

Dec. 8, 1942.

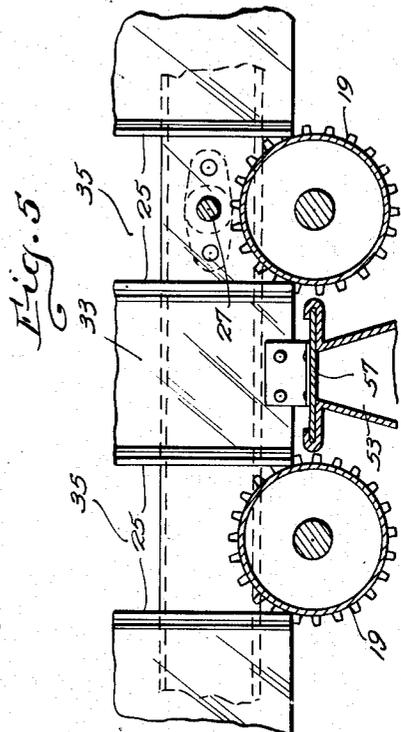
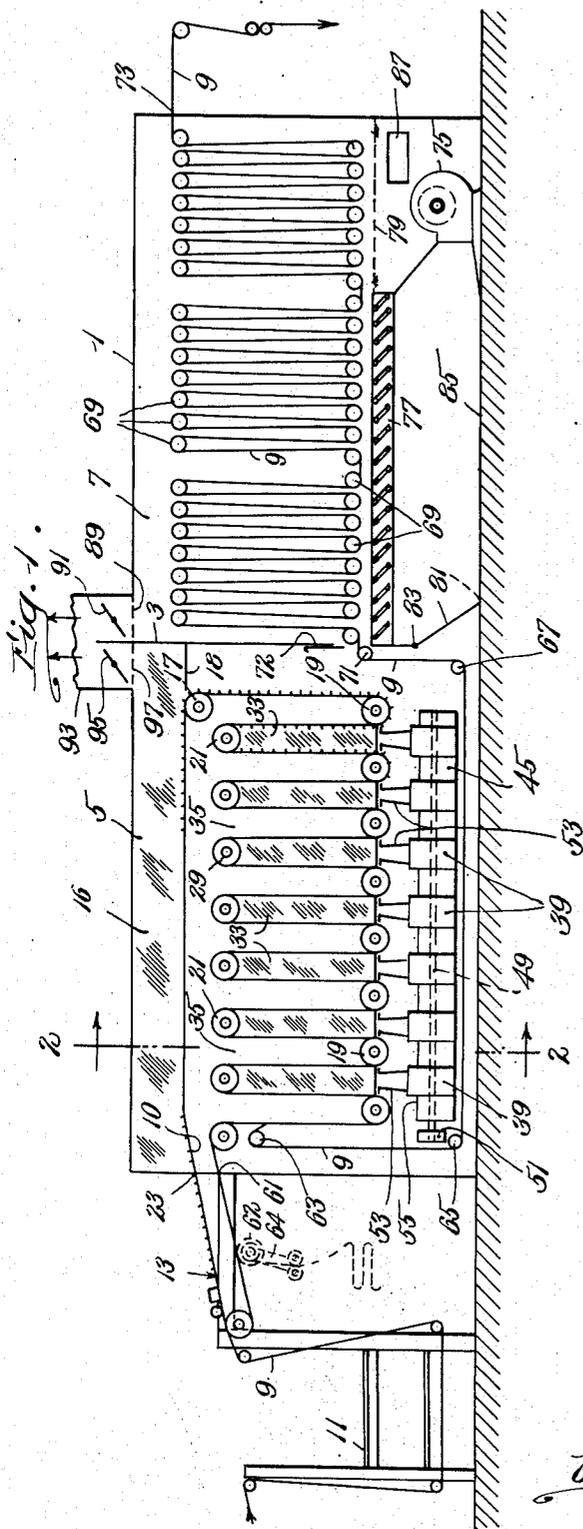
F. B. MORRILL

2,304,506

DRIER

Filed Feb. 16, 1939

3 Sheets-Sheet 1



Inventor.
FRANK B. MORRILL
by Robert K. Randall,
att'y.

Dec. 8, 1942.

