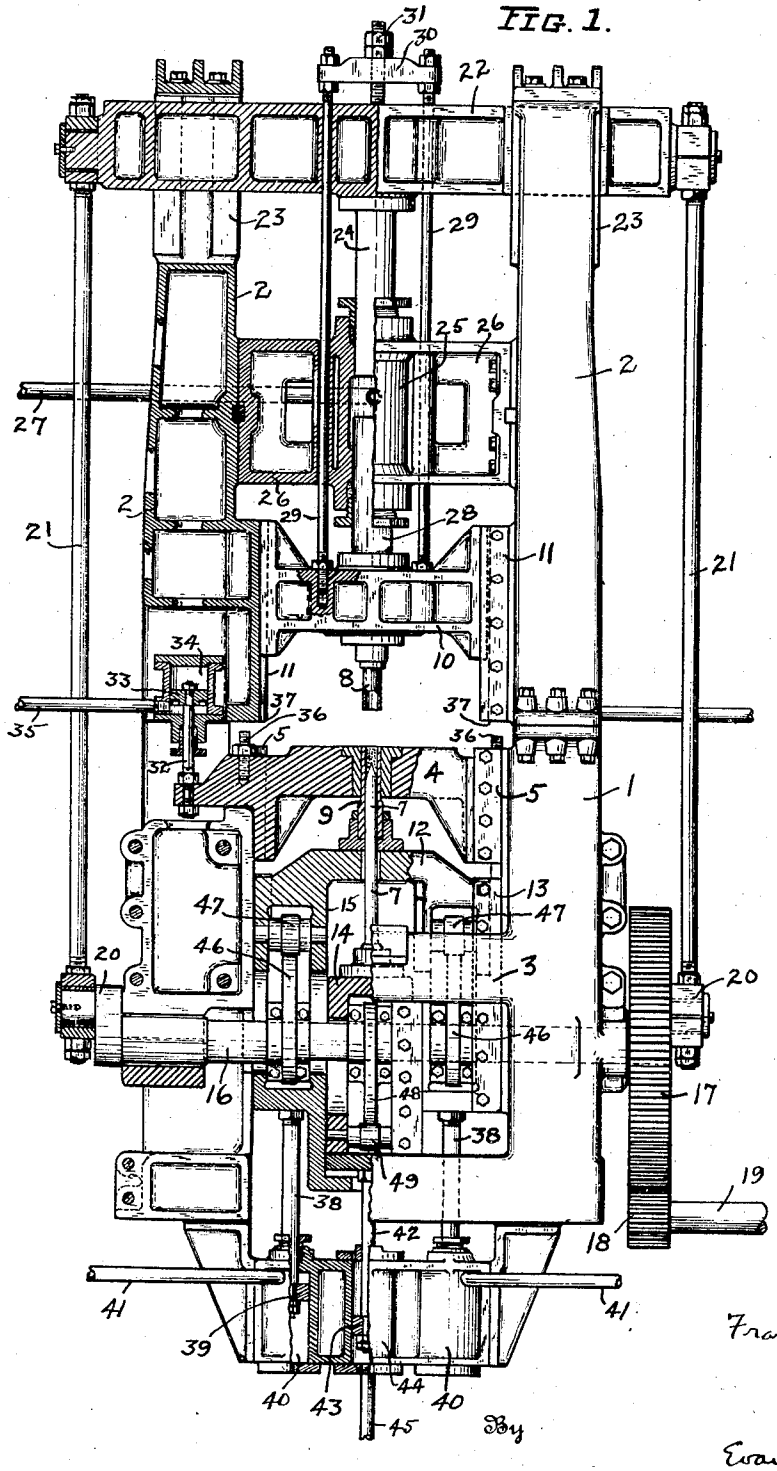
June 24, 1930. F. H. SMITH 1,766,265

PRESS

Original Filed Feb. 15, 1928 4 Sheets-Sheet 1

FIG. 1.



