(No Model.) 2 Sheets—Sheet 1.

H. B. TATHAM, Jr.

Incubator.

No. 230,086. **Patented July 13, 1880.**

FIG. 1.

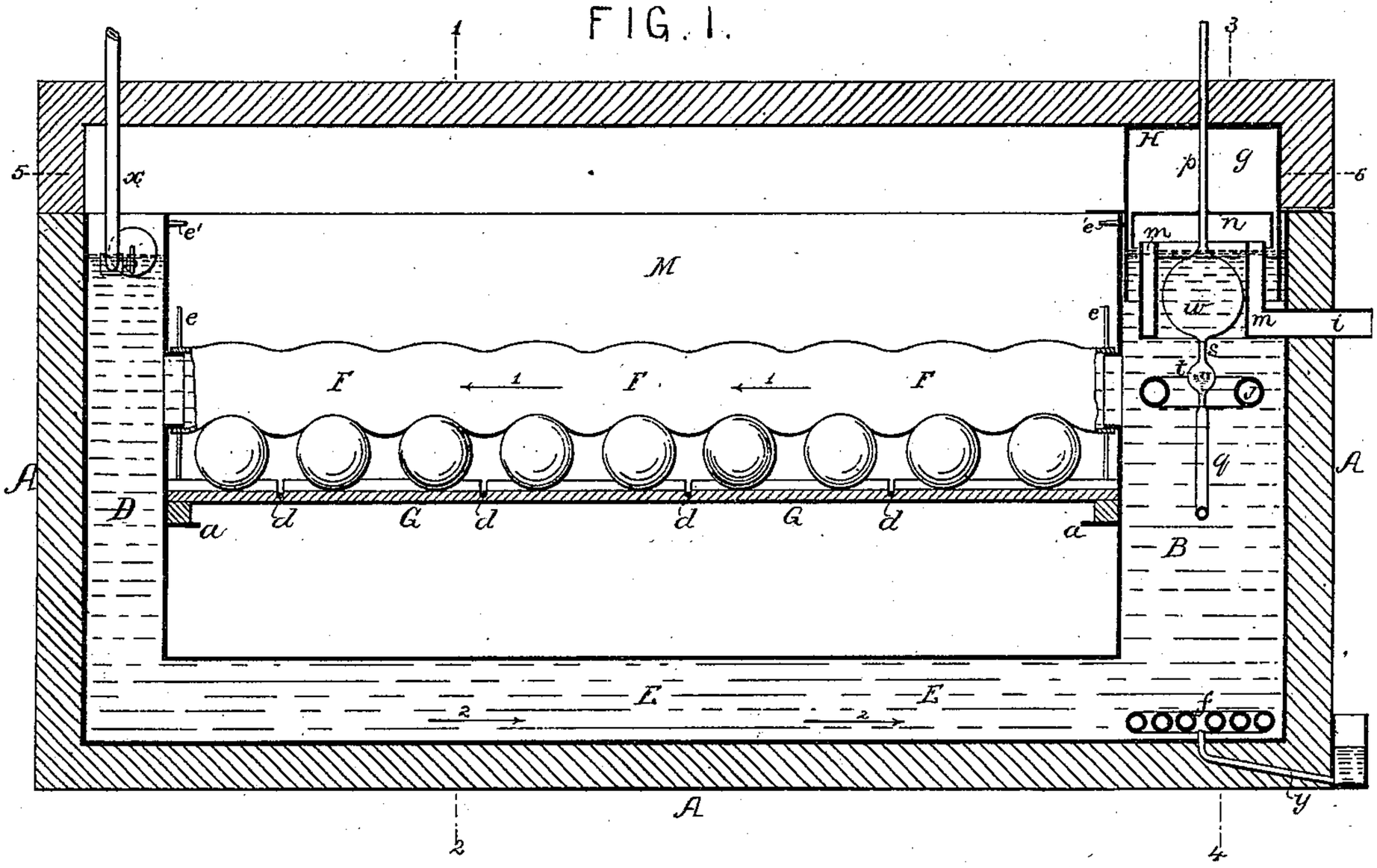


FIG. 2.

