

Jan. 19, 1943.

M. W. MAYES

2,308,767

APPARATUS FOR DEHYDRATING YARN

Filed May 18, 1939

2 Sheets-Sheet 1

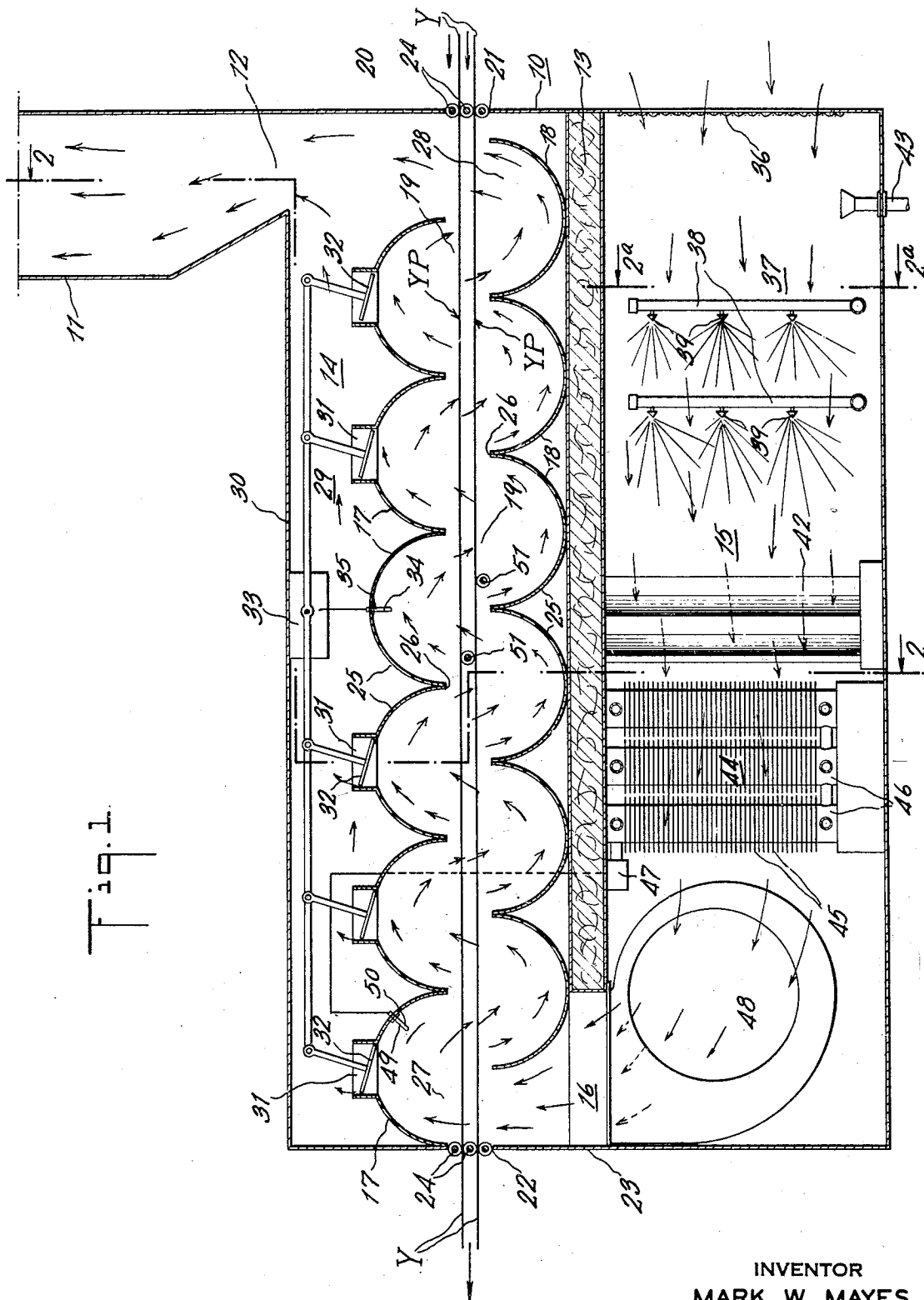


Fig. 1.

INVENTOR
MARK W. MAYES
BY
Orton and Griswold
ATTORNEYS

Jan. 19, 1943.

