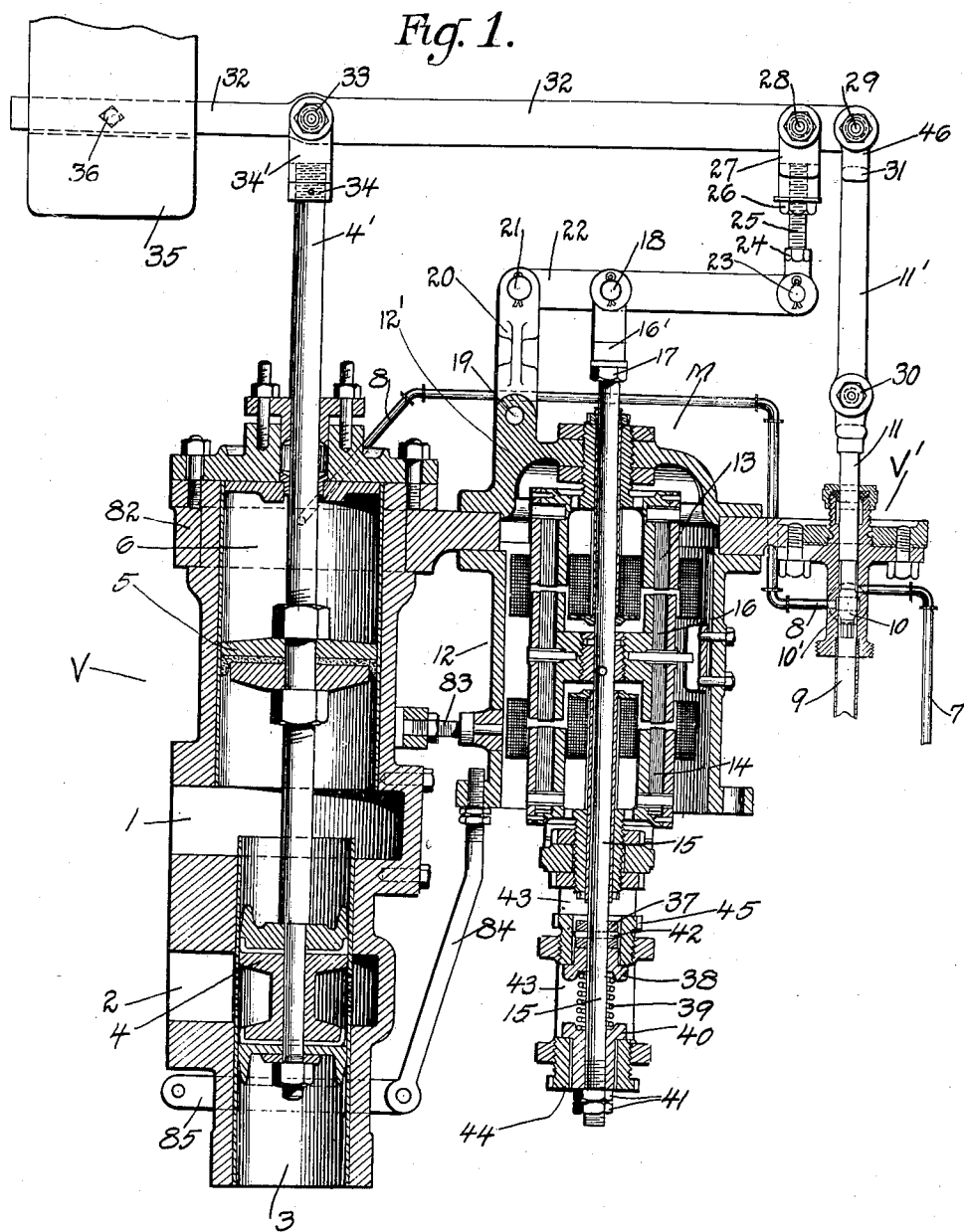


F. W. NEWELL.
 ALTERNATING CURRENT ELECTROMAGNETIC VALVE APPARATUS.
 APPLICATION FILED APR. 2, 1907.

937,634.

Patented Oct. 19, 1909.

