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J. E. BARNEY.
DRYING APPARATUS.

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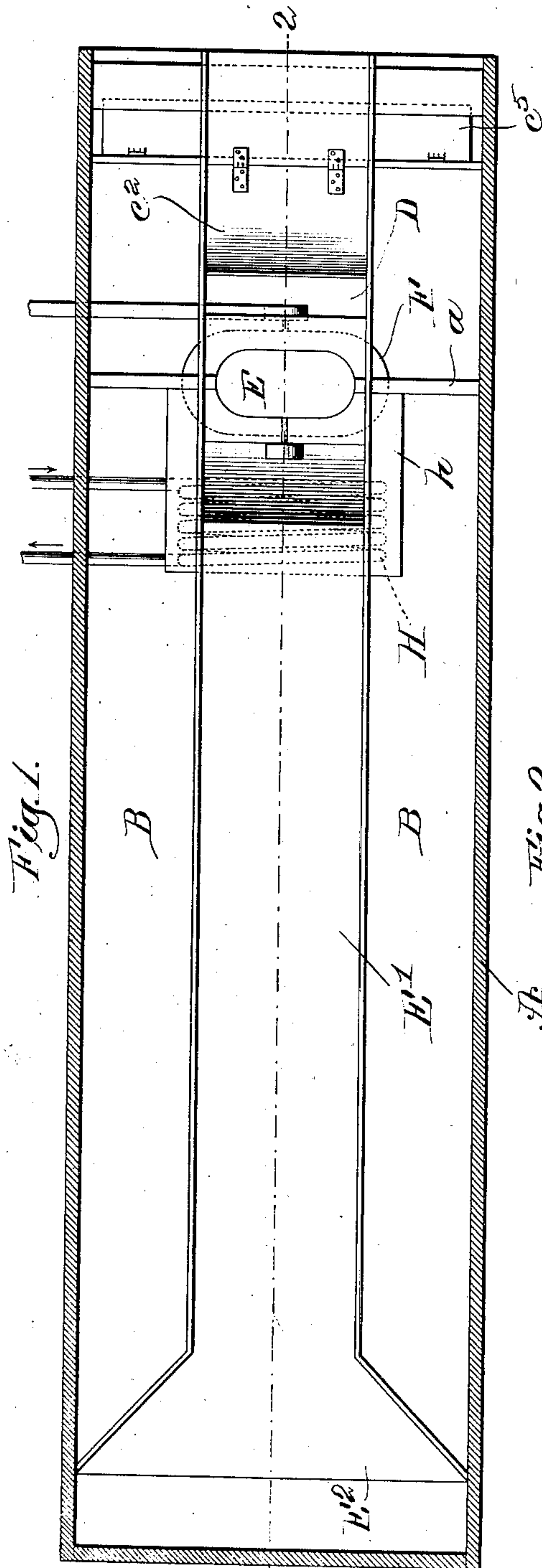


Fig. 1.

