R. KLETT.

INCUBATOR.

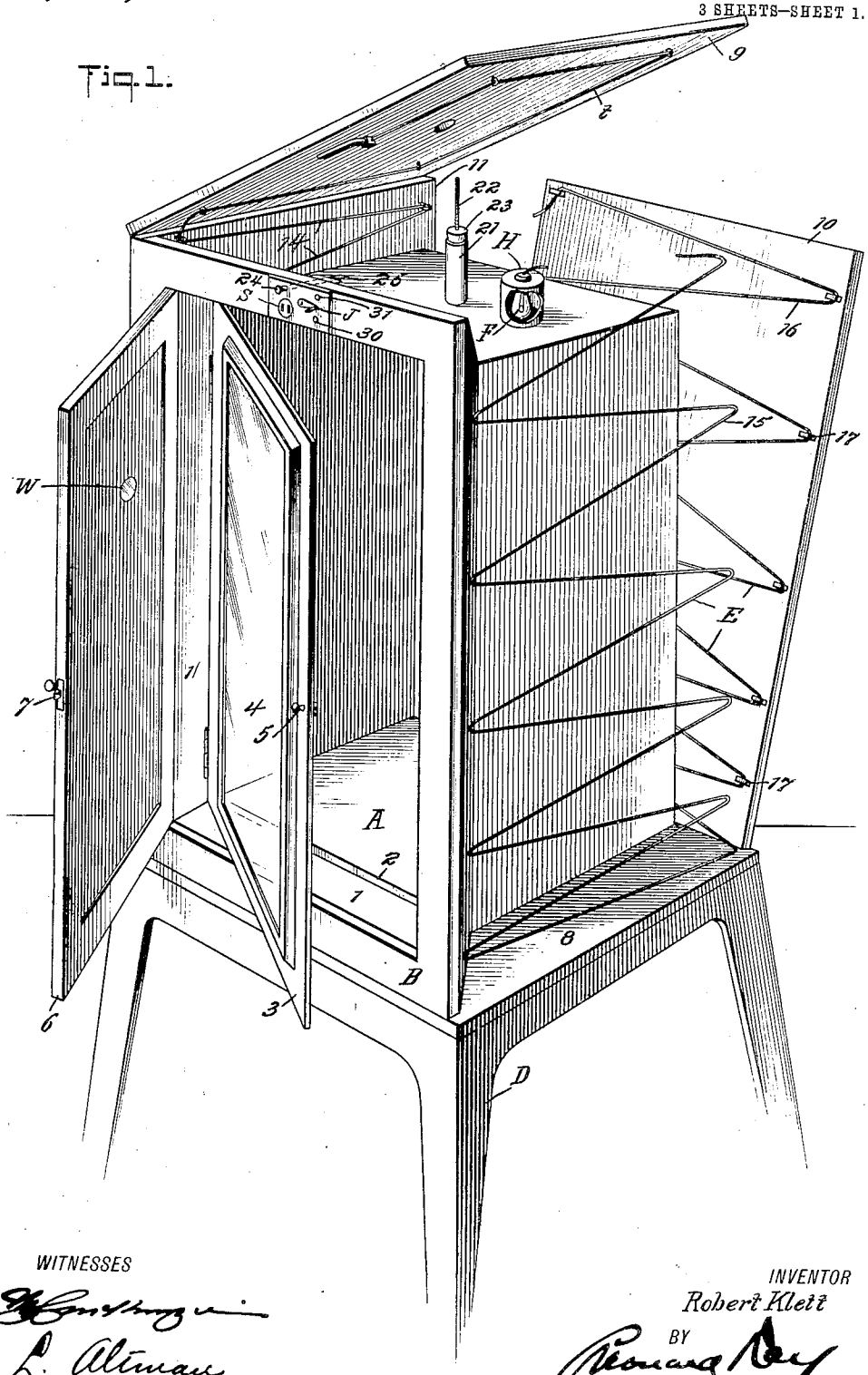
APPLICATION FILED JUNE 12, 1914.

1,127,021.

