May 11, 1965 H. T. HALL 3,182,353

GUIDE MEANS FOR HIGH PRESSURE PRESS

Filed Jan. 29, 1963 *5 Sheets-Sheet 1*

Fig 1.

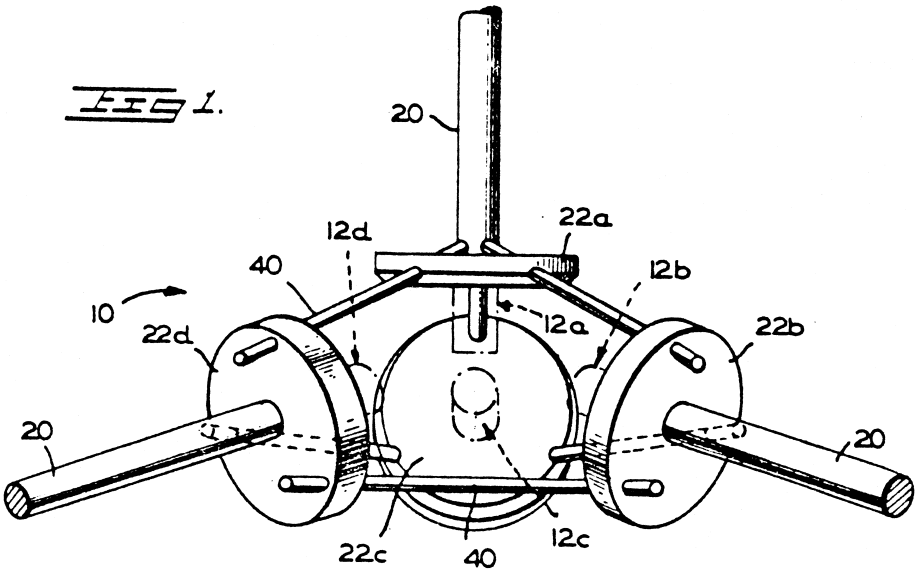
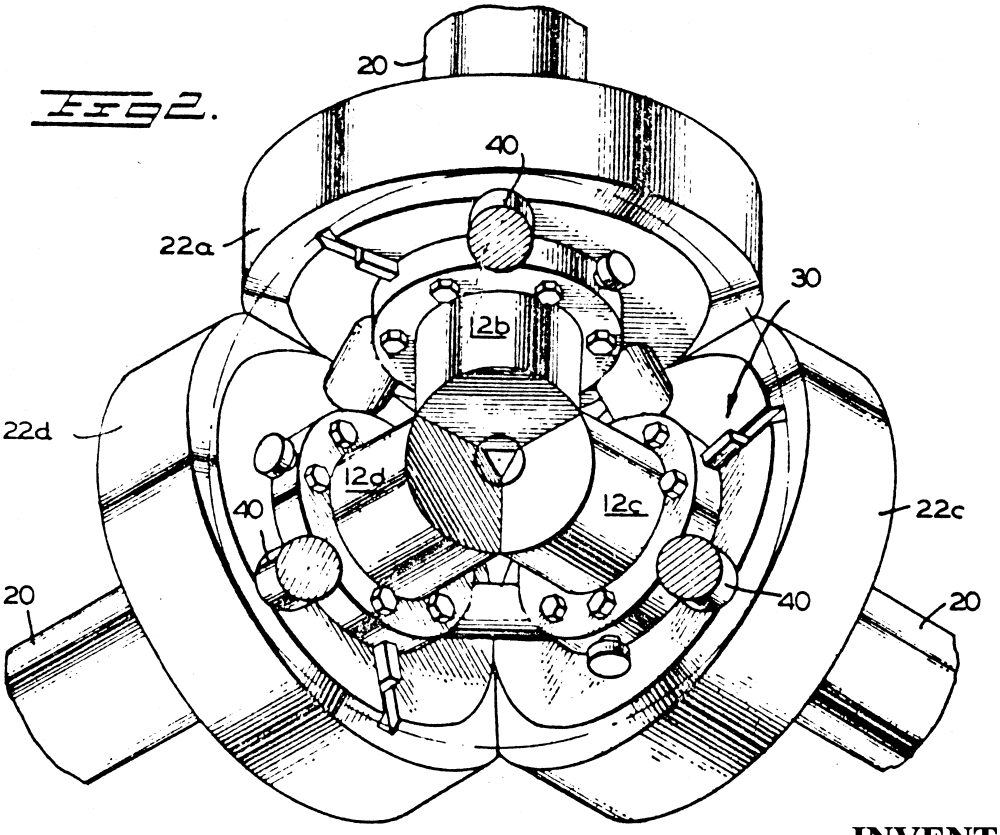


Fig 2.



