

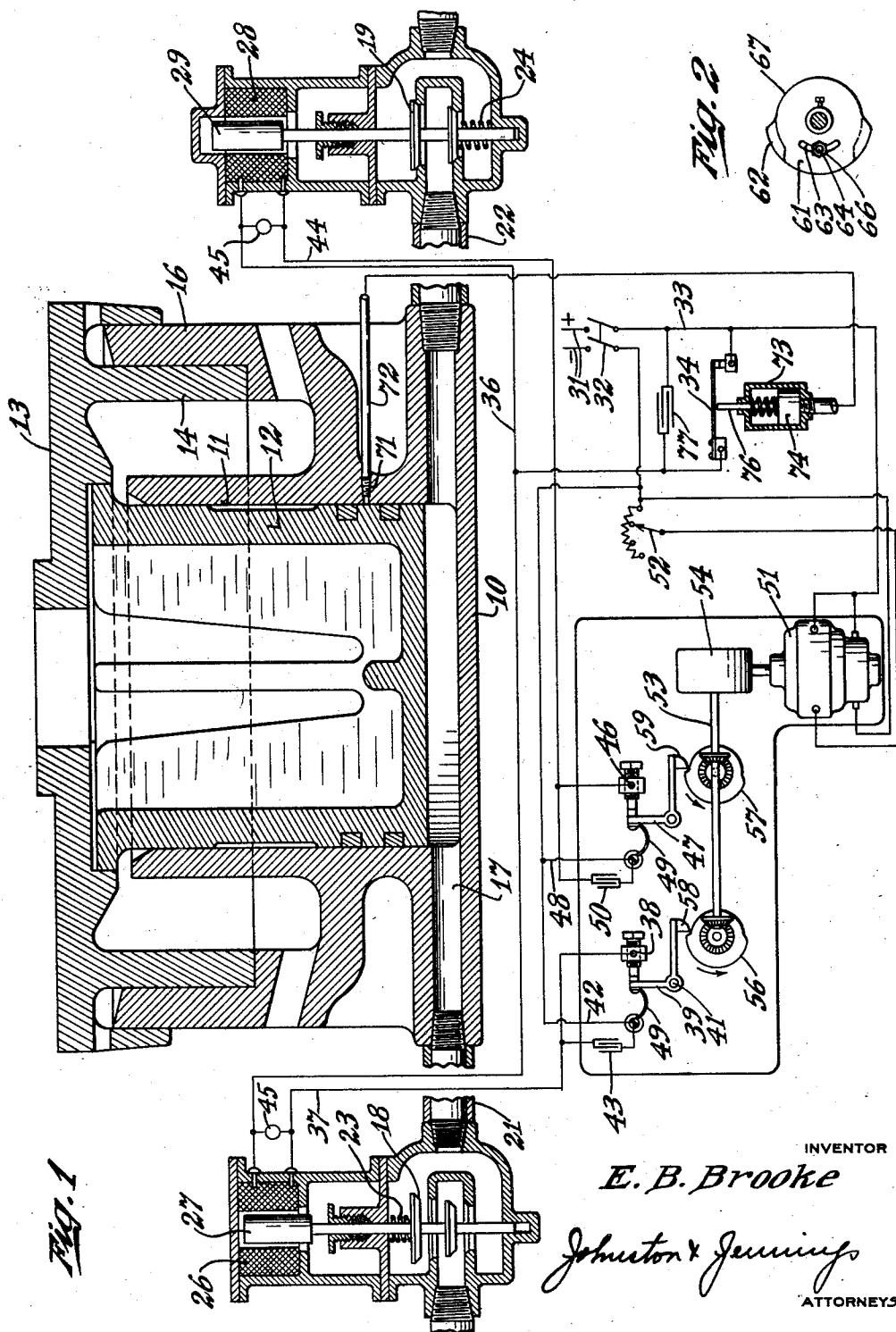
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JARRING MACHINE

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JARRING MACHINE

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My invention relates to jarring machines, such as are employed in ramming sand molds, more particularly to operating means therefor, and has for its object the provision of apparatus of the character designated, which shall be simple of design and effective to produce relatively rapid operation of the ramming table, thereby greatly reducing the time required for ramming a mold.

