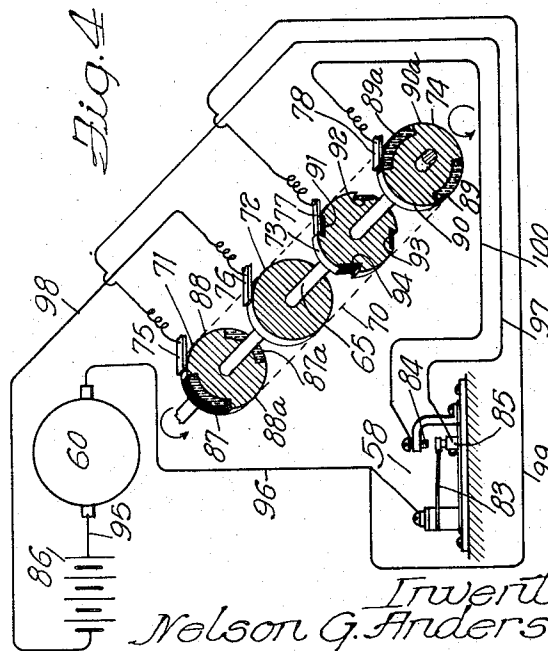
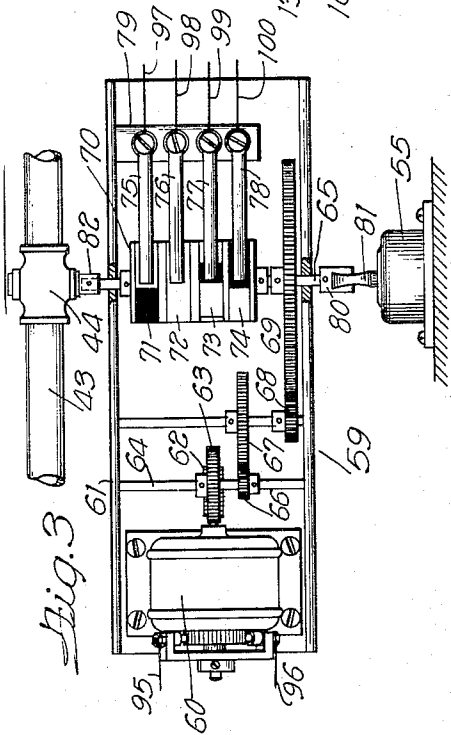
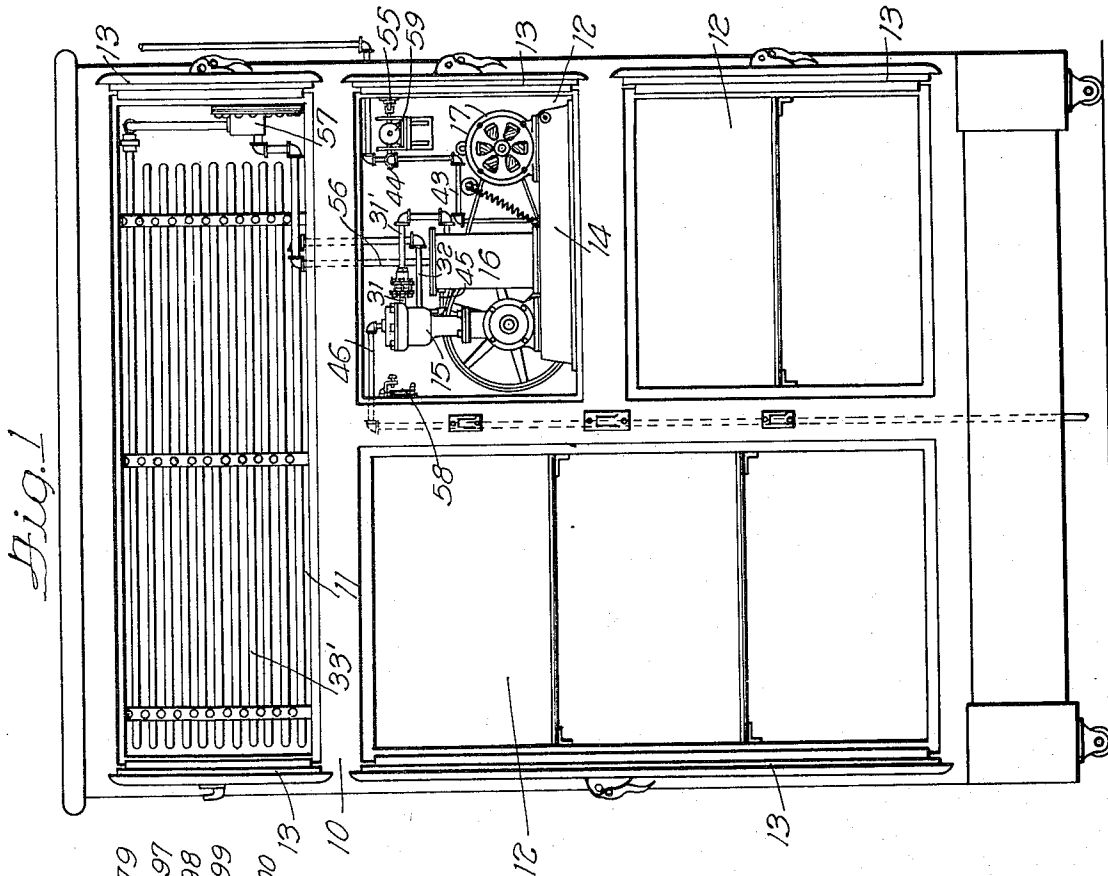