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GUIDE MEANS FOR HIGH PRESSURE PRESS

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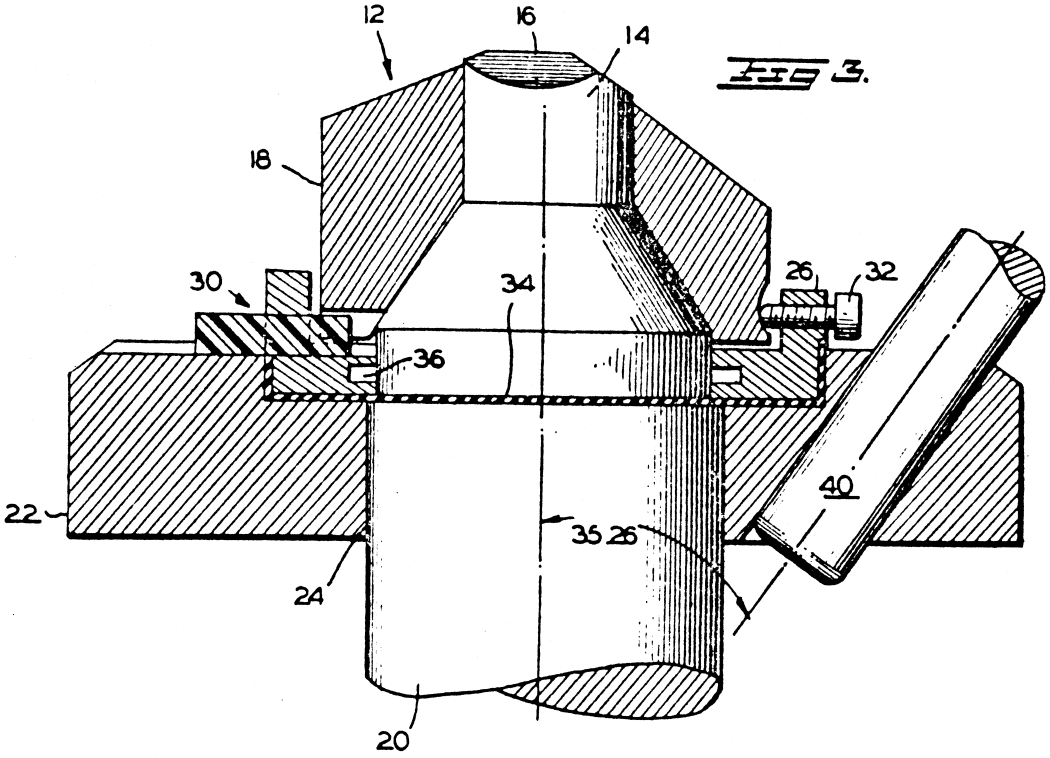
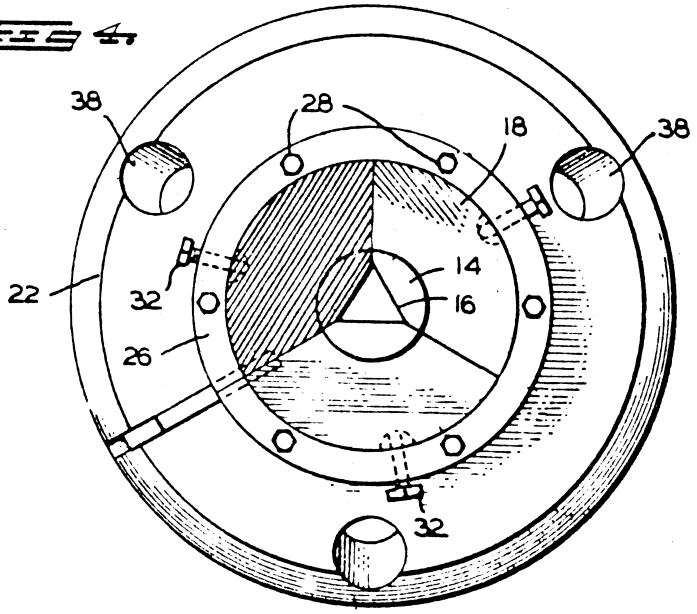


Fig 3.

