April 11, 1944. H. J. PATTISON 2,346,182

APPARATUS FOR EXTRACTING MOLDS

Filed Jan. 29, 1943 3 Sheets-Sheet 1

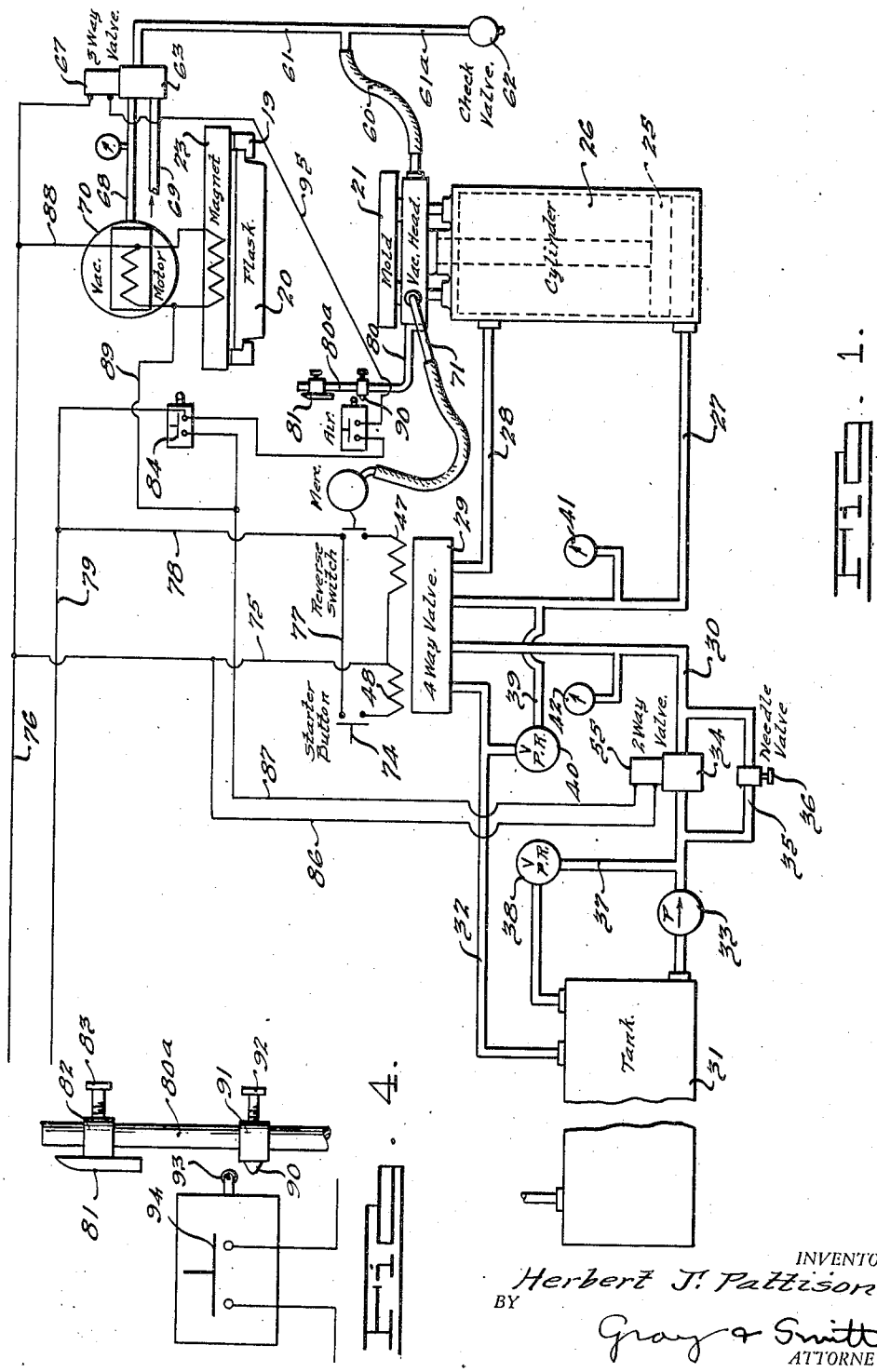


Fig. 1.

Fig. 4.

INVENTOR
Herbert J. Pattison.
BY
Gray & Smith
ATTORNEYS.

