June 23, 1942. C. F. GEDGE 2,287,237

HUMIDIFIER AND CONTROL FOR INCUBATORS

Filed Aug. 14, 1939 2 Sheets-Sheet 1

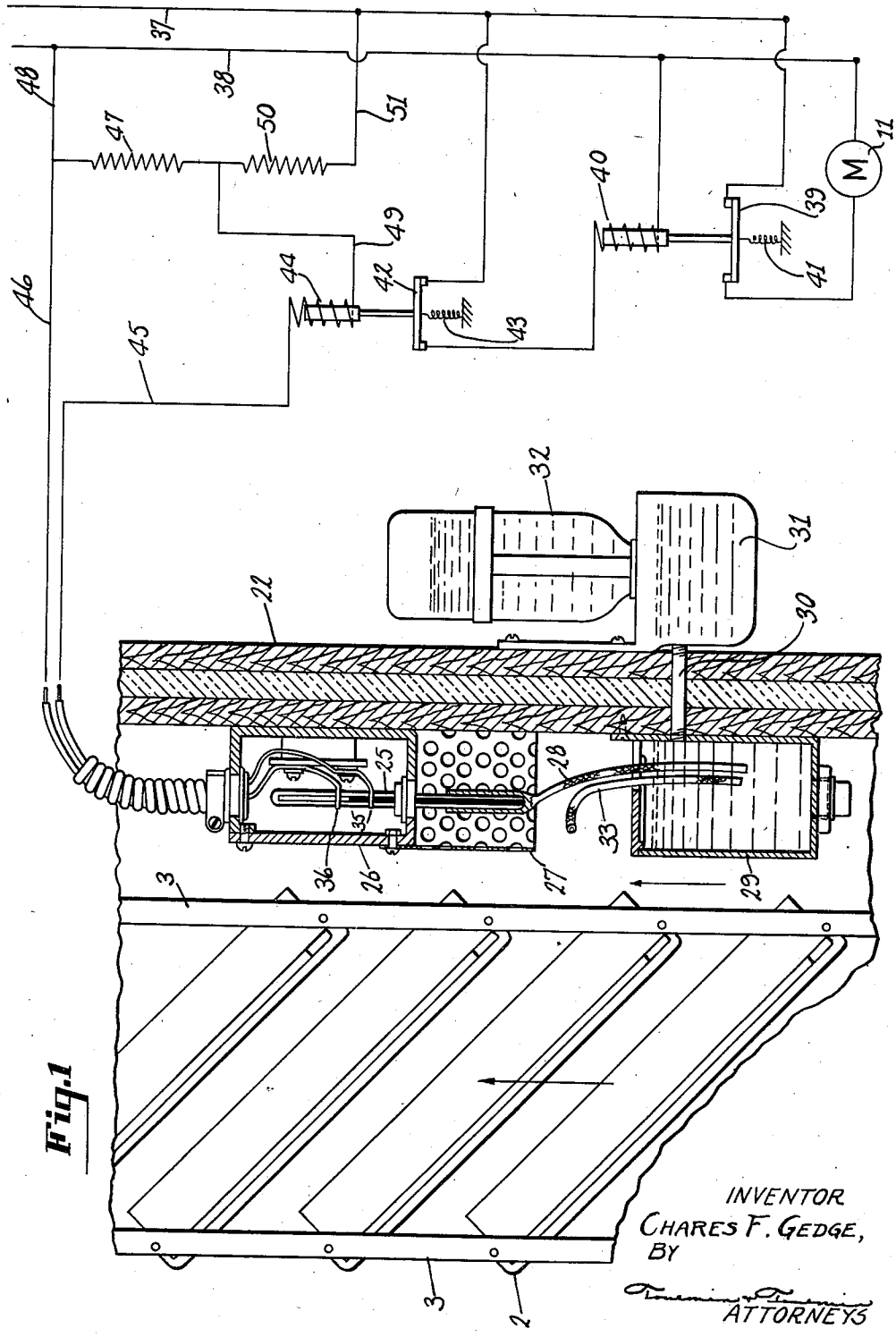


Fig. 1

INVENTOR
CHARES F. GEDGE,
BY

ATTORNEYS

June 23, 1942. C. F. GEDGE 2,287,237

HUMIDIFIER AND CONTROL FOR INCUBATORS

Filed Aug. 14, 1939 2 Sheets-Sheet 2

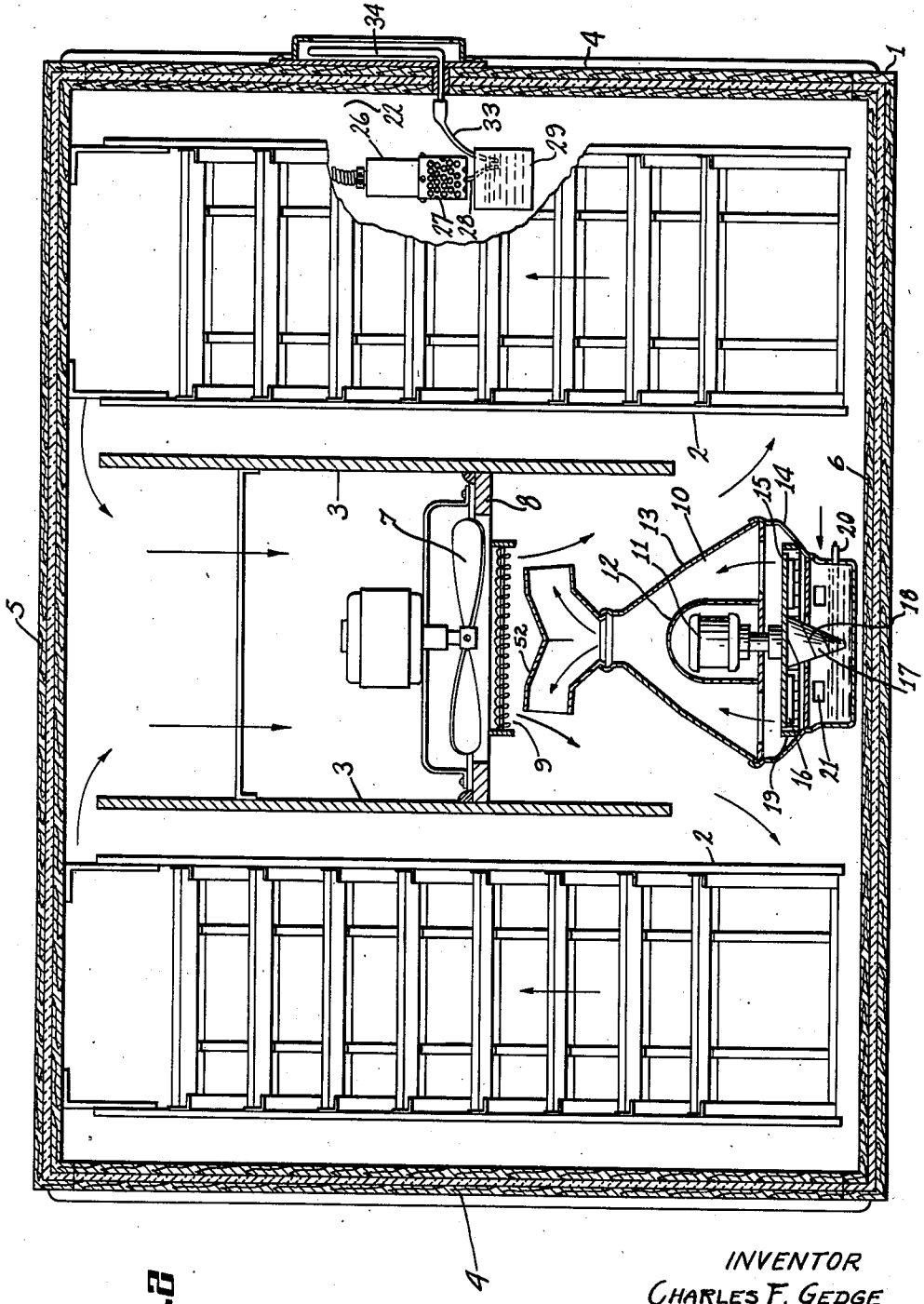


Fig. 2

INVENTOR
CHARLES F. GEDGE,
BY
ATTORNEYS

Patented June 23, 1942 2,287,237

UNITED STATES PATENT OFFICE

2,287,237

HUMIDIFIER AND CONTROL FOR INCUBATORS

Charles F. Gedge, Springfield, Ohio, assignor to The Buckeye Incubator Company, Springfield, Ohio, a corporation of Ohio

Application August 14, 1939, Serial No. 290,050

6 Claims. (Cl. 236—44)

This invention relates to an incubator humidifier and control mechanism therefor. More particularly, it relates to a mechanism for automatically maintaining the wet bulb temperature within the incubator at a predetermined level, the humidifier unit being automatically placed in operation whenever the wet bulb temperature is below the desired point.

The principal object of the present invention is to devise a humidifying mechanism to be applied to an incubulator for maintaining the wet bulb temperature within the incubator at the predetermined level.

