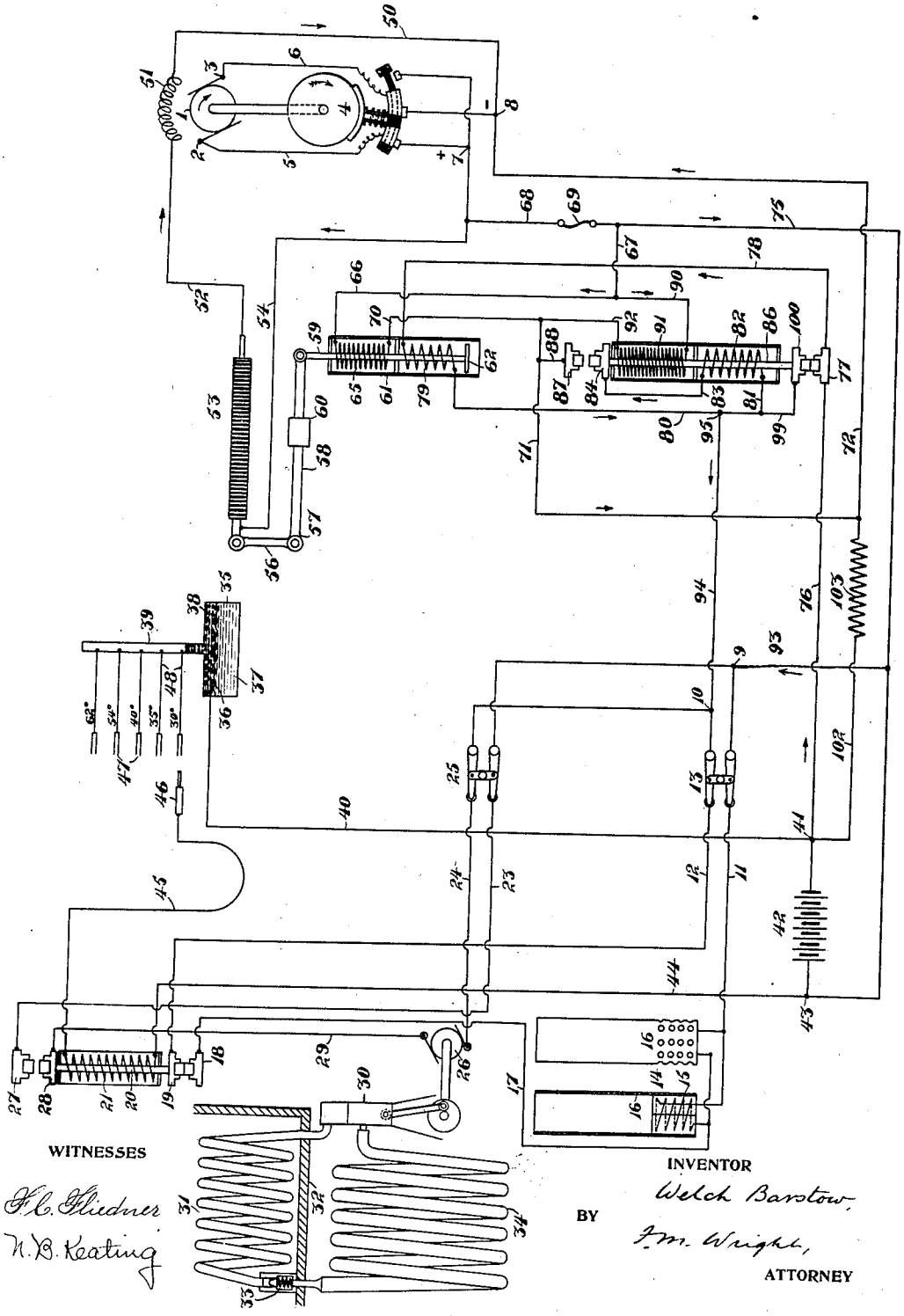
W. BARSTOW.

TEMPERATURE REGULATING MEANS FOR CARS AND THE LIKE.

APPLICATION FILED MAY 21, 1912.

1,054,815. Patented Mar. 4, 1913.



