J. M. BRADFORD.

Electrical Heat and Moisture Regulator for Factories.

No. 212,653. Patented Feb. 25, 1879.

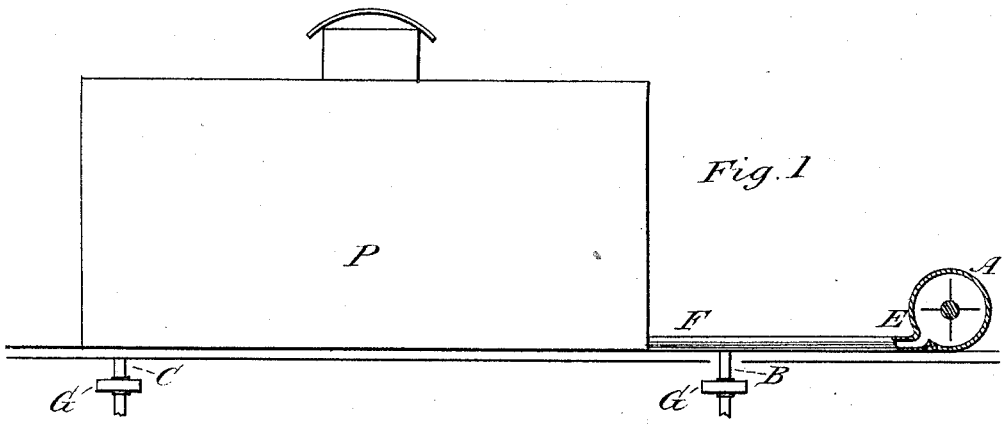


Fig. 1

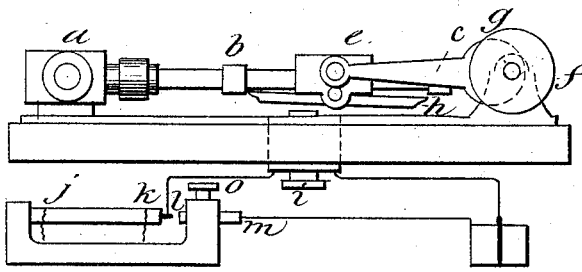
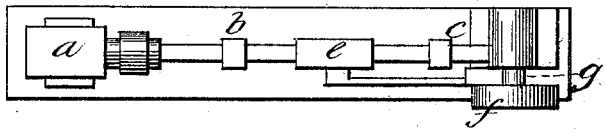


Fig. 3.

Fig. 4.



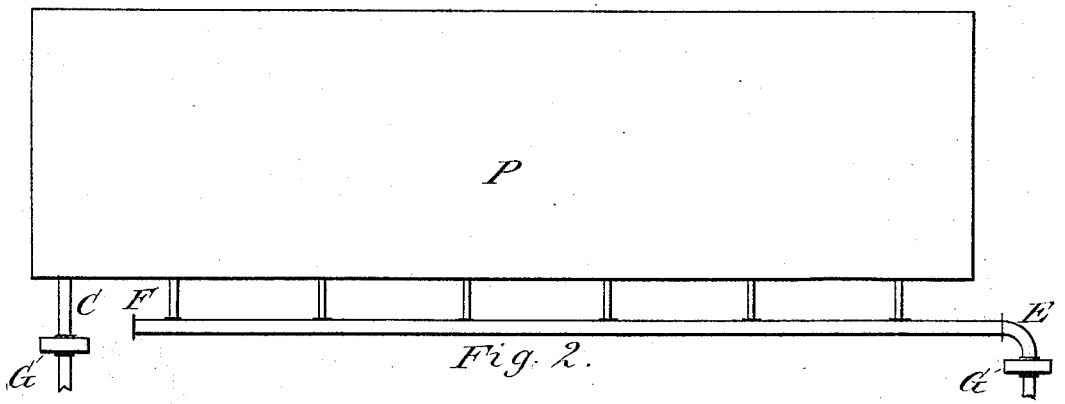


Fig. 2.

