July 2, 1929. C. C. KENYON 1,719,612

TENTERING AND DRYING MACHINE

Filed May 11, 1923 3 Sheets-Sheet 1

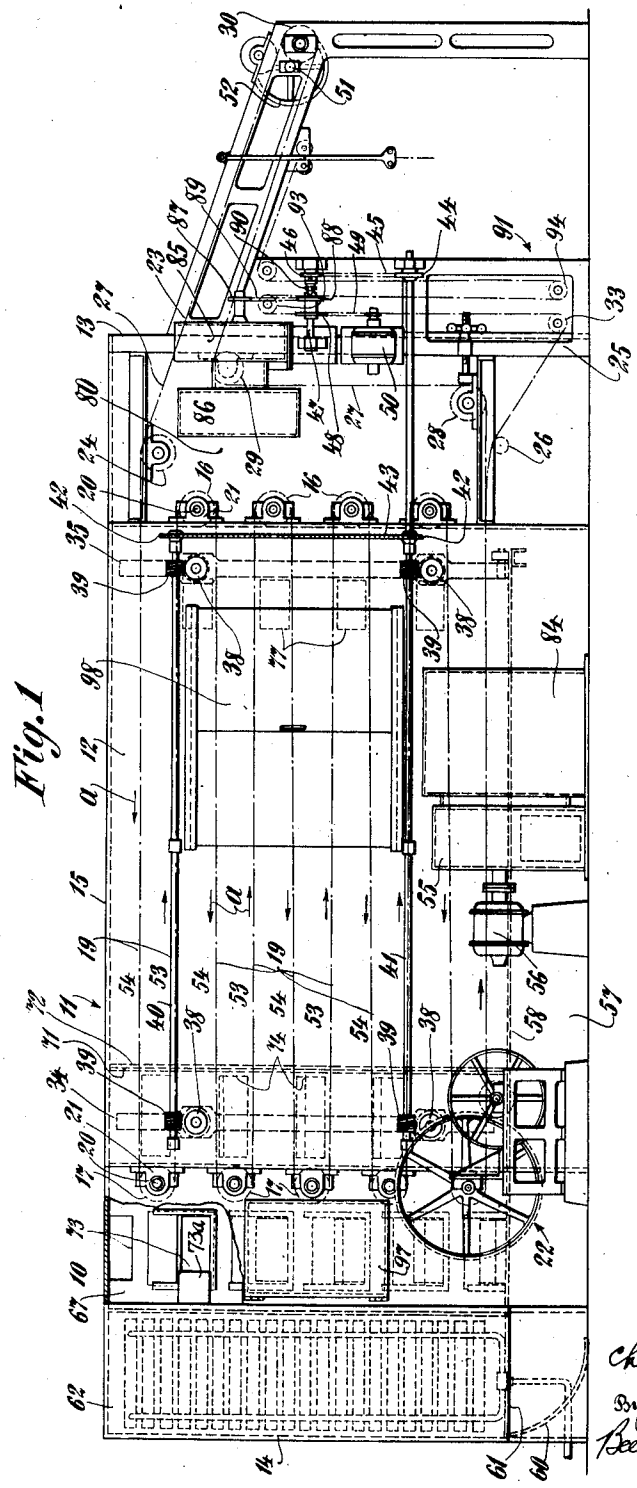


Fig. 1

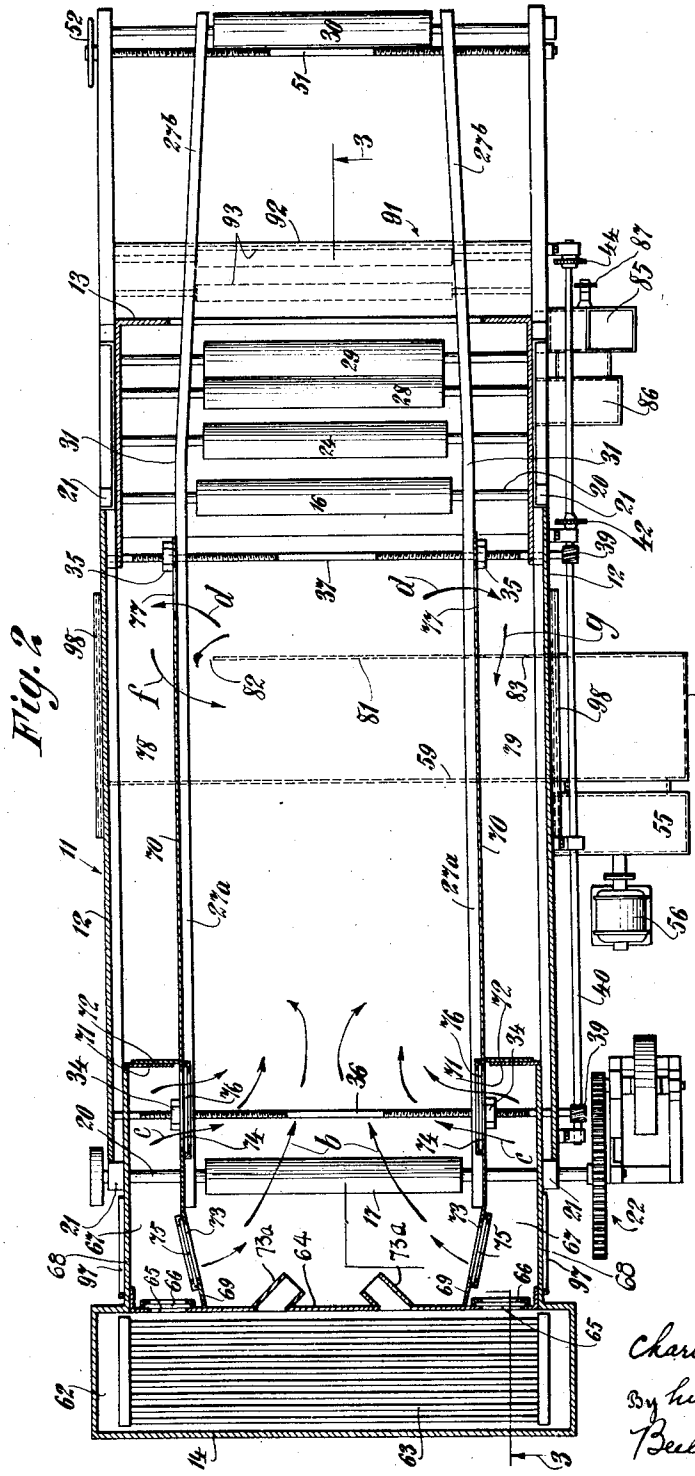
Inventor:
