

PATENT SPECIFICATION (11)

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 (72) Inventors: JOSEPH D. BULSO, JR.
 WILLIAM R. LEWERS



(54) DOUBLE ACTION REDRAW PRESS

(71) We, REDICON CORPORATION, of 4150 Belden Village Street, Canton, Ohio 44718, United States of America, a corporation organized under the laws of the State of Delaware, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to double action redraw presses. Such presses may be used in the forming of containers from sheet stock of either steel or aluminium.

The present invention arises from our attempts to provide practical embodiments of double action redraw machine wherein a container may be formed with considerable cost savings and improved performance as compared with arrangements previously available.

In accordance with the present invention, we provide a double action redraw press, comprising: a fixed base; inner and outer rams reciprocal with respect to said base; die means carried by said base; a pneumatically actuated pressure sleeve system including coaxially aligned pistons arranged for engagement with each other and with a pressure sleeve carried by said outer ram for movement toward said die means into contact with a workpiece in response to pneumatic pressure and away from said workpiece in response to movement of said outer ram; and a drawing horn carried by said inner ram for movement toward and away from said die means into and out of contact with said workpiece independently of the movement of said pressure sleeve system.

In redrawing containers, it is necessary to clamp or to hold the container flange while inserting a horn or other forming member to accomplish the redraw.

The prior art relative to redrawing two-piece containers basically involves one of two approaches.

First is utilization of a single action press wherein the holding means and the forming means travel together and contact the metal nearly simultaneously. We have found that there are some serious difficulties with regard to this type of structure, however. In instances,

such as are now common, where the metal is pre-coated with a protective material, we have found that the impact of the holding and forming members, considering the distance travelled thereby in conjunction with the press travel, is such that the coating will often be damaged. Since the coating is the material which ultimately actually contacts the contents of the container, this damage is unacceptable to us.

A second approach is utilization of double action presses; but the known double action presses are also deficient in our view in that the length of travel, etc., required is such that considerable impact is still made on the metal, with a consequent damage to the coating of the metal, so we have found.

Also, in these presses, the action of the holding and forming members is normally controlled mechanically which we have found causes further difficulties if either the metal or the coating material is either over or under size. Since the clearance between the holding member and the die is pre-set mechanically, if the material is undersize, there really is no clamp. Conversely, if the material is oversize, there is an over clamp and what might be termed as "squeezing" of the material. Either situation can be undesirable.

We have now found that by providing a double action redraw press wherein the holding action on the metal prior to forming is pneumatically controlled by the outer ram of the press, with the forming controlled by the inner ram, that many of the above-noted disadvantages can be overcome.

Thus, we have found that a pressure sleeve system tied to the movement of the outer ram and a forming system tied to the movement of the inner ram can achieve significant advantages. The holding sleeve system, operating independently of the forming system and moving with the outer ram, has a relatively short travel and is essentially pneumatically controlled. This in turn provides the advantage of cushioning the impact of the sleeve on the metal, and thereby eliminates the difficulty previously encountered with regard to damage of the coating.

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We have found that this also renders the problem of over or under size material moot, because of the more or less floating nature of the sleeve system.

- 5 We have also found that in preferred embodiments of apparatus of this nature, a number of other advantages can also be obtained,

- For example, the weight of the press can be reduced to about one-third of the normal weight, and the horsepower of the motor driving the press can be reduced even further. Furthermore, by providing a stacked arrangement of a plurality of sleeves and pistons in the sleeve system, the air required for the hold down operation is reduced about seventy percent. This has the advantage of permitting smaller air passages, with a consequent reduction of mass in the hold down members.

- Accordingly, utilization of an apparatus such as is specifically disclosed herein after will produce numerous savings both in costs, energy consumption, space requirements, and also produce the advantage of redrawing the container without running the risk of damaging the coating on the pre-coated stock.

OF THE DRAWINGS:

Figure 1 is an elevational view in section, showing a redrawing station.

- Figures 2, 3, 4 and 5 are partial schematic views, showing the relative positions of the press components during various stages of the redrawing operation.

- Figure 6 is a graph of the movement of the inner and outer rams and the operational sequence thereof.

- Referring to Figure 1 for a general description of the apparatus, it will be noted that an inner ram 10 and an outer ram 110 are illustrated. A bottom bolster or base member 20 is also provided. The apparatus also includes a pressure sleeve system 30 consisting of a sleeve 31 and pistons 32 and 33, retainers 80, 81 and 82, and forming horn 40 and redraw die 22.

- The overall structure and operation of a double action press of the general type involved has not been shown in detail, except as is necessary to illustrate the specific improvements of this invention; but an example may be seen in Ridgeway U.S. Patent No. 3,902,347.

