APPARATUS FOR CONDITIONING TEXTILE MATERIAL BEING DRAFTED

Joe R. Whitehurst, Bessemer City, N.C., assignor to Ideal Industries, Inc., Bessemer City, N.C., a corporation of North Carolina


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ABSTRACT OF THE DISCLOSURE

Apparatus for conditioning textile material being drafted through a plurality of successive drafting zones which includes means for directing an air stream from a source into one drafting zone independently of other drafting zones, and wherein means are provided for sensing the condition of the air in the drafting zone and for compensatively conditioning the incoming air stream in response to sensed variations thereof from a predetermined desired condition.

This application is a continuation-in-part of my copending application Ser. No. 264,328 filed Mar. 11, 1963 (now Patent No. 3,247,551), and entitled, Apparatus and Method for Conditioning Textile Material Being Drafted.

My said copending application discloses a method and apparatus for conditioning fibrous textile material being drafted by sensing and compensatively adjusting the temperature and/or relative humidity of the air immediately surrounding the textile material being drafted and the associated drafting machine elements. The specific apparatus embodiment disclosed in said copending application includes a large enclosure into which conditioned air is directed and which encloses the entire upper portion of the textile machine, including all the drafting zones, areas preceding the drafting zones through which the textile material is being directed to the drafting zones, and areas following the drafting zones, including the collar head, so as to condition the textile material prior to its entering the drafting zones, while it passes through the drafting zones, and while it passes from the drafting zones to the collar head.

Although such an arrangement greatly improves the drafting of textile fibers, it has been determined that the efficiency of the drafting mechanism and the efficiency of the conditioning of the textile material being drafted therethrough may be further improved, in accordance with the instant invention, by directing a conditioned air stream in a localized area at a particular drafting zone. The directing of such conditioned air stream into the front drafting zone defined between the set of delivery rolls and the immediately preceding set of drafting rolls is especially beneficial, because the largest amount of draft is imparted to the fibers in the front drafting zone, as a consequence of which the fibers normally generate considerably more heat in the front drafting zone than they do in the preceding drafting zones. Further, the drafting rolls which define the front drafting zone rotate at substantially higher speeds and generate substantially more heat than preceding drafting rolls. Since the greatest amount of heat is generated in and adjacent the front drafting zone in a series of drafting zones, and the front drafting rolls rotate at substantially higher speed than the preceding drafting rolls of the corresponding series, it has been determined that the front drafting zone requires conditioned air which is conditioned quite differently from surrounding the preceding drafting zones as well as surrounding the material being fed to and emanating from the drafting zones.

Accordingly, it is an object of this invention to provide an apparatus for conditioning fibrous textile material passing through and being drafted through a series of spaced sets of drafting rolls defining a series of drafting zones between respective adjacent sets of drafting rolls, wherein an air stream is directed from a source through an enclosure means substantially confining one of the drafting zones independently of the other drafting zones, and wherein the air stream flows past and against the material being drafted through the corresponding drafting zone while the condition of the air stream is being sensed as it passes through the enclosure means, and also wherein the air stream is compensatively conditioned in its course from a source to the enclosure means in response to the sensing of variances in the condition therefrom of a predetermined condition.

In addition to the aforementioned advantages of providing a localized conditioned area in the drafting zone for conditioning the fibrous material being drafted therethrough, is opposed to confining the entire upper portion of the textile machine as disclosed in the specific embodiment of my aforementioned copending application, it has been determined that the instant invention readily permits the incorporation therewith of the cleaning system disclosed in application Ser. No. 479,554, filed by Ronald David Kincaid on Aug. 13, 1963, and entitled Textile Machine Cleaning System and Method, owned by the assignee of the present invention. The aforementioned cleaning system is primarily concerned with the utilization of air streams for cleaning the collar head and areas surrounding the same, and areas beneath the drafting zones, as well as providing means for dissipation of lint and fly escaping from the material being drafted as it passes from the delivery rolls to the collar head. While many of the advantages of a textile machine equipped with such a cleaning system are apparent to those skilled in the art, the concurrent conditioning of textile material being drafted in accordance with the instant invention offers additional advantages to be pointed out in greater detail hereinafter.

It is therefore another object of this invention to provide an apparatus for localized conditioning of fibrous textile material being drafted in a textile machine while concurrently directing air streams across and adjacent upper portions of the textile machine for aiding in the cleaning of the machine without interfering with the conditioning of the textile material.