Feb. 13, 1923.

1,444,862.

N. G. ANDERSON.
REFRIGERATING APPARATUS.
FILED MAR. 4, 1920.

2 SHEETS—SHEET 1.



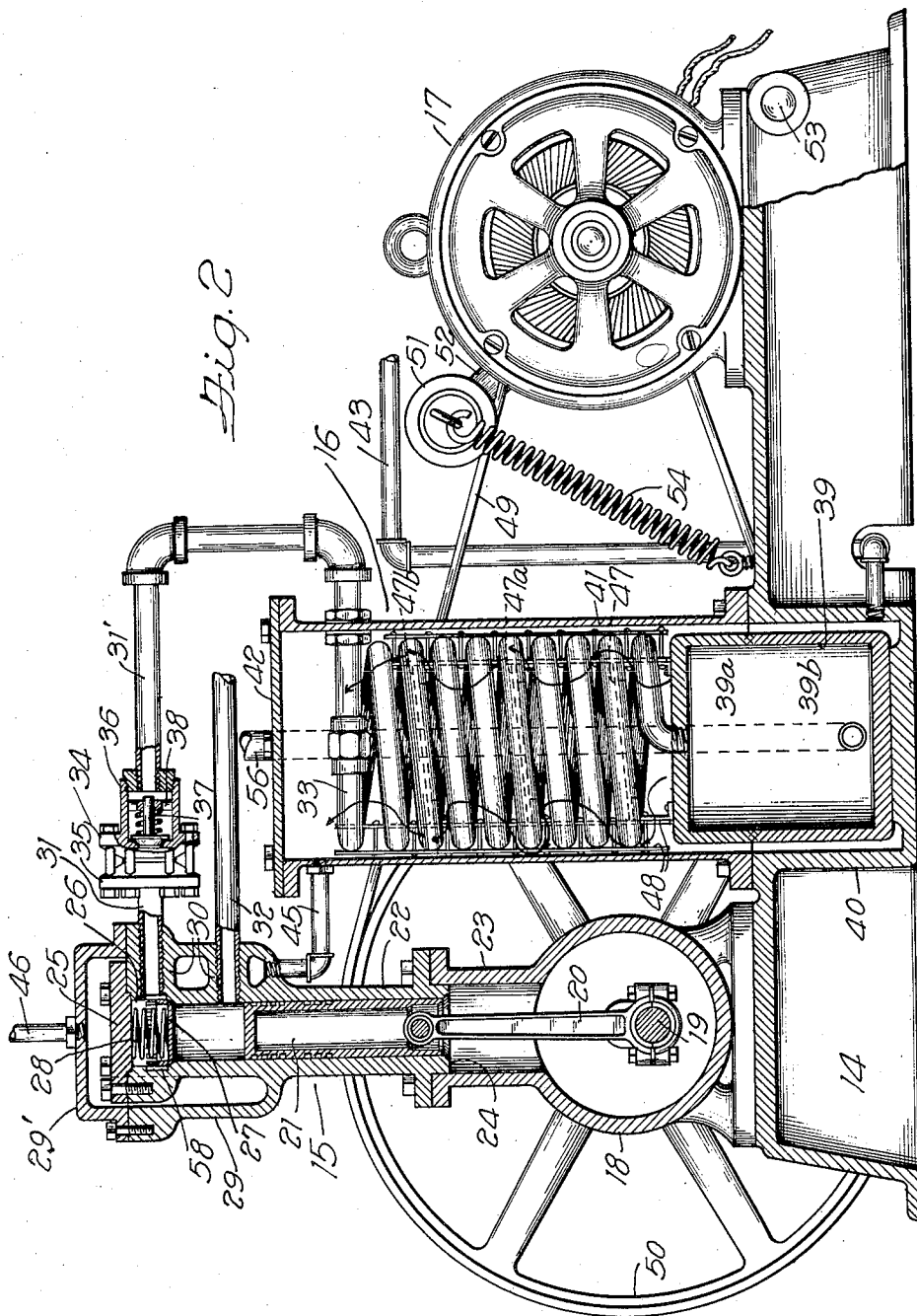
Inventor
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Williams, Bradbury & See
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

