No. 864,990. PATENTED SEPT. 3, 1907.

W. J. RICHARDS & C. P. TOLMAN.

WATER GOVERNOR.

APPLICATION FILED OCT. 24, 1904.

2 SHEETS—SHEET 1.

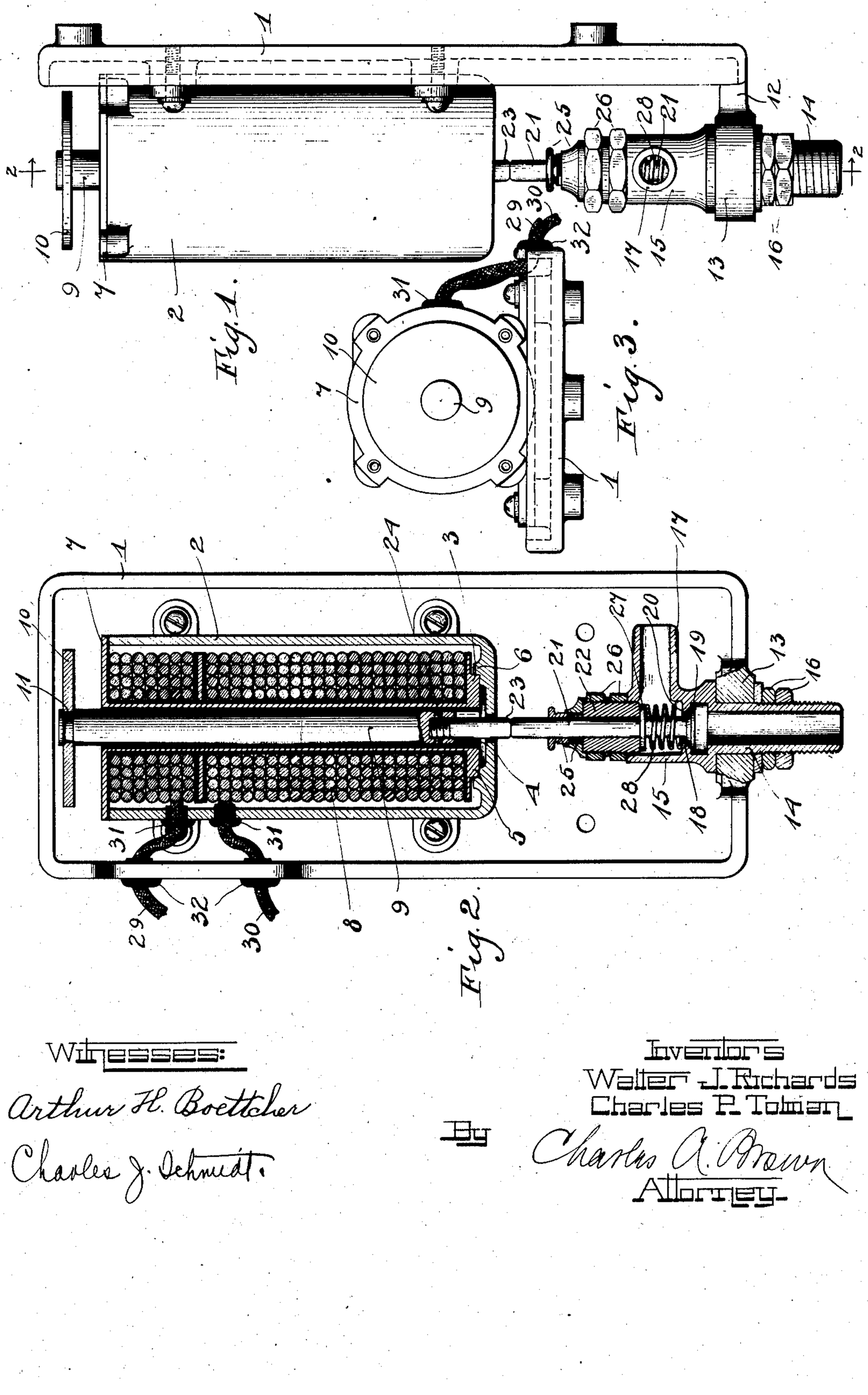


Fig. 1.

Fig. 3.

Fig. 2.

Witnesses:
Arthur H. Boettcher
Charles J. Schmidt.

Inventors
Walter J. Richards
Charles P. Tolman
By Charles A. Brown
Attorney.

No. 864,990. PATENTED SEPT. 3, 1907.

