United States Patent [19]

Merrill

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[54] **STATIC PRESS**

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[52] **U.S. Cl.** ..... **100/35,** 100/269 A, 100/264, 264/DIG. 50, 425/405

[51] **Int. Cl.** **B30b 13/00**

[58] **Field of Search** ..... 100/35, 269 A, 264; 144/281 A; 264/DIG. 50; 425/405, DIG. 19; 164/280

[56] **References Cited**

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877,139	1/1908	Tatarinoff	100/269 A
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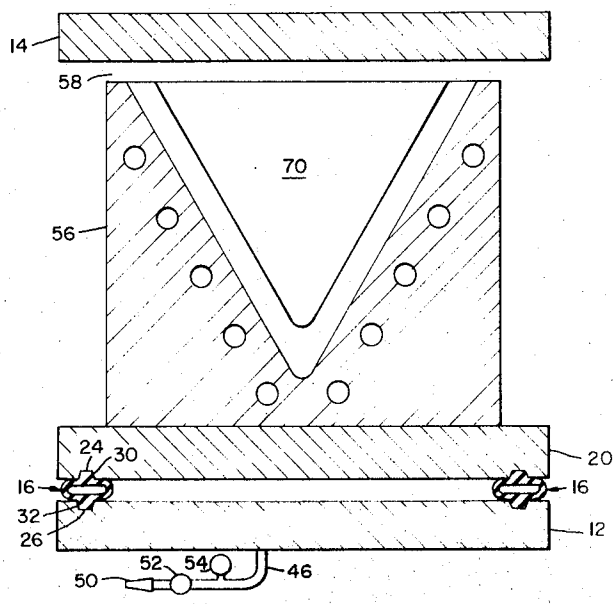
Primary Examiner—Billy J. Wilhite
Attorney—Townsend & Townsend

[57] **ABSTRACT**

A static press of relatively simple construction is provided having first and second spaced apart stationary plates, a movable third plate intermediate said first and second plates and a flexible conduit in the form of an annulus separating the first and third plates. The conduit defines a chamber which is enclosed by the first and third plates.

An object is introduced between the second and third plates with a small amount of headroom, so that upon pressurizing the conduit the object is pressed between the plates and the chamber hermetically sealed. The chamber is then pressurized to provide a uniform work force against the object. When the object is to be released, the pressure in the chamber and conduit is released, lowering the object out of engagement with the second plate.