Inventor
Frank H Smith

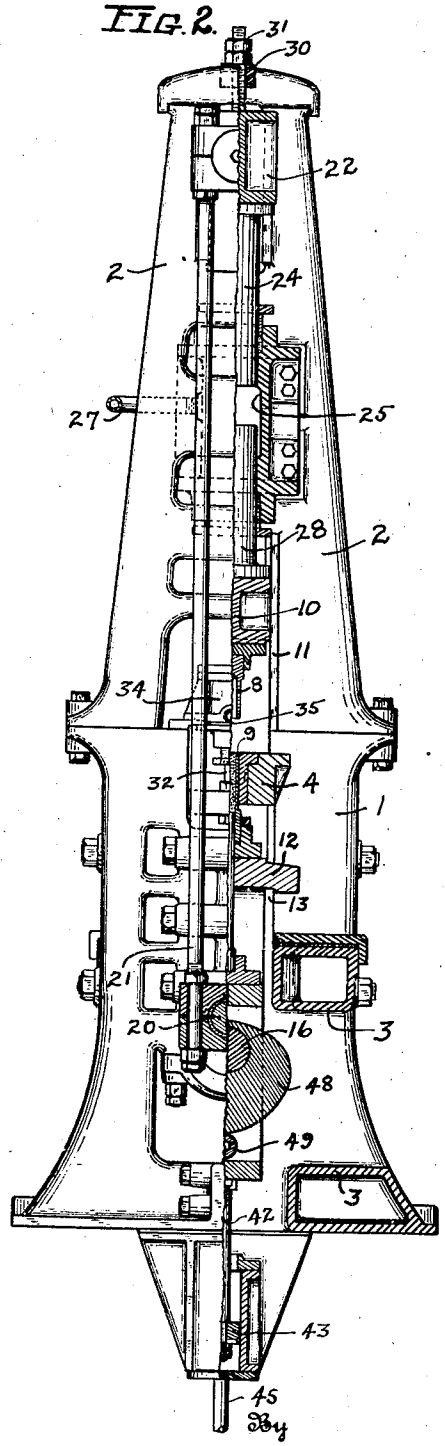
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June 24, 1930. F. H. SMITH 1,766,265

PRESS

Original Filed Feb. 15, 1928 4 Sheets-Sheet 2

FIG. 2.



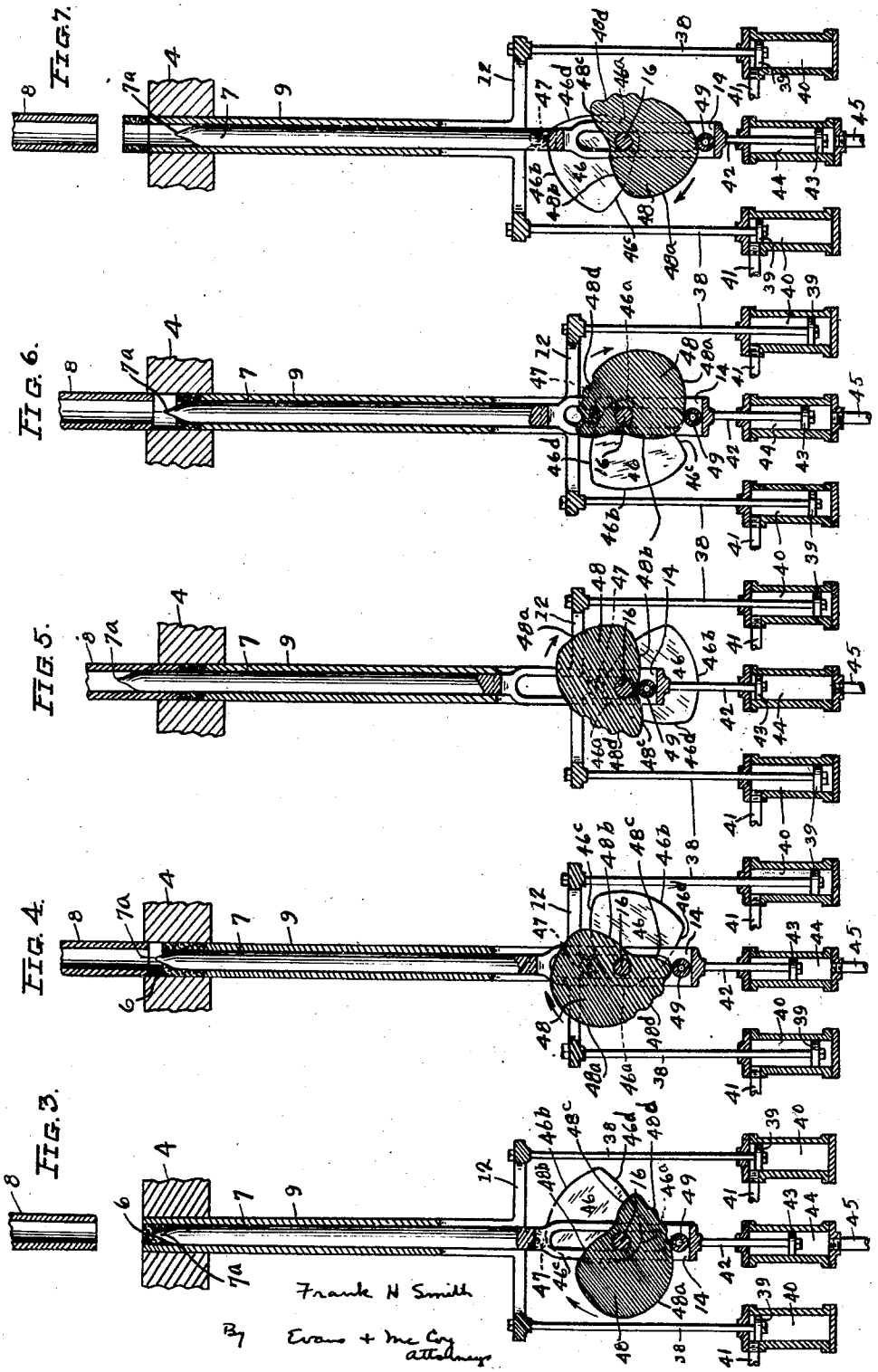
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June 24, 1930. F. H. SMITH 1,766,265