April 11, 1944. H. J. PATTISON 2,346,182

APPARATUS FOR EXTRACTING MOLDS

Filed Jan. 29, 1943 3 Sheets-Sheet 2

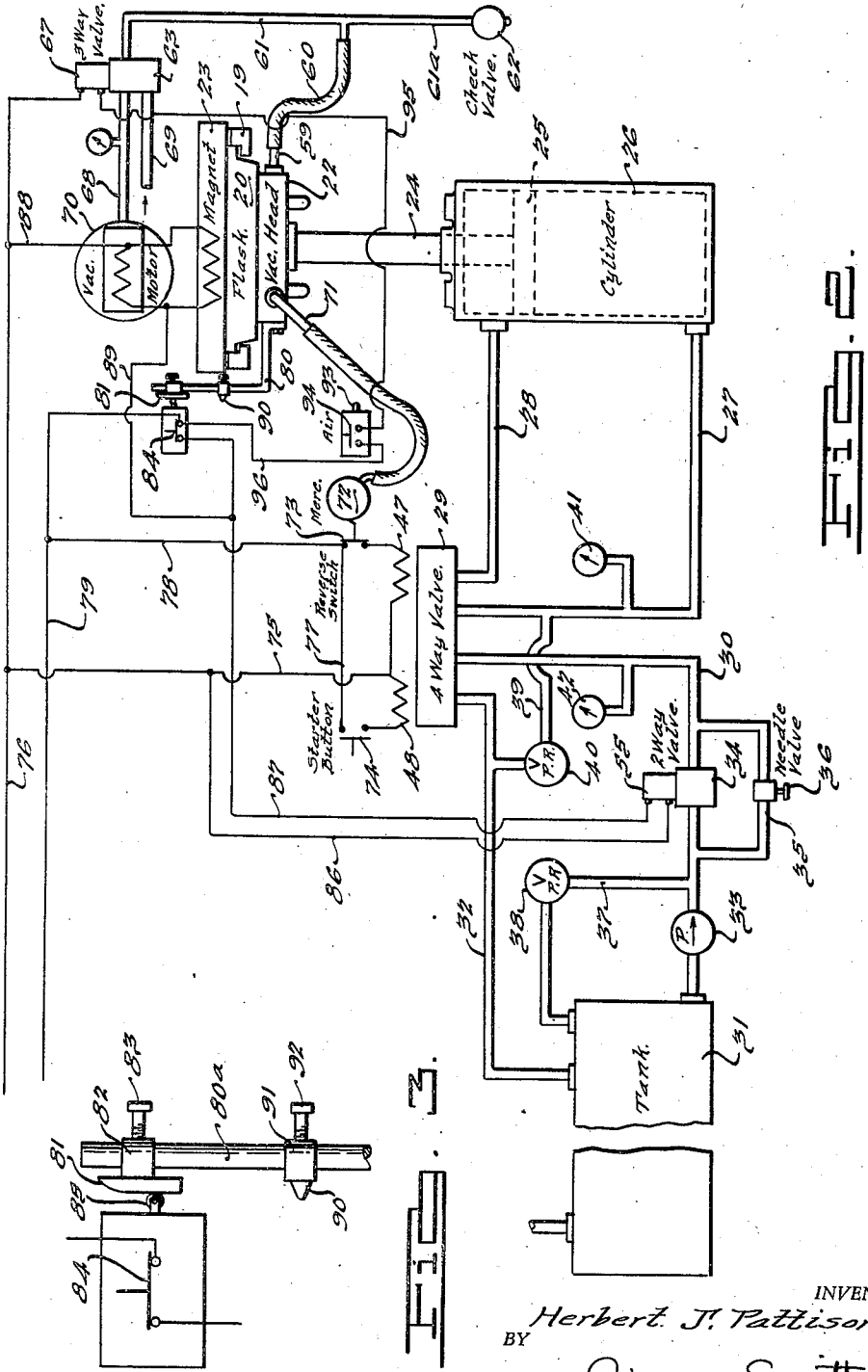


FIG. 2.

FIG. 3.

INVENTOR
Herbert J. Pattison.
BY
Giay & Smith
ATTORNEYS.

April 11, 1944. H. J. PATTISON 2,346,182

APPARATUS FOR EXTRACTING MOLDS

Filed Jan. 29, 1943 3 Sheets-Sheet 3

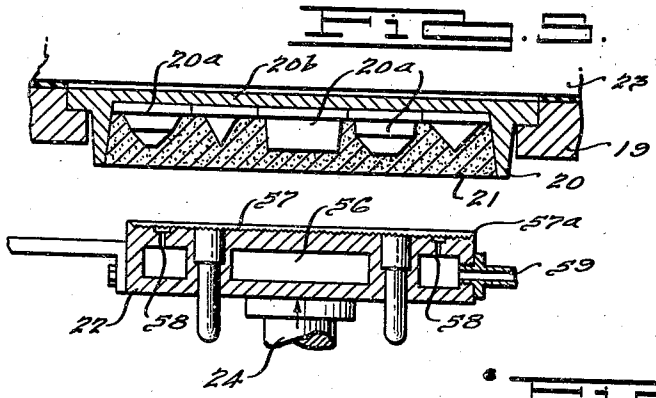


Fig. 5.

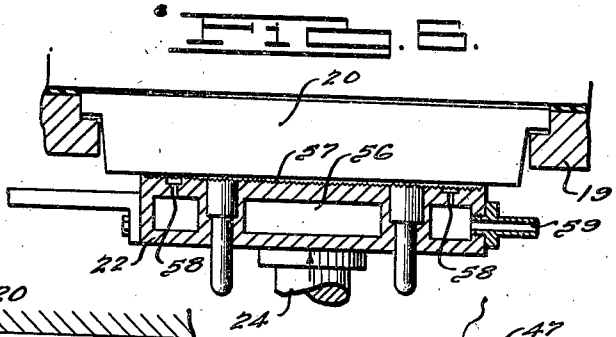


Fig. 6.

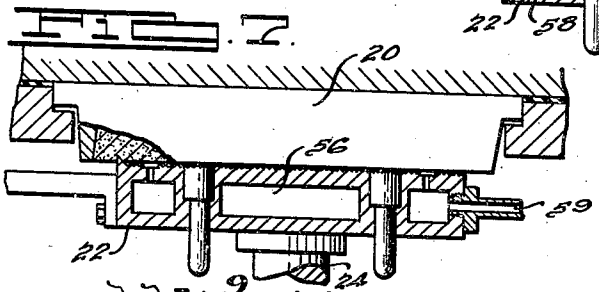


Fig. 7.

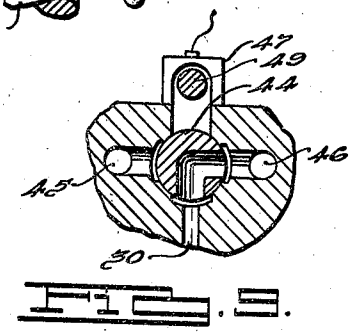


Fig. 8.

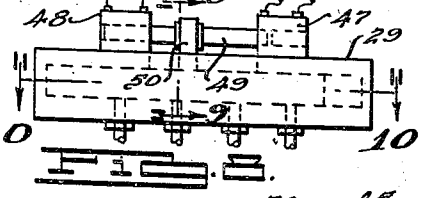


Fig. 9.

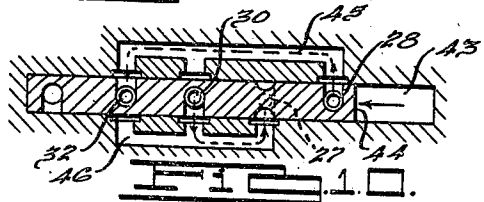


Fig. 10.