Fig 4.



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GUIDE MEANS FOR HIGH PRESSURE PRESS

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Fig 5.

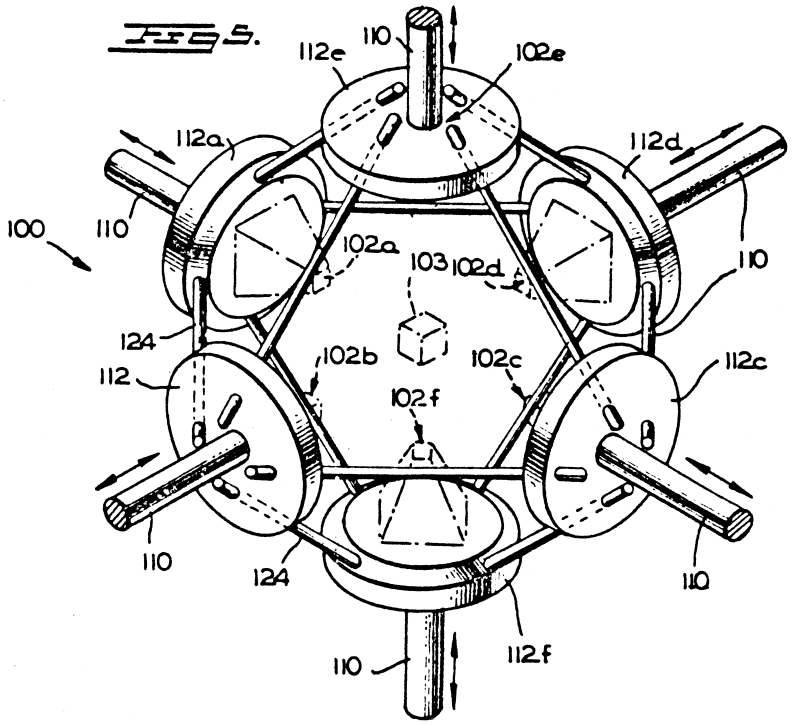

Fig 6.

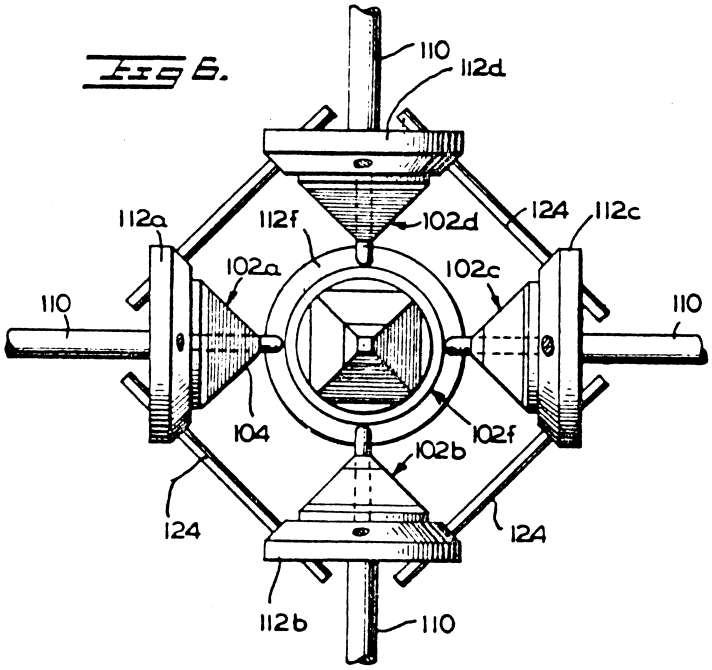

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Fig 7.