F. B. MORRILL

2,304,506

DRIER

Filed Feb. 16, 1939

3 Sheets-Sheet 2

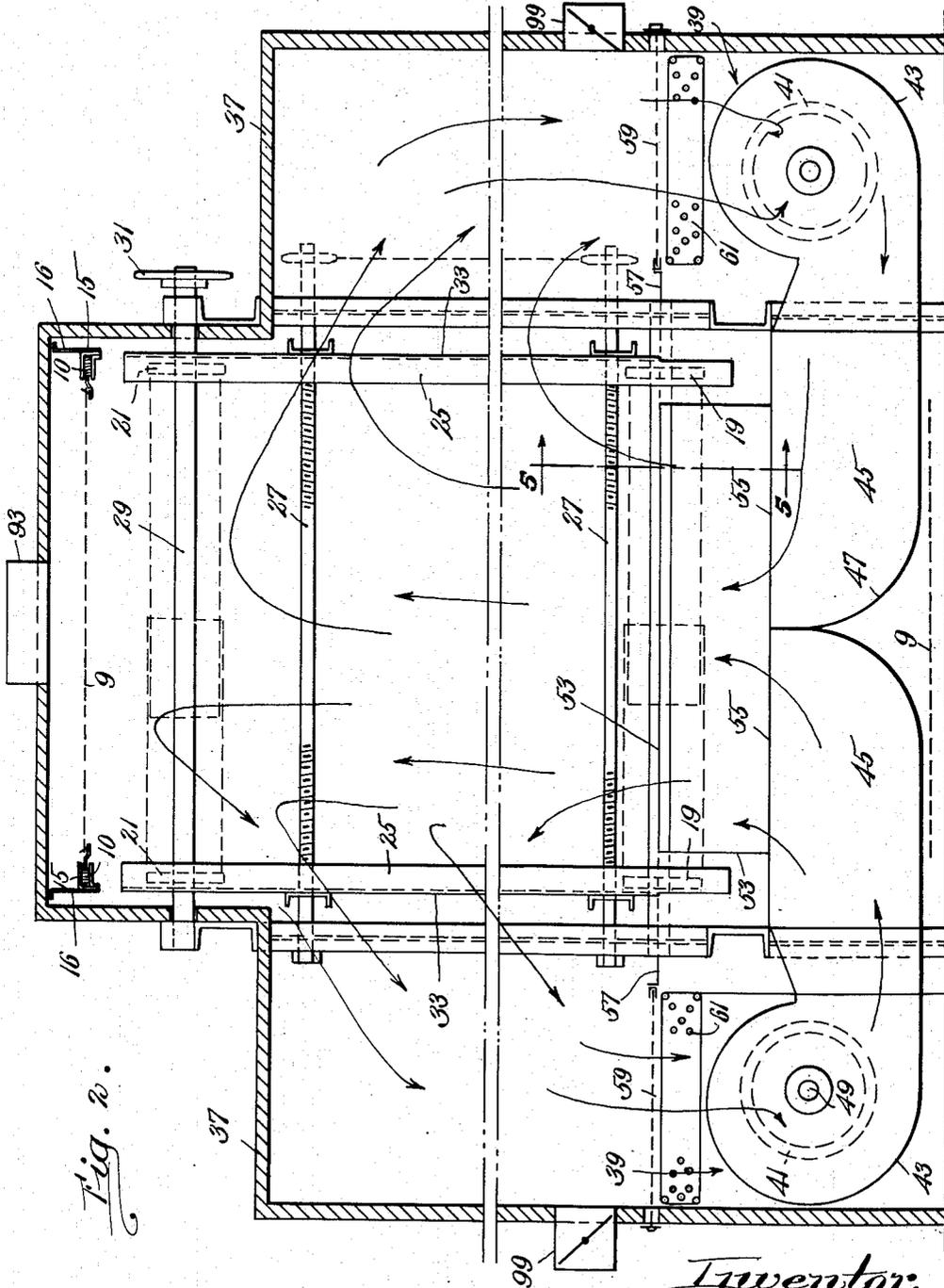


Fig. 20.

Inventor:
FRANK B. MORRILL
by Robert K. Randall,
att'y.

Dec. 8, 1942.

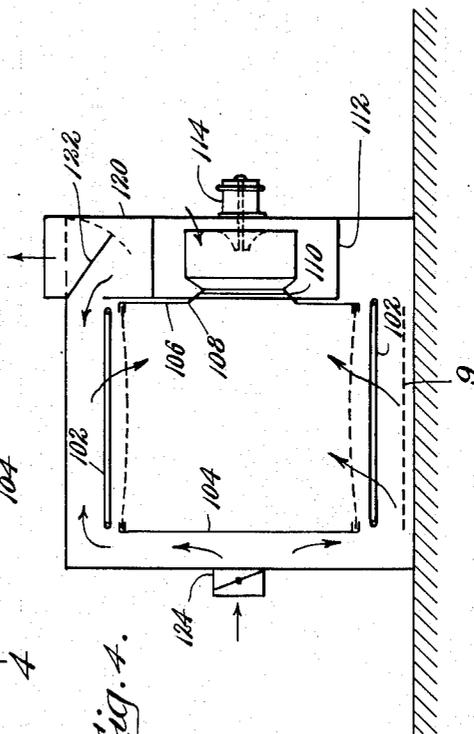
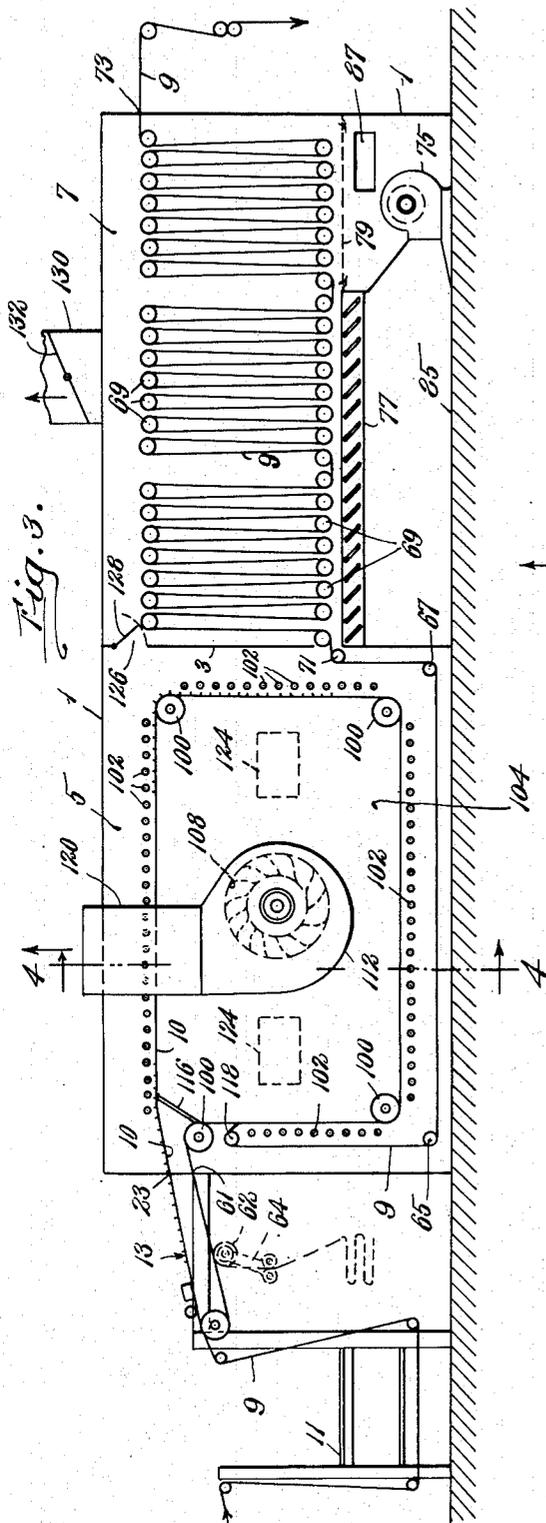
F. B. MORRILL