M. W. MAYES

2,308,767

APPARATUS FOR DEHYDRATING YARN

Filed May 18, 1939

2 Sheets-Sheet 2

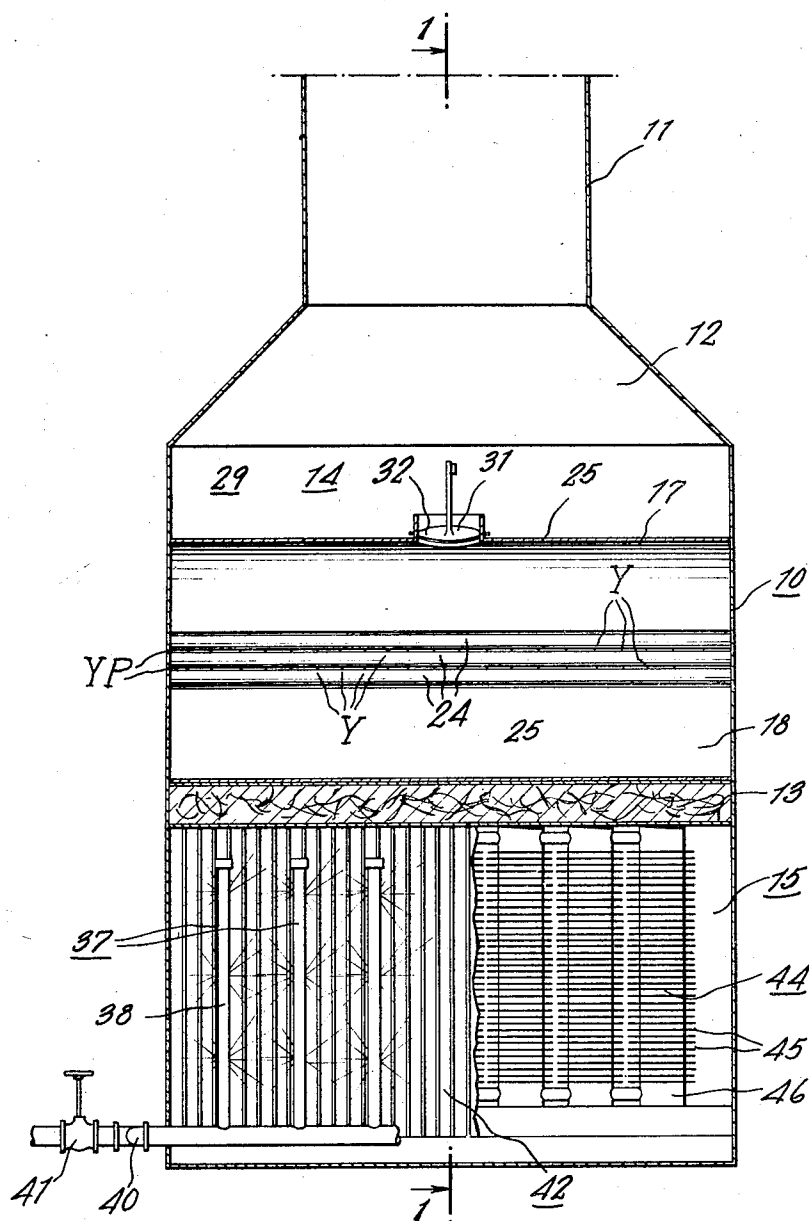


Fig. 2.

INVENTOR
MARK W. MAYES

BY
Orton and Griswold
ATTORNEYS

UNITED STATES PATENT OFFICE

2,308,767

APPARATUS FOR DEHYDRATING YARN

Mark W. Mayes, Marietta, Ga.

Application May 18, 1939, Serial No. 274,313

4 Claims. (Cl. 34—50)

The invention relates in general to a method for controlling the moisture content of yarn in the course of slashing the yarn and to apparatus for use in practicing the method.

While the invention is particularly directed to the usual condition in slashing yarn where it is desired to reduce the water content of the yarn and for this reason reference is specifically made herein to dehydrating the yarn, it is within the scope of the disclosure to otherwise condition the yarn as by adding water and thus hydrate the yarn to secure an optimum condition of the finished yarn.

In the following reference to yarn, it is to be understood that reference is made to yarn of silk, wool, cotton, rayon and other synthetic substances of the type generally passed through slashing machines.