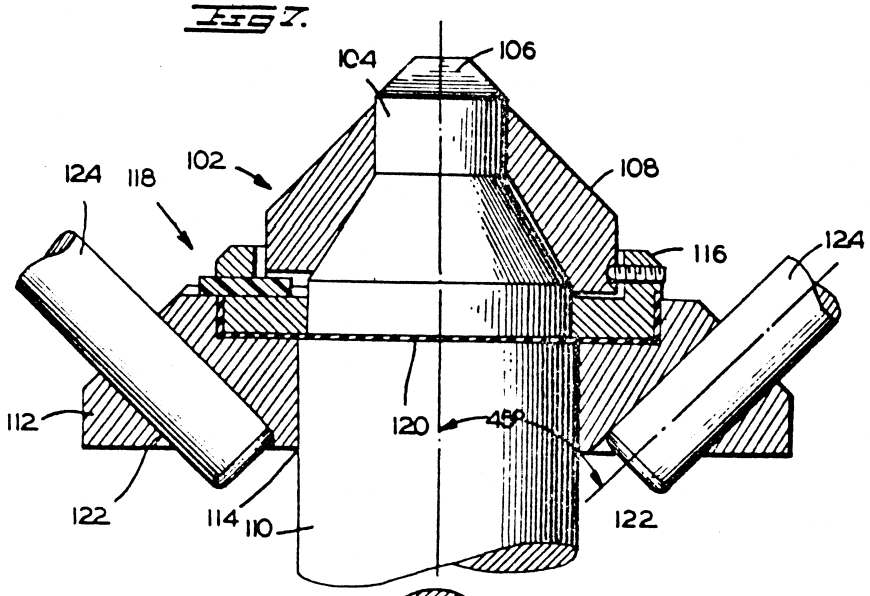

Fig 8.

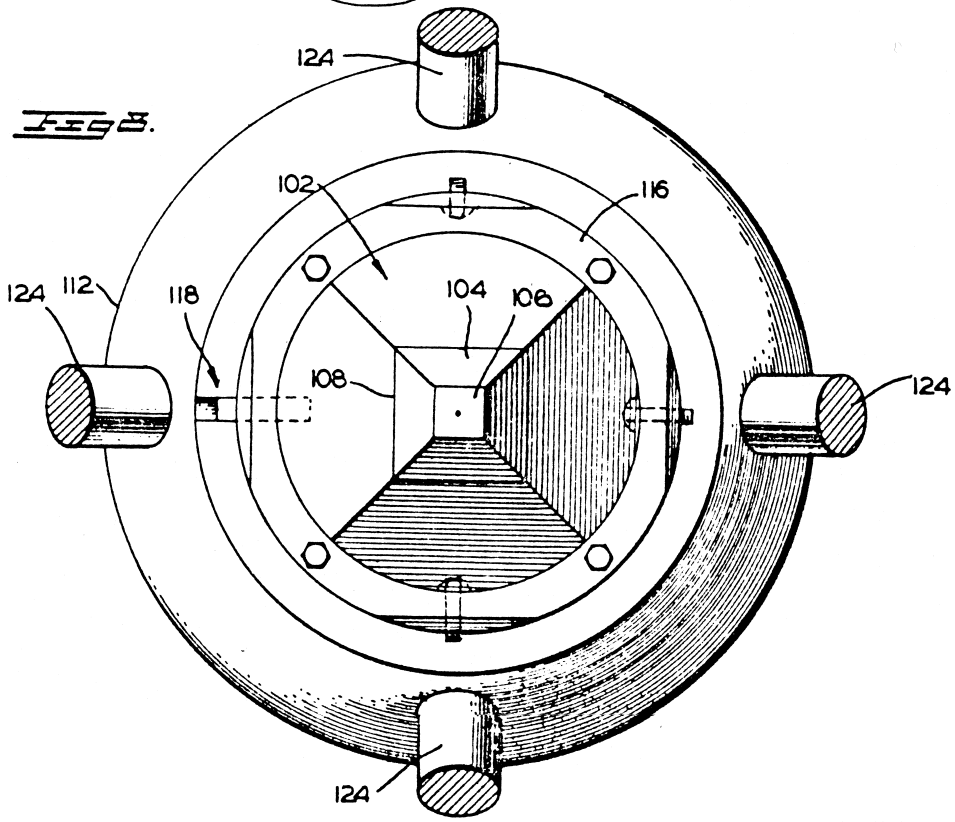

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Fig 9.