9 Claims, 7 Drawing Figures



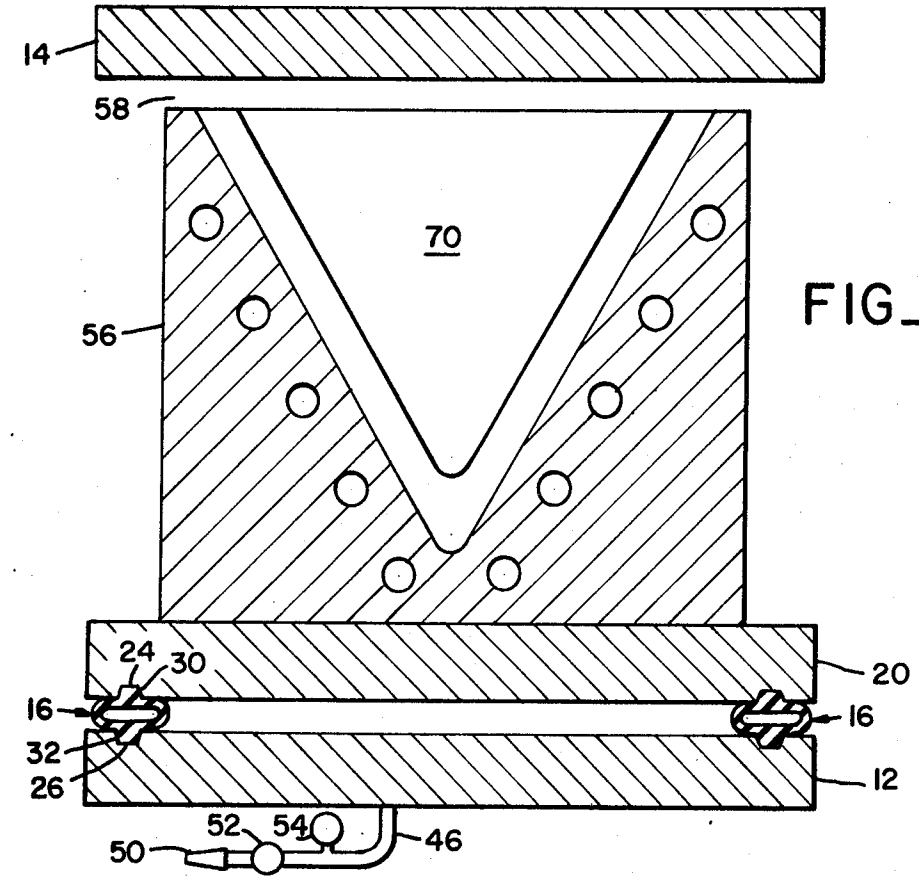

14
58
70
56
24
30
20
16
16
32
26
12
52
54
46
50

FIG_1

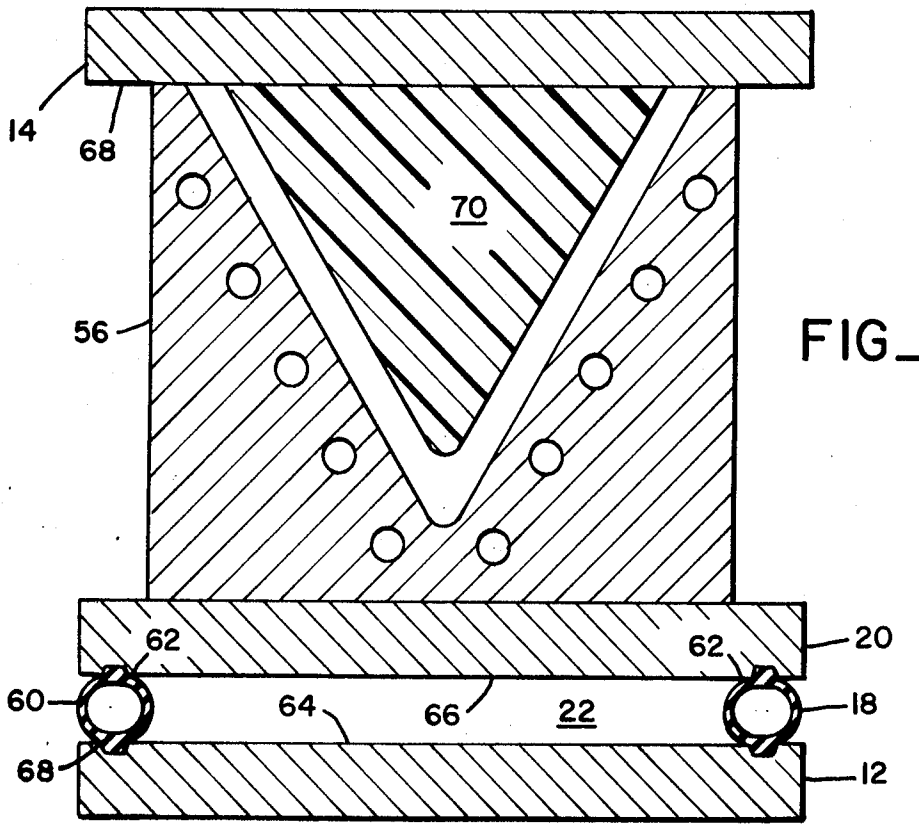

14
68
70
56
62
62
20
60
64
66
22
18
68
12

FIG_2

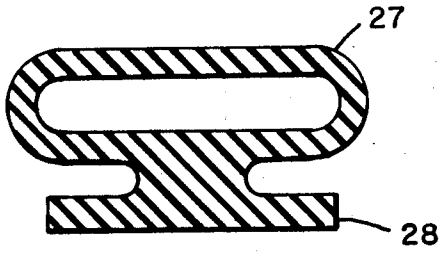


FIG_4B

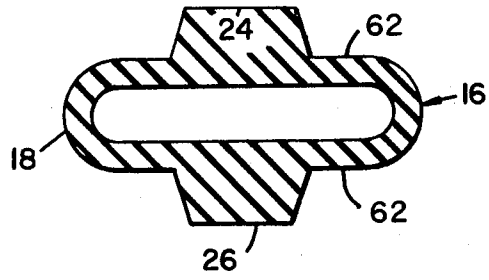


FIG_4A

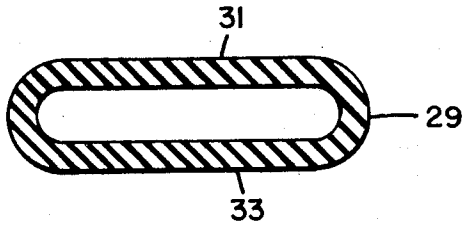


FIG_4C

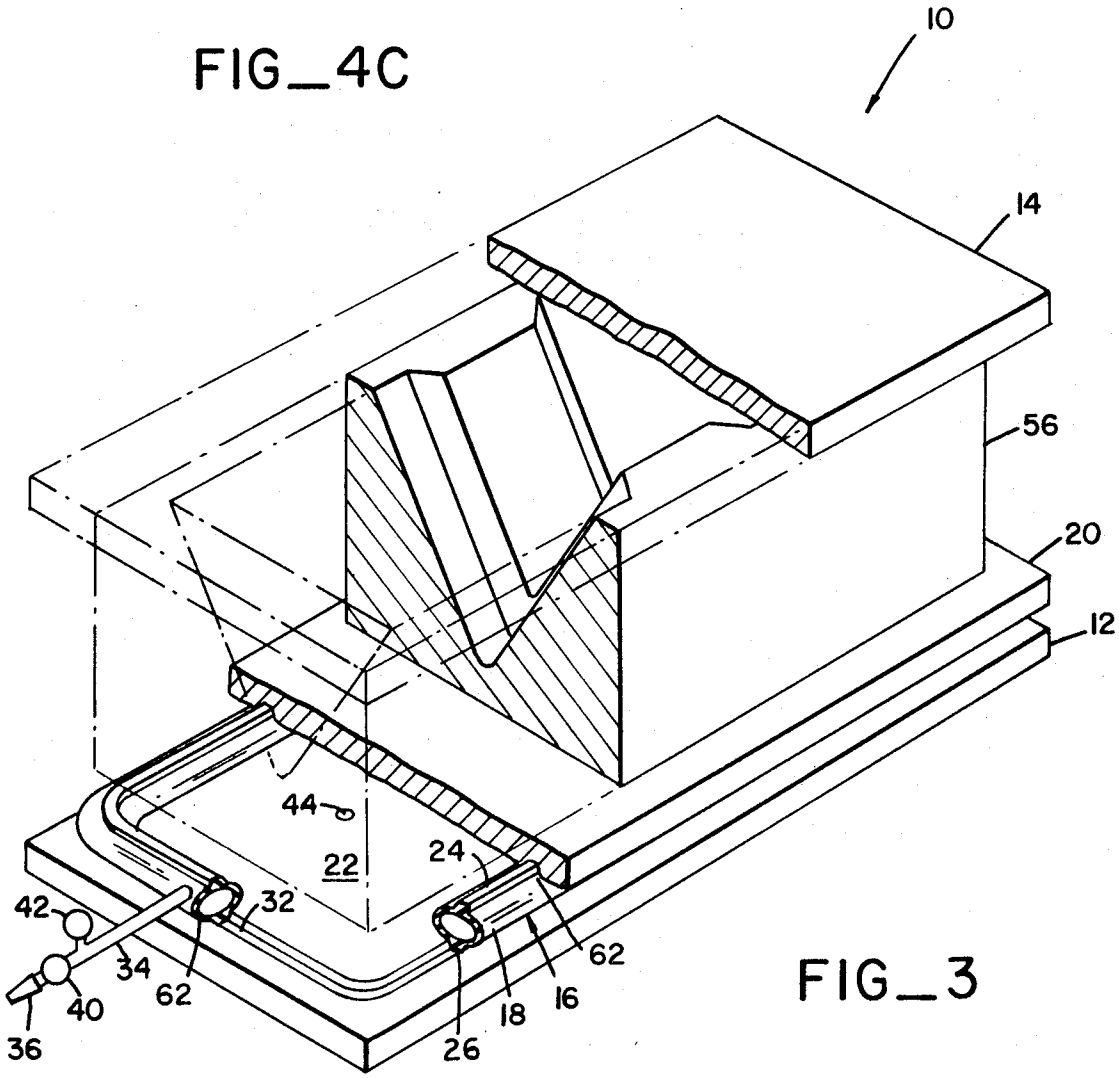


FIG_3

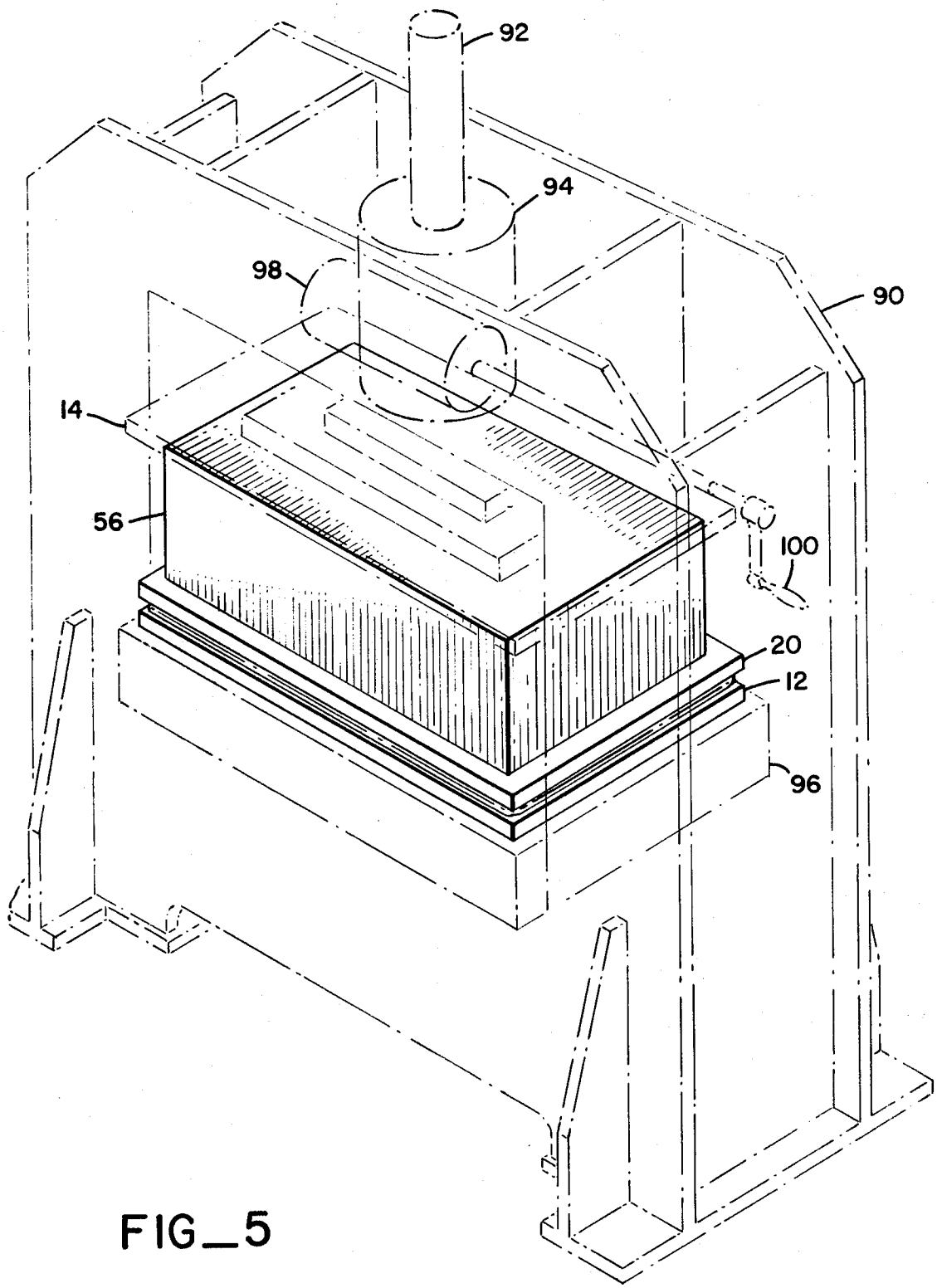


FIG_5

STATIC PRESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

In many situations, it is necessary to restrain an object or assembly under relatively high pressures. Fabrication, both in plants and in the field, frequently require that superatmospheric pressures be applied to achieve a desired bond or form. Clamps or presses which can provide uniform high pressures may be used advantageously in molding, particularly in restraining expanding foam plastic materials within a closed mold; in adhesive bonding, for example, in laminating two or more sheets; and in holding or otherwise securing assemblies and/or sub-assemblies during fabrication.