WITNESSES

H. C. Fliedner

N. B. Keating

INVENTOR

Welch Barstow,

BY

F. M. Wright,

ATTORNEY

UNITED STATES PATENT OFFICE.

WELCH BARSTOW, OF SAN FRANCISCO, CALIFORNIA.

TEMPERATURE-REGULATING MEANS FOR CARS AND THE LIKE.

1,054,815. Specification of Letters Patent. Patented Mar. 4, 1913.

Application filed May 21, 1912. Serial No. 698,815.

To all whom it may concern:

Be it known that I, WELCH BARSTOW, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Temperature-Regulating Means for Cars and the Like, of which the following is a specification.

The object of the present invention is to provide an apparatus which can be used either to heat, or to cool, the interior of an apartment, room, railway car, or the like, and by which the heat of said interior may be automatically maintained constant at any desired temperature within the limits of operation of the apparatus. It is especially adapted for use in railway cars, containing edible or other products which are liable to be injured by extremes of heat or cold, or which it is important to preserve at a constant temperature.

In the accompanying drawing, the figure is a diagrammatic view of my improved apparatus.

Referring to the drawing 1 indicates an electric generator having positive and negative poles 2, 3. One of the most important uses of this invention is that of maintaining at any desired constant temperature the interior of a railway car, for which purpose it is contemplated to rotate the generator from a wheel of said car. Since the car may be coupled up to run in either direction, the generator may also be rotated in either direction, generating an electric current flowing in either direction between its poles 2, 3. But the present apparatus is designed for a current flowing in a uniform direction. Hence it is necessary to employ an automatic reversing switch, connecting the wires from the generator poles with the circuit wires reversely automatically with each change in the direction of the rotation of the generator. Any well known type of automatic reversing switch may be used, and said switch is in the drawing indicated diagrammatically by the numeral 4. Wires 5, 6, lead through said automatic reversing switch 4, to terminals 7, 8. Said terminals 7 and 8 are connected respectively, by means which will hereinafter be more particularly described, with lead terminals 9 and 10. Two branch circuits lead from said terminals 9 and 10, one consisting of the wires 11, 12, controlled by a single-throw double-pole switch 13, the wire 11 leading to binding posts of electric heaters 14, the high-resistance wires 15 of which, arranged within apertured tubes 16, open at top and bottom, are in parallel, and are connected to a wire 17 leading to a contact 18 adapted to be connected with a contact 19 carried by a core 20 of a solenoid 21, said contact 19 being connected to the wire 12 leading to the switch 13. When no current is passing through the solenoid the circuit through the heaters is closed and the heaters are in operation. From said terminals 9, 10, wires 23, 24 of another branch circuit lead through a single-throw double-pole switch 25 the wire 24 to a brush of an electric motor 26, and the wire 23 to a contact 27 adjacent to the upper end of the core 20, the circuit through which contact 27, when a current is passing through the solenoid 21, is adapted to be closed by a contact 28 carried by the upper end of the core 20, which contact 28, by a wire 29 is electrically connected to the other brush of the motor 26. When the solenoid 21 is energized, in the manner to be presently described, the branch circuit is closed between the contacts 27 and 28 and the motor is rotated. Said motor is operatively connected to a compressor pump 30 which can compress ammonia in coils of pipe 31 separated by a wall or partition 32 from the remainder of the apparatus, as, for instance, outside a railroad car which it is desired to maintain at constant temperature, through which coils the ammonia parts with its sensible heat due to compression, and then escapes through a pressure valve 33 into coils 34 in the apartment or car to be cooled, and thence to the inlet opening of the compressor pump 30. The ammonia by its expansion in said coils 34 produces a refrigerating effect upon the air surrounding said coils. In order to automatically regulate the temperature at which the said heating and cooling apparatus respectively shall be brought into action, there is provided a thermostat 35 comprising a vessel having therein a flexible corrugated diaphragm 36 dividing the vessel into the lower compartment 37 and an upper compartment 38. The lower compartment 37 is filled with a fluid such as acetone whose coefficient of expansion is high, and the upper compartment is filled with mercury, which mercury also extends into a tube 39 extending vertically from the vessel. The mercury in the upper compartment is electrically connected, by a wire 40 to the negative terminal 41 of a storage battery 42,

the positive pole 43 of which battery is connected by a wire 44 with one end of the solenoid 21, the other end of the solenoid being connected by a flexible cord 45 with a plug 46, which is adapted to be inserted into any one of a series of sockets 47 severally connected by wires 48 with the interior of the tube 39 at different elevations thereof.