- Therefore, with regard to provision of the specific structure required for an embodiment of press in accordance with this invention, it will be noted that the base 20 has a matrix 21 secured thereto by suitable bolts (not shown) and supports a redraw die 22. No detail has been shown with regard to the interconnection between these members, since that is believed to be well within the knowledge of one skilled in this art.

- Mounted on the inner ram 10, which is shown schematically, is a forming assembly which generally consists of the horn 40 and riser 50 secured by one or more bolts 51 to inner ram 10. Horn 40 and riser 50 are secured together by one or more screws 41 and are

capable of being forced into the cavity in the die 22 by movement of the inner ram 10, as will be described.

Horn 40 and riser 50 have through longitudinal bores 40a, 40b and 50a, 50b therein, as clearly shown in Figure 1. The bores 40b and 50b form a vent system with bore 10b in inner ram 10, communicating with the surrounding atmosphere so as to prevent collapse of the container when the horn is withdrawn.

Bores 40a and 50a also communicate with bore 10a in inner ram 10 so as to provide a passageway for injecting coolant if desired.

Finally, connecting screw 41 permits relative adjustment between horn 40 and riser 50. In this regard, surfaces 42 and 52 are machined for a substantially flush fit while surfaces 43 and 53 will not require such machining. In some instances, this results in surfaces 43 and 53 being spaced from each other. However, the close fit between surfaces 42 and 52 together with seal 54 provides for a substantially air and fluid tight arrangement between horn 40 and riser 50.

The pressure sleeve system 30 carried by outer ram 110 includes a plurality of cylindrical retaining or holding sleeve 31 and pistons 32 and 33 which are stacked one upon the other. The sleeve 31 and pistons 32 and 33 have outwardly directed peripheral flanges 31a, 32a and 33a of their upper surfaces which have seals 31b, 32b and 33b on their outer edges for contact with the inner surfaces of the retainers, as will be described below. Finally, wear pads 31c, and 32c and 33c are disposed on the inner surfaces for engagement respectively with horn 40 and with the periphery of guide 34 which is fixed to outer ram 110. This sleeve 31 and pistons 32 and 33 are received within the retainers 80, 81 and 82 for purposes which will be described more fully below.

The retainers 80, 81 and 82 are carried by outer ram 110 and have cylindrical bodies which terminate at their lower edges in inwardly directed flanges 80a, 81a and 82a for cooperation with the sleeve 31 and pistons 32 and 33, as will be described.

Fixed base 20 has a bore 20a therein and a piston rod 71 of knockout means 70 which is received therein. One end of rod 71 carries piston head 72 which has annular wear rings 73, 73 thereon and which is sized for movement within the central bores 22a of shaping die 22 and 21a of matrix 21. The opposed end of rod 71 is secured to a pneumatic or hydraulic cylinder (not shown) although it could, and often is, mechanically actuated.

In operation, it is assumed that a drawn can or container has been placed in position as shown in Figure 2, as indicated by the letter C. At this point, the inner ram 10 and outer ram 110 have begun their downward course of movement (see Figure 6), and the sleeve system 30 is being held down in response to continuous air pressure through conduits 200,

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200, with this pressure bearing on the top of flanges 32a and 33a of pistons 32, 33.

This system is such that the sleeve 31 will move into a position where it contacts the can C (see Figure 3), and the air pressure is then utilized to hold it into contact therewith. In this regard, it should be noted that the contact is such that the metal can shift slightly in reaction to the action of the horn 40, as will be described below. Thus, proper pressure is maintained to hold the flanges and permit normal redrawing of the container.

At all times, the lower edge of the body of piston 32 will contact flange 31a of the sleeve 31, and the lower edge of the body sleeve 33 will contact flange 32a of sleeve 32 to assist in the hold-down operation.

Once the sleeve 31 has contacted the container C, as just described, the retainers 80, 81 and 82 will continue to move downwardly for a period of time in reaction to the movement of the outer ram 110 (see Figure 6).

Once contact has been made in this fashion, the inner ram 10 will begin to force the riser 50 and the attached horn 40 down into the cavity of the die 22, thereby completing the forming operation by redrawing the can to its desired diameter and height, as shown in Figures 4 and 6.

With reference to Figures 1 and 6, it will be noted, however, that the actual working travel of the sleeve system 30 is about thirty percent of the working travel of the horn 40, with the working travel of the horn being, of course, equal to the desired redrawn depth of the can. Thus, the sleeve working travel is indicated by the letter S, while the horn working travel is indicated by the letter H. This reduction in travel produces several advantages not the least of which is reducing the impact on the container flange, and thereby reducing damage to the coated container surface.