2,304,506

DRIER

Filed Feb. 16, 1939

3 Sheets-Sheet 3



Inventor.
FRANK B. MORRILL
by Robert K. Randall,
att'y.

UNITED STATES PATENT OFFICE

2,304,506

DRIER

Frank B. Morrill, North Adams, Mass., assignor to
The James Hunter Machine Company, North
Adams, Mass., a corporation of Massachusetts

Application February 16, 1939, Serial No. 256,699

16 Claims. (Cl. 34—82)

This invention relates to driers primarily intended for the drying of woolen, worsted, and other textile fabrics in continuous lengths, and has as its object the provision of novel and improved tentering and drying structures for general use and also having special advantages when combined with a carbonizing drier to operate simultaneously upon a length of fabric.

Tenter driers in which the drying air is caused to travel lengthwise, i. e., warpwise, of the fabric have certain recognized advantages, of which probably the most important is that the drying effect across the width of the fabric can be completely equalized, so that all zones in the width of the material are dried at the same rate and to the same extent, due to the fact that the air can be introduced under equal pressure and volume uniformly across the entire width of the fabric.

Prior warpwise draft tenter driers have customarily disposed the fabric in horizontal runs, because the alternative arrangement of the fabric in vertical passes has involved the necessity of solving a number of rather troublesome problems avoided when the fabric is arranged in horizontal runs. But a serious drawback of the warpwise draft horizontal type drier from the commercial viewpoint and as met with under actual conditions of use in the mills is that once built and installed the capacity of the horizontal pass warpwise draft tenter drier does not admit of being increased to fit the needs of expanded production in the mill, which is a factor necessary to be considered by the mills in buying equipment. This is because space limitations in the mill and structural limitations in the framework of the machine nearly always forbid any increase in the height of the machine subsequent to its original set-up; while extension in the logical direction of the length of the machine is not possible because the useful length of the runs of the fabric is limited by the amount of air which can be economically introduced into the original spacing of the runs chosen in designing the machine. That is, while the space between runs into which air can be introduced to blow warpwise of the runs is fixed, the attempt to increase the length of the runs in the effort to give added production introduces more leaks and more friction as well as more free area of cloth to be treated by the blast, and consequently the same pressure cannot be built up throughout the increased lengths of runs to force the air through the cloth and thus maintain the same proportionate rate of drying or efficiency as in the machine in its original form, without involving excessive friction losses and prohibitive power consumption in attempting to use larger volumes of air. So the waste of power incident to the introduction of higher velocities of air through

the same available apertures soon passes the useful point.

The vertical pass arrangement, however, admits of lengthwise extension of an existing machine of this type to any desired degree or capacity, because the nature of the arrangement permits as many additional pairs of up-and-down passes to be added to the length of the machine as may be desired. However, the problem is to devise such a structure convenient and useful enough for commercial use while avoiding the creation of drawbacks outweighing the advantages gained. To have practical value, the cloth must be capable of being applied to the tenter chains on the spreading wings at a point where the tenter pins point upward; likewise, the tenter pins must point inward into the intervals between adjacent runs into which the drying air is injected, as otherwise the volume of air is seriously limited by the risk of blowing the fabric off of the pins. Additionally, the air should be re-circulated for economy of heat, and should be kept in contact with the fabric throughout as much of the re-circulation path as possible, and the paths of re-circulation should be short for economy of power, and thus the blowers should be numerous and distributed throughout the length of the machine. For proper servicing, these blowers and their appurtenant driving means and air guiding means should be at or near floor level for accessibility; thus placed, the structure of the machine is simplified, and vibration incident to the use of high-speed fans minimized.