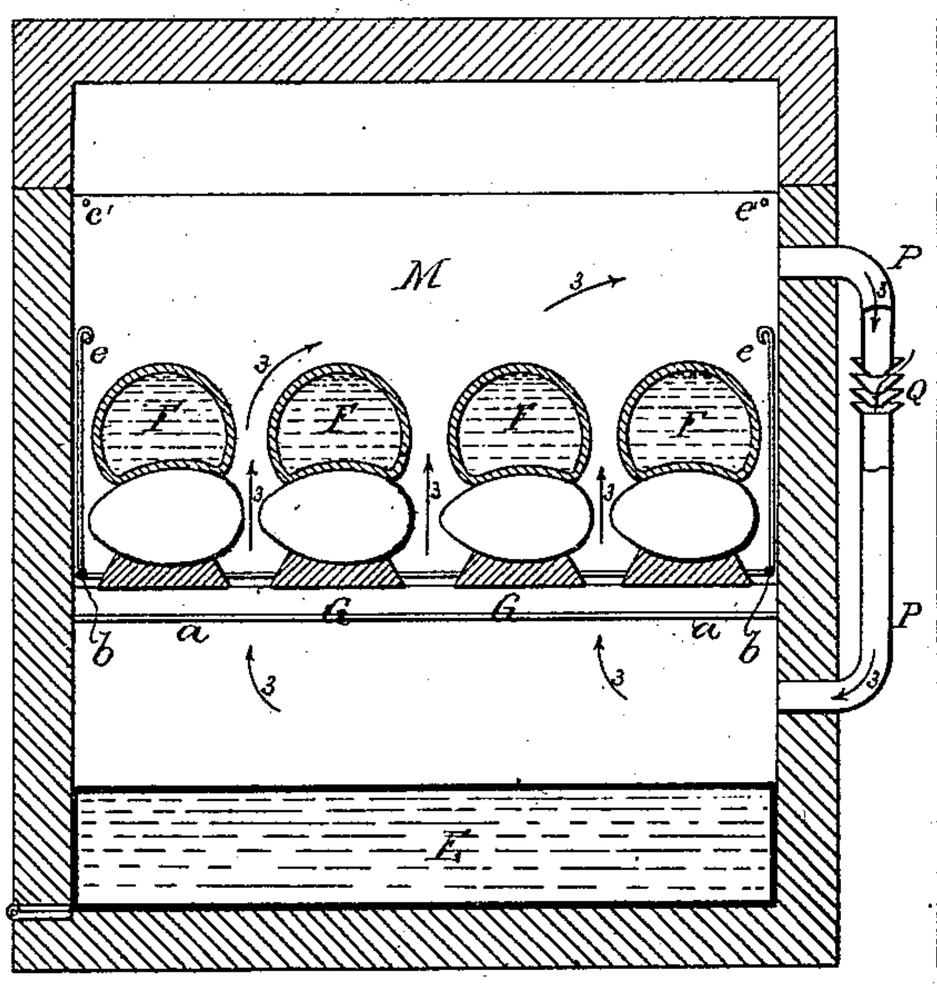
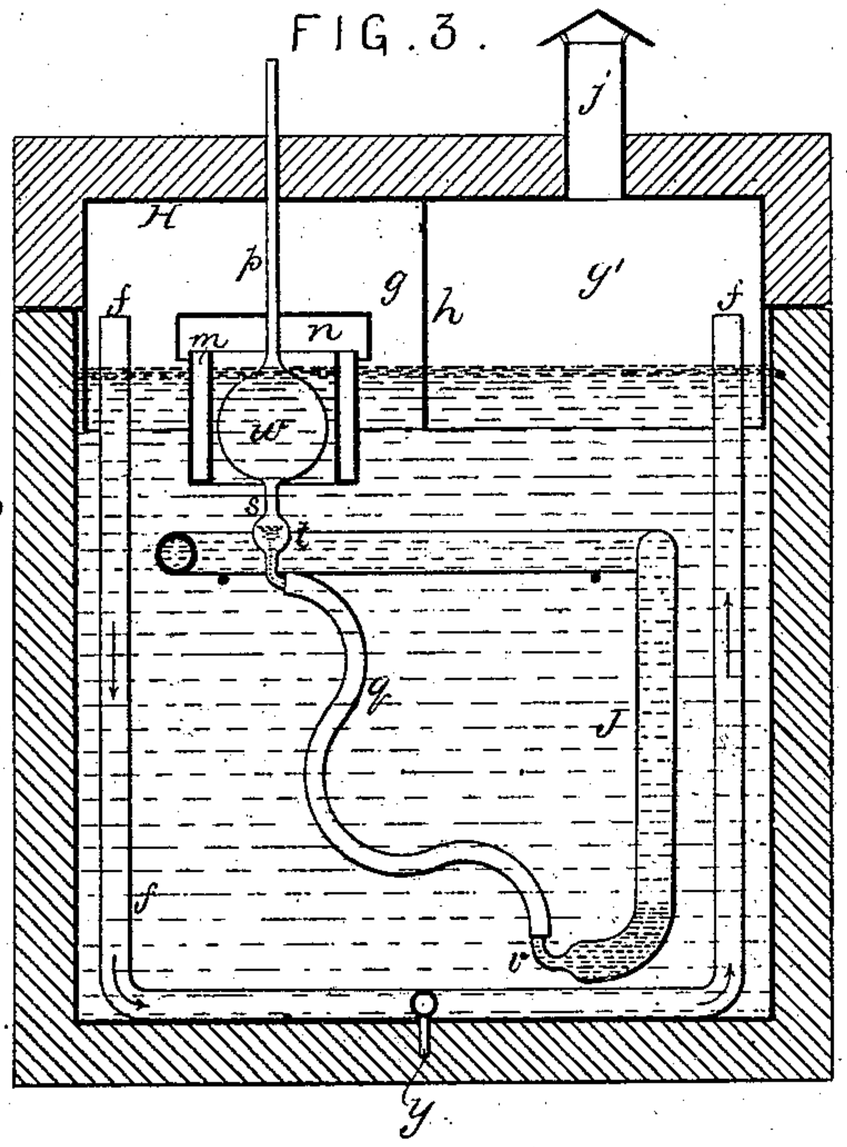


