March 3, 1953 L. A. RUNTON ET AL 2,629,940

APPARATUS FOR DRYING CLOTH

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Fig. 1.

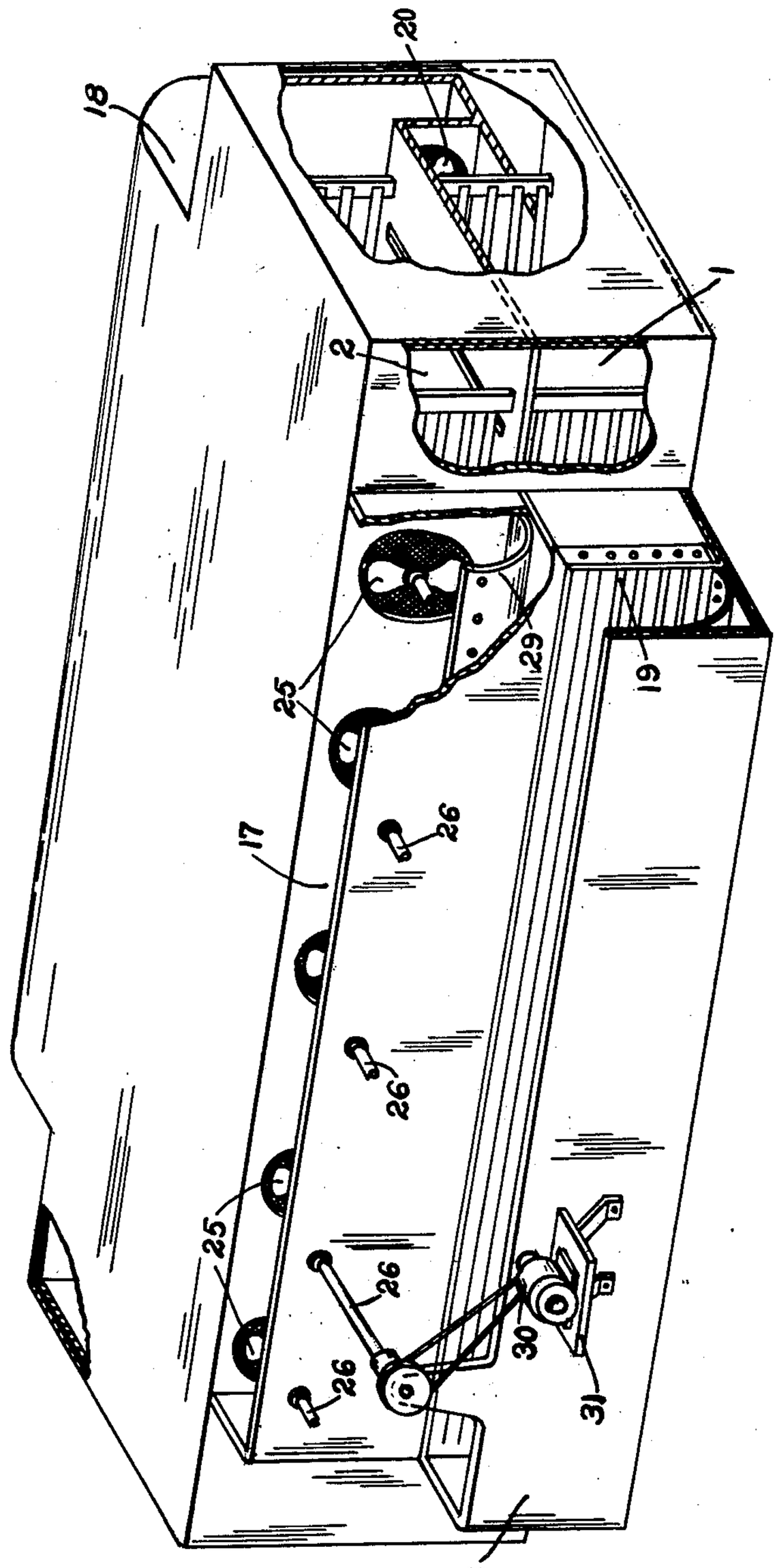

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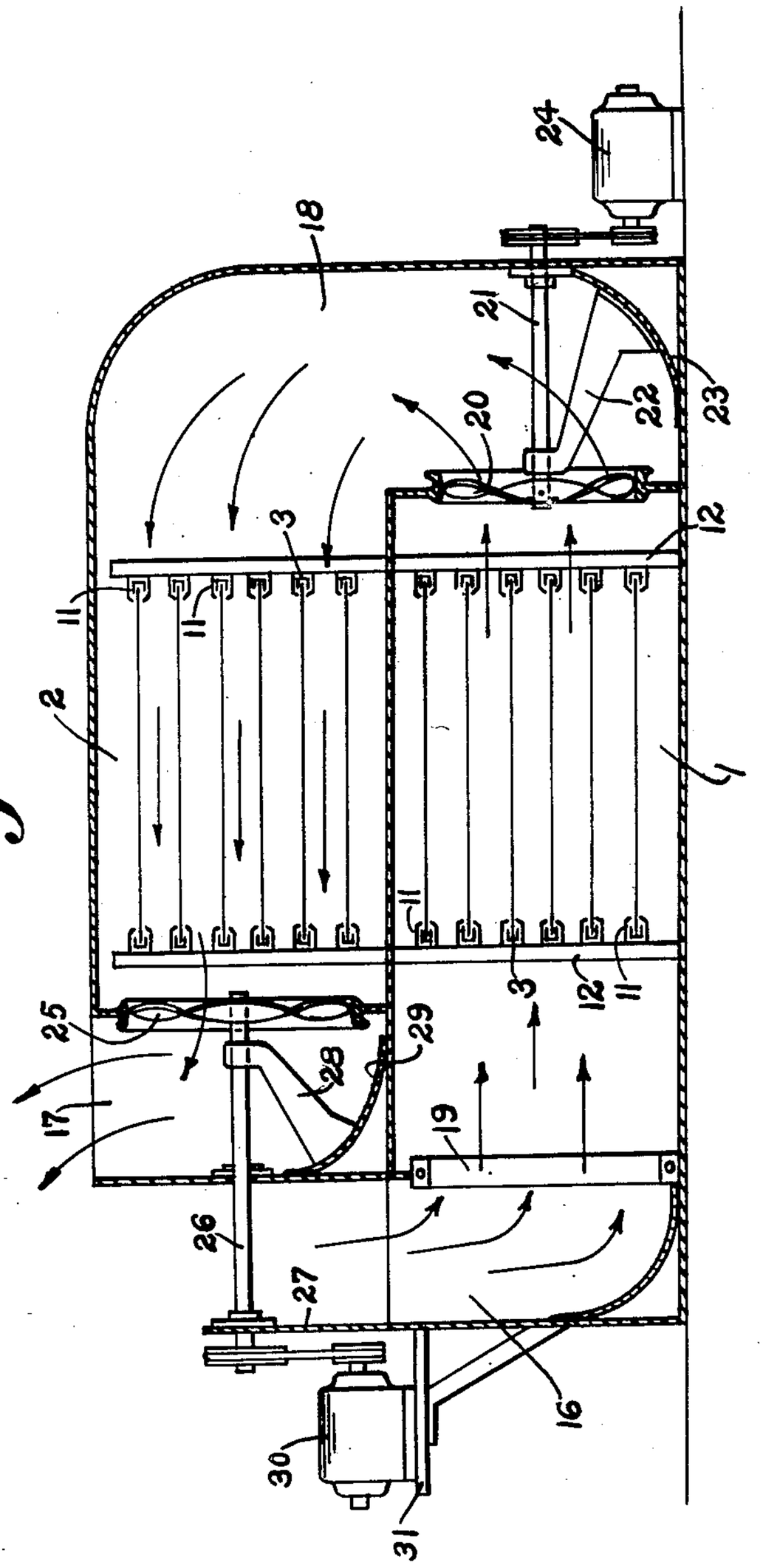
Fig. 2.