A further object of my invention is to provide valve operating means for a pressure actuated jarring machine which shall be extremely flexible and rapid in operation, and which shall include closely adjustable means for determining the time of opening and closing of the valves.

A still further object of my invention is to provide operating means for a pressure actuated jarring machine in which balanced valves are provided for admitting and exhausting fluid under pressure to and from the machine, together with improved electromagnetic means for operating the valves.

A still further object of my invention is to provide valve operating means for a pressure actuated jarring machine including a limit means effective upon overtravel of the rammer piston, to close the admission valve and open the exhaust valve to the rammer cylinder.

In the operation of pressure actuated jarring machines, it is highly important that a sufficient volume of air under pressure be quickly admitted to the rammer cylinder to raise the piston and be quickly exhausted therefrom to permit the piston to drop to produce the necessary jarring effect. It is furthermore highly important that there be accurate timing of the valves to insure their prompt opening and closing.

These benefits are accomplished by means of my invention in which I employ a pair of balanced valves, preferably of the poppet type, one for admitting air to the rammer cylinder, and the other for exhausting it therefrom. The admission valve is spring-biased toward a closed position, while the exhaust valve is spring biased toward an open position. Electric solenoids are employed to open and to close the valves, respec-

tively, the circuits being controlled by cam operated circuit breakers, and the cams being driven by a variable speed motor. Each of the cams is comprised of two similar parts bolted together through a slot, being thereby angularly movable with respect to each other to vary the duration of controlling effect exerted by its associated solenoid. In addition, I provide an improved travel limit device effective upon overtravel of the rammer piston, to open both of the solenoid circuits, thereby permitting the springs to close the admission valve, and open the exhaust valve, thereby stopping the operation of the machine.

Apparatus embodying features of my invention is shown in the accompanying drawings, forming a part of this application, in which Fig. 1 is a diagrammatic view showing the rammer cylinder and operating valves together with the circuit controlling means associated with the solenoid; and

Fig. 2 is a detail view showing one of the cams employed to operate the circuit breakers.

Referring now to the drawing for a better understanding of my invention, I show a conventional jarring machine, comprising a base casting 10, having formed therein a cylinder 11, in which is disposed a ramming piston 12. A jolt table 13 is disposed on the base casting 10 to be raised by the piston 12 and allowed to drop by gravity. The ramming table 13 is provided with downwardly extending flanges 14 which cooperate with guides 16 formed on the base casting 10 to insure the ramming table remaining in its proper relative position. In the lower part of the base casting 10 is a passage 17 leading to the cylinder 11 for the admission and exhaust of air to and from the cylinder 11. Preferably, the piston 12 is made separate from the ramming table 13 in order to avoid lateral strain on the piston.

Air is admitted to the cylinder 11 through a balanced admission valve 18, which is preferably of the poppet type, and is exhausted from the cylinder by a similar balanced valve 19. These valves are connected to the base casting, preferably by means

of flexible connections 21 and 22, thereby preventing the vibration of the base casting affecting the operation of the valves.

The admission valve 18 is biased toward a closed position by means of a coil spring 23, while the exhaust valve is biased toward an open position by means of a coil spring 24. The admission valve 18 is moved to an open position by means of an electric solenoid 26 having its core 27 arranged to exert an opening effect on the valve stem when the solenoid is energized. A similar solenoid 28 is associated with the exhaust valve 19, and has its core 29 so arranged as to exert a closing effect on the exhaust valve 19 when the solenoid is energized.

The means for controlling the operation of the solenoids 26 and 28 forms a very important feature of my invention, and will now be described. At 31 is shown a circuit from any suitable source of electric energy, and having a controlling switch 32. To the switch 32 is connected a lead 33 which passes through a limit switch 34 to a conductor 36 leading to both the solenoids 26 and 28. The conductor 37 forms the other side of the circuit to the solenoid 26 and leads to a contact element 38 controlled by a bell crank switch 39 pivoted at 41. When the switch 39 is closed, the circuit continues through a conductor 42 and back to the switch 32. A condenser 43 is shunted across the switch 39 to prevent arcing when the switch is opened and closed, and also to discharge the induced current in the solenoid 26 when the circuit thereto is broken.