FIG. 3.



WITNESSES

H. L. Fulenwider.

Henry Howson Jr.

INVENTOR.

Henry B. Tatham Jr.
by his Attorneys

Howson and Son

(No Model.) 2 Sheets—Sheet 2.

H. B. TATHAM, Jr.

Incubator.

No. 230,086. Patented July 13, 1880.

FIG. 4.

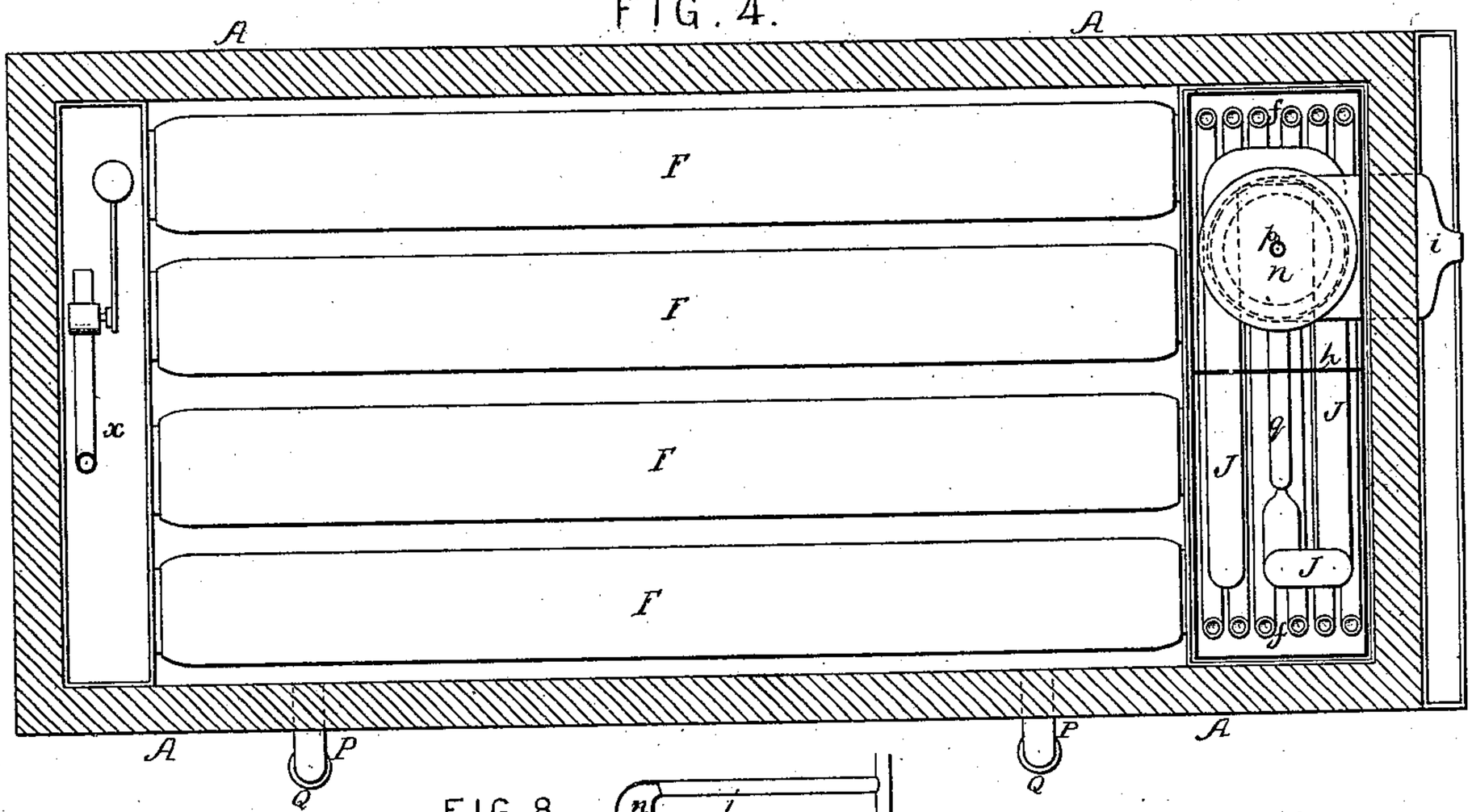


FIG. 8.

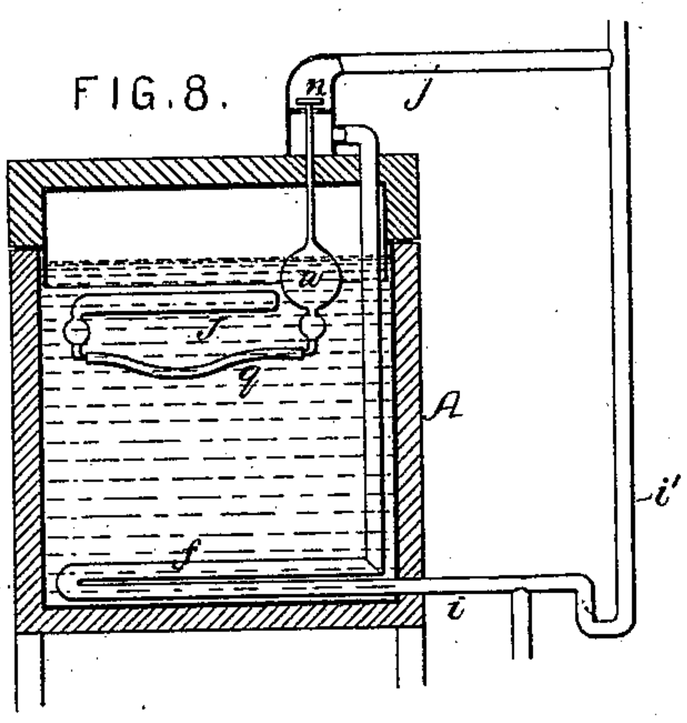


FIG. 5.

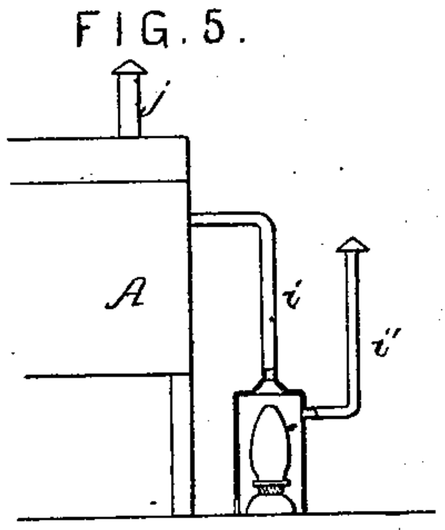


FIG. 6.