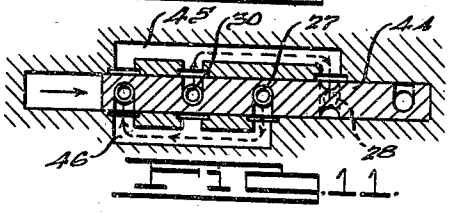


Fig. 11.

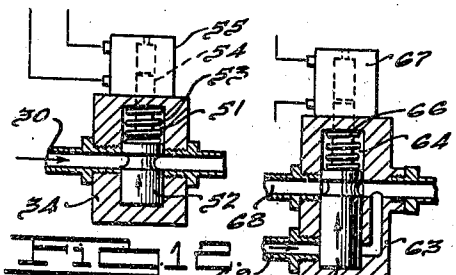


Fig. 12.

Fig. 13.

INVENTOR
Herbert J. Pattison.
BY
Gray & Smith
ATTORNEYS.

Patented Apr. 11, 1944

2,346,182

UNITED STATES PATENT OFFICE

2,346,182

APPARATUS FOR EXTRACTING MOLDS

Herbert J. Pattison, Grosse Pointe Park, Mich., assignor to Briggs Manufacturing Company, Detroit, Mich., a corporation of Michigan

Application January 29, 1943, Serial No. 473,983

20 Claims. (Cl. 22—34)

This invention relates to the manufacture of molds or molding apparatus, particularly those formed principally of plaster or calcined gypsum, the present invention pertaining especially to an apparatus for extracting the mold from the flask or other mold form.

In the production of plaster or gypsum molds for casting metals it is the practice to prepare a mixture of water and plaster, the plaster or gypsum usually being first mixed with a small quantity of silicate fiber, asbestos pulp, or the like. The plaster-water mix is fed into the mold form or flask within which are mounted the pattern or patterns for forming the casting cavities. The plaster is allowed to set so as to have sufficient solid consistency to enable the plaster mold to be withdrawn from the flask and then baked in a drying oven, after which the cope and drag portions of the mold are assembled for the pouring operation.

Although the plaster mold, when withdrawn or extracted from the flask, is in a solid state, it is quite soft and readily susceptible to breakage, fracture or deformation and, therefore, must be handled with considerable care. Extraction of the soft plaster mold from the flask presents considerable difficulties and should be undertaken carefully and under accurately controlled conditions in order to minimize losses due to breakage, disruption, or the like encountered during mold extraction operations.

Heretofore it has been the practice in connection with one commercial plaster molding system to extract the plaster mold from the flask by applying vacuum through a reciprocating head or platen to the exposed face of the mold while supporting the metal base of the flask through the medium of a magnetic chuck. In the use of this type of apparatus the flask containing the plaster mold is inverted and positioned immediately below the magnetic chuck. The vacuum head is shifted upwardly through the medium of a hydraulically operated piston and the ribbed upper face of the vacuum head is pressed tightly against the exposed surface of the plaster mold. Control mechanism is provided for the purpose of arresting the upward travel of the piston and vacuum head when the desired tight sealing engagement between the vacuum head and plaster mold has been obtained. Heretofore, this arresting of the upward travel of the vacuum head preparatory to reversing its travel in order to withdraw the mold by suction has been dependent upon the building up of pressure in the syster. In practice this method has not produced the control constant intended or desired. For example, it did not eliminate overtravel of the piston and vacuum head due to the momentum or inertia thereof. As a consequence, the range of upward travel of the vacuum head and the extent of its engagement with the relatively soft bottom face of the plaster mold have varied during successive operations of the extractor mechanism, resulting in variations in the pressure exerted by the vacuum head against the mold. As a further consequence of this method of control, the ribbed surface of the vacuum head frequently engaged and embedded itself in the face of the mold under excessive pressure, before the travel of the head was fully arrested, and in many instances this resulted in crushing or deforming the plaster mold rendering it defective or unusable.

A further disadvantage of the foregoing method of extraction has been due, according to my observation, to the lack of correlation between the travel of the vacuum head, during its final stage of upward movement, into sealing engagement with the plaster mold and the vacuum or negative pressure exerted to withdraw or extract the mold from the flask. Previously, it has been the practice to first effect tight sealing engagement between the vacuum head and mold and thereafter to provide a dwell period or interval to allow the vacuum to build up in the head sufficiently to effect withdrawal of the mold when the head starts to travel downwardly away from the flask. Thus, no relation existed between the movement of the vacuum head into sealing engagement with the mold and the creation of the negative pressure necessary to withdraw the mold, nor any constant relation between the building up of negative pressure sufficient to extract the mold and the time when the travel of the vacuum head is reversed to initiate extraction, consequently causing an undesirably high percentage of damaged molds.

An object of the present invention is to overcome the foregoing difficulties and eliminate the disadvantages incident to prior practice, and to provide an improved extractor mechanism as well as an improved method for withdrawing the plaster mold from the flask capable of reducing materially the percentage of damaged molds resulting from the extraction operation.

A further object of the invention is to provide a mold extracting method and apparatus in which the final travel of the vacuum head into sealing engagement with the mold and the build-up of vacuum at the juxtaposed faces of the head and

mold are so correlated that withdrawal of the mold from the flask is accomplished more easily and gently with less danger of causing damage to the mold.

Still another object of the invention is to minimize or reduce greatly the danger of damage to the mold during the final travel of the vacuum head into engagement therewith, this being accomplished by providing a slow or retarded travel of the vacuum head near its upper limit of movement, eliminating any danger of over-travel due to inertia, so that as the vacuum head during this retarded rate of travel moves into sealing engagement with the mold the vacuum is built up within the head and when this vacuum or negative pressure reaches a predetermined magnitude the upward travel of the head is instantly arrested. As a consequence, the vacuum head, by virtue of its very slow final travel, does not crush or damage the mold since the extent of this travel is accurately determined by the negative pressure in the head, the magnitude of which may be set accurately at any constant value.

