United States Patent [19]

Fleming

[11] **3,810,315**

[45] **May 14, 1974**

[54] **APPARATUS FOR TREATING MATERIALS**

[75] Inventor: **Myron T. Fleming,** Maple Glen, Pa.

[73] Assignee: **Thermal Exchange Systems, Inc.,** Morton, Pa.

[22] Filed: **Apr. 19, 1972**

[21] Appl. No.: **245,327**

[52] **U.S. Cl.** **34/160,** 34/23, 34/29, 34/229

[51] **Int. Cl.** **F26b 13/00**

[58] **Field of Search** 34/23, 29, 34, 155, 162, 34/160, 222, 229; 26/18.5

[56] **References Cited**

UNITED STATES PATENTS

3,099,541	7/1963	Hildebrand	34/23
3,257,938	6/1966	Goyette	34/110
3,287,815	11/1966	Yunghahn	34/155
3,325,911	6/1967	Fleisher et a.	34/162
3,371,427	3/1968	Thygeson, Sr.	34/155

Primary Examiner—Carroll B. Dority, Jr.
Assistant Examiner—Larry I. Schwartz
Attorney, Agent, or Firm—Denny & Patane

[57] **ABSTRACT**

Material treating apparatus comprising a housing and means for conveying material through the housing in a substantially untensioned condition. Agitating and drying means are provided for moving the material rapidly between limiting barriers disposed on opposite sides of the material, the agitating and drying means comprising high velocity air jets directed through these barriers by means of nozzles located on opposite sides of the material. The air blasts from the nozzles, which may be mounted for oscillation, continuously thrust successive portions of the material into and out of abutment with the limiting barriers. The limiting barriers comprise foraminous aprons which are mounted for continuous movement by means of conventional roller chains. The aprons are substantially open and are made of interwoven strands of wire which allow the air jets to pass therethrough but which limit movement of the material. The aprons form a part of a transport means which includes two endless conveyors disposed one above the other. The treated material, during its movement through the dryer, is disposed between the top run of lower conveyor and the bottom run of the upper conveyor.

