(No Model.) 3 Sheets—Sheet 1.

W. H. HILLIER.

INCUBATOR.

No. 382,527. Patented May 8, 1888.

Fig. 1.

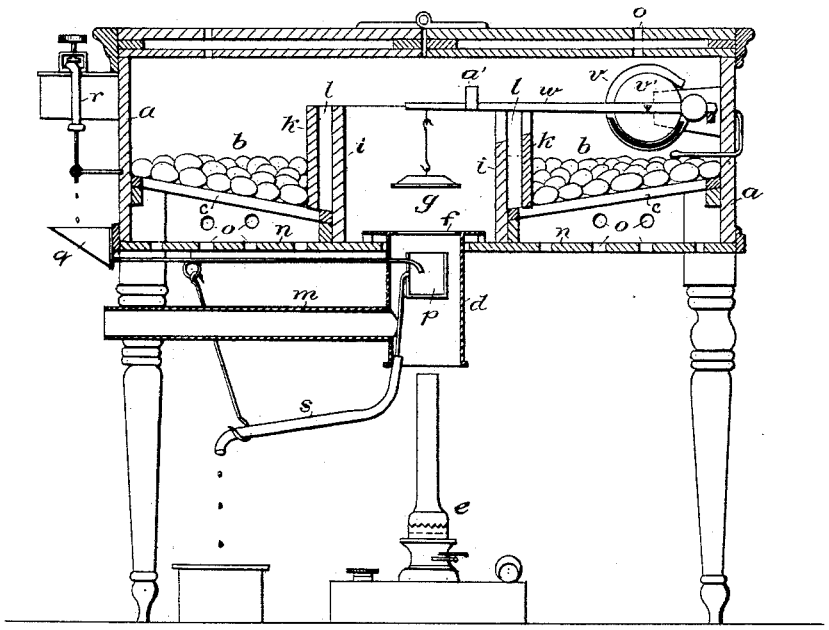
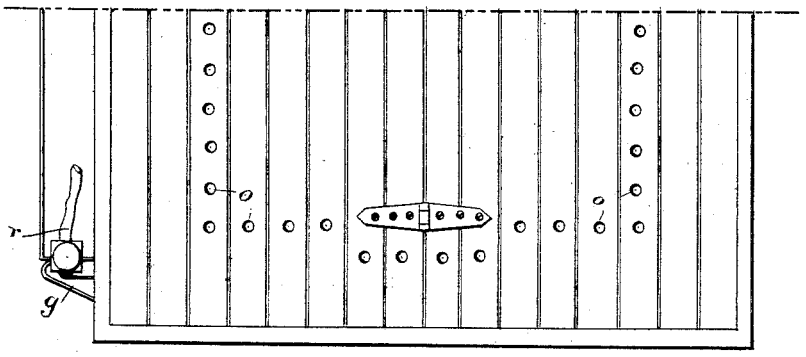


Fig. 2.



WITNESSES:

Thomas Davis.

Percival J. Frank.

INVENTOR:

Walter H. Hillier,

By his Attorneys,

Arthur G. Fraser & Co.

(No Model.) 3 Sheets—Sheet 2.

W. H. HILLIER.

INCUBATOR.

No. 382,527. Patented May 8, 1888.

Fig. 3.

