C. E. ADAIR.

MULTIPLE COMPARTMENT INCUBATOR.

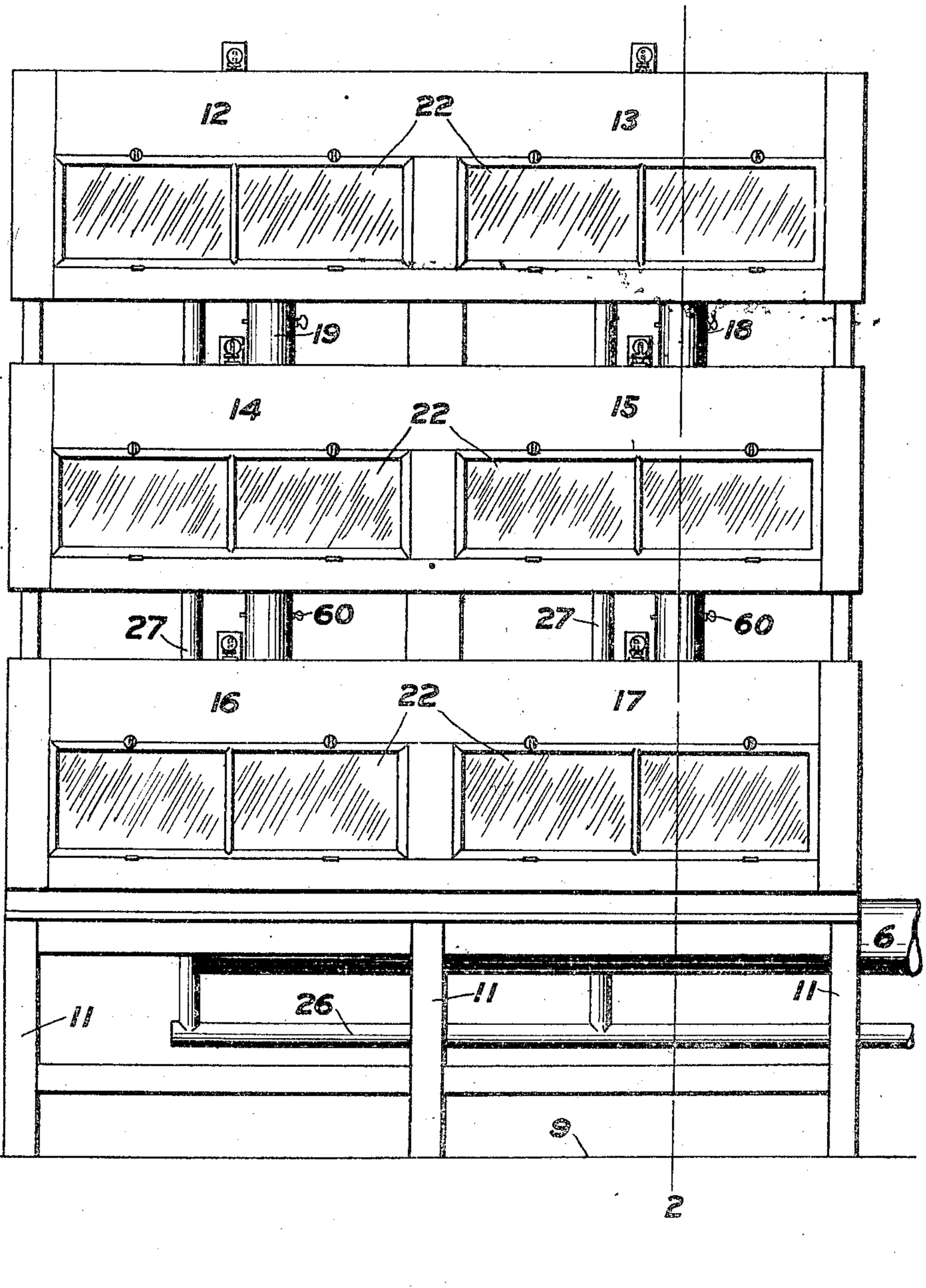
APPLICATION FILED JAN. 29, 1906.

934,986.

Patented Sept. 28, 1909.