PRESS

Original Filed Feb. 15, 1928 4 Sheets-Sheet 3

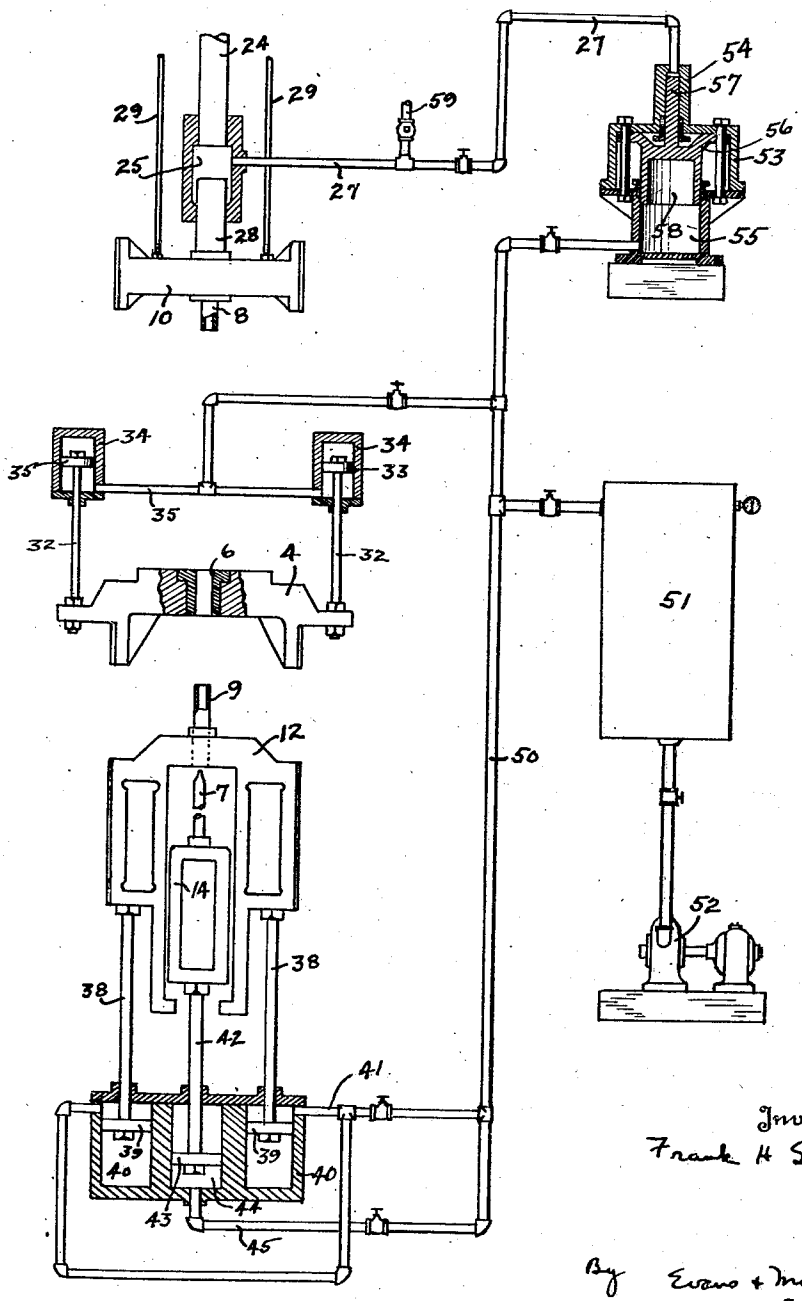


June 24, 1930. F. H. SMITH 1,766,265

PRESS

Original Filed Feb. 15, 1928 4 Sheets-Sheet 4

FIG. 8.



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UNITED STATES PATENT OFFICE

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PRESS

Application filed February 15, 1926. Serial No. 254,375. Renewed May 9, 1930.

This invention relates to presses for molding loose material, and more particularly to presses for molding loose granular or plastic material about a core to form hollow articles, such as bearings, bushings and the like.

Among the most important objects of the invention is the provision of a press capable of applying heavy pressure to the material in forming the hollow articles and by means of which uniform density is imparted to the hollow articles, and further, to provide a press in which the articles are freed from the core and ejected from the mold chamber in such a manner as to avoid damage thereto.

A further object of the invention is to provide a press of the character above referred to which operates continuously and rapidly without spilling the loose material from which the articles are molded.