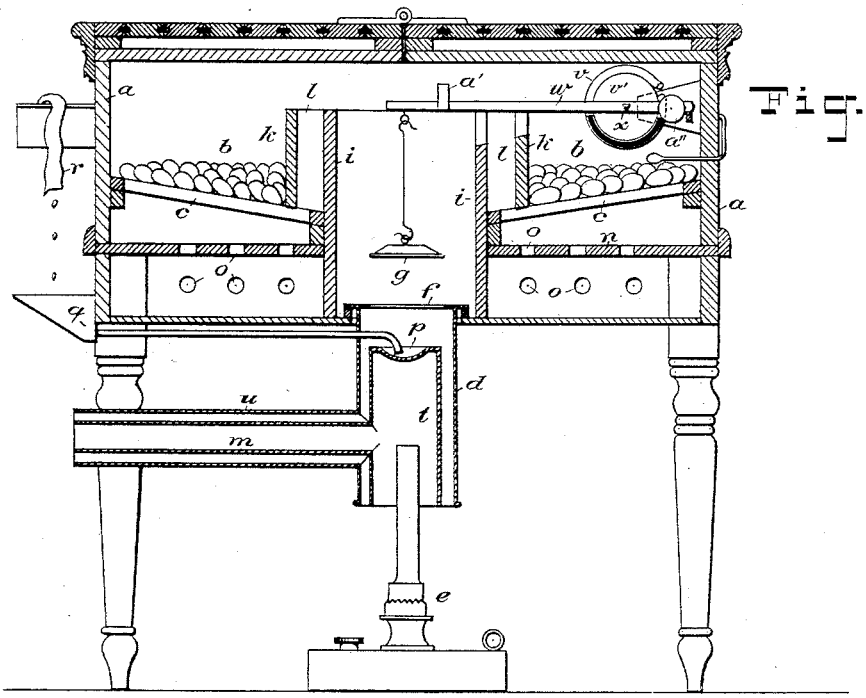
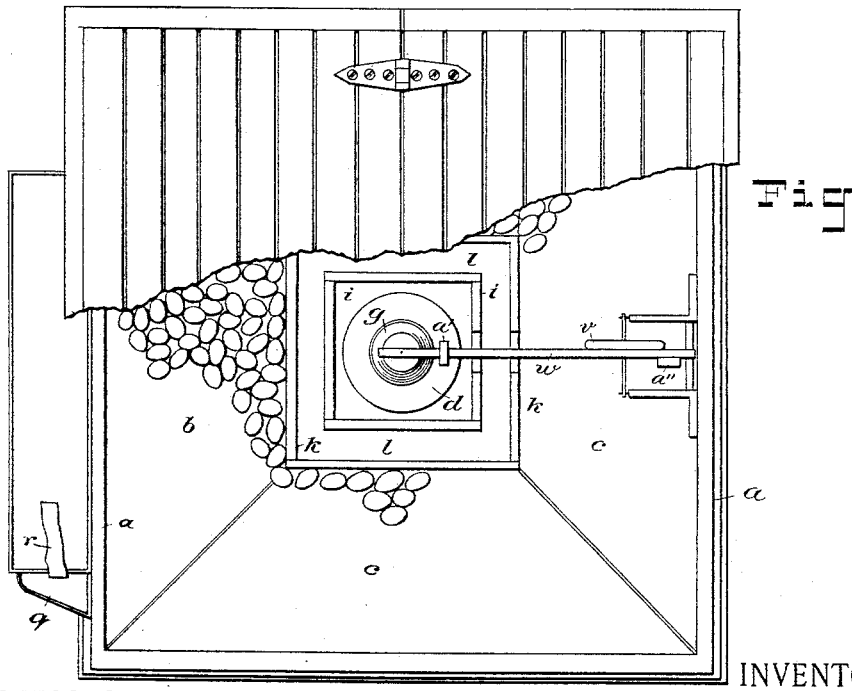


Fig. 4.



WITNESSES:

Thomas Davis.

Poschal J. Ferraia.

INVENTOR:

Walter H. Hillier,

By his Attorneys,

Arthur G. Brazer & Co.

(No Model.) 3 Sheets—Sheet 3.

W. H. HILLIER.

INCUBATOR.

No. 382,527. Patented May 8, 1888.