According to a preferred embodiment of the invention, suction heads of a well-known type are positioned in close proximity to and extend longitudinally of top and bottom drafting rolls defining the corresponding or front drafting zone therebetween, and a blowing nozzle emitting a broad, narrow air stream therefrom is located between the drafting rolls defining the front drafting zone. Strips of pliable, preferably impervious, material are positioned between and connected to the blowing nozzle and the upper suction heads, and an additional strip of pliable material extends between and is connected to adjacent bottom suction heads so that the strip of pliable material is adjacent the blowing nozzle and the suction heads cooperate with the drafting rolls in forming an enclosure substantially confining the front drafting zone independently of the preceding drafting zones and into which a conditioned air stream is directed from the blowing nozzle to be withdrawn from the enclosure by a flow of air into the suction heads. Further, suitable sensing means are provided within the enclosure for sensing the temperature and/or relative humidity of the air within the enclosure, which sensing means control an air-conditioning device
through which the air stream is directed from a source to the blowing nozzle, thus insuring that the air in the enclosure and surrounding the material passing through the front drafting zone is maintained at substantially a given temperature and/or humidity at all times.

Some of the objects of the invention having been stated, others which will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a fragmentary vertical sectional view through the drafting mechanism and coller head of a drawing frame or the like showing the improved air-conditioning system in association therewith;

FIGURE 2 is a diagrammatic illustration of the essential components of the invention and showing an electrical circuit for controlling the apparatus of the present invention;

FIGURE 3 is an enlarged partially exploded perspective view of the blowing nozzle and one of the suction heads showing how corresponding pliable strips may be formed and connected to the blowing nozzle and adjacent suction head;

FIGURE 4 is an enlarged fragmentary detail of the front drafting zone and adjacent drafting rolls shown in FIGURE 1 to better illustrate the construction of the individual enclosure for the front drafting zone; and

FIGURE 5 is a view similar to FIGURE 4, but showing an enclosure especially constructed for use with a drafting zone having a relatively small slip drafting roll therein located between the two bottom drafting rolls defining the corresponding drafting zone.

Referring more specifically to the drawings, the apparatus of the present invention is shown in association with a drawing frame or machine including a series of spaced sets of top and bottom drafting rolls 11, 11'; 12, 12'; 13, 13'; 14, 14', preferably of the longitudinally fluted, intermeshing type and defining a series of drafting zones between the adjacent sets of drafting rolls. Rolls 11-12, 11'-12' may be driven by conventional means, which may include a motor 15 (FIGURE 2) operatively connected to drive roll set 11, 11' at a relatively slow speed and to drive roll sets 12, 12'; 13, 13'; 14, 14' at progressively increased speeds, as is usual, for drafting fibrous textile material such as textile slivers S therefrom. Rolls 11-14, 11'-14' are mounted on a frame member or girt 16 of a frame 20 which also supports a spectacle 21 extending beneath and forwardly from girt 16. After passing through and being drafted by the rotating drafting rolls 11-14, 11'-14', the textile material may pass through a suitable sliver guide or denser 22 and then through a trumpet 23 where it is condensed into a sliver S' and drawn between a pair of calender rolls 24 to a coiler head or tube gear 25 for coiling the sliver S' into a can, not shown, as is usual. Coiler head 25 is supported upon spectacle 21, and the coiler head as well as calender rolls 24 may be driven in a well-known manner by an electric motor 15. Reference is made to said copending application Ser. No. 264,328 for a more detailed disclosure of the manner in which the drafting rolls and calender rolls are mounted and driven.

The drawing frame herefore described is of typical conventional construction and the apparatus for carrying out the method of the present invention is shown in association therewith by way of illustration only, since there are many types of drafting machines, such as roving frames, spinning frames and the like, with which the present apparatus may be used without departing from the spirit of the invention.

According to the present invention, air directing means, to be later described, is provided for directing an air stream into one of the drafting zones independently of the others and past and against the material passing therethrough and being drafted therein. Since the required temperature and humidity conditions of the air are most critical in the area of the front drafting zone, as defined between the front or delivery drafting rolls 14, 14' and the immediately preceding set of drafting rolls 13, 13', the aforementioned air directing means directs an conditioned air stream into the front drafting zone and, conveniently, a suction cleaning apparatus of a type such as is disclosed in my U.S. Patent No. 2,934,797, is employed by suction nozzle means for withdrawing air from the front drafting zone while also removing fine fibers and dust from the drafting rolls. However, it is to be understood that other types of suction heads or nozzles may be positioned in close proximity to the drafting rolls and/or the textile material being drafted for withdrawing the air from the front drafting zone. The suction heads or nozzles a-d are provided above the respective top drafting rolls 11-14 and suction heads or nozzles a-d' are disposed beneath the respective bottom drafting rolls 11'-14'. Each suction head is disposed in close proximity to and extends longitudinally of each respective upper and lower drafting roll. The suction heads are suitably supported so that the opposed side walls thereof are positioned in close proximity to but spaced from the corresponding drafting rolls to permit air to flow between the front and rear walls of the suction heads and the respective drafting rolls and thus into the heads.