In known methods of slashing yarn, it is a common practice to train the wet yarn as it comes from the sizing box about large diametered heating drums for the purpose of drying the yarn by direct contact with the hot drum surfaces before it is passed on to subsequent steps in its treatment. This and similar baking processes have not proven satisfactory in service and are open to numerous practical objections. For instance, where the dry, and usually unleased yarn, contacts the heated surface of the revolving cylinders, a quick, hot ironing of the material takes place with a resulting deleterious effect on the resiliency, elasticity and fluffiness of the resulting yarn. The separate individual strands or ends of the yarn become matted and in the subsequent necessary leasing a large percentage of the loose fibres becomes separated from the balance of the yarn and this constitutes a serious loss of material. Further, by following these known processes, the yarn contacting the heating drum becomes flattened, slasher marks detract from the desired uniform color, the strands lose their original round shape with resulting difficulties in the subsequent weaving processes and the production of an inferior grade of cloth where such flat yarn is used.

The primary object of the invention is to provide an improved and simplified technique in the art of evaporating moistened sized yarn and to do this in such way as will eliminate the defects inherent in the present cylinder ironing and baking processes and in general to provide a method which can be practiced economically, which will minimize the former loss of material during the slashing operation and which will produce an improved form of resulting yarn.

Broadly the method features the subjecting of the wetted yarn to the drying effect of heated and slightly moistened air at relatively low temperatures but at temperatures sufficiently high to have a dehydrating effect on the yarn and in supplying the air in volume per unit length of yarn treated just sufficient to obtain the desired degree of dryness, or rather to obtain optimum moisture content required of the particular type of yarn under treatment.

More specifically described, the method consists in leasing the yarn immediately after it leaves the size box and before the sizing has had an opportunity to congeal so that the ends may separate readily without disturbing the fibres. The leased yarn is then fed freely along an air conduit while being suspended therein in such a way as to expose its entire perimeter to the effect of a current of the warm air directed transversely and repeatedly through the yarn as it moves in a contradirection to the general direction of movement of the air.

The invention has for another object certain incidental practices which will tend to effect economy in the operating costs in treating the yarn as herein featured. The most serious expense in practicing a drying process in treating yarn is the cost of the necessary heat. It is, of course, within the scope of this disclosure to use ordinary atmospheric air with whatever moisture content it may happen to have and then heat it to increase its initial moisture absorbing capacity by the time it reaches the yarn. As a general rule, the higher the temperature of the incoming atmospheric air, the greater is its moisture content and the greater its moisture content the more heat must be added to bring it to the dehydrating condition necessary to the effective practicing of the method.

In order to minimize the amount of heat necessary to heat condition the air, it is herein suggested that the incoming air be chilled so that it will be dehydrated at least to some extent. Air with a sufficiently low moisture content could be utilized as a dehydrating agency even without the addition of heat, but some heat would, of course, speed up the yarn drying step.

According, a refinement in the method is to cool the incoming air as far as it is practical under the conditions present so as to discharge it of as much of its entrained water as possible and then by the addition of some heat raise its water absorbing capacity to effect the desired rapid drying of the yarn under treatment.

Preferably, this objective is attained by direct-

ing a spray of cold water into the incoming air and which operation will have the effect not only of chilling the air but of washing it free of lint and other foreign matter which may be in suspension in the air flow.

The disclosure also features a careful control, preferably by automatic means, of the temperatures and moisture content of the treating air so that the yarn will have its moisture content controlled as desired in the shortest possible time and thus effect an economic operation and at the same time carefully avoid any deleterious effecting of the resulting yarn.

In one practical demonstration of the method herein featured, recently sized cotton yarn was leased and immediately passed while suspended in air along an air conduit ten feet long. While the yarn was travelling in one direction, it was subjected to the action of a stream of dehydrating air passing in the opposite direction. This air contained some water entrained therein and in one case in an amount approaching saturation at the current room temperature but heated at a temperature of about 160° F. to provide water absorbing capacity. This air was passed through the conduit in an amount approximately 100 cubic feet per second. It is understood, of course, there there is nothing critical in either the temperature or in the volume of air mentioned or in the water content suggested in this example and in actual commercial practice the temperature, initial water content and volume and speed best suited to any particular condition should be ascertained experimentally and that condition of air selected which results in the best condition of marketable yarn.