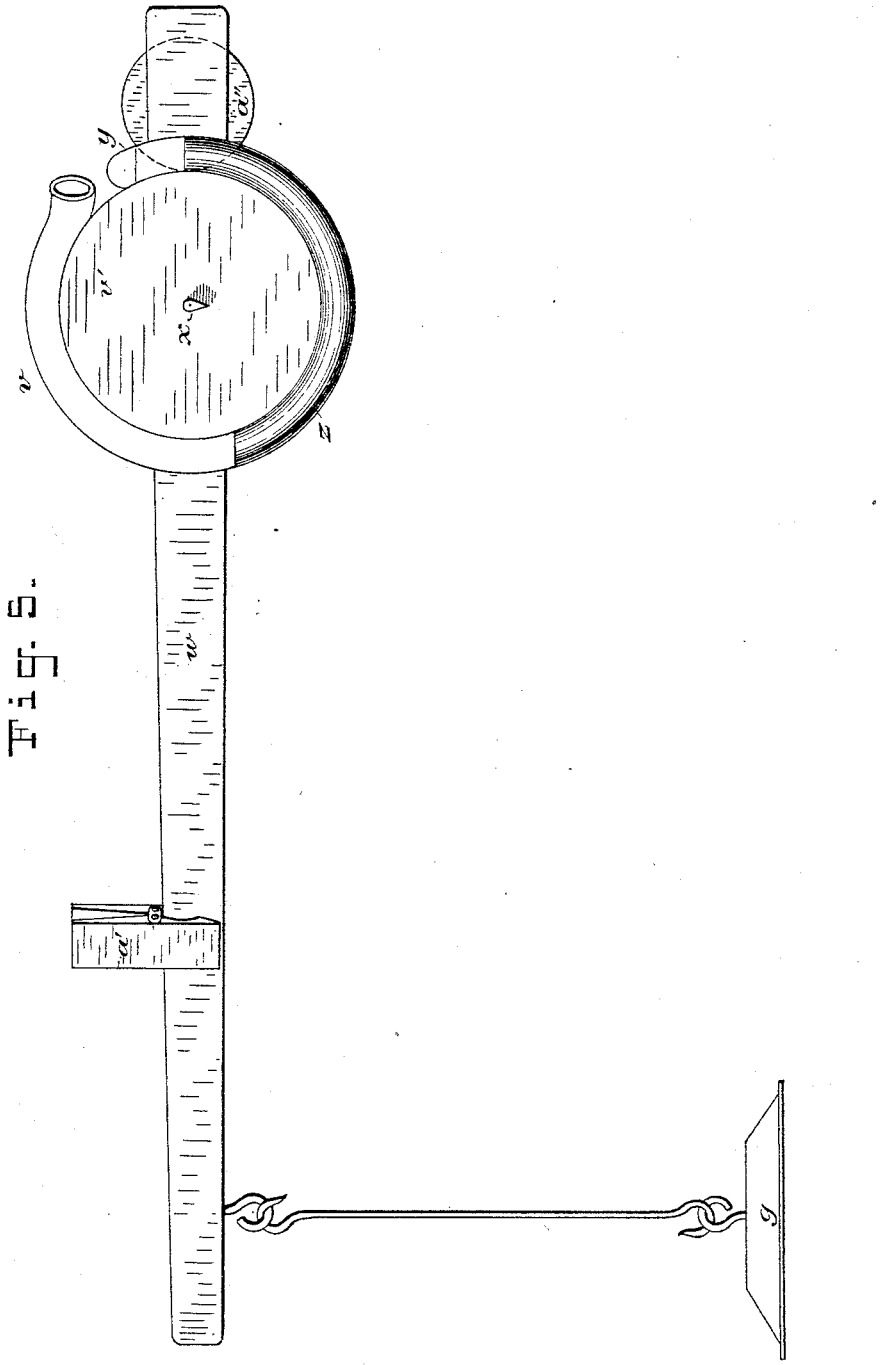


Fig. 5.

WITNESSES:

Thomas Davis.

Rachal J. Ferrara.

INVENTOR:

Walter H. Hillier,

By his Attorneys,

Arthur O. Brasen & Co.

UNITED STATES PATENT OFFICE.

WALTER H. HILLIER, OF NAILSWORTH, ENGLAND.

INCUBATOR.

SPECIFICATION forming part of Letters Patent No. 382,527, dated May 8, 1888.

Application filed February 7, 1887. Serial No. 226,768. (No model.) Patented in England March 11, 1886, No. 3,436.

To all whom it may concern:

Be it known that I, WALTER HIRST HILLIER, of Nailsworth, England, have invented certain new and useful Improvements in Incubators, (patented in Great Britain March 11, 1886, No. 3,436,) of which the following is a specification.

My invention essentially consists in constructing incubators in such manner that a supply of heated air or vapor is admitted direct to the hatching-chamber, the admission being controlled automatically by any suitable thermostatic motor or thermostat which acts upon an inlet-valve so that this valve admits only sufficient heated air or vapor to maintain an equable or nearly equable temperature in the hatching-chamber. If the chamber tends to rise above or fall below the normal temperature the thermostatic motor proportionately closes or opens the valve.