Charles C. Kenyon
By his attorneys
Baker & Schumacher

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Fig. 2



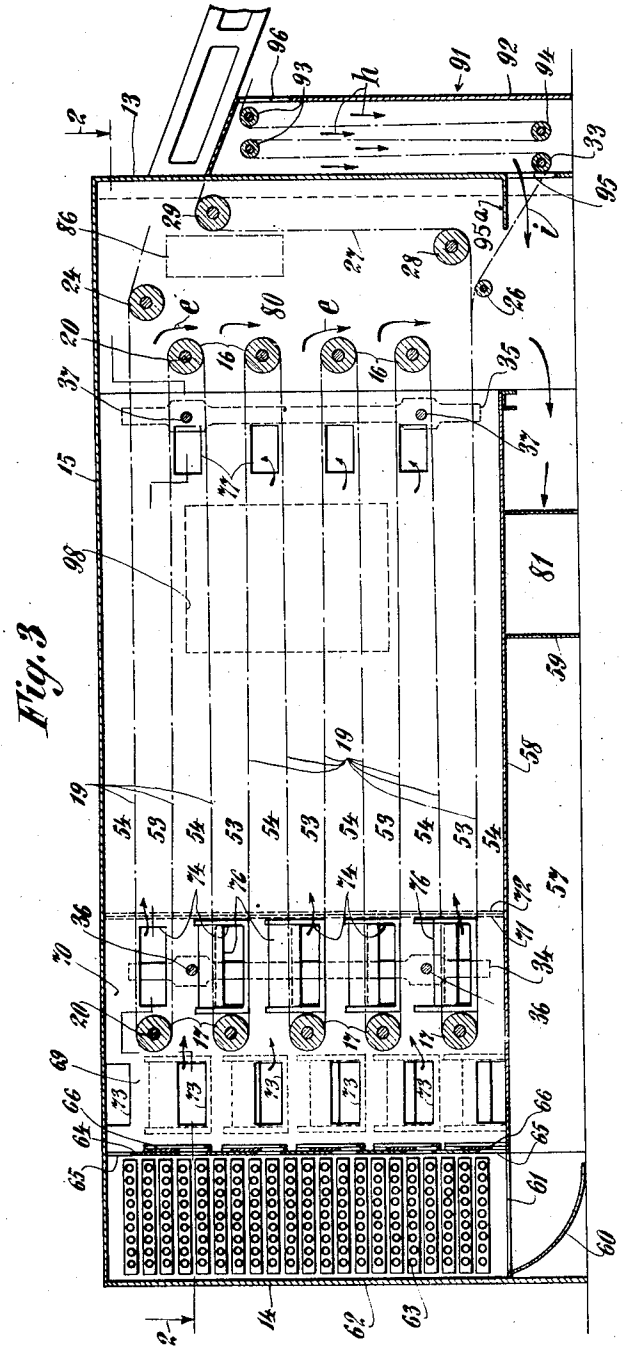
Inventor:
Charles C. Kenyon
By his attorneys
Beeler & Schumacher