In general, the temperature suggested for the air should be much less than the temperature at which the usual heater drums are now kept and on the other hand air which is at the ordinary room temperature is too low for the requisite rapidity of operation required in commercial operation. Air at a temperature of between 150° and 200° F., moving under pressure of about 1½ inches water gauge and which is almost but not quite dry, has been found to be satisfactory in actual practice.

Referring to the apparatus aspect of the disclosure, the primary object of the invention is to provide a simple form of slasher which features compactness in its yarn drying portion and to provide a form of dryer through which the yarn may be fed as a continuous process and in which atmospheric air may be first conditioned to cleanse it and give it its requisite temperature and low moisture content and by means of which the air so conditioned is brought repeatedly into contact with all portions of the travelling yarn in such manner as to extract from the yarn the desired amount of moisture required of the particular type of yarn under treatment.

The invention also has for an object the providing of automatic controls for regulating the thermal and hygroscopic condition of the dehydrating air as it is fed to the yarn and to provide for an automatic release of all or a part of the treating air at different points along the path of the yarn under treatment as may be required to avoid any excessive drying of the yarn.

Various other objects and advantages of the invention will be in part obvious from a consideration of the method features of the disclosure and from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one

method of practicing the invention, and the invention also consists in certain new and novel modifications of the preferred method and other features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings:

Fig. 1 is a view largely in diagrammatic outline of a vertical sectional view taken longitudinally through a preferred embodiment of the invention and taken on the line 1—1 of Fig. 2; and

Fig. 2 is a transverse vertical sectional view, the upper portion and the lower right portion of which is taken on the line 2—2 of Fig. 1; the lower left portion of Fig. 2 is taken on the line 2^a—2^a of Fig. 1.

In the drawings there is disclosed a mechanism containing casing 10 formed of sheet steel suitably fastened together to form the box-like construction illustrated. At one end of the casing there is provided an upstanding air discharging stack 11 having a constricted throat 12 to regulate the rate of discharge of the waste air as it moves out of the casing. A horizontally extending partition 13 within the casing divides its interior into an upper yarn treating chamber 14 and a lower air conditioning chamber 15. Preferably, this partition is formed of insulated material to minimize heat transference between the chambers and is provided at one end with a long narrow passageway 16.

Positioned within the upper chamber 14 and extending lengthwise thereof is a conduit forming means comprising an upper series of baffles 17 and a lower series of baffles 18 vertically spaced apart and coacting to form therebetween a long flat air conduit 19 constituting a closed space in which the yarn is treated. The conduit opens at one end through the end wall 20 of the casing adjacent the stack 11 to form a yarn inlet 21. At the opposite end of the air conduit 19 a yarn outlet 22 is provided in the opposite end wall 23 of the casing. A plurality of parallel leasing rods 24 form closures for the inlet 21 and for the outlet 22. While only three of these rods are illustrated it will be understood that in actual practice a much larger number of rods will usually be employed. It will be understood that the casing will be located to bring the inlet 21 close to the last squeeze roller of the size box (not shown) and that yarn Y after leaving the size box is passed into the casing between each adjacent pair of rods forming the closure for the inlet, that the yarn extends through the air conduit thus forming a yarn path YP and is discharged through the correspondingly located rods in the outlet 22.

The two series of air baffles are of peculiar design and are intended to cause the air passing between the same to surge back and forth across the several yarn paths. Each series is formed of a series of half cylinders 25 arranged in parallel relation with the contacting edges 26 secured together to form a corrugated effect. The series of baffles is arranged in a laterally offset relation with the edges 26 of one series disposed opposite to the concaved portion of the other series. The two series thus coact to form a sinuous or undulating path for the air in its passage from one to the other end of the conduit 19. The conduit is provided at one end with a downwardly facing air intake 27 overlapping and in line with the passageway 16 and at the opposite end with a long narrow main air discharge port 28 opening upwardly in position to discharge its contents towards the throat 12 of the stack.

The upper series of baffles 17 act to provide a normally dead air space or by-pass 29 between itself and the top wall 30 of the casing and from which space its contents discharge into the stack 11.