A further object of the invention is to provide an improved, simplified apparatus for extracting molds, such as plaster molds, from flasks by the application of vacuum or suction to the mold, in which more accurate controls are achieved with consequent reduction in the percentage of mold loss due to damage thereto during the extracting operation.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is principally a diagrammatic view illustrating a mold extracting apparatus embodying the present invention, the vacuum head and hydraulically operated piston being shown in their down position after an extracting cycle and preparatory to a succeeding cycle of operation.

Fig. 2 is a view similar to Fig. 1 illustrating the vacuum head and piston in their elevated positions.

Fig. 3 is an enlarged fragmentary view illustrating particularly the upper limit switch for controlling the slow period of travel of the vacuum head.

Fig. 4 is a view illustrating particularly the lower limit switch.

Fig. 5 is an enlarged vertical section showing the vacuum head and the flask containing the plaster mold.

Fig. 6 is an enlarged sectional view illustrating the position of the vacuum head and mold at the commencement of their sealing engagement.

Fig. 7 is a view similar to Fig. 6 illustrating the position of the vacuum head and mold when in sealing engagement and at the point when extraction commences.

Fig. 8 is an enlarged side elevation of the four-way valve.

Fig. 9 is an enlarged section taken substantially through lines 9—9 of Fig. 8 looking in the direction of the arrows.

Fig. 10 is an enlarged section taken substantially through lines 10—10 of Fig. 8 looking in the direction of the arrows.

Fig. 11 is a view similar to Fig. 10 illustrating a different position of the solenoid operated control valve.

Fig. 12 is a sectional view illustrating the two-way valve.

Fig. 13 is a sectional view illustrating the three-way valve.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In the drawings I have illustrated, by way of example, one embodiment of the invention as applied to an apparatus for extracting molds, such as plaster or gypsum molds, from flasks or mold forms in which vacuum is applied through a reciprocating vacuum head to the exposed face of the mold while at the same time the opposite metallic face of the flask is held by a magnetic chuck. In Fig. 5 there is illustrated at **20** a suitable metal flask containing a plaster mold **21**. The flask is in the form of a container having surrounding side walls and a flat base **20***b* to the inner surface of which are secured any suitable number of patterns **20***a* which form the casting cavities in the mold **21**. As heretofore stated, before the extraction operation the flask containing the patterns is charged with a mixture of water and plaster and after this mixture has set within the flask the flask is inverted and fed into position on guides **19** directly above a vacuum head **22** and directly beneath a magnetic chuck **23**. Thus, the mold **21** is extracted from the flask **20** while in inverted position, as illustrated in Figs. 5 to 7, inclusive.

The vacuum head **22** is carried at the outer end of a piston rod **24** secured to a piston **25** reciprocable within a cylinder **26**. The piston is hydraulically operated in one or the other direction by the introduction of fluid or liquid under pressure successively at opposite sides of the piston. A pipe or conduit **27** communicates with the lower end of the cylinder **26** below the piston **25**, and a pipe or conduit **28** communicates with the upper end of the cylinder above the piston. The pipes **27** and **28** communicate at their opposite ends with a four-way valve unit **29**. Leading into this valve is a pipe or conduit **30** which communicates with a constant pressure tank **31**. A return pipe or conduit **32** leads from the four-way valve to the tank **31**. Liquid is forced through the conduit **30** to the valve **29** and thence through either conduit **27** or conduit **28** to the cylinder **26** by means of a pump **33** interposed in the conduit **30**.

Also interposed in the conduit **30** between the pump **33** and the valve **29** is a two-way valve **34** which may be operated selectively to cause the flow of liquid from the pump directly through the conduit **30** to the four-way valve or around the two-way valve **34** through a by-pass conduit or pipe **35**. When the two-way valve **34** is closed liquid will be forced by the pump around this valve through the by-pass conduit **35** and thence to the four-way valve **29**. Interposed in the by-pass conduit **35** is an adjustable needle valve **36** which may be adjusted so as to provide a restricted or metered orifice and hence a restricted flow of the liquid through by-pass conduit **35** and thence through conduit **30** to the four-way valve. Accordingly, when the flow of liquid through by-pass **35** is restricted by the needle valve the excess liquid from the pump **33** will flow back to the tank **31** through a return pipe

or conduit 37 in which return line is interposed a pressure relief valve 38. A relief line 39 also connects the pipe or conduit 27 with the return pipe line 32, a second pressure relief valve 40 being interposed in the line 39. Pressure in the lines 27 and 30 is indicated by pressure gages 41 and 42.

The four-way valve 29 may be of any suitable or conventional construction. One form of valve suitable for the present purposes is illustrated in Figs. 8 to 11, inclusive. As therein illustrated, the valve comprises a body or casing having a central passage 43 within which is mounted a slide valve 44. The body of the valve has two passages 45 and 46 at opposite sides of the main central passage 43 and constructed to direct the fluid from the pump through conduit 30 alternately to the lines 27 and 20 leading to the hydraulic cylinder 26, and also adapted to connect these lines alternately with the return line 32 to the tank. The movement of the slide valve 44 to the positions shown in Figs. 10 and 11 is controlled through the medium of two solenoids 47 and 48. These solenoids may be energized selectively to shift the plunger 49 in one direction or the other, the plunger being connected to a member 50 secured to the slide valve 44. Thus, when the solenoid 48 is energized the plunger 49 and the slide valve 44 will be shifted to the position shown in Fig. 10, and when the solenoid 47 is energized the plunger 49 and slide valve 45 will be shifted to the position shown in Fig. 11. It will be readily understood from the construction of the four-way valve 29 illustrated in Figs. 8 to 11, inclusive, that in the position of the slide valve shown in Fig. 10 liquid under pressure from line 30 will be directed through passage 46 into conduit 27 and thence to the bottom of the cylinder, thereby shifting the piston 25 upwardly. At the same time liquid will be exhausted from the upper end of the cylinder, above the piston, through pipe 28 and thence through passage 45 of the four-way valve into the pipe or conduit 32 and thence to the tank 31. On the other hand, when the slide valve 44 is positioned in the manner shown in Fig. 11 liquid under pressure from the conduit 30 will be directed through passage 45 of the valve 29 and thence into the pipe or conduit 28 to the upper end of the cylinder, this operation resulting in shifting the piston 25 downwardly within its cylinder. At the same time the liquid will be discharged from the lower end of the cylinder through line 27 and thence through passage 46 of the slide valve into the return line 32.

