Nov. 13, 1934. H. H. BELCHER 1,980,163

MACHINE FOR DRYING TEXTILE MATERIALS

Filed July 13, 1931 3 Sheets-Sheet 1

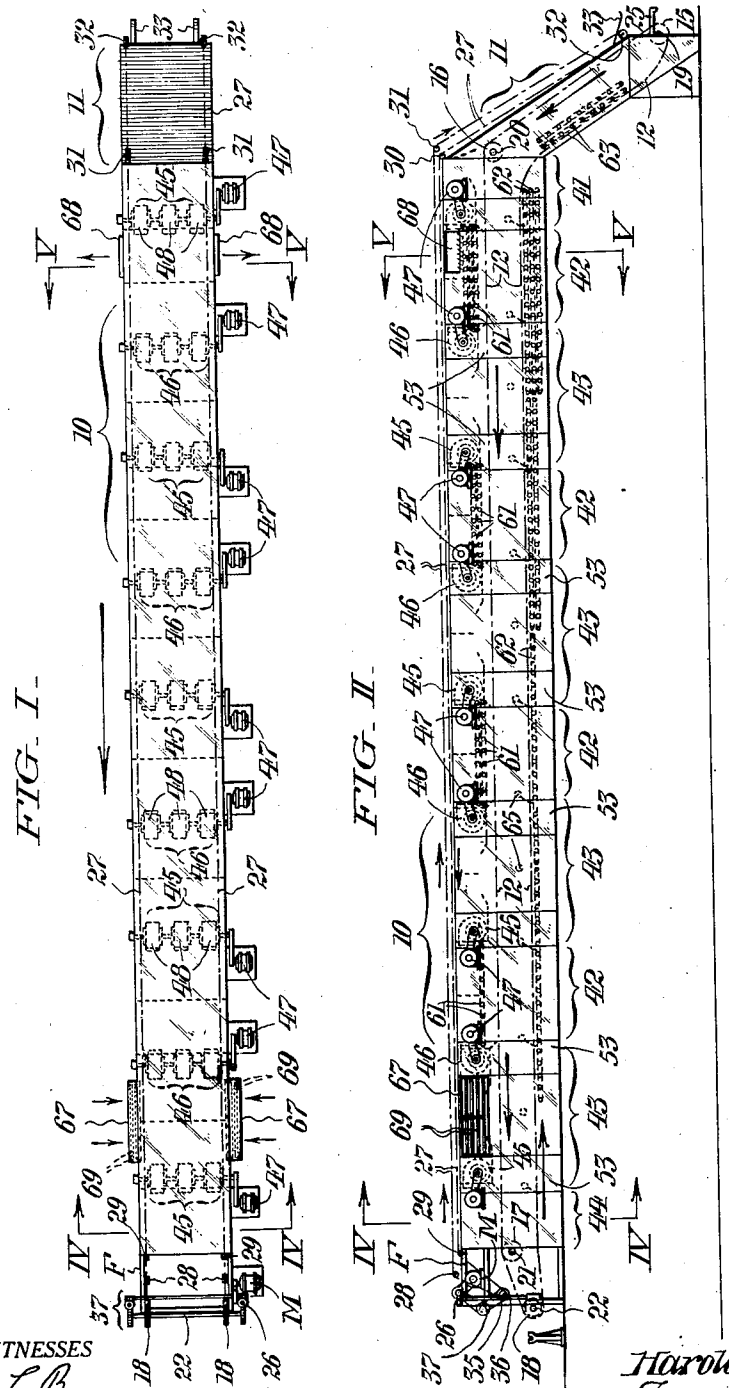

FIG. I.

FIG. II.