One or more of the half cylinders 25 forming the upper series of baffles and preferably one or two of the baffles adjacent the intake 21 are provided with one or more supplemental air discharge ports 31 in the top arched portion of these half cylinders. This is to permit a controlling of the moisture content while the yarn is damp and before the size has congealed or case hardened. Under some conditions it is advisable to withdraw the air at different points along the conduit and for this purpose a few of the half cylinders are shown equipped with discharge ports. These supplemental ports are each controlled either manually or automatically so that by controlling the amount of air passed there-through the amount of air which is permitted otherwise to pass the entire length of the air conduit before it is discharged through the main port 28 is governed. The simplest form of device would be to have the dampers set initially to give the requisite amount of air flow through the main discharge port 28.

As illustrative of one means by which the dampers and thus the ports controlled thereby can be regulated automatically, it is suggested that the damper or dampers be operated to move to and from their opened and closed position by a damper motor 33 which may be pneumatic or electric driven type in turn controlled by a hygrostat 34, the control element 35 of which is located in the conduit 19 at that point along the length thereof where its installation may be most convenient and where the moisture content is most apt to be uniform and most apt to be truly indicative of the average moisture condition along the length of the conduit.

The air conditioning chamber 15 is provided in the end wall 20 with a screened air inlet 36 through which atmospheric air is admitted into the right end of the chamber as shown in Fig. 1. Considering the showing in this figure from right to left, there is positioned therein and adjacent the screened inlet a dehumidifier 37 for cooling the incoming air. The dehumidifier is illustrated as comprising two banks of water pipes 38 each provided with a vertically spaced series of discharge nozzles 39, all pointing in the direction of air flow through the chamber 15. The two banks of water pipes are supplied from a main water pipe 40 leading from a suitable source of cold water supply and controlled by a valve 41. Natural well water chilled to a temperature of 40 to 65° F. has been employed successfully in cooling the air in practicing the process herein featured. It is also suggested that the water be chilled by any mechanical refrigerating process and passed repeatedly through the nozzles by means of a circulating pump. The air cooled as it passes the space into which the nozzles direct the cooling spray is deprived of at least a part of its water.

In advance of the dehumidifier 37 is a series of closely positioned deflectors 42 coacting to form a water eliminator which functions to remove additional surplus water from the air as it passes therethrough. The water trapped out of the air flow by the eliminator as well as the surplus water from the dehumidifier is discharged through an overflow drain 43 or may be recirculated. Preferably, pipe 40 supplies cold water

under high pressure to the several nozzles 39 and which pressure may be obtained by the use of a suitable motor driven water pump (not shown). The nozzles 39 are designed to eject the water in finely divided spray form into the chamber 15 and into the space between the dehumidifier and the eliminator. From the eliminator the air with some entrained particles of water is passed through a heating device 44 to give it the requisite temperature. The form of heater illustrated includes heat distributing fins 45 heated by steam in pipes 46 supplied from a suitable source of steam supply through control valve 47. It is a feature of this disclosure that a heater of relatively small capacity is all that is necessary to raise the temperature of the more or less dehydrated air and only that amount of heat is added which will give the requisite rapidity of drying of the yarn sufficient to condition the yarn during the time delay while it is in the short drying conduit. The air so heated in its passage through the device 44 is picked up by the rotary fan 48 and discharged thereby through passage 16 into the air conduit 19 as previously described.

Obviously the steam controlling valve 47 may be manually controlled and set in position depending upon the amount of heat required for any particular condition of the yarn under treatment. It is herein suggested that the heat supplied to the air be thermostatically controlled by the temperature of the heated air as it is discharged into the conduit 19. For this purpose a controlling thermostat 49 has its control element 50 positioned in the conduit 19 adjacent its intake end and is conventionally connected to the steam valve 47 for regulating the opening and closing movement of the same.

In operation the apparatus is first set up to handle the yarn to be sent therethrough, the cooling water supplied to the dehydrator is turned on; the heater and fan are set into operative condition and the hygrostat and thermostat adjusted experimentally or as may be dictated by prior operation of the device so as to give the desired drying of the particular yarn about to be fed through the device. The yarn from the sizing box is passed therefrom promptly through the leasing rods at the yarn inlet 21, then it is passed while suspended freely in air through the air conduit 19 and finally discharged out through the leasing rods at the outlet 22. If the distance which the leasing rods are spaced apart at opposite ends of the conduit is too far and the yarn sags too much in its distended position, it is suggested that support rollers 51 be located in the conduit where they will be most effective in holding the yarn suspended and free of contact with any part of the mechanism between the leasing rods at opposite ends of the casing. The yarn is then drawn through the device, more or less conventionally, except that no more tension is placed on the yarn than is necessary simply to draw it through the conduit. As there has been eliminated from this disclosure the usual drying cylinders, there has been incidentally also eliminated the usual and undesirably great tension to which yarn has been subjected in the known slashing processes where the yarn is trained about the drying cylinders.