The two-way valve 34, which may be closed for the purpose of by-passing liquid under pressure from the pump 33 through by-pass line 35 and past needle valve 36, may be of any suitable construction and one form of such valve is illustrated in Fig. 12. This valve comprises a valve body having a passage therethrough forming a continuation of the main intake line 30. The valve body also has a cylindrical chamber 51 within which is mounted a shiftable slide valve 52 held in normally open position, as illustrated in Fig. 12, by means of a compression spring 53. The stem 54 of the slide valve 52 is adapted to be actuated by a solenoid 55, so that when the solenoid is energized the valve member 52 is raised against the action of the spring 53 to close off the passage 30 through the valve body, thus causing the liquid from the pump to be by-passed through line 35 around the valve 34. The needle valve 36 is of any conventional construction and adjustable so as to close off the by-pass conduit 35 to the desired extent, thereby reducing the flow of liquid through conduit 30 in the four-way valve 29 and, consequently, retarding the rate of travel of the piston. By suitable adjustment of the needle valve any desired slow rate of travel of the piston and, hence, the vacuum head may be obtained when the liquid is by-passed through line 35.

The vacuum head 22 comprises a hollow body provided with communicating chambers 56. The upper mold engaging face 57 of the vacuum head is ribbed to provide multi-interconnecting grooves so as to form a suction face in which the negative pressure is uniformly distributed over the entire area. Extending continuously around the margin of the upper face of the vacuum head is a relatively sharp rib 57*a* which is adapted to embed itself in the face of the mold 21, as illustrated in Fig. 7, so as to seal the vacuum or negative pressure within the intervening ribbed area 57. The vacuum chamber 56 within the head communicates with the surface 57 by means of a suitable number of ports 58, and communicating with this chamber is a conduit 59 connected through a flexible coupling 60 with a conduit 61 leading to a three-way valve 63. The conduit 61 has a depending extension 61*a* terminating in a check valve 62 which is adapted to close when the pressure is reduced within the vacuum head by suction induced in conduit 61.

The three-way valve 63 may be of any suitable construction and one form thereof is illustrated in Fig. 13. As therein shown, this valve comprises a valve body having a cylindrical chamber 64 within which is mounted a slide valve 65 held normally in the down position by a compression spring 66. The stem of the valve member 65 is adapted to be actuated by a solenoid 67 so that when this solenoid is energized the valve member 65 is raised from the position shown in Fig. 13 against the action of the spring 66. Leading into the three-way valve 63 is a vacuum line 68, and also communicating with this valve is an air pressure line 69. When the valve member 65 is in the position shown in Fig. 13 communication is established between the vacuum line 68 and the conduit 61 leading to the chamber 56 within the vacuum head 22. When the solenoid 67 is energized the valve member 65 is elevated to close off the vacuum line 68 and to open communication between the air pressure line 69 and the conduit 61.

The vacuum line 68 is connected to a vacuum pump 70 which is operable to exhaust air from the chamber 56 in the vacuum head when the three-way valve 63 is in the position shown in Fig. 13. It will be understood that the vacuum pump is operated by an electric motor, the operation of which at predetermined times is controlled as hereinafter described.

For the purpose of stopping and staring the electric motor which operates the vacuum pump and at the same time energizing the magnetic chuck 23, I provide a conventional type of Mercoid switch 72 which is controlled by the pressure within the chamber 56 in the vacuum head 22 through the medium of a conduit 71 extending from the chamber in the vacuum head to the pressure chamber in the Mercoid switch 72. This Mercoid switch is adapted to actuate a reverse switch 73. When the switch 73 is open, as illustrated in Fig. 1, the electric circuit to the vacuum motor or pump 70 and the magnetic chuck 23 is broken and, hence, at this time the pump does

not operate and the magnetic chuck 23 is de-energized. When the switch 73 is closed, as illustrated in Fig. 2, the vacuum motor is operated and the magnet 23 is energized.

A cycle of operation for the purpose of extracting a mold from the flask 20 commences with the piston 25 and vacuum head 22 in their positions shown in Fig. 1. Before the commencement of this operation the mold 21, as shown in Fig. 1, extracted in a previous operation, is removed from the vacuum head. Movement of the piston 25 upwardly within the cylinder for the purpose of carrying the vacuum head toward the flask 20 to extract a mold therefrom is initiated by the starter button 74. The solenoid 43 of the four-way valve 29 is supplied with current by a conductor 75 connected to a main conductor line 76 which in turn is connected to a source of electric power. Actuation of the starter button 74 will complete the circuit through solenoid coil 43 from line 75 through conductor 77 which is connected by a wire 78 to a main line 79 through which the current flows out of the system. Thus, by actuating the starter button 74, resulting in energizing the solenoid 43, the slide valve 44 of the four-way valve will be shifted into the position shown in Fig. 10 whereby liquid under pressure will flow from conduit 30 through conduit 27 into the lower end of the hydraulic cylinder. Inasmuch as the two-way valve 34 is open at this time, as shown in Fig. 12, the piston 25 will be subjected to maximum hydraulic pressure so as to move upwardly at its maximum speed. Mounted on the vacuum head 22 is a bracket 80 having a contact carrying bar or member 80*a*. Adjustably mounted adjacent the upper end of this bar is a contact shoe 81. As illustrated in Figs. 3 and 4, this shoe has a cam shaped end and is carried by a sleeve 82 which is adjustable vertically on the bar or rod 80*a* and held in adjusted position by means of a set screw 83. Mounted in proximity to the travel of the contact shoe 81 is an upper limit switch 84 which is of the type normally held open by a spring and which may be closed by means of a lever terminating in a contact roller 85 in position to be engaged by the shoe 81 during its upward travel and thereby shifted to close the limit switch 84 in the manner shown in Fig. 3.