4 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

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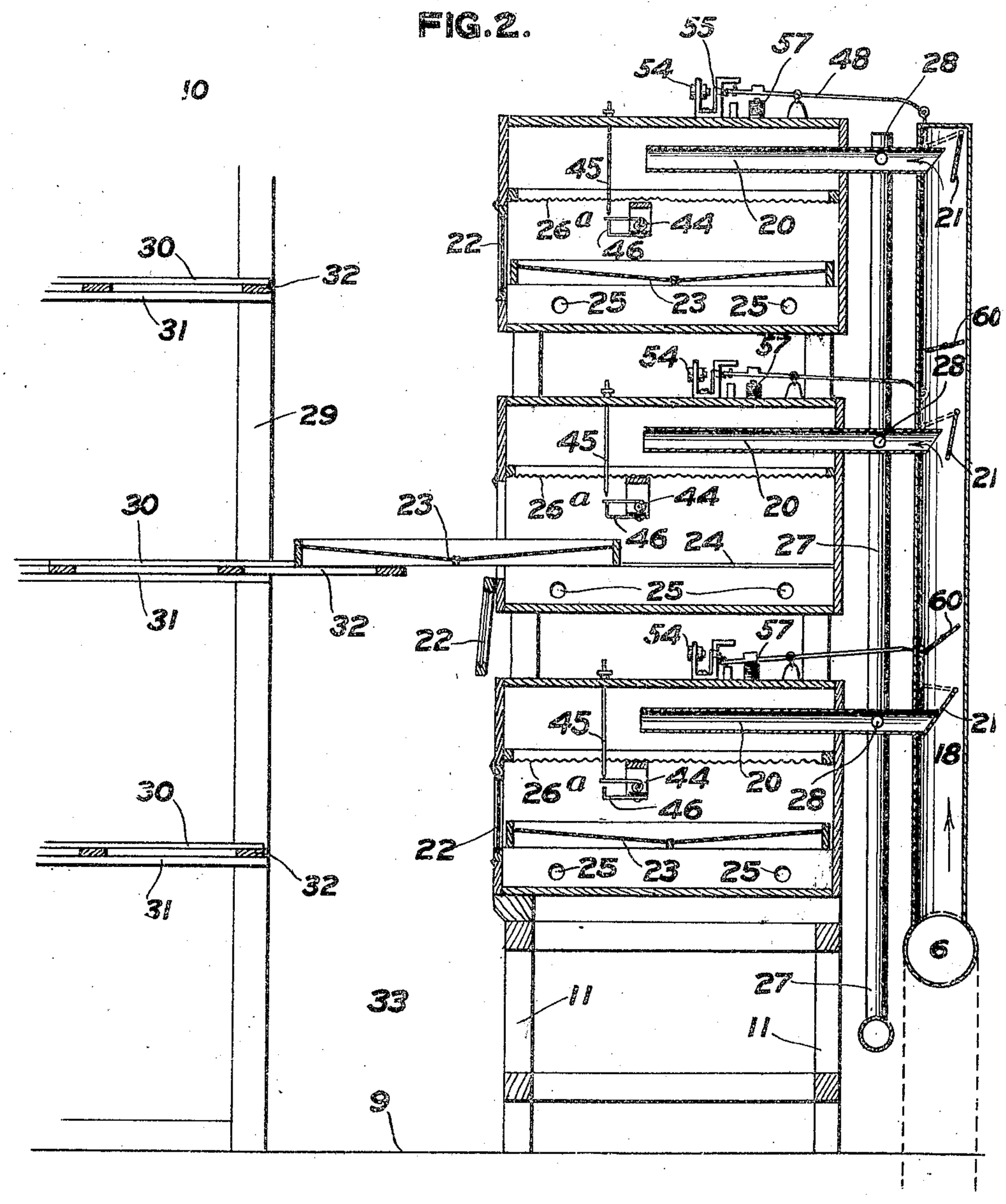
4 SHEETS—SHEET 2.

FIG. 2.