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TENTERING AND DRYING MACHINE

Filed May 11, 1923 3 Sheets-Sheet 3

Fig. 3



Inventor:
Charles C. Kenyon
By his attorneys
Baker & Schumacher

Patented July 2, 1929. 1,719,612

UNITED STATES PATENT OFFICE.

CHARLES C. KENYON, OF SOMERVILLE, NEW JERSEY.

TENTERING AND DRYING MACHINE.

Application filed May 11, 1928. Serial No. 276,827.

This invention relates to tentering and drying machines, and to a process of tentering and drying cloth.

Generally stated, the invention provides a tentering and drying machine having a localized heating unit, for heating the air used for drying the cloth. The air leaves the heating unit in a series of streams at temperatures which vary in accordance with the quantity of moisture of the layers of cloth whereto the streams of air are supplied.

One object of this invention is to provide a device of the character described having improved means to cause the circulating air to pass between the layers of cloth.

Another object of the invention is the provision of an improved device of the class alluded to comprising a localized heating unit for the air.

Another object of this invention is to provide a device of the nature set forth wherein improved means supplies streams of air from a heating unit to a series of layers of cloth, the streams of air varying in temperature with the moisture content of the layers of cloth.

A further object of the invention is to produce a device of the type mentioned, in which improved means furnishes the air in different volumes to the layers of cloth, according to the amount of moisture in the respective layers.

A further object of the invention is to create a device of the character set forth, in which the means governing the flow of air between the layers of cloth has improved coaction with the tentering means.

Another object of the invention is the production of a device of the nature specified having improved means to cause the air to have a swirling flow between the layers of cloth.

A further object of the invention is to furnish a tentering and drying machine having associated in an improved manner therewith a device for cooling the cloth.

A further object of the invention resides in the provision of a tentering and drying machine having an improved air circulatory system.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawings:

Figure 1 is a view in elevation of a device embodying the invention.

Fig. 2 is a plan thereof in section taken on line 2—2 of Fig. 3.

Fig. 3 is a vertical section of the machine taken on line 3—3 of Fig. 2.

The advantages of the invention as here outlined are best realized when all of the features and instrumentalities thereof are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

The volume and velocity of flow of the several streams differ with the moisture content of the layers of cloth. The air is caused to flow wholly between the layers of cloth, instead of around the edges thereof, so that a high efficiency is obtained. In order to so confine the air, an auxiliary casing encloses the layers of cloth, which casing is adjustable to suit any width of the cloth upon which the machine may be operating. The means discharging the air between the layers of cloth causes the air to swirl and eddy so as to pass substantially through the entire space between the layers. After leaving the auxiliary casing, part of the air is recirculated through the machine, while part thereof is expelled. After being dried, the cloth is passed through a unit wherein cool air is circulated to cool the cloth. This cool air is supplied by the same fan which furnishes the air for drying the cloth. An auxiliary fan removes a portion of the moisture laden air from the machine, so that a uniform and constant circulation is obtained in all parts thereof. In connection with the said machine, an improved process for tentering and drying cloth in an economical and efficient manner is indicated.

Referring in detail to the drawing, 10 denotes a device embodying the invention. The same comprises a casing 11 having side walls

12, a front end wall 13, a rear end wall 14, and a top 15. These walls are made of a thin sheet metal, and are preferably insulated.