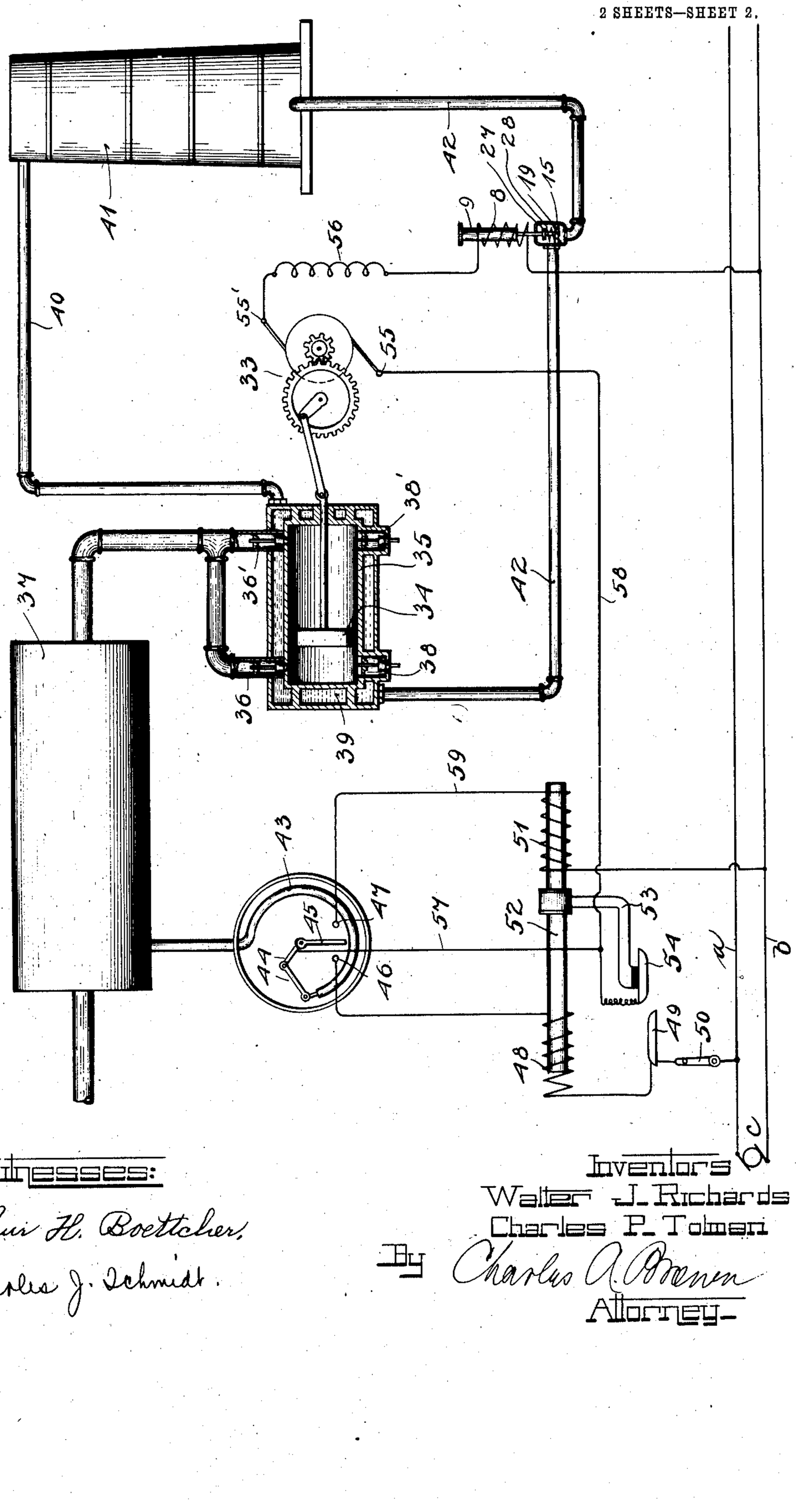
W. J. RICHARDS & C. P. TOLMAN.

WATER GOVERNOR.

APPLICATION FILED OCT. 24, 1904.

2 SHEETS—SHEET 2.

Fig. 4.



Witnesses:

Arthur H. Boettcher.

Charles J. Schmidt.

Inventors

Walter J. Richards

Charles P. Tolman

By Charles A. Brown

Attorney.

UNITED STATES PATENT OFFICE.

