

Dec. 4, 1945.

F. B. MORRILL

2,390,451

TENTER DRIER

Filed June 27, 1942

5 Sheets-Sheet 1

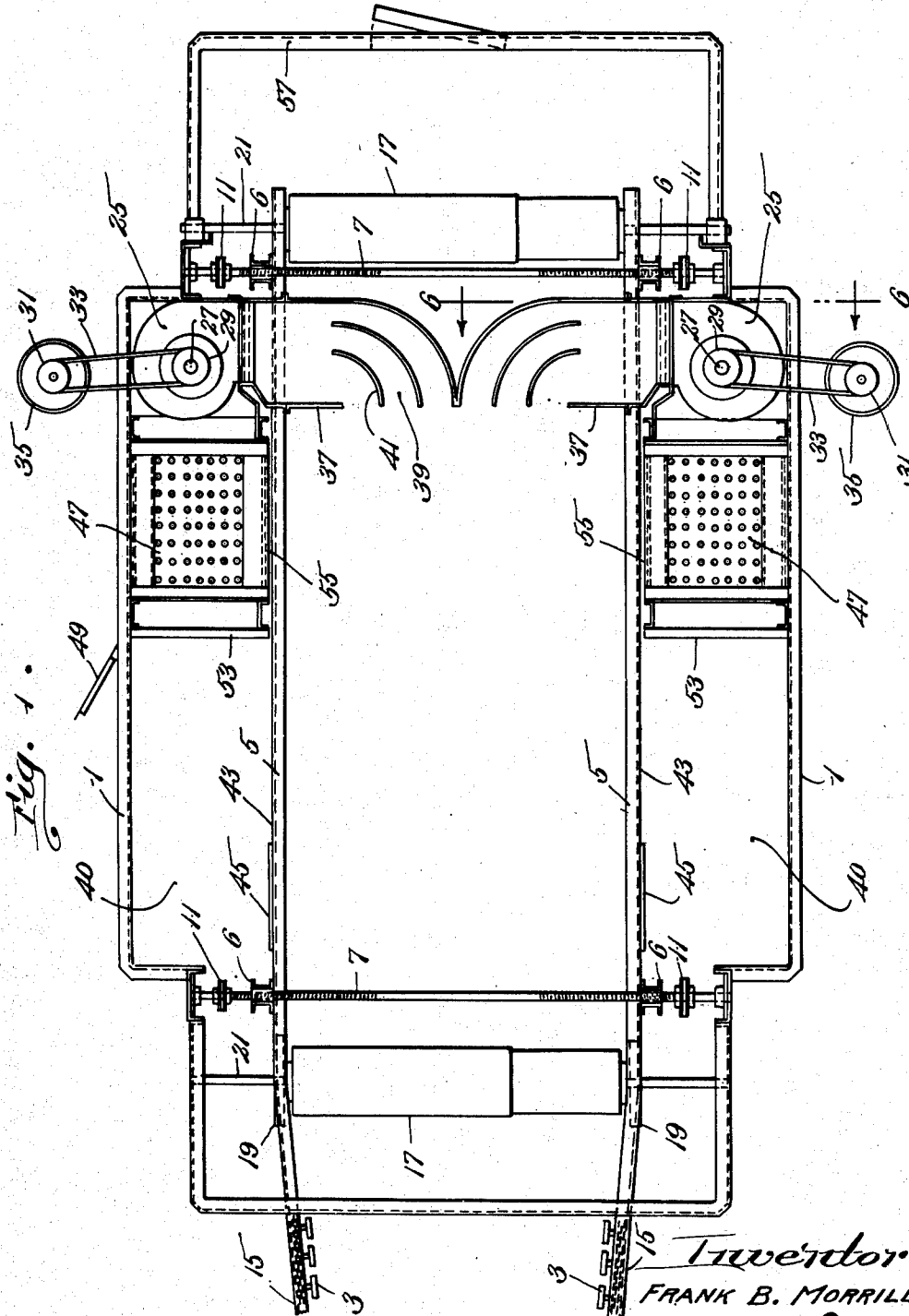


Fig. 1.

Inventor.
FRANK B. MORRILL
by Robert K. Randell
att'y.

Dec. 4, 1945.