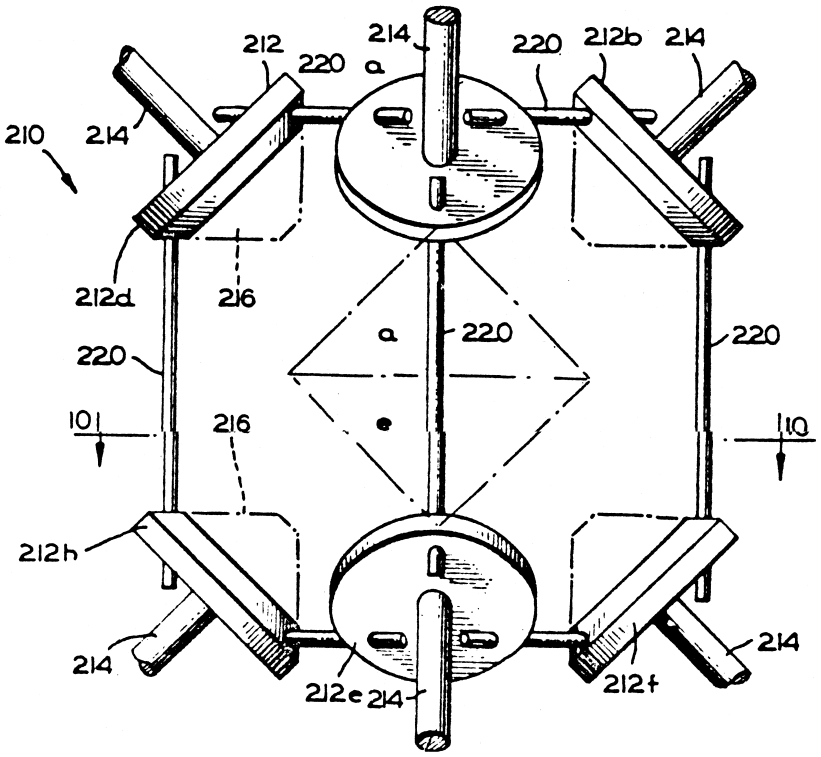
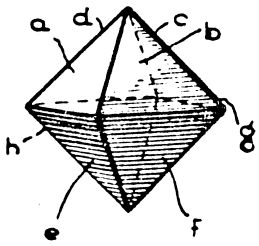


Fig 11.



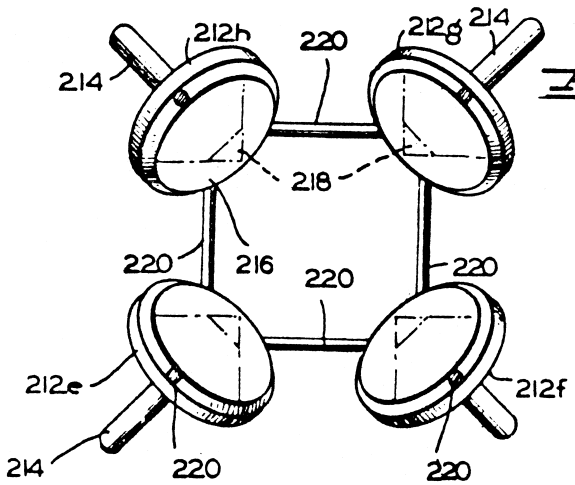


Fig 10.

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United States Patent Office 3,182,353

Patented May 11, 1965

3,182,353

GUIDE MEANS FOR HIGH PRESSURE PRESS

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Filed Jan. 29, 1963, Ser. No. 254,747

5 Claims. (Cl. 18-16)

This invention relates to guide and alignment means for multiple press member, high pressure presses and, in particular, to guide and alignment means for high pressure presses which include a plurality of press members which are moved rectilinearly toward a common point to form a closed polyhedral press cell.

It is a particular object of the present invention to provide guide means which simplify the operation of multiple press member presses by greatly reducing the time required to close the press members and which insure proper alignment of the press members at all times, thereby substantially increasing the operating life of the press members and, at the same time, providing for more reproducible results from high pressure apparatus.

It is another object to provide guide and alignment means for high pressure presses having a plurality of press members which move along rectilinear paths toward a common point to form closed regular polyhedra such as the tetrahedron, cube, octahedron, and dodecahedron and which may also be employed with unsymmetrical polyhedra, the press elements of which move along rectilinear paths toward a common center to form triangular prism shaped cells, rectilinear parallelepiped cells and the like.

In general, the invention embodied in a high pressure press including a plurality of press members, means for moving each of the press members rectilinearly toward a common point to form a closed polyhedral press cell; guide means interconnecting the press members whereby each press member is simultaneously guided toward the common point comprising a guide block secured to move with each press member toward the common point, a rectilinear opening in each of the guide block's axially aligned with a cooperating rectilinear opening in each adjacent guide block, and a rectilinear guide rod having opposite end portions slidably positioned in each cooperating, pair of openings in adjacent guide blocks.

