United States Patent

Schmaus

[15] **3,647,332**

[45] **Mar. 7, 1972**

[54] HYDRAULIC PRESS

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[73] Assignee: **Parker Hannifin Corporation,** Cleveland, Ohio

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[21] Appl. No.: **854,222**

[52] **U.S. Cl.** **425/78,** 425/344

[51] **Int. Cl.** **B30b 11/00**

[58] **Field of Search** 18/16.5, 16.7

[56] **References Cited**

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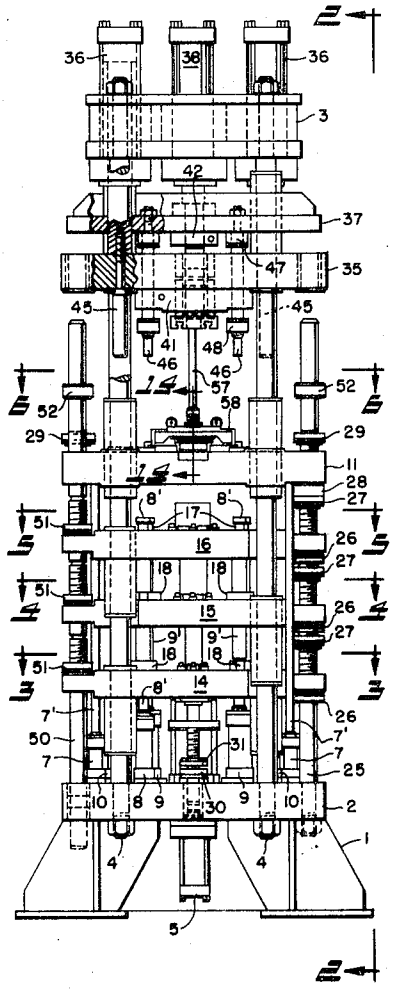
Primary Examiner—J. Howard Flint, Jr.

Attorney—Oberlin, Maky, Donnelly & Renner

[57] **ABSTRACT**

A hydraulic press having upper and lower hydraulically actuated punches which are moved toward each other in a die containing powdered metal, the upper punch and die having interengageable positive stops and the upper and lower punches having interengageable positive stops so that the powdered metal is compressed by the punches to form an article of precise size. The downward force of the upper punch exceeds the upward force of the lower punch to assure engagement of the upper punch and die stops and to prevent premature upward movement of the upper punch out of the die. The press has control valves operative to cause upward movement of the punches in unison with respect to the die while the upper and lower punch stops are retained in engagement, thus to strip or eject the article from the die. In a press which has multiple lower punches pressure control valves set at selected pressures control the upward and downward sequence of operation of the lower punches respectively to produce an article of uniform density and to effect stripping or ejection of the article from the lower punches without chipping off corners of the article. Multiple fluid motors of different sizes may be selectively coupled to multiple lower punches according to the sizes of the punches.

11 Claims, 15 Drawing Figures



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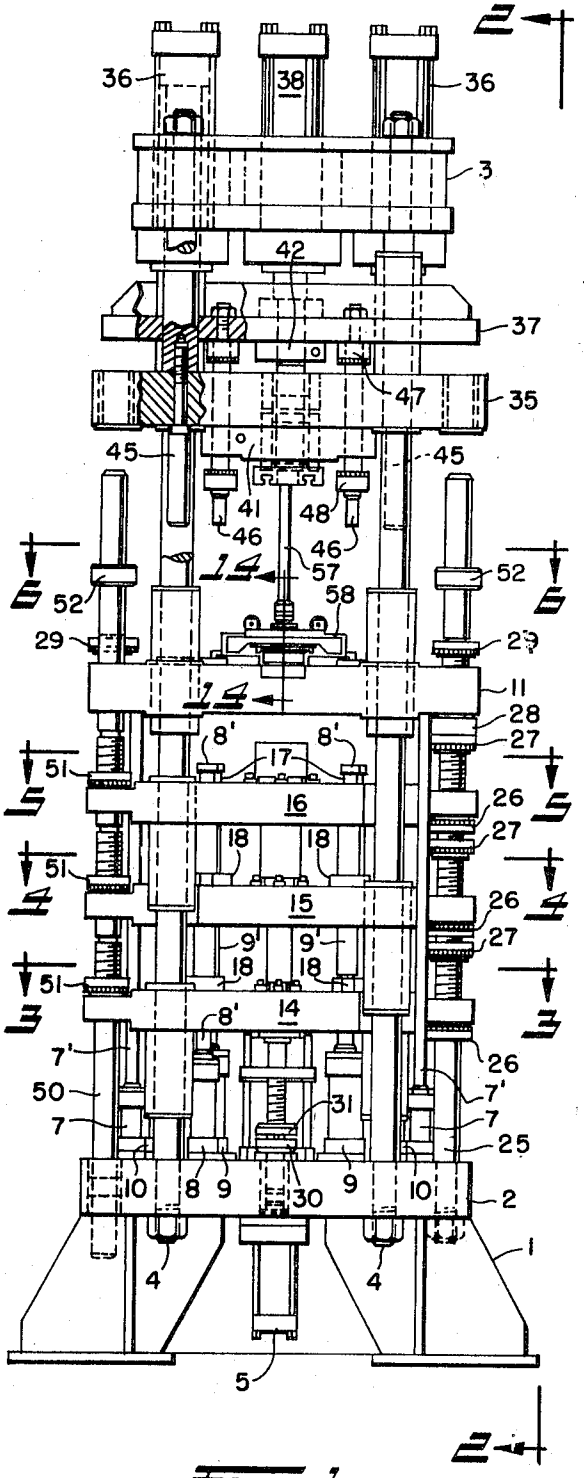