Desirably, a clamp or press should permit rapid introduction and removal of the mold, device or parts into the press, rapid achievement of the desired pressure, and easy removal of the fabricated object from the press. Furthermore, the device should be capable of providing a fairly uniform force or pressure over a relatively wide area. The device should also be safe to employ, easily repairable and subject to minimal breakdown. In addition, the system should permit easy manipulation and control of the pressure applied to the assembly held by the press.

2. Description of the Prior Art

Numerous hydraulically and pneumatically operated clamping devices and presses have been disclosed in the prior art. The following U. S. Pats. are considered illustrative: Nos. 877,139, 2,363,779, 2,598,190, 2,717,421, 2,852,807, 3,135,998, 3,213,739, and 3,237,252.

SUMMARY OF THE INVENTION

The subject invention provides a static press or clamp whereby a relatively large pressure area on the underside of a platen is achieved by initially pressurizing a flexible collapsible hose, which moves the platen and a work piece or other object seated on the platen a short distance against a stationary plate. This results in sealing a main pressure area which is then pressurized to the desired pressure providing the necessary force against the work piece or other object.

The device therefore requires two stationary plates in spaced apart relation, an intermediate platen separated from one of the plates by a pressurizable expandable hose or conduit and means for pressurizing the hose or conduit and the area defined by the hose or conduit and the lower and upper plates.

When employing the clamp, the work piece or other object is introduced between the platen and a second or upper plate. The hose or conduit is pressurized, moving the work piece in engagement with the second plate, so as to seal the main pressure area between a first or lower plate and platen. The main pressure area is then pressurized to provide the desired pressure or work force against the work piece.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is an elevational cross sectional view of the static press of this invention in the deflated mode with a mold die between the plates.

FIG. 2 is a cross sectional elevational view of the static press in operation.

FIG. 3 is a fragmentary perspective view of the static press with a mold between the plates.

FIGS. 4A, 4B and 4C are cross-sections of different conduits.

FIG. 5 is a prospective view of a housing containing the mold.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS OF THE INVENTION

The subject invention concerns a clamp or press which is fluid pressure actuated. The press employs first and second adjustable stationary plates with a movable plate or platen intermediate the first and second plates. The platen is separated from the first plate by an inflatable flexible conduit which closes on itself to form a continuous loop. The conduit defines a chamber with the first plate and the movable platen. Means are provided for pressurizing the conduit and the chamber.