WITNESSES

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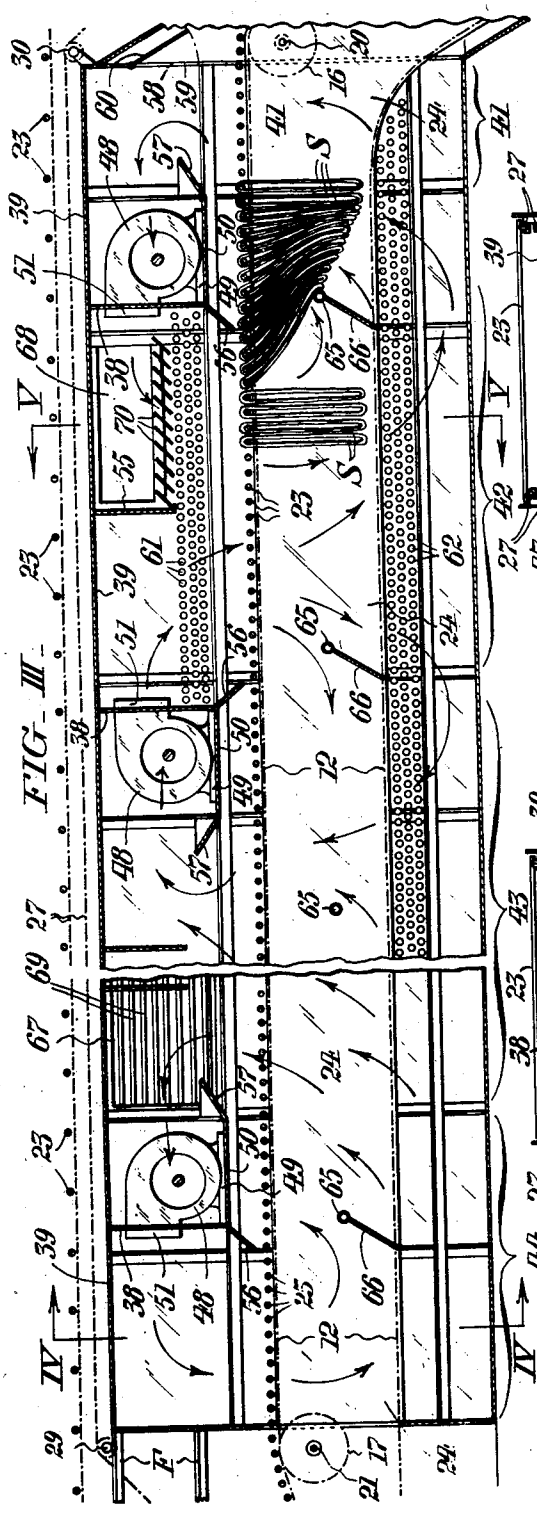

FIG. III.

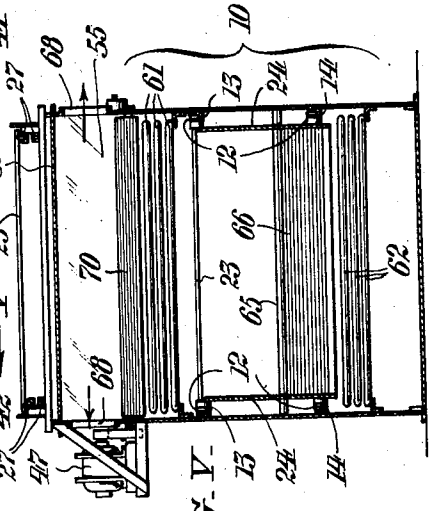

FIG. V.

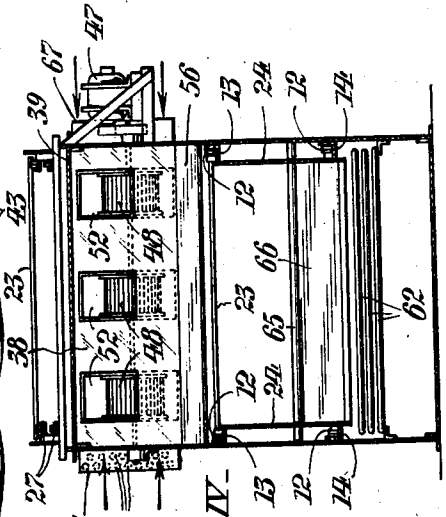

FIG. IV.