The invention will be more particularly described with reference to the accompanying drawings wherein:

FIG. 1 is a diagrammatic perspective view of a tetrahedral press including the guide blocks and guide rods of the invention;

FIG. 2 is an enlarged detailed perspective view of three press members and associated guide plates and guide rods for the tetrahedral press;

FIG. 3 is an enlarged partial sectional view of one anvil member guide plate and guide rods for the tetrahedral press;

FIG. 4 is a top plan view of the structure shown in FIG. 3;

FIG. 5 is a diagrammatic perspective view of a cubical press including the guide plates and guide rods;

FIG. 6 is a sectional view of the structures shown in FIG. 5 through the axis of four of the ram elements of the press;

FIG. 7 is an enlarged fragmentary partial sectional view of one of the press elements and guide plates illustrated in FIGS. 5 and 6;

FIG. 8 is a top plan view of the structures shown in FIG. 7;

FIG. 9 is a diagrammatic perspective view of an octahedral press including the improved guide rods and guide plates of the invention;

FIG. 10 is a section substantially on line 10-10 of FIG. 9; and

FIG. 11 is a perspective view of an octahedron.

In multiple, press member high pressure apparatus, typified by the tetrahedral press disclosed in my United States Patent 2,918,699, issued December 29, 1959, the hydraulic rams have usually been valved independently for urging each of the press members toward the press closed position. The position of each ram and, consequently the position of each press member, during the operation of closing of the press has been indicated by precision gauges. To operate a tetrahedral press such as shown in Patent No. 2,918,699, it has been customary to individually position the lower triad of press members to form a nest. The sample containing pyrophyllite tetrahedron is then oriented with

one of its apices facing downwardly in the nest formed by the triad of press elements. Then the upper, vertical press member is brought into position against the upward facing base of the pyrophyllite tetrahedron. At this point each of the press elements is individually moved by small incremental amounts until the press elements have positively engaged the pyrophyllite tetrahedron sample holder and a good press gasket has formed by extrusion of the pyrophyllite tetrahedron edges between the sloping press faces. This procedure usually requires a total of three incremental adjustments for each press ram performed in systematic order. After the pyrophyllite gasket has formed, all valves to the hydraulic rams driving the press members are opened and hydraulic pressure is then simultaneously applied to each ram. During the course of increasing pressure, it has been found to be often necessary to stop the flow of hydraulic fluid to individual rams for brief intervals in order to maintain equal advance of the press members toward the common center point of the tetrahedral cell.

Failure to maintain equal press member advance leads to premature gasket formation which results in a loss of press

Through the use of the anvil guide and alignment means of the invention, this problem is eliminated

The simplest polyhedra is the tetrahedron and guide means for a tetrahedral press of the type disclosed in United States Patent No. 2,918,699 is illustrated in FIGS. 1 through 4 of the drawings. Referring to FIGS. I through 4, 10 generally designates a tetrahedral high pressure press and includes four press members which, while identical in construction and generally designated with the reference numeral 12, are also identified by the letter designations a, b, c and d so that the orientation of the press members with respect to one another may be more readily visualized.

Each of the press members 12 comprises an anvil member 14 having an equilateral triangular face 16 at the extended end thereof with the side walls of each of the members 14 sloping away from its equilateral triangular face 16 along each of the edges thereof as more clearly shown in FIGS. 3 and 4.

In the form of the invention shown in the drawings, each of the anvil members is supported in a binding ring 18, and each binding ring is provided with sloping faces which form continuations of the sloping faces of the anvil members 14.

Each of the four press members 12 is moved along a rectilinear path toward a common center by four hydraulic rams, the piston rods of which are illustrated at 20. As is known in the art and as shown in U.S. Patent 2,918,699, each of the piston rods 20 is associated with a hydraulic ram which rams are connected to a source of pressure fluid through suitable valved conduit means whereby each press member 12 may be moved into and out of the press closed position.

The press member guide and aligning means of the invention includes a guide plate or block 22a, b, c and d, one for each of the press members. The guide blocks 22 are bored as at 24 to receive the extended end of its respective piston rod 20 and each of the guide blocks 22 may be secured to the end of its piston rod by suitable set screws or the like, not shown in the drawings. Each of the guide blocks 22 is adapted to receive a centering ring or plate 26 which is secured to the guide plates by suitable threaded studs 28. Further, each of the press members, centering rings and guide blocks 22 is oriented by means of suitable keys and keyways generally designated 30 cooperating with centering screw means 32. A suitable electrical insulating strip 34 may be provided between each of the guide blocks, the top of its piston rod and its cooperating centering ring or plate where electrical means are utilized for heating a sample maintained in the press during the pressing operation. Also, as illustrated in FIG. 3, a channel 36 may be provided in the centering ring and means, not illustrated in the drawings, may be employed for directing a cooling medium through said channel to prevent overheating of the press members or transmission of heat from the sample to other elements of the press assembly.