The medial portion of each suction head a-b, a'-b' remote from the respective drafting roll has a flexible conduit 30 communicatively connected thereto and extending laterally outwardly therefrom and communicatively connected to a corresponding manifold pipe, two of which are shown in FIGURES 1 and 2. The front ends of manifolds 31, 32 are closed and the rear ends thereof are communicatively connected to an upright duct or hollow standard 34, connected by conduits or ducts 35, 36 to the air inlet or suction side of a fan housing 37. Housing 37 is provided with an air impeller or fan 40 therein driven by an electric motor 41 (FIGURE 2). A suitable filter 42 filters the air stream entering housing 37 to separate lint and other lightweight material therefrom before the air stream reaches impeller 40.

Housing 37 may be provided with two air outlets 43, 44 on the exhaust or blowing side thereof. Outlet 44 may exhaust to the atmosphere surrounding the textile machine and may be provided with a manually or automatically operated valve 45 therein for controlling the amount or volume of air which may be exhausted into the atmosphere as compared to the amount of air in the air stream directed through outlet 43, for purposes to be later described.

In order to direct a conditioned air stream from the source embodied in fan 40 into one of the drafting zones, e.g., the front drafting zone, the broad, narrow discharge end or orifice 46 of a blowing nozzle 50 is disposed between top drafting rolls 13, 14 and spaced closely above the fibrous textile material S passing through the front drafting zone defined by the drafting rolls 13, 14; 13', 14'. The length of orifice 46 of blowing nozzle 50 preferably is about the same as the length of the fluted portions or bosses of the corresponding drafting rolls. In any event, the length of the orifice of blowing nozzle 50 should be about at least as long as the width of the web or strands of fibrous textile material S passing through the corresponding drafting zone. Although a single air discharge orifice 46 is shown, it is to be understood that several air discharge orifices may be provided in the front drafting zone. As shown in FIGURE 3, opposed side walls of blowing nozzle 50 converge upwardly and terminate in a tubular portion 52 which is the end of a flexible conduit 53 (FIGURES 1 and 2) communicatively connected thereto.

As shown in FIGURE 2, the other end of conduit 53 must be communicatively connected to a rigid conduit 54 which extends upwardly and communicatively connects with an air conditioning chamber 56 which is also communicatively connected to the outlet 43 of fan housing 37. The air conditioning
chamber 56 and the elements to be described in association therewith may be constructed and operated in substantially the manner disclosed in said pending application Ser. No. 264,728 and, accordingly, only a general description thereof will be given hereon in this context and reference is made to said pending application for a more detailed description thereof.

In order to maintain efficient control of the air flow in the front drafting zone, it is preferred that the front drafting zone be provided with an enclosure which is independent of the remaining drafting zones in the series. Accordingly, in order to provide means substantially enclosing the drafting zone while permitting adjustment of the drafting rolls to vary the spacing between adjacent sets of drafting rolls, as is the case in changing over the machine from the drafting of textile fibers of one length to the drafting of textile fibers of another length, enclosure strips 60 of thin pliable material are attached to and bridge the distance between blowing nozzle 50 and the adjacent suction heads c, d. Also, a similar strip of thin pliable material 63 is connected to and spans the distance between the adjacent bottom suction heads c', d'.

Each pliable strip 60, 62 is preferably made from an impervious material, such as a suitably coated fabric or molded plastic material, and may be detachably connected to the corresponding nozzles. As best shown in FIGURES 6, 7, each pliable strips 60, 62 is provided with an enlarged or thickened bead portion 63 extending throughout each longitudinal edge thereof. Those outer surfaces of nozzles 50, c, d, c', d' to which the pliable strips are to be connected are each provided with a longitudinally extending groove 64 therein of lesser width than the corresponding outer surfaces of the nozzles than it is inwardly thereof. Thus, the corresponding beads 63 may be inserted in the ends of the grooves 64 with the bodies of the pliable strips extending outwardly therefrom and then the strips may be slid along the grooves 64 until they are properly aligned with the corresponding nozzles, thus facilitating assembling and disassembling the pliable strips 60, 62 with respect to the corresponding blowing and suction nozzles.

It is to be noted that strips 60, 62 cooperate with the nozzles 50, c, d, c', d' and with drafting rolls 13, 13', 14, 14' to form a drafting zone enclosure and designated at 65 in FIGURES 1, 2 and 4. Since the air stream entering the front drafting zone is constantly in motion, special means need not be provided for closing opposed ends of enclosure 65 adjacent the ends of the boxes 11 and 12. As is well known, the ends of suction heads a-d, a'-d' are usually located closely adjacent the usual bearing blocks in which the drafting rolls are mounted so such bearing blocks may serve to close substantially the ends of enclosure 65.