2 SHEETS—SHEET 1.



WITNESSES:

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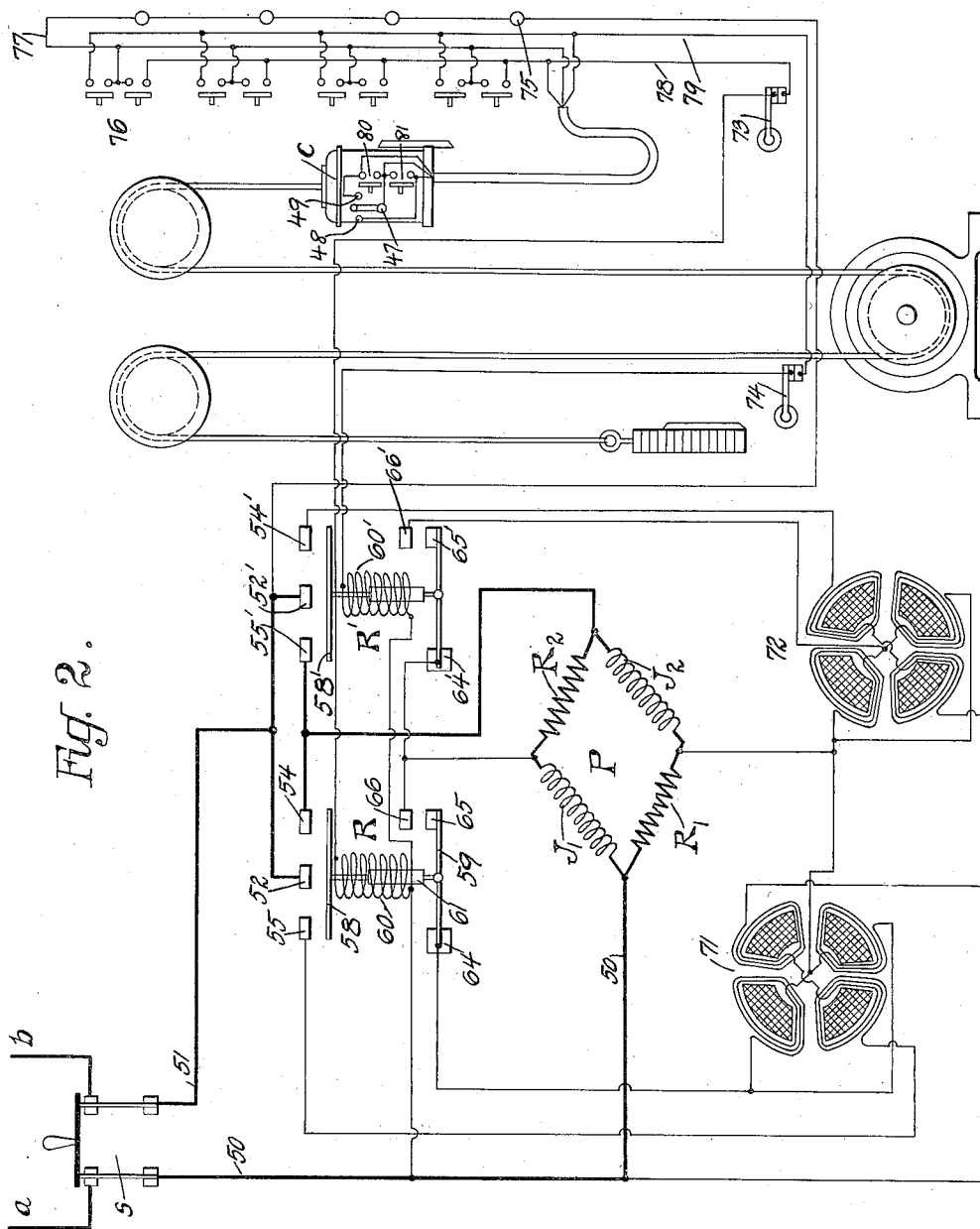


Fig. 2.

Witnesses:

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ALTERNATING-CURRENT ELECTROMAGNETIC VALVE APPARATUS.

937,634.

Specification of Letters Patent.

Patented Oct. 19, 1909.

Application filed April 2, 1907. Serial No. 365,968.

To all whom it may concern:

Be it known that I, FREDERICK W. NEWELL, a citizen of the United States, residing in Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Alternating-Current Electromagnetic Valve Apparatus, of which the following is a specification.

My invention relates to electrically operated valve apparatus and one of its objects is the provision of a device operated by alternating current for controlling the operation of valve apparatus.

