A multicavity isostatic hydraulic clamp press where the clamp cylinder and piston rod act as the press frame and which is adapted to fully automatic operation.
ISOSTATIC CLAMP PRESS

This invention utilizes a hydraulic piston and cylinder to apply sealing pressure to isostatic pressing chambers and as a frame to withstand the forces.

In the drawing,

FIG. 1 is a front elevation, partly in section, of an isostatic press;
FIG. 2 is a top plan view; and
FIG. 3 is a fragmentary side elevation.

In a preferred form, a base platen 1 carries a clamp cylinder 2 and a plurality of pressure chambers 4 arranged in a circle around the clamp cylinder with open ends of the chambers on opposite sides of the cylinder.

The number of pressure chambers is a matter of design. Two chambers are shown on 180 degree spacing or diametrically opposite each other. Six chambers on 60 degree spacing from each other is convenient. In the cylinder 2 is a piston 2a having a piston rod 2b on the upper end of which is mounted the mid section of a cross bar 3. Shoulders 2c, 2d, transmit axial thrust to the cross bar and a sleeve bearing 2e permits rotation of the cross bar on the piston rod in a plane perpendicular to the axis of the clamp cylinder. The piston is raised by fluid supplied through fitting 2f and is closed by fluid applied through fitting 2g.

A table top 5 mounted on the base platen 1 by rods 5a has openings 5b receiving the upper ends of the chambers 4. In the closed position, the lower surface of the cross bar 3, the upper surface of the table top 5 and the open upper ends of the chambers 4 lie in a common plane and the cross bar seals the open upper ends 4a of the chambers 4 as shown in FIG. 1. A removable wear plate 4b may be provided on the sealing surfaces of the upper ends of the chambers 4. Within each of the chambers 4 is an isostatic pressure bag 4c of flexible material such as a urethane or other elastomer compatible with the material to be pressed. The particular bag shown, which was designed to press ceramic tubes 8 inches long and with a wall thickness of 40 mils, is cylindrical with the inner surface 4d concentric with and spaced from a core rod and ejector pin 4e to provide the required wall thickness. Both the upper and lower ends of the bag 4c are provided with sealing flanges 4f/4h which makes fluid-tight sealing engagement with the upper and lower ends of the chamber 4 with a bore 4g. The bag is surrounded by cylindrical filler blocks 4i having radial holes 4i of which only one hole is shown for transmitting fluid pressure to the outside of the bag 4c. The sole purpose of these filler blocks is to reduce the quantity of fluid which must be moved in pressurizing and depressurizing the chambers. Fluid pressure is supplied to and removed from the pressure chambers through a fitting 4j.

The completed parts are ejected from the pressure chambers by an ejector cylinder 6 having a piston rod 6a connected to a cross bar 6b fastened to the lower ends of the core rods 6c. The ejector cylinder is mounted on the base platen and is supplied by pressure operating fluid through fittings 6d and 6d. The two cavities are filled with the powder to be pressed from hoppers 7 having nozzles 7a which ride on the upper surface of the table top. The nozzles have wear rings spring loaded against the table top so as to accommodate the opening and closing movement of the cross bar 3. The nozzles are connected to the cross bar so as to move angularly with the cross bar. This can be done by mounting the hopper 7 on the cross bar or by having flexible connections between the nozzles 7a and the hoppers so as to permit the angular movement.

In the closed position of the press as shown in FIG. 2, the nozzles 7a are to one side of the openings 4a at the upper ends of the pressure chambers 4. The nozzles are brought to the fill position by pivoting the cross bar 3 in a counterclockwise direction to bring the fill nozzles 7a into alignment with the openings 4a. This allows the material in the hoppers to flow through the openings and fill the cavities around the core rods 4e. A movement of the cross bar 3 in a clockwise direction from the position shown in FIG. 2 uncovers the openings 4a to permit ejection of the pressed parts from the cavities.