A further object of the invention is to provide a mechanically operated press of the continuously reciprocating type in which the pressure to which the material is subjected may be accurately regulated.

A further object of the invention is to provide a mechanically operated reciprocating press in which the material is molded under a predetermined pressure which is maintained during a substantial portion of the stroke of the press.

A further object of the invention is to provide a press in which the mold chamber and core member are yieldably supported so that they may have a movement in the direction of movement of the pressure plunger while pressure is being applied to the material whereby the entire mass of material in the mold chamber is compressed with substantial uniformity so that the molded articles are of substantially uniform density throughout.

A further object of the invention is to provide a press in which opposed tubular plungers have a sliding fit on a central core member and within the mold chamber to compress material in the mold chamber surrounding the core member, in which means is provided for simultaneously imparting vibrations to the core member and a downward movement to the lower of the tubular plungers to dispose the material in the mold chamber around the central core member without forcing any of the loose material out of the mold chamber.

Having in view the objects above set forth and others which will appear as the description proceeds, the invention may be said to comprise the press as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification, in which

Figure 1 is a sectional elevation in which the press is shown in section to the left of the vertical center line and in front elevation to the right of the center line.

Fig. 2 is a sectional elevation showing the press in section to the right of the vertical center line and in side elevation to the left of the center line.

Figs. 3 to 7, inclusive, are fragmentary vertical sections showing the mold members and plungers in successive positions which they occupy during the cycle of operations.

Fig. 8 is a diagrammatic view showing the fluid pressure connections to the various cylinders of the press.

Referring to the accompanying drawings, the press frame is indicated generally by the reference numeral 1, and includes spaced vertical standards 2 which may be detachably secured to the base portion of the frame which consists of side members alined with the standards and rigidly connected by integral cross members 3. The spaced side members of the frame provide guideways for a number of vertical movable crossheads. A mold crosshead 4 is mounted for limited vertical movement in guides 5 secured to the inner faces of the side members of the frame, and this crosshead carries a vertically disposed mold chamber 6 which is in the form of a cylindrical bore extending through the crosshead.

Cooperating with the mold chamber 6 there is a cylindrical core member 7, which has a pointed upper end and which is of lesser diameter than the mold chamber 6. The core member 7 is disposed coaxially with respect to the chamber 6 and is of a size to fit within a tubular pressure applying plunger 8 which moves downwardly into the mold chamber and onto the core member. Slidable upon the core member 7 there is a pressure receiving and ejecting plunger 9, which fits within the mold chamber 6 and closes the lower end of the annular space in the mold chamber surrounding the core member while the material is being compressed in the space surrounding the core member and moves up to eject the molded article after each compression stroke.

The pressure applying plunger 8 is fixed to a crosshead 10 which is mounted to slide in vertical guides 11 secured to the standards 2 of the frame. The pressure receiving plunger 9 is fixed to a crosshead 12 which is mounted to slide in vertical guides 13 secured to the side members of the frame below the mold crosshead.

The core member 7 is fixed to a crosshead 14 which is mounted in the crosshead 12 in guides 15 permitting vertical movement of the crosshead 14 therein. Extending across the lower portion of the frame 1, and through the crossheads 12 and 14, there is an operating shaft 16 having a gear 17 fixed to one end thereof which is driven by a pinion 18 fixed to a suitable drive shaft 19. At its opposite ends this shaft 16 is provided with cranks 20 which are connected by means of connecting rods 21 with a crosshead 22 mounted in vertical guides 23 at the upper ends of the standards 2. The upper crosshead 22 has fixed to the under side thereof a plunger 24 which slides in a vertical cylinder 25 carried by a cross member 26 fixed to the standards 2 and extending across the space between the same. The cylinder 25 is a hydraulic cylinder which is supplied with liquid through a suitable pipe 27. Extending into the lower end of the cylinder 25 is a plunger 28 fixed to the pressure plunger crosshead 10.

Upon downward movement of the crosshead 22, pressure is transmitted from the plunger 24 through the liquid in the cylinder 25 to the plunger 28 carried by the crosshead 10 to move the crosshead 10 in a downward direction. The crosshead 10 is lifted upon the upward movement of the crosshead 22 by means of tie rods 29 which are fixed to the crosshead 10 at their lower ends, and at their upper ends extend through the crosshead 22 and are connected to a cross bar 30 which carries an adjustable stop member 31 which is engaged by the crosshead 22 upon upward movement of the crosshead. The crosshead 22 is slidable on the tie rods 29 so that during the downward stroke of the crosshead, it may move away from the stop member 31, but upon upward movement of the crosshead, a direct lifting connection is provided through the members 31, 30 and tie rods 29. The mold crosshead 4 is fixed at its opposite ends to vertically disposed piston rods 32 which are connected to pistons 33 in pneumatic cylinders 34 which are supplied with air under pressure through pipes 35. The pressure is admitted to the cylinders 34 below the pistons so that the mold crosshead is normally supported in its uppermost position, which is determined by the setting of stop screws 36 which engage with shoulders 37 at the lower ends of the crosshead guides 11. The crosshead 12 is attached to the upper ends of the piston rods 38 which are connected at their lower ends to pistons 39 of pneumatic cylinders 40 which have pressure supply pipes 41 for admitting air under pressure to the spaces in the cylinders above the pistons 39. The core crosshead 14 is connected to the upper end of a vertical piston rod 42 to the lower end of which is attached a piston 43 which operates in a pneumatic cylinder 44 provided with an air inlet pipe 45 communicating with the lower end thereof.