Another object of the invention is the provision of an electro-magnet in combination with valve mechanism to effect the operation of the latter by means of minimum consumption of electric current.

A further object of the invention is the provision of an alternating current electro-magnet in combination with valve mechanism to secure quick initial action of the latter.

Another object of the invention is the provision of valve mechanism and an alternating current electro-magnet for operating the same to make the entire structure available in an alternating current elevator system, or wherever direct current is not available.

Other objects of the invention will appear hereinafter, the novel combinations of elements being pointed out in the claims hereto appended.

In the accompanying drawing, Figure 1 shows in sectional elevation a preferred form of my apparatus; and Fig. 2 is a wiring diagram showing an application of the invention in a push button hydraulic elevator system.

Similar reference characters denote similar parts throughout the drawings.

Referring to Fig. 1, V designates in general a differential main or motor valve apparatus of well known construction, the purpose of which is to control the admission to or exhaust from the power cylinder, (not shown), which in turn contains a part of the moving means for the elevator car. The port 1 is connected to the source of pressure supply and the port 2 is connected to the power cylinder, while the port designated 3 is the discharge pipe. The main valve 4 is shown in the drawing in its central or closed position. When moved upwardly it establishes communication between the power cyl-

inder and the exhaust 3, thereby causing the elevator car to descend. When moved downwardly it establishes a connection between the pressure supply port 1 and the cylinder port 2, which effects an upward travel of the car. In its intermediate position, as shown, both the pressure supply and the exhaust are shut off from the power cylinder and the elevator car is at rest.

It will be noticed that the valve apparatus V has cylindrical portions of different diameter, this being a characteristic feature of all differential valve apparatus. The upper cylindrical portion contains a piston 5, while the lower or smaller portion contains the piston valve 4. The piston 5 and the valve 4 are rigidly mounted upon the same valve stem 4' and move in unison. The adjacent faces of the pistons 5 and 4 are at all times subjected to the full pressure of the supply from the port 1, and since the area of the piston 5 is larger than that of the piston valve 4, the tendency is to move the valve stem 4' upwardly. The control of the valve apparatus V is dependent, however, upon the pressure on the upper side of the piston 5, this pressure being itself controlled or regulated by means of the pilot valve mechanism V'. This pilot valve mechanism in its operation effects the movement of the main valve 4 by controlling the amount of pressure in the upper part of the cylinder 6. This is well known in the art and needs no further description.

The pilot mechanism V' comprises, in this instance, a simple piston valve 10 movable in a small cylinder provided with three pipe connections, namely, that designated 8 connecting the pilot valve cylinder 10' with the motor cylinder 6; that designated 7 connecting the pilot valve cylinder 10' to a source of fluid pressure supply; and that designated 9 being the exhaust pipe. The pressure pipe 7 may be connected to the pressure supply port 1 of the main valve or it may be connected to some other pressure supply. The discharge pipe 9 may also be connected to the main discharge 3 if desired.

The pilot valve 10 is shown in its central position closing the passage between the pipe 8 and the cylinder 10'. If the valve 10 be moved upwardly communication is established between the cylinder pipe 8 and the exhaust pipe 9. Similarly, if the pilot valve 10 be moved downwardly the cylinder pipe 8 is placed in communication with the pres-

sure pipe 7. Located in this instance between the main valve apparatus V and the pilot valve mechanism V' is shown an alternating current electro-magnet M of the poly-phase type. The essential features of this magnet are preferably such as disclosed in the Patent No. 744,773, granted November 24, 1903 to David L. Lindquist, but in the present instance the construction of the magnet is modified somewhat in order to adapt it to this particular use. The details of this electro-magnet may be varied as desired, the construction set forth being merely by way of illustration of an efficient multiphase magnet employing alternating current for its operation.

The electro-magnet as shown in Fig. 2 is arranged to be supplied with alternating current from single phase mains, and comprises as indicated in Fig. 1, an outer frame 12 which contains laminated magnet cores 13 and 14 rigidly fixed or secured to the frame 12. These magnet cores each have four equidistant cutaway portions, thus forming four pole pieces upon which are mounted four magnet coils. Centrally disposed between the fixed magnet poles 13 and 14 is the laminated armature 16. This armature has eight projections or magnet poles, four on each side, and corresponding to the fixed magnet poles 13 and 14, and are arranged to cooperate therewith. Each fixed pole piece is associated with a magnet coil wound so as to embrace only a portion of the pole piece, the remaining space in the magnet coil being arranged to receive the corresponding pole piece on the armature.

