United States Patent

Dunn

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[54] DRAWN AND IRONED CONTAINERS

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[52] **U.S. Cl.** **72/349**, 72/467

[51] **Int. Cl.** **B21d 22/28**

[58] **Field of Search** 72/349, 467, 468, 347, 348

[56] **References Cited**

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1,742,795	1/1930	Tanner	72/349
3,359,775	12/1967	Langewis	72/344
3,399,558	9/1968	Smith et al.	72/468
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[57] **ABSTRACT**

A tool pack assembly for an ironing press for forming thin-walled container bodies including a die block having an open slot herein for receiving a plurality of ironing rings which are secured in the die block by means of an axially expandable hollow jack screw, with the die orifices in the rings in co-axial alignment with the press mandrel. Spacer rings are provided between the ironing rings and have means associated therewith for introducing lubricant around the entire periphery of the container body prior to movement of the body through successive ironing rings.

8 Claims, 4 Drawing Figures

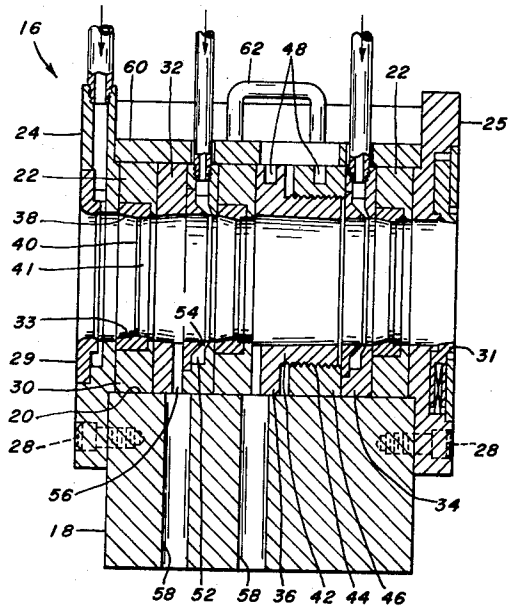

FIG. 1.

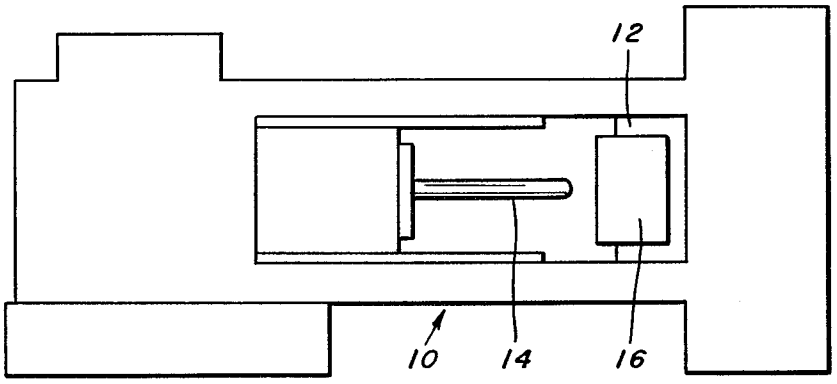

FIG. 2.