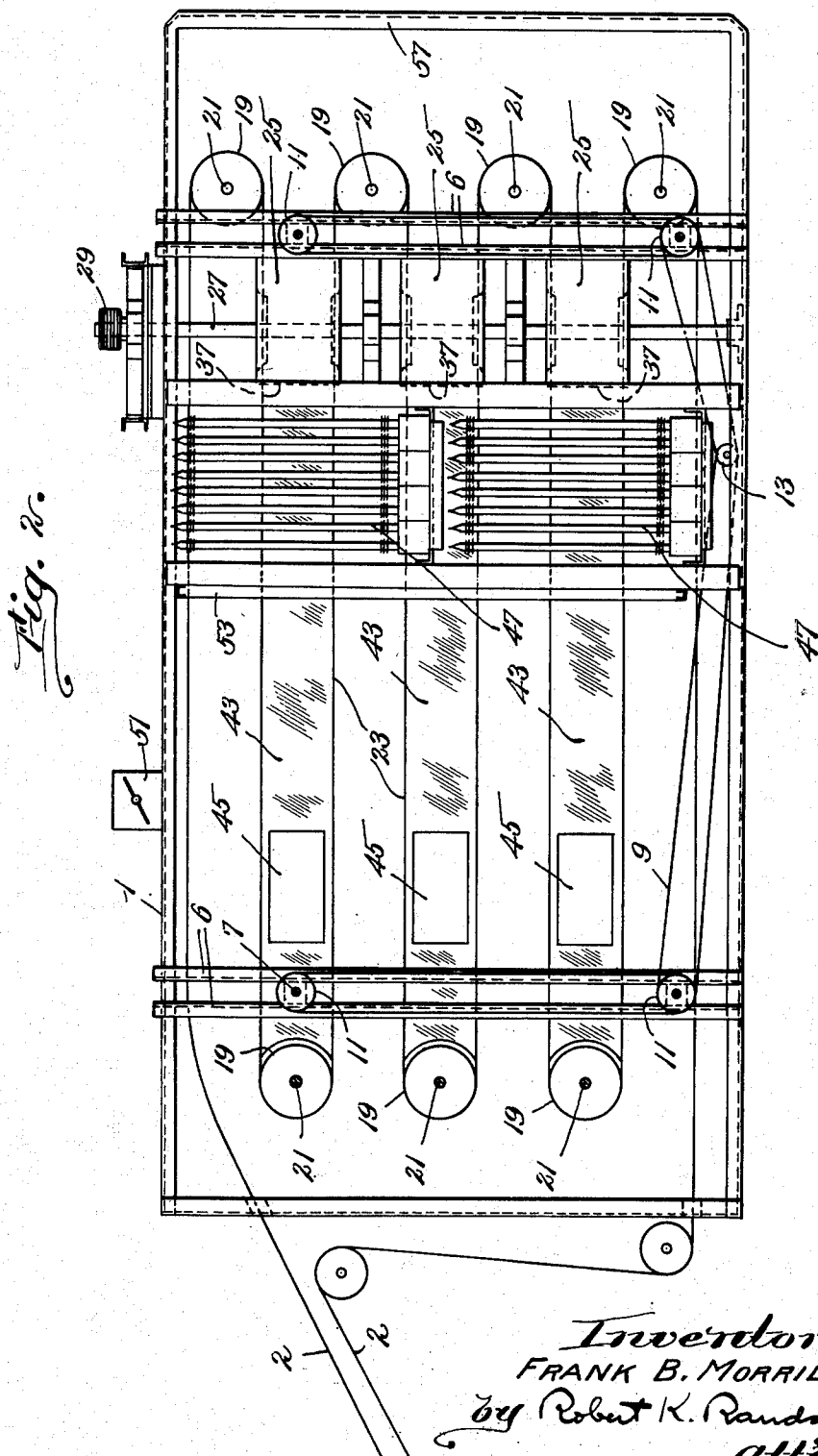
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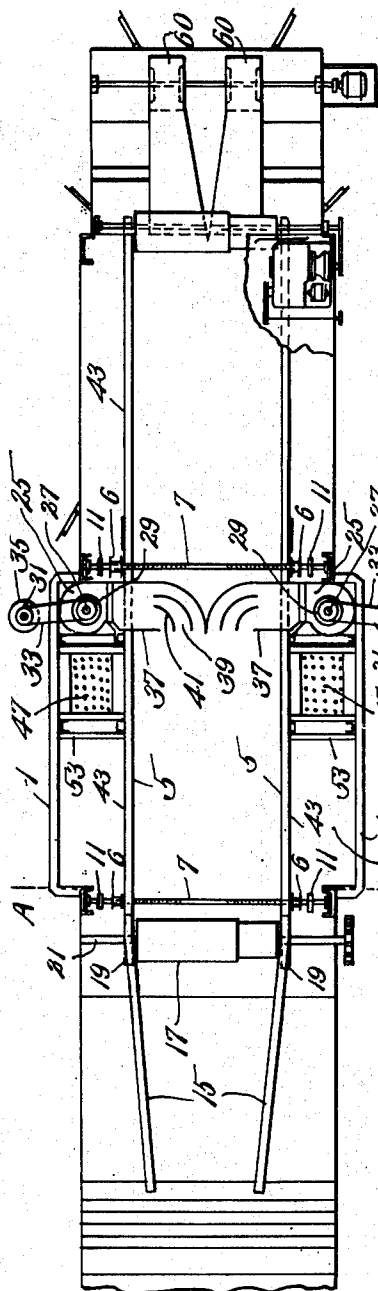


Fig. 4.