It will be apparent that the crosshead 12 is acted upon continuously by pneumatic pressure in the cylinders 40 tending to hold the crosshead in its lowermost position and that the crosshead 14 is continuously acted upon by pneumatic pressure in the cylinder 44 tending to hold it in its uppermost position. In order to impart reciprocating movements to the crosshead 12, a pair of cams 46 fixed to the operating shaft 16 engage with rollers 47 mounted in the crosshead 12 above the operating shaft, the cams 46 serving to lift the crosshead in opposition to the pneumatic pressure in the cylinders 40, the cylinders 40 serving by downward pressure on the crosshead 12 to press the rollers 47 against the cams 46 so that upward and downward movements are imparted to the crosshead 12 and plunger 9, the timing of the movements and the extent thereof being determined by the contour of the cams 46 which are of identical form. For imparting downward movement to the crosshead 14, and core member 7 in opposition to the pneumatic pressure in the cylinder 44, a cam 48 is fixed to the operating shaft 16 midway between the cams 46, which engages with a roller 49 mounted in the crosshead 14 beneath the operating shaft 16.

All of the pneumatic cylinders above referred to preferably receive pressure from a common source, the pipes 35 connected to the cylinders 34 and the pipes 41 and 45 connected to the cylinders 40 and 44 being connected to a supply line 50, which communicates with a pressure supply tank 51 in

which a predetermined pressure is maintained by means of an automatically regulated compressor 52 which may be any one of the several standard types.

The purpose of the hydraulic cylinder interposed between the connecting crosshead 22 and the pressure plunger crosshead 10 is to provide a connection between the mechanical actuating means and the plunger crosshead which will yield upon pressure exceeding a predetermined amount to prevent damage to the plunger and mold and to prevent application of pressure to the material in the mold in excess of a predetermined amount. It is desirable, however, that there be no yielding between the actuating crosshead and the plunger crosshead at pressures below the predetermined pressure above mentioned and that the maximum pressure be maintained upon the material for an appreciable time during the stroke. To this end, liquid, which is an incompressible medium, is supplied to the cylinder 25 through the pipe 27 and means is provided for automatically permitting some of the liquid to be forced from the cylinder 25 when the pressure therein reaches a predetermined amount without reducing the pressure on the liquid. This is accomplished by means of a pneumatic pressure balancing device similar to that disclosed in patent to Smith and Nowak No. 1,473,388 granted Nov. 6, 1923.

As shown in Fig. 8 of the drawing, this pressure balancing device is indicated by the numeral 53 and comprises a hydraulic cylinder 54 of relatively small diameter with which the pipe 27 communicates and a pneumatic cylinder 55 of a diameter relatively large with respect to that of the cylinder 54. A differential piston 56 is interposed between the cylinders 54 and 55 and has a small piston 57 fitting in the cylinder 54 and a large piston 58 fitting in the cylinder 55. The cylinder 55 is connected to the air pressure supply line 50 so that a predetermined pressure is maintained upon the large piston 58 which normally holds the differential piston 56 at its upper limit of movement. As the crosshead 22 moves downwardly, the plunger 24 acting through the liquid in the cylinder 25 forces a plunger 28 and crosshead 10 downwardly. As the downward movement with the crosshead 10 meets with resistance, pressure in the cylinder 25 gradually increases until the hydraulic pressure becomes sufficient to force the piston 56 downwardly in opposition to the air pressure in the cylinder 55. Since the pneumatic pressure upon the under side of the large piston 58 is always the same, the downward movement of the plunger 24 with respect to the plunger 28 is accomplished without variation in the hydraulic pressure exerted on the plunger 28 so that during this relative movement, while the pressure plunger 8 is moving at a rate slower than the crosshead 22, or is stationary, the material in the mold is subjected to a constant pressure, the hydraulic cushion interposed between the mechanical actuating means and the pressure plunger causing the pressure plunger to act upon the material with constant pressure as in a hydraulic press so that the advantageous uniform pressure of a hydraulic press is obtained together with the greater speed of operation due to mechanical reciprocation. In order to replace any liquid lost by leakage and to maintain the desired amount of liquid in the hydraulic chamber, the pipe 27 may be connected through a suitable valve with a liquid supply line 59.

