July 28, 1959 J. DUNGLER 2,896,335

DRYING OF FABRICS, PAPERS, CARDBOARDS, AND OTHER LENGTHY MATERIALS

Filed July 24, 1956

Fig.1

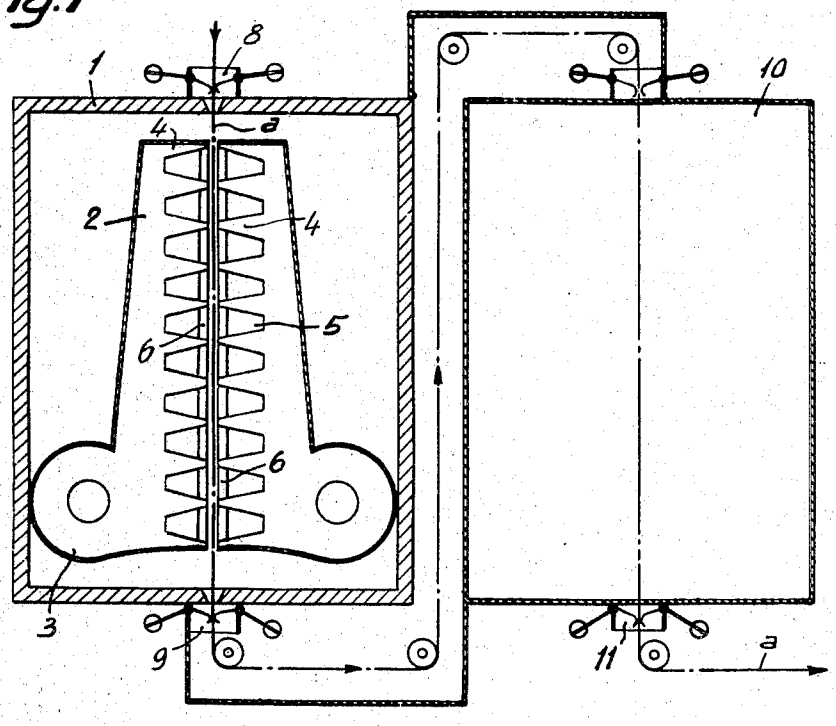


Fig.2

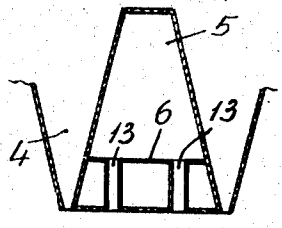


Fig.5

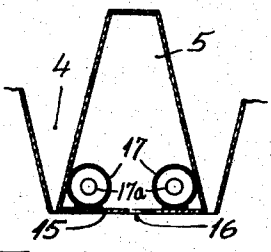


Fig.7

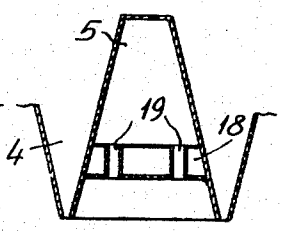


Fig.3

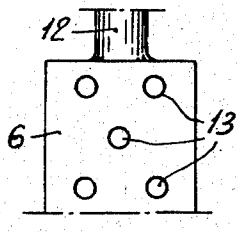


Fig.6

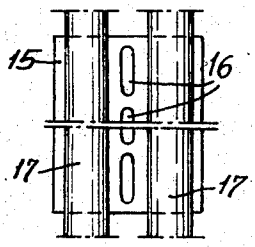
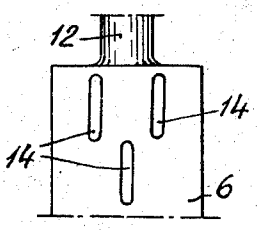


Fig.4



United States Patent Office 2,896,335
Patented July 28, 1959

2,896,335

DRYING OF FABRICS, PAPERS, CARDBOARDS, AND OTHER LENGTHY MATERIALS

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Application July 24, 1956, Serial No. 599,845

Claims priority, application France July 28, 1955

7 Claims. (Cl. 34—68)

The invention relates to machines for drying fabrics, papers, cardboards and other lengthy materials, and more particularly to machines of the type in which the material to be treated is simultaneously subjected to the action of a circulating gas or gaseous fluid and to the radiations emitted by radiant elements arranged on either side of the material being treated and extending in a direction parallel with the latter.