FIG. 1

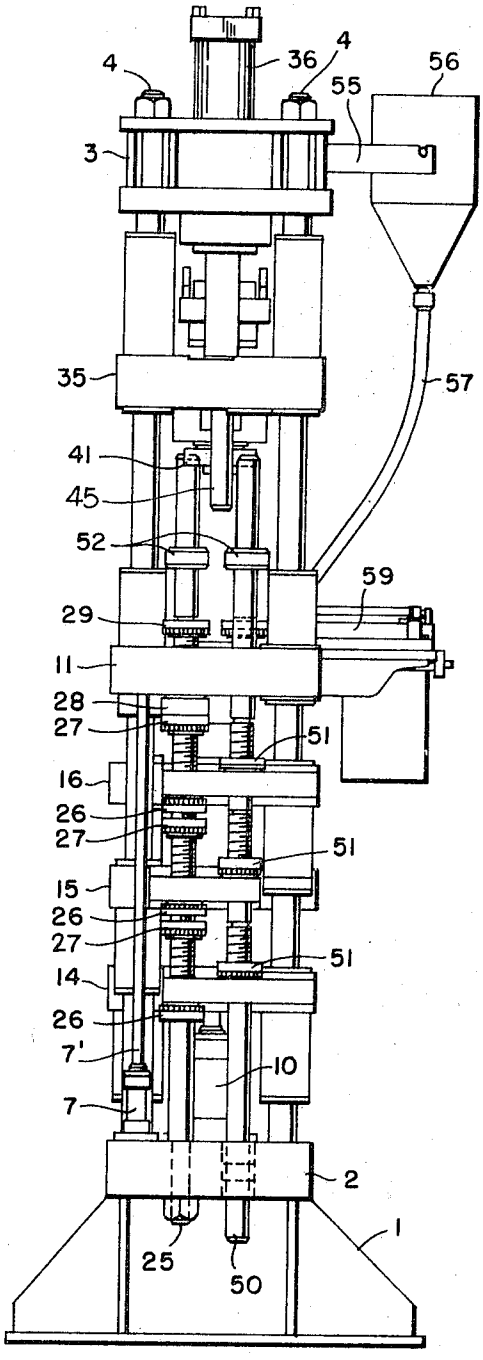


FIG. 2

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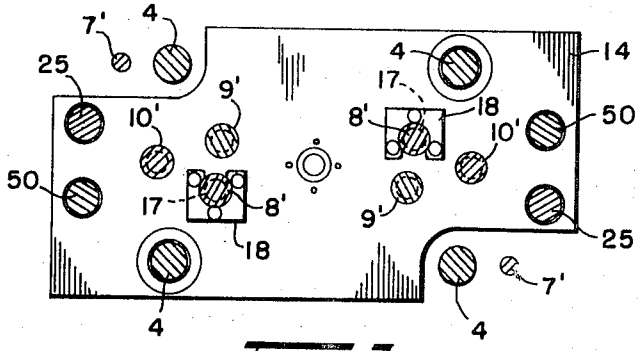