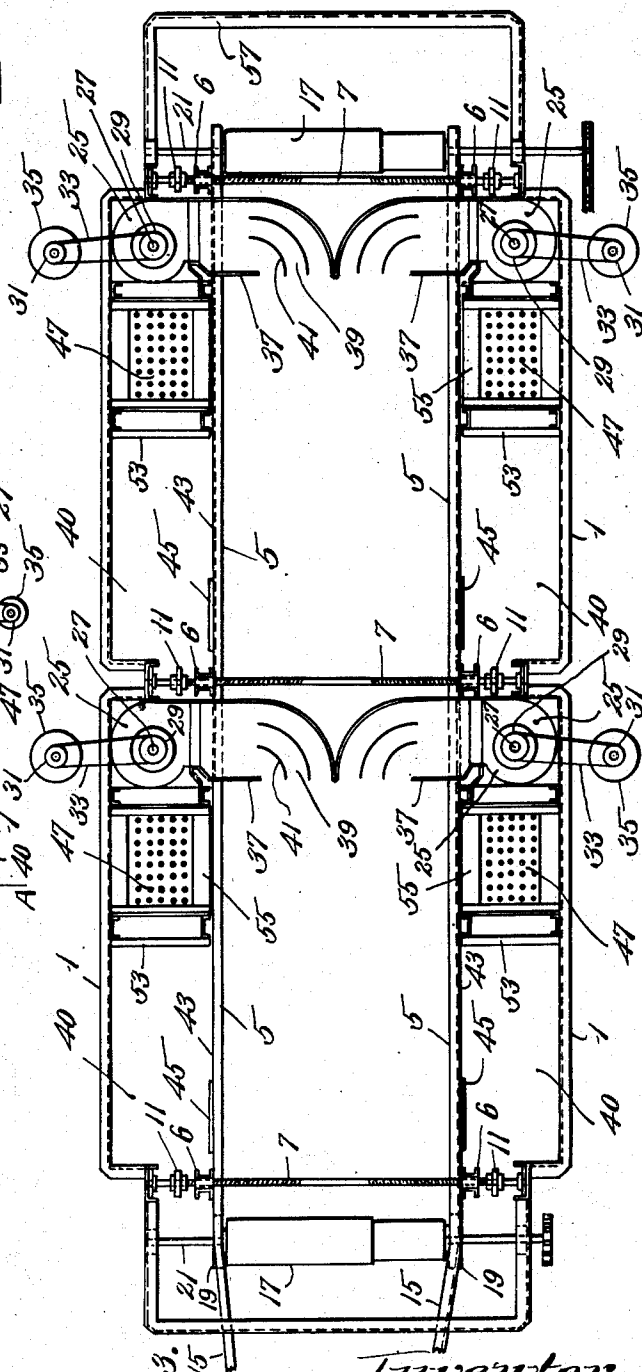


Fig. 3.

Inventor
FRANK B. MORRILL

by Robert K. Randall,
att'y.

Dec. 4, 1945.