Another object is to provide such an incubator humidifier wherein a mercury wet bulb thermometer controls the application of the humidifier unit; in a preferred embodiment, the mercury thermometer is provided with contacts placed in a preset position at the factory so that there can be no adjustment of the point at which the circuit is to be established through the thermometer by the user of the incubator.

Another object is to provide a humidifier control wherein a sensitive relay is interposed between the control thermometer contacts and the relay which controls the humidifier motor; the interposition of this sensitive relay between the motor-operating relay and the mercury thermometer allows limitation of current passing through the thermometer to a maximum of 3 to 4 milliamperes, thereby preventing any possibility of injury to the thermometer due to excessive current passing therethrough, causing volatilization of the mercury, overheating and sparking.

Another object is to provide a humidifier control wherein the humidifier is in operation whenever the wet bulb temperature is below the predetermined desired level; the electrical control for the humidifier unit is such that it shuts off the motor whenever the humidity has been raised to a point sufficient to cause the wet bulb thermometer to make the circuit between the two contacts thereupon; thus whether the humidity be raised to this temperature by the humidifier unit, by the setting eggs, or by combinations thereof, the humidifier motor is automatically shut off when the wet bulb temperature reaches the predetermined level.

Other objects will more fully hereinafter appear.

In the accompanying drawings;

Figure 1 is a vertical sectional view through a wall of the incubator cabinet showing in end elevation, a tier of egg setting trays, showing the wet bulb thermometer and water supply therefor and showing the wiring diagram for humidifier control.

Figure 2 is a vertical section at right angles to Figure 1 showing the two tiers of trays in the incubator setting cabinet and showing the humidifying unit and circulation of air through the incubator.

In the drawings, reference numeral 1 represents the usual incubator cabinet provided with two parallel rows of setting trays designated generally as 2, each of which is disposed between a longitudinal partition 3 and a side wall 4 of the cabinet. Partitions 3 are spaced apart from one another a distance approximating the distance between partition 3 and wall 4, and extend vertically from a point adjacent the top 5 of the incubator to a point substantially halfway between the middle of the incubator and the bottom 6. Circulating fans 7 are disposed longitudinally on a horizontal partition 8 located between partitions 3 at a point approximately in the middle of the incubator. Electrical heating elements 9 are mounted below the fans 7 so that the air circulated downwardly by fans 7 is warmed thereby.