Positioned within the casing 11, are a plurality of rollers 16 and 17 in proximity to the front and rear ends of the casing, to receive a materal and support the same in a plurality of spaced layers as indicated at the dot dash lines 19. The said rollers may be spaced in any desired relation, but preferably the distances between centers, and likewise the sizes of the rollers are uniform. The axes of the respective rollers 16 and 17 lie in vertical planes transverse to the casing 11, and the rollers at one end of the machine are staggered with respect to those at the opposite end, so that a uniform and continuous series of layers may be formed on passing the material 19 successively about the rollers 16 and 17.

The rollers 16 and 17 are preferably telescopic for a purpose hereinafter described, and are mounted on shafts 20 which are journaled for rotation in bearings 21 at the sides of the casing. On rotating a roller 17, as, for example, by means of a gear train 22, the material is fed through the casing as indicated by arrows *a*. The material enters the casing 11 at an upper portion thereof at 23, passing over a roller 24, and leaves the casing at the bottom thereof at 25, after passing over a roller 26.

Coacting with the rollers aforementioned are means to stretch the material, while the same is moving through the machine. The said means includes an endless chain 27 at each side of the machine, which chain follows along the dot dash lines 19, coinciding with the several layers of the material. Each chain 27 is guided at the ends of the rollers by any means at 27^a well known in the art, and therefore not shown. Auxiliary rollers 28, 29 and 30 guide the said chains in their travel into and out of the casing 11.

The chains 27 engage the side edge portions of the cloth by means of hooks, or the like, the nature of which is well known. Accordingly, the said chains are effective to stretch the cloth in a widthwise direction. The material is attached to the chains externally of the casing 11. Since the chains move apart from each other up to the points 31, as indicated by the diverging members 27^b, the cloth may be stretched accordingly. Thereafter, the chains retain the cloth taut while it is being dried. At the roller 26, the cloth is automatically disengaged from the chains 27, owing to the diffent paths assumed by each, since the chains follow the roller 28 while the cloth is received by the roller 33.

In order to take care of materials of varying widths, the chains 27 may be set at any desired distance apart from one another, and likewise the rollers 16, 17 may be lengthened or shortened, correspondingly. The first result is accomplished by adjusting the guides 27^a, 27^b, which are actuated by the vertical screw bars 34 and 35, which are disposed within the casing 11 and in proximity to the sides thereof. The said screw bars are set by means of the left-hand, right-hand screws 36, 37 coacting with the respective screw bars. These said screws 36, 37 extend horizontally through the machine, a plurality of these being provided to co-operate with each screw bar. To actuate the screws, certain ends thereof project outside the casing 11, and are provided with gears 38, the teeth of which mesh with worms 39 on the horizontal shafts 40 and 41. These shafts are interconnected by sprockets 42 and chain 43. The shaft 41 extends to the front end of the machine at which it is provided with a sprocket 44. A chain 45 interconnects the latter with a sprocket 46 on a shaft 47.

On the shaft 47 is mounted a pulley 48 connected by a chain 49 to a motor 50. It will be seen, therefore, that the motor is operative to turn the screws 36, 37 to adjust the screw bars 34, 35 for setting the chains 27, according to any width of the cloth which the machine is intended to handle. At the front end of the machine, a left-hand, right-hand screw 51, operated by a hand wheel 52, permits the guides 27^b to be adjusted for a desired spacing.

In order to dry the cloth, preheated air is supplied to the spaces 53, 54 between the layers thereof. The cloth simultaneously travels through the machine so that it is dry when it leaves the same. It will be appreciated, therefore, that the upper layers of cloth contain the most moisture, and that the moisture content decreases constantly toward the lower layers of the cloth.

A centrifugal fan 55, driven by a motor 56, blows air into a duct 57 at the bottom of the casing 11. The said duct is formed by a horizontal wall 58 extending from side to side of the casing 11, and a vertical end wall 59. At the opposite end of the duct, is a curved plate 60 to deflect the air upward through an opening 61 in the plate 58, into a heating unit 62. The latter extends vertically, and in a transverse direction to the layers of cloth, into proximity to the top of the casing 11. While the heating unit may be of any well known construction, it consists preferably of a series of coil 63, through which is passed a heating medium, such, for example, as steam. The coils 63 extend in a horizontal direction, and may be separately controlled by valves (not shown) so that various temperatures may be obtained in different parts of the heating unit. The air is heated by passing up and around the coils 63.