It should be noted that the utilization of the stacked system embodying the sleeve 31 and pistons 32 and 33 permits sufficient surfaces for the air to work on to build up sufficient pressure to hold the container C, with sufficient force for alignment purposes while permitting some movement for the redrawing operation, and avoiding unnecessary increase in the overall size of the press.

Once the container C has been formed, as shown in Figures 1 and 4, the outer ram 110 will begin moving slowly upwardly (see Figure 6), at which time the retainers 80, 81 and 82 will move upwardly until flanges 80a, 81a, and 82a contact the bottom surface of flanges 31a, 32a and 33a of sleeve 31 and pistons 32 and 33. They will then travel further upwardly pulling the sleeve and pistons along with them overcoming the air pressure so that, in effect, there is a lost motion type of action on the return travel.

At about the same time, the inner ram, which starts upward movement slightly after

outer ram 110, will begin to draw the riser 50 and the horn 40 upwardly until they are clear of the container C, with the venting through bores 10b, 40b and 50b preventing collapse of the container during withdrawal. At this time, knockout punch 70 will be activated, and piston rod 71 will move relatively of base 20 and head 72 which will contact the bottom of the container C and eject it from the die cavity (see Figure 5). No detail has been shown with regard to knockout means 70, since provision of the necessary pneumatic, mechanical, or hydraulic actuating means is believed to be within the skill of one knowledgeable in this art.

Figure 6 shows graphically the motions taken by the inner and outer rams during the just described working operation. Thus, the dimension S corresponds to the working travel of the sleeve system 30, while dimension H corresponds to the working travel of inner ram 10, and thus of the horn 40.

This travel, which is caused by a crankshaft having a set of throws for inner ram 10 and a second set for outer ram 110, such as generally shown in Ridgeway U.S. Patent No. 3,902,347, is such that the sleeve working travel occurs at the bottom of the out ram stroke so as to save material weight, and thus energy.

Although the scale is not shown in Figure 6, in the specific embodiment to which it relates travel S of the sleeve system 30 is about 1 3/8 inch, while the travel H of the horn 40 is about 4 1/2 inches or, in other words, S is about thirty percent (30%) of H. In prior art single action presses, these distances would be equal, or the sleeve travel would be greater.

Thus, an improved embodiment of redraw apparatus is specifically described herein wherein proper hold down pressure can be achieved without excessive sleeve travel and the risk of damage to coating material. Furthermore, this can be achieved while permitting accommodation of varying material thicknesses.

While certain dimensions for sleeve and horn travel have been referred to, they are intended to be illustrative only. However, the relation between the distances would remain constant, i.e., sleeve travel is approximately thirty percent (30%) of horn travel.

Similarly, the stroke lengths can also be varied from those shown in Figure 6; and the lead between the inner ram 10 and outer ram 110, which is illustrated at about 25° is also illustrative only and could be varied.

WHAT WE CLAIM IS:-

1. A double action redraw press, comprising: a fixed base; inner and outer rams reciprocal with respect to said base; die means carried by said base; a pneumatically actuated pressure sleeve system including coaxially aligned pistons arranged for engagement with each other and with a pressure sleeve carried by said outer ram for movement toward said die means into



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- contact with a workpiece in response to pneu-
matic pressure and away from said workpiece
in response to movement of said outer ram; and
a drawing horn carried by said inner ram for
5 movement toward and away from said die
means into and out of contact with said work-
piece independently of the movement of said
pressure sleeve system.
2. A press according to Claim 1, wherein a
10 retainer is carried by said outer ram for move-
ment therewith, and is disposed in encircling
relationship with said sleeve system; said
sleeve system is slidably received within said
15 retainer for movement toward said workpiece;
and engagement means are carried by said re-
tainer for engagement with said sleeve system
upon movement of said outer ram away from
said base, whereby said sleeve system may be
20 moved toward said die independently of said
retainer and away from said die with said re-
tainer.
3. A press according to Claim 2, wherein
said sleeve system includes a cylindrical pressure
sleeve having an outwardly directed flange at
25 its top end, and at least one cylindrical pneu-
matically actuated piston disposed above said
sleeve and having an outwardly directed flange
at its top end; and wherein said engagement
means of said retainer includes a plurality of
30 inwardly directed flanges, each disposed beneath
one of said flanges of said sleeve and said piston
and engageable therewith upon movement of
said outer ram away from said base.
4. A press according to any preceding claim,
wherein said drawing horn is slidably received 35
within said sleeve system.
5. A press according to any preceding
claim, wherein a knockout assembly is carried
by said base for movement into and out of
said die means. 40
6. A double action redraw press substantially
as hereinbefore described with reference to the
accompanying drawings.
7. A workpiece whenever formed on a press
according to any preceding claim. 45
- LLOYD WISE, TREGEAR & CO.
Chartered Patent Agents,
105-109 Strand
London WC2R 0AE. 50