NELSON G. ANDERSON, OF CHICAGO, ILLINOIS.

REFRIGERATING APPARATUS.

Application filed March 4, 1920. Serial No. 363,265.

To all whom it may concern:

Be it known that I, NELSON G. ANDERSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Refrigerating Apparatus, 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.

My invention relates to refrigerating apparatus and more particularly to refrigerating apparatus of the well known compression type wherein a liquefiable gas such as ammonia is mechanically compressed for cooling or refrigerating purposes.

One of the objects of this invention is to provide an apparatus of this type wherein various elements are so improved in design and construction that the apparatus as an entirety is rendered more compact, durable and efficient, so that it is better adapted for use in refrigerating systems such as are in general domestic use.

Other objects will more definitely appear from the following description, in which reference is made to the accompanying drawings illustrating the invention.

In the drawings Figure 1 is a front elevation of a refrigerator wherein the improved refrigerating apparatus of my invention is installed;

Figure 2 is a side elevation of a portion of the refrigerator apparatus, consisting briefly of the compressor, condenser and the motor for driving the compressor.

Figure 3 is a plan view of an improved control mechanism which I prefer to provide for controlling the flow of the cooling fluid and also the operation of the motor for driving the compressor; and

Figure 4 is a diagrammatic view of the circuit connections which are secured by the control mechanism shown in Figure 3.

The same reference numerals will be used to designate like parts throughout the following detailed description.

It will be understood that while the invention is shown as embodied in a refrigerating machine of the compression type and installed in a refrigerator of the kind generally in domestic use as exemplified by the refrigerator shown in Figure 1, certain features of my invention are applicable to refrigerating systems of various types and forms.

Referring to the drawings and for the present to Figures 1 and 2, in particular, 10 represents a domestic refrigerator of the usual type, which comprises a refrigerating compartment 11 and storage compartments 12, all of which are provided with heavy heat insulating doors 13, which are shown open to disclose more clearly the interior of the compartments in which is located the refrigerating apparatus to be presently described in detail.

The refrigerating apparatus comprises a hollow base 14, upon which is mounted a compressor, a condensing unit, and an electric motor for driving the compressor, which are indicated respectively by the reference numerals 15, 16 and 17. The compressor comprises a crank case 18, in which is journaled a crank shaft 19. A connecting rod 20 connects the crank shaft with an elongated compressor piston 21, which is provided with a comparatively large number of piston rings to prevent leakage past the piston of ammonia vapors on compression strokes. The piston 21 is arranged to reciprocate in the compressor cylinder 22, which is bolted upon a cylindrical extension 23 of the crank case 18. The diameter of the compressor cylinder 22 is so proportioned with respect to the cylindrical extension 23 that a rather substantial shoulder 24 is afforded. This shoulder prevents oil from the crank case from entering the cylinder 22, so that the ammonia vapor compressed in the cylinder cannot be contaminated. The upper part of the cylinder 22 is provided with lugs which receive bolts to clamp down the cylinder head 25. The annular groove 26 in the wall of the cylinder 22 receives a disk valve 27, which is held in engagement with its seat by a compression spring 28. Formed integral and concentric with the cylinder 22 is a water jacket 29, which is suitably provided with a cap 29'. Extending between the cylinder wall and the water jacket 29 are webs 30, 30, which are internally screwthreaded to receive the pipes 31 and 32.