WALTER J. RICHARDS AND CHARLES P. TOLMAN, OF MILWAUKEE, WISCONSIN.

WATER-GOVERNOR.

No. 864,990. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed October 24, 1904. Serial No. 229,880.

To all whom it may concern:

Be it known that we, WALTER J. RICHARDS and CHARLES P. TOLMAN, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Water-Governors, (Case 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to water governing valves, and particularly to magnetically operated valves to be employed in connection with air compressors or other electrically driven machinery utilizing water jackets, and its object is to provide a magnetic valve which will be automatically operated to open the supply circuit through the water jacket when the compressor or other machine is in operation and to automatically close the water circuit when the compressor or the machine is at rest.

Our invention is particularly adaptable for use in connection with electric motor driven air compressors that are to be run intermittently and the controlling coil of the valve may be so connected with the circuit operating the driving motor that the controlling valve is opened when the motor is started and closed when the motor ceases running, the controlling valve being interposed in the path of the water flowing from the supply source to the water jacket about the compression cylinder.

The valve mechanism consists of a solenoid winding disposed about the core, and in which the core is adapted to be drawn upon energization of the coil, which coil may be included serially in the motor circuit, or otherwise connected therewith to insure energization thereof when the motor starts and deënergization thereof when current flow is withdrawn from the motor. The stem of the controlling valve engages with the end of the core and upon energization of the winding is moved by the attracted core to open passage through the valve chamber and to allow the passage of water to the water jacket, a spring serving to close the valve upon deënergization of the solenoid winding.

Our invention is best understood by reference to the accompanying drawings, in which:

Figure 1 shows a side elevation of the valve and controlling mechanism, Fig. 2 shows a longitudinal sectional view thereof taken on line 2—2 of Fig. 1, Fig. 3 is a top view thereof, and Fig. 4 shows a utilization of the magnetically operated valve for controlling the water jacket supply for the compression chamber of an air compressor.

Like reference characters refer to like parts throughout the figures.

A supporting base 1 is adapted to be screwed or bolted to any support and a cylindrical cup-shaped casing 2 is secured to the upper part of the base. Within the casing 2 is a spool frame 3, preferably of non-magnetic material, having a central core opening 4. The lower flange 5 of the spool is held in place by an annular shoulder 6 and the upper flange 7 of the spool is secured over the top edge of the casing 2 to protect the windings 8 carried by the spool. A core 9 of soft iron is adapted to slide within the core opening 4 and at its top is provided with a circular flange or disk 10 secured in the annular recess 11, and also formed of wrought iron. Upon current flow through the windings 8, the tendency would be to complete the magnetic circuit through the core 9, the disk 10 and through the walls of the casing 2, which may be of cast or wrought iron, or other magnetic material. An arm 12 extends from the lower part of the base 1 and supports a bushing 13 for receiving the hollow stem 14 of the valve frame 15, the stem being threaded and engaged by lock nuts 16, 16 by means of which it may be secured in the bushing 13, the lower end of the stem being adapted for threaded connection with piping. A hollow stem 17 extends from the valve frame 15, a valve seat 18 being disposed between the stems. A valve 19 engages the seat 18 and controls the valve opening 20 between the stems, the valve being secured to the lower end of a valve stem 21, passing upwardly from the valve through a bushing 22 threaded into the upper part of the valve frame 15. A brass stud 23 engages with the upper end of the valve stem 21 and its other end is secured in the lower end of the core 9, being shown as threaded therein and further secured by means of a pin 24. A stuffing box 25 engages over the end of the bushing 22 and by means of lock nuts 26, 26 having threaded engagement with the bushing 22 the position of the valve with respect to the solenoid core may be adjusted. A collar 27 is secured to the valve stem below the bushing 22 and a compression spring 28 is disposed between this collar and the valve seat and when there is no current flowing through the solenoid winding this spring will maintain the valve firmly against its seat. Upon energization, however, of the solenoid winding, the core 9 and attached disk 11 will be attracted into the core opening and the valve stem will be pushed downwardly to remove the valve from its seat and to open the passageway between the stems 14 and 17, the spring upon deenergization serving to close the valve and to return the core to its normal position. The stud 23, as before stated, is preferably of brass, or other non-magnetic material, to prevent neutralization of the magnetic pull on core 9. The terminals 29 and 30 of the solenoid winding pass through insulated bushings 31 extending through the casing 2 and also through insulated bushings 32, 32 extending through the wall of the base and are thus securely held in place and well insulated.