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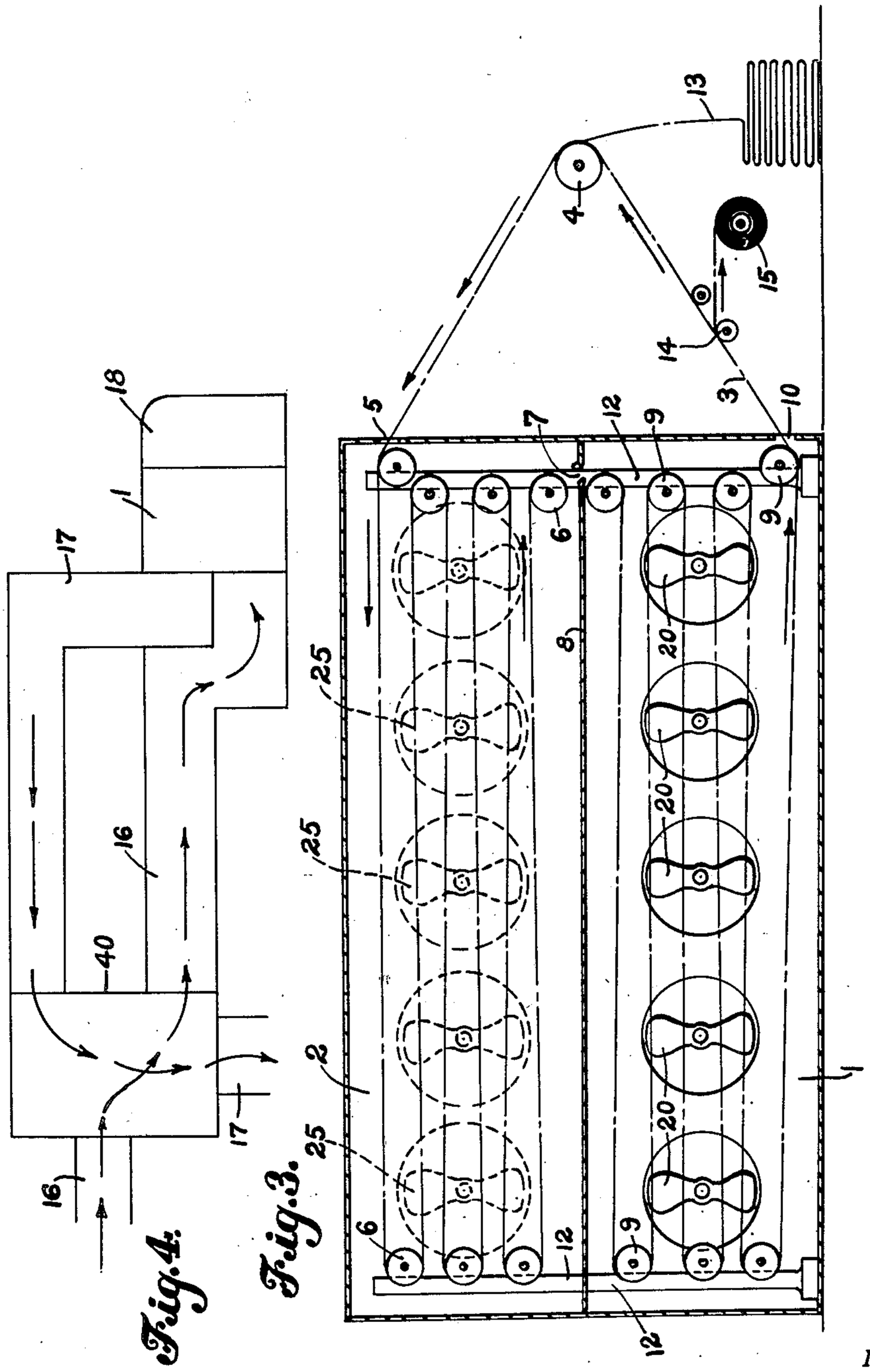

Fig. 4.