18 Claims, 7 Drawing Figures

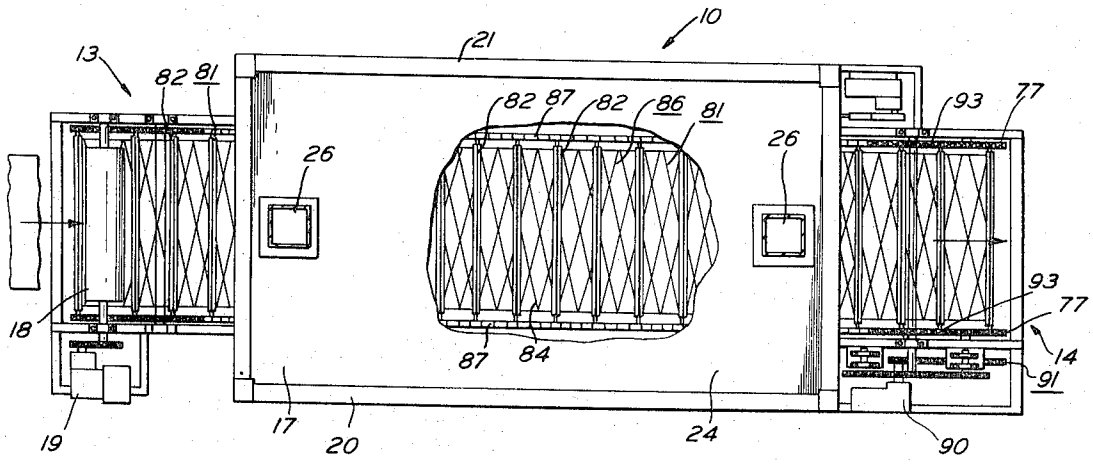
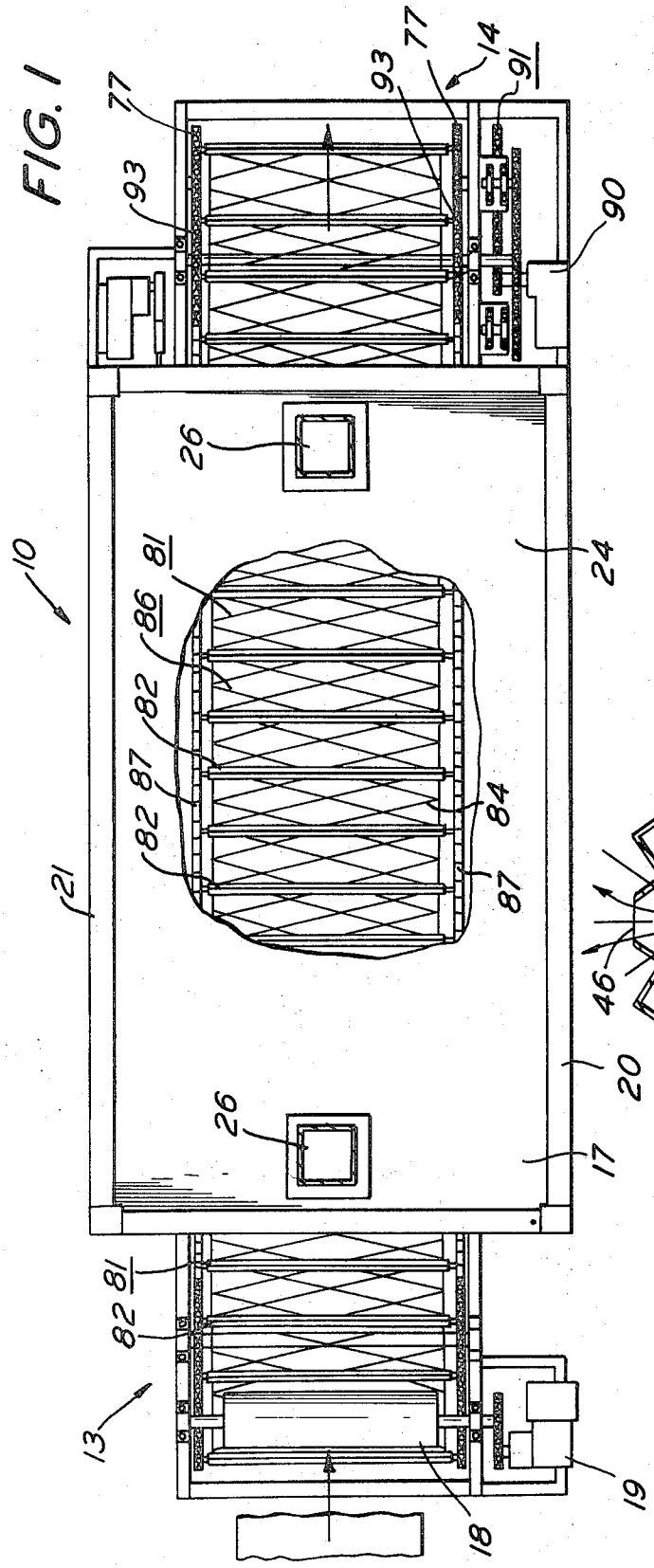