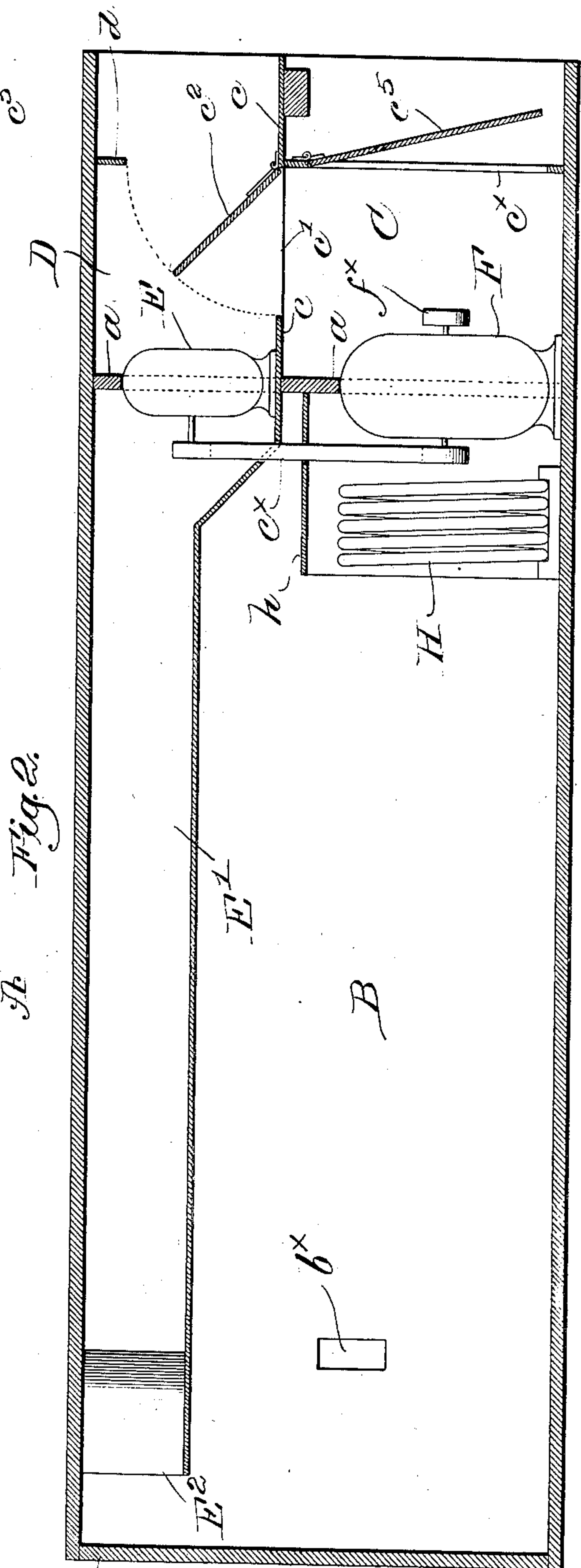


Fig. 2.

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DRYING APPARATUS.

No. 840,037.

Specification of Letters Patent.

Patented Jan. 1, 1907.

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To all whom it may concern:

Be it known that I, JAMES E. BARNEY, a citizen of the United States, residing at Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Drying Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The main object to be attained in drying apparatus is the removal of the maximum of moisture from the material to be dried in the minimum of time and in the most economical manner, while at the same time the texture or physical structure of the material to be dried must be preserved from injury.

In the ordinary dry-room operated by the aid of fans the temperature is uneven in practice, the lower part of the room being cold and the upper part hot, and this is noticeable even when the heat is supplied by steam pipes or coils laid along the floor, and uneven and imperfect drying results inevitably. The heated air rises and the moist heated air is found at the top of the drying room or chamber, and when the saturation-point is reached (whatever the degree of temperature) the heated air has absolutely no value as a drying agent, and while its circulation may be continued no useful result is attained. In many instances it is positively detrimental, as when drying fine fabrics and yarns of mixed colors.

My present invention has for its object the production of drying apparatus so constructed and arranged that a substantially even temperature will be maintained in all parts of the drying-chamber, while at the same time the moisture released from the material is removed and the heat retained.

In the present embodiment I use two volume fans or wheels of unequal size and capacity, the larger one being located at one end of the drying-chamber and rotated at such velocity that it acts as a plenum-fan, forcing the air with considerable pressure upon all surfaces within the chamber. The other and smaller fan is used as a positive exhaust for the air in the chamber, and when the two fans are used in conjunction, as hereinafter fully described, it will be apparent that the plenum-fan forcibly impinges the air against all surfaces within the chamber in greater volume than can be removed by the exhaust-fan. The heated air is thus held within the chamber until it has caused the re-

lease of moisture from the material to be dried, and the moisture-laden air is then conducted through a suitable exhaust-duct and removed from the chamber when it has reached the limit of its value as a drying agent.