In Fig. 4 we have shown an air compressor driven by an electric motor, the circuit for which is controlled by a switch arm actuated and adjusted by the pressure in

the reservoir connected with the compressor. The electric motor 33 is connected with the plunger 34, reciprocating within the compression cylinder 35. The compressor cylinder is provided with outlet valves 36, 36′ leading to the reservoir 37 and with inlet valves 38, 38′. A water jacket 39 surrounds the compressor cylinder and connects by piping 40 with the top of a cooling fluid reservoir 41 and also connects by piping 42 with the bottom of the reservoir, and a magnetically controlled valve mechanism, such as described in Figs. 1, 2 and 3, controls the circuit through the piping 42. The tube 43 of a well known Bourdon gage is connected with the reservoir 37 and at its end engages through link mechanism 44 with a switch arm 45 adapted to engage terminals 46 and 47. A solenoid coil 48 connects with the contact 46 and with a shoe 49 connected through a switch 50 with the main conductor *a* of the supply circuit *c* while a solenoid winding 51 connects with the contact 47 and with the main conductor *b*. A core 52 is adapted to pass through the solenoids and is provided with an arm 53 terminating in a shoe 54, the shoe 54 being connected with the switch arm 45 and with one terminal 55 of the motor 33. The motor 33 is shown as a series motor and the other terminal 55′ thereof is connected through the field winding 56 and through the solenoid winding 8 of the magnetic valve with the supply conductor *b*.

As the pressure in the reservoir 37 becomes too low, the switch arm 45 will move over and engage the contact 46, whereupon a circuit is closed from the supply conductor *a*, through the switch 50, shoe 49, winding 48, contact 46, switch arm 45, conductor 57, conductor 58 through the motor armature and field winding and through the solenoid winding 8 of the magnetic valve to the supply main *b*. The winding 48 upon energization attracts the core 52, whereby the shoe 54 is brought into engagement with its companion shoe 49, and thereupon current will flow from the main conductor *a* through the shoes 49 and 54 directly through the motor and through the magnetic valve. Upon current flow through the motor and through the solenoid winding 8 the motor will start and at the same time the core 9 of the magnetic valve will be drawn inwardly to remove the valve 19 from its seat to allow the water from the supply tank 41 to flow through the piping 42 and into the water jacket, the valve being held open as long as current flows through the solenoid winding 8, that is as long as the motor is running. As the pressure in the reservoir 37 increases, due to the operation of the motor, the switch arm 45 will gradually move toward and will engage the contact 47, whereupon a current will flow from the main conductor *a* through the switch 50, shoes 49 and 54 through conductor 57, through switch arm 45, conductor 59 and through solenoid winding 51 to supply main *b*. Upon energization thereby of the winding 51 the core 52 will be attracted and the shoe will be removed from the shoe 49, thus disrupting the circuit through the motor and through the solenoid winding 8. The motor therefore stops and the valve 19 is closed, due to the spring 28.

We thus provide electrically controlled valve means which allow water supply to the water jacket only upon operation of the compressor piston. We do not wish to be limited, however, to the adaptation of the magnetically controlled valve as herein shown, as a valve of this kind may be employed wherever an electric circuit is utilized in connection with the machine or engine.

We claim as new and desire to secure by Letters Patent:—

The combination of a compression cylinder surrounded by a water jacket, an electric motor for reciprocating a piston within said cylinder, an electric circuit for said motor, a supply pipe leading to said water jacket, a valve chamber interposed in the path of said supply pipe, a valve in said chamber for normally closing passage through said supply pipe, a stem extending from said valve, a bushing through which said valve stem extends, a collar on said valve stem, a spring interposed between said collar and valve seat to normally hold said valve in a closed position, a solenoid core, a solenoid winding for said core connected in the motor circuit in series with the motor, a piece of non-magnetic material secured to said core and engaging said valve stem, energization of said solenoid causing attraction of said core towards said valve stem to cause the valve to be opened to admit passage of water through said water jacket, said solenoid being energized and deënergized upon closure and opening of the motor circuit.

In witness whereof, we hereunto subscribe our names.

WALTER J. RICHARDS.
CHARLES P. TOLMAN.

Witnesses as to signature of Walter J. Richards:
ANNA F. SCHMIDTBAUER,
ALMA A. KLUG.

Witnesses as to signature of Charles P. Tolman:
LEE LICHTENSTEIN,
JOHN J. RYAN.