No. 846,154. PATENTED MAR. 5, 1907

N. C. SPRAGUE.

INCUBATOR.

APPLICATION FILED JAN. 29, 1906.

2 SHEETS—SHEET 1.

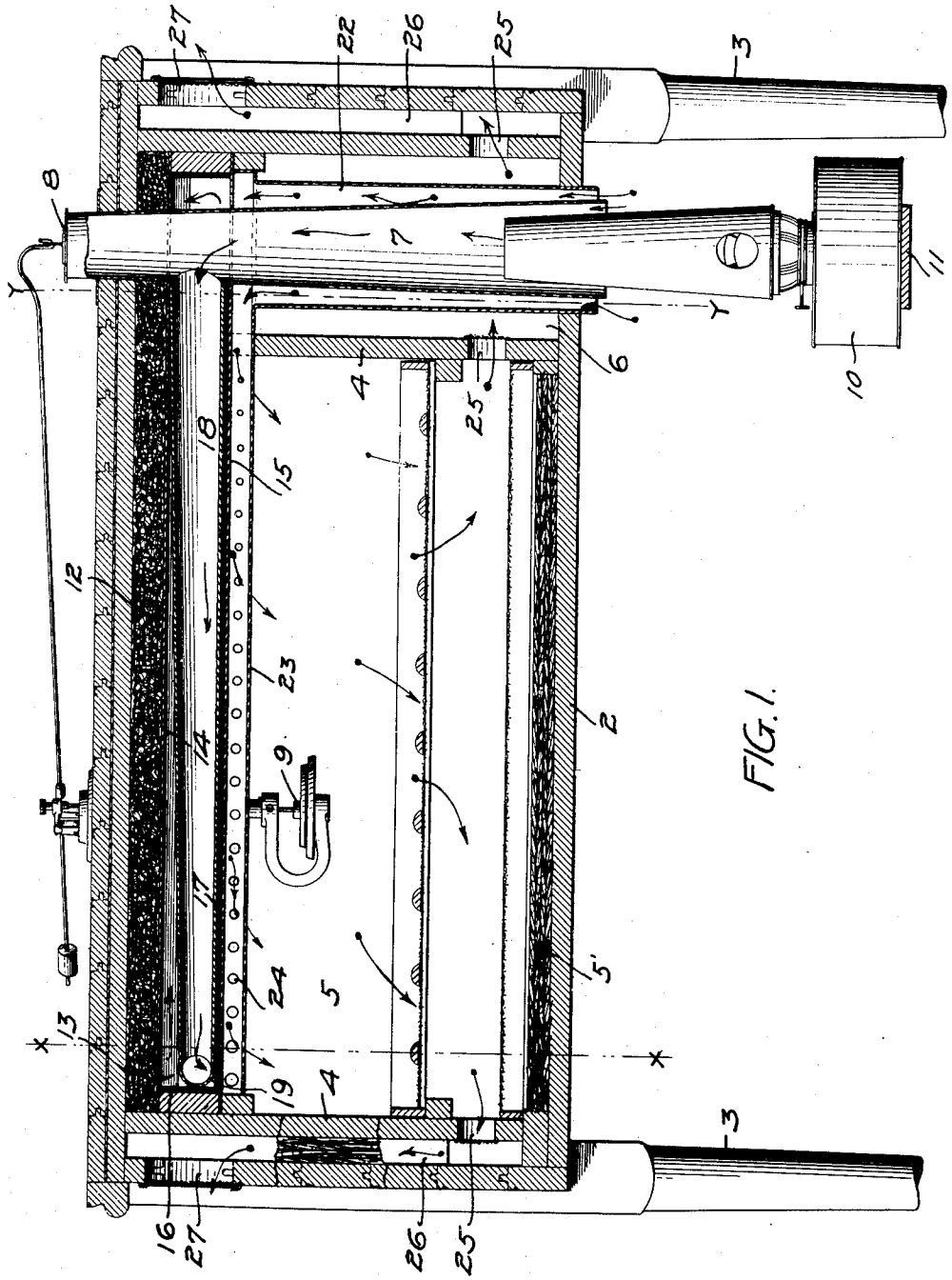


FIG. 1.

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2 SHEETS—SHEET 2.