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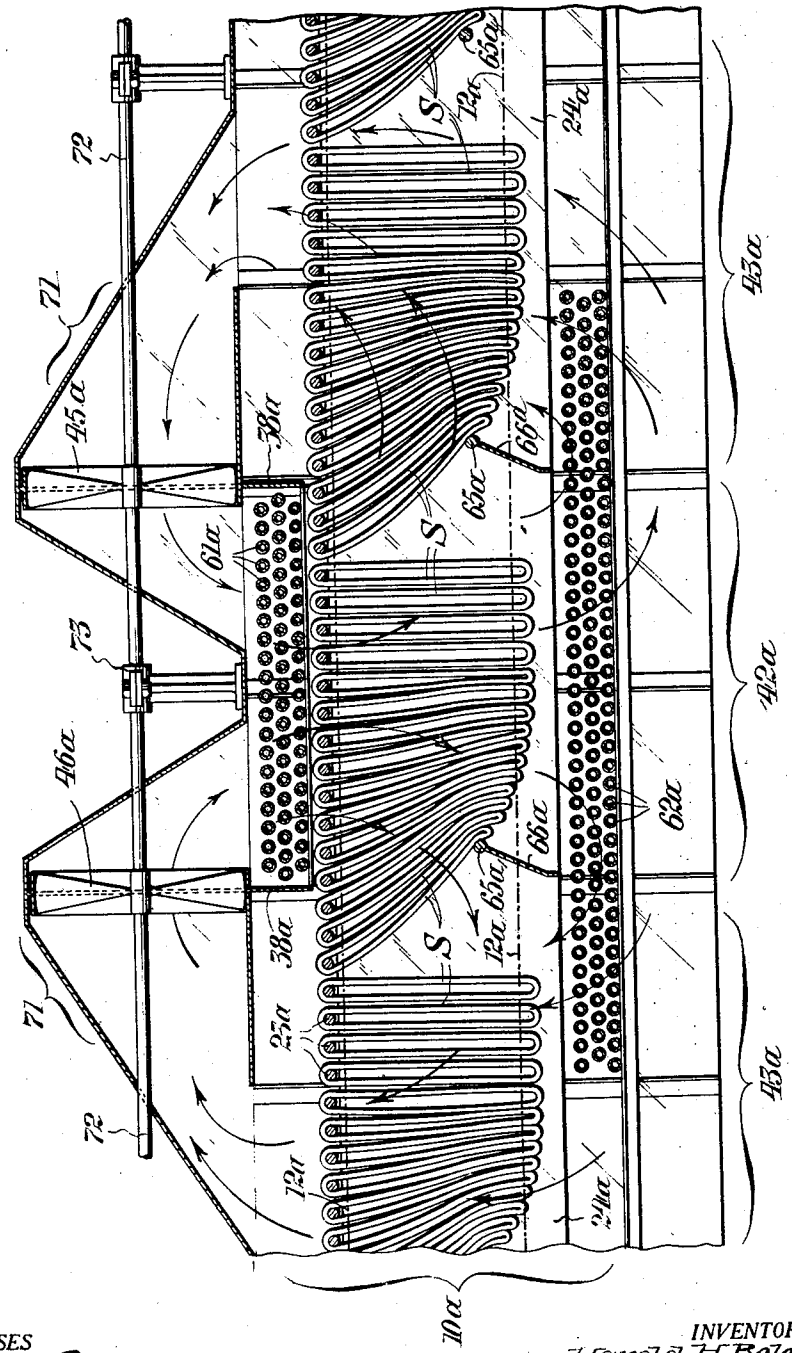
FIG. VI.



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UNITED STATES PATENT OFFICE

1,980,163

MACHINE FOR DRYING TEXTILE MATERIALS

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Application July 13, 1931, Serial No. 550,444

5 Claims. (Cl. 34—12)

This invention relates to machines for performing drying and analogous operations on textile materials; and it has reference more particularly to machines for treating materials such as yarns and the like in skein form.

My invention has for its main object the provision of a machine of the specified character, which is simple in construction and operation; which is compact and therefore accommodated in a minimum of floor space; which is highly efficient both as regards power consumption and the time required in the treatment of the materials; and which can be relied upon for the thoroughness and uniformity of the treatment performed by it.