The pipe 31 communicates with the condensing coil 33 through a combined union and check valve shown at 34. This combined union and check valve comprises the two disk shaped clamping members 35, which are suitably bolted together to clamp between them a lead gasket to form a fluid tight joint. One of these members is provided

with a hollow cylindrical boss which is internally screwthreaded to receive a bushing, in which the end of the pipe 31' is threaded. A valve 37 is arranged to reciprocate in a spider 38, which likewise serves as an abutment for a compression spring, which holds the valve on its seat.

It was necessary in prior devices to use a vertical check valve and a union independent of the valve, but by combining the two as here described, a considerable saving in space is effected, which results in a more compact apparatus.

The pipe 32 communicates with the discharge end of the expansion coil 33', and receives the vaporized ammonia, which has performed its refrigerating function in the refrigerating chamber 11 of the refrigerator.

The condensing coil 33 communicates at its lower end with a receiver 39, which comprises the two cup shaped cylindrical members 39^a and 39^b, suitably welded together at their edges, as shown, to form a closed receptacle. The receiver 39 fits closely within a depression 40 in the base 14 so as to provide only a slight space between its walls and the walls of the depression. A hood 41 is bolted down upon the base over the depression 40 and entirely surrounds the condensing coil 33. A removable cover 42 closes the upper end of the hood 41 thereby forming a closed water jacket for the condenser and receiver. A pipe 43 has communication through a valve 44 with a source of cooling fluid under pressure. The cooling fluid coming from the pipe 43 enters the water jacket at the depression, passes upwardly in the space around the receiver walls and then up and around the condensing coil 33 and out through the pipe 45 and into the water jacket 29 of the compressor cylinder 22. After circulating about the compressor cylinder the fluid is discharged through pipe 46, which may have communication with the sewer or other waste receptacle. In this way the refrigerant receiver 39 is cooled to the lowest possible temperature and to the lowest temperature of the cooling fluid circuit.

Permanent gases are frequently formed in refrigerating plants and are a great source of nuisance, principally because they interfere with the correct indications of gages and with the efficient working of the plant generally. These gases are formed usually through the decomposition of the ammonia into its constituent elements. This decomposition is generally brought about through improper or insufficient cooling of the refrigerant receiver and condensing coil and of the compressor cylinder. It is, therefore, of utmost importance that the cooling of certain refrigerator elements be accomplished with certainty and that any unnecessary and un-

desirable obstructions to the flow of cooling fluid be avoided.

I provide a series of circular baffle plates 47, 47^a and 47^b, which are secured to the braces 48, which support and space the convolutions of the condensing coil 33. The cooling fluid, which would ordinarily take a path of least resistance that is, directly up through the central opening in the coil 33, is thereby forced to assume a path approximating that of the arrows shown in Figure 2.

With the aforesaid purpose in view, a series of lugs in place of a flange is provided on the compressor cylinder 22, to afford means to which to clamp the head 25. This construction avoids a serious obstruction to the flow of the cooling fluid.

The electric motor 17 is mounted on the base 14 on that side of the condensing unit 16 away from the compressor 15. The motor 17 drives the compressor 15 through a belt 49, which passes around the pulley 50, which is keyed or otherwise secured on the crank shaft 19 of the compressor.

An idler pulley 51, secured to the free end of an arm 52, which is pivoted at 53 to the base 14, is arranged to exert a constant downward pull upon the belt 49 through the medium of a tension spring 54. The tension of the belt 49 is therefore always constant.

The electric motor 17 is connected to a source of current through the snap switch 55.

A pipe 56 is connected to the lower part of the receiver 39 through a union (not shown), and communicates with the expansion coil 33 through an expansion valve 57, which may be of conventional design.

The operation of the apparatus thus far described is as follows:

The refrigerant in a gaseous state is drawn into the compressor cylinder 22 through the pipe 32 as the piston 21 reaches its lower dead center. As the piston rises on its return upstroke, the gaseous refrigerant is compressed. The valve 27 is forced off its seat against the tension of the spring 28. The compressed gas by-passes through a plurality of channels 58 formed in the cylinder wall, and enters the pipe 31, where it is forced through the non-return or check valve 37 into the condensing coil 33. The temperature of the compressed gas is then substantially that of the cooling fluid. The refrigerant liquefies and discharges into the receiver 39, from which point it is forced through the pipe 56 and the expansion valve 57 into the expansion coil 33. The expansion valve 57 has a pressure reducing opening, and as the refrigerant passes through this opening, a great reduction in pressure results. The refrigerant consequently evaporates, resulting in a considerable reduction in temperature of the refrigerating medium,

which thereby extracts heat from the air or other fluid which surrounds the coil. The vapor is then returned under pressure to the compressor cylinder, through the pipe 31, and the process is repeated continuously.