The following is the mode of operation of this portion of the apparatus: When it is desired that the temperature of the car, apartment, or other inclosed space is to be maintained at, say, a temperature of 30°, the plug 46 is inserted in the socket 47 corresponding to that temperature. So long as the level of the mercury in the tube 39 is below the point of contact of the corresponding wire 48 in said tube, then the circuit through the solenoid is broken, the contact 19 at the lower end of the core 20 is in contact with the contact 18, and the circuit is closed through the heaters, which are therefore in operation and heat the surrounding air. But when, by the rise of temperature of the air, the fluid in the lower compartment 37 is expanded, then the mercury in the upper compartment is pushed upwardly and the level of the mercury rises in the tube 39, until contact is closed through the wire 48 of the aforesaid socket corresponding with the desired temperature. Thereupon the current flows through the solenoid 21, raising the core 20 and breaking the circuit through the contact 18, and closing the circuit through the upper contact 28 and causing an electric current to pass through the motor 26, which thereupon operates the compressor pump, and actuates the refrigerating apparatus, which cools the air. When the temperature of the air is lowered, so that the contact in the tube 39 with the wire 48 corresponding with the desired temperature is broken then the heater is again set in operation, and so on indefinitely, the air being thus maintained at a temperature of approximately 30°. Should it not be desired to maintain the temperature constant but merely below a certain degree, then the switch 13 is thrown so as to permanently break the circuits through the heaters, or, on the other hand, should it be desired to maintain the temperature merely above a certain degree, then the switch 25 is similarly thrown. Should it be desired to throw both the heating and the cooling apparatus out of operation, then both switches are thrown open.

50 indicates a wire leading from the terminal 8 to one end of the field coils 51 of the generator 1, from the other end of which a wire 52 leads to a carbon pile 53, from the other end of which a wire 54 leads to the other terminal 7. The conductivity of this carbon pile is varied, so as to vary the resistance in the field coil, in the following manner: The end of the carbon pile to which is connected the wire 54 is loosely connected to an arm 56 of a bell crank lever 57, a long arm 58 of which, having a slidable weight 60 thereon, is connected to the upper end of a core 59 of a double solenoid. The coils of said solenoid, hereinafter more particularly described, are contained in an iron tube 61, and the lower end of the core has attached thereto an iron disk 62 of substantially the same diameter as the interior of the tube, the object of this construction being to close the magnetic circuit through and around the solenoid.

One solenoid coil 65 is made of fine wire, and one terminal thereof is connected by a wire 66 with a wire 67, connected with a wire 68, leading through a fuse 69, said wire 68 being connected with the terminal 7. The other end of the coil 65 is connected by a wire 70 with a wire 71 connecting with a wire 72 leading to the other terminal 8. As the result of this construction, when the speed of the dynamo-electric machine is, from any cause, reduced, so that the voltage of the current generated thereby is also reduced, the attraction on the core 65 is proportionately reduced, and consequently the downward pull on the arm 58 of the lever due to its weight and that of the core 59 and of the weight 60 is increased, causing said arm 58 to fall and the arm 56 to compress the carbon pile, increasing its conductivity, and therefore increasing the current through the field coils, and thus tending to maintain the voltage of the dynamo-electric machine constant, notwithstanding any diminution in its speed.