The foregoing advantages I secure in a machine having the form of an elongated enclosure which is interiorly subdivided into a number of differently heated drying zones, and which embodies means to support a continuous succession of the skeins while progressing them horizontally through the several drying zones successively, and provisions for independently circulating the air in the several zones so as to flow up and down, through and between the skeins of the material.

Provisions are also made for constantly replacing a proportionate amount of the spent air within the enclosure by fresh air from the exterior; and for spreading and opening up the skeins periodically incident to progression through the machine so as to more effectively expose the fibers of the material to the action of the air circulated as aforesaid in the several drying zones.

Still other objects and attendant advantages of this invention will be manifest from the following description taken in connection with the attached drawings; wherein, Fig. I is a plan view of a machine for treating textile materials embodying my improvements.

Fig. II is a side elevation of the machine looking from the bottom of Fig. I.

Fig. III is a fragmentary longitudinal sectional view of the machine drawn to a larger scale.

Figs. IV and V are cross sections taken respectively as indicated by the arrows IV—IV and V—V in Figs. I, II, and III; and,

Fig. VI is a view corresponding to Fig. III showing an alternative embodiment of the machine.

Referring first to Figs. I–V, the embodiment of my improved treating machine shown comprises a housing 10 which affords an elongated horizontal heating chamber, the walls of this housing being, in reality, constructed double from sheet metal with interposition of suitable thermo-insulation after the practice generally followed in this art. At the right hand (Figs. I and II) or feeding end, the housing 10 has an angularly-depending extension 11, which, in the present instance, permits loading of the machine at a lower level.

To slowly progress the yarn skeins S, which are to be treated in the machine, longitudinally through the chamber within the housing 10, I employ a conveyor consisting of a pair of spaced endless sprocket chains 12, 12 whereof the upper and lower runs are guided on horizontal angle tracks 13, 14 secured to the side walls of the housing 10, see Figs. IV and V. The path traced by the conveyor chains 12 is otherwise defined by sprocket wheels 15, 16, 17, 18 which are mounted in pairs, on as many transverse shafts 19, 20, 21 and 22, respectively. The links of the conveyor chains 12, 12 are suitably configured to take the ends of a multiplicity of detachable crosswise poles or rods 23, each capable of carrying a number of the skeins S side by side transversely of the treating chamber. The skeins S are prevented from becoming entangled with the conveyor chains 12 by guard plates 24 which are secured, along opposite sides of the treating chamber, to the tracks 13 and 14, see Figs. IV and V.

From Fig. II it will be observed that in rounding the sprockets 15 at the feeding end of the machine, the conveyor chains are brought to the exterior at a loading shelf 25 to enable placement of the poles 23 upon them. It will also be noted from Fig. II that the conveyor emerges from the left hand or delivery end of the machine as it rounds the sprockets 17, and that the upper run of said conveyor travels downward at an angle enroute to the sprockets 18, to facilitate removal of the poles 23. The shaft 22 for the sprockets 18 has journal bearing in an open frame work F which extends beyond the delivery end of the machine. The power for operating the conveyor is derived from an electric motor, shown at M from which motion is transmitted, through a speed reducing worm gear 26, to the shaft 22 which carries the conveyor sprockets 18, see Figs. I and II. After removal of the treated skeins S at the delivery end of the machine, the empty poles 23 are placed on a double chain return conveyor conventionally indicated at 27 in Figs. I and II, said conveyor being guided forwardly over the top of the enclosure by idler sprocket wheels 28, 29, 30 and 31, and then downwardly over the declining extension 11 of the housing 10 to another

set of idler sprockets 32. Immediately above the sprockets 32, there is a magazine 33 into which the empty poles 23 are released for re-use by the operator stationed at the loading end of the machine. At the delivery end of the machine, the pole return conveyor 27 is trained about drive sprocket wheels 35 on a shaft 36 which also derives motion, through suitable speed reduction gearing 37, from the motor M.