Referring to Figs. 3 to 7 of the drawing, it will be observed that the cams 46 and 48 are so designed that when the plunger 8 is in its uppermost position a sufficient distance above the crosshead 4 to permit material to be fed into the mold chamber, the crosshead 12 is in its uppermost position with the upper end of the tubular plunger 9 substantially flush with the upper end of the mold chamber as shown in Fig. 3 and with the core member 7, is in an intermediate position with its point slightly below the top of the mold chamber so that the volumetric capacity of the tubular plunger 9 above the core member is just sufficient to contain the amount of material necessary to form the article to be molded. It will be observed that the cam 46 is provided with dwell portions 46^a and 46^b and with releasing and lifting portions 46^c and 46^d. The cam 48 is provided with a dwell portion 48^a, depressing and releasing portions 48^b and 48^c and a portion 48^d of irregular or wavy contour for imparting vibrations to the core member 7. In Fig. 3 of the drawing, the cams 46 have reached a position in which the rollers 47 are about to leave the dwell portion 46^b and ride down the releasing portions 46^c and the cam 48 has reached a position in which roller 49 is approaching the end of the dwell portion 48^a and is about to be engaged by a wavy portion 48^d. Continued rotation of the cams from the position shown in Fig. 3 causes the rollers 47 to move down the releasing portions 46^c of the cams 46, to lower the tubular plunger 9 to the position shown in Fig. 4. Simultaneously, the cam 48 has been turning to cause the roller 49 to engage the wavy portion 48^d to vibrate the core member 7 while the tubular plunger 9 has been moving to the position adjacent the bottom of the mold chamber shown in Fig. 4. The vibration of the core member causes the loose material in the mold chamber to settle into the space surrounding the core member 7 where it will be acted upon by the pressure plunger during its descent. The cranks 20

on the shaft 16 are so positioned with respect to the cams that the downward movement of the pressure plunger 8 begins while the plunger 9 is moving downwardly.

As the pressure plunger 8 moves into the mold, the roller 49 on the crosshead 14 engages with the releasing portion 48[c] of the cam 48 so that the core member is forced upwardly by the pneumatic pressure in the cylinder 44. While pressure is being applied to the material in the mold, the pressure receiving plunger 9 is held in a fixed position by the dwell portions 46[a] of the cams 46 and forms a fixed abutment against which the material in the mold is pressed, as shown in Fig. 5. The mold crosshead 4 and the core member 7, however, during the pressure stroke, are pressed upwardly by pneumatic pressure in the cylinders 34 and 44 so that if there is excessive friction between the material being compressed and the surface of the chamber wall or of the core member, between the material and the surface, the crosshead 4 and the crosshead 14, either or both, which are then yieldingly supported, may move in downward direction with the plunger 8 with the result that the pressure exerted on the material is applied with substantial uniformity throughout the mass in the mold chamber and the tubular article formed in the chamber will have substantially uniform density throughout. During the downward stroke of the pressure plunger 8, the maximum pressure permitted by the pressure regulating device 53 will be reached and maintained during the remainder of the down stroke and through as much of the return stroke of the actuating crosshead 22 as is required to enlarge the space between the plungers 24 and 28 sufficiently to permit the differential plunger 56 to move to its uppermost position.

During the return stroke of the plunger 8, the cam 48 reaches the position in which the depressing portion 48[b] engages the roller 49, forcing the core member 7 downwardly and the cams 46 reach a position in which the lift portions 46[d] engage the rollers 47 so that while the compressed material is held between the plungers 8 and 9, the core member 7 is moved downwardly within the mold material to break any adhesion between the surface of the core member and the inner surface of the mold article and at the same time, the plunger 9 follows the plunger 8 upwardly to slide the molded article in the mold member 6 and break any adhesion between the outer surface thereof and the surface of the mold chamber while the molded article is held between the plungers. During the final portion of the cycle, the plunger 8 reaches its uppermost position and the plunger 9 reaches a position flush with the top of the crosshead 4 so that the molded article is completely ejected from the mold chamber. In the meantime, the core member 7 has moved down to its lowermost position so that simultaneously with the ejection of the molded article the parts are restored to the position for receiving a fresh charge of material, as shown in Fig. 7. A suitable feed device (not shown) may be employed for depositing a charge of material in the mold and pushing aside the molded article during the interval in which the plunger 8 is held in its uppermost position.

It will be apparent that the present invention provides a machine for rapidly and economically molding hollow articles from granular, powdered, plastic or other loose material, that the articles molded in the machine of the present invention will be of uniformly good quality by reason of the fact that they are compressed to uniform density throughout and by reason of the fact that the molded articles are freed from the walls of the mold and core in such manner as to avoid marring of its surfaces.

Furthermore, it will be apparent that the machine of the present invention may be operated very rapidly without the disadvantages usually inherent in mechanically operated presses due to inequalities in pressure exerted on the work. In addition, it will be noted that the press is of rugged construction throughout, and employs only mechanical and fluid pressure actuating elements capable of use for long periods without replacement or repair.