When employing the clamp or press, the work piece or assembly to be held by the clamp is introduced between the platen and the second plate, while the inflatable conduit is in the collapsed or uniflated mode. If necessary, the second plate is adjusted to leave a small space between the work piece and the second plate, usually only a fraction of an inch. The conduit is then inflated, which results in moving the work piece a small distance into engagement with the second plate, placing the work piece or assembly under compression. This results in firmly griping the work piece or assembly, and sealing the area enclosed by the conduit and the first plate and platen, so as to form a chamber. The chamber is now pressurized to a pressure somewhat below the pressure in the conduit, but at sufficient pressure to provide the necessary compression of the work piece or assembly held between the platen and the second plate.

In providing a clamping apparatus, a housing, clamps, or other structure will be employed for maintaining the stationary plates in adjustable spaced apart relationship Means are provided for positioning the second plate to provide a relatively small gap between the work piece or assembly to be introduced between the platen and the stationary plate. In some instances, the upper stationary plate will be supported by the work piece. In that event, movement of the upper plate beyond a small distance will be restrained. Any convenient type of housing may be used, which allows for adjustment and maintenance of the space between the stationary plates and provides access to the area between the platen and the stationary plates.

The flexible conduit will be of relatively small diameter, providing a small work stroke when inflating the conduit and compressing the work piece or assembly. Heavy conduits can be used to accomodate the relatively high pressures employed.

The platen and stationary plate in contact with the object or assembly may be equipped for heating or cooling, either liquid or air, for providing a vacuum, or other treatment which may be required while the clamp is in use. The facilities used in conjunction with clamps and presses are well known in the art and do not require extensive discussion here.

Turning now to a consideration of the drawings, a clamp or press **10** is provided having a base **12.** While in the figures, the clamp **10** has the base **12** in a horizontal position, the clamp could also be situated with

the base in a vertical or inclined position, where such positioning would be desirable or required. Where the plates are not horizontal, some form of restraining bracket would be employed to maintain the plates in alignment. The particular orientation of the clamp is not an essential element of the operation of the clamp.

A second or upper plate **14** is provided which is secured so as to withstand the pressure exerted upon it. The manner of securing is shown in FIG. **5**, and, but can vary widely, depending on whether the clamp or press is fabricated as a permanent assembly or is a combination of parts for assembling and disassembling. As already indicated, various housings, clamps or other equipment may be employed to secure and restrain the upper plate **14** when the clamp is in use and to maintain the plate in spaced relation with the base at the desired distance. The base **12** is also secured and supported in order to be able to withstand the pressures and forces generated during the use of the clamp. A housing **90** can be employed, having upper plate **14** rigidly engaged by shaft **92**. Shaft **92** passes through collar **94**, and operatively engages screw jactuator **98**, which is turned by handle and arm **100**. The base **12** is supported by housing plate **96**. The housing plate **96** may be mounted on a similar mechanism as employed for raising and lowering the upper plate **14**, if adjustment of the lower plate is desirable.

Positioned on the base is a flexible inflatable conduit **16**. Resting on the conduit **16** is platen **20**, whose sides extends beyond the outer edge **18** of conduit **16**. Conduit **16** forms an annulus, so as to define a closed chamber **22** with base **12** and platen **20**.

The conduit **16** may be of any convenient design as to its cross section and the shape of the area enclosed by the conduit **16**. Therefore, the chamber **22** may be circular, rectangular, with or without rounded corners, and at any length and width, which provides the desired work area and can be supported by the inflated conduit.

The cross section of the conduit is designed to provide the necessary hermetic sealing of the chamber **22**, when the conduit **16** is inflated and under compression during use. In FIGS. **3** and **4A**, the conduit **16** has upper and lower ridges **24** and **26** which are seated in grooves **30** and **32** respectively. In FIG. **4B**, the conduit **27** has a sealing base **28** while in FIG. **4C** the conduit **29** is an oblate ring having flat sides **31** and **33** for forming a seal.