It will be noted that the shoe 81 is adapted to engage the roller 85 and close the upper limit switch 84 near the upper limit of travel of the vacuum head 22 just prior to its engagement with the mold 21 in the flask 20. The closing of switch 84 completes a circuit through conductors 86 and 87 which are connected in circuit with the solenoid 55 of the two-way valve 34. Closing of this circuit by means of switch 84 results in energizing the solenoid 55, thereby raising the valve member 52 (Fig. 12) into closed position and by-passing liquid from the pump 33 through by-pass conduit 35 past the needle valve 36. This operation results in a reduction in pressure to line 27 into the cylinder and slows down the upward travel of the piston 25 and, hence, the vacuum head 22. As previously stated, the rate of slow travel of the vacuum head may be controlled by adjusting the needle valve 36. Hence, it will be seen that the final travel of the vacuum head into sealing engagement with the mold, the extent of which may be governed by suitable adjustment of the contact shoe 81, may be very slow so that when this upward travel is finally arrested there will be no material over-travel of the head due to its inertia.

In addition to energizing the solenoid 55 and operating the two-way valve 34, as above described, closing of the switch 84 completes the circuit through the electric motor of the vacuum pump 70 and the electro-magnetic coil of the magnetic chuck 23 through the medium of conductors 88 and 89. Thus, it will be seen that when the switch 84 is closed three things occur. First, the two-way valve 34 is closed so as to by-pass liquid under pressure through by-pass conduit 35, causing slow travel of the vacuum head. Second, the vacuum motor is started to operate the pump and exhaust air from the vacuum head through conduits 59, 61 and 68. Third, the magnetic chuck 23 is energized, producing a magnetic field adapted to hold the flask 20 tightly against the bottom face of the magnetic chuck and away from the ways 19 during the extracting operation.

The Mercoid switch 72 may be set so as to operate when a predetermined negative pressure or partial vacuum has been reached within the chamber 56 of the vacuum head, such as a negative pressure of ten inches of mercury. When this negative pressure has been reached in the vacuum chamber 56 and also the conduit 71, the Mercoid switch 72 will be actuated to close reversing switch 73 as shown in Fig. 2. When switch 73 is closed a circuit will be completed through solenoid 47, thereby shifting the slide valve 44 of the four-way valve 29 to the position shown in Fig. 11, reversing the flow of liquid from the pump and causing it to flow through conduit 28 into the upper end of the cylinder. The piston 25 within the hydraulic cylinder will then move downwardly, oil or liquid at the under-side of the piston being exhausted from the cylinder through conduit 27 as hereinbefore described. The initial portion of the downward stroke of the piston will be at a slow rate while the contact shoe 81 is in engagement with the roll 85, maintaining the switch 84 closed in the manner shown in Figs. 2 and 3. This initial slow downward stroke of the piston as well as vacuum head 22 corresponds in rate of speed to the final slow upward stroke of the vacuum head into sealing engagement with the mold, and has the desirable advantage of providing a gentle and slow withdrawal of the mold from the flask. When the contact shoe 81 passes below the contact roll 85 the switch 84 will immediately open, thereby breaking the circuit to the vacuum pump motor 70 and the magnetic chuck 23 and at the same time deenergizing the solenoid 55 of the two-way valve 34. The valve member 52 of the two-way valve is then returned to open position by its spring, permitting direct flow of liquid from the pump 33 under pressure through the valve 34 and conduit 30 and thence through the four-way valve and conduit 28 into the upper end of the cylinder. This action occurs when the mold has been withdrawn from the flask and initiates the fast downward stroke of the piston 25.

Mounted on the upright bar 80*a* of the bracket 80 and below the contact shoe 81 is a contact member 90 carried by a sleeve 91 adjustable on the bar or rod 80*a* and held in adjusted position by means of a set screw 92. The contact member 90 is adapted to engage a contact roll 93 at the end of a lever adapted to actuate a lower limit switch 94. This switch is adapted to complete a circuit through the solenoid 67 of the three-way valve 63 by means of the conductors or wires 95, 96 and 79. The switch 94 is of the conventional type which works only in one direction, being normally open as shown in Fig. 2. The

lower contact 90 is of the cam type which is adapted during the final portion of the downward stroke of the vacuum head to engage and pass over the contact roll 93, which operation momentarily closes the switch 94, thereby energizing the solenoid 67, lifting the valve member 65 of the three-way valve, and closing off the vacuum passage 68 through the valve. This results in momentarily opening the air pressure line 69 through the three-way valve and permitting a momentary blast of air to pass through the conduit 61 into the chamber 56 of the vacuum head, relieving the negative pressure within the head and restoring the pressure therein to normal atmospheric pressure, thereby restoring the Mercoid switch to zero and opening the reversing switch 73. When the air under pressure is forced through conduit 61 it will also open check valve 62, thereby blowing any water out of line 61 which has accumulated during the operation of the vacuum pump.

Since the engagement of the cam contact 90 with the roll 93 of the lower limit switch 94 is but momentary, the solenoid 67 will be deenergized by the opening of the lower limit switch 94 when the contact member 90 has passed below the roll 93, as shown in Fig. 4. The valve member 65 is thereupon returned by spring 66 to its position shown in Fig. 13 so as to maintain communication between the vacuum line 68 and the conduit 61 which leads to the chamber within the vacuum head 22. At this time the condition of the system is as illustrated in Fig. 1, the piston 25 being at the bottom of its travel and the mold 21 supported upon the vacuum head. Until the commencement of a succeeding extracting operation, which is initiated by actuation of starter button 74, the slide valve member 44 of the four-way valve remains in the position shown in Fig. 11 with the upper side of the piston 25 under continuous pressure from lines 30 and 28. As a consequence, the piston is held in its full down position until the start of the next cycle of operations.