Fig. 3

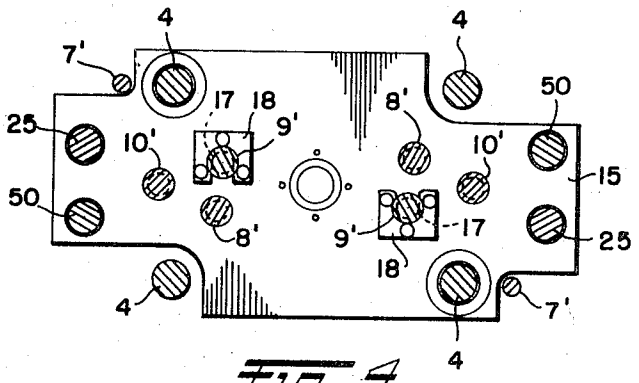


Fig. 4

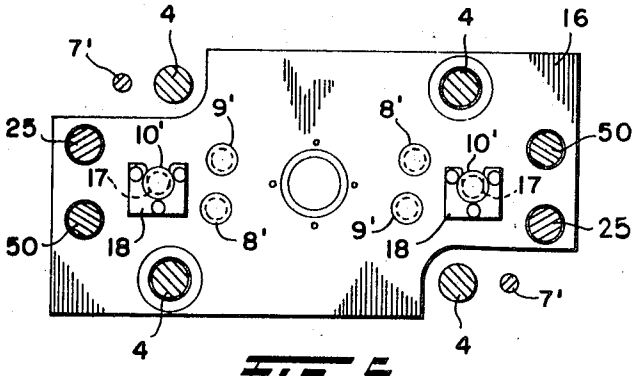


Fig. 5

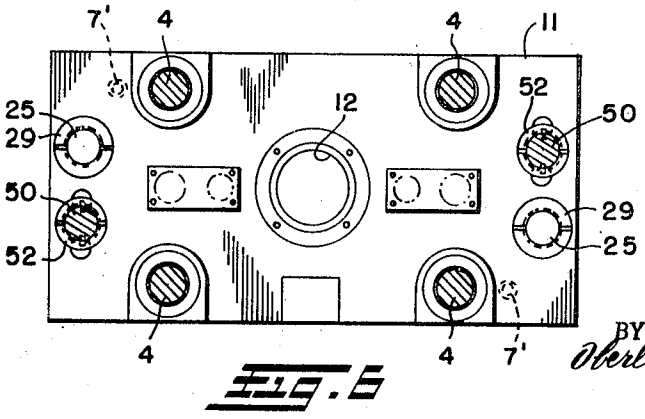


Fig. 6

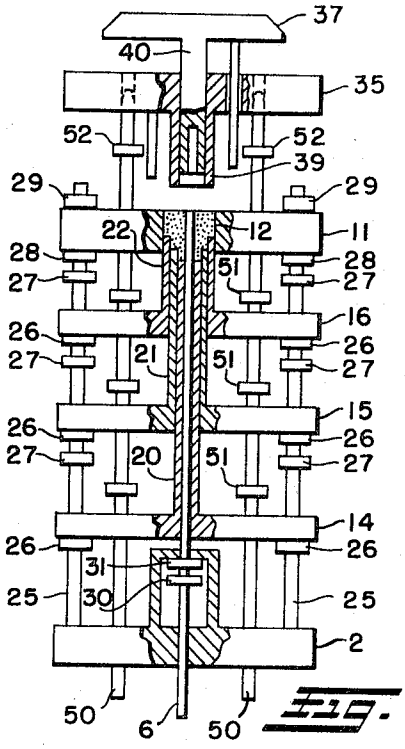


Fig. 7

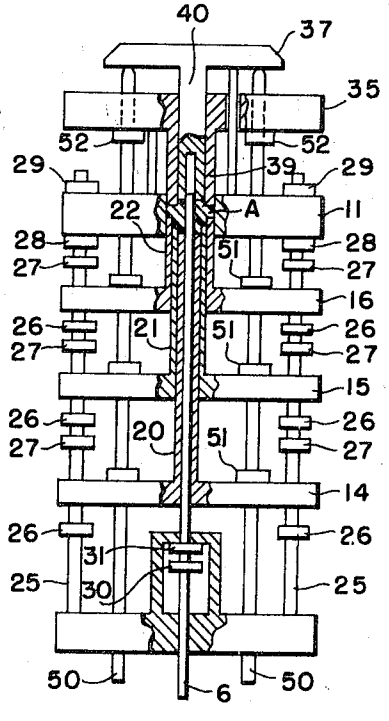


Fig. 8

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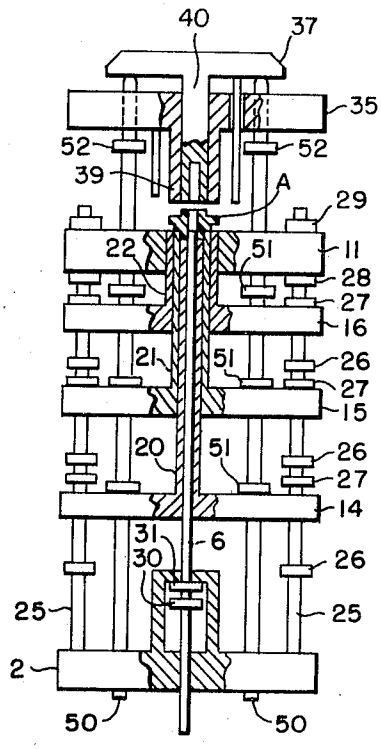