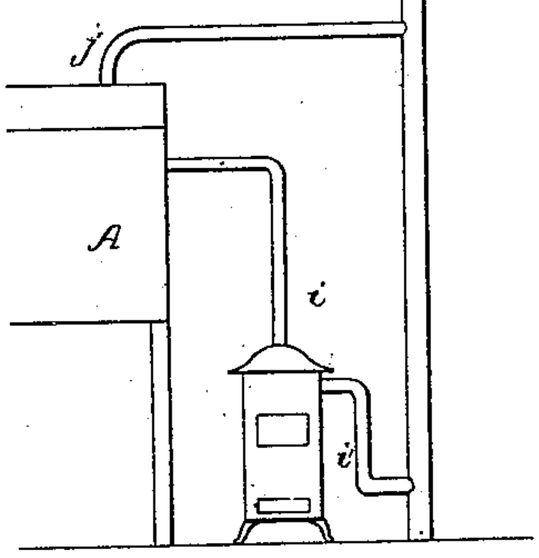


FIG. 9.

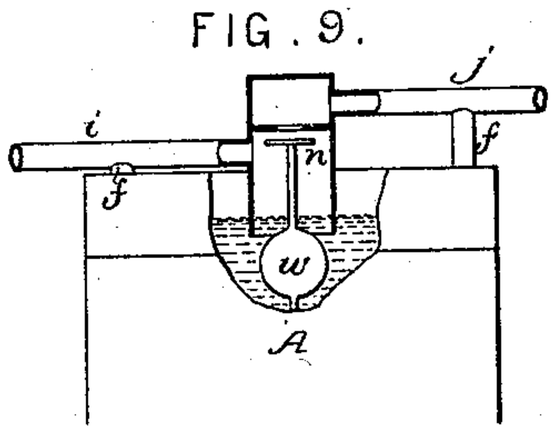
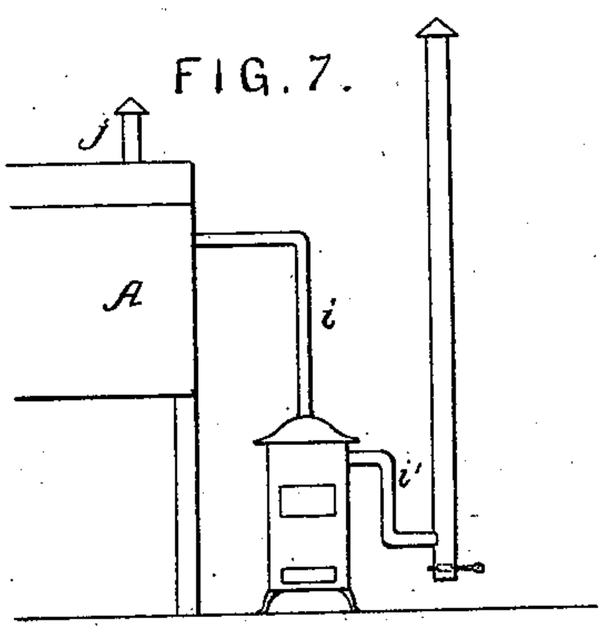


FIG. 7.



WITNESSES

H. L. Fulenwider.

Henry Howson Jr

INVENTOR.

Henry B. Tatham Jr

by his attorneys

Howson and Sons

UNITED STATES PATENT OFFICE.

HENRY B. TATHAM, JR., OF PHILADELPHIA, PENNSYLVANIA.

INCUBATOR.

SPECIFICATION forming part of Letters Patent No. 230,086, dated July 13, 1880.

Application filed April 22, 1880. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. TATHAM, Jr., a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Incubators, of which the following is a specification.

The objects of my invention are to provide an exceedingly sensitive heat-regulating device for the incubator, to effect the thorough ventilation of the egg-chamber, and to insure a full supply of air to the eggs during the period of incubation. These objects I attain in the manner too fully described hereinafter to need preliminary explanation, reference being had to the accompanying drawings, in which—

Figure 1, Sheet 1, is a longitudinal section of my improved incubator; Fig. 2, a transverse section on the line 1 2, Fig. 1; Fig. 3, a transverse section on the line 3 4, Fig. 1; Fig. 4, Sheet 2, a sectional plan on the line 5 6, Fig. 1; and Figs. 5 to 9, inclusive, diagrams illustrating different methods of applying heat to the incubator.