In known machines, the circulating gas and the radiant elements are brought up to temperature by a single source of heat, namely a heat exchanger directly insuring the heating of the gas which, in its turn, travels through the radiant elements arranged along its path of travel, which has as an effect the bringing of the latter to their rated temperature.

The machine which is the object of the present invention is essentially characterized in that it is the radiant elements which are directly brought up to their rated temperature by a source of heat provided for this purpose, whereas the circulating gas is indirectly heated by its contact with said direct heating elements.

Further objects and advantages of the invention will be apparent to those skilled in the art, from a consideration of the following description of some specific embodiments of the invention, shown by way of examples, in the accompanying drawings, in which:

Fig. 1 is a diagrammatical vertical section of a machine according to the invention,

Fig. 2 shows, in vertical section and on a larger scale, one embodiment of the radiant elements,

Fig. 3 is a plan view corresponding to Fig. 2,

Fig. 4 shows a modification also in plan view,

Fig. 5 is a view similar to that of Fig. 2 and shows a further modification,

Fig. 6 is a plan view corresponding to Fig. 5, and

Fig. 7 shows, also in a view similar to that of Fig. 2, still a further modification.

The machine represented in Fig. 1 comprises a heat insulated enclosure **1** in which are arranged, on either side of the treated product *a*, such as fabric or the like, two blowing boxes **2** supplied with blowing fluid, such as superheated steam or the like, by blowers **3**. The boxes **2** are fitted with individual blowing nozzles **4** separated from each other by discharge channels **5**.

Radiant elements **6** are arranged within the discharge channels **5** in a direction parallel with the treated fabric *a* and, preferably, at a short distance from the latter.

The fabric enters the enclosure **1** as at **8** and runs out of the latter as at **9** and is directed to a further treating machine **10** supplied, for instance, with treating fluid derived from the excess fluid from the machine contained in the enclosure **1**. The fabric leaves the machine **10** as as **11**.

As already hereinabove explained, the radiant element **6** and a blowing fluid set in circulation by the blower **3** are brought up to their rate temperature by the same source of heat, namely that serving for heating the radiant elements.

Figs. 2 and 3 show a first embodiment of the radiant elements **6** adapted to yield the result sought for. For this purpose, the radiant elements **6** are in the form of hollow bodies through which is circulated a heating gas or fluid, such as steam, burnt gases or the like, supplied through the pipe **12**. Of course, this heating fluid has a temperature such that it brings the radiant elements up to a temperature ensuring the emission of heat radiations, i.e. to a temperature of at least 250° C., and, preferably, to a temperature of 400° C and even more.

The radiant elements **6** are traversed by channels for the passage of the circulating blowing fluid. These channels may assume any desired shape, for instance the shape of tubes **13** (Figs. 2 and 3) or of elongated passages **14** (Fig. 4).

While circulating through the machine, the treating fluid delivered by the nozzles **4** is discharged, subsequent to its action upon the fabric, through the discharge channels **5**.

In order to reach the latter, it has to flow through the passages **13** or **14** provided through the radiant elements **6** which are brought up to a high temperature by the heating fluid supplied through the pipe **12**. While flowing through the radiant elements **6** in the passages **13** or **14**, the circulating fluid, therefore, in its turn is brought up to its rated temperature, the upper and lower faces of the radiant elements also bringing their contribution to this heating effect.

This arrangement has the advantage of providing a very efficient heating of the circulating fluid, owing to the widely extended contact area between the latter and the heating surfaces constituted by the walls of the passages **13** or **14**. Furthermore, in the case of heating by means of burnt gases, the treating fluid does not engage the latter and remains therefore free from impurities.