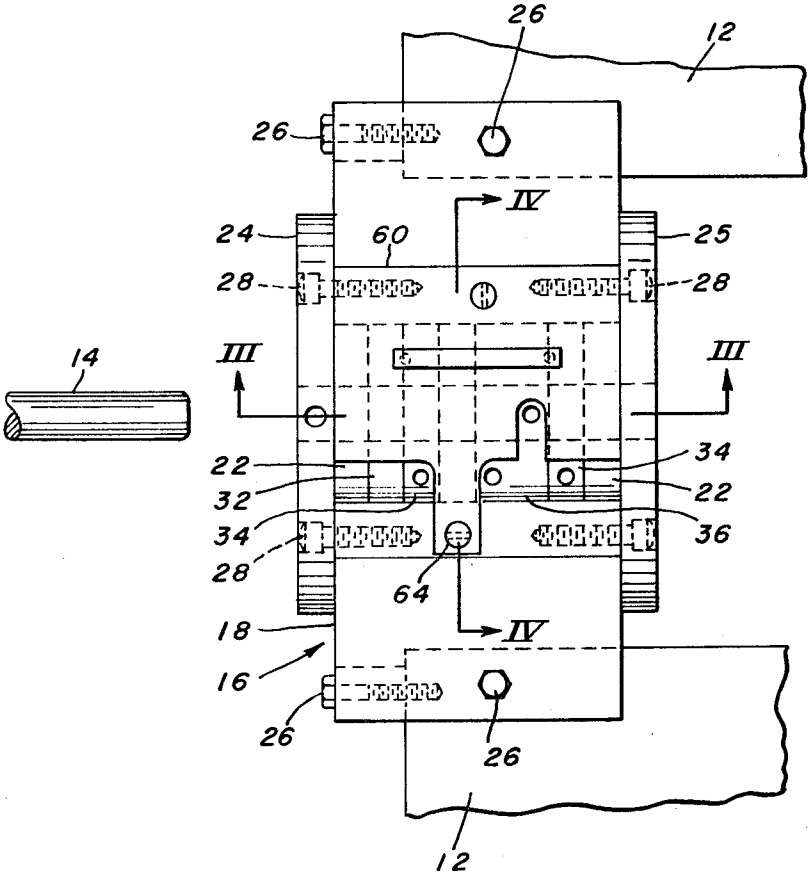

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FIG. 3.

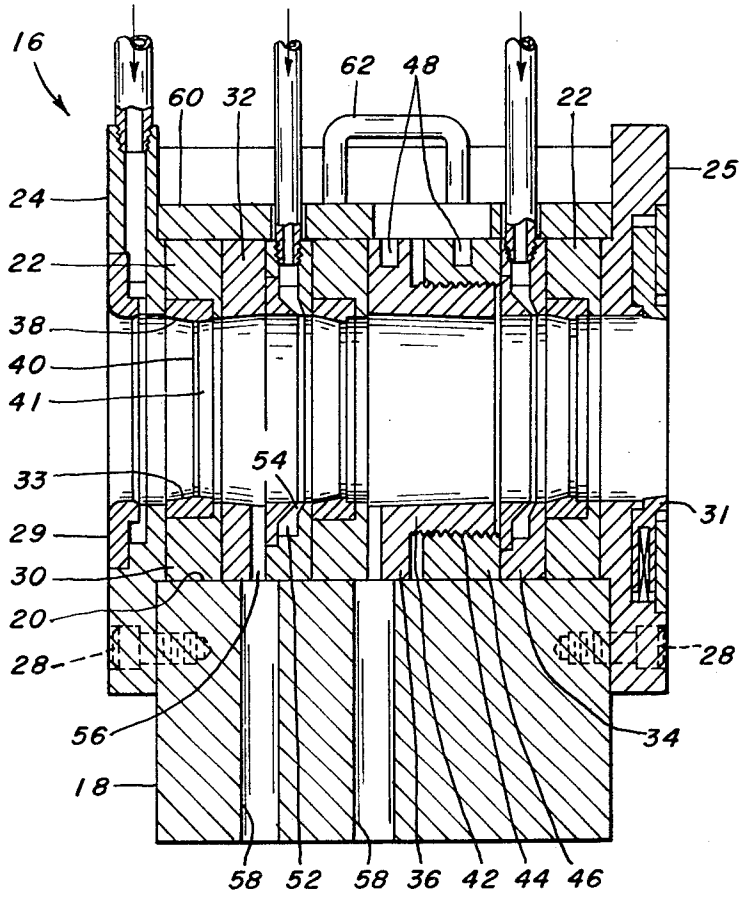
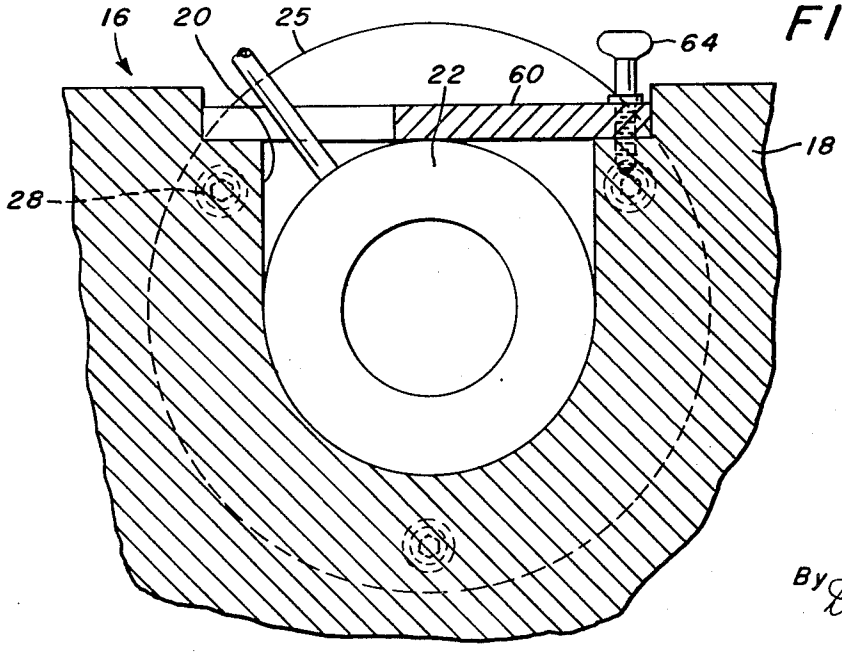