The outer casing or box, A, of the incubator has a hinged or detachable cover, and one of its sides is by preference hinged, as shown in Fig. 2. This outer casing is constructed for the reception of a structure of sheet metal comprising vertical reservoirs B and D, arranged at opposite ends of the box, and a chamber, E, serving to afford communication between the said reservoirs at and near the lower ends of the same.

Communication between the upper portions of the reservoirs is afforded by a series of tubes, F, of rubber or other water-proof and flexible material. When the water in the reservoir B is heated by the appliances described hereinafter its circulation must be induced from the said reservoir to the reservoir D through the tubes F, as indicated by the arrows 1 in Fig. 1, and the water must return in a partially-cooled condition from the reservoir D to the reservoir B through the chamber E, as indicated by the arrows 2.

Four flexible tubes, F, are shown in the present instance; but a greater or less number may be used, as desired. Each of these tubes rests upon the top of a row of eggs carried by one of the longitudinal strips of a tray, G, this tray being supported by projecting ribs *a* on the sides of the reservoirs B and D, and being free to slide on said ribs, so that on opening the side of the outer casing, A, the tray may be withdrawn from the egg-chamber M for the purpose of examining and turning the eggs.

It will be seen that the flexible tubes conform to the shape of the eggs, and that a portion of the surface of each egg is covered by the material of which the tube is composed.

In order to permit the withdrawal of the tray, the tubes F should be supported clear of the eggs, and for this purpose I provide a frame consisting of longitudinal wires *b* and transverse wires *d*, the frame having at each corner a hooked rod, *e*. When this frame is elevated so that the transverse wires *d* support the tubes F, these hooked rods are adapted to pins *e'*, which support the frame in its elevated position. When the hooked rods are released from the pins and the frame is depressed the transverse wires *d* rest in suitable slots formed in the longitudinal strips of the tray G, as shown in Fig. 1.

It will be observed that spaces intervene between the tubes F and between the adjacent rows of eggs, the object of this arrangement being to insure a free circulation of air in contact with the ends of each egg, for I have found that during the period of incubation a free circulation of air in contact with the eggs must be maintained; otherwise the majority of the chicks will be weak and particularly subject to disease.

Exterior tubes, P, afford communication between the upper and the lower portions of the egg-chamber M the continuity of each tube being, in the present instance, interrupted for the reception of a series of inverted cones, Q, separated slightly from each other, so as to form an inlet for fresh air. As the hot air from the upper portion of the egg-chamber M enters the tubes P it becomes chilled and descends, the downward current thus created inducing limited supplies of fresh air to enter the tubes at the inlets Q; hence a circulation of air in the direction of the arrows 3 is maintained, the warm air being continuously drawn off from the upper portion of the egg-chamber M, and supplies of cooled and fresh air being introduced into the lower portion of said chamber, thereby insuring proper ventilation.

The water is heated in the following manner: A series of bent tubes, *f*, is placed in the reservoir B, one end of each tube communicating with a chamber, *g*, in an inverted vessel, H, and the opposite end of each tube communicating with another chamber, *g'*, in said inverted vessel. The lower edge of the vessel extends below the level of the water in the reservoir B, and thus forms a seal, and a transverse partition, *h*, between the chambers *g g'* also extends below the surface of the water.

Air heated by a lamp or stove enters the chamber *g* through a pipe, *i*, and through an annular chamber, *m*, and, after passing, in the course pointed out by the arrows, through the pipes *f*, escapes from the chamber *g'* through the flue *j*. A drain-pipe, *y*, prevents the accumulation of water in the pipes *f*.

The passage of hot air from the annular chamber *m* into the chamber *g* is governed by a valve, *n*, which is secured to a tubular stem, *p*, projecting upwardly from a hollow float, *w*, the latter having also a downwardly-projecting tubular stem, *s*, provided with a bulb, *t*. This stem *s* is connected by means of a flexible tube, *q*, to the branch *v* of a bent pipe, J, which rests upon and is supported by transverse wires in the reservoir B, as shown in Fig. 3, and contains the expansible liquid whereby the regulation of the heat is effected. I prefer to fill the body of the pipe J with alcohol, ether, or other liquid which is influenced by slight changes of temperature, the lower portion of the pipe J, the flexible tube *q*, and part of the stem *s* and its bulb *t*, however, being filled with mercury, which may be introduced through the tubular stem *p* and hollow float *w*.