To insure efficient functioning of the refrigerating apparatus, it is essential at certain times that the compressor cease to operate, as when the temperature of the refrigerator storage compartments has reached a predetermined low temperature. A thermostat 58 is provided in the storage compartment 12, which is operable, as usual, by increases or decreases in temperature, and serves to regulate the operation of the compressor and the circulation of the cooling fluid. However, the movement of the thermal element is generally very feeble and uncertain. In various prior devices of this type a very substantial increase or decrease in temperature is necessary to insure a proper regulation of the refrigerating apparatus. A regulation between narrow limits has therefore been impossible. I provide, in conjunction with the thermostat 58, an improved form of control mechanism indicated generally in Figures 1 and 3 by the reference numeral 59. Through the provision of this mechanism the slightest flickering movement of the thermal element effects the desired alteration in the further operation of the refrigerating apparatus.

The control mechanism comprises a comparatively small motor 60, which is mounted in a suitable channel-shaped frame 61. A worm 62, keyed or otherwise secured to the armature shaft of the motor 60, meshes with a worm gear 63 on the shaft 64. Rotation of the gear 63 is communicated to the shaft 65 through a train of reduction gears 66, 67, 68 and 69. Mounted on the shaft 65 adjacent the gear 69 is a drum 70, which carries the four interrupter segments 71, 72, 73 and 74, upon which ride the leaf spring brushes 75, 76, 77 and 78 respectively. The outer ends of these brushes are mounted on a block of insulation 79.

One end of the shaft 65 projects through the side wall of the frame 61, and is there provided with a clip 80, which embraces the key 81 of the snap switch 55. As above stated, the switch 55 controls the operation of the motor 17, which drives the compressor. The other end of the shaft 65 projects through the other side wall of the frame 61, and is there secured in the end of the stud shaft 82, which in turn operates the valve element of the valve 44. The valve 44, as above stated, controls the flow of the cooling fluid, which normally circulates around the receiver, the condensing coil and the compressor cylinder.

The operation of the control mechanism is entirely automatic. The compressor is operated to compress the spent refrigerant

when the temperature of the storage compartments 12 of the refrigerator rises beyond a predetermined point. The thermostat 58 is so constructed that its switch element 83 will respond at proper temperatures to make contact with either one of the contacts 84 or 85 to close a circuit from the battery 86 through the motor 60, the thermostat 58 and the proper interrupter segments of the drum 70 back to the other side of the battery 86. The interrupter segments are provided with insulation sectors at such intervals as to permit the motor 60 to run only long enough to cause the shaft 65 to make a quarter revolution. Thus the key of the snap switch 55 is continuously rotated in the same direction to alternately make and break the circuit for the motor 17. Likewise the valve element of the valve 44 is continuously rotated to permit the circulation of the cooling fluid or to stop the same. The drum 70 is shown diagrammatically in Figure 4. From an inspection of Figure 3 it will be seen that the space between the interrupter segments 71, 72, 73 and 74 is composed of an electrical conducting material. The various interrupter segments, with the exception of segment 72, are provided, as aforesaid, with sectors of insulating material. The segment 71 has the diametrically oppositely disposed insulation sectors 87 and 87^a, with the diametrically opposed conducting sectors 88 and 88^a.

The segment 74 has the diametrically opposed insulation sectors 89 and 89^a and the conducting portions 90 and 90^a.

It will be seen that the insulation sectors are not as great geometrically as the conducting sectors. The purpose for so proportioning these sectors will presently be obvious.

The interrupter segment 73 is provided with four insulated steps 91, 92, 93 and 94. As the drum 70 rotates the leaf spring brush 77 rides on the periphery of the segment 73 and springs down into a step at every quarter revolution of the drum.

The control mechanism just described operates as follows: Assuming the apparatus is at rest, and that the temperature of the refrigerator has reached an undesirably high point, the thermostatic switch element 83 makes contact with the lower contact member 85. The following circuit is thereby completed: battery 86, conductor 95, motor 60, conductor 96, switch element 83, contact 85, conductor 97, leaf spring brush 75, conducting sector 88 of interrupter segment 71, through the intervening conducting portion of the drum 70, through segment 72, brush 76, conductor 98, to the other side of battery 86.