FIG. 4.



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DRAWN AND IRONED CONTAINERS

BACKGROUND OF THE INVENTION

In forming thin-walled container bodies, it is conventional to provide a plurality of ironing or drawing rings through which each container body is moved to thin and elongate its side wall. Continuous operation of an ironing press results in considerable wear of the ironing face of such rings and requires replacement of the rings at regular intervals. Accordingly, it is desirable to provide ironing rings that may be easily and quickly removed, replaced and aligned. It is also desirable to provide a convenient means for introducing lubricant into an ironing ring tool pack assembly for lubricating the rings and the container body as it moves therethrough. Heretofore, a variety of systems have been employed for securing drawing or ironing rings in a press, including positioning the rings in a die carrier as shown in Bolt et al. U.S. Pat. No. 3,203,218, locking the dies in a pair of leaf-like elements as shown in Smith et al. U.S. Pat. No. 3,399,558, and positioning the dies in a series of longitudinal spaced transverse slots or grooves as shown in Smith U.S. Pat. No. 1,977,327. However, none of these systems have proven to be completely satisfactory from the standpoint of speed of tool change and accuracy of co-axial alignment of the die orifices with the press mandrel. Accordingly, an improved tool pack assembly that facilitates quick and easy replacement and alignment of ironing rings is desirable.

SUMMARY OF THE INVENTION

The invention provides a tool pack assembly for an ironing press which includes a die block having an open slot therein and an apertured cap at both ends of the slot, and having a plurality of ironing rings disposed in the slot with spacer-lubricators therebetween. An axially expandable hollow jack screw is disposed in the slot for locking the draw rings in position in co-axial alignment with the press mandrel. The ironing rings and spacers in such a tool pack assembly can be quickly and easily changed by contracting the jack screw to release the rings and spacers so that worn rings can be lifted out of the slot for replacement with new ones.

Accordingly, it is an object of this invention to provide an improved tool pack assembly for an ironing press.

Another object of the invention is to provide a tool pack assembly for an ironing press in which the ironing rings can be changed quickly.

A further object of the invention is to provide a tool pack assembly which facilitates quick and accurate co-axial alignment of the die orifices in the ironing rings with the press mandrel.

Another object of the invention is to provide a tool pack assembly which facilitates lubrication of the container body during ironing.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention will be more fully understood and appreciated with reference to the following description and drawings wherein:

FIG. 1 is a top plan view illustrating an ironing press with an improved tool pack assembly secured therein;

FIG. 2 is an enlarged top plan view of the tool pack in the ironing press of FIG. 1;

FIG. 3 is a cross-section elevational taken along line III—III of FIG. 2; and

FIG. 4 is a cross-section elevational taken along line IV—IV of FIG. 2.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, an ironing press, generally indicated by the numeral 10, is illustrated including a press bed 12 and a reciprocating mandrel or ram 14, and having a removable tool pack assembly 16 secured in the press bed. Referring to FIGS. 2–4, the tool pack assembly 16 comprises a steel die or holder

block 18 with an open slot 20 therethrough for receiving ironing rings 22. The block 18 serves as a bridge from the press frame or bed to provide a rigid structure to maintain the rings 22 in positive alignment with ram 14. Preferably, slot 20 is U-shaped with an arcuate bottom, and for a horizontal press like the one selected for illustration, opens upwardly to facilitate access to the slot from the top of the press. Die block 18 may be secured on the press bed 12 with the corners of the press bed projecting into mounting recesses in the side of the die block, and with means such as bolts 26 securing the die block to the press bed. With the die block secured to the press bed, slot 20 in the die block is in alignment with the press mandrel 14. This alignment can be accomplished by a variety of means such as by machining the mating surfaces of the die block and press bed, by shimming between the die block and press bed or by providing adjustable bolts and tapered mating surfaces on the press bed and the die block for relative positioning of the same. Preferably, holder block 18 is heat treated and stabilized before final grinding for accurate positioning and ring alignment.