Patented Feb. 2, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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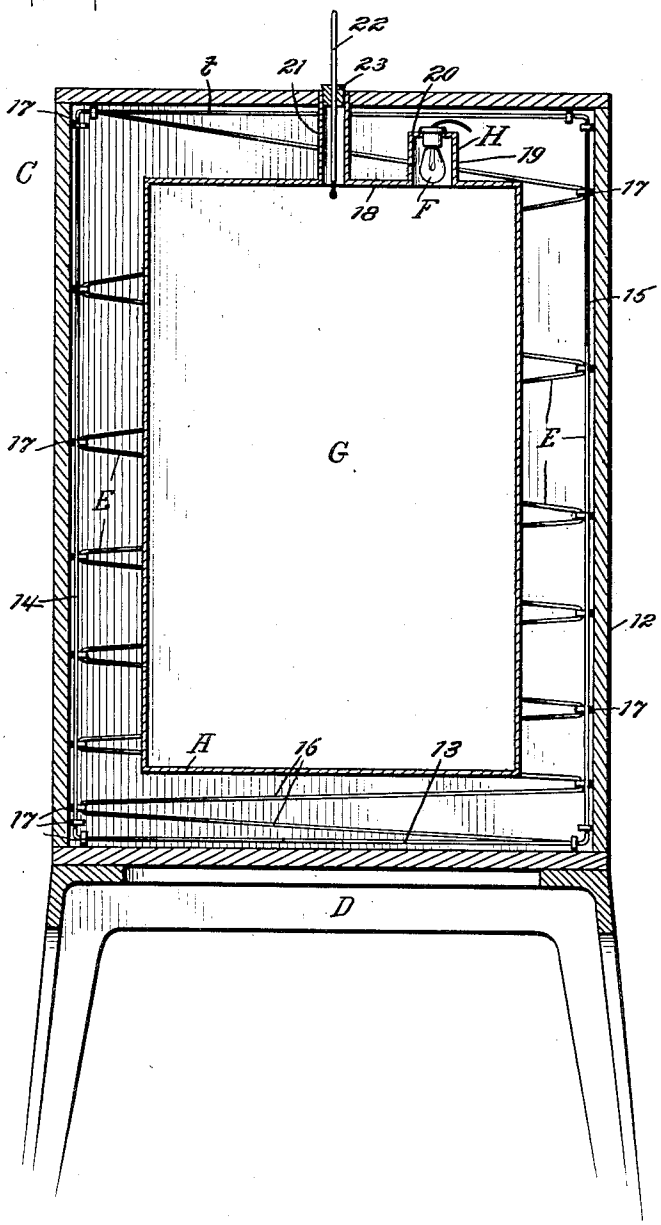
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3 SHEETS—SHEET 2.

Fig. 2.



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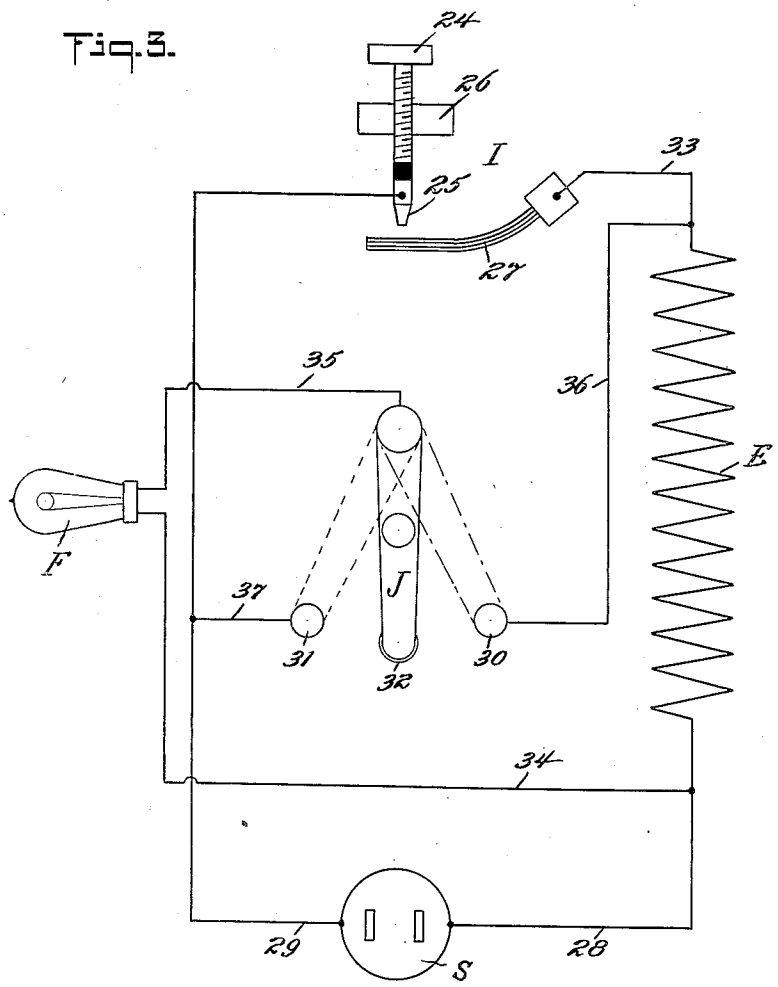
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