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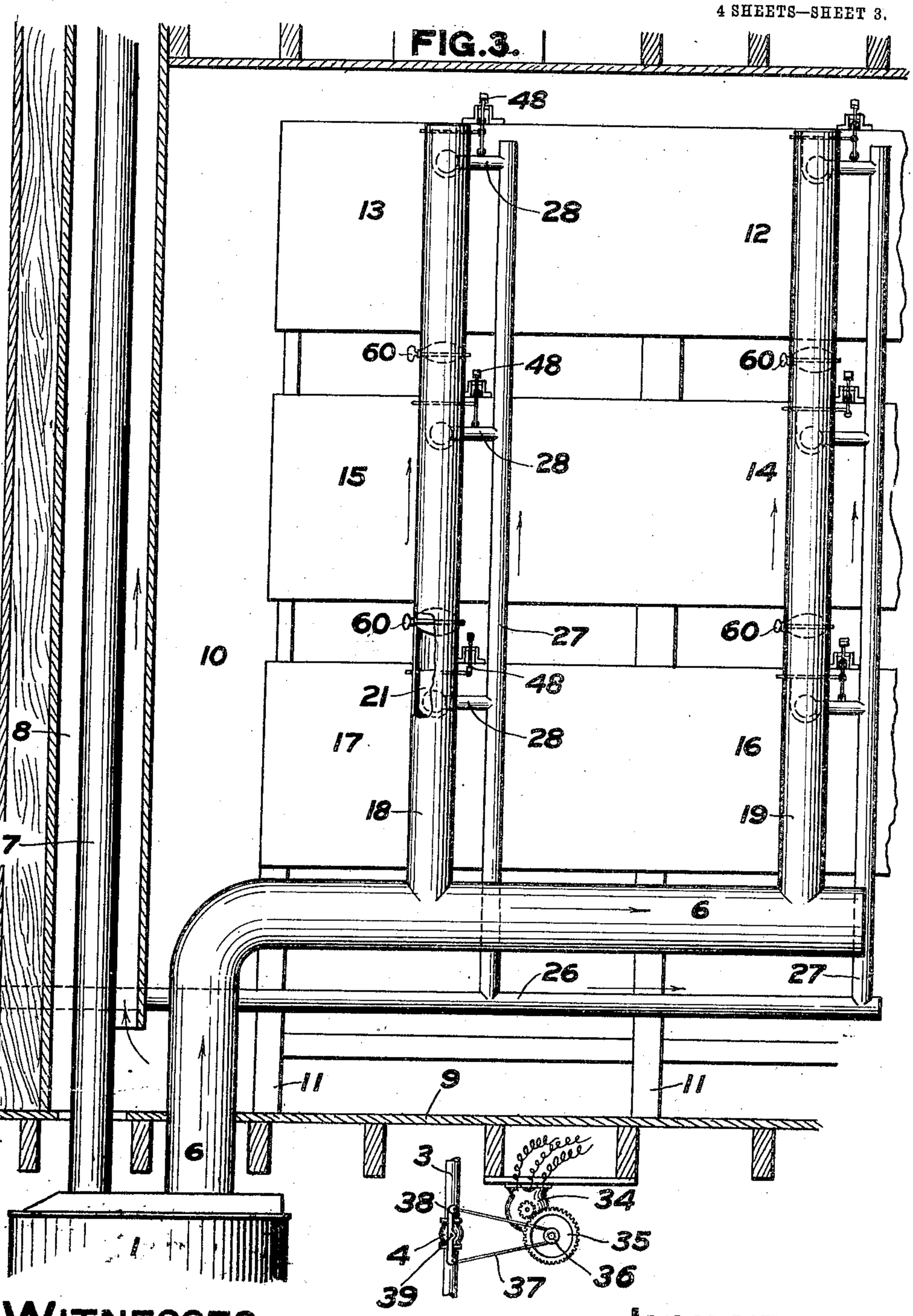
4 SHEETS—SHEET 3.

FIG. 3.



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4 SHEETS—SHEET 4.

FIG. 4.