Die block 18 has centrally apertured caps 24, 25 or other retaining means, secured to it on the ends of slot 20 by means of bolts 28. End caps 24, 25 and die block 18 are machined so that the end caps fit on the die block with the faces on the end caps square or perpendicular to the inner surface of the slot 20 in the die block and to the longitudinal axis of ram 14. A sizing or pre-draw ring 29 may be located in the aperture in the front end cap 24 on the entrance end of the die block 18, and mechanical strippers 31 may be located in the aperture in the rear end cap 25 as is hereinafter described.

Tool pack assembly 16 preferably includes three ironing rings 22, a spacer ring 32, two spacer-lubrication rings 34 and a hollow jack screw 36, all of which are transversely disposed in the slot in the die block. However, more or fewer ironing rings and spacer-lubricators may be employed as desired. Ironing rings 22, selected for illustration, each comprises a steel ring 30 which is shrink fitted on a carbide insert 33. The steel ring 30 is preferably large enough in diameter and has a sufficient section mass to resist significant expansion of the ring due to the stresses produced therein during ironing. A conventional carbide insert 33 has a die orifice therethrough including an entry portion 38, a land 40 and a relief portion 41, although various other known ring profiles may be also employed. Inasmuch as the ironing rings are designed to progressively thin the wall of a container as it moves therethrough on mandrel 14, the die orifices are of decreasing diameter progressing from the first ring adjacent the entrance end of the tool pack to the third ring adjacent the exit end of the tool pack. Typically, the inside diameter of the working land 40 of each of the rings is a few thousandths of an inch less than the diameter of the mandrel plus the double thickness of the container wall as it enters such ring.

Preferably, the rings are spaced so that a container body will be worked or ironed by only one ironing ring 22 at any one time. The rings are therefore spaced so that a container body will have moved completely through the working land 40 of the preceding ironing ring before moving into the working land of the next ring. Since the wall of the container is elongated as it is ironed, rings 2 and 3 are spaced further apart than are rings 1 and 2 in order to avoid working of the container wall in more than one ironing ring at any one time. Such spacing depends on the length of the cup being ironed, the side wall thickness of the cup, and the precent reduction in thickness of the side wall which is being effected. Spacer 32, lubrication rings 34 and jack screw 36 are selected with appropriate thicknesses to properly space the ironing rings 22. To allow for thermal expansion of the rings and for alignment of the rings in slot 20, a small radial clearance is provided between the rings and the sides of the slot. With rings approximately 6 inches in diameter, a radial clearance of approximately 0.0025 inch has been found to provide an adequate clearance for such purposes.

Jack screw 36 is adapted to be axially expanded and contracted to lock the ironing rings 22, spacers 32, 34 and jack screw 36 in the slot 20 between end caps 24, 25 and comprises a sleeve 42 which is threaded at 44 for assembly with a collar 46. By turning collar 46 relative to sleeve 42, the jack screw can be axially expanded and contracted to either lock the assembly together or release the assembly for replacement of rings. Adjustment holes 48 are provided in sleeve 42 and collar 46 to facilitate such relative rotation of the members.

The front end cap 24 and each lubrication ring 34 has a feed hole therein which communicates with an annular lubrication chamber 52 and an annular feed passageway 54 around the die orifice. The feed passageway 54 is narrower than is chamber 52 to ensure that lubricant is supplied onto the surface of a container body around its complete periphery as will be hereinafter explained. Lubrication lines are attached to the feed holes in the lubrication rings, and drain slots 56 are provided in spacer 32 and jack 36 for draining lubricant, and extraneous matter carried by the lubricant, through drain openings 58 in the die block and into a drain tank or the like not shown. Extraneous matter carried by the lubricant may include dirt and particles or fragments of the container bodies which may be clipped therefrom during ironing.