In the annexed drawings, Figure 1 is a sectional elevation, and Fig. 2 a half-plan, of an incubator constructed according to my invention in its preferred form. Fig. 3 is a sectional elevation, and Fig. 4 a plan, with part of the lid or cover broken away, of a somewhat different construction. Fig. 5 is a view, on a larger scale, of the thermostatic motor which I prefer to employ.

Referring first to Figs. 1 and 2, *a* is the body of the apparatus, which is formed of wood, earthenware, or other suitable material.

b is the hatching-chamber, and *n* the floor or bottom of the same.

c c are the trays, formed of perforated zinc, secured to laths or strips of wood or other material, which hold and support the eggs. The trays preferably slope toward the center, as shown. Below the center of the hatching-chamber I fit a vertical hot-air chamber, *d*, preferably cylindrical, which will usually be made of metal, and underneath or at the lower end of this chamber a lamp, *e*, or a gas or other suitable burner, or any other source of heat, will be placed for supplying and maintaining the requisite heat. The hot-air chamber *d* is closed at its upper end except that it has an aperture, *f*, which forms a passage through which the heated air or vapor is admitted to the hatching-chamber, this aperture being fitted with a valve, *g*, controlled by a thermostat, *v*, in the hatching-chamber, so as to automatically regulate the admission of the heated air or vapor as the temperature of the hatching-chamber may require. In the hatching-chamber is a flue, *i*, which extends from the inlet-opening *f* nearly to the top of the chamber, in order to carry the heated air or vapor to the upper part of the hatching-chamber, and around the flue *i* is a wooden frame, *k*, which, with the intervening annular space *l*, serves to keep the eggs from too close contact with the flue *i*. The hot-air chamber *d* has an escape-flue, *m*, at the side to carry off surplus heat, the part of the vertical chamber above this flue forming a reservoir for heated gases or air for supplying the hatching chamber, as already explained.

In the floor or bottom *n*, and in the side of the box near the floor, are holes *o o*, through which the heated air or vapor as it cools passes, being replaced by fresh warm air or vapor from the hot-air chamber. The hatching-chamber is thus heated and ventilated without the introduction of cold drafts from below. The holes for the escape of the heated air or vapor at the bottom *n* may open directly into the atmosphere, as shown; or they may communicate, as shown in Fig. 3, (hereinafter described,) with a false bottom having holes at the sides communicating with the atmosphere; or the bottom *n*, Fig. 1, may be entirely open, or nearly so. In Figs. 1 and 2 holes are shown in the lid of the apparatus. To moisten the air, I arrange in the hot-air chamber *d* a water vessel or cup, *p*, the water in which evaporates and causes moisture to rise with the heated air or vapor. The water is supplied to the cup *p* from a funnel, *q*, which is itself fed by a siphon, *r*, or in other suitable manner. *s* is an overflow-pipe. The hatching-chamber is opened when required by simply raising the lid, which is hinged.

The construction represented in Figs. 3 and 4, which embodies my entire invention, differs from that shown in Figs. 1 and 2 in that within the hot-air chamber *d* is placed an inner concentric radiating-chamber, *t*, closed at the top, this radiating-chamber being heated by the lamp or gas burner. The hot-air chamber *d* will thus form an annular space or reservoir, in which the air admitted thereto is heated

and stored before passing through the valve *g* to the hatching-chamber. The cold air supplied to this reservoir enters it either at the bottom below the level of the burner or source of heat or through the outer pipe, *u*, and is therefore pure and free from all products of combustion. The top of the inner chamber, *t*, forms the water vessel or cup *p*.