ROBERT KLETT, OF NEW YORK, N. Y., ASSIGNOR TO KNY-SCHEERER COMPANY, A CORPORATION OF NEW YORK.

INCUBATOR.

1,127,021. Specification of Letters Patent. Patented Feb. 2, 1915.

Application filed June 12, 1914. Serial No. 844,600.

To all whom it may concern:

Be it known that I, ROBERT KLETT, a subject of the Emperor of Germany, and a resident of 1680 Clay avenue, in the borough of Bronx, New York, have invented certain new and useful Improvements in Incubators, set forth in the following specification.

This invention relates to incubators and particularly to that class of incubator adapted for the scientific incubation of bacteria.

The general object of the invention is to increase the rapidity with which the desired incubating heat can be produced in an incubating chamber; to render the production and maintenance of the desired heat more economical; to improve and refine the maintenance of the desired heat at the desired temperature; to reduce the cost of the structures of the class described; to render the heating of the incubating chamber as nearly uniform throughout its extent as possible; and to provide for the lighting of the incubating chamber and the contemporaneous conservation of the heat generated by the lighting lamp without effecting an undesired local heating of any particular portion of the incubating chamber.

In carrying out the general objects of the invention, it is purposed to do away with the employment about the incubating chamber of a jacket of liquid having a high specific heat. Incandescent lamps have heretofore been employed quite generally to produce the heat required in an incubator.

In carrying out the objects of the invention the heating element contemplated is changed to one of extensive longitudinal extent disposed so as to practically uniformly envelop the incubating chamber. A source of radiant heat as nearly as possible uniformly enveloping the incubating chamber is employed, but is spaced apart a uniform distance therefrom so that the transmission of the radiant heat through the said distance will make more uniform its distribution about the surface of the shell forming the incubating chamber. The shell forming the incubating chamber is also made of excellent heat-conducting material for the purpose of increasing the uniform distribution of heat about the incubating chamber.

A heat-trap for the lamp illuminating the incubating chamber is also contemplated and is embodied in the incubator in such a manner as to conduct the trapped heat to a large area of the shell forming the incubating chamber.

The space in which the heating element is located contains a medium readily permitting the passage of radiant heat and itself having an extremely low specific heat so that a minimum amount of energy will be absorbed before the incubating chamber itself has reached the desired temperature and so that there will be a consequent saving by eliminating unavailable stored heat after the desired process of incubation has been completed.

The above and further objects of the invention will be clear from the following claims and the following description, which is directed to an illustrative embodiment of the invention shown in the accompanying drawings in which like chracters designate corresponding parts, in the several figures, which form part of this application, and in which,

Figure 1 is a perspective view, with a part of the outer shell removed, showing the relative positioning of the various parts of an incubator of my invention; Fig. 2 is a vertical cross-section through the incubator shown in Fig. 1; and Fig. 3 is a diagram illustrating the electric circuits and the thermo-static controller therefor.

An inner box shaped shell A of excellent heat-conducting material such as copper is provided. This shell has top, bottom, rear and two side walls all connected together in a suitable manner forming excellent heat-conducting joints. All of the walls except the rear wall are extended forwardly and flared outwardly into flanges 1 which are secured mechanically, in a suitable manner, to a door frame B of heat non-conducting material. Formed on these flanges 1 is a ledge 2 against which the inner door 3, having the panel 4 of transparent material, seats and is latchable by the latch 5. The outer door 6 of heat non-conducting material is hinged to the door frame B and is latchable by any suitable latch 7.

The bottom slab 8, top slab 9, rear slab 10 and side slabs 11 and 12 of heat-non-conducting material such as asbestos board complete an outer heat-non-conducting shell C.