To meet these requirements, the invention employs the tenter chains in standard manner on the spreading wings, and thereafter disposes the chains so as to carry the cloth lengthwise of the machine in a horizontal run extending clear to the far end of the housing and near the top wall thereof. Thereafter, by carrying the chains vertically downward to a point well down toward the bottom of the housing, they can be disposed in substantially vertical runs forming a series extending back to the front of the machine so that they will cause the fabric carried by them to be arranged in a series of substantially vertical passes while maintaining the tenter pins in inwardly pointing relation with respect to the downwardly-opening intervals defined by each pair of adjacent reversely-traveling runs of the fabric which come together at the top of the machine. This makes it possible to introduce into these downwardly-opening intervals an unlimited volume of air directed upwardly under any desired pressure, without danger of blowing the fabric off from the tenter pins. It further permits the use of baffles to fill the area at each side of the machine which lies between the adjacent chain tracks carrying the fabric defining

these intervals, so that all drying air blown into the open bottom of the space thus enclosed by the opposing runs of fabric and the baffles, which space may be termed a pressure chamber, is forced to pass through the fabric. By this arrangement also, the blowers and their driving means and the air guiding means can be placed at floor level, or at least below the level of the bottom ends of the runs of fabric and at close range thereto, and can even be included within the width of the fabric if desired for economy of floor space. Further, lateral extensions of the housing are provided so that air returning downwardly between the runs of fabric to the blowers located below the level of the bottom runs via the spaces between the runs of the fabric which are not baffled off laterally as just described, and which may be termed the suction chambers, can get around the ends of the rolls closing these alternate spaces at their bottom and into the blowers, thus providing for free and copious air movement through and over the entire surface of the fabric disposed in vertical runs while keeping down the expenditure of power required to run the blowers. Also, the air from the blowers is introduced into the pressure chambers from two series of blowers located respectively at each side of the machine, and directed into the pressure chambers through long narrow nozzles each centrally aligned with respect to the center line of the open bottom end of a pressure chamber. Each nozzle is fed throughout half its extent across the machine by a blower at one side of the machine, and throughout the other half of its extent by a blower at the other side, so that the blast of air forced into the pressure chamber is symmetrical and equalized throughout the entire width of the fabric, giving equal drying across such width and avoiding shading; sliding closure means is carried by the movable chain tracks, so that the extent of the nozzles across the machine is limited to substantially the width of the fabric being handled, avoiding waste of the air-blasts. An additional feature of the arrangement is that the air wasted from the housing is passed through the horizontal entering run of the fabric to impart its heat to the cold material, thus effecting economy by extracting substantially all useful heat from the wasted air.

With the reversely-traveling runs of the tenter chain in vertical relation instead of the customary horizontal disposition, the escape of the margins of the fabric from the tenter pins does not cause it to sag down onto the pins of a reversely-traveling chain immediately below, to be torn or otherwise injured by engagement with such pins, as often happens in prior machines.

The invention includes as a further feature provision for delivering the stretched and dried fabric from the tenter drier at the opposite end of the housing from which it enters, while keeping it on the tenter chains throughout substantially the full length thereof that is within the drier. By this provision, which is not limited in its utility to vertical-pass tenter driers, the tenter drier is specially adapted to be combined in a unitary structure with a carbonizing drier. By this arrangement, the fabric is passed directly into the carbonizing drier at high temperature without leaving the housing and thus without losing any of its heat or dryness through exposure to the outside air, with corresponding economy of operation; and also economy in cost of construction is attained, because one end wall of the housing of the otherwise separate indi-

vidual machines is done away with, with the corresponding avoidance of the problem of preventing heat losses through such walls, a simple baffle forming the common wall between the two combined parts and requiring no heat insulation except where the tenter drier section is to be used extensively alone. Likewise, this arrangement makes for substantial operating economies under certain specialized conditions, as heated air which must be wasted from the carbonizing section of the drier can be introduced into the tenter drier section, to aid in raising the temperature therein to the lower working degree at which this section operates.

Arrangement is made for controlling and cutting off the transfer of air from the carbonizing section to the tenter drier section, and for leading the cloth out of the tenter drier otherwise than through passing it into the carbonizing drier, as referred to later.

The drier of the invention is intended to take the place of the separate tentering and carbonizing driers which must form parts of the equipment of every finishing plant, while offering superior and increased production and other economies over the separate units. But since there are occasions when fabrics require to be stretched and dried without necessarily being carbonized, the tenter drier is arranged to be used independently of the carbonizing drier if desired, the fabric simply being allowed to remain on the chains until the latter emerge from the housing, and being stripped off therefrom outside the housing at the feed end of the machine instead of being led directly into the carbonizer without emerging into the outside air.

Other features and aims of the invention, and the manner of their attainment are as made plain hereinafter.

Illustrative embodiments of the invention are shown in the accompanying drawings, in which—

Fig. 1 is a diagrammatic side elevation of the tenter drier of the invention shown as combined with a carbonizing drier, with the insulated housing partly removed.

Fig. 2 is a somewhat more complete elevation corresponding to a transverse section on line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic side elevation corresponding to Fig. 1 showing a modified form.

Fig. 4 is a vertical transverse section on line 4—4 of Fig. 3.

Fig. 5 is a vertical section taken on line 5—5 of Fig. 2.