Furthermore, it is to be understood that the particular form of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. In a press for molding loose material, a mold chamber having an open end, a core member mounted in said chamber, an ejecting plunger mounted in the chamber for movement toward and from the open end thereof, a pressure applying plunger movable into and out of the open end of the chamber and having a sliding fit in the chamber and on the core member, means for reciprocating the latter plunger, and means for retracting the ejecting plunger and vibrating the core member before the pressure stroke and for advancing the ejecting plunger during the return stroke of the pressure applying plunger.

2. In a press for molding loose material, a mold chamber having an open end, a movable core member mounted in said chamber, a thrust receiving and ejecting plunger mounted in said chamber for movement to-

ward and from a position in which its end is substantially flush with the open end of said chamber and having a sliding fit within the chamber and on the core member, a pressure applying plunger movable into and out of the open end of the chamber and having a sliding fit in the chamber and on said core member, means for reciprocating the latter plunger, and means for retracting the ejecting plunger from the open end of the chamber and simultaneously vibrating the core member before the initial portion of the pressure stroke to dispose loose material in the chamber exteriorly of the core, and for retracting the core member to free the molded article therefrom and advancing the ejecting plunger to eject the article during the return stroke of the pressure applying plunger.

3. In a press for molding tubular articles from loose material, a mold chamber having an open end, a core member disposed centrally of said chamber and movable toward and from the open end thereof, a pressure applying plunger of tubular form mounted for movement into and out of the open end of said chamber and having a sliding fit in said chamber and on said core member, a thrust receiving and ejecting plunger mounted in the chamber for movement toward and from the open end thereof and having a sliding fit in said chamber and on said core member, means for reciprocating said pressure plunger, and means for retracting said ejecting plunger from the open end of the chamber and vibrating said core member before the pressure stroke of the pressure applying plunger, for advancing the core member toward the open end during the pressure stroke, and for advancing said ejecting plunger toward the open end and retracting said core member therefrom during the return stroke of the pressure applying plunger.

4. In a press for molding tubular articles from loose material, a mold chamber having an open upper end, a vertically movable core member disposed centrally of the chamber, a bottom plunger slidably fitting within the chamber and on the core member, said plunger being movable to a position in which its upper end is substantially flush with the upper end of the chamber, a top plunger mounted above the chamber and movable into and out of the same, the latter plunger having a sliding fit in the chamber and on the core member, and means for reciprocating the top plunger means for moving the core member upwardly during the portion of the pressure stroke of the top plunger in which said plunger is in said chamber, and means for moving the bottom plunger upwardly and the core member downwardly during the return stroke of the top plunger.

5. In a press for molding loose material, a mold chamber, a core member in said chamber, a pair of opposed plungers, each having a sliding fit in said chamber and on said core member, means for reciprocating said plungers, one with a stroke longer than the stroke of the other and with their simultaneous movements in the same direction, one of said plungers being movable into and out of said chamber to permit entry of loose material thereto and the other of the plungers being movable in the chamber to the open end thereof to eject a molded article, and cushioning means interposed between one of said plungers and its actuating means.

6. In a press for molding loose material, a movably mounted mold chamber, a core member in said chamber, a pair of opposed plungers, each having a sliding fit in said chamber and on said core members, means for reciprocating said plungers one with a stroke longer than the stroke of the other and with their simultaneous movements in the same direction, the first of said plungers being movable into and out of said chamber to permit entry of loose material thereto, and the second plunger being movable in the chamber to the open end thereof to eject a molded article, and cushioning means for yieldingly pressing said mold chamber toward said first plunger during the pressure stroke thereof.

7. In a press for molding loose material, a movably mounted mold chamber, a core member in said chamber, a pair of opposed plungers, each having a sliding fit in said chamber and on said core members, means for reciprocating said plungers one with a stroke longer than the stroke of the other and with their simultaneous movements in the same direction, one of said plungers being movable into and out of said chamber to permit entry of loose material thereto, and the other of the plungers being movable in the chamber to the open end thereof to eject a molded article, cushioning means for said mold chamber, and a fixed stop for limiting the movement of said mold chamber.

8. A press for molding loose material, a vertically movable cross head having a vertically disposed mold chamber therein open at its top, vertically movable cross heads above and below said first mentioned cross head, plungers carried by said cross heads axially alined with said mold chamber and formed to have a sliding fit therein, the upper plunger being movable into and out of the mold chamber, means for reciprocating said upper and lower cross heads, a yielding support for the intermediate cross head, and yielding means interposed between one of said reciprocating cross heads and its actuating means.

9. A press for molding loose material, a vertically movable cross head having a vertically disposed mold chamber therein open at its top, vertically movable cross heads above and below said first mentioned cross head, plungers carried by said cross heads axially alined with said mold chamber and formed to have a sliding fit therein, the upper plunger being movable into and out of the mold chamber, means for reciprocating said upper and lower cross heads, a yielding support for the intermediate cross head, and hydraulic cushioning means interposed between one of the plungers and its actuating means.