Fig. 3.

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APPARATUS FOR DRYING CLOTH

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5 Claims. (Cl. 34—159)

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This invention has for its object to secure in a continuous operation the drying of cloth rapidly, efficiently, economically and without injury to the cloth, particularly when composed largely or wholly of wool fibre.

In the manufacture of cloth it is necessary, often more than once, to perform a drying operation to remove moisture from the cloth. The contained moisture is the result of the treatment, usually by immersion, of the cloth in dyeing and other operations. The liquid employed in the treatment may contain a percentage of sulphuric acid, or other ingredients, but water is basically the liquid which has to be removed by the drying operation.

It has been found that a high degree of temperature together with a high relative humidity of the air employed in the drying operation is not only inefficient because of the low moisture absorption quality of the air, but the effect, particularly upon wool fibre, is detrimental and may result in permanently damaging the wool. It is therefore one of the objects of the invention to provide for the maintenance of a low relative humidity in the air employed in the drying operation.

It has also been found that in the ordinary drying operation a film of vapor is formed above and adjacent the cloth which has an insulating effect and unless constantly removed seriously reduces the efficiency of the drying operation.

In the present invention the cloth is caused to travel in open width in a plurality of runs through a chamber, and preferably successively through two juxtaposed chambers, and a large volume of atmospheric air is passed through the chamber from side to side throughout an area substantially coextensive with the area traversed by the runs of cloth. The term "chamber" as employed herein is to be understood as meaning a chamber substantially closed except for the passage of the cloth thereinto and out thereof and for the admission thereinto and the discharge therefrom of the air employed in the drying operation.

This large volume of air, in accordance with the principles of this invention, is not recirculated, but is taken from the atmosphere either outside of or from within the factory. This atmospheric air before passing into contact with the cloth is then heated to the required drying temperature. But atmospheric air, even when the relative humidity is high, has a very low relative humidity when heated to a drying temperature, say of 180°, and consequently at the

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latter temperature has a high moisture absorbent quality. For example, if the outside air, as in winter, had a temperature of 40° and was saturated, or at 100% relative humidity, it would contain only about 40 grains of moisture per pound of dry air, so that if this air were raised to 180° temperature still containing this 40 grains its relative humidity would be in the vicinity of one-fourth of one per cent, and consequently it would have a very high capacity to absorb moisture which is the requisite of a drying operation. The present invention by making use of a large volume of atmospheric air and by not recirculating this air maintains at all times the air employed in the drying operation at a low relative humidity with a consequent high moisture absorbent quality.

The invention also prevents the formation of any insulating film of vapor adjacent the surface of the cloth by providing for the continuous passage of this large volume of air transversely across the runs of cloth so as to sweep away the vapor which would otherwise form such a film.

Further, it will be recognized that reduction in barometric pressure causes an increase in the vapor pressure of the moisture in the cloth, and the present invention has for its further object to take advantage of this principle by maintaining in the chamber through which the cloth is traveling a sub-atmospheric pressure thus proportionately increasing the vapor pressure of the moisture in the cloth and the speed and efficiency of the drying operation.

While the invention employs continuous passage of a large volume of heated atmospheric air through the chamber transversely across the runs of cloth, and this air is not recirculated in accordance with the principles of the invention, nevertheless the total efficiency of the method and apparatus may be increased by transferring the heat contained in the air discharged from the drying operation to the entering volume of fresh atmospheric air, and as a further feature of the invention this is secured by passing the discharged air from the drying operation and the atmospheric air entering the drying operation through a suitable heat exchanger.

Wool cloth dried in accordance with the principles of this invention is left with a high moisture regain capacity, undamaged, and substantially in its natural state.