A rod 15 passes centrally through the entire magnet and to this rod is rigidly connected the armature 16. The magnet frame 12 has a lower portion 43 to which is attached the valve centering mechanism comprising a centering spring 39 located between two stop collars 38 and 40 which are provided with recesses for receiving the centering spring 39. Screw-threaded bushings 45 and 44 receive the stop collars 38 and 40, respectively, and are screwed into the downwardly extending portion 43 which is an extension of the frame 12. A collar 37 is rigidly attached to the rod 15 by means of the pin 42, and at the lower end of the rod 15 are two nuts 41 on a screw-threaded portion of said rod.

The action of the centering device is as follows: Assuming that the rod 15 is pulled upwardly by the magnet M, the stop collar 40 is caused to move along with the rod 15 by reason of the nuts 41, and the spring 39 is, therefore, compressed between the stop collars 40 and 38, the latter being held stationary by the bushing 45. As soon as the magnet ceases to exert an upward pull on the rod 15, the spring 39 returns the rod 15 to its original position where the head or an-

nular flange on the stop collar 40 engages the bushing 44. Should the magnet exert a downward pull the collar 37 which is secured to the rod 15 effects a downward movement of the stop collar 38 compressing the spring 39 between itself and the collar 40. When the magnet is deenergized the spring 39 returns the collar 38 and rod 15 to normal position. It is, therefore, evident that whether the rod is moved upwardly or downwardly, the single spring 39 always tends to return the rod to normal position and does so when said rod is released by the deenergization of the electro-magnet. To the upper end of the rod 15 is connected an adjustable yoke 16' and a lock nut 17. The yoke 16' is threaded onto the upper end of the rod 15 so that its vertical position with respect to the rod may be varied and then locked in the desired position by the nut 17. Similar yokes and adjusting means are provided at the upper extremities of the main valve stem 4', pilot valve stem 11, and links 11' and 25.

Pivoted at 33 to the yoke 34' upon the upper end of the valve stem 4' is a weighted lever 32, one end of which carries the movable weight 35, and the other end of which is connected to the yokes 27 and 46 which are respectively on the upper ends of the links 25 and 11'. The weight 35 may be placed in any desired position along one arm of the lever 32, and locked in position by means of the set screw 36, for example. The purpose of this weight is to counterbalance the various parts connected to the other arm of the lever 32. The latter is connected by the pin 29 to a yoke 46 which is adjustably fastened to the link 11' which in turn is connected to the pilot valve stem 11 at 30. A short distance from the pin 29 is pivoted at 28 the yoke 27. A link or connecting rod 25 joins this yoke to a lever 22 at 23, the lock nuts 26 and 24 permitting any desired adjustment to be made. The lever 22 is connected to the yoke 16' on the magnet rod 15 by the pin 18 at an intermediate point. Its left-hand end is connected by the pin 21 to the link 20, the latter being pivoted at 19 to an extension 12' of the magnet frame 12.

82 designates a frame which serves to support the main valve V, magnet M, and pilot valve mechanism V'. An adjustable screw-threaded brace rod 83 is provided for the lower portion of the electro-magnet and the parts connected thereto. There is also shown a brace 84 which is securely fastened to the magnet casing and to iron straps about the lower portion of the main valve casing. One of these straps is shown at 85.

I will now explain the operation of my device as illustrated in Fig. 1, not considering at this time the various electrical circuits depicted in Fig. 2.

Let it be assumed that the upper set of

magnet coils are excited with alternating current to effect the lifting of the armature 16 and rod 15. The lever 22 will then be swung about the pivotal point 21 to transmit motion to the link 25 and the lever 32, causing the right-hand end of the latter to be moved upwardly and with the same the link 11', the valve stem 11, and the pilot valve 10. As before pointed out, when the valve 10 is moved upwardly, the connection is established between the cylinder 6 and the exhaust pipe 9 through the connecting pipe 8. This relieves the pressure in the cylinder 6 and allows the pressure through port 1 to effect an upward movement of the main valve 4 since the opposite pressures on the pistons 5 and 4 are not equal owing to the larger area of the piston 5. As the main valve moves upwardly, however, carrying with it the lever arm 32, it swings the latter about the stationary point 28, thus effecting a movement of the pilot valve 10 to its original central position, cutting off the flow of liquid through the pipe 8, and thereby preventing the main valve 4 from having any further upward movement owing to the liquid remaining in the chamber 6. All the parts remain in this position so long as the magnet remains energized and the armature is in its upper position. When the current is cut off from the magnet M, the spring 39 returns the magnet stem 15 to its central position. This action effects a downward movement of the pilot valve 10, which at once connects the pressure pipe 7 with the cylinder pipe 8 and causes liquid to flow into the chamber 6, causing the main valve to move downwardly, which will, of course, again lift the pilot valve 10 to its central position, and by so doing, cut off the supply to the chamber 6 through the pipe 8. By this time the main valve has come to rest in its midway position and all of the parts assume once more the position shown in Fig. 1 of the drawings.