It is to be understood that this outer heat-non-conducting shell need not of necessity be formed in the manner illustrated as any heat-non-conducting shell known to the art is contemplated, provided its inner surface is spaced apart from the inner shell A.

A supporting frame D shows an embodiment of suitable means for supporting the incubator. It is to be understood that any suitable framing means known to the art are contemplated for completing the mechanical structure of the outer heat-non-conducting shell illustrated, but these means such as strips, clips, screws and binders are too well known in the art to require specific illustration and description.

A net-work E of electrically conducting resistance wires is mounted in the dead air spaces formed between the inner shell A and the outer shell C and is suitably insulated from the inner shell A and the outer shell B. In the embodiment illustrated one course 13 of this resistance wire is arranged in a zig-zag series beneath the bottom of the inner shell A; a second course 14 is arranged in a zig-zag series opposite the left hand side wall of the inner shell A; a less extensive course *t* is arranged above the top wall of the inner shall A; a fourth course 15 is arranged in a zig-zag series opposite the right hand side wall of the inner shell A; and a fifth course 16 is arranged in a zig-zag series opposite the rear wall of the inner shell A. All these courses of resistance wires which are preferably mounted in zig-zag form are located at a uniform distance from the adjacent wall of the inner shell and within an effective heat-radiating-distance therefrom. The method of mounting illustrated in the present embodiment is by insulating cleats 17 secured directly to the inner faces of the outer shell and all courses are connected in series.

A pilot-lamp F is provided for illuminating the incubating chamber G formed within the inner shell A and for serving two additional functions,—one the function of aiding in the uniform heating of the incubating chamber, and the other for serving as a visible detector or indicator of the operation of the net-work E of resistance wires. In the embodiment illustrated, the lamp F is shown located above the top of the incubating chamber G. A turret H of excellent heat-conducting material such as copper is heat-conductingly connected to the top wall 18 of the inner shell A about a suitable opening; extends outwardly therefrom and comprises a cylindrical wall 19 and an outer end closure 20. This turret forms a heat-trap for the lamp F but is open for the passage of light into the incubating chamber G so that the light from the lamp F may stream into the chamber G. The mouth of the turret may be covered by a transparent heat-non-conducting window. The size and configuration of the turret H is such as to trap and absorb in its walls practically all the heat given off by the lamp F and then to conduct this heat directly to the heat conducting wall of the inner shell A where it is rapidly distributed uniformly throughout the same. It is preferred that this turret H be located extending outwardly from the top wall of the inner shell but location extending outwardly from another wall of the inner shell is permissible. A tube 21 for providing entrance to a thermometer 22 is provided and is formed of the same material as the inner shell A. A perforated stopper 23 forms an outer closure for this tube.

Any suitable thermo-static circuit-controller may be employed for the control of the electric circuit through the net-work E of resistance wires. A simple form of thermo-static controller I is illustrated. An adjusting member 24 for the controller should extend outwardly to be accessible from the exterior of the incubator. In the embodiment illustrated this adjusting member is shown in the form of a screw with a contact tip 25 insulated from the shank of the screw which has threaded engagement with a suitable bearing 26 mounted on the frame of the incubator.

27 is the movable member, which is so formed as to tend to move away from the contact point 25 on a rise in temperature.

A suitable source of current may be connected in a well known manner to the plug socket S, having leads 28 and 29 for supplying the needs of the incubator, so that this socket will be regarded as the source of electric power. A controlling switch J is provided and is adapted to coöperate with either of the contacts 30 or 31 and has a neutral position 32. The net-work E of resistance wires is always connected with the source of electricity S through the thermo-static controller I. This circuit may be traced as follows:—from source S to lead 28, net-work E, wire 33, thermo-static element 27, contact-tip 25, lead 29, back to the source S.

The pilot light F is serviceable as an indicator of the passage of electric current through the heater E when the switch J is thrown on to the contact 30. When so connected its source of current is occasioned by the fall in potential across the net-work E and its circuit may be traced as follows:—lead 28, wire 34, lamp F, wire 35, switch J, contact 30, wire 36, to the opposite ends of the net-work E. When desired, the pilot lamp F may be connected in a circuit for constant illumination by throwing the switch J on to the contact 31. When so connected its circuit may be traced as follows,—

source S to lead 28, wire 34, lamp F, wire 35, switch J, contact 31, wire 37, lead 29 back to source S.