In the form shown in Figs. 1 and 2, the housing 1 is of generally rectangular shape, air-tight and heat-insulated as usual. It is divided at substantially midlength by a vertical partition 3 into two separate chambers, 5 forming the tenter drier and 7 forming the carbonizing drier. The fabric 9 is guided under the operator's platform 11 and through an automatic edge-guide and impaled on the pins of the paired opposed tenter chains 10 at the wings 13 by which the chains are brought outside the housing, all in customary or in any preferred manner. On entering the housing, the chains and the fabric borne thereby first traverse the full length of the tenter-chamber 5 in horizontal relation by way of horizontal tracks 15, Fig. 2, thence pass downward around sprockets 17 and a telescoping roll extending from one sprocket to the other, and thereafter alternately around paired low sprockets 19 and intervening rolls and high sprockets 21 and intervening rolls, so that the chains and the fabric are disposed in a series

of alternately reversely-traveling vertical runs reaching back nearly to the front of the machine through which the chains and fabric entered the housing at 23. The chains are guided in tracks 25, Fig. 2, in traveling from the low sprockets 19 to high sprockets 21 and reversely, these tracks and tracks 15 being mounted on the usual movable side-frames which are engaged with the usual screws 27 geared together by chains and sprockets and shiftable inwardly or out in order to fit the spaced relation of the opposed tracks to the desired width of the fabric. Each pair of high sprockets 21, fixed on a common shaft 29, is driven by a sprocket 31, all sprockets 31 being linked together by chains and driven in unison in customary manner through a variable speed transmission from an electric motor, these devices being standard equipment and not requiring to be shown.

The spaces at each side of the machine between the pairs of chain tracks which guide the chains successively to and from each high sprocket 21 are closed by baffles 33, which are shaded in Fig. 1 to indicate their presence and extent. The alternate spaces 35 between the chain tracks are left open.

Along each side of the tenter drier section 5 are lateral extensions or air-trunks 37 extending from floor level nearly to the level of the high sprockets 21. At the bottom of these trunks are located the air-propelling and re-circulating devices which here comprise a series of centrifugal blowers 39 at each side of the machine, each consisting of a rotor 41 within a housing 43 discharging into a plenum chamber 45 common to all the blowers at one side of the machine and extending halfway across the width of the machine, terminating in a curved deflecting wall 47 diverting the horizontal blast upwardly toward the fabric. The rotors 41 of each series of fans are all mounted on a common shaft 49, driven by a pulley 51 from a suitable source of power.

Nozzles 53 extend across the otherwise closed tops 55 of the plenum chambers 45 to discharge air from such chambers solely into the pressure chambers defined by the baffles 33 and the associated upwardly-looping paired runs of the fabric. For this purpose, the center line of each transverse nozzle is located in the vertical transverse plane of the center line of each pressure chamber, and each nozzle has a blower 39 at each side of the machine located in the center-line of the nozzle; also, each movable side with its chain tracks 15, 25 and baffles 33 carries a sliding cover 57 which slides on the outwardly-bent horizontal flanges at the tops of the long side walls and over the tops of the end-walls of each nozzle, such sliding cover being fixed to its movable side so that when the sides are moved inward toward each other to accommodate fabric of less than maximum width the unneeded end portions of nozzles 53 will be closed and the length of the discharge aperture at the upper end of the nozzle shortened to fit the width of the fabric. These horizontal flanges at the tops of nozzles 53 also serve to close the excess width of the entrance to the pressure chambers over and above the portion of such width that is occupied by the apertures themselves of the nozzles, the edges of the flanges approaching closely to the rolls around which the cloth reverses its direction of travel and thus permitting the use of relatively long, narrow apertures in the mouths of the nozzles capable of emitting air at relatively high speed, and at the same time making it possible to build up a pressure within the

pressure chamber sufficient to force the air copiously through the fabric. The particular disposition of the chains makes the tenter-pins point inwardly into these pressure chambers, so that the force of the air-blast has no tendency to blow the cloth off from the pins.

From the foregoing construction it will be seen that barring unavoidable leaks all air propelled by the blowers is compelled to pass through the fabric, which aids greatly in attaining thorough and rapid drying. After doing so, this air is drawn downwardly between the runs of fabric and over the surface of the latter through the spaces 35 alternating with the baffled-off pressure chambers and outwardly in both transverse directions around the ends of the bottom rolls into the empty upper portions of trunks 37, whence it descends through horizontal screens 59 and horizontally disposed heaters 61 to enter the axial intakes of the several blowers 39 to be again re-circulated through the course thus described. A certain amount of hot air reaches the vertical runs at the two ends of the machine, so that these portions of the fabric likewise partake of the drying effect.

Baffles 16 running the length of the housing extend upwardly from horizontal chain-tracks 15 to the top of the housing, being mounted on the tracks and moving in and out therewith as the width of the machine is varied. Another baffle 18 closes the space between the far end of the initial horizontal run of the fabric along tracks 15 and the adjacent end of the housing, so that all air wasted from the tenter drier through exhaust-stack 93 is compelled to pass through the cold wet material and surrender thereto substantially all its useful heat, thus preheating the fabric.

The fabric 9 remains on the tenter chains 10 until it has substantially reached the point of emergence 61 of the chains from the housing, and then is stripped off from the chains through being passed around a small roll 63, thence downwardly and around roll 65 to travel the full length of the tenter chamber 5, entirely sheltered from the blast of the blowers beneath the plenum chambers 45, around roll 67 upwardly again to the level of the bottom rolls 69 of the carbonizing chamber 7, thence around roll 71 and through a passage formed for it in the partition 3, and thus enters the carbonizer 7, through which it is carried in substantially vertical reversely-traveling successive runs until it emerges therefrom at 73. When it is not to be put through the carbonizer, it is left on the chains to emerge therewith from the housing at 61, to be stripped off over roll 62 through folder 64 in customary manner, sliding damper 72 being closed to shut the cloth-passage through partition 3.