The tool pack assembly further includes a cover plate 60 with a handle 62 attached thereto. This plate 60 is positioned over the rings and spacers in slot 20 in the die block 18, and is secured on the die block by means of bolts 64. Referring to FIG. 2, cover plate 60 is partially cut away to provide access to the lubrication feed holes in lubrication rings 34 and to the adjustment holes in jack 36. Cover plate 60 is designed primarily to be a safety shield over the rings.

Heretofore, tool pack assemblies have required considerable time to change ironing rings since they have had no quick and easy means for securing and aligning the rings in the assemblies. Tool pack assemblies have usually required removal and/or disassembly of the complete tool pack in order to change either one ironing ring or all the ironing rings. The lubrication connections and the locking and alignment means provided in such assemblies have made it difficult to change tools in less than 10 to 15 minutes. The present invention greatly simplifies tool changes and has permitted reducing the time for such changes to approximately two minutes or even less. In the present invention, any one or all of the ironing rings can be removed and replaced without complete removal and/or disassembly of the entire tool pack.

To change ironing rings in the tool pack 16 of the invention, the two bolts 64 on the cover plate are removed and the cover plate is lifted off the die block 18. Jack screw 36 is then contracted to free the jack screw and the rings so that worn or broken ironing rings can be lifted out of the slot in the die block and replaced with new rings. If desired, the lubrication rings 34 may also be lifted out of slot 20, with or without the lubrication lines attached, but such removal is not necessary for changing ironing rings. Preferably, the slot 20 and the ironing rings 22 are sufficiently close in relative diameters for the rings, as loosely positioned in the slot, to be in approximate alignment with the mandrel, but leaving a small clearance around the rings so that they can shift and/or expand in the slot. A radial clearance of approximately 0.0025 inch between the rings and the slot has been found to provide sufficient space for thermal expansion of the rings as previously discussed and to provide the desired preliminary alignment with space for shifting into final co-axial alignment with the mandrel. Alternatively, auxiliary means such as shims or the like may be provided for effecting approximate initial alignment of the rings in the slot.

With new ironing rings positioned in slot 20 in approximate alignment with mandrel 14, jack screw 36 is partially expanded to a point where the rings are held snugly in position, but loose enough for them to shift in response to a positive force applied thereagainst. Mandrel 14 with a container body thereon is then run through the die assembly. Since the ironing rings are free to shift, running the mandrel and container body through the rings effects automatic centering of the rings about the mandrel and workpiece. Thereafter, jack screw 36 is further axially expanded to lock the entire assembly together with the ironing rings in perfect co-axially alignment with the mandrel. This centering can also be accomplished while the press is in operation since access has been provided to the locking jack screw.

The tool pack assembly 16 and the mandrel 14 may be connected to a lubricant supply system, not shown, which is employed primarily to reduce friction during ironing, but which may also be used to control the temperature of the mandrel and ironing rings. Accordingly, the system may include means for heating or cooling the lubricant during operation, as well as means for cleaning the lubricant. Preferably, the lubricant is initially heated prior to commencement of ironing and then cooled during continuous operation to maintain the lubricant, and thus the tools, at a relatively constant temperature. One suitable lubricant that has been used is an emulsion of oil in water, but the invention is not limited to the use of such lubricant. The lubrication system may include various pumps, filters, gauges, valves and lubrication lines which are connected to the front end cap, the lubrication rings and the mandrel for circulation therethrough.

As illustrated in FIG. 3, the front end cap 24 and the two lubrication rings 34 are particularly adapted for supplying lubricant around the entire periphery of a container body as it moves through the tool pack assembly. The provision of an annular chamber 52 in the rings followed by an annular passageway 54 which is narrower than chamber 52 assures that the chamber will be completely filled with lubricant for application to the surface of a container via passageway 54. The narrow passageway produces a pressure differential between the chamber 54 and the mouth of the passageway, which in turn causes the lubricant to completely fill the chamber for supply around the entire periphery of a container.

The mandrel 14 may also have a passageway through it which is connected to an airline and to either the atmosphere or a vacuum system for venting of the inside of a drawn cup as mandrel 14 is moved into the cup, and to a compressed air system to effect stripping of an ironed container from the mandrel at the completion of the ironing stroke as described in my U.S. Pat. application Ser. No. 20,297, filed Mar. 17, 1970, for "Method and Apparatus for Stripping Container Bodies from a Reciprocal Mandrel," and executed and filed concurrently herewith.