Any suitable form of thermostat may be employed for automatically controlling the admission of the heated air or vapor to the hatching-chamber. That which I prefer is represented in Figs. 1, 3, and 4, and is shown on a larger scale in Fig. 5. It consists of a tube, *v*, of glass or other material, bent into a circle and secured to a disk, *v'*, to which is fixed a balance-lever, *w*, the whole being hung on a center or knife-edge, *x*, so that it is free to turn. The valve *g* is carried on the outer end of the lever *w*. The end *y* of the tube is sealed and the other end is open. At the sealed end *y* are an air bubble and a small quantity of dilute ether or other volatile liquid, and part of the remainder of the tube is filled with a column of mercury, *z*.

a' is a balance-clip, the position of which on the lever can be adjusted so as to regulate the temperature at which the device will act.

a'' is a balance-weight immovably secured to the lever. When the required heat is attained in the hatching-chamber, the ether by its expansion drives the mercury toward the open end of the tube *v*. The balance-lever is thus caused to lose its balance, so that it turns on the center *x*, and thereby lowers the valve *g* to about one-eighth of an inch from the hot-air inlet *f*, where it keeps rising and falling not more than one thirty-second of an inch, thereby alternately admitting and checking the hot air. The variations of temperature are too minute to be read on the scale of an ordinary thermometer. The lever will not return to its original position, as shown in the figures, unless the heat falls several degrees, as would be caused by an insufficient flame or by opening the lid of the incubator.

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

1. In an incubator, the combination, with the hatching-chamber, of a hot-air-inlet opening communicating therewith, a valve for controlling the admission of heated air to the hatching-chamber, and a thermostat in the hatching-chamber connected to and operating said valve, substantially as set forth, whereby the admission of heated air is automatically regulated and an equable temperature in the hatching-chamber is maintained.

2. In an incubator, the combination, with the hatching-chamber, of a hot-air chamber communicating therewith through an opening, a valve for controlling said opening, and a thermostat in the hatching-chamber connected to and operating said valve, substantially as set forth.

3. In an incubator, the combination, with the hatching-chamber, of a hot-air chamber beneath it, an opening in the bottom of the hatching-chamber for admitting heated air from said hot-air chamber, a flue leading from said opening to the upper part of the hatching-chamber, a valve for controlling said opening, and a thermostat in the hatching-chamber connected to and operating said valve, substantially as set forth.

4. In an incubator, the combination, with the hatching-chamber constructed with a hot-air inlet-opening in its bottom, a flue extending from said opening to the upper part of the chamber, and a partition between said flue and the egg-holder forming an intervening air space, of a valve for controlling said opening and a thermostat in the hatching-chamber connected to and operating said valve, substantially as set forth.

5. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot-air chamber communicating with said opening, a water-vessel in said hot-air chamber, whereby its vapor moistens the heated air at its entry into the hatching-chamber, and a valve for controlling said opening, substantially as set forth.

6. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot-air chamber communicating with said opening, a water-vessel in said hot-air chamber, whereby its vapor moistens the hot air at its entry into the hatching-chamber, a water-supply for replenishing the water in said vessel, an overflow-tube for removing any excess of water from said vessel, a valve for controlling the passage of heated air through said opening, and a thermostat connected to and operating said valve, substantially as set forth.

7. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot air chamber communicating with said opening, an escape-flue for conducting away the excess of heated air or gases, a valve for controlling the admission of heated air through said opening, and a thermostat in the hatching-chamber connected to and operating said valve, substantially as set forth.

8. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot-air chamber communicating therewith, a valve for controlling said opening, a thermostat in the hatching-chamber connected to and operating said valve, a radiator-chamber for warming the air in said hot-air chamber, an escape-flue for conducting away the heated gases from said radiating-chamber, and a lamp or equivalent source of heat for heating said radiating-chamber, substantially as set forth.

9. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot-air chamber communicating therewith, a valve for controlling said opening, a balance-lever, to one end of which said valve is connected, and a thermostat within the hatching-chamber connected to said lever

and adapted to vibrate it as the temperature varies, substantially as set forth.

10. In an incubator, the combination, with the hatching-chamber having an inlet-opening, of a hot-air chamber communicating therewith, a valve for controlling said opening, a balance-lever, to one end of which said valve is connected, a thermostat within the hatching-chamber connected to said lever and adapted to vibrate it as the temperature varies, and a counter-weight adjustable along said lever in order to regulate its initial position, and thereby to determine the normal temperature within the hatching-chamber, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WALTER H. HILLIER.

Witnesses:

A. E. SMITH,
Solicitor, Nailsworth.

I. S. BROWN,
Accountant, Nailsworth.