Referring now to the conditioning chamber 56 shown in FIGURE 2, in order to condition the air stream as it flows from the source through fan outlet 43, through conditioning chamber 56, and before it is discharged from blowing nozzle 50 into the front drafting zone, the lower portion of conditioning chamber 56 serves as a reservoir and contains a supply of water W (FIGURE 2) or other suitable liquid therein. A pair of spaced filters or screens 70 is suspended in conditioning chamber 56 and located in the path of flow of the air stream from the inlet to the outlet of conditioning chamber 56. The lower portions of screens 70 extend into the water W so that air entering chamber 56 must pass through filters 70 in its course to duct 54 and nozzle 50. In this instance, filters 70 are suitably secured to and suspended from respective pipes 71 which are perforated along their lower portions and are connected to the discharge side of a suitable pump P driven by an electric motor M. Pump P may be submerged in the water W so that it pumps liquid from the lower portion of chamber 56 into pipes 71 and onto the respective screens 70, thus forming a thin sheet of liquid (water screen) for introducing moisture into the air stream passing therethrough in its course to blowing nozzle 50. The amount of water or other liquid directed to screens 70 determines the relative humidity of air flowing to and being discharged from blowing nozzle 50 and thereby determines the amount of moisture which will be maintained in the fibrous material S passing through the front drafting zone.

Depending upon the type and speed of fibers being drafted, it is desirable to maintain the air in the immediate vicinity of the front drafting zone at a relative humidity in the range of approximately 40%-65% in order to maintain the desired amount of moisture in the textile material being drafted. Accordingly, the electric motor M for pump P may be controlled by a suitable hygrometer or hygromast which may be positioned between bottom drafting rolls 13', 14' at least partially within the enclosure 65 and in close proximity to the material being drafted therefrom. Hygromast H may be of any well known type which will actuate or close an electrical circuit between a pair of conductors 72, 73 whenever the relative humidity of the ambient air drops below a predetermined minimum and to thereby energize pump motor M. When the moisture added to the air stream by screens 70 raises the relative humidity in the front drafting zone to the desired range, hygromast H breaks the circuit to electric motor M.

The desired range of relative humidity of air in the front drafting zone should be maintained while the temperature of the air flowing through the drafting zone is within a range of from about 60°-90° F. For example, in the drafting of cotton sliver, cotton fibers respond to the drafting operation most effectively when the air in the front drafting zone is maintained at a temperature of about 65° F. and at a relative humidity of about 55%. In drafting of certain synthetic staple fibers, such as Dacron, the fibers respond to the drafting operation most effectively when the air in the immediate area of the front drafting rolls or in the front drafting zone is maintained at a temperature of approximately 90° F. and at a relative humidity of approximately 60%.

In order to maintain the temperature of the air in the enclosure 65 which substantially confines the front drafting zone, at or below a predetermined maximum temperature regardless of the amount of heat generated by drafting rolls 13, 14, 13', 14' and the fibrous material S being drafted, thermostatically controlled means are provided for cooling the water W in the lower portion of conditioning chamber 56 so that air passing through screens 70 may pick up a relatively cool moisture. Whereupon the temperature of the air stream in its course to the enclosure at the front drafting zone.

As shown in FIGURE 2, the temperature of the water W in the lower portion of conditioning chamber 56 may be maintained below a predetermined maximum temperature by means of a cooling or refrigerating device generally designated at 75 and which may include a cooling coil 76 having a portion extending into the lower portion of conditioning chamber 56 and being submerged in the water W. Opposed ends of cooling coil 76 are connected to a compressor 77 which may be driven by an electric motor 80. A thermostatic switch T is electrically connected in an electrical circuit in series with motor 80 and is located closely adjacent and beneath the textile material passing through the front drafting zone. Thermostatic switch T is also at least partially located within front drafting zone enclosure 65. Thus, upon the temperature of the air in the front drafting zone reaching a predetermined maximum temperature, thermostatic switch T will actuate electric motor 80 to cool the water in conditioning chamber 56 until the air stream being directed into the front drafting zone from nozzle 50 has cooled the front drafting zone to a temperature below the maximum permissible temperature, whereupon thermostatic switch T will deactivate or interrupt the flow of electrical energy to refrigeration motor 80.
In order that the drafting mechanism will operate efficiently and for other purposes to be later described, it is highly desirable that the front drafting zone and rolls 13, 14, 15 defining the same are heated to a predetermined minimum temperature before operation of the drafting mechanism is started following the stopping of the drafting mechanism for any substantial period of time. Accordingly, in addition to providing means for maintaining the temperature of the air stream flowing into the drafting zone below a predetermined maximum temperature and at a predetermined relative humidity, means is also provided, in the form of an electric heater 85, for heating the air in its course to blowing nozzle 59.