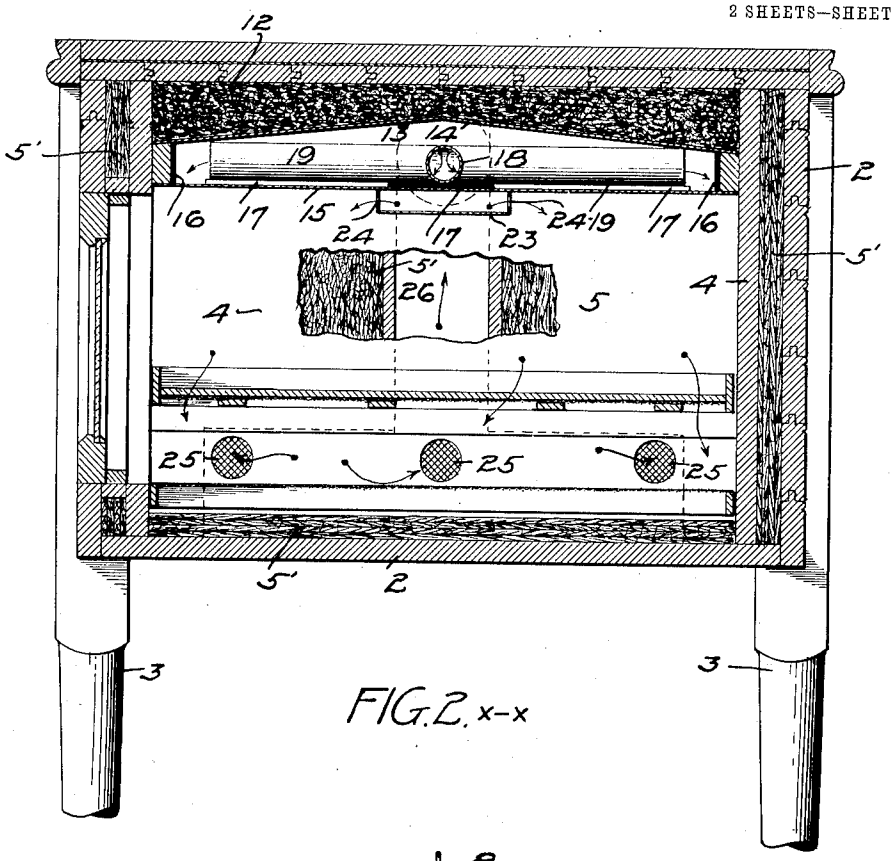


FIG. 2. X-X

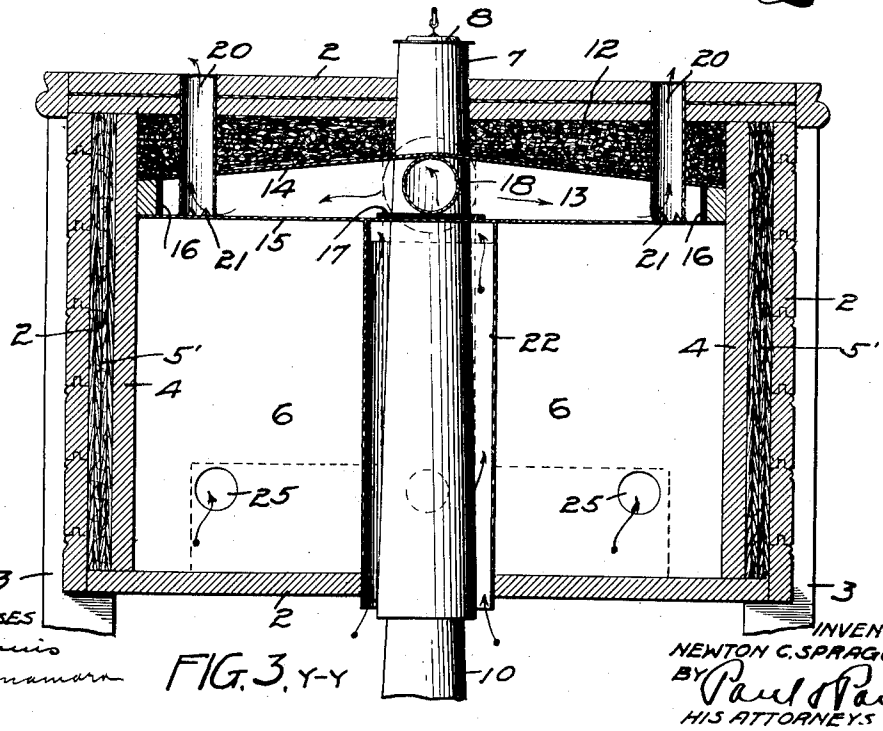


FIG. 3. Y-Y

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UNITED STATES PATENT OFFICE.

NEWTON C. SPRAGUE, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO M. W. SAVAGE, OF MINNEAPOLIS, MINNESOTA.

INCUBATOR.

No. 846,154. Specification of Letters Patent. Patented March 5, 1907.

Application filed January 29, 1906. Serial No. 298,302.