The principles of the invention as set forth are further illustrated and described in connection with a simple and preferred form of appa-

ratus embodying the invention and which may be employed in carrying out the method of the invention. Such an apparatus is illustrated largely diagrammatically in the drawings, in which:

Fig. 1 is a perspective view, partially broken away, of the apparatus;

Fig. 2 is a vertical transverse cross section of the construction of apparatus shown in Fig 1;

Fig. 3 is a vertical longitudinal cross section of the apparatus shown in Fig. 1; and,

Fig. 4 is a diagrammatic illustration of the apparatus employing a heat exchanger.

The apparatus illustrated comprises two similar juxtaposed rectangular chambers 1 and 2 constructed of suitable size and the usual materials required for cloth dryers. The cloth is caused to travel through the chambers in a plurality of runs in each chamber extending normal to the sides of the chambers. The runs of cloth are shown extending horizontally and guided around rolls near the ends of the chambers and with the cloth held in open width, but the particular means for causing the cloth to travel in the plurality of runs, and the position of the runs in the chambers, are not important so long as the runs are normal to the sides of the chamber through which the aid is introduced and discharged so that the air sweeps across the surfaces of the cloth.

In the construction illustrated endless tenter-like chains 3 are continuously driven passing from the roll 4 into the chamber 2 at the opening 5 and thence back and forth around the rolls 6 in the chamber 2, thence through the opening 7 in the partition 8 which separates the chambers, thence back and forth around the rolls 9 in the chamber 1, and thence out through the opening 10. These chains run in suitable guides 11 mounted on uprights 12.

The cloth, indicated at 13, is continuously connected to the tenter chains as it passes over the roll 4 and is then carried by the chains through the plurality of horizontal runs indicated in each chamber and emerges with the chains through the opening 70, is disconnected from the chains at 14, and is shown rolled up in dried condition at 15.

An admission duct 16 is connected to one side of the chamber 1 throughout an area substantially coextensive with the area traversed by the runs of cloth, it being noted that the runs of cloth do not extend, by reason of the supports for the tenter chains, etc., to the ends of the chamber. Thus air entering from the admission duct passes directly across all the runs of cloth and both surfaces of each run practically throughout their length.

A discharge duct 17 is shown connected to the same side of the second chamber 2, also through an area substantially coextensive with the area traversed by the runs of cloth. An auxiliary chamber 18 is shown connected to the opposite sides of both chambers 1 and 2 also throughout substantially the same areas coextensive with the areas traversed by the runs. This auxiliary receives the air discharged from the chamber 1 and supplies the air introduced to the chamber 2.

The volume of atmospheric air is drawn into the admission duct 16 and for that purpose the duct is extended to a convenient position for receiving either outside or inside atmospheric air. This air drawn into the admission duct is continuously supplied with heat and any suitable means for that purpose may be provided, preferably a steam heated fin type of radiator 19 is located in the admission duct adjacent the inlet therefrom to the chamber 1.

The heated atmospheric air thus drawn through the admission duct is continuously passed, in the construction illustrated, first through the chamber 1 transversely across the runs of cloth, then through the auxiliary chamber 18, thence through the chamber 2, across the runs of cloth in a direction opposite to its passage in the chamber 1, and thence out through the discharge duct 17. This continuous passage of the air into, through the chambers, and the discharge therefrom is secured by two series of fans, preferably of the propeller type, which are highly efficient in moving large volumes of air. One series of fans 20 is located at the exit side of the first chamber 1 with the fans arranged in parallel throughout the area traversed by the runs. While these fans, of course, cannot cover the entire area they effectively move the volume of air through the entire area across the runs of cloth. These fans may be mounted and driven in any suitable manner. They are illustrated as carried by individual shafts 21 journaled in the outer wall of the auxiliary chamber and in a bracket 22 supported from the curved bottom plate 23 and with each shaft driven by an individual motor 24.

A second series of fans is mounted at the exit side of the second chamber 2 with these fans also arranged in parallel throughout the area traversed by the runs. These fans 25 are shown as of the same type as the fans 20 each being carried by a shaft 26 journaled in an upright portion 27 of the admission duct wall and a bracket 28 mounted on the curved bottom platen 29 of the discharge duct and each driven by an electric motor 30 supported on a bracket 31 on the outer wall of the admission duct 16.