The humidifying unit designated generally as 10 is located approximately centrally of the bottom 6 of the incubator. This unit comprises an electric driving motor 11 mounted with its shaft vertically and centrally disposed in a motor housing 12 in turn mounted centrally of the humidifier housing 13 which is disposed over a combined rotor housing and water reservoir 14. Fixedly mounted on the lower end of the motor shaft of motor 11 is a circular disk 15 provided with radiating ribs 16 on its lower face. Disk 15 is provided centrally with a downwardly extending cone 17 which is formed with a spiral groove 18. Cone 17 extends downwardly into the water in the water reservoir so that as motor 11 is operated, cone 17 draws water upwardly on its spiral groove 18 into contact with rotating disk 15 which throws the water outwardly, ribs 16 aiding in hurling the water radially outwardly at high speed. The water is hurled from the outer edge of disk 15 and ribs 16 through the vanes of an annular stationary squirrel cage diffusion member 19. The water reservoir is float-controlled in any suitable manner to maintain the level of water therein substantially constant, water being admitted through a water inlet pipe 20. Ports 21 are provided above the level of the water and in the housing 14 for admission of air to aid in the diffusion and vaporization of the water, this air being pulled upwardly along with the water and being intimately commingled with the water by the rotor plate 15 and the squirrel cage 19, the highly vaporized mixture of water in air being forced upwardly through the space between housings 12 and 13 into a T outlet 52 which discharges the vaporized water horizontally outwardly in a position to be circulated downwardly by fans 7. In operation, motor 11 is rotated at relatively high speed, say 3400 R. P. M. and the disk 15 throws the water

centrifugally at high speed into contact with the vertical vanes of the squirrel cage 19 where it is further atomized and vaporized.

During operation of the incubator, air is circulated by circulating fans 7 in an elliptical path upwardly through the tiers of setting trays 2 and thence downwardly on the inside of partitions 3 in direction indicated by the arrows on Figure 2. The arrows within the humidifier unit 10 indicate the entrance of air thereinto and the direction of travel of air and vaporized water therethrough.

The wet bulb control thermometer designated as 25 is mounted inside of the incubator cabinet 1 in any accessible position therein, and preferably upon a front wall 22 of the cabinet. The wet bulb thermometer 25 is thus mounted in a position where the upward circulation of air adjacent setting trays 2 causes thermometer 25 to accurately indicate the wet bulb temperature within the incubator 1. In order to protect the wet bulb thermometer 25, it is mounted within a casing 26 attached to wall 22 and provided with a downwardly extending perforated guard member 27 which surrounds the bulb of thermometer 25, allowing access of air thereto so as to give a correct reading and yet protecting the bulb. The bulb is provided with a wick 28 which extends downwardly into a wick tank 29 supplied with water through a pipe 30 from a reservoir 31 attached on the outside of wall 22 and in turn supplied from a water bottle 32 so that the water supply in wick tank 29 may be maintained constant from the outside of the incubator 1. Another wick 33 disposed in wick tank 29 maintains wet the bulb of a visual wet bulb thermometer 34 mounted on a side wall 4. Thus, thermometer 34, readable from the outside of the incubator 1, gives a reading identical with the reading of control wet bulb thermometer 25.

Control thermometer 25 is of the mercury-in-glass type, and is provided with a lower common contact 35 which is always in contact with the mercury column during operation of the incubator. Thermometer 25 is also provided with an upper control contact 36 which is pre-located at the factory at the desired wet bulb temperature to be maintained. In an incubator setting unit, the dry bulb temperature is commonly maintained at 99.5° F. and it has been found desirable to maintain the wet bulb temperature at 86° F. In a hatching unit to which the eggs are removed after eighteen days in the setting unit, it is customary to maintain the dry bulb temperature at 97° F. and it has been found desirable to maintain the wet bulb temperature at 87°. Accordingly, control contact 36 will be located at 86° F. in a setting unit such as is shown, and at 87° F. in a hatching unit.