By means of spaced vertical partitions 38 (Fig. III) reaching down from the roof 39 of the housing 10 substantially to the level of the upper runs of the progressing conveyor chains 12, the treating chamber is subdivided lengthwise of the machine into a number of zones 41, 42, 43 and 44. Of these, the end zones 41, 44 and the zones 42 are considerably shorter in length than the zones 43, the reason for this difference being fully explained hereinafter. Disposed in the top of the housing 10 above the upper run of the conveyor and symmetrically allocated with regard to the zonal subdivisions 42 and 43, are opposing blower units 45, 46 which are driven by individual motors 47 supported by brackets exteriorly of said housing. In this instance, each of the blower units 45, 46 comprises three separately-encased coaxial centrifugal wheel fans 48 which are mounted on a common base 49. Each unit 45, 46 is supported upon a shelf 50 extending crosswise of the interior of the housing 10, see Figs. III and IV, with the outlets 51 of the fan casings discharging through openings 52 in the corresponding partition 38. By reason of the contiguous placement of the component fans 48 of the blower units 45, 46 the induced air stream will obviously be of the full width of the treating chamber. As a consequence, the passing yarn skeins S will be subjected to uniform drying action irrespective of their relative positions on the supporting poles 23. The construction of the machine, with regard to the allocation of the blower units 45, 46 in the top of the housing 10, is furthermore advantageous in that it favors greater compactness and conservation of floor space as compared to the ordinary types of skein treating machines wherein the fans are housed in a lateral offset of the housing 10; and also in that the said units 45, 46 can be removed endwise from the machine when necessary, from either side, for which purpose the housing 10 is in the present instance provided with removable sections or panels 53 in its side walls, see Fig. II. By the same means, access may be had to the suspended yarn skeins S from either side of the machine, as well as to other parts within the housing 10, yet to be described. By reason of being arranged in opposing pairs, it will be seen that the fan units 45 and 46 will cause downward flow of the air in the zones 42 of the treating chamber, and upward flow in the alternating zones 43 as indicated by the arrows in Fig. III. Due to the larger proportioning of the zones 43 as compared to the zones 42, it is evident that the upward flow of the air in the zones 43 will have considerably less velocity than the downward flow in the shorter zones 42, with effective avoidance of whipping of the skeins S and possible entanglement of the yarns. Downward deflection of the opposing air streams discharged by the opposing blowers 45, 46 into the zones 42 is in part determined by central vertical baffles 55 in the upper portions of the said zones against which the opposing fans 48 react. Oppositely inclined supplemental baffles 56, 57 at opposite ends of the shelves 50 by which the blower units 45, 46 are supported, cooperate in determining circulation of the air longitudinally of the machine in the several contiguous zonal subdivisions 42 and 43, downward and upward through and between the skeins S after the manner shown by the arrows. A further function of the supplemental deflector 57 is to cooperate with the fan units 45, 46 adjacent their suction inlets in such a manner as to insure uniform distribution of the air in the up draft zones 41 and 43. The flow of the air in the zone 41 at the loading end of the machine is upward or in the same direction as in the zones 43, while in the zone 44 at the delivery end of the machine, the air flow is downward as in the zones 42.

In order that drying of the skeins S may be initiated in the depending lead-in extension 11 of the housing 10, I have provided for conducting air up through and around the yarn in the lead-in extension 11, this air being later drawn into the end zone 41 through an opening 58 in the upper part of the end wall 59 of the said enclosure, see Figs. II and III, the said opening being controllable by a damper 60.

To accelerate the drying of the yarn skeins S, heating coils 61 are placed in the zones 42 above the upper run of the conveyor in the downward paths of the air circuits. There are also heating coils 62 provided within the enclosure beneath the lower run of the conveyor. As shown in Fig. II, the coils 62 are graduated as to capacity from the loading end of the machine toward the discharge end, so that the yarn skeins S progressed in the direction of the arrow in Fig. II, through the several air circulating zones 41—44 successively, are subjected to the highest temperature at the beginning of the treating operation and to a gradual decreasing temperature as they approach the delivery end of the machine. A steam coil 63 is also placed in the lead-in extension 11 of the housing 10 to promote drying in the initial stage of the operation.