Attest:

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UNITED STATES PATENT OFFICE.

JULIEN M. BRADFORD, OF PORTLAND, MAINE, ASSIGNOR OF ONE-HALF HIS RIGHT TO ZEBULON K. HARMON, OF SAME PLACE.

IMPROVEMENT IN ELECTRICAL HEAT AND MOISTURE REGULATORS FOR FACTORIES.

Specification forming part of Letters Patent No. **212,653**, dated February 25, 1879; application filed May 31, 1877.

To all whom it may concern:

Be it known that I, JULIEN M. BRADFORD, of Portland, Maine, have invented an Improvement in Apparatus for Regulating the Heat and Moisture in Aging-Boxes and other Compartments, of which the following is a specification:

The object of my invention is to regulate the amount of heat and aqueous vapor in the air of rooms. The apparatus is particularly designed to be used in connection with "aging-boxes," for the purpose of securing uniformity in oxidizing and fixing the mordants on printed fabrics, but can also be used in spinning and weaving rooms, and in other places where regulation of aqueous vapor is necessary.

In order to obtain the best and most uniform results from aging-boxes, it is essential to maintain a temperature within the box not exceeding 100° Fahrenheit, and a degree of moisture sufficient to cause the wet-bulb hygrometer to mark not less than 97°.

The aging-box mostly used at the present time derives its supply of aqueous vapor from a number of small steam-jets issuing from pipes on the bottom of the box, and this jet apparatus also maintains the temperature. A heating-coil is supplied for the purpose of keeping it warm and dry when not in use; but this coil is seldom or never used to increase the temperature while the box is in operation. A ventilator is also arranged at the top, which may be opened to allow the escape of acid vapor disengaged from the mordanted prints.

In carrying out my invention, I intend to make use of apparatus which will produce a copious supply of aqueous vapor without overheating the aging-box; also, make use of a separate heating-coil, which will be in frequent operation to increase the temperature; and, lastly, regulate the heat and vapor so supplied by means of electric governors.

Figure 1 is a view of the apparatus in side elevation and section, showing its application to aging-boxes. Fig. 2 is a side elevation of the apparatus, showing its application to spinning and weaving rooms, &c. Fig. 3 represents the electric governor in side elevation. Fig. 4 is a plan view of Fig. 3.

Similar letters of reference indicate corresponding parts.

In Fig. 1, A represents a blower, which forces a small current of air into the aging-box P while it is in operation. The pipe E F, through which this air passes, has several branch pipes, which are pierced with holes and extend to different parts of the box. The steam for saturating the air with moisture enters this air-pipe through the pipe B. This steam is carried into the box by the air-current, and this arrangement insures perfect mixture of the vapor with the air of the aging-box. A heating-coil enters the box at C. This coil may or may not have one or more small openings in it, so that it will inject a portion of steam into the box, to enable it to heat the air quicker than it would without such openings; but these openings will not cause the coil to introduce an excess of moisture, because they do not diffuse the steam perfectly, and the coil exposes a large radiating-surface.

The steam, before entering the air-pipe E F and the heating-coil C, passes through the valves of the governors at G. The governor, connected to the heating-coil C, is in electrical connection with a thermometer situated in the box, and the other one is in electrical connection with a hygrometer situated in the same place.

The control of this apparatus is such that if there is any deficiency in the temperature or moisture of the air, the governor-valves are open to allow the steam to enter the box and supply the deficiency; but as soon as these deficiencies are supplied the valves close and stop the supply.

In Fig. 2 the steam enters the vapor-pipe E F, and distributes itself through a number of small openings in the branches of this pipe. The heating-coil enters at C. The vapor-pipe will be arranged so as to produce a greater saturating effect than is generally obtained. This is accomplished by excluding the pipe E F from the chamber, or by taking other equivalent means to prevent the heat resulting from the condensation of steam inside of the pipes from entering the room. This expedient of preventing the surface-radiation of the pipes

from entering the room enhances the saturating power of the vapor apparatus, since a rise of temperature is equivalent to a diminution of moisture, it having the effect to expand the vapor in the air farther from a state of maximum density.