Each of the guide blocks 22 is provided with three rectilinear bores 38 spaced 120º from each other and oriented with respect to the triangular edges of the face 16 of its anvil member 14 such that one is positioned directly opposite an apex of the triangular face 16 as illustrated in FIG. 4 of the drawings. Further, each of the rectilinear bores 38 forms an angle of 35.26º with the center line of its piston rod 20 as illustrated in FIG. 3 of the drawings. Within each of the rectilinear bores 38 is slidably received one end of one of the guide rods 40, thus the assembly includes six guide rods to interconnect the four guide blocks of the tetrahedral press. Referring particularly to FIG. 1, it will be seen that the guide rods slidably received in the three bores in guide plate 22d extend to each of the other three guide plates 22a, b and c. Of the remaining three guide rods, one interconnects guide block 22a with guide block 22c; another

interconnects guide block 22a with guide block 22b; and the last interconnects guide block 22b with guide block 22c.

In an assembly where the diameter of the guide block is about 8 1/2 inches, it has been found that guide rods approximately 5 inches long and 1 inch in diameter will provide very satisfactory results. Further, it has been found that for case of operation, it is helpful if one end of each of the guide rods is secured such as by a set screw in one of the bores of one of its guide blocks, leaving the opposite end free to reciprocate in the bore in the adjacent guide block as the press is opened and closed.

It will be particularly noted that the axes of the guide rods form a regular tetrahedron and since all of the press members are interconnected by guide rods and plates, each of the four rams are forced to move synchronously together. Consequently, the press members move simultaneously and symmetrically toward the center of the press and as the rams move inwardly, the regular tetrahedron defined by the guide rod axes decreases in size.

The press member guide device described above for the tetrahedral press can be adapted for use with other types of multiple press member presses. For example, a cubic press utilizing six press members would require six guide blocks and 12 guide rods as illustrated in FIGS. 5, 6, 7 and 8. The guide blocks fastened to each of the six hydraulic rams would have four guide rod holes spaced around the periphery at 90º angles to each other with the axes of the rectilinear openings being at 45º angles with respect to the ram axes.

Referring particularly to FIGS. 5, 6, 7 and 8, such a cubic press provided with the press member guide and alignment means of the invention is generally illustrated at 100. The cubic press includes six press members which, while identical in construction and generally designated with the reference numeral 102 are also identified by one of the letter designations a through f so that the orientation of the press members may be more readily visualized. It will be particularly noted in FIGS. 5 and 6 that the sides of the cubical cell 103 are formed by press members 102a, b, c and d while the top is formed by press member 102e and the base by press member 102f.

Each of the press members 102 comprises an anvil member 104 having a square face at its extended end and each of the side walls of each of the members 104 slopes away from its square face along each of the edges thereof as more clearly shown in FIG. 8.

In the form of the invention shown in FIGS. 5 through 8, each of the anvil members 104 is supported in a binding ring 108, and each binding ring is provided with sloping faces which form continuations of the sloping faces of the anvil members 104.

Each of the six press members 102 is moved along a rectilinear path toward a common center by a hydraulic ram, the piston rods of which are illustrated at 110 and correspond with the piston rods 20 illustrated in FIGS. 1 through 4.

The press member guide and aligning means of the invention includes a guide block or plate 112a, b, c, d, e and f, one for each of the press members. The guide blocks 112 are bored as at 114 to receive the extended end of its respective piston rod 110 and each of the guide blocks 112 is secured to the end of its piston rod by suitable fastening means not shown in the drawings. The guide blocks 112 are each adapted to receive a centering ring 116 which corresponds to centering rings 26 of the form of the invention illustrated in FIGS. I through 4. The centering rings, the guide blocks and the press members are oriented by means of suitable keys and keyways generally designated at 118 and as illustrated in the prior form of the invention, an insulating strip 120 may be provided between each of the guide blocks, the top of its piston rod and its centering ring and press member.

Each of the guide blocks 112 is provided with four rectilinear bores 122 spaced 90º from each other and oriented with respect to the square edges of the face 106 of the anvil members 104 such That one is positioned directly opposite an edge as illustrated in FIG. 8 of the drawings. Further, each of the rectilinear bores 122 forms an angle of 45º with respect to its ram axis. Within each of the rectilinear bores 122 is slidably received one end of one of the guide rods 124, thus the assembly includes 12 guide rods to interconnect the six guide blocks of the cubical press.