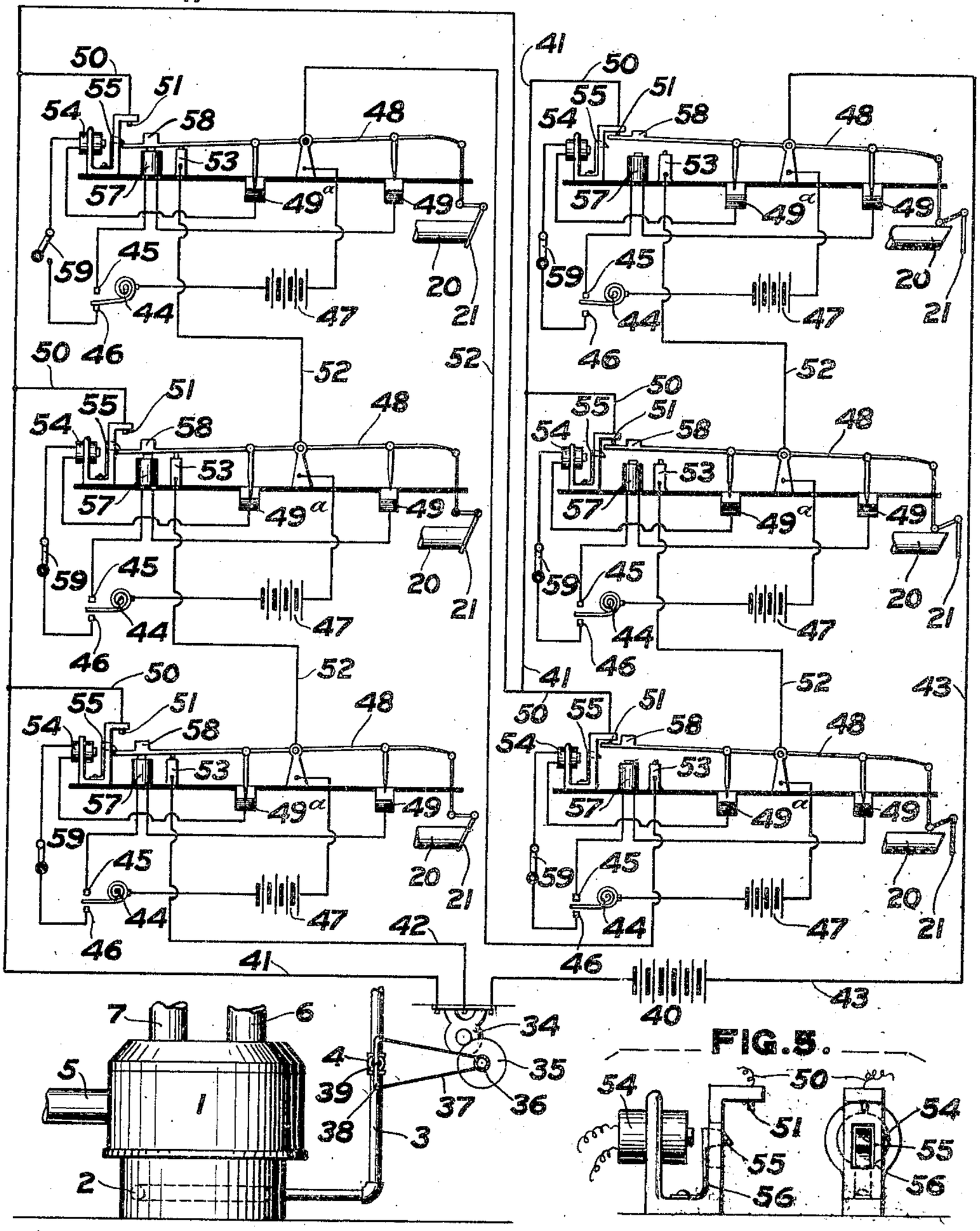

FIG. 5.

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UNITED STATES PATENT OFFICE.

CHARLES E. ADAIR, OF BUFFALO, NEW YORK, ASSIGNOR TO CYPHERS INCUBATOR COMPANY, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

MULTIPLE-COMPARTMENT INCUBATOR.

934,986. Specification of Letters Patent. Patented Sept. 28, 1909.

Application filed January 29, 1906. Serial No. 298,388.

To all whom it may concern:

Be it known that I, CHARLES E. ADAIR, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Multiple-Compartment Incubators, of which the following is a specification.

This invention relates to multiple compartment incubators, and consists in the apparatus hereinafter described and claimed.

The object of the invention is to provide a complete incubator apparatus embodying a series of compartments suitably heated, ventilated, and supplied with moisture, from common sources, and in which the temperature of each compartment is independently regulable, but in which each compartment is also under control by reason of the temperature of one or more other compartments, and also a device in which means are provided for the better removal of the egg trays for examination, or for airing and cooling the eggs.

In the drawings:—Figure 1 is a front elevation of an incubator embodying this invention having six compartments; Fig. 2 is a vertical section on the line 2—2 of Fig. 1, showing also the devices for receiving the egg trays from the separate incubator compartments; Fig. 3 is a rear elevation of a portion of the same device shown in Fig. 1, including elevations of sufficient portions of the heating and controlling apparatus to illustrate the same; Fig. 4 is a diagram of the electrical mechanisms and circuits of the device; and Fig. 5 shows enlarged end and side elevations of a detail.