When any article to be dried is first placed in the drying-chamber, such article is cold and contains more or less moisture, according to its character, and obviously the temperature should be raised to accelerate the expulsion of the moisture. At this point the value of the two fans working in conjunction becomes evident, the smaller or exhaust fan backing off or neutralizing the normal pressure of the outer air and tending to form a partial vacuum at its intake side, such partial vacuum being at once filled by the pressure of the larger or plenum fan. By such arrangement I am able to effect a positive discharge of moisture-laden air to the atmosphere under the most adverse circumstances. In order to control the direction of the air-current, I have provided an adjustable deflector or trap in the air-duct at a point between the discharge side of the exhaust-fan and the outside air, as will appear more fully hereinafter.

The various novel features of my invention will appear hereinafter in the subjoined specification and will be particularly pointed out in the following claims.

Figure 1 is a top plan view of a drying apparatus embodying my invention, the top or roof being omitted. Fig. 2 is a longitudinal vertical section thereof on the line 2 2, Fig. 1, both fans being shown in elevation.

Referring to the drawings, an elongated compartment A of suitable width and height is divided by an upright partition *a* into a drying-chamber B and an air-chamber C, an opening *c'* being made in the top *c* of the air-chamber adapted to be closed at times by a deflector or trap *c'*. (See Fig. 2.) The compartment D above the air-chamber has an exit or outlet *d* of such a size that it can be closed by the trap *c'* when desired, the compartment D directly communicating with the discharge side of an exhaust-fan E, located in an opening in the upper part of partition *a*. The air-chamber C has a large inlet-opening *c''*, (see Fig. 2,) and a force or plenum fan F is located in an opening in the lower part of partition *a*, the air-chamber forming the intake for said fan, which discharges directly into the drying-chamber B. The fans are

herein shown as belted together at c^x , and by a pulley f^x the plenum-fan can be driven by a belt (not shown) from any suitable source of power.

5 A heating-coil H is shown in the drying-chamber in front of the fan F to heat the air forced thereby into the chamber B. At the top of the latter chamber I provide an exhaust-duct E', which communicates with the
10 drying-chamber only at the end farthest from the fan F, and referring to Fig. 1 it will be seen that the inlet of the said duct is enlarged or flared at E^2 , the sides of the flared portion extending to the side walls of the
15 drying-chamber. Said duct E' leads directly to the exhaust-fan E, and the outlet compartment D is practically a continuation of the duct beyond said fan. It will be understood that the drying-chamber B will in
20 practice be provided with a suitable door or doors to introduce and remove the articles to be dried. The heating-coil H is located within a casing h, so that the air forced in by the fan F must traverse the coils before pass-
25 ing along the drying-chamber, the latter having a small pane of glass b^x let into one of its side walls, as shown in Fig. 2. Referring to Fig. 1 it will be seen that the exhaust-duct is wide enough to accommodate the fan E and
30 that the outlet-chamber D is of substantially the same width.

In operating the apparatus the articles to be dried are placed in the chamber B; the heat turned on to the heating-coils or heater
35 H to raise the temperature of the chamber, all doors or other entrances thereto being closed. The trap c^2 is swung up to close the outlet d , and by a similar door or trap c^5 the air-inlet c^x is closed, and the fans F and E are
40 started, thereby causing a movement of the contained air through the loaded drying-chamber, exhaust-duct E', compartment D, and air-chamber C, the opening c' then being uncovered by the trap or deflector c^2 . The
45 air current or circulation thus set up is caused to pass several times through the heater H, the force or plenum fan F (having the greater capacity) forcing the warm air through the articles to be dried in larger volume than can
50 be removed simultaneously by the smaller exhaust-fan E. This causes the warm air to impinge on all surfaces within the drying-chamber B, resulting in release of moisture from the articles therein to be taken up by
55 the air, the latter being withdrawn through the duct E' and passed through the heater again, the operation being continued until the dew-point or full saturation has been reached. When this point has been attained,
60 the glass b^x will be clouded with vapor. I then move the trap c^2 down to open the outlet d and close the opening c' and open the trap or door c^5 , opening the inlet c^x into the air-chamber C. Fresh outside air is thus ad-
65 mitted and is forced by the fan F into the