As a further aid to accelerate the treatment and also to insure access of the air currents to all parts of the yarn skeins S, I have made provisions for periodically opening up or spreading the said skeins concurrently with their progression through the machine. The means for this purpose comprises a number of cross bars 65 whereof there is one located in each of the zonal subdivisions 41—44 of the machine, the said bars being at such a level as to be encountered by the passing skeins S suspended on the poles 23 of the conveyor, thereby causing the said skeins to drag as shown at the right hand end of Fig. III. In this way, the rows of skeins S on contiguous conveyor poles 23 are separated successively with formation of intervals through which the air may freely pass and contact intimately with the individual yarns. At the same time, behind the deflected skeins S, a number of others is in each instance bunched up to form a solid barrier which influences the circulation of the air, in that it operates as a baffle in the region between the down and up flow currents of the air to prevent excessive short circuiting from the pressure to the suction sides of the fans 48 by way of the upper part of the conveyor space. Thus most of the air is forced down in the intervals created by the arresting bars 65 with attainment of the maximum drying effect. Associated with the arresting bars 65 and declining at an angle therefrom, are baffles 66 which serve to deflect the downward air currents through the coils 62 below the skeins S for reheating preparatory to upward flow in completing the circulating cycles.

For the purpose of constantly displacing a proportionate amount of the air from within the enclosure by fresh air from the exterior, I have provided the housing 10, at opposite sides near the left hand or delivery end of the machine, with lateral inlets 67 for induction of the outside air, and adjacent the opposite or loading end with similar lateral ports or openings 68 for escape of the saturated air from within the machine. As shown in Figs. I–III, the openings 67 communicate into one of the up-draft zonal subdivisions 43 of the enclosure, so that the fresh air is drawn in by the suction of the blower units 45, 46 at that region, and commingled with the heated air circulated within the said zone. Preferably steam coils 69 are placed within the inlets 67 to preheat the incoming fresh air. The outlets 68, on the other hand, lead from one of the down-draft zonal subdivisions 42 of the enclosure at the pressure sides of the fans 45, 46 of that zone. The outlets 68 are preferably made somewhat smaller than the inlets 67; and in the region of the first mentioned, a regulatable damper 70 is placed over the heating coils 61 to control the amount of air circulated and exhausted from the corresponding zone 42.

With the described arrangement, it will be evident that the general flow of the air in the machine will be from left to right progressively through the several zonal subdivisions 42 and 43, or in a direction contrary to the travel of the yarn skeins S. The general air flow, zonal circulation with alternate up and down flow, and the graduated heating are thus all contributory toward bringing about thorough and uniform drying of the skeins S in a minimum of time, the action being also greatly facilitated by the periodic opening up and spreading of the skeins. From a practical standpoint, it will furthermore be appreciated by those familiar with the art to which my invention pertains, that the ease with which access may be had to the blowers 45, 46, the heating coils 61, 62 and the skeins S from either side of the machine, is highly advantageous in emergencies since it avoids long delays and shutdowns. It will also be apparent that by employing centrifugal wheel fans 45, 46, arranged as set forth, the heated air is not only evenly distributed all over definite areas above the yarn skeins S, but that I provide a structure which practically assures uniform circulation of the heated air through the yarn and throughout that portion of the machine which is occupied by the skeins S.

In the modification of Fig. VI, I employ opposing disk units 45*a*, 46*a* in pairs in lieu of the centrifugal fans 45, 46 of the first described embodiment of my invention. As shown, the disk fans 45*a*, 46*a* are individually accommodated in upward offsets 71 of the enclosure 10*a*, whereof the walls are sloped to act as deflectors for the air circulated by the fans. If desired, individual motors may be provided to drive the fans 45*a*, 46*a*; or the said fans may be mounted, as herein shown, with other sets along the length of the machine, on a common longitudinally-extending drive shaft 72 with journal support in bearings 73 exteriorly of the upward offsets 71 of the housing 10*a*. In all other respects, both the construction and operation of the modified form of my invention are exactly as hereinbefore described; and to preclude the necessity for repetitive description, all corresponding parts have been identified by the same reference numerals previously used, but with addition, in each instance, of the exponent "*a*" for the purposes of distinction.