Fig. 9

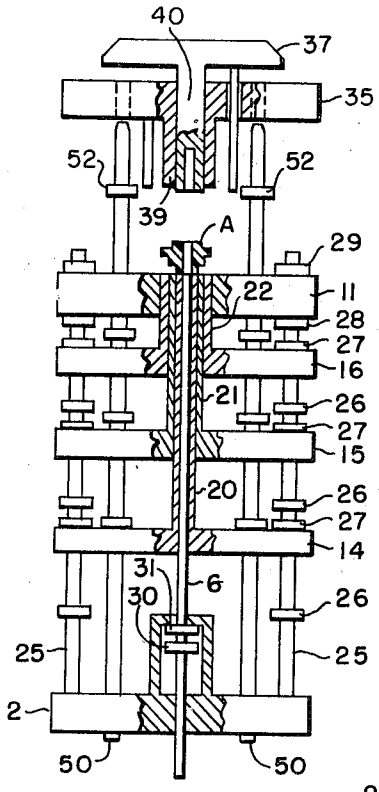


Fig. 10

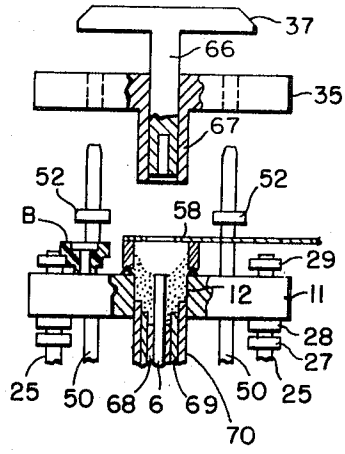


Fig. 11

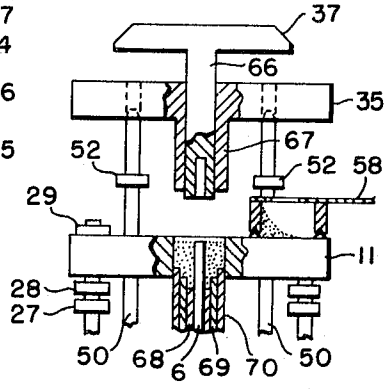


Fig. 12

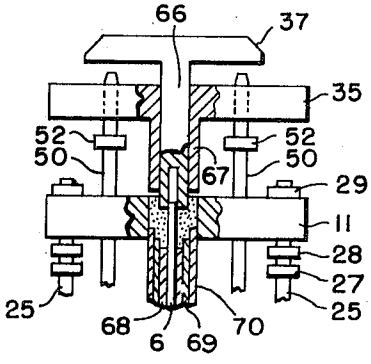


Fig. 13

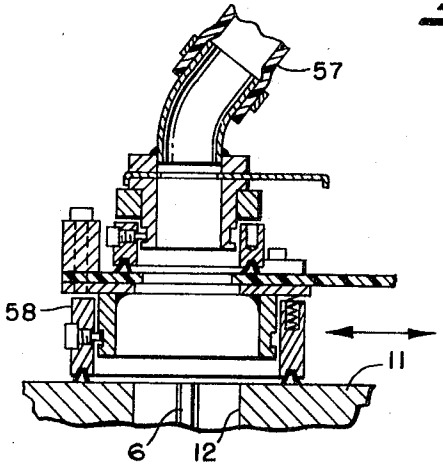
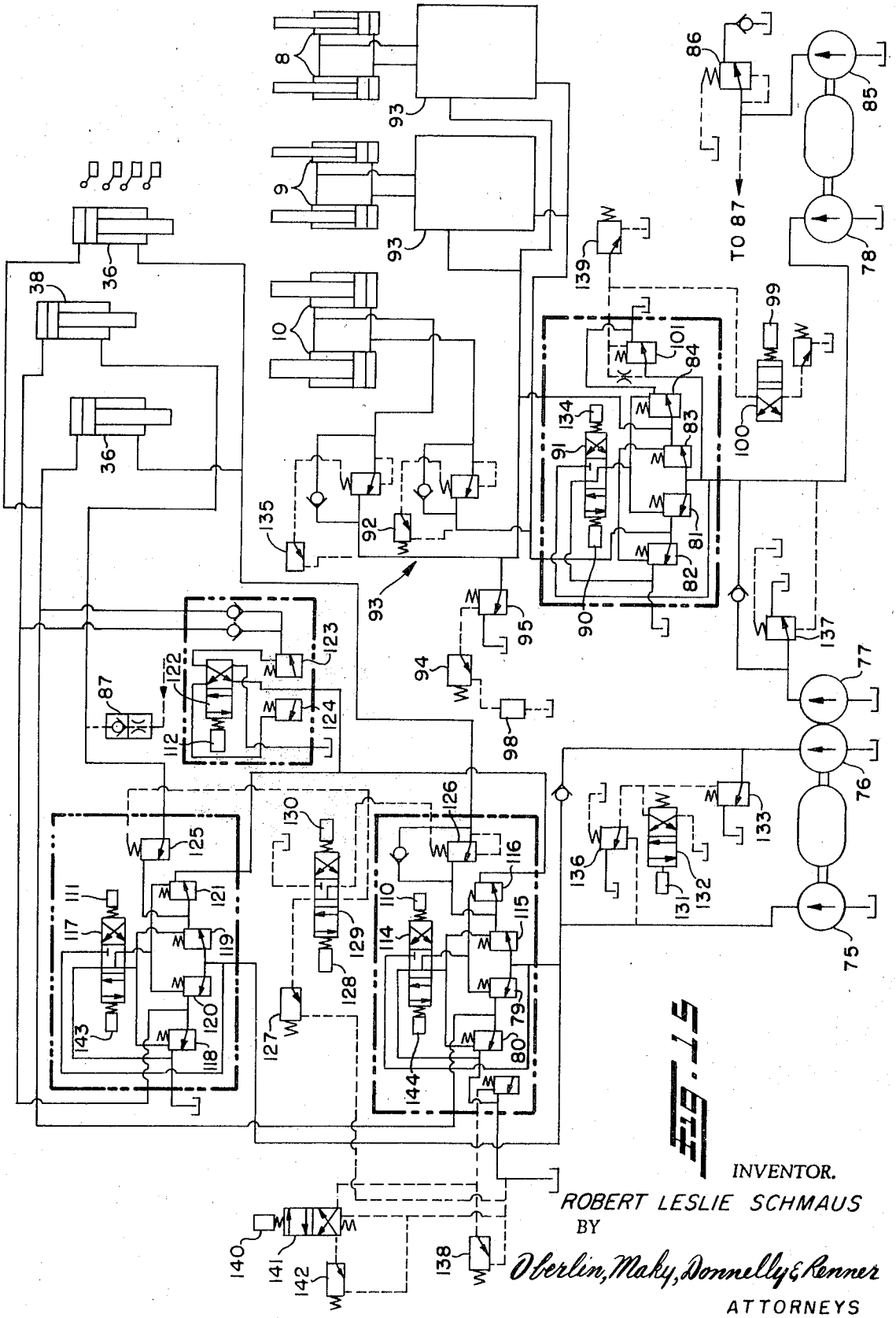


Fig. 14

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HYDRAULIC PRESS

BACKGROUND OF THE INVENTION

The production of articles from powdered metal involves (1) mechanical consolidation of the powder and (2) heating of the compacted article to a temperature whereat the particles cohere by grain growth or by fusion of one of the constituents. Generally, a measured amount of powder is fed into the die and is compacted therein by punches to produce an article which may have a density of about 80 percent of that of solid metal. However, except in the case of low melting point powdered metals, the compacted article is mechanically weak and must be handled with care.

In known compacting presses, one punch defining one end portion of the article is inserted into a die and is backed up against retraction by a removable stop, and another punch defining the other end portion of the article is hydraulically actuated to compress the powder against said one punch whereby the size of the compacted article is determined by the hydraulic pressure and the initial volume or weight of powder in the die. Accordingly, the end to end dimensions of the compacted article may vary substantially, and when the compacted article is to be stripped or ejected from the die, the removable stop is disengaged from said one punch whereby continued actuation of said another punch pushes the compacted article out of the die while the released punch is correspondingly moved by the article itself. Thus, the back pressure of the released punch due to gravitational and/or frictional forces applies compressive load on the compacted article as it emerges unsupported by the die which is apt to cause breakage or disintegration of the then mechanically weak article.

SUMMARY OF THE INVENTION

In the press herein disclosed, opposed punches are moved toward each other and into the die cavity to form the molded article, both punches engaging an interposed spacer member to limit travel of the punches toward each other, and both punches and the spacer member while so engaged being movable in one direction for ejecting the article from the molding cavity to thereby avoid compressively loading that portion of the article not supported by the die during ejection, this constituting a principal object of this invention.

It is another object of this invention to provide a hydraulic press of the character indicated wherein a plurality of punch-actuating cylinders may be selectively coupled to the respective punches, the cylinders preferably being of different sizes so that the smaller punches may be actuated by the smaller cylinders to provide for desired compaction pressure.

Another object of this invention is to provide a hydraulic press of the character indicated wherein a plurality of punch-actuating cylinders are operated in desired sequence by varying the counterbalance or back pressure so that the cylinder with the lowest counterbalance pressure is first actuated so that its plunger presses the powder to predetermined extent, whereupon as the reaction pressure builds up to that of the cylinder with the next higher counterbalance pressure is actuated so that its plunger commences to press on the powder, etc.

It is another object of this invention to provide a hydraulic press of the character indicated wherein after the punches have been actuated to their predetermined stop positions, i.e., the locked position wherein the punches are fixed relative to one another, fluid pressure in the cylinder at one end is decreased so that pressure in the cylinder at the other end will overcome gravitational and/or frictional forces and will move the punches in unison to eject the article from the die without relative movement of the punches with respect to one another.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation view of a hydraulic press embodying the present invention;

FIG. 2 is a side elevation view as viewed along the line 2—2, FIG. 1;

FIGS. 3 to 6 are horizontal cross section views taken along the lines 3—3, 4—4, 5—5, and 6—6 of FIG. 1, respectively;

FIGS. 7 to 10 are diagrammatic views illustrating the relative positions of the press parts during the making of a powdered metal article;

FIGS. 11 to 13 are diagrammatic views illustrating operation of the press in such manner that, after filling of the die with a predetermined amount of powder, the die cavity is enlarged so that the level of the powder is beneath the top of the die as is desirable in forming an article having a recess in its upper end, thus to prevent spilling over of the powder when the upper punch enters the die;

FIG. 14 is a cross section view of a powder feeder for filling the die; and

FIG. 15 is a schematic piping diagram of the hydraulic system for operating the press.