The heating unit 62 may be positioned directly within the casing 11 at the end 14 thereof, being enclosed therein by a vertical wall member 64 extending between the sides 12,

and from the top 15 of the casing to the lower plate 58 thereof.

Formed in the plate 64 in proximity to the sides of the casing, are a plurality of openings 65. These constitute two series that extend in a vertical direction, and may be in alinement with the spaces 54 between the layers of the material that is being dried. The heated air leaves the unit 62 through these openings 65, and the volume thereof may be adjusted by slidable regulators or doors 66. Thus the air is tapped from the heating unit at a plurality of spaced points in its path of travel therethrough so that streams of air are obtained at different temperatures, corresponding with the length of travel of the air through the heating unit, or the period of time spent therein. Obviously, the air stream leaving the top of the unit will be at the highest temperature, the temperatures for the several streams decreasing toward the bottom of the machine.

On leaving the heating unit, the air enters the vertical ducts 67, which are narrow and of comparatively limited cross sectional area. These ducts are formed between the portions 68 of the side walls of the casing 11, and the members 69.

The latter may constitute part of the side plates 70 which are attached to the screw bars 34 and form an auxiliary casing about the layers of material, extending from the top 15 of the main casing to the bottom plate 58 thereof. A plurality of plates 71, 72 having sliding engagement with each other, are secured to the portions 67 of the main casing 11 and to the side walls 70 of the said auxiliary casing, forming walls for the ducts 67.

Formed in the plates 69 are a plurality of vertically spaced openings 73, corresponding in elevation with the several spaces 54 into which they discharge streams of air. Due to the angularity of the plates 69 and consequently of the openings 73 with respect to the spaces 54, the streams of air flow thereinto in the direction of arrows *b* so as to impinge against each other and produce a swirling and eddying flow. This insures a circulation of the air throughout the spaces 54, with a consequent uniform drying of the material. Angular orifices 73ª may also be formed in the plate 64.

To supply air to the spaces 53 between the layers of the material, a plurality of vertical spaced openings 74 are provided in the plates 70. This permits air from the ducts 67 to discharge into the aforesaid spaces in opposing streams, indicated by arrows *c*, which produce an eddying flow of the air through the spaces 53. As a result a uniform and efficient drying of the material is obtained.

Since the air leaving the heating unit flows in a series of comparatively direct paths through the openings 73, 74 into the spaces between the layers, the air streams are so utilized for drying the material that the temperatures of the air streams vary with the moisture content of the material at the several layers thereof.

To permit adjustment of the openings 73 and 74, slidable door members 75, 76 are provided, which may be set to discharge any desired quantity of air into the spaces 53, 54. It is contemplated that volumes of air passed into the spaces 53, 54, vary with the moisture content of the material at the said spaces.

The plates 70 are disposed in proximity to the edges of the layers of material that is being dried, so as to confine the air to the spaces 53, 54 and prevent the air from flowing between the said edges and the walls 12 of the main casing. Being secured to the screw bars 34, as above specified, the plates 70 are movable therewith when the machine is adjusted for a material of a different width. The plates 70 therefore function regardless of the width of the material that is being treated. Likewise the joints at the members 71, 72 are always effective as closures for the ducts 67. Since the members 69 are movable with the plates 70, the air is always discharged at the proper angle therethrough.

The air in the spaces 54 passes therefrom through openings 77 in the plates 70, into the vertical ducts 78, 79, as shown by arrows *d*. The air in the spaces 53, on the other hand, passes into the chamber 80 in the front end of the casing 11, and flows downward therethrough as shown by arrows *e*. The air in the ducts 78, 79 and in the chamber 80 intermingles beneath the lower plate 58 of the machine and enters duct 81 through openings 82 and 83 at both sides of the casing 11, as is clearly indicated by arrows *f* and *g*. The duct 81 conveys the air to a plenum chamber 84, which communicates with the suction side of the fan 55. The air, having a part of its initial pressure is then recirculated by the fan through the machine.

An auxiliary fan 85 exhausts a part of the air in the chamber 80 so that fresh air may be supplied to the machine to retain the circulating air from becoming saturated. The fan 85 exhausts through a plenum chamber 86, and is driven by the motor 50. The drive includes sprockets 87, and 88 on the fan shaft and on the countershaft 47 respectively, these being interconnected by a chain 89. A clutch 90 permits the motor to drive either the fan 85 or to turn the screw 37, as may be desired.