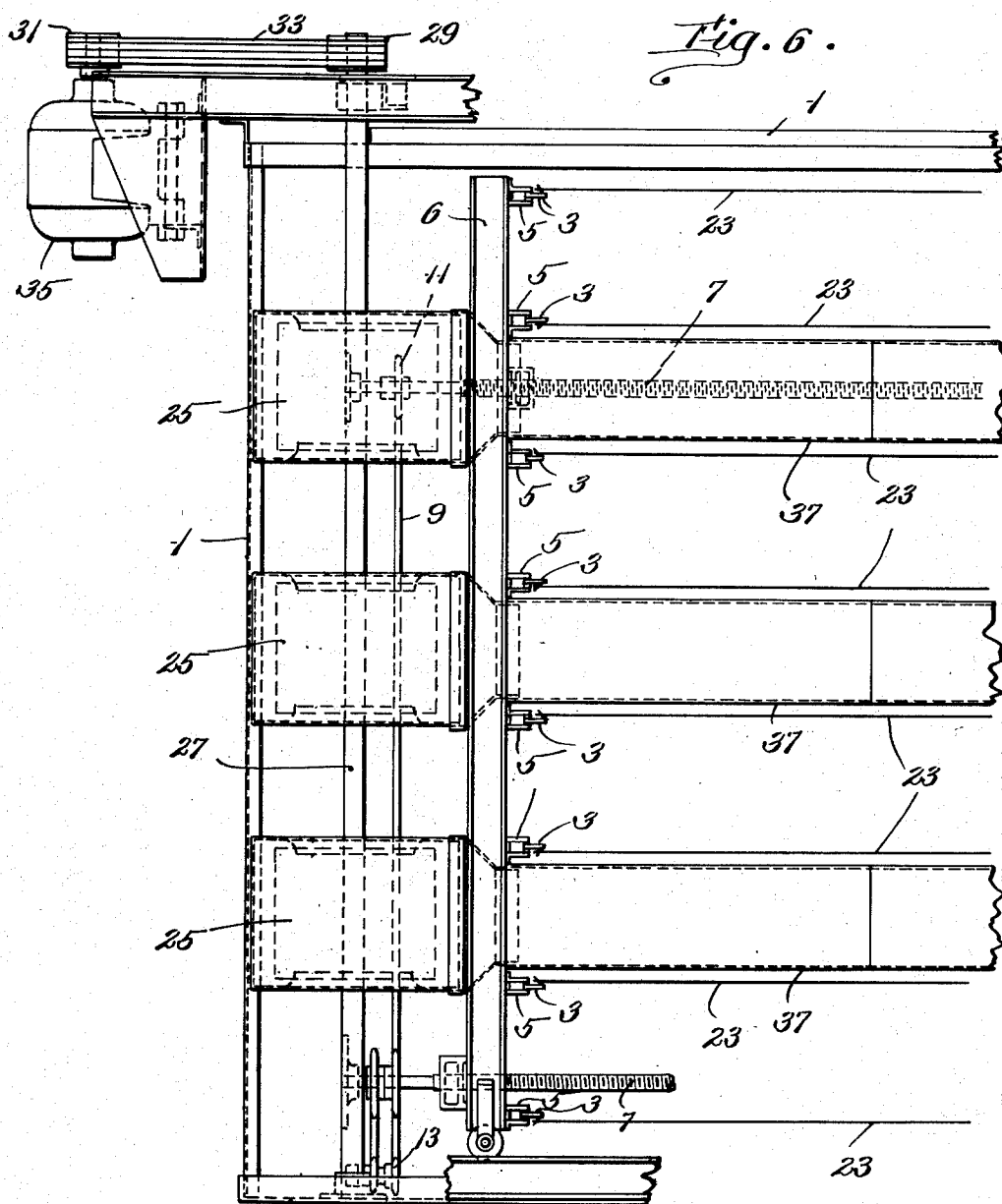
F. B. MORRILL

2,390,451

TENTER DRIER

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5 Sheets-Sheet 5



Inventor.
FRANK B. MORRILL
by Robert K. Randall
Atty.

UNITED STATES PATENT OFFICE

2,390,451

TENTER DRIER

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

Application June 27, 1942, Serial No. 448,749

20 Claims. (Cl. 26—60)

This invention relates to tenter driers, and has particular reference to horizontal pass driers of the end-draft type. Its main object is to provide a useful and practicable means of enabling the building of new driers of this type which shall have greatly increased capacity over existing machines, and also of increasing the capacity of end-draft machines already built and in use.

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, thus avoiding shading of the fabric.

Warpwise draft tenter driers customarily dispose the fabric in horizontal passes or runs, because the alternative arrangement of the fabric in vertical passes involves 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 has not admitted 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 simple 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 at the ends of the drier into the original spacing of the runs chosen in designing the machine. That is, since the blowers or fans or the points of delivery of the blasts created thereby have practically always been located at the ends of the runs, while the space between runs into which air can be introduced to blow warpwise of the runs is fixed by the sprocket sizes and the location of the tracks and bearing-supporting structural elements, and too difficult and costly to change, the attempt to increase the length of the runs in the effort to give added production lengthens the recirculation

path of the air beyond the point where results are satisfactory, and introduces more leaks and more friction as well as more free area of cloth to be treated by the blast. Consequently the same pressure cannot be built up throughout the increased lengths of runs in order 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, as it involves 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, raising the cost per yard of drying the fabric to a point making it cheaper to buy an additional or a larger machine when increased production is demanded.

For example, extending the length of the runs of fabric to 24 feet, in a drier of this type having runs originally 12 feet long, will give no appreciably greater rate of drying with the same heaters and blowers. There is seldom room to add supplemental blowers at the end of the machine, and the addition of more heaters does more harm through impeding the flow of the air than it helps by raising the temperature. So it is not a simple mechanical problem to make any improvement in production by lengthening the drier. To solve this problem, I have devised a new arrangement and combination of parts which makes it economically feasible and advantageous to extend horizontal pass tenter driers lengthwise. Through use of the invention principles, driers of this type can either be built anew or built over to attain at the same relative operating cost a rate of production impossible heretofore in such machines, at a cost far less than that of a plurality of separate driers having the same output. In addition, the novel combination has other advantages and economies when employed alone as the basic construction of new driers.