The storage battery 42 is charged from the generator in the following manner: An electric current passes from the positive pole 7 by the wire 68, fuse 69, and a wire 75, to the positive pole 43 of the battery, then through the battery 42 to the terminal 41, and through a wire 76 to a contact 77, thence by a wire 78 to one terminal of a heavy wire solenoid coil 79, around the core 59, then through said coil 79 to the other terminal and by wires 80, 81, to the lower terminal of a heavy solenoid coil 82, then through said coil to the upper terminal thereof, then by a wire 83 to a contact 84 carried on the upper end of a core 86 of said solenoid 82, which contact 84, is, when the core is raised, by means to be presently explained, in contact with a contact 87, connected by a wire 88 with the wire 71, which is connected to the wire 72 and leads to the negative pole 8 connected to the generator. This coil 79 of the solenoid, in series with the generator, serves to maintain at an approximately uniform magnitude that branch of the current from the generator which charges the storage battery, irrespective of any variation in speed which the generator may be subjected

to while the battery is being brought up to a full charge. When, owing to an increase of speed, the current from the generator increases, the core 59 of the solenoid is thereby raised, and the pressure on the carbon pile is diminished, and its resistance is thereby increased, and the current through the field magnet coils is correspondingly decreased, and the out-put of the generator is then reduced. Conversely, when, owing to a decrease in speed of the generator, the current diminishes, the upward pull of the coil against gravity is decreased, and the carbon pile is compressed and its resistance lowered, and the current through the field coils increased, so that the out-put of the generator is increased. When the battery becomes fully charged the voltage of the current sent through the shunt coil 65 is then sufficient to counteract the pull exerted by the series coil 79 to just such an extent that the compression of the carbon pile is sufficiently decreased to reduce the field strength to that required to produce a current only sufficient to take care of the load, which current is now diminished, because the current for charging the battery is no longer required.

It is necessary to provide means whereby, when the electric generator is not in operation, the circuit through said generator and the storage battery will be broken, for otherwise the storage battery would then be discharging through the generator. At the same time it is necessary that this means should include means for closing the circuit through the battery and generator automatically when the generator is set in operation. These means are provided in the following manner: From the wire 67, connected with the positive pole of the generator, a wire 90 leads to one terminal of a solenoid coil 91 of fine wire which can actuate the core 86 previously described, from the other end of which coil a wire 92 connects, in the same manner as the wire 70 from the other fine wire solenoid coil, with the wire 71 connected to the wire 72 leading to the negative terminal 8 of the generator. Therefore, as soon as the electric generator is operated, an electric current is sent through the solenoid coil 91. This solenoid coil is of such dimensions that, when the out-put from the generator is sufficient to be effectual for the purpose of this apparatus, the coil is energized by the current sufficiently to raise the core 86. The following main circuit is then closed between the contacts 84 and 87: from the positive pole 7 by the wire 68, fuse 69, wire 75, then by two branches, proceeding through the load and battery respectively, the branch through the load being as follows: by a wire 93 to the terminal 9 of the load, then through the load, then from the terminal 10 of the load by a wire 94 to a point 95, where it joins the branch circuit through the battery, which is as follows: by the wire 75, through the battery 42, then by the wire 76, contact 77, wire 78, solenoid coil 79, wire 80 to the point 95. From the point 95, the main circuit continues by the wire 80, wire 81, coil 82, wire 83, contact 84, contact 87, (the core 86 being raised) wire 88, wire 71, wire 72, to the negative pole 8 of the generator. It will be seen that when the battery is fully charged, and the generator is in full operation, the current energizes the solenoid 82 so as to reinforce and strengthen the action of the solenoid 91, but when the voltage of the generator falls below that of the battery, then part of the current from the battery goes through the load at the proper voltage to take care of the load, and part goes through the electric generator, and the current from the battery flows in the opposite direction, and the solenoid 82 is energized so that the polarity of the solenoid is reversed, the current from the battery flowing by the wire 75, 68, pole 7, through the generator to the pole 8, by the wire 72, 71, 88, contacts 87, 84, wire 83, solenoid 82 in the downward or reverse direction, wires 81, 80, solenoid coil 79, wire 78, contact 77, wire 76 to the negative pole of the battery. This reversal of the polarity of the solenoid 82 causes the attraction of the solenoid 91 to be overcome, so that the contacts 84 and 87 are separated, and the generator circuit is open. Substantially the full current from the battery then flows by the wires 75, 93 to the terminal 9 of the load, thence through the load and to the terminal 10, thence by wires 94 and 80 to a wire 99, and contact 100, which then contacts with the contact 77, and thence by the wire 76 to the negative pole of the battery, allowing substantially the full current of the battery to flow through the load. A minute portion of the current flows by the branch circuit wire 80, solenoid 79, and wire 78, but this amount of current is so small as to produce substantially no effect in the lifting of the core and therefore does not reduce the compression of the carbon pile, it being necessary that the conductivity of said pile should be at its maximum magnitude under these conditions, so that the circuit through the field magnet coils should be of maximum strength when the generator is started.