Associated with the machine, is a unit 91 for cooling the cloth after the same leaves the casing 11. The said unit 91 comprises a vertical narrow casing 92 extending across the front end of the casing 11. Disposed in the casing 92 are a plurality of upper and lower rolls 93, 94 over which the cloth is passed on entering the unit through the opening 95 in the wall 13. The said cloth

leaves the unit through an upper opening 96.

Comparatively cool air is circulated through the unit 91, and preferably the circulation referred to is caused by the main fan 55. Thus air enters the said unit through the opening 96, passes downward therethrough as shown by arrows *h*, and thence through opening 95 into the main casing 11. Thus the air exhausted by fan 85 is replaced. At 95ª is shown a plate for baffling the air into a path of flow indicated by arrows *i* so as to cause the same to be passed through the heater 62 before entering the drying chamber.

In the practice of this invention, it is intended that the regulators 66, 75, and 76 be given merely an initial adjustment, after which they may be retained in the position in which they were originally set, without further attention.

To afford access to the said regulators, doors 97 may be provided at the adjacent portions of the sides of the casing. The sliding doors 98 afford entrance to the ducts 78, 79.

Within the scope of the invention, the heating unit may be placed at a side of the machine, and the air circulatory system modified accordingly. This arrangement may possess considerable utility particularly where the length of the machine may be greater, and may comprise, for example, a plurality of tentering and drying units placed end to end. The length of the path of travel of the air, between the layers of material, can, in such a construction, be kept within a predetermined limit for efficient functioning of the machine.

I claim:

1. A device of the character described, including a casing, means therein to support a material in spaced layers, means to move the material through the casing, means to feed air to the layers to dry the material, and means to heat the said air, the air feeding means supplying the air in decreasing volumes to the layers in accordance with the decrease in the moisture content of the layers of material.

2. A device of the character described, including a casing, means therein to support a material in spaced layers, means to move the material through the casing, means to feed air to the layers to dry the material, and means to heat the said air, the air feeding means supplying the air in streams of decreasing velocities to the layers in accordance with the decrease in the moisture content of the layers of material.

3. A tentering and drying machine comprising means to support a material folded in spaced layers, and to feed the material through the machine, said means serving to stretch the material, other means to supply air in streams impinging against one another at an angle to the spaces between the layers to dry the material, the said spaces being substantially unoccupied to receive a maximum volume of air, and means to heat the air to different temperatures for the different layers in accordance with the moisture content of the said layers, for efficient absorption of moisture.

4. A device of the character described, including a tentering and drying machine to stretch and dry a material with heated air, and a unit to cool the material with cool air, said unit passing its air into the machine, said unit directly receiving the material from said machine, and supportng the outgoing material in a plurality of spaced layers.

5. A device of the character described, including a tentering and drying machine to stretch and dry a material with heated air, and a unit to cool the material with cool air, said unit directly receiving the hot, dried material from said machine and supporting the same in a plurality of layers to thoroughly cool the material.

6. A tentering and drying machine comprising means to support a material in a plurality of spaced layers, and to feed the material through the machine, and other means to supply preheated air to the spaces between the layers of material to dry the same, the last mentioned means including a duct extending at a different elevation than the layers, and in parallel relation thereto, a second duct communicating therewith and extending transversely of the layers, said second duct discharging air to the spaces between the layers, a third transverse duct remote from the second duct to receive the air from between the layers and to return the same to the first duct.

7. A tentering and drying machine comprising means to support a material in spaced layers, and to feed the material through the machine, said means serving to stretch the material, means to supply air in streams to the layers to dry the material, and means to heat the air, the means supplying the air including a duct communicating with said heating means, auxiliary means to supply the air from the heating means directly to the spaces between the layers, and another duct extending transversely to the layers remote from the first duct to receive the air from the layers.

8. A tentering and drying machine comprising means to support a material in spaced layers, and to feed the material through the machine, said means serving to stretch the material, other means to supply air to the layers to dry the material, a heating unit to heat the air, and means to cool the material after drying, the means supplying the air including a duct communicating with the heating means and extending transversely to the layers to supply the air to the spaces therebetween, another duct remote from that first

mentioned to receive the air from between the layers, a third duct to return a part of the air from the second duct to the heating means, means to supply air to the material cooling means, and means to conduct air from the cooling means to the heating unit.