From the solenoid 28 the circuit returns through a conductor 44 to a contact 46, having associated therewith a pivoted bell crank switch 47 similar to the switch 39. When the switch 47 is closed, the circuit continues through a conductor 48 to join the conductor 42 and thence back to the switch 32. Both the bell crank switches 39 and 47 are biased to a closed position by means of springs 49. Associated with the switch 47 is a condenser 50 similar to the condenser 43 and for the same purpose. I have also found that better action of the solenoids is obtained by interposing a suitable discharge resistance, such as a lamp 45 across the circuits to the solenoids 26 and 28. The lamps 45 serve the further purpose of indicating the proper flow of current to the solenoids 26 and 28.

Arranged in parallel with the switches 39 and 47 is a variable speed motor 51 controlled by a rheostat 52. The motor 51 drives a cam shaft 53 through a reduction gear 54. Driven by the cam shaft 53 are two cams 56 and 57, which for convenience of illustration are shown as being arranged at right angles to the shaft 53. Bearing upon the cam 56 is a shoe 58 carried by one arm of the switch 39, and bearing upon the cam 57 is a similar shoe 59 carried by one

arm of the switch 47. As the cams 56 and 57 are rotated, the circuits to the solenoids 26 and 28 are alternately opened and closed.

Referring to Fig. 2 of the drawing, I show a detail view of one of the cams 56 and 57. Each of these cams is comprised of two similar halves 61 and 62, each of said halves being an independent cam, and the shoes 58 and 59 being made wide enough to cover both. The part 61 is provided with an elongated slot 63 through which extends a bolt 64 from the part 62, which bolt is provided with a nut 66 to hold the two parts in adjusted position.

Each of these two cam parts is provided with a portion 67 having a lesser radius than the remaining portion, so that when the shoes 58 and 59 ride up on the portion of greater radius, the switches 39 and 47 are opened to de-energize the solenoids 26 and 28; and when the shoes 58 and 59 bear against the reduced portion 66 of the cams, the switches 39 and 47 are closed to de-energize the solenoids.

The cams 56 and 57 are so arranged and adjusted as to give the following sequence of operations of the valves 18 and 19: With the switches 39 and 47 in the closed position, as shown, the solenoids 26 and 28 are both energized, and the inlet valve 18 is held open against the spring 23, while the exhaust valve 19 is held closed against the spring 24, and the piston 12 is moved upward. As the cams 56 and 57 rotate, the solenoid 26 is de-energized slightly in advance of the solenoid 28 so as to close the admission valve 18. Immediately thereafter, the solenoid 28 is de-energized to permit the spring 24 to open the exhaust valve 19, and the piston 12 drops by gravity.

It will be seen that the construction of the eccentrics 56 and 57 permits a close adjustment of the sequence of operation, while the prompt movement of the valves by the solenoids permits rapid operation of the ramming piston 12. The employment of balanced valves to admit and exhaust air from the cylinder 11, reduces the force required to operate the valves to a minimum, and further facilitates the quick operation of the valves.

The action of the solenoids 26 and 28 in promptly releasing the cores 27 and 29 when the circuits are broken is made possible by the provision of the condensers 43 and 51. As is well known, when the circuit to a solenoid winding is broken, there is a current surge which prolongs the magnetic flux and causes the solenoid core to be held until the surge is dissipated. The condensers 43 and 51 serve to immediately discharge this induced current and permit the immediate release of the solenoid cores. By this means I have been enabled to more than triple the rate of operation of the valves 18 and 19.

In order to prevent overtravel of the piston

12, which might result in damage to the apparatus, I provide an opening 71 in the side of the cylinder 11, and connect thereto a conduit 72 leading to a pressure responsive device 73. The pressure responsive device 73 is provided with a plunger 74 and a plunger stem 76, the latter bearing against the switch 34 in the main circuit 33. In the event the inlet valve 18 should become stuck open, or from any other cause the piston 12 should rise sufficiently to uncover the opening 71, the pressure responsive device 73 acts to open the switch 34, thereby breaking all of the electric circuits. This action causes an opening of the exhaust valve 19 by the spring 24 and relieves the pressure from beneath the piston 12. Associated with the switch 34 is a condenser 77 which serves to minimize arcing and to discharge the induced current in the solenoids when the circuit is broken.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In a pressure operated jarring machine, the combination of a cylinder, valves for admitting and exhausting fluid under pressure to and from the cylinder, electro-magnetic means for operating the valves, a cam shaft, cams on the shaft for controlling the electro-magnetic means, adjustable means for varying the controlling surfaces of the cams, and means for driving the cam shaft.