It is found that at times the thermostatic switch element 83 will not make a good con-

tact with the contact 85, due, perhaps, to the fact that it is not sufficiently responsive to the slight temperature change which has occurred. At such times the contact will be but very feeble and flickering. With this objection in view, the segment 73 is provided. It will appear from Figure 4 that at the moment the above described circuit is closed, the brush 77 is resting on the insulated step 91 of the segment 73. As soon as the above mentioned circuit is closed the drum 70 commences to rotate slowly. Almost simultaneously the brush 77 rides off the insulated step 91 and onto the intervening conducting portion of the segment 73. The following circuit is thereby closed: battery 86, conductor 95, motor 60, conductor 96, conductor 99, leaf spring brush 77, segment 73, intervening conducting portion of the drum 70, segment 72, leaf spring brush 76, conductor 98 and back to the other side of the battery 86.

The drum 70 is thereby rotated until the leaf spring brush 75 rides upon insulation sector 87^a and until the leaf spring brush 77 springs into the insulated step 92 of the segment 73. The shaft 65 has thereby completed a quarter revolution and the switch key 81 has been turned to its "on" position. The motor 17, and hence the compressor 15 is thereby caused to operate. Likewise the valve 44 has been opened to permit the flow of the cooling fluid thru pipe 43.

After the above described quarter revolution of the drum 70, the leaf spring brush 78 will have passed over the insulation sector 89^a and made contact with conducting sector 90^a.

After a sufficient interval of time has elapsed wherein the refrigerating apparatus has functioned to bring the temperature of the refrigerator beyond a desirable low point, the thermostatic switch element 83 will make contact with the contact 84 to close the following circuit: battery 86, conductor 95, motor 60, conductor 96, switch element 83, contact 84, conductor 100, leaf spring brush 78, conducting sector 90^a, of interrupter segment 74, the intervening conducting portion of the drum 70, interrupter segment 72, leaf spring brush 76, conductor 98, back to the other side of the battery 86.

As before stated, the contact with the switch element 83 is, at times, very feeble and flickering. To insure at all times the proper functioning of the control apparatus, and to decrease the detrimental sparking at the thermostat contact, the segment 73 is provided as aforesaid. When the above circuit is closed, the drum 70 commences to rotate slowly. Practically simultaneously the brush 77 rides off the insulated step 92 onto the intervening conducting portion of the segment 73, and a circuit parallel with that just above described is closed. This circuit has been described in connection with the

operation of the control mechanism which results from a rise in temperature of the refrigerator compartments, and, therefore, it need not be repeated. It will appear that as above, upon a circuit being closed through the motor, the drum will rotate slowly through a quarter revolution, whereupon the leaf spring brush 77 will spring down onto the insulated step 93 of the segment 73. Likewise the leaf spring brush 78 will then assume a position in contact with the insulation sector 89 of the segment 74. The brush 75, on the contrary, will ride over the segment 71 into contact with the conducting sector 88^a thereof.

The shaft having rotated through a quarter revolution, the snap switch key 81 will have been turned to its "off" position, and likewise the valve 44 will have been closed to prevent further immediate flow of the cooling fluid.

While I have described the preferred embodiment of my invention, I do not limit myself to the details of construction disclosed, but cover all equivalent embodiments coming within the scope and spirit of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A condenser comprising a receptacle, a receiver fitting closely within said receptacle, a condenser coil connected with said receiver and disposed adjacent the receptacle wall, an inlet connection for the admission of cooling fluid adjacent the base of the receptacle and receiver, an outlet for said fluid disposed upwardly from the inlet, a support, baffle plates secured to the support, and adapted to deflect the flow of cooling fluid in its passage from the inlet to the outlet around the inner and outer peripheries of the condenser coil.

2. A condenser comprising a receptacle, a receiver fitting within said receptacle, a condenser coil connected with said receiver, and disposed adjacent the vertical walls of the receptacle, an inlet connection for the admission of cooling fluid adjacent the base of the receptacle and receiver, an outlet for said fluid, a support mounted on the receiver and disposed adjacent the inner periphery of the condenser coil, baffle plates secured to the support, the diameter of said baffle plates being substantially the same as the inside diameter of the condenser coil, said baffle plates being disposed to deflect the passage of cooling fluid around the inner and outer peripheries of the condenser coil.

In witness whereof, I hereunto subscribe my name this 1st day of March, 1920.

NELSON G. ANDERSON.

Witnesses:

WARREN DEWER,
EDNA V. GUSTAFSON.