As discussed with reference to the tetrahedral press, one end of each of the 12 guide rods is preferably secured by a set screw or the like in one of the bores of one of its guide blocks thereby leaving the opposite end to reciprocate in its adjacent guide block as the press is opened and closed.

In this form of the invention, it will be noted that the guide rods define a cube and since

all of the press members are interconnected by guide rods and plates, each of the six rams are forced to move synchronously and simultaneously together. Consequently, the press members are moved simultaneously and symmetrically toward the center of the press and as the rams move inwardly, the cube defined by the guide rod axes decreases in size.

The press member guide device is illustrated as applied to a press consisting of eight press members in FIGS. 9 and 10 with the press members closing to form a regular octahedron perspectively illustrated in FIG. 11. In the case of an octahedral press, there are a total of 12 guide rods symmetrically disposed at 120º angles with respect to each other around each ram axis. Thus, there are three bores in each of the guide plates of the octahedral press with each guide hole forming an angle of 54.74º with respect to its ram axis.

Referring specifically to FIG. 11, a regular octahedron is illustrated with faces a, b, c, d, e, f, g, and h. The press is thus provided with eight guide plates 212a through 212h (plate 212c not being shown in the drawings). Each of the guide plates is secured to the end of a piston rod 214 associated with a hydraulic ram not illustrated in the drawings. Each of the guide plates 212a through h also has secured thereto a press member 216 including an anvil portion having a regular triangular face 218. The press guide plates 212a through h are each provided with three rectilinear bores symmetrically disposed at 120º angles with respect to each other with the bores aligned with the edges of the triangular faces 218 of their respective anvil members.

The rectilinear bores in each of the guide plates form an angle of 54.74º with respect to the axis of their respective piston rods 214. The assembly also includes 12 guide rods 220. Opposite ends of the guide rods are slidably received in their respective bores in the guide plates whereby each guide plate is interconnected to adjacent guide plates to provide an assembly of guide rods which define an octahedron which decreases in size as the press members are urged toward the press closed position.

As hereinbefore discussed, the principles of the invention are also applicable to unsymmetrical polyhedral presses. It will be appreciated that in the case of unsymmetrical polyhedral presses, the number of openings in each of the guide blocks also correspond to the number of edges on its respective press member and that the interconnecting guide rods are positioned to define the selected unsymmetrical polyhedral press cell.

I claim:

1. In a high pressure press including a plurality of press members, means for moving each of the press members rectilinearly toward a common point to form a closed polyhedral press cell; guide means interconnecting the press members whereby each press member is simultaneously guided toward the common point comprising a guide block secured to move with each press member toward the common point, a rectilinear opening in each of the guide blocks axially aligned with a cooperating rectilinear opening in each adjacent guide block, and a rectilinear guide rod having opposite end portions slidably positioned in each cooperating pair of openings in adjacent guide blocks.

2. In a high pressure polyhedral press including a press member for each face of the polyhedra means for moving each of the press members rectilinearly toward a common point to form a closed polyhedral press cell, each of the press members having a face, the edges of which correspond to the edges of the respective face of the polyhedral press cell, guide means interconnecting the press members whereby each press member is simultaneously guided toward the common point comprising a guide block secured to move with each press member toward the common point, a rectilinear opening in each of the guide blocks opposite an edge of the face formed on each of the press members and axially aligned with a cooperating rectilinear opening in adjacent guide blocks, and a rectilinear guide rod having opposite end portions slidably positioned in each cooperating pair of openings in adjacent guide block.

3. The invention defined in claim 1 wherein the polyhedral press cell comprises a regular polyhedron.

4. The invention defined in claim 3 wherein the regular polyhedron comprises a tetrahedron.

5. In a high pressure tetrahedral press including four press members, means for moving each of the press members rectilinearly toward a common point to form a closed tetrahedral press cell; guide means interconnecting the press members whereby each press member is simultaneously and uniformly guided toward the common point comprising a guide block secured to move with each of the press members toward the common point, three rectilinear openings in each of the guide blocks axially aligned with cooperating rectilinear openings in each adjacent guide block, and a rectilinear guide rod having

opposite end portions slidably positioned in each cooperating pair of openings in adjacent guide blocks.

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