It should be further noted that the path of travel of the treated product *a* is arranged vertically, which makes it possible to feed the latter through the machine in the direction of gravitational force and without having to resort to supporting or transporting members. In fact, such members would be brought up to a very high and dangerous temperature unless provision were made for cooling means.

In the embodiments of Figs. 5 and 6, the radiant elements are constituted by mere plates **15** with perforations **16** of any suitable shape. These radiant plates **15** are brought up to their rate temperature by pipes **17** welded to the plates **15** and in which a suitable heated fluid is circulated. The operation of this embodiment is substantially the same as that of the embodiments of Figs. 2 to 4, with the exception that, here, the circulation blowing fluid is heated not only by passing through the plates **15**, but also by its direct contact with the pipes **17**. Pipes **17** may include electrical heating or resistor elements **17***a* in the alternative.

In the embodiments of Figs. 2 to 6, the radiant elements are located practically in coplanar relation with the mouths of the nozzles **4**, that is to say at a very short distance from the treated material.

The circulating fluid, therefore, follows a certain path along the treated material between the exit from the nozzles **4** and the inlets of the passages **13**, **14**, **16**.

When very high temperatures are used, it may be desirable to position the radiant elements at some distance away from the fabric. Such a disposition is represented in Fig. 7 where the radiant elements **18** with passages **19** for the blowing fluid are arranged in receded relation with respect to the discharge channels **5**. In this case, the circulating fluid delivered by the nozzles is immediately directed away from the treated material after having come into contact with the latter.

Of course, the embodiments hereinabove described and represented in the drawing are given by way of mere examples and the shape, the nature, the disposition and the mounting of their elements may be modified in any suitable manner without the scope of the invention being thereby departed from.

Thus, the discharge of the blowing fluid through the discharge channels **5**, subsequent to its action upon the treated material, may be effected either transversely of the latter, as represented, or perpendicularly to the surface thereof. The heating of the radiant elements may be ensured by any suitable means, for instance by electric resistors such as elements **17***a* in Fig. 5. The machine may be utilized for any thermal treatment. In the embodiment of Figs. 5 and 6, the radiant elements may be constituted by grates or mesh works, and the heating pipes **17** may assume a square or other cross-section, adapted to increase the area of contact with the radiant elements proper. The radiant elements may be provided with fins or others positioned in the stream of treating fluid and adapted to increase the area of thermal exchanges with the latter.

What I claim is:

1. Drying apparatus comprising an enclosure for accommodating material to be dried, the material having a determinable path of travel in the enclosure, radiating elements adapted for being heated and operatively disposed along opposite sides of said path, the radiating elements constituting the sole effective source of heat in the enclosure, means for circulating a drying medium within the enclosure, a plurality of boxes operatively associated with said means to receive the drying medium, said boxes being disposed on opposite sides of the path and arranged to confine the path and to enclose the radiating elements, said boxes each including a plurality of nozzles interposed between said radiating elements and supporting the same along said path, said boxes further including sections between the nozzles defining with the radiating elements enclosed discharge chambers adapted for the discharge of said medium and extending transversely of said path, said radiating elements defining openings coupling said path and discharge chambers for the removal of the medium brought to said path by the nozzles.

2. Apparatus as claimed in claim 1 wherein the radiating elements are hollow and comprising means coupled to the radiating elements for circulating a hot liquid therethrough.

3. Apparatus as claimed in claim 1 wherein the radiating elements are electrical resistors.

4. Apparatus as claimed in claim 2 wherein the nozzles are in perpendicularly intersecting relation with the path and the discharge channels are aligned transversely of the path.

5. Apparatus as claimed in claim 2 wherein the nozzles and radiating elements are equidistantly spaced from said path.

6. Apparatus as claimed in claim 2 wherein the nozzles and radiating elements are spaced at different distances from the path.

7. Apparatus as claimed in claim 2 wherein the radiating elements include walls adjacent and parallel to said path.

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