FIG. 1


77
93
77
14
91
93
90
26
10
81
86
24
82
82
87
84
82
87
21
26
20
17
81
82
13
19
18

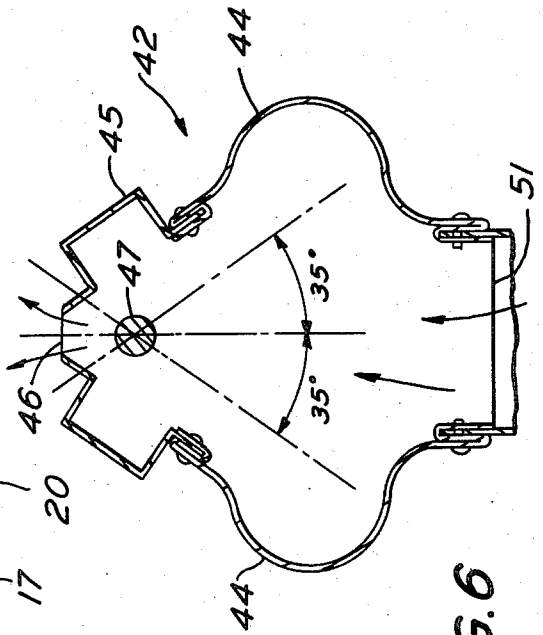
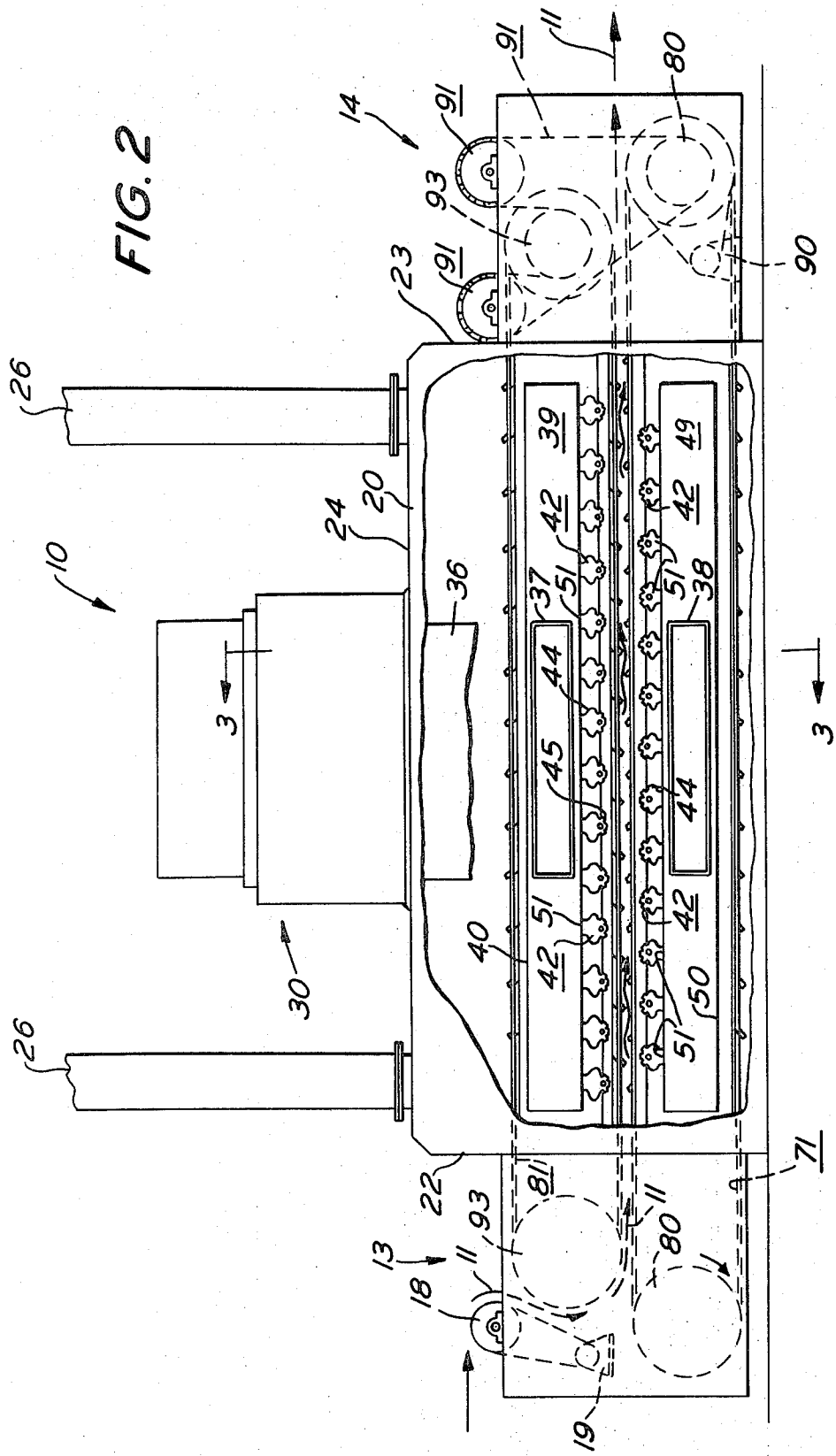

42
44
45
51
47
35°
35°
46
44

FIG. 6

FIG. 2


14
91
111
80
93
90
23
26
24
20
10
39
49
42
36
37
38
51
3
44
45
30
40
50
22
71
81
13
18
19