In order to maintain a sub-atmospheric pressure in the chamber 1 and thus increase the vapor pressure of the moisture in the cloth the suction of the series of fans 20 is adjusted to exceed the pressure of the air at the inlet side of the chamber. This is readily effected by adjusting the speed of these fans to cause the suction produced by them materially to exceed the resistance offered by the passage of the air through the admission duct and the heating element 19. So also a sub-atmospheric pressure is maintained in the chamber 2 and in the apparatus illustrated this is secured by making the series of fans 25 of larger diameter and therefore more powerful in the displacement of air than the series of fans 20. That is, these two series of fans are thus correlated to cause the suction produced by the fans 25 to exceed the pressure of the fans 20.

Only a short portion of the admission and discharge ducts are illustrated in Figs. 1 and 2, but it will be understood that these ducts are to be extended and particularly so that there will be no danger of air discharged from the discharge duct entering the admission duct and being recirculated.

The air passed through the apparatus illustrated is shown as heated by the steam heated construction 19 but as already pointed out substantial increase in efficiency and economy may be secured by causing the discharged heated air from the discharge duct 17 to transfer heat to the air entering the admission duct and such an apparatus is diagrammatically illustrated in Fig. 4 where the discharge duct 17 and the admission duct 16 are shown extended through a heat exchanger 40.

Any suitable or standard heat exchanger where the two streams of air pass through separate passages and the heat is transferred from the one

to the other through separating walls of metal of high diathermancy may be employed and no claim is made to such an exchanger per se.

The apparatus illustrated as a simple and preferred embodiment of the invention, as pointed out, may be made of any suitable size and should, of course, be well insulated to conserve the heat.

The invention has been found to be highly effective in the rapid and efficient drying of wool cloth. With an apparatus such as outlined in the drawings having effective areas in the side walls of the chambers of about 24'x9' and with the two chambers containing about 100 yards of wool cloth traveling therethrough at the rate of about forty yards per minute and with the atmospheric air introduced through the admission duct on the order of one hundred thousand cubic feet per minute, it has been found that the drying time of the cloth has greatly decreased over that secured by drying operations now in use, that the comsumption of steam for heating has been cut about one half, and the total cost of the operation greatly decreased. The original quality and strength of the wool fiber of the cloth is well preserved, there are no serious defects in the cloth and it is left with a high moisture regain capacity. All this is due to the principles of the invention which have herein been pointed out.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A cloth drying apparatus comprising two juxtaposed chambers, means for guiding the travel of cloth in open width successively through said chambers in a plurality of runs in each chamber extending normal to the sides of the chamber, an admission duct connected to the side of one chamber throughout an area substantially coextensive with the area traversed by the runs, a discharge duct connected to the same side of the second chamber throughout an area substantially coextensive with the area traversed by the runs, an auxiliary chamber connected to the opposite sides of both chambers throughout substantially the same aforesaid areas, a series of fans at the exit side of the first chamber arranged in parallel throughout the area traversed by the runs and a second series of fans at the exit side of the second chamber arranged in parallel throughout the area traversed by the runs, the said two series of fans acting continuously to draw atmospheric heated air into the admission duct and pass the said air therefrom through the first chamber, thence through the auxiliary chamber, thence through the second chamber and to discharge the said air laden with moisture out through the discharge duct.

2. A cloth drying apparatus comprising two juxtaposed chambers, means for guiding the travel of cloth in open width successively through said chambers in a plurality of runs in each chamber extending normal to the sides of the chamber, an admission duct connected to the side of one chamber throughout an area substantially coextensive with the area traversed by the runs, a discharge duct connected to the same side of the second chamber throughout an area substantially coextensive with the area traversed by the runs, an auxiliary chamber connected to the opposite sides of both chambers throughout substantially the same aforesaid areas, a series of fans arranged in parallel transversely of the auxiliary chamber and a second series of fans arranged in parallel transversely of the discharge duct, the said two series of fans acting continuously to draw atmospheric heated air into the admission duct and pass the said air therefrom through the first chamber, thence through the auxiliary chamber, thence through the second chamber and to discharge the said air laden with moisture out through the discharge duct.