Referring now to the electrical connections between the control thermometer 25 and the humidifier motor 11, the incoming power lines are designated as 37 and 38. Motor 11 is adapted to be connected across lines 37 and 38 by means of a switch 39 adapted to be closed by the energizing of a solenoid 40 against the action of a spring 41. Solenoid 40 is adapted to be connected across lines 37 and 38 by a switch 42 normally held closed by a spring 43. Switch 42 is adapted to be opened to thereby de-energize solenoid 40 and to thereby stop humidifier motor 11 by the energization of a sensitive relay or solenoid 44. Solenoid 44 is adapted to be energized by the flow of an extremely small current between contacts 35 and 36. A lead 45 connects contact 35 to one side of solenoid 44. A lead 46 connects contact 36 to one side of a 4000 ohm resistance 47 which is connected on the same side to power line 38 by a lead 48. The other side of solenoid 44 is connected by a lead 49 to the other side of resistance 47 and to one side of a 5000 ohm resistor 50, the other side of which is connected by a lead 51 to the other power line 37. Relay coil 44 is of such design that when the mercury in thermometer 25 is across contacts 35 and 36, a current of not over 3 to 4 milliamperes is flowing through the thermometer and through coil 44. The electrical connection is thus such that no damage to thermometer 25 can result either during making the circuit thereby, during the maintenance of the circuit therethrough, or during the break of the circuit therethrough.

In order to use a mercury tube in an electric circuit it is essential that the current flowing through the mercury tube shall be of an extremely low value to prevent volatilization of the mercury. The resistances 47 and 50 reduce the line current to a value sufficiently low that it can be used in the mercury tube switch. The current to be used in the mercury tube switch is in the order of 3 or 4 milliamperes. Such low current values are not practical for direct control of relay apparatus which can directly control an electric motor. The solenoid coils of relay apparatus of the direct control type demand more than 3 or 4 milliamperes of current for their operation. It is thus essential that a small relay shall be interposed between the mercury tube switch and the relay apparatus for the electric motor. The relay 44 is such a relay. However, this relay 44 is only large enough to be operated by the low current values used in the circuit of the mercury tube, hence this relay must provide the means for establishing circuit to a more powerful motor relay apparatus, such as the relay 40.

As a result of the electrical connections, sensitive relay coil 44 is in series with contacts 35 and 36, and the circuit of relay coil 44 and of contacts 35 and 36 is in parallel with resistor 47. The total current through the parallel circuits of resistor 47 and of relay coil 44 and contacts 35 and 36 is limited to that flowing through resistor 50. Resistor 47 is of slightly smaller resistance than resistor 50 so that the current through coil 44 which is high resistance and through contacts 35 and 36 is limited to the very low value desired. Whenever contacts 35 and 36 are not connected, resistor 47 carries all of the current. Thus it is ensured that a sufficiently small current will flow through the mercury as to prevent difficulties on making the circuit therethrough or overheating on maintaining the circuit therethrough for prolonged periods, or excessive sparking on breaking the contact between the mercury column and contact 36. On breaking the circuit through the contacts, resistor 47 operates in conjunction with the high impedance of coil 44 to prevent a rapid surge of current across the gap between the contact 36 and the mercury.

The electrical connections are such that humidifier motor 11 is operating whenever the wet bulb temperature in the incubator is below the predetermined level since whenever it is below such level no circuit is established through sensitive relay 44 and consequently switch 42 remains closed, thereby maintaining relay 40 energized and maintaining motor 11 energized. Should the humidity within the incubator rise to the predetermined figure, whether due to humidity given off from eggs or to the humidity

supplied by humidifier 10, the mercury establishes a circuit across contacts 35 and 36, the extremely small current flowing through coil 44 breaking switch 42 which in turn breaks motor switch 39. The humidifier motor 11 will thus remain off until the humidity within the incubator drops so as to break the circuit across contacts 35 and 36, whereupon the motor 11 will again operate to supply humidity to the incubator.