The indexing motion of the cross bar for filling and ejecting may be accomplished by any suitable means. An index cylinder 11 connected by swivel fitting 11a to the under side of the table top 5 and having its piston rod 11b connected by a swivel fitting 11c to the cross bar 3 is one way of providing the indexing movement when only two pressure chambers 4 are used. If six pressure chambers were used it would be more convenient to index the cross bar 3 in 60 degree steps so that at each position two of the chambers could be in the pressurizing position, two of the chambers in the fill position and the remaining two of the chambers in the eject position.

The high pressure fluid for the pressure chamber 4 can be supplied by any conventional pumping system (not shown) (booster pump, intensifier, hydraulic pump, hydraulic-air pump, etc). Fluid at lower pressure, e.g. before its pressure is boosted by an intensifier, etc. may be used for the clamp, ejector and index cylinders.

The pressure chambers 4 are designed to operate at low or high pressure. The operating pressure range is limited only by the material used and by the pressure intensification system and not by the design concept.

The pressure chambers 4 are rigidly mounted to the base platen 1 and all high pressure connections are rigid and require no moving seals.

The base sequence of operation of the two pressure chambers 4 and the six pressure chambers 4 press are the same. However, the indexing of the cross bar 3 is different on the two presses. The basic sequence for both presses are:

1. Fill the pressure chamber 4 with powder.
2. Press the powder.
3. Eject the finished, pressed, part. On the two cavity press, the indexing required of the cross bar 3 to achieve the above basic sequence is as follows:
   1. Index the cross bar 3 clockwise, and eject the finished part from the two pressure chambers 4.
   2. Index the cross bar 3 again clockwise until the feed discharge outlets 7a are over the pressure chambers 4. This will fill the pressure chambers 4 with powder.
3. Index the cross bar 3 counter clockwise until the cross bar 3 is directly over the two pressure chambers 4. Clamp the cross bar 3 against the top of the pressure chambers 4 with the clamp cylinder 2, sealing the two pressure chambers 4. Pressureize the two pressure chambers 4 with high pressure fluid and depressurize. Release the clamping action on the cross bar 3 and elevate the cross bar 3 above the table top a small amount (e.g. 1/16") with the clamp cylinder 2. Return to step one above and
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index the cross bar 3 clockwise, starting a new cycle. On the six cavity 4 press, the indexing required of the cross bar 3 to achieve the basic sequence is as follows:

1. The indexing on this press consists of six equal steps of 60° each for 360°. At each step, the basic sequence listed above is accomplished. In other words, the three functions of press, fill and eject are all accomplished at the same time. Two pressure chambers 4 under the cross bar 3 will be pressurized and depressurized. The two pressure chambers 4 in front of the cross bar 3 will be filled with powder from the feed discharge outlet 7a. And the last two pressure chambers 4 located in back of the cross bar 3 will be ejecting finished parts. The clamp cylinder 2 will then unclamp the cross bar 3 and the cross bar will index 60° and the above cycle will be repeated.

What is claimed is:

1. An isostatic press comprising, a base platen, a clamp cylinder mounted on the platen, pressure chambers for isostatic pressing fluid mounted on the platen in a circle around the cylinder, said chambers having open ends on opposite sides of the cylinder, a piston in the cylinder, a cross bar, means for mounting the mid section of the cross bar in thrust relation to the piston and for rotation relative to the piston in a plane normal to the axis of the cylinder with the ends of the cross bar adapted to be pulled by the piston into sealing engagement with the open ends of the pressure chambers, said piston and cylinder comprising the frame of the press taking the load exerted by the pressure chambers on the base platen and cross bar, a flexible envelope means in said chambers, and means for supplying fluid pressure to said chambers for isostatic pressing material within said envelope means.

2. The press of claim 1 having a table top with an upper surface lying in a plane normal to the axis of the cylinder and common to the open ends of said chambers.

3. The press of claim 1 having material feed nozzles and means for indexing the feed nozzles into registry with the open ends of the chambers by rotation of the cross bar.

4. The press of claim 1 in which the envelope means has open upper ends sealed to the chambers in register with the open ends of the chambers.

5. The press of claim 4 in which the isostatic pressure is supplied external to the envelope means.

6. The press of claim 3 in which the feed nozzles are on hoppers carried by the cross bar.

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