DETAILED DESCRIPTION OF THE INVENTION

The hydraulic press herein illustrated comprises a base 1 having a lower fixed head 2 and an upper fixed head 3 interconnected by four posts or tie bars 4. The lower head 2 has mounted thereon (a) a central hydraulic cylinder 5 which operates the core rod 6 (see FIGS. 7 to 13) for forming the passage in the article A (or for forming a recess or hub in the lower end of the article) and (b) four pairs of cylinders 7, 8, 9 and 10 whose piston rods 7', 8', 9', and 10' are respectively connected to a die platen 11 which has a die opening 12 (see FIGS. 7 to 14) defining the outside wall of the article A and to bottom, middle, and top platens 14, 15, and 16, the platens 11, 14, 15, and 16 being vertically slidably guided on said tie bars 4. As shown in FIGS. 1 and 3 to 5, the three pairs of piston rods 8', 9', and 10' each have three grooves 17 which connect to the respective platens 14, 15, and 16 by means of clamp blocks 18 bolted onto the platens to the selected grooves 17. Thus, any one of the platens 14, 15, or 16 may be operated by any pair of cylinders 8, 9, or 10. In the present case, the inner punch 20 on the bottom platen 14 is actuated by the smallest pair of cylinders 8, the middle punch 21 on the middle platen 15 is actuated by the intermediate size cylinders 9, and the outer punch 22 on the top platen 16 is actuated by the largest pair of cylinders 10.

The lower head 2 has secured thereto a pair of fixed columns 25 having adjustable stop collars 26 and 27 thereon of which the collars 26 determine the lowermost (die filling) positions of the punch platens 14, 15, and 16, as shown in FIG. 7 and of which the collars 27 determine the uppermost (article ejecting) positions of the punch platens 14, 15, and 16, as shown in FIG. 10.

The lower collar 28 on each column 25 is fixed to determine the fixed lower position of the die platen and the upper adjustable collar 29 determines the uppermost (underfill) position of the die platen 11 as shown in FIG. 12. Similar adjustable stop collars 30 and 31 on the piston rod 5' determine the lowermost and uppermost positions of the core rod 6.

The upper outer or main punch platen 35 is actuated by a pair of hydraulic cylinders 36 mounted on the upper head 3 and the upper inner punch platen 37 is actuated by a single cylinder 38 on said upper head 3. The punches 39 and 40 mounted on the respective platens 35 and 37 are adjusted as by means of worm gear adjusted nuts 41 and 42. The main upper platen 35 has a pair of stop rods 45 secured thereto adapted to engage the die platen 11, and the upper inner punch platen 37 also has a pair of rods 46 extending through the main platen. The rods 46 have adjustable collars 47 and 48 thereon to permit predetermined relative movement of the platens 35 and 37 during advance toward the die platen 11 or during ejection or stripping of the article A from the punches 39 and 40.

Slidably guided in said lower head 2 and die platen 11 and extending through the punch platens 14, 15, and 16 and the die platen 11, are a pair of floating spacer columns 50 having

adjustable stop collars 51 to determine the positions of the three punch platens 14, 15, and 16 with respect to the fixed reference collars 52 on said floating columns 50, said reference collars 52 being adapted to engage the main upper platen 35 as the platens 14, 15, and 16 move upwardly and as the columns 50 move upwardly by engagement of the adjustable collars 51 with the platens 14, 15, and 16. The upper ends of the floating columns 50 are also adapted to engage the upper inner punch platen 37 whereby, as shown in FIG. 8, all of the platens 14, 15, 16, 35, and 37 are in locked condition to accurately form the article A by the precise and fixed relative spacings of the punches 20, 21, 22, 39, and 40. In order to compensate for shortening of the floating columns 50 under compression and to assure that the upper ends thereof and the fixed reference collars 52 thereof will firmly abut the platens 37 and 35 respectively, the lower ends of the rods 46 will be slightly higher than the lower ends of the stop rods 45. In this way, the upper ends of the floating columns 50 will engage platen 37 with accompanying squeezing of the article A between the punches 20, 21, 22 and the main punch 39 until collars 52 firmly engage the main platen 35.

The upper head 3 has thereon a bracket 55 on which is mounted a powder feed hopper 56 having a flexible tube 57 which is connected to a feedbox 58 as best shown in FIG. 14, the feedbox 58 being actuated as by means of a pair of hydraulic cylinders 59 to and from a position to fill the die 12 with powder and to strike off the powder level with the upper surface of the die platen. As will later be explained, when the feedbox 58 is in the FIG. 14 position, it will be shaken back and forth to assure complete filling of the die 12.

Before referring in detail to the hydraulic system of FIG. 15, brief reference will be made to FIGS. 7 to 10 and FIGS. 11 to 13. In FIG. 7, the lower platens 14, 15, and 16 and punches 20, 21, and 22 are in the positions relative to one another as is required for correct filling of the die prior to compaction. In FIG. 7, the main upper platen 35 and punch 39 has advanced downwardly with respect to the inner punch platen 37 and punch 40 so that the outer punch 39 will first enter the die 12 to form an initial seal, and as the lower punch platens 14, 15, and 16 move up (preferably in sequence as described in connection with FIG. 15) to final position as shown in FIG. 8, they are engaged with the respective collars 51 on the floating columns 50 and the floating columns 50 are engaged with the main upper platen 35 and the inner punch platen 37 with the powder in die 12 compressed to form the compacted article A to precise size. Now, if the downward pressure on the upper platens 35 and 37 is decreased, all of the platens 14, 15, 16, 35 and 37 will move upwardly in unison by predominant upward force applied by the lower cylinders 8, 9, and 10 thus to eject or strip the article A as shown in FIG. 9 where the side of the article A was first ejected from the die 12 as the outer punch 22 moved to flush position (platen 16 engaged with stop collar 27) and then the article was ejected from the outer punch 22 as the middle punch 21 moved to the flush position (platen 15 engaged with stop collar 27). Finally, as shown in FIG. 10 when the inner punch 20 reaches the flush position (platen 14 engaged with stop collar 27) the article A will have been ejected from the middle punch 21, and during each stage aforesaid the article A is being stripped from the core rod 6. When the operation of the lower punches 22 and 21 reach the stage of FIG. 9, the main punch 39 may first be withdrawn with respect to the inner punch 40 followed by withdrawal of the inner punch 40. If desired, the press may be operated so that the core rod 6 is pulled out of the article before ejection of the article from the die 12.

