pressure exerted by the outer ram is uniform and it is transmitted to the hold down ring 23 so that a uniform holding pressure may be maintained upon the blank B regardless of gauge variations, the hydraulic fluid disposed in the chamber 32 will maintain a uniformly distributed pressure upon the blank B regardless of gauge variations and variations in the thickness and characteristics of the metal stock. It can be seen that the pressure upon the blank B would vary from piece to piece because of the differences in gauge thickness between successive blanks of metal stock. It is of paramount importance in drawing operations of the type contemplated herein that the pressure be equal with respect to each piece of metal stock employed. Too great a pressure will prohibit the proper flow of metal and cause breakage, whereas too little a pressure will permit too easy a flow of the material and permit wrinkles to form during the drawing operation. Without equalized pressure, excessive scrap and waste in drawing operations would occur because of the nonadjustability of present day double action presses to compensate for such hereinbefore described variations in metal stock thicknesses.

Adverting to Fig. 3 wherein a modified structure of the present invention is illustrated, it can be seen that a tube-like member 61 is operatively disposed in the chamber 32 of the embodiment shown in Fig. 1. In accordance with the construction of the embodiment illustrated in Fig. 3 the blank holder cushion comprises, in general, a blank holder bottom member 62, a blank holder top member 63, a tube-like member 61 made of a flexible material such as, for example, rubber

and being adaptable to receive and retain a suitable hydraulic fluid, said tube-like member being operatively disposed between said blank holder bottom member 31 and being adaptable to maintain a constant pressure on the blank B which is being held between the hold down ring 23 and the draw ring 22 as shown in Fig. 1, whereby equal pressure upon the blank B will be maintained regardless of gauge variations in the thickness and characteristics of the metal stock, and a means, such as a pipe 50, operatively connected to said tube-like member 61 and adaptable to maintain a constant variable hydraulic pressure within the tube-like member 61.

Adverting to Fig. 2, wherein there is illustrated one form adaptable to maintain a constant variable hydraulic pressure, the accumulator means 40 comprises in general a cylinder 75 having operatively disposed therein a piston 76 operated by a suitable hydraulic fluid 77, said piston having a predetermined number of weights 78 related thereto by means of a lever arrangement 79, said cylinder being operatively connected to the chamber 32 of the tube-like member 61, depending upon which one of the two designs is employed, by means of suitable flexible tubing as at 50. Is can be seen that the lever arrangement will cause a predetermined pressure upon the piston which will cause the compression of the hydraulic fluid 77 in the cylinder 75, which pressure in turn will be transmitted to the chamber 32 or to the tube-like member 61, as the case may be, by means of the flexible hose 50, whereby an equal pressure will be maintained upon the blank piece B regardless of variations in thickness of the metal stock. The amount of pressure desired may be obtained by the removal or addition of weights 78. Moreover, the device contemplated herein will compensate for such variations in the thickness of the metal stock by causing variations in the amount of hydraulic fluid contained in the chamber 32 or the tube-like member 61, as the case may be. It is important to understand that the differential in the thickness of metal stock is transmitted through the chamber 32 or the tube-like member 61 which causes the variations of the amount of hydraulic fluid contained within such chamber 32 or such tube-like member 61 and such excessive fluid will be caused to flow between said chamber or said member and the cylinder 75 of the accumulator 40. Equal pressure at all times is maintained by the provision of the weighted piston arrangement hereinbefore described and illustrated in the drawing.

While the illustrated accumulator means 40 may be advantageously employed in the construction of the present invention, it can be seen that other forms may be readily substituted, such as, for example, a constant pressure pump with a relief valve, such pump sometimes being termed a pressure unloading pump, or any other means may be advantageously employed which will allow the selection of a constant variable predetermined pressure. It is apparent that such devices, when adjunctively employed to the blank holder cushion arrangement hereinbefore described and with which the present invention is particularly concerned, each will accomplish the same results and are replaceable one by the other.

It is notable that the mechanism disclosed herein may be advantageously employed in mass production manufacturing methods where quick and easy drawing operations result in economies in manufacture which determine the final cost of the units drawn.

From the foregoing disclosure, it may be observed that I have provided a blank holder cushion which efficiently fulfills the objects thereof as hereinbefore set forth and provides numerous advantages which may be summarized as follows:

1. Structurally simple, efficient and durable;

2. Economical to manufacture and readily adaptable to mass production manufacturing principles; and

3. The provision of a blank holder cushion readily adaptable for incorporation in double action presses and providing a constant equalizing predetermined pressure on the blank positioned therein, regardless of gauge variation of the metal blank.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of my invention and I do not wish to be limited to the precise details of construction set forth but wish to avail myself of all changes within the scope of the appended claims.

I claim:

1. A blank drawing press comprising a drawing punch, a drawing die arranged to receive said punch, a hold-down member associated with said die for holding a blank in position, pressure means for urging said hold-down member toward said die, pressure distributing means interposed between said hold-down member and said pressure means comprising a first block disposed about said punch and having a channel formed therein surrounding said punch, a second block disposed about said punch and associated with said first block, a complementary protruding portion of said second block extending into said channel to define therewith an enclosed pressure chamber, a surface of said second block bearing against an opposed surface of said hold-down member, said opposed bearing surfaces having complementary recessed and shouldered portions for the purpose of aligning said hold-down member and said pressure distributing means, means carried by one of said blocks and connected to the other of said blocks for limiting the movement of said blocks in opposite directions, sealing means interposed between said protruding portion and the walls of said channel to prevent leakage from said chamber, a hydraulic fluid in said chamber, and accumulator means connected to said chamber for supplying and maintaining a predetermined hydraulic pressure in said chamber.

2. A blank drawing press comprising a drawing punch, a drawing die arranged to receive said punch, a hold-down member associated with said die for holding a blank in position, pressure means for urging said hold-down member toward said die, pressure distributing means interposed between said hold-down member and said pressure means comprising a first block disposed about said punch and having a channel formed therein surrounding said punch, a second block disposed about said punch and associated with said first block, a complementary protruding portion of said second block extending into said channel to define therewith an enclosed pressure chamber, a surface of said second block bearing against an opposed surface of said hold-down member, said opposed bearing surfaces having complementary recessed and shouldered portions for the purpose of aligning said hold-down member and said pressure distributing means, means carried by one of said blocks and connected to the other of said blocks for limiting the movement of said blocks in opposite directions, sealing means interposed between said protruding portion and the walls of said channel to prevent leakage from said chamber, a hydraulic fluid in said chamber, accumulator means connected to said chamber for supplying and maintaining a predetermined hydraulic pressure in said chamber, and a vent passage defining means including a control valve for controlling venting of air trapped in said pressure chamber connected to the side of said pressure chamber.

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