The principle of the invention is that of providing blowers or other air-propelling devices at the sides of the runs of fabric instead of at the ends of the runs, while still discharging their blasts lengthwise of the runs. Thereby the arrangement enables the lengthening of these runs, through supplementing the existing blowers blowing air lengthwise into the alternate intervals between successive runs of fabric, by discharging additional air into the same intervals in the same direction at an intermediate point or points in the length of such runs. With these auxiliary blowers arranged to recirculate air in their own

closed recirculation paths, the standard lengths of the air-recirculation paths, capacity, and efficiency of the original blowers are retained without change, as are most of the main working parts of the drier. Thus, the lengthwise extension to increase the drier's capacity entails merely the installation of the added blowers and their drives, ducts and supplemental heaters, in addition to the insertion of the necessary sections of chain, track, and housing to give the runs the extra length.

Thus, according to the invention, means is provided for introducing blasts of drying air transversely, i. e. weftwise, of the fabric simultaneously from opposite sides of the machine, preferably at directly opposed points at the same level, into the spaces between adjacent runs of fabric at one or more locations intermediate the length of the runs, turning these blasts at right angles before permitting them to impinge upon the fabric, and after such deflection releasing them to travel lengthwise of the said spaces in contact with the upper and lower runs defining such spaces. Preferably, but not necessarily, the air will be introduced into the same intervals between successive runs of fabric into the open ends of which the air is blown by the original blowers or other air impelling devices present in the machine. Thus located, the ducts which bring the air from the added blowers of the invention into these intervals serve as transverse baffles to close substantially the space between the runs defining such intervals, and since in practically all modern driers the air is returned to the blowers for recirculation these ducts thus incidentally serve to limit the onward travel of the air from the original blowers and make it possible to maintain the same course of the air and length of circulation path for which the machine was originally designed, while providing for the establishment of new and supplemental recirculation paths of identical type permitting the lengthwise extension of the runs of fabric as far as desired.

The ability to put the blowers of an end-draft drier on the sides of the machine instead of at the end without loss of efficiency also makes it possible to build new machines that are shorter and more compact and thus require less floor space for the same lengths of the runs than equivalent machines of prior design, as well as new machines which are proportionally shorter even when the runs are lengthened in accordance with the invention to double or otherwise increase their capacity.

Other objects 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 plan view with the top of the housing removed, and Fig. 2 is a side elevation, mainly diagrammatic and with the rear side of the housing removed, of a new end-draft horizontal pass tenter drier of normal length and capacity, embodying the novel blower arrangement of the invention.

Fig. 3 is a plan view similar to that of Fig. 1, of the same type of drier, embodying the invention principle to produce a drier of double normal length and capacity.

Fig. 4 is a plan view similar to that of Fig. 1, and Fig. 5 a side elevation, mainly diagrammatic, with the rear side of the housing removed, of an end-draft horizontal pass tenter drier of common prior type having its blowers at the end of its

runs, showing the use of the invention to extend the length of the drier to double its capacity.

Fig. 6 is a view in vertical transverse section on line 6-6, of Fig. 1, showing the arrangement of the blowers of the invention together with their ducts and drives.

In the form of Figs. 1 and 2, the improved arrangement of the blowers with their ducts and heaters is illustrated in connection with a horizontal pass tenter drier especially built to utilize the features of the invention in producing an end-draft drier of average capacity which is shorter and more compact and therefore more economical of floor space than prior types of these machines. The housing 1 completely enclosing the machine is made as usual of sheet metal combined with heat-insulating material, the two opposed tenter chains 3 carrying the fabric 2 being carried in the usual tracks 5 both of which are adjusted inwardly and outwardly toward and from the center line of the machine by the usual screws 7 driven in unison by chains 9 and sprockets 11 from a common point 13, the customary hinged wings 15 being provided at the front end of the machine to facilitate the application of the fabric to the chains. Telescoping cans 17 extend between the chain sprockets 11 on shafts 21 to support the fabric at the turns which make the ends of the runs 23 of the fabric. Other parts of the machine, except as noted hereinafter, are as usual heretofore or as preferred.

In accordance with the invention, the fixed side walls 1 of the housing are spaced slightly wider apart than usual, to provide room between themselves and the movable tracks 5, when the latter are in their outermost positions, for a series of involute blowers 25 located one directly above another on a common drive shaft 27 driven through V-pulleys 29, 31, and intermediate belts 33, by electric motors 35. One of these vertical series of blowers is located at each side of the machine, intermediate the length of the runs 23 of fabric and as closely adjacent to the cans 17 at the ends of the runs at the rear end of the machine as is convenient, each blower being located in the illustrated embodiment at the level of those intervals between successive runs which open toward the rear of the machine and which intervene between vertically adjacent cans 17, though in other installations they are sometimes placed instead in the intervals closed by such cans.