The carbonizing drier 7 is of standard or any preferred construction, occasional ones of the rolls 69 being driven to propel the fabric therethrough. Air is circulated up through the open spaces between the runs in the first two-thirds of its length adjoining the tenter drier by means of a plurality of blowers 75 on a common shaft disposed transversely across the width of the machine, such blowers propelling the air upwardly through heating coils 77. After passing through or around the runs of cloth in the said portion, the air is drawn downwardly in the terminal portion through a screen 79 and again passes through the blower to be re-circulated over the course defined.

To control the transfer of heated air between

the tentering chamber and the carbonizing chamber a swinging baffle 81 pivoted at 83 to the bottom of partition 3 is provided across the space below the foot of such partition. In its closed position shown, it serves to deflect upwardly the entire amount of the blast of air reaching this point from blowers 75; but when raised partway from the floor 83 of the carbonizer it allows the desired amount of air from the carbonizer to pass into the tentering chamber adjacent the intakes of the nearest blowers 39 therein, thereby to be re-circulated within the tentering chamber. Make-up air is admitted into the carbonizer through damper-controlled fresh-air port 87. Provision of an independent waste-air port 89 controlled by damper 91 in an exhaust-stack 93 common to both compartments 5 and 7 of the drier and coupled to a suction fan (not shown) makes it possible to waste air from the carbonizer without putting it through the tenter drier if desired. Also, a damper 95 in connection with waste-air port 97 of the tentering chamber provides control of the wastage of air therefrom. Fresh air ports for the tentering chamber are provided at 99 in the sides of the air-trunks 37, controlled by suitable dampers.

In the alternative form of Figs. 3 and 4 is shown in combination with the carbonizing drier an arrangement of the tentering and drying section of the machine which is more simply and less expensively constructed and maintained, and which is suitable for use under various conditions, as where material presenting less difficulty in drying than in the case of the first form is to be operated on. In this form, the tenter chains 10 within the tentering compartment 5 are led by sprockets 100 and appropriate intervening chain tracks in a nearly completely closed rectangular path, or loop, following the walls of the tentering chamber 5. Heating coils 102 are disposed transversely of the material just outside the loop, and parallel to the sides thereof. Baffles 104, 106, at each side of the machine disposed vertically lengthwise of the tentering chamber extend to the chain tracks at top and bottom and at each end and thus close both lateral ends of the loop. Baffle 104 is without holes or passages, but baffle 106 has a central aperture 108, registering with and connected to the intake 110 of a centrifugal blower 112 mounted on the main supports of one side wall of the tentering chamber and driven by motor 114. One or both of the sides carrying the baffles and associated chain tracks are movable in adjusting the width of the machine to the fabric. A baffle 116 substantially closes the portion of the loop left incomplete by the fabric in its circuit thereabout.

By this construction, fabric 9 put onto the chains as in the case of the other form by means of the wings 13 and associated automatic guiding devices enters the housing at 23, travels horizontally along the top portion of the tentering compartment, thence vertically down parallel to the partition 3, thence reversely along the floor of the compartment, and finally upwardly to be stripped off from the tenter chains by being carried over roll 118 and thence downwardly, horizontally, and upwardly to pass through partition 3 and enter the carbonizing drier over roll 71 as in the form of Fig. 1. The horizontal run unsupported by tenter chains is located at the bottom of the housing where the air-currents outside the loop are least troublesome. As before, if the tenter drier is to be used alone, the

fabric will be carried out through the exit slot 61 with the chains, to be stripped off over roll 62 and delivered by the folder 64 outside the machine.

The blower 112 exhausts the air in copious quantities from the interior of the loop, and because the latter is closed on four sides by the fabric and on the remaining two sides by the baffles creates a decided reduction of the air-pressure therein below atmospheric pressure, thereby expediting the evolution of water vapor from the fabric and effecting rapid drying. The air withdrawn is discharged upwardly through an exhaust-stack at 120, in which is a swinging baffle 122 adjustable from outside the machine and which in its vertical position causes all air withdrawn from inside the loop to be discharged outside the housing, and in its horizontal position causes all air withdrawn from the loop to be discharged over and around the outside of the loop, but keeping it wholly within the housing, and in its intermediate positions optionally determines the ratio of air discharged from the housing to that re-circulated within. Such air as is not vented to the outside via the top of stack 120 is of course compelled to pass inwardly through the fabric at some point in the four sides of the loop, after first passing through the heating coils 102 and being re-heated thereby. These coils also act on the fabric by direct radiation, being able to be located in very close proximity to the fabric forming the loop without danger of contact therewith, as the inward course of the draft at all points in the circuit of the loop pulls the cloth radially inward and thus safely away from the coils. Direct radiation also heats the cloth from the time it leaves the chains clear to the point where it enters the carbonizing drier at roll 71, thus insuring its delivery hot and dry to the carbonizer.