I wish it to be understood that I intend to include as within my invention such modifications as may be necessary to adapt the same to varying conditions and uses and as fall within the scope of the spirit or terms of the appended claims. This invention is applicable to either an incubator or a hatcher and the term "incubator" in the claims is to be construed as including both an incubator (i. e. a setting unit) and a hatcher.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an incubator humidifier control, a humidifying sprayer, an electrical driving motor therefor, a relay for said motor, a mercury wet bulb thermometer adapted to respond to wet bulb temperature within the incubator and having a lower common contact and an upper contact set at the predetermined wet bulb temperature desired to be maintained, said contacts being located so as to be interconnected by the mercury, means for limiting the current flow through said contacts to an extremely low value, and a sensitive relay operated by said current flow interposed between said contacts and said motor relay instantly responsive to a make or a break of said contacts and adapted to accordingly de-energize said motor relay and stop said motor when the mercury contacts the upper contact and to allow said motor relay to be energized to operate said motor when the mercury level is below the upper contact.

2. In an incubator humidity control, humidifying means adapted to supply humidity to the incubator, a mercury control thermometer adapted to respond to the wet bulb temperature in the incubator, said thermometer having contacts adapted to be electrically interconnected by the mercury therein when the predetermined wet bulb temperature is attained, means for controlling the operation of said humidifying means in accordance with the electrical interconnection or disconnection of said contacts, a visual wet bulb thermometer adapted to respond to the wet bulb temperature in the incubator and having its scale portion located on the exterior of the incubator, and a common wick tank within the incubator for supplying wicked water to the bulbs of said control and visual thermometers.

3. In an incubator humidity control, humidifying means adapted to supply humidity to the incubator, a mercury control thermometer adapted to respond to the wet bulb temperature in the incubator, said thermometer having contacts adapted to be electrically interconnected by the mercury therein when the predetermined wet bulb temperature is attained, means for controlling the operation of said humidifying means in accordance with the electrical interconnection or disconnection of said contacts, a visual wet bulb thermometer adapted to respond to the wet bulb temperature in the incubator and having its scale portion located on the exterior of the incubator, a common wick tank within the incubator for supplying wicked water to the bulbs of said control and visual thermometers, and means for supplying water to said wick tank from a point exterior of said incubator.

4. A humidity control for an incubator comprising a moisture dispersing device constructed and arranged that moisture dispersion is stopped immediately upon stopping the operation of the device including electrical means for controlling the operation of the device, a relay for controlling energization of said electrical means, a mercury wet bulb thermometer responsive to wet bulb temperature within the incubator and having a common contact in constant engagement with the mercury column in said thermometer and a second contact positioned at the wet bulb temperature desired to be maintained, said contacts being located so as to be interconnected by the mercury column, means for limiting the current flow through said contacts to an extremely low value, and a sensitive relay operated by said current flow interposed between said contacts and said first mentioned relay instantly responsive to a make or break of said contacts to control the operation of said first mentioned relay and thus the operation of said moisture dispersing device.

5. In an incubator, a moisture dispensing device comprising a rotatable moisture spraying means, electrical means for rotating said spraying means, means for circulating air through and around the incubator trays in the incubator, means driven by said means for rotating said spraying means for circulating air through said spraying means, a mercury wet bulb thermometer having the bulb thereof disposed within the incubator so positioned therein that the air circulated within the incubator will impinge upon the bulb of said thermometer, wick means for supplying moisture to the bulb of said thermometer, contacts in said thermometer adapted to be electrically interconnected by the mercury therein due to a change in height of the mercury column caused by changing conditions of the circulating air which impinges upon the bulb of said thermometer, relay means for controlling current flow to the electrical means for driving said spraying device, and a sensitive relay operated by said current flow through said mercury thermometer, said sensitive relay controlling current flow to said first mentioned relay to control the operation thereof and thus control the operation of the electrical means for rotating said spraying means.

6. In an incubator humidifier control, a humidifying sprayer, an electrical driving motor therefor, a relay for said motor, a mercury wet bulb thermometer adapted to respond to wet bulb temperature within the incubator and having a lower common contact and an upper contact set at the predetermined wet bulb temperature desired to be maintained, said contacts being located so as to be interconnected by the mercury, means for limiting the current flow through said contacts to an extremely low value, and a sensitive relay operated by said current flow interposed between said contacts and said motor relay instantly responsive to a make or a break of said contacts and adapted to control the operation of said motor relay.

CHARLES F. GEDGE.