If the lower coils of the magnet M are excited with current the magnet armature 16 and rod 15 are drawn downwardly, causing the pilot valve 10 to also move downwardly, and thereby causing the liquid to flow from the pressure pipe 7 into the chamber 6, and cause a corresponding downward movement of the main valve 4, which movement acting through the various levers and connections, will center the pilot valve and cause the main valve to remain stationary. Upon cutting off the current supply to the magnet M, the centering spring 39 acts as before and all the parts automatically return to their original positions, the operations being similar to those described.

I will now refer to Fig. 2 and explain the operation of my device as applied to a push-button operated hydraulic elevator. The system of circuits and connections shown

in this figure are set forth and claimed in the co-pending application of D. L. Lindquist, filed June 1, 1907, Serial No. 376,863.

S designates a main line switch which serves to connect a source of single phase alternating current from the mains *a* and *b* to the wires 50 and 51, respectively.

R and R' are single phase magnet reversing switches similar in construction, the only difference being in the wire connections leading thereto. The left-hand magnet switch comprises a solenoid 60 which operates when energized to raise a central core or plunger 61 carrying on its upper end a contact plate 58 which is adapted to electrically connect three fixed contacts 55, 52 and 54 directly above. The lower end of the magnet core rests on a spring 59 which carries a contact 65. This spring is secured to the block 64 and will move the contact 65 into engagement with a similar fixed contact 66 directly above, when released. P designates a phase splitting device which is the invention of David L. Lindquist, disclosed and claimed by him in a pending application for U. S. Patent. Generally speaking it consists of two resistance elements and two inductance elements so arranged and connected as to furnish a polyphase alternating current adapted to the magnet construction illustrated in Fig. 1.

71 designates the four upper magnet coils shown in Fig. 1, while 72 designates the four lower magnet coils.

C designates an elevator car which may be operated by any well known hydraulic or fluid pressure motor, and has within it two push buttons 80 and 81, also a car switch comprising a switch lever 47 and two fixed contacts 48 and 49.

76 designates hall buttons of which there are two on every floor, one for up and the other for down.

75 designates door contacts and 73 and 74 are limit switches.

73 is operated by the car itself when it reaches its lower limit, while 74 is operated by the counterweight as the car reaches its upper limit. The purpose of the limit switches 73 and 74 is to prevent any over-running of the car beyond its normal limit of travel, the switches operating to open the circuit leading to the various push-buttons at the proper time.

It will be seen upon inspection of the wiring diagram that the switch in the car is in parallel relation to the car push-buttons, and this circuit is in parallel to the push-button circuits leading to the hall buttons. All of the buttons and the car switch have in common the wire 77 which also connects in series the door contacts 75 one at each floor landing. This common wire 77 is connected directly to the main wire 51. The upper push-button on every floor landing and in the car

has a common wire 79 which connects through the up limit switch 74 to the magnet winding 60' of switch R', the other terminal of this magnet winding being connected directly to the main wire 50. If, therefore, the up button on the car or on any floor landing be pressed, a circuit is closed through such button which will include the limit switch 74 and magnet coil 60'. The reversing switch magnet is thereupon energized to effect the lifting of its core and the electrical connection of the contacts 55', 52' and 54', and at the same time permitting the connecting together of the contacts 65' and 66'. A circuit is now completed to the magnet coils 72 of the valve magnet and the same is energized to effect the operation of the pilot and main valves of the elevator system as before pointed out, causing the elevator car to ascend. As soon as the push-button is released the circuit through the switch R' is broken, its magnet becomes deenergized, causing it to drop its core and the attached circuit-closing mechanism. This operation will break the circuit through the phase-splitting device P and the valve magnets 72 which will cause the elevator valve to automatically cut off the fluid-pressure supply to the power cylinder and the car is brought to rest.