I am aware that there is nothing new in the use of jet-pipes for the purpose of saturating the air of rooms with aqueous vapor; but I believe the use of a vapor apparatus with its surface so protected as to prevent radiation from interfering with the saturating power of the jets is new. The steam, before entering the vapor-pipe E F and the heating-coil C, passes through the valves of the governors at G. One of these governors is controlled by a suitable hygrometer; the other by a thermometer.

The operation of the above-described electric governor is as follows: In Fig. 3, *a* represents a steam-chest containing a valve which controls the steam moistening the air of the room; consequently, when this valve is closed no steam enters the room. On the other hand, while this valve is open the steam passes freely into the room and moistens the air. This valve has a rod, *b c*, attached to it, on which is the sleeve *e*, which derives a reciprocating motion from the pulley *f* and eccentric *g*. This sleeve carries a pawl, *h*, beneath which is the temporary magnet *i*. When an electric current passes around this magnet it pulls down one end of the pawl, so that the opposite end nearest the eccentric catches a collar on the rod *b c*, and by this means the rod is pushed to the right and the valve closed. On the other hand, while the current remains broken the superior weight of the end of the pawl nearest the eccentric causes the opposite end to engage with the collar at *b*, push the rod to the left, and open the valve. The valve, therefore, is always open while the electric circuit is broken, and always closed while the circuit is closed. The electric circuit is broken and closed by the variations of the moisture in the room through the medium of a hygrometer.

The apparatus above described for regulating the valves is the same in general principle, and particularly in the construction and operation of the lever *h* and its connections, as that shown in my patent granted August 18, 1878, and numbered 154,214.

Several kinds of hygrometer can be used. The one described below is suited to aging-boxes. It consists of a rod of vulcanized rubber, *j k*, which is kept wet by a cloth with which it is enveloped absorbing water from a pan under it. This rod terminates in a metallic wire, *l*, and a metallic pin, *m*, is added, which may be adjusted at any distance from the wire *l*. This instrument is set by the mercurial hygrometer of the box; or, in other words, when the mercurial hygrometer indicates that the proper degree of moisture has been obtained, the pin *m* is pushed in so as to touch the wire *l*, and is then made fast by the set-screw *o*. A contraction or expansion of this instrument of less than one-two-thousandth of an inch is sufficient to break or close the circuit, and this sensitiveness enables the arrangement to compensate for slight changes.

The steam entering the heating-coil will be regulated by a machine the same as that above described, working in electrical connection with a thermometer instead of a hygrometer.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an aging-box or like compartment, the combination of a steam-pipe, the surface of which is excluded from contact with the atmosphere of the box or compartment, with a series of orifices or pipes conducting the steam from said main pipe directly to the room, as and for the purpose set forth.

2. The combination, with a steam-supply pipe, the surface of which is excluded from the box or compartment, and which is connected direct to the interior of the box by a series of pipes or orifices, with a steam-heating coil located within the said box, all as and for the purpose set forth.

3. The steam-supply pipe the surface of which is excluded from the box or compartment, and which is connected with the interior of said box or compartment by a series of pipes or orifices, a steam-heating coil within the box, and electrical regulating-valves adapted to the heating and moisture pipes, all combined and operating as set forth.

4. The combination of the steam-supply pipe having orifices for the diffusion of steam in the box or compartment, of a valve to regulate the supply of steam through said pipe, of the stops *b* and *c* on the stem of said valve, and the stem *e*, sliding them and carrying the lever *h*, with the temporary magnet battery hygrometer and described connections, all arranged and operating as set forth.

JULIEN M. BRADFORD.

Witnesses:
H. M. BRADFORD,
CLARENCE HALE.