It is the intent herein that the apparatus shall function automatically after it has been once set in motion. Where the thermostat is used to control the amount of steam supplied to the heating element, it is obvious that if the air for the

time being discharged into the conduit is too hot, the steam will be proportionately shut off and, on the contrary, if the air is too cool to effect the desired rate of dehydration of the yarn, the thermostat will respond to permit a greater supply of steam to the heating device. Similarly, if the air is being supplied in such amounts as will tend to effect a too dry condition of the yarn by the time it is discharged, the hygostat will function to open the dampers more or less and thus permit for the time being some of the dehydrating air to by-pass the initial stretch of the yarn as it comes into the conduit from the size box and in this way delay the lapse of time the yarn is in contact with the hotter part of the air. The air not used is by-passed out of the conduit and discharged idly out through the stack.

The staggered arrangement of the baffle parts with an inlet of one half cylinder disposed vertically opposite the outlet of the next proceeding half cylinder on the opposite side of the yarn path has the effect of providing an air conduit much longer than the path of the yarn in its movement therethrough. Tracing out the path of the conditioning air while in the conduit, it will be noted that the fan discharges the air at its highest temperature and highest speed, transversely across the driest portion of the yarn at the left of Fig. 1. It is particularly noted that this air passes more or less perpendicularly across the plane or planes containing the yarn rather than lengthwise of the yarn. After passing across the yarn at any unit portion of its length, the air current strikes the concaved reflecting surface of the opposing half cylinder which acts to change the direction of the air and it then passes in reverse direction, first upwardly and then downwardly, successively through the succeeding unit lengths of the yarn. As the yarn moves much slower than the air every unit length of yarn has air substantially at the same temperature and moisture content pass therethrough repeatedly.

During this tortuous travel of the air successively through succeeding portions of the yarn, the air gradually lowers its temperature while extracting from the yarn either substantially all of its water content or rather that amount which is controlled by the temperature and volume of the air which passes the same. As the air with its maximum water content reaches the main discharge port 28, it is contacting with the incoming and thus wetted portion of the yarn before the water laden air is finally discharged out through the stack 11.

By practicing the method using the apparatus hereindisclosed, it is possible to condition the yarn and at the same time avoid the deleterious effects thereon when the yarn was subjected to the hot baking or ironing operation which characterizes present known methods. Following the method herein featured, the yarn will retain its original round shape permitting the weaving of a cloth having a superior face. There is eliminated the loss of the short fibers with a resulting increase in production of the conditioned yarn; its elasticity will be retained which will facilitate an improvement in the subsequent weaving conditions and there will be a resulting saving in material otherwise lost by the present processes in excessive drying and breakage due to sticking and baking on the cylinders and lapping up. There is also attained economy in operation as there is less loss from the fin type heaters here-

in suggested to be used over the relatively large heat loss from the present form of slasher drum. Finally, as the operations herein featured are conducted at relatively low temperatures, there has been avoided the heat losses which inevitably flow from processes where high temperature heat is employed. It is further obvious that the high speed of the air as it is directed along the air conduit reacts with the yarn to develop a surface friction which in turn tends to heat the yarn and at least to some extent effects a saving in the amount of heat necessary to be supplied initially to the air as it is passed into the yarn treating conduit.

Particular care must be exercised in balancing the controlling conditions to obtain the best form of finished yarn. Considering a dehydrating operation, the drying will, of course, first occur on the surface of the yarn and in order to increase the surface area exposed to the air is one reason why the yarn is leased just before it is passed into the conduit 19.