9. A tentering and drying machine including means to support a material folded in spaced layers, means to feed the material through the machine, means to stretch the material, means to supply streams of preheated air impinging upon each other in the spaces between the layers to dry the material, and means to confine the air to the said spaces, the last mentioned means being adjustable for materials of varying width, the streams of air being supplied at constantly decreasing temperatures with the decrease in the moisture content of the layers of material.

10. A tentering and drying machine including means to support a material in spaced layers, means to feed the material through the machine, means to stretch the material, and means to supply preheated air to the spaces between the layers to dry the material, the last mentioned means supplying the air in streams decreasing in volume and temperature with the decrease in the moisture content of the material of the adjacent layers.

11. A process of drying a pliable material which includes forming the material into spaced continuous layers, moving the material continuously in layers, and feeding heated air to the spaces between the layers in streams decreasing in velocity with the decrease in the moisture content of the material at the respective layers.

12. A process of drying a pliable material which includes forming the material into spaced continuous layers, moving the material continuously in layers, and feeding heated air to the spaces between the layers at one end thereof in streams decreasing in temperature and volume with the decrease in the moisture content of the material at the respective layers, said streams entering certain of the spaces laterally of the longitudinal direction of the layers, and at both sides of each of the spaces referred to, and entering the alternate spaces longitudinally of the layers.

13. A device of the character described, including a casing, means therein supporting a material folded in spaced layers, means to feed the material through the casing, and means to supply preheated air to the spaces between the layers in streams impinging against one another between the layers to promote a swirling flow of the air.

14. A tentering and drying machine comprising a main casing, means to support a material in a plurality of spaced layers, means to feed the material through said main casing, means to stretch the material, the stretching means being adjustable according to the width of the material, means to supply preheated air to the spaces between the layers to dry the material, and an auxiliary casing to confine the air within said spaces, said auxiliary casing being adjustable according to the width of the material, said auxiliary and main casings co-operating to form a duct therebetween for the flow of the air.

15. A tentering and drying machine comprising a main casing, means to support a material in a plurality of spaced layers, means to feed the material through said main casing, means to stretch the material, the stretching means being adjustable according to the width of the material, means to supply preheated air to the spaces between the layers to dry the material, and an auxiliary casing to confine the air within said spaces, said auxiliary and main casings having an expansible connection with each other forming a duct between the casings for the air.

16. A tentering and drying machine comprising a main casing, means to support a material in a plurality of spaced layers, means to feed the material through said main casing, means to stretch the material, the stretching means being adjustable according to the width of the material, means to supply air to the spaces between the layers to dry the material, a heating unit to heat the air, means to confine the air within said spaces, said heating unit having the air therein traveling in a direction transverse to said layers, said heating unit permitting a flow of air therefrom at a plurality of spaced points in the path of travel of the air corresponding to said spaces, to furnish streams of air of temperatures decreasing with the decrease in the moisture content of the material of the adjacent layers, and a duct into which the streams of air discharge, said duct supplying the air in streams to the spaces between the layers of material, as aforesaid.

17. A device of the character described to receive a hot dry fabric as it leaves a tentering and drying machine, said device having means to support the fabric in a plurality of spaced layers, and including associated means to cause a flow of cool air between the said layers.

18. A device of the character described, including a main casing, means therein to support a material in a plurality of spaced, folded layers, an auxiliary casing to receive the dried material from said main casing, means to supply cool air to said auxiliary casing, heating means, a duct to pass the air from the said auxiliary casing to the heating means, and other means to supply the air from the heating means to the main casing to dry the material, the heating means and the auxiliary casing being positioned respectively adjacent to the ends of the said main casing.

19. A device of the character described,

including a casing, means therein to support a material in spaced layers, means to move the material through the casing, means to feed air to consecutive spaces between the layers to dry the material, and means to heat the said air, the air feeding means supplying the air in decreasing volumes to the spaces between the layers in accordance with the decrease in the moisture content of the said layers, and means to confine the air to said spaces and cause the air in all of said spaces to flow in the same longitudinal direction with respect to the layers.

20. A device of the character described, including a casing, means therein to support a material in spaced layers, means to move the material through the casing, means to feed air to the consecutive spaces between the layers to dry the material, and means to heat the said air, the air feeding means supplying the air in streams of increasing velocities to the layers in accordance with the decrease in the moisture content of the said layers, the air being confined to said spaces and flowing in the same direction in the consecutive spaces.

In testimony whereof I affix my signature.

CHARLES C. KENYON.