10. In a press for molding loose material, a mold chamber having an open end through which loose material may be delivered thereto, a movable core member in said chamber, a pair of opposed plungers, each formed to fit within the chamber and on the core member, one movable into and out of the open end of the chamber and the other movable in the chamber toward and from the open end thereof, means for actuating the first mentioned plunger to compress loose material about the core member to form a molded article, means for reciprocating the first mentioned plunger to compress material in the chamber and for automatically limiting the pressure exerted on the material to a predetermined amount, means for actuating said last mentioned plunger to eject the molded article, and means for simultaneously retracting the core member from the molded article.

11. In a press for molding loose material, a mold chamber having an open end through which loose material may be delivered thereto, a movable core member in said chamber, a pair of opposed plungers, each formed to fit within the chamber and on the core member, one movable into and out of the open end of the chamber and the other movable in the chamber toward and from the open end thereof, means for reciprocating the first mentioned plunger to compress loose material about the core member to form a molded article, means for moving the second plunger toward the opening to discharge a molded article and for moving said second plunger away from the opening during the interval in which the first plunger is out of the mold chamber and means for moving the core member away from the open end of the chamber during said movement of the second plunger toward the open end to permit entry of loose material to the interior of the second tubular plunger and for moving the core member toward the opening simultaneously with the movement of said second plunger away from the opening to eject loose material from the interior of the plunger into the mold chamber around the core member.

12. In a press for molding loose material, a mold chamber having an open upper end, an axially disposed endwise movable core member in the chamber, a pressure plunger movable into and out of the chamber, a tubular plunger in the chamber having a sliding fit within the chamber and on the core member, means for delivering material into the chamber when said plunger is at the upper end of its stroke, and means for simultaneously vibrating the core member and moving the tubular plunger down.

13. In a press for molding loose material, a vertically disposed mold chamber, an upper plunger movable into and out of the mold chamber, a tubular plunger slidable in the mold chamber, a core member within the tubular plunger, means for delivering loose material into the tubular plunger, and means for vibrating the core member and moving the tubular plunger down on the core member to eject the material from the tubular member into the chamber around the core member.

14. In a press for molding loose material, a vertically disposed mold chamber, an upper plunger movable into and out of the mold chamber, a tubular plunger slidable in the mold chamber, a core member within the tubular plunger, means for reciprocating the upper plunger, means for lowering the lower plunger at the beginning of the pressure stroke and raising the same during the return stroke of the upper plunger, and means for yieldingly supporting said core member and mold chamber.

15. In a press for molding loose material, a vertically disposed mold chamber, an upper plunger movable into and out of the mold chamber, a tubular plunger slidable in the mold chamber, a core member within the tubular plunger, means for reciprocating the upper plunger, means for lowering the lower plunger at the beginning of the pressure stroke and raising the same during the return stroke of the upper plunger, means for yieldingly supporting said core member and mold chamber, and means for cushioning the stroke of said upper plunger.

16. In a press for molding loose material, a supporting frame, a cross head mounted for limited vertical movement in said frame, pneumatic means for normally molding said cross head in its uppermost position, a vertically disposed mold chamber in said cross head, vertically movable cross heads mounted in said frame above and below said first mentioned cross head, tubular plungers carried by said upper and lower cross heads adapted to have a sliding fit in said mold chamber, a core member within the lower plunger and supported independently thereof, and means for reciprocating said upper and lower cross heads.

17. In a press for molding loose material,

a supporting frame, a cross head mounted for limited vertical movement in said frame, pneumatic means for normally holding said cross head in its uppermost position, a vertically disposed mold chamber in said cross head, vertically movable cross heads mounted in said frame above and below said first mentioned cross head, tubular plungers carried by said upper and lower cross heads adapted to have a sliding fit in said mold chamber, a core member within the lower plunger and supported independently thereof, mechanically actuated hydraulically cushioned means for reciprocating the upper cross head, and means for reciprocating the lower cross head.

18. In a press for molding loose material, a supporting frame, a cross head mounted for limited vertical movement in said frame, pneumatic means for normally holding said cross head in its uppermost position, a vertically disposed mold chamber in said cross head, vertically movable cross heads mounted in said frame above and below said first mentioned cross head, tubular plungers carried by said upper and lower cross heads adapted to have a sliding fit in said mold chamber, a core member within the lower plunger and supported independently thereof, a crank shaft, and means connecting the crank shaft to the upper cross head to actuate the same, pneumatic cylinders connected to the lower cross head and to said core member for actuating each in one direction, and cams on said shaft for actuating the lower cross head and core member in opposition to said cylinders.

In testimony whereof I affix my signature.

FRANK H. SMITH.