This example of this invention is shown as employing hot air for the heating medium. The air heater which supplies the hot air for this heating purpose is capable of direct control by lowering or reducing its heating power, and in addition the admission of the heating fluid to each compartment is also capable of increased reduction or complete exclusion.

This form of the invention is intended to be used in a suitable room or inclosure, which is heated by the warmed air that has passed through the incubator compartments, and this warmed air surrounds the whole incubator device and tends to maintain the heat therein. This air is then drawn off from the room with the same speed as the air is carried into the incubator compartments so that the air discharged is in direct and necessary relation to the air introduced into the incubator compartments for the purpose of heating it. At the same time cool air carrying a proper percentage of moisture is delivered directly to each incubator compartment in order to maintain the proper degree of humidity therein for hatching purposes.

In the drawings 1 is an air heater preferably heated by a gas burner 2 connected with a gas service pipe 3 controlled by a valve 4. Air is drawn into the heater through a suitable air inlet 5, and is discharged therefrom through the main 6. The smoke pipe 7 carries away the products of combustion, and, preferably for economical purposes, passes through the room containing the incubator. A casing 8 surrounds the pipe 7 and has an inlet opening at its bottom and near to the floor 9 of the room, and the air heated in the space between the smoke pipe and the casing 8 tends to rise and thereby to carry out the air from the room 10. The air heater 1 may conveniently be placed in the cellar, or beneath the floor 9. The incubator is preferably set up on legs 11 in order to avoid the impure or colder air which naturally lies next to the floor. In the present case, as above stated, the incubator shown is composed of six separate compartments 12, 13, 14, 15, 16 and 17. In the present case the compartments are arranged in two vertical tiers of three horizontal compartments each. The hot air main 6 extends along preferably parallel to the floor for a portion of its length, and is of sufficiently great area to carry freely all the air which needs to be delivered to the incubators. From the main 6 are conduits to each of the compartments of the incubator, and in the present case these conduits are conveniently made by providing lateral means 18 and 19, extending vertically from the main 6, and adapted to deliver air to the three compartments in each vertical tier. Lateral pipes 20, preferably horizontal, extend from the vertical mains 18 and 19, as the case may be, into the upper portion of each incubator compartment, and each pipe 20 is controlled by a valve 21 adapted to close the said pipe and to prevent the admission of air therethrough into the incubator compartments.

Each incubator compartment has a door

22 giving access to the egg chamber, in which is an egg tray 23 adapted to slide in and out of said egg chamber on suitable guides 24, of which that at one end of each incubator compartment is shown in Fig. 2. In or near the bottom of the compartment are one or more air outlets 25, these outlets being always beneath the position of the egg tray. Above the egg tray, and entirely across the compartment, is a porous diaphragm 26ª. The air conduits 20 lead into the compartment above the said diaphragm so that air introduced into a compartment by the conduit 20 passes downward through the porous diaphragm, through the egg tray, and out through the orifices 25.

The air conduits 20 are connected to fresh air mains 26, connected with the outer air by any suitable means such as the lateral vertical conduits 27 and a connection 28 therefrom to each compartment. By the fresh air mains, air carrying the normal percentage of moisture of the outer air is carried to and meets the inwardly flowing current of heated air that passes through the conduits 20, and thus a percentage of moisture is added to the heated air, so that a higher degree of humidity is maintained in the egg chamber. Of course, the air passage in the main 26 or in its connection to an incubator compartment can be opened, or closed, artificially if desired; or suitable means, such as a thermostat, may be provided for controlling the heat supply of each compartment, and independent means for controlling the heat supply to the whole incubator may also be provided.

Before proceeding to the description of the controlling mechanism, a means for handling large egg trays from this multiple compartment incubator will be described.

A short distance from the front of the incubator a framing 29 is provided having horizontal guide bars 30 and 31, between which slides a supporting frame 32, that is adapted to be extended from between said guide bars into the same plane as the guides 24 for the egg trays, so that when the frame 32 is extended, the egg tray 23 for which it is provided may be slid out of its compartment and directly on the frame 32, and then the frame 32 may be slid back into position, leaving the passage way 33 between the framing 29 and the incubator entirely free. The egg tray when thus placed upon the frame 32 is in position for handling the eggs and for airing them. Thus there is provided a movable egg tray supporting device adapted to receive the egg tray directly from any compartment.