To this end, electric heater 85 is suitably mounted in a medial portion of duct 54 so that all the air passing through conditioning chamber 56 may move past and be heated by electric heater 85 whenever the air in the front drafting zone is below the desired minimum temperature. Energization of electric heater 85 may be controlled by a suitable thermostatic switch 'T' whose upper end, at least, is positioned within enclosure 65 and immediately below the path of travel of the fibrous material 8 through the front drafting zone. Thermostatic switch 'T' is inserted in the electrical circuit of FIGURE 2 in series with the armature of relay 25, the latter serving to automatically control the energizing of the electric heater 85, whenever the temperature of the air in the front drafting zone is below the predetermined minimum of approximately 65°F, for example, and which will open and break the circuit to the electric heater 85 whenever the air in the front drafting zone is above the predetermined minimum.

In order to assure that properly conditioned air is being introduced into the front drafting zone whenever the machine is operating, it will be observed in FIGURE 2 that fan motor 41 is arranged in the electrical circuit in series with the coil of an electromagnetic switch or relay 87 and a manual switch 90, and the main drive motor 15 is in series with the armature of relay 87 and a manual switch 92. It is apparent, therefore, that the main drive motor 15 cannot be started until the blower or impeller 40 is rotating and circulating air through enclosure 65, since the closing of switch 90 energizes fan motor 41 and the coil of relay 87 so that manually operable switch 92 may not, until then, become effective, when closed, for energizing main drive electric motor 15 through the armature of relay 87. Manually operable switches 93, 94, 95 may be provided as a convenience to manually stop the flow of electrical energy to motor 80 of refrigerating device 75, heater 85, and pump motor M, respectively, if desired. However, during normal operation of the drawing frame, all three switches 93, 94, 95 would occupy closed position.

From the foregoing description, it is apparent that, whenever the relative humidity of the air in the front drafting zone is below the predetermined minimum and the manually operable switch 95 is closed, the hygrostat 12 closes and completes the circuit to electric motor 79 which drives pump P and thus causing water to flow over the screens 60 to add moisture to the air flowing into conditioning chamber 56 until such time as the relative humidity of the air in the front drafting zone is raised to the desired minimum level. Also, whenever the temperature of the air in the front drafting zone is below the desired minimum temperature, thermostatic switch 'T' closes the circuit to heater 85 so the air stream passing through conditioning chamber 56 and duct 54 is heated until it reaches the desired minimum temperature within the enclosure 65 at the front drafting zone, whereupon thermostatic switch 'T' is opened. Further, whenever the temperature of the air in front drafting zone enclosure 65 exceeds a predetermined maximum temperature, thermostatic switch 'T' is closed and completes the circuit to electric motor 80 to drive compressor 77 and thereby cool the water W in conditioning chamber 56. Upon the temperature of the air stream flowing into the front drafting zone being cooled to the desired extent by the cold water flowing over screens 70, thermostatic switch 'T' then opens and breaks the circuit to compressor motor 89.

By providing means for delivering a conditioned air stream directly into the front drafting zone independently of the rear drafting zones in the series in accordance with the instant invention, it now becomes practicable to utilize auxiliary air streams for continuously pneumatically removing undesirable waste material such as lint, dust, pepper trash and other light material, from various parts and areas above spectacle 21 of the drawing frame during operation thereof without adversely affecting the condition of the air stream being directed into the front drafting zone from blowing nozzle 59. Such parts and areas may include areas adjacent the drafting rolls generally, the grit 16, silver guide 22, trumpet 23, cooler head 25 and exposed portions of the textile material S, S' in its travel above spectacle 21 and into cooler head 25.

Accordingly, it will be observed in FIGURE 1 that frame 20 of the drawing frame supports a housing 100 whose upper portion may be in the form of a tiltable cover and which may be constructed substantially in the manner of the disclosed embodiment of applicatior Ser. No. 479,554. The upper surface of duct 35, grit 16 and spectacle 21 of FIGURE 1 collectively define and serve as the bottom of housing 100. Housing 100 serves as a common enclosure for all the drafting rolls, their suction nozzles, the silver guide 22, trumpet 23, calender rolls 24, cooler head 25, updraft duct 34, and adjacent elements of the drawing frame. Spaced above the drafting rolls and the condenser or silver guide 22, and positioned within housing 100, is a suction chamber 101 having a conduit 102, preferably of the flexible type, connecting the rear wall of suction chamber 101 to the upper portion of upstanding duct 34. As heretofore stated, upstanding duct 34 is communicatively connected to the inlet of suction fan housing 37 (FIGURE 2) so that suction is produced continuously in suction chamber 100 during operation of fan 40.