To all whom it may concern:

Be it known that I, NEWTON C. SPRAGUE, of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Incubators, of which the following is a specification.

In incubators as usually constructed it has been necessary to provide inclined egg-trays and various constructions of egg-chambers to obtain as nearly as possible a uniform temperature throughout the chamber. It has been found, however, that such a temperature is hardly obtainable even with the devices described except perhaps in incubators having a small capacity. Obviously it is necessary to have a uniform temperature maintained throughout the egg-chamber to insure the best results.

The object, therefore, of my invention is to provide an incubator equipped with a system of heating and ventilating which will insure the maintenance of a uniform temperature throughout the egg-chamber and regardless of the capacity of the said chamber.

A further object is to provide an incubator of simple but strong and durable construction and one in which there is no danger of the egg-chamber becoming overheated or chilled by the lack of watchfulness on the part of the attendant. A mild even temperature will be maintained in the egg-chamber from one end to the other during the period of time that the lamp or other heating means is supplying heat thereto.

The invention consists generally in an incubator having an improved system of heating and ventilating.

In the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal vertical sectional view of an incubator embodying my invention. Fig. 2 is a transverse sectional view on the line *x x* of Fig. 1. Fig. 3 is a similar view on the line *y y* of Fig. 1.

In the drawings, 2 represents a suitable casing supported by legs 3 and having an inner wall 4 surrounding the egg-chamber 5, a space being provided between the inner and outer walls wherein a suitable non-heat conductor or packing material, such as asbestos 5′, is placed. At one end of the egg-chamber is a space 6, separated by an inner wall 4 from the egg-chamber and extending from the bottom of the incubator to a point near the top thereof. A vertical pipe or flue 7 is arranged within the space 6 and projecting through the top and bottom walls of the incubator. This pipe preferably tapers slightly from the bottom toward the top and is provided at its upper end with a valve 8, controlled by a regulating device 9 of ordinary construction, on which I make no claim in this application. The lower end of the pipe 7 is open and adapted to receive the chimney of a lamp 10, resting upon a suitable support 11 beneath the incubator. Near the top of the incubator and separated therefrom by a packing of mineral wool or other suitable material 12 is a horizontally-arranged tank or chamber 13, extending from end to end and from side to side of the egg-chamber and forming the top thereof. The top and bottom of this chamber are composed preferably of sheet-metal plates 14 and 15, the latter forming the ceiling of the egg-chamber and the former being inclined downwardly from the center toward the sides of the chamber, as indicated in Figs. 2 and 3, for the purpose of deflecting the heat in the chamber and causing it to be directed toward the floor thereof.

Strips of asbestos 16 are preferably provided in each side of the chamber, and a sheet or strip 17 of similar material is arranged centrally along the floor of said chamber from one end to the other, and a horizontal flue 18 rests upon this asbestos strip 17 and communicates at one end with the vertical flue 7. This horizontal flue has right-angled extensions 19 at one end opening into the chamber 13 and also resting upon asbestos strips which form lateral continuations of the sheet 17. These asbestos strips beneath the horizontal flues prevent the direct contact of these flues with the floor of the chamber, and thereby prevent the direct radiation or transmission of heat from these flues to the egg-chamber. The horizontal flue 18 gradually decreases in diameter as it recedes from the vertical flue, and consequently the currents of hot air flowing through this horizontal flue will be compressed to a certain degree and prevented from expanding until they are discharged into the heating-chamber 13. If the horizontal flue should be made the same diameter throughout or larger at its discharge end than at its receiving end, the current of heated air passing therethrough would accumulate so rapidly at

the discharge end and the radiation would be so great at that point that it would be extremely difficult if not impossible to establish and maintain an even uniform temperature in the egg-chamber. By tapering this flue, however, and compelling the currents to flow more slowly or preventing their expansion I am able to obtain a result which has hitherto been impossible in incubators as usually constructed. After leaving the horizontal extensions 19 the heated air will flow around in the chamber 13 and contacting with its floor will warm it and the egg-chamber beneath. In one end of the chamber 13, preferably near the vertical flue 7, I provide vertical discharge flues or pipes 20, leading through the top of the incubator to the open air and having holes 21 near their lower ends, through which a draft or suction will be established to draw the air out of the chamber 13 and maintain a circulation through the said chamber and the horizontal flue 18. It will be noted that the heated air is compelled to pass through the flue 18 the whole length of the chamber 13 and then back to the receiving end of said chamber before it is allowed to pass out through the pipes 20. It is essential in an apparatus of this kind to provide some means for insuring a circulation of pure air in the egg-chamber; otherwise it will be impossible to maintain a uniform even temperature therein and one which will insure the best results during the period of incubation. With this end in view I provide a vertical air-trunk 22, open at its lower end and inclosing the pipe 7, a suitable space being provided between the walls of said trunk and said pipe to allow the passage of cool air. The upper end of the air-trunk 22 communicates with a horizontal cold-air flue 23, which is suspended beneath the floor 15 of the circulating-chamber and extends from end to end thereof, and is provided in its side walls with a series of perforations 24, which gradually increase in diameter from one end of the said flue toward the other, the larger holes being at the end of the flue the greatest distance from the cool-air intake-opening. The heat of the chamber will create a considerable suction or draft within the air-trunk 22 and cause the air to flow upwardly therein and through the holes in the horizontal flue into the egg-chamber. The air will move less rapidly as it travels away from the intake-opening, and consequently the discharge-openings are made larger to permit the escape of a greater volume of the air.