When using the ridged conduit **16**, base plate **12** and platen **20** are grooved in an appropriate design and dimension so as to conform to conduit **16** in providing the desired size chamber **22**. The grooves **30** and **32** provide a relatively snug fit for the ridges **24** and **26** respectively, so that under compression, the ridges **24** and **26** will be pressed tightly into the grooves and portions of the conduit adjacent the ridges will be pressed against the base plate **12** and the platen **20**, hermetically sealing the chamber **22**.

Depending on the nature of the materials employed, various designs of the conduit may be used which provide for hermetic sealing. The significant factor is that there is substantial contact between the conduit **16** and the surfaces of the plate **12** and platen **20** with which the conduit **16** is in contact to provide the desired seal. Various conduits are available from a variety of materials, such as neoprene, silicone, SBR, EPT, butyl and natural rubber, etc. A number of these conduits of varying design are sold by the Presray Corporation under the mark Pneuma-seal. The conduit may be bonded to the base **12**, the platen **20** or both. The platen **20**, however, is preferably unfastened and rides freely on the conduit. When the base **12**, platen **20** and conduit **16** are free, the clamp **10** is easily assembled and disassembled and can be easily transported.

The conduit **16** is fitted with a hose **34** having nozzle **36**, valve **40**, and pressure gauge **42**. The pressure gauge **42** may be on either side of the valve **40**, depending on whether one wishes to continuously meter the pressure in the conduit **16**. By using a mechanical air pump, hydraulic fluid pump or a source of gas under high pressure, the conduit **16** may be pressurized to the desired pressure and then sealed by closing valve **40**. As the conduit **16** expands, platen **20** will move until the work piece set on the platen **20** engages the upper plate **14**. The conduit **16** will then be under compression by means of the work piece being compressed in the clamp, and thus hermetically sealing the chamber **22**, which may then be pressurized. Base **12** has aperture **44** which connects with chamber hose **346**. The chamber hose **46**, like the conduit hose **34**, is fitted with a nozzle **50**, valve **52** and pressure gauge **54**. The chamber **22** is then pressurized hydraulically or pneumatically to provide the desired pressure and compression against the work piece, mold or other object or assembly, held by the clamp **10**.

The subject invention finds particular advantage with molding of foamed plastic materials, where a substantial restraint of the foamed material must be maintained during the molding. Therefore, the method employed in using the subject press or clamp will be described in relationship to the molding of a foamed plastic material.

In using the subject press, the distance between the base **12** and the upper plate **14** is adjusted to allow for introduction of the mold die **56** with a small amount of head room **58**. The conduit **16** is in its deflated or collapsed state. A source of fluid, either gaseous or liquid, is attached to the nozzle **36** and valve **40** is opened. The conduit **16** is then pressurized so as to expand to its inflated state **60** as shown in FIG. **2**. The ridges **24** and **26** are pressed into the grooves **30** and **32** respectively so as to form an hermetic seal. Usually, the outer surface **62** of the conduit **16** adjacent the ridges **24** and **26** will be pressed against the upper surface **64** of the base **12** and the lower surface **66** of the platen **20**. As the conduit expands, the platen **20** will rise so as to press the mold die **56** against the lower surface **68** of the upper plate **14** and place the die under compression.

In those instances where the mold die **56** is open at the top, the surface **68** will serve to seal the area in which the object is to be formed. The foamed plastic may now be introduced into the mold cavity **70** through an opening in the mold die **56**, not shown.

A source of fluid, gaseous or liquid, under pressure is attached to nozzle **50**, valve **52** opened, and the chamber **22** pressurized to the desired pressure, a pressure below the pressure in the conduit **16**. The valve **52** is then closed sealing the chamber at the desired pressure. When necessary, heat may now be applied to the mold die **56** to cure the plastic or some other operation may be performed. When the molding is completed, valve **52** is opened, releasing the pressure in the chamber **22**. Valve **40** may be opened simultaneously with valve **52** or subsequent thereto, so as to release the

pressure in the conduit **16**. The conduit **16** will then deflate or collapse, lowering the platen **20** and die **56** and restoring the headroom **58**, so that the die may be easily removed from the press. The press is then ready to be used again.