As shown in FIG. 10, the platens 14, 15, and 16 are now engaged with the upper stop collars 27 whereby the punches 20, 21, and 22 will be flush with the top of the die platen 11 so that the pressed article A may be removed and the feeder box 58 may be actuated to fill the die 12 as in FIG. 7 after the platens 14, 15, and 16 have been lowered to engage their lower stop collars 26.

As previously mentioned, the die platen 11 is adapted to be actuated upwardly by the hydraulic cylinders 7 as when the article B is to have a recess in its upper end as shown in FIG. 11. Thus, the die cavity 12, after being filled with powder (while the die platen 11 is down against fixed stop collars 28 as in FIG. 11), is enlarged by raising the die platen 11 to engage the adjustable stop collars 29 which causes the level of powder to be spaced below the upper surface of the die platen 11 as shown in FIG. 12. Thus, as the upper inner punch 66 moves down in advance of the upper outer punch 67, it will contact the powder but there will be no spillage or overflow because the level of the powder is below the level of the upper side of the die platen. During the course of the compressing of the powder between the upper and lower punches 66, 67 and 68, 69, and 70, the die platen 11 will move down to engage its bottom stop collar 28 as is shown in FIG. 11.

Having thus generally described the operation of the press herein, detailed reference will now be made to FIG. 15 which shows the valve control circuits for achieving advance speed lowering of the upper platens 35 and 37, the advance of the platen 35 with respect to the platen 37, the desired sequence of actuation of the lower punch platens 14, 15, and 16, and the decreased hold pressure to achieve ejection while holding the punches 20, 21, 22, 39, and 40 in locked condition.

In the preceding description mention was made of reducing the down pressure in the upper cylinders 36 and 39 so that the up pressure in the lower cylinders 8, 9, and 10 overcomes said down pressure, the weight of the platens 35 and 37, and the friction between the article A and the die 12. In lieu of such reduction in down pressure in the upper cylinders 36 and 38, up pressure may be applied in the upper cylinders 36 and 38 of a value less than the weights of the upper platens 35 and 37 whereby a lower up pressure may be used in the lower cylinders 8, 9, and 10 to move the upper platens 35 and 37 and to eject the article A from the die 12.

In FIG. 15, only the hydraulic circuitry for actuation of the cylinders 8, 9, 10, 36, and 38 for the respective punch platens 20, 21, 22, 39, and 40 has been illustrated. The core rod cylinder 5, the die platen cylinders 7, and the feeder cylinders 59 may be controlled in known manner by solenoid operated four-way valves, flow control valves, unloading valves, check valves, etc.

Referring now in detail to FIG. 15, when the press is in idling condition, the pumps 75 and 76 and 77 and 78 are discharging through their respective control valves 79, 80, 118, 120 and/or 115, 116, 119, 121, 124 for pumps 75 and 76, and 81 and 82 and/or 83 and 84 for pumps 77 and 78; and the pilot pump 85 generates pilot and feedback pressure at the setting of valve 86. Valve 87 is set to bleed just enough feedback oil into the lower area of the upper cylinder 38 to compensate for static leakage and prevent down drift thereof and of the upper cylinders 36. The balance of the flow from pump 85 passes through a filter and heat exchanger (not shown) to the tank.

As the feeder 58 feeds powder into die 12 solenoid 90 is energized to shift pilot valve 91 to block valves 81 and 84 and allow valves 82 and 83 to open, whereby pumps 77 and 78 oil is delivered to the upper areas of the lower platen cylinders 8, 9, and 10 dropping the lower platens 14, 15, and 16 and punches 20, 21, and 22 to enlarge the die cavity 12. The sequence in which the platens drop is determined by the counterbalance pressure applied below each pair of cylinders 8, 9, and 10, these pressures being set by control valves 92 in the respective valve assemblies 93. The upper areas of the lower platen cylinders 8, 9, and 10 are all acted on by equal pressure as they are connected to a common delivery source (pumps 77 and 78). Hence, the cylinder 8, 9, or 10 with the lowest counterbalance pressure setting of valve 92 drops first pulling the connected platen 14, 15, or 16 and punch 20, 21, or 22 followed by the other cylinders having higher counterbalance pressure settings of their valves 92. The lower platens 14, 15, and 16 come to rest in turn against the stop collars 26. The pressure available is determined by valves 94 and 95 and is set

at a relatively low value. The excess flow passes to tank through valve **95** closing the pressure switch **98** as valve **94** opens. The pressure switch **98** starts a timer (not shown), which is set to allow all of the lower platens to complete their strokes after which a timer contact energizes the solenoid **99** of valve **100** to open the vent of valve **101** to depressurize the system.

The core rod **6** can also be lowered and raised during the die filling operation to help in filling the die cavity.

After the feeder **58** has been retracted, the solenoids **110**, **111** and **112** are energized. Solenoid **110** shifts valve **114** to block valves **80** and **115** and allow valves **79** and **116** to open. Solenoid **111** shifts valve **117** to block valves **118** and **119** and to allow valves **120** and **121** to open. Oil from pumps **75** and **76** is thus directed to the upper areas of the three upper cylinders **36** and **38**. Solenoid **112** shifts valve **122** to block valve **124** and to allow valve **123** to open whereby lower area return flow joins pump delivery to the upper area for high-speed approach. The cylinder rod end oil is forced through valves **125** and **126** at a counterbalance pressure as determined by the setting of valve **127**. For articles that are basically flat on top, both upper platens **35** and **37** are locked together by collars **47** and **48** on stop rods **46** and advance as a unit carrying a single punch. For articles A with an upper hub, the outer punch **39** is extended ahead of the inner punch **40** for the initial die entry. For this action solenoid **128** is energized to shift the valve **129** to unload valve **126** and remove the counterbalance pressure from the outer punch cylinders **36**. The outer punch **39** thus extends first until the platen **35** contacts the lower collars **48** extending from the inner punch platen **37** after which both punches **39** and **40** move together. For articles B with a counterbore in the upper surface, the reverse action is generally required with the inner punch **66** (FIGS. **11–13**) extended for initial die entry. This is accomplished by energizing solenoid **130** which unloads valve **125**. The inner punch **66** then extends before the outer punch **67** until its upper collars **47** engage the outer punch platen **35** after which both punches **66** and **67** move together. In both cases, the collars **47** and **48** are set for the required inner or outer punch advance.