The down motion of the car is accomplished in a similar manner. It is merely necessary to operate the down button on the car or floor landings, a circuit thereby being closed through the door contacts 75, limit switch 73, and magnet solenoid 60. In this instance the switch R is operated thereby closing a circuit to the valve magnet coils 71, thus effecting a movement of the pilot and main valve in a direction which will cause the elevator car to descend. Since the switch in the car is connected in parallel to the car buttons, a movement of its lever 47 to the right onto contact 49 closes the same circuit as the upper button in the car or at any floor landing. A movement of the switch in the opposite direction closes the same circuit as the lower button in the car or at any floor landing.

It is readily seen from the foregoing that in order to operate the elevator system it is merely necessary to push the desired button and hold the same closed. The car will travel in any desired direction and stop as soon as the push-button is released, the action of the various parts of the elevator system being entirely automatic in their operation.

In order to clearly point out the operation of my alternating current valve device, I have described it in connection with a push-button hydraulic elevator system, but I wish it to be clearly understood that there are numerous other applications to which my invention can be put. In an elevator system,

however, it offers great advantages over any device heretofore used to operate valves. I will endeavor to point out a few of its novel features and advantages.

In push-button operated hydraulic elevators it frequently happens that the only available source of electricity is single-phase alternating current. It is well known, however, that the usual type of single-phase alternating current magnet is very deficient, for, not only is such a magnet extremely noisy and wasteful of current, but its lifting power is very poor and unreliable, and its operation is unsatisfactory in every way. The polyphase magnet which I show in connection with my valve device overcomes all of these objectionable features. It is very quiet in operation and economical in current consumption, and at the same time is very powerful and positive in its action. It is particularly adapted to the operation of the valves of a hydraulic elevator, since owing to its almost instantaneous operation, the valve is quickly opened, thereby producing a rapid start of the elevator car which is of great advantage. Another feature is the small amount of current consumed after the magnet has operated and thereby closed its own magnetic circuit. This feature is important, since an alternating current apparatus which continually uses a heavy current is objectionable on a supply circuit.

The alternating current magnet which I have heretofore described is especially constructed for the use of quarter-phase or two-phase current, but by using a different number of magnetic poles and magnetizing coils therefor, it is equally useful on any alternating current supply circuit be it of two-phase, three-phase, or any other phase, all of the advantages remaining substantially unaltered.

The wiring diagram illustrated in Fig. 2 shows one type of push-button operation, but my invention is not limited in its sphere of usefulness to the above system of electrical circuits or to any other specific system, since it may be readily adapted to any known system of electrical control of valve apparatus.

I do not desire to be limited to the specific construction or arrangement of parts above described, since it is obvious to those skilled in the art that various changes may be made in the details without departing from the spirit and scope of my invention.

Therefore, what I claim to be new and desire to have protected by Letters Patent of the United States is:—

1. The combination with main valve apparatus, of pilot valve mechanism, connections between said valve apparatus and said pilot valve mechanism, a multiphase electromagnet associated with said connections to actuate the pilot valve mechanism, and means for balancing said connections.

2. The combination with main valve apparatus, of pilot valve mechanism for controlling the same, a multiphase electro-magnet, connections between the main valve apparatus and both the electro-magnet and said pilot valve mechanism, and a single spring for actuating said connections upon the deenergization of the electro-magnet to effect the operation of the pilot-valve mechanism and the consequent actuation of the main valve.

3. The combination with main valve apparatus in vertical position, of pilot valve mechanism in vertical position, a multiphase electro-magnet, means associated with said main valve apparatus for supporting said electro-magnet intermediate the pilot valve mechanism and said main valve apparatus, balanced connections between the pilot valve mechanism and the main valve apparatus,

auxiliary connections between said electro-magnet and said balanced connections, and means for restoring the parts to normal position upon the deenergization of said electro-magnet.

4. The combination with valve apparatus comprising valves movable in opposite directions from a normal position, of a multiphase electromagnet for effecting the operation of said valve apparatus, and a single resilient device for restoring all parts to normal position upon the deenergization of said electromagnet.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK W. NEWELL.

Witnesses:

JOHN FOLSZ, Jr.,
W. I. COOPER.