3. A cloth drying apparatus comprising two juxtaposed chambers, means for guiding the travel of cloth in open width successively through said chambers in a plurality of runs in each chamber extending normal to the sides of the chamber, an admission duct connected to the side of one chamber throughout an area substantially coextensive with the area traversed by the runs, a discharge duct connected to the same side of the second chamber throughout an area substantially coextensive with the area traversed by the runs, an auxiliary chamber connected to the opposite sides of both chambers throughout substantially the same aforesaid areas, a series of fans at the exit side of the first chamber arranged in parallel throughout the area traversed by the runs and a second series of fans at the exit side of the second chamber arranged in parallel throughout the area traversed by the runs, with the two series of fans correlated to cause the suction of the second series to exceed the pressure of the first series thereby to produce sub-atmospheric pressure in the second chamber, the said two series of fans acting continuously to draw atmospheric heated air into the admission duct and pass the said air therefrom through the first chamber, thence through the auxiliary chamber, thence through the second chamber and to discharge the said air laden with moisture out through the discharge duct.

4. A cloth drying apparatus comprising two juxtaposed chambers, means for guiding the travel of cloth in open width successively through said chambers in a plurality of runs in each chamber extending normal to the sides of the chamber, an admission duct connected to the side of one chamber throughout an area substantially coextensive with the area traversed by the runs, a discharge duct connected to the same side of the second chamber throughout an area substantially coextensive with the area traversed by the runs, an auxiliary chamber connected to the opposite sides of both chambers throughout substantially the same aforesaid areas, a series of fans at the exit side of the first chamber arranged in parallel throughout the area traversed by the runs and a second series of fans at the exit side of the second chamber arranged in parallel throughout the area traversed by the runs and in which the suction of the first series of fans exceeds the pressure of the air at the inlet to the first chamber thereby to produce sub-atmospheric pressure in the first chamber, the said two series of fans acting continuously to draw atmospheric heated air into the admission duct and pass the said air therefrom through the first chamber, thence through the auxiliary chamber, thence through the second chamber and to discharge the said air laden with moisture out through the discharge duct.

5. A cloth drying apparatus comprising two juxtaposed chambers, means for guiding the travel of cloth in open width successively through said chambers in a plurality of runs in each chamber extending normal to the sides of the chamber, an admission duct connected to the side of one chamber throughout an area substantially coextensive with the area traversed by

the runs, a discharge duct connected to the same side of the second chamber throughout an area substantially coextensive with the area traversed by the runs, an auxiliary chamber connected to the opposite sides of both chambers throughout substantially the same aforesaid areas, a series of fans at the exit side of the first chamber arranged in parallel throughout the area traversed by the runs and a second series of fans at the exit side of the second chamber arranged in parallel throughout the area traversed by the runs in which the suction of the first series of fans exceeds the pressure of the air at the inlet to the firt chamber and in which the two series of fans are correlated to cause the suction of the second series to exceed the pressure of the first series thereby producing sub-atmospheric pressure in both chambers, the said two series of fans acting continuously to draw atmospheric heated air into the admission duct and pass the said air therefrom through the first chamber, thence

through the auxiliary chamber, thence through the second chamber and to discharge the said air laden with moisture out through the discharge duct.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
175,644	Becker	Apr. 4, 1876
411,836	Proctor et al.	Oct. 1, 1889
1,471,803	Parkes	Oct. 23, 1923
1,530,065	Walsh	Mar. 17, 1925
1,768,455	Sibson	June 24, 1930
1,924,255	Prat	Aug. 29, 1933
2,101,974	Belcher	Dec. 14, 1937