The amount of mercury should be so gaged that when the water in the reservoir B is at the proper temperature the weight of mercury in the stem *s* and bulb *t* will maintain the lower edge of the valve *n* above the level of the water in the reservoir B, thereby permitting the hot air from the chamber *m* to escape beneath said valve and enter the chamber *g*, whence it passes through the heating-pipes *f*.

Any undue increase in the temperature of the water in the reservoir B causes an expansion of the liquid in the pipe J, and forces an additional quantity of mercury into the stem *s*, the weight on the float being so far increased that it will descend and cause the immersion of the edge of the valve *n* in the water, thus cutting off the supply of hot air to the chamber *g*, and preventing its circulation through the tubes *f* until the temperature of the water is reduced to such an extent as to cause the withdrawal of a portion of the mercury from the stem *s*, a consequent decrease in the weight on the float, and a rising of the latter and the valve *n*. This valve should be so located in respect to the float *w* that the latter will be wholly submerged when the valve is open, and the bulk of water displaced in effecting the opening and closing of the valve will merely equal the bulk of the submerged portion of the tube *p*, the proper sensitiveness of action being thus assured.

In order that the water in the reservoirs B and D shall always be maintained at a uniform level, the supply-pipe *x* is provided with an automatic valve governed by a float, and operating in a manner common to valves of this class.

To prevent the passage of vapor into the egg-chamber M from the reservoir D said reservoir may be furnished with a suitable cap or cover.

The supply of heated air for the incubator may be derived from a lamp, as in Fig. 5, or from a stove, as in Figs. 6 and 7, the hot air passing through the pipe *i* when the valve *n* of the incubator is open, but passing off through a waste-pipe, *i'*, when said valve is closed. In Fig. 7 the draft of the stove is regulated by operating a valve at the lower end of the chimney.

In Figs. 8 and 9 the regulating-valves are differently constructed and arranged, the action of the valves, however, not being materially modified. Thus in Fig. 8 the hot air passes through the pipes *i*, *f*, and *j* when the valve is open, and through the pipe *i'* when the valve is closed by an increase of temperature, while in Fig. 9 the hot air passes through the pipes *i*, *f*, and *j* when the valve is closed, which is its normal position, the hot air passing directly from the pipe *i* to the pipe *j* through the valve-chest when the valve is opened, owing to an increase in temperature within the incubator.

The governing device may, in fact, be applied to valves arranged in any convenient manner to control the flow of heated air, or, where gas is used to furnish heat, the governing device may be arranged to control the supply of gas to the burner or burners.

Open channels or troughs may be substituted for the tubes F in some cases, although the use of the tubes is preferred.

I claim as my invention—

1. The combination, in an incubator, of water-reservoirs, a tray for supporting a row of eggs, and a flexible tube or trough, F, which rests upon the eggs and forms a water-channel, but permits the free upward passage of air, as set forth.

2. The combination, in an incubator, of an egg-chamber, M, an egg-tray, G, one or more flexible water tubes or troughs, F, and means whereby a circulation of air is induced within said chamber M and around the eggs and water-tubes, as set forth.

3. The combination of the egg-chamber M and egg-tray G with external circulating pipes, P, each having an inlet, Q, as specified.

4. The combination of the outer casing, A, the reservoirs B and D, the tubes F, the sliding egg-tray G, and a frame for supporting the tubes F clear of the eggs on the tray, as described.

5. The within-described heat-regulating de-

vice, in which are combined a valve, the adjustment of which governs the supply of heat, a float connected to or controlling said valve, a tube or reservoir containing expansible liquid, and a connection between said tube or reservoir and the float, whereby the weighting of the latter is governed by the expansion and contraction of the liquid in the tube or reservoir under the influence of varying degrees of heat, all substantially as specified.

6. The combination of the heat-governing valve, the float *w*, connected thereto and having a stem, *s*, the tube or reservoir J, having a branch, *v*, and the flexible connection *q* between the stem *s* and branch *v*, as set forth.

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

HENRY B. TATHAM, JR.

Witnesses:

JAMES F. TOBIN,

HARRY SMITH.