Ducts 37 project inward from each side of the machine from the involute housings of each blower 25 for half the width of the machine, having their discharge openings 39 faced lengthwise of the runs 23 of fabric in a direction away from the rear end of the machine and toward the front end at which the fabric 2 enters and leaves the housing, being curved at their inward ends and equipped with similarly curved vanes 41 so as to turn the blasts of air, directed transversely of the fabric 2 by blowers 25 and the portions of ducts 37 proximate thereto, a quarter turn so that they are directed substantially lengthwise of the fabric when released from the ducts to impinge upon the runs of fabric forming the top and bottom limits of the intervals into which such air is forced. By reason of the paired and opposed blowers and their ducts, a sheet of air is delivered which becomes of substantially uniform intensity across the entire width of the fabric shortly after leaving the mouths of ducts 37, and which serves to dry the fabric rapidly because of the extreme tur-

bulence of the air resulting from the impinging of the paired blasts upon each other.

Baffles 43 are applied to the sides of the intervals into which the air is introduced by blowers 25 to close the lateral sides of these intervals so as to force the air to pass through the runs of fabric immediately above and below and defining these intervals. These baffles are fixed to the chain tracks 5 or to the uprights 8 carrying the tracks, and extend from the front side of ducts 37 clear to the sprockets 19 at the front end of the machine, so as substantially to close all exit from the said intervals except through the cloth. But to provide for the handling of fabrics which are difficult or impossible to blow through, sliding dampers 45 are provided in baffles 43 near their forward ends, which are opened to permit the air blown in between the runs to escape laterally after having traversed nearly the entire length of the baffled intervals, or are adjusted so as to compel any desired fraction of the impelled air to pass through the cloth while releasing the remainder via the openings partly closed by the dampers 45.

The entire amount of air impelled by blowers 25, with the exception of a small amount of make-up air admitted from outside the housing by leaks and by door 49, is taken from the space 40 left between the chain tracks 5 and the adjacent side wall 1 of the housing. Thus, the air forced through the runs of fabric forming the top and bottom limits of the baffled intervals is drawn rearwardly and obliquely outwardly along the surfaces of these runs of fabric through the intervals intervening between those baffled off as described, to enter the intakes of the blowers for recirculation. Heaters 47 are located in the space 40 in the path of all air returning to the blowers, so that all air taken in by the latter is warmed immediately before being introduced between the runs. Moist-air outlets 51 are provided in the top of the machine over each space 40, and are controlled by dampers located therein. Screens 53 across the spaces 40 extend from top to bottom of the machine to keep lint and flocks out of the heaters, a sheet metal baffle 55 extending down the entire height of the banks of heaters 47 between the latter and the chain tracks to cause all air entering the heaters to pass through screens 53.

With the blowers and heaters thus located at the sides of the runs at intermediate points in their length, instead of at the rear end of the machine as usual, the housing is extended rearwardly beyond the ends of the runs as indicated at 57 only so far as is needed to give an attendant sufficient working space between the cans 17 and the rear end of the housing, for purposes of cleaning and adjusting upon occasion.

Fig. 3 shows how the invention makes it possible to build an end-draft horizontal pass drier of twice the prior maximum capacity for the same height without reduction of efficiency by reason of the losses inevitable hitherto upon increasing the lengths of the runs. This drier is in effect formed by doubling the length of the runs of the drier of Figs. 1 and 2, while inserting at mid-length of the runs and at each side of the machine an extra series of the blowers 25 with their appurtenant heaters 47 and ducts 37. In this combination exactly the same air circulation prevails in each half of the length of the machine as in the form of Figs. 1 and 2, there being no intentional interchange of air between the forward half and the rearward half of the drier except that there will be an incidental drift of air

through the intervening unbaffled intervals between adjacent runs to and from one half or the other. Because the intervals having baffles 43 along their sides, i. e., those which are not closed at the rear of the machine by cans 17, are substantially completely closed at midlength of the machine by the ducts 37 as indicated in Fig. 6, the air blown into these baffled intervals by the blowers at the rear end of the machine will be substantially all forced to pass upward or downward through the fabric or out through the dampers 45 in the baffles 43 to return to the blowers whence it came. Similarly, a separate recirculation is maintained in the front half of the machine by the blowers and ducts located at midlength, and in each case the closed recirculation path is kept within the limits of efficient and economical operation taught by past experience, so that the losses and waste of power incident to excessive friction, leaks, and free area of cloth to be treated are avoided. The remaining parts of the drier of Fig. 3 are as described in connection with the form shown in Figs. 1 and 2, or are made as desired.