In operation of ironing press 10, a drawn cup is positioned, by means not shown, at the entrance end of the tool pack assembly, with the cup open toward mandrel 14. The cup to be ironed preferably has an inside diameter which is approximately 0.025 inch greater than the outside diameter of mandrel 14 so that the mandrel can be moved into the cup without difficulty. When the cup is in position at the entrance end of the tool pack assembly, lubricant from the lubrication system is sprayed onto the inner and outer surfaces of the cup. The mandrel 14 then moves into the cup and carries it into and through the tool pack assembly 16. As the cup is carried through the assembly, pre-draw ring 29 centers the cup on mandrel 14 and draws the side wall of the cup inward. Preferably a small clearance remains between the cup and the mandrel after such preliminary drawing, but the pre-draw ring may, if desired, draw the side of the cup into intimate contact with the mandrel. As the cup exits the pre-draw ring, additional lubricant is supplied from annular passageway 54 around the exit end of the draw ring onto the outer surface of the cup. The cup then moves through the three ironing rings 22 which progressively thin and elongate the side wall of the cup to form a container body. Additional lubricant is applied to the cup during such ironing by the two lubrication rings 34. At the completion of the ironing stroke, the ironed container body may be stripped from the mandrel 14 by means of compressed air as is described in my above identified U.S. patent application, or by other means known in the art. Mechanical

strippers 31 may be provided in end cap 25 for such stripping or as a safety check for air stripping as is described in said application.

It is therefore seen that the present invention provides an improved tool pack assembly wherein the ironing rings can be quickly and easily removed for inspection or replacement, and which incorporates an efficient and simple lubrication system which does not interfere with tool changes. While a particular embodiment of the invention has been illustrated and described, it will be obvious to one skilled in the art that numerous variations and modifications can be made therein. For example, a hydraulic jack could be used in a tool pack assembly in place of a jack screw so that expansion of the ironing rings, spacers, etc. due to heat or the like could be compensated for by controlling the hydraulic pressure in the jack. By controlling the pressure in a hydraulic jack, the jack could be compressed in response to expansion of the rings in the tool pack assembly. The end caps on the tool pack assembly could also be integral parts of the die block. The slot in the die block could be cut into the block leaving metal on both ends of the slot to retain the rings and spacers in the slot. As a substitute for the bolts which are illustrated for holding the cover plate in place, a clamp or clamps could also be used for such purpose. The cover plate could be hinged or otherwise restrained on one edge and a clamp could be employed to lock or secure the opposite edge of the plate against accidental removal.

What is claimed is:

1. In an ironing press having a press bed and a reciprocal mandrel, a tool pack assembly secured to the press bed comprising:

a. a die block having an elongated open slot therein with its longitudinal axis aligned with the press mandrel;

b. a plurality of ironing rings transversely disposed in the slot in the die block, said ironing rings having radial dimensions which are less than the transverse dimensions of the slot to permit axial alignment of the rings in the slot;

c. apertured means at the ends of the slot in said die block for retaining said ironing rings in the slot between said means while permitting the press mandrel to pass therethrough; and

d. adjustable means disposed in the slot in the die block between said apertured end means for applying pressure, either directly or indirectly, against said ironing rings parallel to the longitudinal axis of the slot to secure the ironing rings in the slot whereby they can be quickly and easily replaced and aligned.

2. A tool pack assembly as set forth in claim 1 which includes a pre-draw ring secured therein on the entrance end of the assembly.

3. A tool pack assembly as set forth in claim 1 which includes at least one centrally apertured lubrication ring in the slot in said die block.

4. A tool pack assembly as set forth in claim 3 in which the lubrication ring has an annular lubrication chamber leading into an annular passageway around the entire periphery of the central aperture in the ring for feeding lubricant onto a container body as it moves through the ring.

5. A tool pack assembly as set forth in claim 1 in which said apertured retaining means at the ends of the slot in the die block have oppositely facing planar surfaces each of which is normal to the axis of the press mandrel for abutment and securement of said ironing rings against said surfaces in axial alignment with the mandrel.

6. A tool pack assembly as set forth in claim 1 in which a small radial clearance is provided between said ironing rings and the slot in the die block.

7. A tool pack assembly as set forth in claim 1 in which the slot in said die block is U-shaped.

8. A tool pack assembly as set forth in claim 1 in which said jack means is a hollow jack screw.

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