As the upper punches **39** and **40** approach the die cavity **12**, the solenoid **112** is deenergized whereby valve **122** shifts to block valve **123** and to open valve **124** allowing the rod and discharge oil to flow directly to the tank. The cylinders **36** and **38** now slow down to feed speed. If an unusually slow approach into the die is required, solenoid **131** of valve **132** is energized to vent the relief valve **133** to unload pump **76** in which case the platens **35** and **37** slow directly to pressing speed only on the delivery of pump **75**.

When the upper punches **39** and **40** enter and seal the die cavity **12**, a limit switch is released, starting a pressure dwell timer (not shown), and a contact therein deenergizes solenoid **90** to reload the pumps **77** and **78**. Another timer contact energizes the solenoid **134** shifting valve **91** to block valves **82** and **83** and to allow valves **81** and **84** to open. Pump **77** and **78** delivery is directed to the lower areas of the lower platen cylinders **8, 9,** and **10** raising the lower punches **20, 21,** and **22** as the upper punches **39** and **40** continue to move down.

As in connection with the filling stroke, the sequence in which the cylinders **8, 9,** and **10** rise is determined by the counterbalance pressure, this time applied from above, these pressures being set by the control valves **135**. Both upper **39** and **40** and lower **20, 21,** and **22** punches move into the die **12** together, compacting the powder above and below for equal density. When the reaction pressure from the article A causes the upper pressure in cylinders **36** and **38** to rise above the setting of the unloading valve **136**, it opens to permit relief valve **133** to open to unload the pump **76** and slow the upper platens **35** and **37** to pressing speed. If pump **76** was previously unloaded by the energization of solenoid **131**, the opening of valve **136** has no effect because the upper platens are already moving at pressing speed.

When reaction pressure causes the lower pressure to rise above the setting of the unloading valve **137** it opens unloading the pump **77** slowing the lower cylinders **8, 9,** and **10** to pressing speed, whereby they are extended only on the delivery of pump **78**. Both upper **39** and **40** and lower **20, 21,** and **22** punches build to full tonnage set on the upper platens **35** and **37** by valve **138** and on the lower platens by valve **139**. The upper platens **35** and **37** bottom on their stop pins **45** and **46** against the die platen **11** forcing it down against the lower stop collars **28** if it was raised for underfill. The lower platens **14, 15,** and **16** come up against the collars **51** on the floating spacer columns **50** which are then butted against the upper platens **35** and **37** to positively space the upper **39** and **40** and lower **20, 21** and **22** punches for accurate part size. The press dwells at full tonnage in this condition until the timer aforesaid times out.

A timer contact is maintained closed to maintain energization of solenoid **134** to pressurize the lower cylinders **8, 9,** and **10** upward for the ejection stroke. The ejection occurs because of the reduction or removal of overhead pressure caused by deenergizing solenoids **110** and **111** and energizing solenoids **144** and **143** unblocking valves **80** and **115** and **118** and **119** and blocking valves **79** and **116** and **120** and **121** directing pump flow to the lower areas of the cylinders **36** and **38** which allows the lower platens **14, 15,** and **16** to rise. When it is desired to provide "light" pressure resistance of the upper platens **35** and **37**, the solenoid **140** is held energized while the upper platen **37** is below an upper limit switch (not shown). Valve **141** shifts the upper platen pressure control to valve **142** which is set to a lower value than is needed to lift the gross weight of the platens **35** and **37**. The balance of the lift if provided by the lower platens **14, 15,** and **16** through the floating spacer columns **50**. This is the top holddown force which can be adjusted from 0 to the full weight of the upper platens **35** and **37** with the control set at "light". When the upper platen **37** is lifted to the aforesaid limit switch level, the solenoid **140** is deenergized, and control of the upper platen pressure shifts back to valve **138** which is set at full compacting tonnage. The upper punches **39** and **40** are immediately lifted off the compact allowing the ejection stroke to be completed normally.

With the ejection control set at "heavy" the solenoids **110** and **111** are maintained energized to keep the upper platens **35** and **37** pressured down, but the upper platen pressure is decreased to the setting of valve **142**. The top holddown pressure in this case is the weight of the upper platens **35** and **37** plus the valve **142** pressure. As ejection proceeds, and the aforesaid limit switch is tripped and the solenoids **110, 111** and **140** are deenergized, the pressure control is again by valve **138**. Solenoids **143** and **144** are then energized as aforesaid to direct pump flow to the lower areas of cylinders **36** and **38**.

For an article B with a straight-sided counterbore in the top surface, the inner punch **66** must be retracted while the outer punch **67** holds the article B down to prevent chipping off the upper corners. Solenoid **110** is at this time energized to hold the outer punch **67** down and solenoid **143** is energized to lift the inner punch **66**. The solenoid **131** then is energized to dump pump **76** oil to reduce the amount of oil as only one cylinder **38** is working. When a timer (not shown) times out, the solenoids **110** and **131** are deenergized while solenoid **144** is energized to lift the outer punch **67** also on full oil volume.

For an article A with a straight-sided hub at the top the outer punch **39** must be retracted while the inner punch **40** presses down on the hub. This is accomplished by energizing the solenoid **111** to hold the inner punch **40** down and when solenoid **144** is energized, the outer punch **39** is lifted. Solenoid **131**, when energized, dumps pump **76** oil as aforesaid, to reduce the amount of oil with only two cylinders **36** working. When the timer times out, the solenoids **111** and **131** are deenergized and solenoid **143** is energized to lift the inner punch **40** also on full oil volume.