Fresh-air inlet ports 124 are provided in the side of the housing that is remote from the fan, and are equipped with adjustable baffles. As in the case of the form of Fig. 1, however, when both chambers are in use some of the air used to replenish that which is wasted up the exhaust-stack 120 can be taken from the carbonizing drier, being brought through the top of partition 3 via the passage 126, and the amount of this transfer is controlled by an adjustable baffle 128 operated in conjunction with the baffle 122 in the exhaust-stack 120. An additional independent waste-air exhaust-stack 130, controlled by adjustable damper 132, is provided on top of the carbonizing chamber at mid-length thereof, and a damper-controlled fresh-air inlet-port 87 is also provided in the carbonizing chamber. In this form, proper manipulation of the blowers, the inlet and exhaust ports, and the intervening baffle 128 makes it possible to transfer air either from the carbonizing chamber to the tentering chamber as described, or reversely from the tentering chamber to the carbonizing chamber. The carbonizing chamber is cut off from the tentering chamber as in the case of Fig. 1, when only the tentering chamber is in use.

As in the case of the vertical-pass tenter drier of Figs. 1 and 2, the tenter drier of this embodiment also admits of being readily extended lengthwise at moderate expense to give increased capacity and production without lessening of its efficiency through air-friction and leakage troubles.

All remaining parts of the combination unit

of Figs. 3 and 4 are or may be as described in connection with the form of Figs. 1 and 2, except where specifically stated to be otherwise.

While I have illustrated and described certain forms in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular forms shown, or to the details of construction thereof, but what I do claim is:

1. A drier for fabric having in combination a housing opposed tender chains bearing tenter-pins stretching the fabric widthwise, means guiding the chains outside the housing, means guiding the entering run of each chain in a substantially straight line from end to end of the housing, means disposing the chains in substantially vertical runs below such entering runs, air-propelling devices including fans and ducts at the bottoms of the runs delivering blasts of air solely into the downwardly-opening intervals between adjacent runs of fabric borne by the vertical chain-runs, and baffles within and spaced from the housing walls closing the lateral ends of such intervals.

2. A drier for fabrics having in combination a housing, opposed tenter chains stretching the fabric widthwise, means guiding the chains in substantially vertical paths so as to dispose the fabric in successive upwardly and downwardly traveling runs extending transversely of the housing, means introducing air under pressure into the downwardly-opening intervals between successive runs of fabric, and means within the housing walls preventing free escape of the air laterally out from between the runs of fabric defining such intervals while permitting free lateral egress of air from the upwardly-opening intervals between runs of fabric.

3. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, tenter chains carrying the fabric through the housing in widthwise-stretched relation in a succession of oppositely-traveling substantially vertical runs, means guiding the chains having capacity for movement widthwise of the fabric, baffles on the latter movable guiding means closing the lateral ends of the downwardly-opening intervals between successive runs, and air-impelling and directing means introducing air upwardly under pressure into the open bottom ends of these intervals.

4. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, tenter chains carrying the fabric through the housing in widthwise-stretched relation in a succession of oppositely-traveling substantially vertical runs, means guiding the chains having capacity for movement within the housing widthwise of the fabric, baffles on the latter movable guiding means substantially closing the lateral ends of the downwardly-opening intervals between successive runs, and air-impelling and directing means introducing air upwardly under pressure into the open bottom ends of these intervals and withdrawing air from the upwardly-opening intervals to force such air through the fabric.

5. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains carrying the fabric through the housing in widthwise-stretched relation in a succession of reversely-traveling adjacent sub-

stantially vertical runs, air-propelling and directing means within the housing sending air upwardly into the downwardly-opening intervals between adjacent runs of fabric, and means closing the lateral ends of such intervals at the selvage edges of the fabric runs defining such intervals, while leaving the lateral ends of the alternate upwardly-opening intervals in communication with the intake of the air-propelling means.

6. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains carrying the fabric through the housing in stretched relation in a succession of reversely-traveling adjacent substantially vertical runs, baffles within the housing walls substantially closing the lateral ends of downwardly-opening intervals between adjacent runs, air-propelling and directing means introducing air under pressure into the open bottom ends of such intervals, and passages conducting the air, thus forced through the fabric and emerging laterally from the upwardly-opening intervals past the selvage edges of the fabric, back to the intake of the air-propelling means for recirculation.

7. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains stretching the fabric widthwise, means guiding the chains in substantially vertical paths so as to dispose the fabric in successive upwardly and downwardly traveling runs extending transversely of the housing, air-circulating means including fans and nozzles for introducing air under pressure into the downwardly-opening intervals between successive runs of fabric, means spaced inwardly from the housing walls preventing free escape of the air laterally out from between the runs of fabric defining such intervals whereby the air is compelled to pass through the fabric, and means guiding the propelled air downwardly in the upwardly-opening intervals and back to the fans for recirculation.

8. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains disposing the fabric in widthwise-stretched relation in a series of vertical runs, air-chests outside the width of the fabric runs extending at right angles to the vertical runs at each side thereof, a series of blowers in each air-chest, distributed along the chests, blowing inward from opposite sides of the housing and withdrawing air via the air-chests outwardly and downwardly from the upwardly-opening intervals between the vertical runs of fabric, means directing the inward oppositely-directed blasts from the blowers upwardly into the downwardly-opening intervals between the runs of fabric, and baffles substantially closing the ends of the latter intervals adjacent the sides of the housing to compel the air directed into such intervals to pass through the fabric before entering the upwardly-facing intervals.