In order to insure that a small current of electricity is provided for building up of the magnetic field of the generator there is provided a wire 102, having therein a resistance 103, which wire is in a circuit through the battery and generator.

I claim:—

1. In an apparatus of the character described, the combination of a heater, a

cooler, each of which is adapted to be operated by means of an electric current, a source of supply of said current, branch circuits connected with said source of supply, and with said heater and cooler respectively, a switch for connecting said source of supply with either branch circuit exclusively of the other, electro-magnetic means for operating said switch, a circuit independent of the branch circuits and connecting the source of supply with said electro-magnetic means, a thermostat in said independent circuit, and means, controlled by the thermostat, whereby the switch circuit is broken or closed.

2. In a temperature regulating apparatus adapted for actuation by a rotor variable in direction, the combination of an electric generator adapted to be actuated from said rotor, a double-pole switch automatically reversed with the reversal of direction of said generator, a heater, a cooler, branch circuits connected with the poles of said switch and with said heater and cooler, respectively, a switch for connecting said poles with either branch circuit exclusively of the other, electro-magnetic means for operating said switch, a circuit independent of the branch circuits and connecting the source of supply with said electro-magnetic means, a thermostat in said independent circuit, and means, controlled by the thermostat, whereby the switch circuit is broken or closed.

3. In an apparatus of the character described, the combination of a heater and a cooler, both of which are adapted to be operated by means of an electric current, an electric generator for supplying said current having shunt field coils, and a variable resistance interposed in the shunt circuit of said field coils, the resistance of which increases or diminishes with the speed of the generator.

4. In an apparatus of the character described, the combination of a heater, a cooler, each of which is adapted to be operated by means of an electric current, a source of supply of said current, branch circuits connected with said source of supply, and with said heater and cooler respectively, a switch for connecting said source of supply with either branch circuit exclusively of the other, electro-magnetic means for operating said switch, a storage battery energized by said source of supply and supplying current to the electro-magnetic means, a thermostat in the circuit of said electro-magnetic means, and means, controlled by the thermostat, whereby the switch circuit is broken or closed.

5. In an apparatus of the character described, the combination of a heater, a cooler, each of which is adapted to be operated by means of an electric current, a source of supply of said current, branch circuits connected with said source of supply, and with said heater and cooler respectively, a switch for connecting said source of supply with either branch circuit exclusively of the other, electro-magnetic means for operating said switch, a storage battery energized by said source of supply and supplying current to the electro-magnetic means, means for maintaining approximately constant the current from the generator leading to the storage battery until the storage battery is fully charged, a thermostat in the circuit of said electro-magnetic means, and means, controlled by the thermostat, whereby the switch circuit is broken or closed.

6. The combination of a temperature-changing device adapted to be operated by an electric current, means for controlling the same, an electric generator for supplying electricity to operate said temperature-changing device, a storage battery energized by current from said generator for actuating said controlling means, and means whereby the current supplied from the generator to the storage battery is approximately constant until said battery is fully charged.

7. The combination of a temperature-changing device, adapted to be operated by an electric current, means for controlling the same, an electric generator for supplying electricity to operate said temperature-changing device, a storage battery energized by current from said generator for actuating said controlling means, and means whereby the current supplied from the generator to the storage battery is approximately constant until said battery is fully charged, and means actuated by the current through the storage battery for reducing the field strength of the electric generator.

8. The combination of a temperature-changing device, adapted to be operated by an electric current, means for controlling the same, an electric generator for supplying electricity to operate said temperature-changing device, a storage battery energized by current from said generator for actuating said controlling means, said temperature-changing device being also in a circuit through the storage battery, and means for breaking the circuit between the generator and storage battery when the generator is not in operation.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WELCH BARSTOW.

Witnesses:
FRANCIS M. WRIGHT,
D. B. RICHARDS.