Operation: The usual containers for the cultures or other media to be incubated are placed in the usual manner within the incubating chamber G, which of course may have shelves if desired. The entire space within the inner shell A is available for the reception of these vessels. A trial adjustment is given to the adjusting screw 24 of the thermo-static controller I. The switch J is thrown onto the contact 30. When current is flowing through the net-work E the pilot-light F remains lighted. During this heating up process the inner door may alone be closed or a transparent window W may be provided in the outer door 6 for the purpose of showing the illumination or lack of illumination of the pilot-light F. The thermometer 22 is watched until the desired temperature within the incubating chamber has been reached and if necessary a new adjustment is given to screw 29. When the desired temperature is reached, the adjusting screw 24 is then backed out until the slightest rise in temperature causes the pilot-light F to be extinguished. This is a sign that the thermostat has broken the circuit through the heater E and provides a very accurate means for adjusting the apparatus for the regulation of temperature. If it is desired to provide continued illumination for the incubating chamber G the switch J may then be thrown on to contact 31 when the pilot-light F remains constantly illuminated and acts as a stabilizer to the intermittently operated heater E; or the switch may be moved to the neutral position 32, when the heater E alone serves as a source of intermittent heat for the purpose of incubation.

The total absence of a jacket of liquid about incubating chamber G aids in rendering this incubator extremely rapid. The resistance wire E, practically as soon as the electric current is passed through it, commences to heat the inner shell A by radiation and is not first required to heat up a large mass of heat absorbing medium. To be sure some of the heating of the inner chamber is accomplished through convection of air but this is not relied upon in the operation of the incubator. The uniform distribution within efficient radiating distance from the inner shell A of the net-work of resistance wire E causes a practically uniform transmission of heat to the outer wall of the inner shell A. Its separation therefrom itself makes more uniform the distribution of the radiated heat when it reaches the inner shell A. On reaching the inner shell A the high-heat-conducting quality of the inner shell also tends to make more uniform the heat distribution about the incubating chamber G. In a similar manner even the heat given off by the pilot-light F is trapped and scattered as uniformly as possible into the wall of the inner shell A.

What I claim and what I desire to secure by Letters Patent is:—

1. A quick heating incubator comprising, an inner shell of excellent heat-conducting metal forming the incubating chamber; a heat-non-conducting shell spaced apart from and surrounding said inner shell and forming an inclosing air-space; a net-work of resistance wire located within said air-space, insulated from said inner shell and surrounding said inner shell within effective heat-radiating distance thereof, the entire surface of said inner shell being exposed directly to said resistance wire; a thermostatic circuit controller; and electric connections for passing an electric current through said net-work of resistance wire under the control of said controller, whereby the low specific heat of the air in said air-space permits the quick flow of radiant heat to said inner shell and whereby the excellent heat-conducting quality of said inner shell causes a quick and uniform distribution of heat throughout its inner surface.

2. An incubator for bacteria comprising, an inner shell of excellent heat-conducting metal forming the incubating chamber; means for heating said shell uniformly throughout its extent; an electric lamp for illuminating the incubating chamber; and means for preventing local heating of said incubating chamber by said lamp and for economically using the heat thereof in the uniform heating of said chamber, comprising an inclosing turret of excellent heat-conducting metal, open for the passage of light into the said chamber, heat-conductively connected with said shell, extending outwardly from said shell adapted to contain said lamp and forming a heat-trap for the same.

3. A quick heating incubator comprising, an inner shell of excellent heat-conducting metal forming the incubating chamber; a heat-non-conducting shell spaced apart from and surrounding said inner shell and forming an inclosing air-space; a net-work of resistance wire mounted on and insulated from the inner face of said heat-non-conducting shell, surrounding said inner shell within effective heat-radiating distance thereof and directly exposed thereto solely through air as the heat-radiating medium; a thermostatic circuit controller; and electric connections for passing an electric current through said net-work of resistance wire under the control of said controller, whereby the low specific heat of the air in

said air-space permits the quick flow of radiant heat to said inner shell and whereby the excellent heat-conducting quality of said inner shell causes a quick and uniform distribution of heat throughout its inner surface.

In witness whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ROBERT KLETT.

Witnesses:
SIDNEY NEWBORG,
LESTER L. COLLOR.