9. A drier for fabric having in combination a housing, fresh air inlets and moist air outlets, opposed tenter chains stretching the fabric widthwise, means guiding the chains in substantially vertical paths so as to dispose the fabric in successive upwardly and downwardly traveling runs, air circulating means including fans and nozzles for introducing air under pressure in a vertical direction into the alternate intervals between successive runs of fabric, means within the housing walls and spaced therefrom prevent-

ing free escape of the air laterally out from such intervals, and means guiding this air in a mainly opposite direction in the intermediate intervals and back to the fans for recirculation.

10. A drier for fabric having in combination a housing, fresh air inlets and moist air outlets, tenter chains carrying the fabric through the housing in widthwise-stretched relation in a succession of oppositely-traveling substantially vertical runs, means guiding the chains having capacity for movement within the housing widthwise of the fabric, baffles on the latter movable guiding means substantially closing the lateral ends of the downwardly-opening intervals between successive runs, and air-impelling means including nozzles introducing air upwardly under pressure into the open bottom ends of these intervals and withdrawing air from the upwardly-opening intervals to force such air through the fabric.

11. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains stretching the fabric widthwise, means guiding the chains in substantially vertical paths so as to dispose the fabric in successive upwardly and downwardly traveling runs, devices adjusting the spacing of the chains toward and away from each other widthwise of the fabric, air circulating means including fans and nozzles for introducing air under pressure in a vertical direction into the alternate intervals between successive runs of fabric, and means connected to said adjusting devices varying the effective extent of the openings through the nozzles to suit the said spacing of the chains.

12. A drier for fabric having in combination a housing, fresh-air inlets and moist-air outlets, opposed tenter chains stretching the fabric widthwise, relatively movable chain tracks permitting adjustment of the spacing of the opposed chains widthwise of the fabric, such tracks guiding the chains in substantially vertical paths so as to dispose the fabric in successive upwardly and downwardly traveling runs, air circulating means including nozzles extending widthwise of the fabric for discharging air under pressure in a vertical direction into the alternate intervals between successive runs of fabric, and fans supplying air to the nozzles, and sliding closure means carried by the movable chain tracks limiting the extent of the nozzle apertures to substantially the width of the fabric being dried.

13. A drier for fabric having in combination a casing, tenter chains carrying the fabric there-through, tracks and sprockets and rollers guiding the chains and the fabric in a plurality of vertical passes defining vertical channels spaced from the casing walls and open alternately at top and bottom and of which the side walls are formed by the vertical passes of the fabric, plates closing the lateral ends of the downwardly-opening alternate channels, the lateral ends of the intermediate channels being open, a plenum chamber within the casing, nozzles leading from said chamber into the downwardly-opening channels which are closed at their lateral ends by said plates, heating means in the casing, and means for forcing heated air from the plenum chamber through the nozzles into such channels and longitudinally along the fabric forming the side walls thereof, thence through these side walls into the inter-

mediate channels, and thence over the surface of the fabric laterally to the open lateral ends of the channels and through the spaces between the channels and the casing walls to re-enter the air forcing means.

14. A drier for fabric having in combination a casing, tenter chains and tracks and sprockets and rollers cooperating to carry the fabric through the casing in a plurality of vertical passes providing vertical channels whose side walls are formed by the vertical passes of the fabric, and which channels are spaced from the casing walls and open alternately at top and bottom, plates closing the lateral ends of the downwardly-opening alternate channels only, a plenum chamber, heating means within the casing, cover plates covering the top of the plenum chamber and including inclined portions co-acting to define nozzles leading into the bottom ends of the said alternate channels, means carried by said portions to close the ends of the nozzles, and means for feeding air heated by said heating means into the plenum chamber under pressure and through said nozzles into the said alternate channels to pass through the fabric forming the side walls thereof into the intermediate channels, and for returning such air through the open lateral ends of the intermediate channels and the spaces between such channels and the housing walls back to the air-feeding means.

15. A drier for fabric having in combination a casing, opposed tenter chains having tenter pins upon which the edges of the web are impaled, tracks and sprockets guiding the tenter chains in a plurality of vertical passes whereby the successive vertical passes of the fabric carried by the tenter chains define channels of which the side walls are formed by the fabric, plates closing the lateral ends of the downwardly-opening alternate channels, the lateral ends of the intermediate channels being open, rollers closing the bottoms of the latter channels, and means for forcing air under pressure into the said alternate channels to pass through the fabric forming the side walls thereof to dry the fabric, the pressure of the air also holding the side edges of the fabric onto the tenter pins and against the tenter chains.

16. A drier for fabric having in combination a casing, tenter chains propelling the fabric, tracks and sprockets and rollers cooperating to guide the tenter chains and the fabric in a plurality of vertical passes making vertical channels whose side walls are formed by the vertical passes of the fabric, which channels are spaced from the casing walls and open alternately at top and bottom, plates closing the lateral ends of the alternate channels which are open at the bottom, the lateral ends of the intermediate channels being open, a plenum chamber within the casing, nozzles leading from said chamber into said alternate channels, heating means in the casing, means for forcing heated air from the plenum chamber through the nozzles into such channels, through the fabric forming the side walls thereof into the intermediate channels, out through the open lateral ends thereof and thence through the spaces between the channels and casing walls back to the air forcing means, and screens in said spaces through which screens the air passes on its way back to the air forcing means.

FRANK B. MORRILL.