In Fig. 4 is shown the use of the invention to double the capacity of an existing end-draft horizontal pass drier of the conventional form in which the blowers 60 have been put on the rear end of the machine in customary manner. In extending the drier, the machine is cut squarely in two transversely along a vertical plane A—A just rearward of the screws 7 adjacent the front set of cans 17, and the entire front half of the machine is moved forward sufficiently to permit the insertion of an entire new section which is fitted in between and attached to the ends of the two parts thus separated, and comprising as in the forms of Figs. 1 and 3 side walls 1 and a top wall, extensions 5 of the chain tracks, baffles 43 if such were used in the older rearward section, a series of blowers 25 on a vertical line shaft at each side of the machine, driven by motors 35, ducts 37, and heaters 47 with screens 53 serving to heat the air recirculated by the blowers 25. With the addition of sufficient lengths of tenter chains to fill the gaps, and an additional pair of screws 7 at midlength of the machine, these comprise all the changes and additions needed to double the capacity, without entailing the serious effort and expense of adding new and separate tenter chains, tracks, sprockets, cans, and supporting shafts and drives therefor, as has been proposed heretofore in the attempt to increase capacity by creating what is in effect two separate driers within a single housing. As in the case of Fig. 3, the recirculation path of the air propelled by the original blowers 60 is entirely separate from that of the new blowers 25, because the ducts 37 practically close the intervals into which blowers 60 discharge; so each recirculation path remains short and efficient. The blowers 60 and all other parts of the rearward original half of the machine remain in use without change, and their operation on the fabric in the parts of the runs located in this original section is just as before. The new blowers 25 and heaters 47 located intermediate the length of the lengthened runs perform their work independently on the fabric passing through their field of action, thus doubling or further increasing the drying capacity or production of the machine to any extent desired. Two or more of the new sections may be inserted after the manner described into an existing machine to increase its production to any extent called for.

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 tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, chain guides movable widthwise of the housing, baffles in connection with the chain guides closing both lateral sides of alternate intervals between the successive runs of fabric while intermediate intervals are left open, heaters located in the space between the chain tracks and the lateral sides of the housing, and air-propelling means located in such space blowing air transversely of the fabric into the said alternate intervals and through the fabric and the intermediate intervals and the heaters in the order named, this air then reentering the air-propelling means for recirculation.

2. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, baffles closing the lateral sides of alternate intervals between successive runs of fabric and spaced inwardly from the lateral walls of the housing, air-propelling means located between the lateral edges of the runs and the interior wall of the housing at each side of the drier, and means directing the air propelled by the said means into the said alternate intervals, thence through the fabric in the runs, and thence through the intervals intervening between the alternate intervals into the space between the lateral edges of the runs and the housing to return therethrough to the air-impelling means for recirculation.

3. A tenter drier for fabric having in combination a housing and tenter chains carrying the fabric therethrough in reversely traveling horizontal runs, the housing walls being straight and disposed in spaced and parallel relation to the tenter chains, baffles in spaced and parallel relation to such walls closing both lateral sides of alternate intervals between successive runs of fabric while the sides of the intermediate intervals are left open and in unimpeded communication with the space between the housing walls and the baffles, blowers located in this space, and means directing the air propelled by the blowers in a course extending successively through the baffled intervals, the cloth, the unbaffled intervals, and the said space, back into the blowers.

4. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in a plurality of reversely traveling horizontal runs, the side walls of the housing being straight and disposed in spaced and parallel relation to the chains, heaters on each side of the machine in the space between the chains and the side walls of the housing, blowers on each side of the machine in the said space, means directing the air entering the blowers so as to pass through the heaters, means directing the air discharged from the blowers transversely and then longitudinally of the runs in the same direction into the alternate intervals between adjacent runs at opposite points in the length of the machine, and baffles closing the lateral sides of these intervals to compel air thus entering such

intervals to pass through the fabric in entering the intervening unbaffled intervals for return to the heaters.

5. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers located in such space alongside the runs blowing inwardly at right angles to the margins of the fabric, and ducts directing and discharging the blasts from the blowers lengthwise of and between the runs.

6. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, blowers blowing air into the open ends of alternate intervals between successive runs of fabric and lengthwise of such intervals, blowers discharging air into the same intervals at an intermediate point in the length of such runs, and means within the width of the fabric deflecting the air from the latter blowers so that it travels in the same lengthwise direction of such intervals.

7. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers located in the said space discharging air into the same intervals at an intermediate point in the length of such runs, and means within the width of the fabric deflecting such discharged air lengthwise of such intervals in the same direction as the air blown into the open ends thereof.

8. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers located in such space discharging air into the same intervals at an intermediate point in the length of such runs, and means deflecting such discharged air lengthwise of these intervals.

9. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers located in such space partway down the length of such intervals discharging air into the same intervals at an intermediate point in the length of such runs, and means deflecting this discharged air lengthwise of the said intervals.

10. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers located in such space at each side of the machine partway down the length of such intervals, and ducts bringing the air impelled by the latter blowers inward over the margins of the fabric into such intervals and discharging it in a direction generally lengthwise of the cloth.

11. A tenter drier for fabric having in combi-

nation a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and located inwardly from the side walls to leave a space between, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers located in the said space at each side of the machine partway down the length of such intervals, and ducts bringing the air impelled by the latter blowers inward over the margins of the fabric into such intervals and discharging it in a direction generally lengthwise of the cloth, such ducts substantially closing the space between the upper and lower runs defining the intervals.

12. A tenter drier having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and spaced inwardly from the side walls, blowers discharging air into the alternate intervals between successive runs at the open ends of such intervals, other blowers located in the space between the side walls and the chains partway down the length of the runs and at opposite points on each side of the machine, discharging air into the same intervals at points remote from where the blasts of the first blowers enter, and baffle means closing the lateral sides of the said intervals except where the air from the blowers enters.

13. A tenter drier having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, and adjustable toward and from each other and toward and from the housing side walls, blowers within the housing located alongside the runs one above another and at each side of the machine at the levels of the respective alternate intervals between successive runs, ducts directing the air from the blowers substantially lengthwise of the fabric before discharging it between the runs, baffles on the sides of these intervals spaced inwardly from the housing side walls compelling the air to pass through the runs of fabric defining such intervals, heaters through which recirculated air is passed by the blowers, and vertical shafts at each side of the machine each driving a plurality of such blowers.

14. A tenter drier for fabric having in combination opposed tenter chains adjustable toward and from each other and carrying the fabric in oppositely traveling horizontal runs, a housing having fixed side walls paralleling the chains in spaced relation thereto, blowers at each side of the housing located between the chains and the side walls and blowing air inward at right angles to the chains into alternate intervals between the successive runs of fabric, and aligned ducts in each of such intervals bringing such air inward over the margins of the fabric and discharging it all in one direction lengthwise of the said intervals.

15. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs and spaced inwardly from the housing walls, and movable toward and from such walls, blowers in the space between the chains and the housing blowing air into alternate intervals between the successive runs only, and baffles closing the lateral sides of such alter-

nate intervals compelling the air thus discharged into such intervals to pass through the runs of fabric defining them, with the intermediate intervals open along their sides permitting free flow of the air therefrom into the said space for return to the blowers.

16. An extension section for horizontal pass tenter driers equipped with air-circulating means having in combination a housing to be added to the housing of the drier to extend its length, chain tracks for extending the length of the runs of the chains, auxiliary air-heating means located between the chain tracks and the housing sidewalls, blowers supplementing the air-circulating means of the drier and located between the tracks and the housing side walls outside the selvages of the fabric carried by the chains and at the levels of the intervals between runs into which air is discharged by the said air-circulating means, and ducts all carrying the blasts from the blowers inward transversely of the fabric into said intervals and discharging such blasts lengthwise of the fabric in the direction away from the air-circulating means of the drier.

17. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, air-impelling means propelling air along the surface of the fabric lengthwise of the runs, such impelling means being located alongside and intermediate the length of the runs, baffles substantially closing the spaces between adjacent runs of the tenter chains and cooperating with the fabric to cause such air to travel in a closed recirculation path, and other air-impelling means and baffles cooperating with the fabric to produce a separate recirculation of air along the surface of the fabric in a closed path extending generally lengthwise of the same runs.

18. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, baffle means enclosing and subdividing an interval between successive runs of fabric, and blower means establishing two independent recirculation paths of air in such interval within the length of a single run of the fabric.

19. A tenter drier for fabric having in combination a housing, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, baffle means enclosing and subdividing an interval between successive runs of fabric, and blower means establishing two independent recirculation paths of air in such interval within the length of a single run of the fabric, both traveling in the same direction lengthwise along a given surface of such run.

20. A tenter drier for fabric having in combination a housing having plane side walls, tenter chains carrying the fabric through the housing in reversely traveling horizontal runs, blowers blowing air into the open ends of alternate intervals between successive runs of fabric, blowers discharging air into the same intervals at an intermediate point in the length of such runs, and baffle means separating the blasts of the first-named blowers from the blasts of the latter blowers to create separate recirculation paths for the air comprising the respective blasts.

FRANK B. MORRILL.