A bottom wall 103 of suction chamber 101 is provided with a plurality of elongate openings or slots 104 therein located above and extending generally parallel with the drafting rolls, and whose effective size may be adjusted by adjustable plates 105. Additionally, the bottom wall 103 of suction chamber 101 is provided with one or more relatively large ingress openings 106 adjacent the forward portion thereof and in substantially vertical alignment with condenser or silver guide 22. A downwardly extending flared suction hood 110 is carried by the bottom wall 103 of suction chamber 101 and has its upper portion communicating with ingress opening 106. The open bottom or mouth of suction hood 110 is positioned in close proximity to and overlies condenser 22, with the area of the mouth of hood 110 being substantially equal to or greater than the area through which the textile material passes in its course from delivery drafting rolls 14, 15' to trumpet 23.

In order to assure adequate cleaning without displacing the textile material from the desired path of movement between the drafting rolls and collar 25, the mouth of hood 110 is spaced a predetermined distance above the path of movement of the textile material as defined by condenser 22. It will be noted that the mouth of hood 110 lies in a plane which extends at a slight angle to the path of movement of the textile material, as is desirable, inasmuch as the textile material emanates from delivery rolls 14, 15' as a thin sheet which is more easily displaced by the flow of air, and thus the greater displacement of the rearward portion of the mouth of hood 110 lessens the likelihood of the textile material being drawn upwardly into suction chamber 101 by the flow of air induced into hood 110.

In order to provide a flow of air for induction into...
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suction chamber 101, and cleaning the area where waste material would otherwise accumulate, a forward portion of enclosure 100 is provided with one or more air inlet openings 115 which may be defined between the forward portion of housing 100 and a lower, fixed front wall portion 113 thereof. It can be appreciated that the positions of the openings 104, 106 in the lower wall 103 of suction chamber 101, the location of the hood 110 and the location of the inlet opening 112 relative to each other are ideally chosen in combination with the more portion of housing 100 and a lower, fixed front wall portion 113 thereof. In this regard, it will be appreciated that a portion of the air mass entering air inlet opening 112 is channeled to flow upwardly adjacent the upper portion of roller head 25, or at least the collar head cover 25c, and to flow through and around the area between the drafting rolls and the collar head 25 to entrap and convey waste material from such areas into the suction chamber 101 and thence into the inlet portion of fan housing 37 to be separated from the air stream by filter 42. A door 37a in the inlet portion of fan housing 37 (FIGURE 2) may be opened periodically for removing accumulated waste and the like from within housing 37 and from filter 42.

It will be observed in FIGURE 1 that the upper wall of the duct 35 extends rearwardly from and occupies substantially the same level as the upper surface of girt 16. The upper wall of duct 35 is defined with longitudinal extending louvered openings or slots 120 which may be of sufficient length to correspond, at least, with the width of the slivers or fibrous material S passing through drafting rolls 11-14, 11'-14'. Thus, the air flow entering air inlet 112 is also channeled to flow more directly rearwardly within housing 100, passing beneath the drafting rolls and across and over the upper surface of girt 16, with some of the air flowing into louvered openings 120 and some of the air being channeled upwardly through the open suction inlets 104 in the bottom wall 103 of suction chamber 101. Thus, relatively heavy weight material, such as paper trash which tends to accumulate on girt 16, is dislodged thereto and conveyed through slots 120 into main suction duct 35. At the same time, lighter weight material, such as fly and short fibers shed from the textile material in process, is conveyed upwardly into suction chamber 101 by the corresponding air stream or streams. Simultaneously with the cleaning provided with the air flows just described, the suction heads or nozzles a-d, a'-d' induce an air flow past the peripheral surfaces of the drafting rolls to keep them clean.

The blowing nozzle 50 is positioned in close proximity to the textile material passing through the front drafting zone and, further, since the front drafting zone is substantially enclosed independently of the other drafting zones, the various auxiliary streams of air flowing within housing 100 and into suction chamber 101 and through slots 120 in main duct 35 do not adversely affect the desired condition of the air stream being directed into the front drafting zone by blowing nozzle 50. Valve 45 (FIGURE 2) is provided in outlet 44 of fan housing 37 so as to control the amount of air discharged into the atmosphere from blowing housing 37 and thereby to insure that the conditioned air stream emanating from nozzle 50 at the desired pressure or velocity without disrupting the fibers passing through the front drafting zone.

From the foregoing description, it can be seen that, by directing a conditioned air stream into the front drafting zone independently of the other drafting zones within the front drafting zone is maintained within a predetermined range of relative humidity and/or within a predetermined range temperature, regardless of the rate at which the textile material is passing through the front drafting zone. Further, the air stream in the front drafting zone also maintains that atmosphere, or, at least, the peripheral surfaces thereof, and the bearings therefor at optimum operating temperature, thus permitting efficient high speed operation of the drafting frame. The continuous removal of waste from the various surfaces of the drafting frame above the spectacle 21 also contributes to efficiency in the operation of the drafting frame at high speeds.