From the foregoing it will be seen that the vacuum head 22 has a two-stage travel in both directions. A relatively fast rate of travel is imparted to the piston 25 and, hence, the vacuum head to and from the point when the contact shoe 81, carried by the vacuum head, actuates the upper limit switch 84. During the final portion of the upward stroke of the piston the vacuum head will have a range of slow travel preferably commencing at or just prior to contact of the head with the mold, such as slightly before the vacuum head reaches the position of Fig. 6. From this point the vacuum head continues to travel upwards at a very slow rate of speed, and during this slow stroke the partial vacuum or negative pressure is built up within the chamber 56 in the head while the marginal sealing ribs 57a on the head embeds itself in the mold, as shown in Fig. 7. Due to this slow travel there is little or no danger of the vacuum head causing damage to the mold. The negative pressure in the head will reach the set position of the vacuum operated switch 72 during the gradual upward movement of the head into progressive sealing engagement with the mold, such as the position of the parts shown in Fig. 7, and at that point the switch 72 will close the reversing switch 73 and instantly actuate the slide valve member of the four-way valve 29, initiating downward travel of the piston and vacuum head by opening the pressure line 28 to the hydraulic pump 33. The initial downward stroke of the vacuum head will be at the slow rate until the contact shoe 81 releases the switch 84, permitting it to open. Whereupon, the two-way valve 34 will be restored to its normal open position causing relatively fast downward travel of the piston and vacuum head. At the same time opening of switch 84 will cut off the current to the magnet 23 and shut off the vacuum pump 70.

It will be seen, further, that there is no dwell or idle stage of the piston and vacuum head during a given cycle of operations, inasmuch as the slow downward stroke of the head follows immediately the slow upward stroke thereof, the point when the head travel is reversed being determined by the negative pressure setting of the switch 72. This setting is reached, so as to reverse the direction of the travel of the head, during the interval of time when the vacuum head is completing its slow stroke in sealing engagement with the mold. The interval of time allowed to build up the vacuum in the vacuum head to the setting of pressure switch 72 may be slightly amplified by arranging the ways 19 so that the vacuum head will first contact the mold and raise the flask 20 from the ways into the field of the magnet, as shown in Fig. 6. Embedding engagement of the head with the mold will continue during the balance of the slow upward stroke until the switch 72 is tripped and the direction of the travel of the head reversed.

I claim:

1. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head, means for shifting said head toward and from said mold, and mechanism for controlling the operation of said means to provide a relatively rapid initial range of travel of the head toward the mold and a relatively slow travel of the head while moving in the same direction into sealing engagement with the mold.

2. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head, means for shifting said head toward and from said mold, mechanism for controlling the operation of said means to provide a relatively rapid initial range of travel of the head toward the mold and a relatively slow travel of the head while moving in the same direction into sealing engagement with the mold, and means controlled by said mechanism for inducing a partial vacuum in said head only during said slow travel thereof.

3. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head, means for shifting said head toward and from said mold, mechanism for controlling the operation of said means to provide a relatively rapid initial range of travel of the head toward the mold and a relatively slow travel of the head while moving in the same direction into sealing engagement with the mold, means controlled by said mechanism for inducing a partial vacuum in said head only during said slow travel thereof, and means controlled by the partial vacuum in said head for reversing the direction of travel of the head.

4. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head adapted to be moved into sealing engagement with the mold, a piston for shifting said head toward and into sealing engagement with the mold, and means for controlling the operation of said piston to reduce the rate of travel of said head during a predetermined final range of

travel of the head into sealing engagement with the mold.

5. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head adapted to be moved into sealing engagement with the mold, a piston for shifting said head toward and into sealing engagement with the mold, means for controlling the operation of said piston to reduce the rate of travel of said head during a predetermined final range of travel of the head into sealing engagement with the mold, and means for inducing a negative pressure in said head during said reduced rate of travel of the head.

6. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head adapted to be moved into sealing engagement with the mold, a piston for shifting said head toward and into sealing engagement with the mold, means for controlling the operation of said piston to reduce the rate of travel of said head during a predetermined final range of travel of the head into sealing engagement with the mold, means for inducing a negative pressure in said head during said reduced rate of travel of the head, and means actuated by a predetermined negative pressure in the head for reversing the direction of travel of the head.

7. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head adapted to be moved into sealing engagement with the mold, a reciprocable piston connected to the head for shifting the same into and out of engagement with the mold, a vacuum pump for inducing a negative pressure in the head, means for imparting a relative rapid initial rate of travel to the piston and head toward the mold, means for imparting a relatively slow rate of travel to the piston in the same direction to move the head into sealing engagement with the mold, and electrically actuated means for controlling both of said means and for actuating said pump only during said slow travel of the piston and head.

8. An extractor mechanism for extracting a mold from a flask, comprising a vacuum head adapted to be moved into sealing engagement with the mold, a reciprocable piston connected to the head for shifting the same into and out of engagement with the mold, a vacuum pump for inducing a negative pressure in the head, means for imparting a relatively rapid initial rate of travel to the piston and head toward the mold, means for imparting a relatively slow rate of travel to the piston in the same direction to move the head into sealing engagement with the mold, electrically actuated means for controlling both of said means and for actuating said pump only during said slow travel of the piston and head, and means controlled by the negative pressure in said head for reversing the direction of travel of the piston and head to extract the mold from the flask.

9. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising means for supporting the flask, a vacuum head, means for shifting said head toward and from the mold, means for imparting a reduced rate of travel to the head while moving into sealing engagement with the mold, means for inducing a negative pressure in the head, and means controlled by the negative pressure in the head for reversing the direction of travel of the head to extract the mold from the flask, said second named means being effective to impart a reduced rate of travel to the head while extracting the mold from the flask.

10. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising means for supporting the flask, a vacum head, means for shifting said head toward and from the mold, means including a limit switch actuated by an element on said head for imparting a reduced rate of travel to the head while moving into sealing engagement with the mold, means for inducing a negative pressure in the head, and means controlled by the negative pressure in the head for reversing the direction of travel of the head to extract the mold from the flask, said second named means being effective to impart a reduced rate of travel to the head while extracting the mold from the flask.

11. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising means for supporting the flask, a vacuum head, means for shifting said head toward and from the mold, electrically actuated means including a limit switch for imparting a reduced rate of travel to the head while moving into engagement with the mold, means controlled by said switch for inducing a negative pressure in said head, and means controlled by the negative pressure in the head for reversing the direction of travel of the head to extract the mold from the flask.

12. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising means for supporting the flask, a vacuum head, means for shifting said head toward and from the mold, electrically actuated means including a limit switch operated at a predetermined time by an element on said head for imparting a reduced rate of travel to the head while moving into engagement with the mold, means controlled by said switch for inducing a negative pressure in said head, and means controlled by the negative pressure in the head for reversing the direction of travel of the head to extract the mold from the flask.

13. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a magnetic device for supporting the flask, a vacuum head, a vacuum pump for inducing a negative pressure in the head, a hydraulically actuated piston for shifting the head toward and from the mold, valve means for controlling the operation of said piston to impart a relatively rapid initial rate of travel to the piston and head toward the mold and a corresponding relatively rapid final rate of travel away from the head, electric means actuated by an element on said head for operating said valve means to impart a relatively slow rate of travel to the piston and head when the head moves in one direction into sealing engagement with the mold and in the opposite direction to withdraw the mold from the flask, and means controlled by said element for operating said pump and energizing said magnetic device during said slow travel of the head.

14. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a magnetic device for supporting the flask, a vacuum head, a vacuum pump for inducing a negative pressure in the head, a hydraulically actuated piston for shifting the head toward and from the mold, valve means for controlling the operation of said piston to impart a relatively rapid initial rate of travel to the piston and head toward the mold and a corresponding relatively rapid final rate of travel away from the head,

electric means actuated by an element on said head for operating said valve means to impart a relatively slow rate of travel to the piston and head when the head moves in one direction into sealing engagement with the mold and in the opposite direction to withdraw the mold from the flask, means controlled by said element for operating said pump and energizing said magnetic device during said slow travel of the head, and means controlled by the negative pressure in the head for reversing the direction of travel of the head to effect withdrawal of the mold from the flask.

15. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a magnetic device for supporting the flask, a vacuum head, a vacuum pump for inducing a negative pressure in the head, a hydraulically actuated piston for shifting the head toward and from the mold, valve means for controlling the operation of said piston to impart a relatively rapid initial rate of travel to the piston and head toward the mold and a corresponding relatively rapid final rate of travel away from the head, electric means actuated by an element on said head for operating said valve means to impart a relatively slow rate of travel to the piston and head when the head moves in one direction into sealing engagement with the mold and in the opposite direction to withdraw the mold from the flask, means controlled by said element for operating said pump and energizing said magnetic device during said slow travel of the head, and means including a pressure actuated switch controlled by the negative pressure in the head for reversing the direction of travel of the head to effect withdrawal of the mold from the flask.

16. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a magnetic device for supporting the flask, a vacuum head, a vacuum pump for inducing a negative pressure in the head, a hydraulically actuated piston for shifting the head toward and from the mold, valve means for controlling the operation of said piston to impart a relatively rapid initial rate of travel to the piston and head toward the mold and a corresponding relatively rapid final rate of travel away from the head, means for operating said valve means to impart a relatively slow rate of travel to the piston and head when the head moves a predetermined distance in one direction into engagement with the mold and a similar distance in the opposite direction to withdraw the mold from the flask, said last named means including a limit switch and an element movable with the head for operating said switch, and means controlled by said switch for operating said pump and energizing said magnetic device.

17. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a magnetic device for supporting the flask, a vacuum head, a vacuum pump for inducing a negative pressure in the head, a hydraulically actuated piston for shifting the head toward and from the mold, valve means for controlling the operation of said piston to impart a relatively rapid initial rate of travel to the piston and head toward the mold and a corresponding relatively rapid final rate of travel away from the head, means for operating said valve means to impart a relatively slow rate of travel to the piston and head when the head moves a predetermined distance in one direction into engagement with the mold and a similar distance in the opposite direction to withdraw the mold from the flask, said last named means including a limit switch and an element movable with the head for operating said switch, means controlled by said switch for operating said pump and energizing said magnetic device, and a pressure actuated device controlled by the negative pressure in the head for reversing the direction of travel of the head to effect withdrawal of the mold from the flask.

18. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a vacuum head, a hydraulically actuated piston for shifting said vacuum head in one direction into engagement with the mold and in the opposite direction to withdraw the mold, means operable to induce a negative pressure in the head to effect withdrawal of the mold by suction, and means controlled by the negative pressure in the head for reversing the direction of travel of the head.

19. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a vacuum head, a hydraulically actuated piston for shifting said vacuum head in one direction into engagement with the mold and in the opposite direction to withdraw the mold, means operable to induce a negative pressure in the head to effect withdrawal of the mold by suction, means controlled by the negative pressure in the head for reversing the direction of travel of the head, and means for reducing the rate of travel of the head during operation of said first named means.

20. An extractor mechanism for withdrawing a mold, such as a plaster mold, from a flask, comprising a vacuum head, means for shifting said vacuum head in one direction into engagement with the mold and in the opposite direction to withdraw the mold, means operable to induce a negative pressure in the head to effect withdrawal of the mold by suction, means controlled by the negative pressure in the head for reversing the direction of travel of the head, and means for controlling said first named means including a limit switch and an element movable with the head for actuating said switch.

HERBERT J. PATTISON.