When the upper platens **35** and **37** reach the ends of their strokes yet another timer (not shown) can be energized to provide a dwell between cycles for manually removing the completed article A or B when the press is continuously cycling. The solenoid **99** is energized to unload the lower

platen cylinders **8**, **9**, and **10** which momentarily build to full pressure against stop collars **27**. Solenoid **134** remains energized until fill is to occur in the next cycle.

If the underfill option is being used, the die platen **11** may be partially lifted from its lower position against collars **28** by friction from the article A or B as it is ejected. In any case, the die platen **11** will be raised the rest of the way until it is against its upper stop collars **29**. If the core rod **6** is below its upper position from a core ejection stroke, it is elevated to its upper position. The press is now in condition for repeating the aforesaid cycle.

I therefore, particularly point out and distinctly claim as my invention:

1. A hydraulic press for making compacted articles from powdered material comprising die and punch members respectively defining the side and end portions of the article when said punch members are moved toward each other against powdered material in said die member; support means on which said punch members are movably supported; fluid motor means on said support means operatively connected to the respective punch members to move them as aforesaid; interengageable stop means between one of said punch members and said die member; a spacer member movable with respect to said die member and disposed between said punch members to arrest relative movement thereof thus to determine the size of the compacted article while said stop means are interengaged; and control valve means operative to control fluid pressures in said fluid motor means so that said punch members and said spacer member are moved in unison in a direction to disengage said stop means, thus to eject the compacted article from said die member.

2. The press of claim **1** wherein said control valve means, during ejection of the article from said die member, conducts fluid under pressure to said motor means tending to move said punch members and said spacer member in the same direction with the magnitude of pressure in said motor means being such that the forces are respectively not greater than and greater than the gravitational and frictional forces whereby said spacer member remains in interengagement between said punch members while the compacted article is ejected from said die member.

3. The press of claim **1** wherein said control valve means, during ejection of the compacted article from said die member, conducts fluid under pressure to said motor means with the magnitude of pressures in said motor means being such that a differential force overcomes gravitational and frictional forces so that said spacer member remains in interengagement between said punch members while the compacted article is ejected from said die member.

4. A press for making compacted articles from powdered material comprising a base having upper and lower heads with vertical guide means extending between said heads; an upper punch platen vertically movably supported by said guide means, and fluid motor means on said upper head operatively connected to said upper punch platen so to vertically move the latter; a plurality of lower punch platens vertically movably guided by said guide means, and plural fluid motor means operatively connected to said lower platens so to vertically move said lower platens; a die platen supported by said base between said upper punch platen and said lower punch platens; said upper and lower punch platens having punches which define with a die on said die platen the sidewall and end walls of the article when the upper and lower punch members are moved relatively toward each other against powdered material in said die and between said punch member; interengageable stop means between said upper punch platen and said die platen; a spacer member vertically movably extending through said die platen and disposed for engagement between said upper punch platen and the respective lower punch platens to arrest vertical relative movement of said upper and lower punch platens thus to determine the size of the compacted article while said stop means are interengaged; said spacer member comprising a vertical rod extending through aligned openings in said lower platens and said die platen to engage said upper platen and having collars spaced therealong engageable by the respective lower platens.

5. The press of claim **4** wherein other stop means are associated with said lower punch platens for movement of the punches thereof to strip the compacted article not only from the die member but from the lower punch members which in the compacting position may be axially offset with respect to each other; said other stop means comprising a vertical stop rod secured to said lower head and extending through aligned openings in said lower platens and having pairs of collars thereon engaged by the respective lower platens to determine the uppermost and lowermost positions of said lower platens for stripping of the compacted article and for loading of powdered material into said die.

6. The press of claim **4** wherein the fluid motor means associated with said lower punch platens are of different sizes, and have actuating rods extending vertically through aligned openings through said lower platens; and wherein connection means selectively connect said actuating rods to said lower punch platens.

7. In a molding press, a support, means carried by the support defining a molding cavity for containing material to be molded into an article, first and second punch members on opposite sides of said cavity, means for moving said punch members toward each other into engagement with the material to form the article, a spacer member engaged by both punch members to limit their travel toward each other, and means to simultaneously move the punch and spacer members in one direction for ejecting the article from the cavity.

8. The press of claim **7** in which there is a means to maintain both punch members in tight engagement with the spacer member during such ejection movement.

9. The press of claim **7** in which there is a fixed stop on said support engageable by one of said punch members to limit travel thereof in a direction opposite to the ejection travel.

10. A press for making compacted articles from powdered material comprising a base having upper and lower heads with vertical guide means extending between said heads; an upper punch platen vertically movably supported by said guide means and fluid motor means on said upper head operatively connected to said upper punch platen so to vertically move the latter; a lower punch platen vertically movably guided by said guide means and fluid motor means on said lower head operatively connected to said lower platen so to vertically move said lower platen; a die platen supported by said base between said upper punch platen and said lower punch platen; said upper and lower punch platens having punches which define with a die on said die platen the sidewall and end walls of the article when the upper and lower punch members are moved rela,ively toward each other against powdered material in said die and between said punches; a vertically movable spacer member extending through said die platen and disposed between said punch platens to arrest vertical relative movement of said upper and lower punch platens thus to determine the size of the compacted article; and valve means controlling actuation of said fluid motor means associated with said upper and lower punch platens to vertically move said upper and lower platens in unison while engaged with said spacer member thus to eject the compacted article from said die; said spacer member comprising a vertical rod extending through aligned openings in said lower head, said lower punch platen and said die platen for engagement of its upper end portion with said upper punch platen; said rod having a collar thereon in engagement with said lower punch platen.

11. The press of claim **10** wherein stop means are associated with said lower punch platen for movement of the punch thereof to strip the sidewall of the compacted article from said die; said stop means comprising a stop rod extending upwardly from said lower head through an opening in said lower punch platen, and a pair of stop collars on said stop rod determining the uppermost and lowermost positions of said lower punch platen for ejection as aforesaid and for filling of said die with powdered material.