Since the present invention provides for efficient control of the temperature and/or relative humidity of air in the front drafting zone, this provides for elongation of the fibers. That is, the life of the crimp imparted to the textile fibers being by the fluided drafting rolls, especially rolls 13, 13', is maintained in the fibers much more effectively than is the case in the absence of efficient control of temperature and/or relative humidity of air in the front drafting zone. By maintaining crimp in the fibers, especially synthetic fibers, elongation of individual fibers is effected due to the consequent cohesion of those fibers surrounding or adjacent the trailing ends of individual fibers effecting a drag on the trailing ends of individual fibers as they are being pulled forwardly in the front drafting zone by the delivery rolls. Such elongation of the individual fibers thus increases the average staple length of the fibers leaving the delivery rolls 14, 14' as compared to the length of the fibers before they are drafted. Thus, it can be appreciated that it is highly desirable that the drafting rolls 13, 13', 14, 14' and the portions of the textile material S in the front drafting zone should be brought with local predetermined relative humidity and the air in the front drafting zone also should be brought up to a predetermined relative humidity, in the manner heretofore described, before the drafting frame is restarted whenever it has been shut off for such a period of time that the temperature and relative humidity of the air in the front drafting zone have dropped below the prescribed minimums.

Referring to FIG. 5, a modified form of individual drafting enclosure 65a is there shown which is particularly devised to enclose a front drafting zone characterized by an intermediate fiber-working or slip roll located between adjacent sets of drafting rolls defining the corresponding front drafting zone therebetween. The slip drafting arrangement of FIGURE 5 is generally as disclosed in my copending application for Slip Drafting Means and Method for Textile Fibers. Ser. No. 499,728, filed Oct. 21, 1965, to which reference is made for a more detailed description thereof.

The fluted drafting rolls 13a, 13a', 14a, 14a' and the relatively small slip roll 130 of FIGURE 5 may be used in place of drafting rolls 13, 13', 14, 14' in FIGURE 1 when it is desirable to utilize the slip drafting in the front drafting zone. Although the top drafting roll 13a is preferably of substantially greater density than drafting rolls 13a', 14a', 14a', suction heads c2, d2, c2', d2', d2' are positioned closely adjacent the respective rolls 13a, 14a, 13a', 14a' in substantially the same manner as the suction heads of FIGURES 1-3 are arranged with respect to the drafting rolls 13, 14, 13', 14'. Also, a blowing nozzle 50a, its orifice 46a, and pliable strips 60a of FIGURE 5 may be arranged as heretofore described with respect to elements 50, 46 and 60 of FIGURES 1-3.

However, since it is desirable to prevent short fibers and trash from accumulating on slip roll 130, a suction head 132, smaller than but similar to suction heads c2, c2', d2, d2', is positioned beneath and in closely spaced relation from the slip roll 130. It should be noted that the roughened, serrated or knurled peripheral surface of slip roll 130 is located in closely spaced relation from and beneath the flutes of top roll 13a. The nip of rolls 13a, 130 preferably is spaced forwardly of the nip of the intermeshing fluted rolls 13a, 13a', a distance about one-half the distance from the nip of rolls 13a, 13a' to the nip of the intermeshing fluted drafting rolls 14a, 14a'. All the rolls 13a, 13a', 14a, 14a' are driven and cooperate as disclosed in the latter application to improve the uniformity of textile materials S2 being drafted there-
through. Since the present invention is not concerned with the particular function of slip roll 130, a further description thereof is deemed unnecessary.

To complete the enclosure 65a and allow for justifiable varying the displacement between rolls 13a', 130, 14a', two pliable strips 62a, 62d, similar to strip 62 (FIG. 1-4), are provided wherein strip 62a is positioned between and attached to the proximal walls of suction heads 13a', 130 and strip 62d' is positioned between and attached to the proximal walls of suction heads 132', 132 in substantially the same manner as that in which pliable strip 62 is attached to suction heads 13a', 13a. The devices T3, T4 for sensing the temperature and relative humidity, respectively, of the air in the front drafting zone and enclosure 65a of FIGURE 5 may penetrate either strip 62a, 62d' or preferably penetrate strip 62d', as shown in FIGURE 5, to more readily sense the condition of the air stream flowing from blowing nozzle 50a against and through the material being drafted.

Suction heads 13a, 130, 14a', 14d' may be connected to the suction side of fan housing 37 (FIGURE 2), blowing nozzle 50a may be connected to conditioning chamber 56, and sensing devices T2, T4 may be connected to the regulator 75 and heater 85 and to the pump 80 or P of FIGURE 2 in substantially the same manner as, and for the same purpose as, the similar elements a-d, a'-d', 50, T, T', H heretofore described, thus a further description of the embodiment of FIGURE 5 need not be given.