In the bottom of the egg-chamber openings 25 are provided leading to the vertical flues 26 between the inner and outer walls of the incubator and communicating with suitable valved openings 27, through which the foul air is allowed to escape from the apparatus. The valves covering the openings 27 are adjustable for the purpose of regulating the discharge of the air. With this apparatus the egg-chamber or incubator can be easily and quickly heated and a uniform temperature maintained therein at all times, so that an egg or a series of them at one end of the tray will be subjected to the same degree of heat as the eggs in the middle on the other end of the tray, and this will be true regardless of the size of the egg-chamber.

Ventilation of the egg-chamber is as essential as the heating of it, and both are requisites of a perfect incubator. In this apparatus pure air is continually flowing into the egg-chamber and, becoming heated, passes down, around, and between the eggs, and as soon as it becomes foul and settles to the bottom is drawn off through discharge-flues and escapes into the open air. The heated air flows through the horizontal flues and around in the circulating-chamber and keeps the temperature of the egg-chamber at the desired degree without entering the said chamber and is finally discharged. In this way a perfect system of heating and ventilating is obtained which will insure almost perfect results in the operation of the incubator.

I claim as my invention—

1. The combination with an incubator and egg-chamber having exhaust-flues for the foul air, of a vertical cool-air flue, a horizontal flue projecting within said chamber and communicating with the said cool-air flue, and said horizontal flue having a series of holes gradually increasing in diameter as they recede from said vertical flue, substantially as described.

2. An incubator having an egg-chamber and a hot-air-circulating chamber in the upper part thereof and provided with a metallic floor, a vertical hot-air flue in one end of said circulating-chamber, a horizontal hot-air flue communicating with said vertical flue and extending centrally of said chamber from one end to the other thereof and discharging into said chamber at one end and spaced from the bottom thereof, said circulating-chamber having discharge-flues leading to the open air, a cold-air flue inclosing said vertical hot-air flue, a horizontal cold-air flue communicating with the vertical one and arranged centrally beneath said circulating-chamber and having a series of openings in its walls leading into said egg-chamber, and a strip of heat-insulating material interposed between said horizontal hot-air flue and the bottom of said chamber and said horizontal cold-air flue, whereby the heating of the bottom of said chamber and the walls of said cold-air flue by direct contact with the hot surface of said hot-air flue, is prevented, substantially as described.

3. An incubator having an egg-chamber and a shallow hot-air-circulating chamber in the upper part thereof extending from end to end and from side to side of the egg-chamber

and having suitable exhaust-openings at one end, a vertical hot-air flue, a horizontal hot-air flue communicating therewith and extending along the center line of said circulating-chamber and having branch pipes at one end discharging into said chamber, said branch pipes being spaced from the bottom of said circulating-chamber a heat-insulating material separating said horizontal hot-air flue from said bottom, and a cold-air flue located beneath said chamber and having openings leading into said egg-chamber, substantially as described.

4. An incubator having an egg-chamber and a hot-air-circulating chamber in the upper part thereof extending from end to end and from side to side of said chamber, said circulating-chamber having a top inclined downwardly from the center toward each side and an insulating material between said top and the top of the incubator and said circulating-chamber having exhaust-openings at one end, a vertical hot-air flue, a horizontal hot-air flue communicating with said vertical flue and extending within said circulating-chamber along the middle line thereof and separated from the floor of said chamber, a cold-air flue arranged beneath the middle line of said circulating-chamber and having a series of openings leading into said egg-chamber, a vertical cold-air flue inclosing said vertical hot-air flue and communicating with said horizontal cold-air flue, and a strip of insulating material separating said horizontal cold-air flue from said hot-air flue, substantially as described.

In witness whereof I have hereunto set my hand this 19th day of January, 1906.

NEWTON C. SPRAGUE.

Witnesses:

ROBERT CHRISTENSEN,

BESSIE P. HALL.