2. In a pressure operated jarring machine, the combination of a cylinder, valves for admitting and exhausting fluid under pressure to and from the cylinder, electro-magnetic means for operating the valves, a cam shaft, cams on the shaft for controlling the electro-magnetic means, adjustable means for varying the controlling surfaces of the cams, and variable speed means for driving the cam shaft.

3. In a pressure operated jarring machine, the combination of a cylinder, a balanced inlet valve for the cylinder, a spring for biasing the inlet valve to a closed position, a balanced exhaust valve, a spring for biasing the exhaust valve to an open position, a solenoid for opening the inlet valve, a second solenoid for closing the exhaust valve, circuits for the solenoids, a cam shaft, cams on the shaft for controlling the circuits, and variable speed means for driving the cam shaft.

4. In a pressure operated jarring machine, the combination of a cylinder, a balanced inlet valve for the cylinder, a spring for biasing the inlet valve to a closed position, a balanced exhaust valve, a spring for biasing

the exhaust valve to an open position, a solenoid for opening the inlet valve, a second solenoid for closing the exhaust valve, circuits for the solenoids, a cam shaft, cams on the cam shaft for controlling the circuits, each of said cams comprising similar parts adjustably movable angularly with respect to each other to vary the controlling surface of the cam, and variable speed means for driving the cam shaft.

5. In a jarring machine having a cylinder and a piston in the cylinder, the combination of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, and variable speed means for synchronously controlling the electro-magnetic means.

6. In a jarring machine having a cylinder and a piston in the cylinder, the combination of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, circuits for both electro-magnetic means, a motor, a shaft driven from the motor, cams on the shaft, and circuit breakers in the circuits for the electro-magnetic means operated by the cams.

7. In a jarring machine having a cylinder and a piston in the cylinder, the combination of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, circuits for both electro-magnetic means, a motor, a shaft driven from the motor, cams on the shaft, circuit breakers in the circuits for the electro-magnetic means operated by the cams, and means for varying the duration of opening of the circuits by the cams.

8. In a jarring machine having a cylinder and a piston in the cylinder, the combination of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, circuits for both electro-magnetic means, a motor, a shaft driven from the motor, cams on the shaft, circuit breakers in the circuits for the electro-magnetic means operated by the cams, means for varying the duration of opening of the circuits by the cams, and condensers shunted across the circuit breakers.

9. In a jarring machine having a cylinder and a piston in the cylinder, the combination

of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, circuits for both electro-magnetic means, a motor, a shaft driven from the motor, cams on the shaft, circuit breakers in the circuits for the electro-magnetic means operated by the cams, means for varying the duration of opening of the circuits by the cams, a limit pressure connection to the cylinder spaced from the bottom thereof, a main circuit controlling the circuits for the electro-magnetic means, a switch in said main circuit, and pressure responsive means connected to the pressure connection for operating said switch.

10. In a jarring machine having a cylinder and a piston in the cylinder, the combination of an inlet valve, means for biasing the inlet valve to a closed position, an exhaust valve, means for biasing the exhaust valve to an open position, electro-magnetic means for opening the inlet valve, other electro-magnetic means for closing the exhaust valve, circuits for both electro-magnetic means, a motor, a shaft driven from the motor, cams on the shaft, circuit breakers in the circuits for the electro-magnetic means operated by the cams, means for varying the duration of opening of the circuits by the cams, a limit pressure connection to the cylinder spaced from the bottom thereof, a main circuit controlling the circuits for the electro-magnetic means, a switch in said main circuit, pressure responsive means connected to the pressure connection for operating said switch, and condensers shunted across the circuit breakers.

In testimony whereof I affix my signature.
EDWARD B. BROOKE.

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