For the heater 1, any suitable, quickly-controlled heater may be employed, but, as stated above, in the present case a gas heater is illustrated, having a controlling valve 4 for the gas supply that is controlled by an electric motor 34, which may drive a suitable gear wheel 35, having a pulley 36, around which is a belt 37 connected to the ends of a cross bar 38 on the stem 39 of said valve 4.

Provision is made for limiting the movement of the bar 38 or of any part of the valve or valve-moving mechanism, whereby the mechanism cannot make movements beyond the needed throw of said valve. Thus, the motor 34 may be capable of only a certain number of revolutions in each direction, sufficient to throw the valve to its extreme open position and to its extreme closed position. In the closed position of the valve 4, a small amount of gas is preferably allowed to pass, so as to keep the burner 2 continuously lighted with a very small flame. Other equivalent means for relighting the burner may be employed for this mechanism.

Means are provided for operating the motor in one direction to open the valve 4, and thus to provide the full heat of the gas burner, when the temperature in any one compartment has fallen below a selected minimum; and other means are provided for closing the valve 4, when the heat in all the compartments has exceeded a selected maximum; further means are provided at each compartment to control the heat supply thereto independently of every other compartment; and further means are provided for excluding each compartment from the system.

In Fig. 4 is shown a diagram of the mechanism and circuits which coöperate for the purposes just described. The motor 34 is of any suitable type, such as the type commercially known as double-wound. A source of electricity, such as the battery 40, is connected to a common connection to both windings of the motor. As is well known, when current is shunted through one of the windings, the motor is revolved in one direction, and when the current is shunted through the other of said windings, the motor revolves in the other direction. To the winding adapted to rotate the motor in a direction that opens the valve 4 is attached the wire 41 of the "opening" circuit, and to the winding that turns the motor in the other direction to close the valve 4 is attached the wire 42 of the "closing" circuit. A common return 43 is connected to the battery for both the "opening" and the "closing" circuits. In each incubator compartment is a thermostatic device, in the present instance shown as a thermostatic coil 44 that makes either of two contacts 45, 46, according as the temperature rises or falls above or below a normal. A battery 47 energizes these circuits, and is connected to the thermostatic coil and to a damper arm 48 that opens and closes the damper 21, and also makes either one of two contacts, preferably by mercury cup and point connec-

tions. When the temperature in a compartment is above the normal, the thermostatic device makes contact with the point 45. This makes a circuit from the battery 47 through the thermostat 44, contact 45, magnet 57, contact 49, arm 48, and back to battery, whereby the armature 58 is attracted by the magnet 57 until the end of the arm is engaged by the hook 55 and is held down, while the other end of the arm is raised and the damper 21 closes the air inlet 20. In this position the contact 49^a is made, and if the temperature in the compartment drops below the normal, so that the thermostatic device makes contact with the point 46, the circuit of the magnet 57 is broken and another circuit is made by the battery 47, through the thermostat 44, point 46, switch 59, magnet 54, contact 49^1, arm 48, and back to battery, whereby the magnet 54 is energized and the arm 48 is released, so that the damper 21 opens and permits a renewed supply of heat to the compartment to which the particular apparatus relates. The arm 48 is balanced so as to tend to open the damper 21 and to take the position shown at the right hand in Fig. 4. The latch 55 is made in any suitable manner so as automatically to catch the end of the arm 48 when it is depressed by the making of a circuit to be described through the contact 45. The latch may be a gravity latch, or, as shown here, it may be a latch supported by a delicate spring 56 so as to be moved easily in latching and also so as to be moved easily in response to the energizing of the magnet 54. In this case a branch 50 from the wire 41 of the "opening" circuit, and a contact 51 therefor, make contact with the arm 48 after it is released, as shown at the right of Fig. 4, and current may flow through said wire 41, branch 50, arm 48, and thence through a connection 52 to the closing connection 53 of the apparatus of the next compartment, as will be described. When the temperature in a compartment rises too high, the thermostatic device 44 makes the contact 45, and current from the battery 47 flows through one of the contacts 49 controlled by the arm 48 and through a magnet 57 that attracts an armature 58 carried by said arm 48, and thus tilts the arm so that the damper 21 is closed, and the latch 55 holds the arm in the position to which it has thus been moved; and at the same time a closing contact 53 is made that is connected to the wire 42 above described. The armature 58 may be employed as the counterbalance for the arm 48. The wire 41 continues through the whole system with a branch 50 to the apparatus of each compartment as described. The return wire 43 is connected to the arm 48 of the last compartment in the whole series. The "closing" circuit begins with the wire 42, passes through the contact 53, the arm 48, the connection 52 to the contact 53 of the next compartment, through its arm 48, the next connection 52, and so on to the return wire 43.