drying-chamber B, causing the saturated air therein to pass out through the exhaust-duct and through the compartment D to the out-
side of the apparatus, the moisture taken up from the articles in chamber B thereby being
70 effectually removed and discharged. If it be desirable to again raise the temperature in the drying-chamber, the traps c^2 c^5 are again returned to position to close the outlet d and inlet c^x , respectively, and the inclosed air will
75 again be circulated and the temperature quickly raised. By setting the trap c^2 at a point between the openings c' and d , as in Fig. 2, a portion of the air will be discharged and the remainder caused to circulate.
80 When the articles are partly or nearly dry, the heating medium is shut off, trap c^2 is dropped to close the opening c' , and the inlet c^x is opened, the heat retained in the drying-chamber completing the drying operation
85 and leaving the articles cool and in the same state as if dried in the open air under the best of natural conditions. When the outlet d is open, the action of the exhaust-fan E neutralizes and overcomes the normal back pres-
90 sure of the outside air, so that under the most adverse atmospheric conditions the removal of the moisture-laden air from the drying-chamber is not retarded or impeded. By
95 flaring the inlet end E^2 of the exhaust-duct E', I secure a complete air circulation from all parts of the drying-chamber and obviate the formation of dead places, so that the drying action is substantially uniform throughout
100 the chamber.

The particular structure of the fans is not material to my invention so long as they will perform the required work; but the force-fan discharging into the drying-chamber must
105 be of greater volumetric capacity than the exhaust-fan, for the reasons hereinbefore set forth. Otherwise the drying operation will not be conducted properly or uniformly and greater time will be required to secure less
110 efficient drying.

With apparatus of this character the most delicate articles can be dried to the desired degree without any burning or destruction of the structure thereof, as the temperature is
115 never high enough in the drying-chamber.

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

1. In drying apparatus, a drying-chamber, a heater therein to raise the temperature of
120 the air, a force-fan to force air into the chamber, an exhaust-duct leading from the opposite end of the said chamber, an exhaust-fan in the duct, of less volumetric capacity than the force-fan, and means to direct the dis-
125 charge from the exhaust-fan to the intake of the force-fan, to cause a circulation of heated air under pressure through the drying-chamber.

2. In drying apparatus, an elongated dry- 130

ing-chamber, a heater therein, a force-fan in one end of the chamber to force air through into the chamber and in contact with the heater, an exhaust-duct at the top of the chamber and opening thereinto at the end opposite the fan, an exhaust-fan in the duct, of less volumetric capacity than the force-fan, and means to direct the discharge from the exhaust-fan to the outside air or to the intake of the force-fan, the latter by reason of its greater capacity causing the air to forcibly impinge upon all objects in the drying-chamber.

3. In drying apparatus, a drying-chamber, a heater therein at one end, a force-fan to force air through the heater into the chamber, an exhaust-duct leading from the opposite end of the said chamber, an exhaust-fan in the duct, an air-chamber leading to the intake of the force-fan, an adjustable inlet for said chamber, an outlet-chamber into which the exhaust-fan discharges, said compartment having an exit-opening and an opening into the air-chamber, and a device to close

one opening and open the other, and vice versa, whereby the exhaust can be discharged directly to the external air or diverted to the intake of the force-fan.

4. In drying apparatus, an elongated drying-chamber, a heater therein at one end, a force-fan in said end of the chamber to force air through the heater into the chamber, an exhaust-duct at the top of the latter having an enlarged or flared inlet-opening into the drying-chamber at the end opposite the force-fan, an exhaust-fan in the duct, of less volumetric capacity than the force-fan, means to direct the discharge from the exhaust-fan to the outside air or to the intake of the force-fan, and means to control the supply of external air to said force-fan.

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

JAMES E. BARNEY.

Witnesses:

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