As already indicated, the press need not be restricted to use for mold dies, but may be used in any operation where it is desirable to hold an object, work piece or assembly under compression. This includes laminating, cutting, assembling, trimming, etc.

The materials employed for the various components of the press or clamp may be varied widely, depending on the pressures employed, the sizes desired, and the auxiliary facilities required. Any solid rigid support may be used as the base, conveniently cast iron or steel. The platen may be of any convenient size as required, varying about half a foot in the smallest dimension to 6 or more feet in the smallest dimension. Pressures can be provided of 200 p.s.i. in the chamber or higher, with slightly higher pressures in the conduit. Usually, the conduit will exceed the pressure in the chamber by about 5 p.s.i. or more. The platen and upper plate will be of sufficient strength to be able to withstand these pressures and transmit the pressure uniformly to the object or assembly in the clamp.

Various controls, both manual and automatic may be used to inflate and deflate the conduit and pressurize and depressurize the chamber.

In accordance with this invention, a relatively simply fabricated clamp or press is provided which can be used to apply high compressive forces to a work piece or assembly. By using a short work stroke, normally a fraction of an inch, hazards to an operator are minimized. Furthermore, the compression on the object being clamped is easily controlled by varying the pressure in the chamber. The apparatus of this invention is readily adaptable to a wide variety of sizes of platens so as to be capable of clamping objects of a wide variety of dimensions. The surface of the platen will normally be flat, particularly in the area adjacent contact with the conduit, but some variation in the shape is permissible. Employing the apparatus of this invention, the use of costly cumbersome and time consuming numbers of individual clamps is avoided and involved opening, closing and locking mechanisms are eliminated.

Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it will be obvious that certain changes and modifications may be practiced within the scope of the invention, as limited only by the scope of the appended claims.

What is claimed is:

1. A pressure actuated static press for holding a member under compression comprising:

first and second plates in spaced apart relationship on opposite sides of said member;

a platen intermediate said first plate and said member;

an inflatable ring separating said first plate and platen and defining a chamber interiorly of said ring, and

means for pressurizing said ring and said chamber to inflate said ring and urge said member into compressive engagement with said second plate, hermetically sealing said chamber and holding said member under relatively uniform compression.

2. A static press according to claim **1**, wherein said ring has opposed ridges on the outer surface of said ring, and said first plate and said platen have grooves in cooperative engagement with said ridges.

3. A press according to claim **1**, wherein said pressurizing means has valve and gauge means for controlling the pressure.

4. A press according to claim **1** having in combination, adjustment means operably connected to one of said first and second plates for adjusting the spacing between said first and second plates.

5. A press according to claim **1**, wherein said ring has a substantially rectangular configuration.

6. A press according to claim **1**, wherein said ring has an oblate cross section.

7. A pressure actuated static press for holding a member in compression comprising:

a housing having spaced apart horizontal lower and upper plates,

means for adjusting the spacing between said upper and lower plates operably connected to said upper plate;

a flexible inflatable annular conduit positioned on said lower plate;

a platen freely riding on said flexible conduit, said lower plate, platen and conduit defining a chamber; and

means for pressurizing said conduit and said chamber to inflate said conduit and urge said member in compressive engagement with said upper plate hermetically sealing said chamber and holding said member under relatively uniform compression.

8. A static press according to claim **7**, wherein said conduit has upper and lower ridges and said lower plate and platen have grooves for cooperative engagement with said upper and lower ridges.

9. A method for maintaining a member under compression which comprises:

introducing said member between a movable plate and a fixed plate, wherein said movable plate rests upon an inflatable ring having inflating means, said ring being situated on an immobile surface and wherein said ring, said movable plate and said immobile surface define a chamber,

inflating said ring so as to move said member against said fixed plate and compressing said member and said ring, forming an hermetic seal between said ring, said movable plate and said immobile surface, and,

pressurizing said chamber to a pressure below the pressure in said ring, so as to provide a substantially uniform pressure against said member.

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