It will now be seen that when the temperature in any compartment rises above the normal or fixed temperature, say 103°, the local battery 47 will energize the damper magnet 57; whereby the arm 48 is tilted and latched and the damper 21 is closed. No current, however, will pass through the "closing" circuit through the wires 42 and 52 until the temperature in all the compartments has risen above the normal. In that case a circuit is made through all these devices, and through the return wire 43, and thus the source of energy 40 will energize the motor 34 to close the valve 4 and to shut off the heat from the whole incubator. As the temperature begins to fall, no effect will occur until the temperature in some one compartment shall have fallen below the normal. In that case the thermostatic device makes the contact 49, energizes the magnet 54, withdraws the latch 55, the magnet 57 is deënergized, the contact 53 in that compartment is broken, and current will flow from the battery 40 through the motor 34, the opening wire 41, the branch 50, the arm 48, the branch 52, and thence on to the series of connections 52 of contacts 53, arms 48 to the return wire 43, thus energizing the motor and causing a revolution thereof in the opposite direction from the last, thus opening the valve 4 and restoring the heat in the heater 1. It will thus be seen that means are provided for restoring the heat at the general heater whenever the temperature of any one compartment has fallen below the normal. It is further to be seen that the local system for each compartment opens and closes the damper 21 in accordance with the rise or fall of the temperature above or below the normal and independently of every other compartment.

When the arm 48 is latched with the damper 21 closed, the heat of the compartment will fall and the contact 45 will be broken by the action of the thermostat. Consequently, the thermostat will not remain long in the position which it took when the temperature rose too high. So too, if the temperature falls, and the thermostat makes the contact 46 the latch is withdrawn from the arm 48, which, being counterbalanced, immediately moves away from its connection 53 and breaks the contact in the circuit of the magnet 54 at the left hand mercury contact 49^a, so that this circuit is soon broken. The right hand mercury contact 49 controls the circuit of the damper magnet 57 so that as soon as the damper is closed that circuit is broken. The latch 55 holds the damper 21 closed without requiring the em-

ployment of electrical force after the first action thereof. A switch 59 is inserted in the circuit of the magnet 54 so that it may be cut out and the latch 55 may hold the arm 48 so as to maintain its damper 21 closed, thus cutting out any one compartment from the heating system. Dampers 60 may be employed in the lateral, vertical pipes 18, in order to prevent the passage of the heating fluid therethrough. The contacts 45 and 46 may be adjustable, in order to set each thermostat for the desired normal and extreme temperatures.

What I claim is:—

1. In an incubator having a series of separate compartments, separate heat supply to each compartment, independent heat controlling means for each compartment, and heat controlling means operative when the temperature of all the compartments has reached a desired point.

2. In an incubator having a series of separate compartments, separate heat supply to each compartment, independent heat controlling means for each compartment, means for reducing the general heat supply when the temperature in all the compartments has risen to a selected degree and for increasing said general heat supply when the temperature has fallen to a predetermined degree in any one of the compartments.

3. In an incubator having a series of compartments, a common source of heated air, conductors for conveying the said heated air to the respective compartments, a fresh air conduit connected to each conductor adjacent to the connection of the latter with the compartments, and means for controlling the warm air supply to the respective compartments, whereby the inmoving warm air draws the fresh air in from the fresh air conduit and the two are mixed as they enter the compartment.

4. In an incubator apparatus, an outer inclosure such as the walls of a room, an air outlet from said inclosure, an incubator device consisting of a series of inclosures constituting compartments in said outer inclosure, a common source of heated air, conductors for conveying the said heated air to the respective compartments, a fresh air conduit connected to each conductor adjacent to the connection of the latter with the compartment and with the open air outside said inclosure, and means for controlling the warm air supply to the respective compartments, whereby the inmoving warm air draws the fresh air in from the fresh air conduit and the two are mixed as they enter the compartment.

5. In an incubator apparatus, an incubator having a series of separate compartments, a hot air main, connections therefrom to each compartment, a fresh air conduit leading from the outer air directly to each compartment, and independent means for controlling the admission of hot air to each compartment.

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