The terminology “conditioning the air” as used herein and in the annexed claims includes varying the temperature, moisture content, and/or relative humidity characteristics of the air acting upon the fibrous material passing through the front drafting zone. Similarly, the terminology of sensing the “condition of the air” includes the sensing of any one or all of the aforementioned characteristics of the air in the front drafting zone.

In the drawings and specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

1. Apparatus for conditioning fibrous textile material passing through and being drafted through a series of spaced sets of drafting rolls defining a series of drafting zones between respective adjacent sets of drafting rolls, said apparatus comprising:
   (a) means for directing an air stream from a source into only one of the drafting zones and past and against the material passing therethrough and being drafted therein,
   (b) means for sensing the condition of the air stream in said one of the drafting zones, and
   (c) means responsive to the sensing of other than a predetermined condition of the air in said one of the drafting zones for compensatively conditioning the air stream in its course of flow from the source to said drafting zone whereby the textile material being drafted is conditioned in a localized zone permitting closer control of the conditions thereof.

2. Apparatus according to claim 1, wherein said only one of the drafting zones is the front drafting zone of said series, and including enclosure means substantially confining said front drafting zone independently of the other drafting zones and into which said air stream is directed and within which said sensing means is at least partially positioned.

3. Apparatus according to claim 2, in which said air stream directing means comprises blowing nozzle means positioned between adjacent sets of drafting rolls defining said front drafting zone and being spaced from, but closely adjacent, the path of the fibrous material passing through the front drafting zone.

4. Apparatus according to claim 2, in which said air stream directing means includes a fan located at said source, said nozzle means positioned closely adjacent the peripheral surfaces of drafting rolls defining said front drafting zone, and means communicatively connecting said nozzle means to the source side of said fan whereby air is sucked out of said front drafting zone.

5. Apparatus according to claim 2, wherein said air stream directing means includes a fan located in said source, and a blowing nozzle having its discharge end located between the sets of drafting rolls defining said front drafting zone and within said enclosure means, and means communicatively connecting said blowing nozzle to the exhaust side of said fan.

6. Apparatus according to claim 5, wherein a coiler head is located forwardly of the drafting rolls for receiving textile material from the rolls, said apparatus also including a common housing substantially enclosing said coiler head, said enclosure means and all the sets of drafting rolls in said series and having an opening adjacent the coiler head communicating with the atmosphere externally thereof and, and communicative means connecting a portion of said housing remote from said last named opening to the suction side of said fan.

7. Apparatus according to claim 5, in which said apparatus includes, said coiler head, wherein said coiler head is provided with the interior of said enclosure means for withdrawing the air stream therefrom.

8. Apparatus according to claim 7, wherein said sets of rolls each comprise a top roll and a bottom roll, said air stream nozzle means comprising an elongate suction nozzle extending longitudinally of each top roll of the sets defining said front drafting zone, said blowing nozzle being located between said suction nozzles, and said enclosure means comprising the combination of said nozzles of elongate strips of pliable material positioned between and having opposed longitudinal edges connected to the blowing nozzle and respective suction nozzles.

9. Apparatus according to claim 8, wherein said suction nozzle means further comprises additional suction nozzles extending longitudinally of the respective bottom rolls of said last named sets, and said enclosure means also comprising means, including an additional elongate strip of pliable material, positioned between and connected to said additional suction nozzles.

10. A structure according to claim 2, in which said sensing means comprises means for sensing the moisture content of the air in said enclosure means, and said responsive means includes means for introducing moisture into the air stream in response to said sensing means detecting less than a predetermined minimum amount of moisture in the air in said enclosure means.

11. A structure according to claim 2, in which said sensing means comprises means for sensing the temperature of the air within said enclosure means, and said responsive means includes means for heating the air stream in response to said sensing means detecting less than a predetermined temperature in said enclosure means.

12. A structure according to claim 2, in which said sensing means comprises means for sensing the temperature of the air within said enclosure means, and said responsive means includes means for cooling the air stream in response to said sensing means detecting a temperature of the air in said enclosure means above a predetermined maximum temperature.

13. Apparatus for conditioning fibrous textile material passing through and being drafted through a series of spaced sets of drafting rolls defining a series of drafting zones between respective adjacent sets of drafting rolls, said apparatus comprising:
(a) means extending into one drafting zone for directing an air stream from a source into said one drafting zone and past and against the material passing therethrough and being drafted therein,
(b) means for sensing the condition of the air stream in said one of the drafting zones, and
(c) means responsive to the sensing of other than a predetermined condition of the air in said one of the drafting zones for compensatively conditioning the air stream in its course of flow from the source to said drafting zone whereby the textile material being drafted is conditioned in a localized zone permitting closer control of the conditions thereof.

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DORSEY NEWTON, Primary Examiner.