As the yarn dries at its surface the moisture in the interior of the strands or ends moves by capillary attraction towards the surface and with different types of yarn the rate of movement of the free, the mechanically and chemically combined water, in the yarn varies with the character of the yarn. It is desirable to so regulate the water absorbing capacity of the air passed along the yarn and the time lapse while the yarn is being subjected to this air drying operation be so timed that at all times while the yarn is being treated, its moisture content should be equalized and no abnormal or too fast drying occur at the surface. As it would be inconvenient to vary the length of the conduit for the different types of yarn passed therethrough, it is suggested that the time delay necessary to provide the delayed drying herein featured, be controlled by varying the rate of movement of the yarn, by varying the air flow at the fan and by varying the degree of opening of all of the outlets 31 or by selectively varying the opening of one or more, and thus control the amount of air permitted to pass the entire length of the conduit 19.

While the disclosure illustrated features a single length of air conduit in which the yarn is to be treated, it is suggested that in those situations where space disposition is a serious problem, that the air conduit be doubled back upon itself, one or more times, to obtain the requisite length of air conduit within a small space. This form of construction has the objection that it is necessary to bend the yarn about rollers at opposite ends of its drying path in order to change its direction. It is a particular feature of this disclosure to minimize if not to entirely eliminate any such change direction rollers as such rollers tend to increase tension on the yarn. As it is a feature of this disclosure to minimize tension as far as possible on the stretch of yarn while it is being subjected to its drying treatment it is preferable to increase the length of the conduit if there is not sufficient time delay to effect the desired drying of the yarn and to depend upon the supporting rollers to avoid undue sag and thus stretch along the length of the yarn.

I claim:

1. In a slasher, the combination of a casing having a yarn treating chamber, means providing an air conduit and a by-pass in said chamber, means at one end of the air conduit providing a yarn inlet and at the opposite end a yarn outlet,

leasing rods defining both the inlet and outlet, means for feeding the yarn in through the leasing rods at the inlet, means for guiding the yarn horizontally through the air conduit without any material amount of sag in the length of the yarn within the chamber, and out through the leasing rods at the outlet, said casing also provided at one end with a stack for discharging the air from the by-pass, and said conduit having a main discharge port opening into the by-pass adjacent the stack, means for passing dehydrating air horizontally through the conduit and said conduit also provided with a dampered supplemental port opening into the by-pass to regulate the amount of air passed to the main discharge port at the stack.

2. In a device for drying yarn, the combination of a casing, means therein defining an air conduit and a by-pass, said air conduit provided at one end with a main air discharge port opening into the by-pass, means for causing a length of yarn to be suspended in said conduit, means for feeding said yarn through said conduit while so suspended, means for forcing air under pressure into said conduit at its other end, said conduit provided with a supplemental port opening therefrom into the by-pass intermediate its ends, a valve for controlling said supplemental port, and hygrostatically controlled means including an element located in the conduit for controlling the opening and closing of said valve thereby to control the air passed along the air conduit.

3. In a machine for conditioning wet yarn, the combination of a treating conduit provided with an air inlet adjacent one end and an air outlet adjacent the opposite end thereof, means for passing the wet yarn through the conduit, means for circulating conditioned air in a general lengthwise direction from end to end of the conduit, baffle means within the conduit adapted to direct

air transversely in serpentine fashion along the entire length of the conduit and thus through and about the yarn in the conduit, said conduit provided with a plurality of air ports spaced apart intermediate the ends of the conduit and control means for simultaneously regulating the opening of all of the air ports thereby to regulate the amount of air permitted to contact different unit lengths of the yarn before it is discharged from the conduit and the yarn passing means and the air current moving means coacting to move the yarn at a much slower rate of feed than the flow of the air.

4. In a slashing machine, the combination of a mechanism containing casing provided adjacent one end with an upstanding air discharge stack, a horizontally extending partition within the casing dividing its interior into an upper yarn treating chamber and a lower chamber, and said partition having a passageway extending there-through adjacent the end thereof opposite the stack, means in the upper chamber constituting a yarn treating conduit, means for feeding leased yarn through said conduit including yarn leasing rods provided at the opposite ends of said conduit, said conduit defined by two vertically spaced apart series of half cylinders with their concaved sides facing inwardly towards each other and arranged to form a sinuous conduit with one end opening downwardly and facing the passageway in the partition and the other end of said sinuous conduit discharging upwardly into the stack, means in the lower chamber for supplying dehydrating air under pressure directly to said passageway, and control means adjacent said passageway for bleeding off from said yarn treating conduit regulated amounts of the air thereby to control the air passed through the sinuous conduit on its way to the stack.

MARK W. MAYES.