Having thus described my invention, I claim:

1. In a machine for treating yarns and the like in skein form, a chamber subdivided into alternating zones of up-and-down flow; means for conveying skeins through said chamber suspended with their lower ends free; and means for circulating suitable treating-medium through said zones; the zones of up-flow being longer and of greater cross-sectional area, on a horizontal plane, than the zones of down-flow, so that the velocity of up-flow is less than that of down-flow and small enough to avoid whipping of the skeins and entanglement of the yarns during treatment.

2. In a machine for treating yarns and the like in skein form; a chamber subdivided into consecutive sections, each section comprising a long zone and a shorter one, respectively of greater and smaller cross-sectional area in a horizontal plane, means for circulating suitable treating medium up through the longer zones and down through the shorter zones with resultant lower velocity through the zones of up-circulation to reduce tangling of the yarns and whipping of the skeins; pole conveyor means supporting successive crosswise rows of the skeins, in suspension with their lower ends free, and progressing them longitudinally through the several sections; a damper controlled outlet associated with one of the down flow zones for constantly displacing a proportional amount of the treating medium; and an inlet opening in one of the up-flow zones for admission of a corresponding amount of fresh treating medium with gradual advancement of such medium from the inlet opening to the outlet opening in a direction counter to the travel of the skeins through the machine.

3. In a machine for treating yarns and the like in skein form; a chamber subdivided into consecutive sections, each section comprising a long zone and a shorter one, respectively of greater and smaller cross sectional area in a horizontal plane; spacedly-opposing blower units in the upper portion of the chamber with associated vertical and reversely inclined baffles for circulating suitable treating medium up through the longer zones and down through the shorter zones with resultant lower velocity through the zones of up-circulation to obviate tangling of the yarns; means supporting crosswise rows of the skeins in suspension with their lower ends free, and progressing them through the consecutive sections; and barrier bars in the path of progression of the skeins so placed as to effect compacting of said skeins at the line of division between the zones of up-circulation and the zones of down-circulation to reduce by-passing through the threads of the treating medium between said zones.

4. In a machine for treating yarns and the like in skein form; a chamber subdivided into consecutive sections, each section comprising a long zone and a shorter one, respectively of greater and lesser cross-sectional area in a horizontal plane, said sections being arranged with the longer zone of one section alignedly adjoining the longer zone of the succeeding section; blower units for circulating suitable treating medium up through adjoining pairs of the longer zones and down through the adjacent pairs of the shorter ones with resultant lower velocity through the zones of up-circulation to reduce tangling of the yarns; pole conveyor means supporting crosswise

rows of the skeins, in suspension with their lower ends free, and for progressing them longitudinally through the several sections; and vertical and oppositely inclined baffles in the upper portion of the chamber determining a general progression of the treating medium in a direction lengthwise of the machine from section to section.

5. In a machine for treating yarns and the like in skein form; a chamber subdivided into consecutive sections, each section comprising a long zone and a shorter one, respectively of greater and smaller area in a horizontal plane; means for circulating suitable treating medium up through the longer zones and down through the shorter zones, with resultant lower velocity through the zones of up-circulation to reduce tangling of the yarns and whipping of the skeins; means supporting successive crosswise rows of the skeins in suspension with their lower ends free, and progressing them through the several sections; heater means within the chamber above the shorter treating zones; heater means below the skeins; barrier bars across the path of progression of the skein so placed as to effect compacting of the rows of skeins, at the line of division between the zones of up-circulation and the zones of down-circulation, to reduce horizontal by-passing of the treating medium between said zones; and baffle means in conjunction with and declining at an angle from said barrier bars to insure passage of most of the down-flowing treating medium through the heater means below the skeins for reheating preparatory to upward flow during each up-and-down circulatory cycle.

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