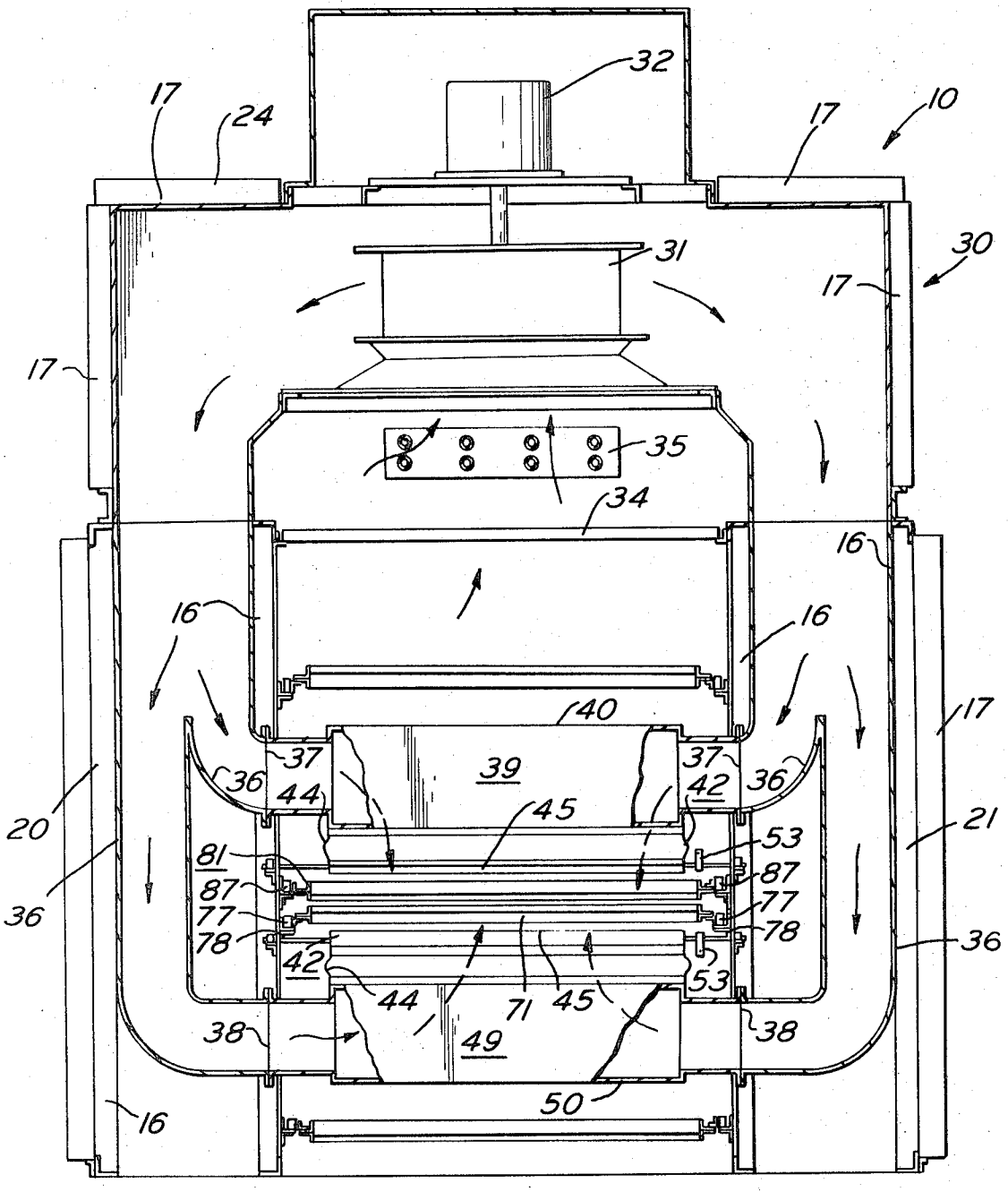

32
17
24
17
10
31
30
17
17
35
34
16
16
16
40
17
37
39
37
20
36
44
42
36
45
21
53
81
87
87
77
77
78
78
36
42
53
44
71
45
38
49
38
50
16

FIG.3

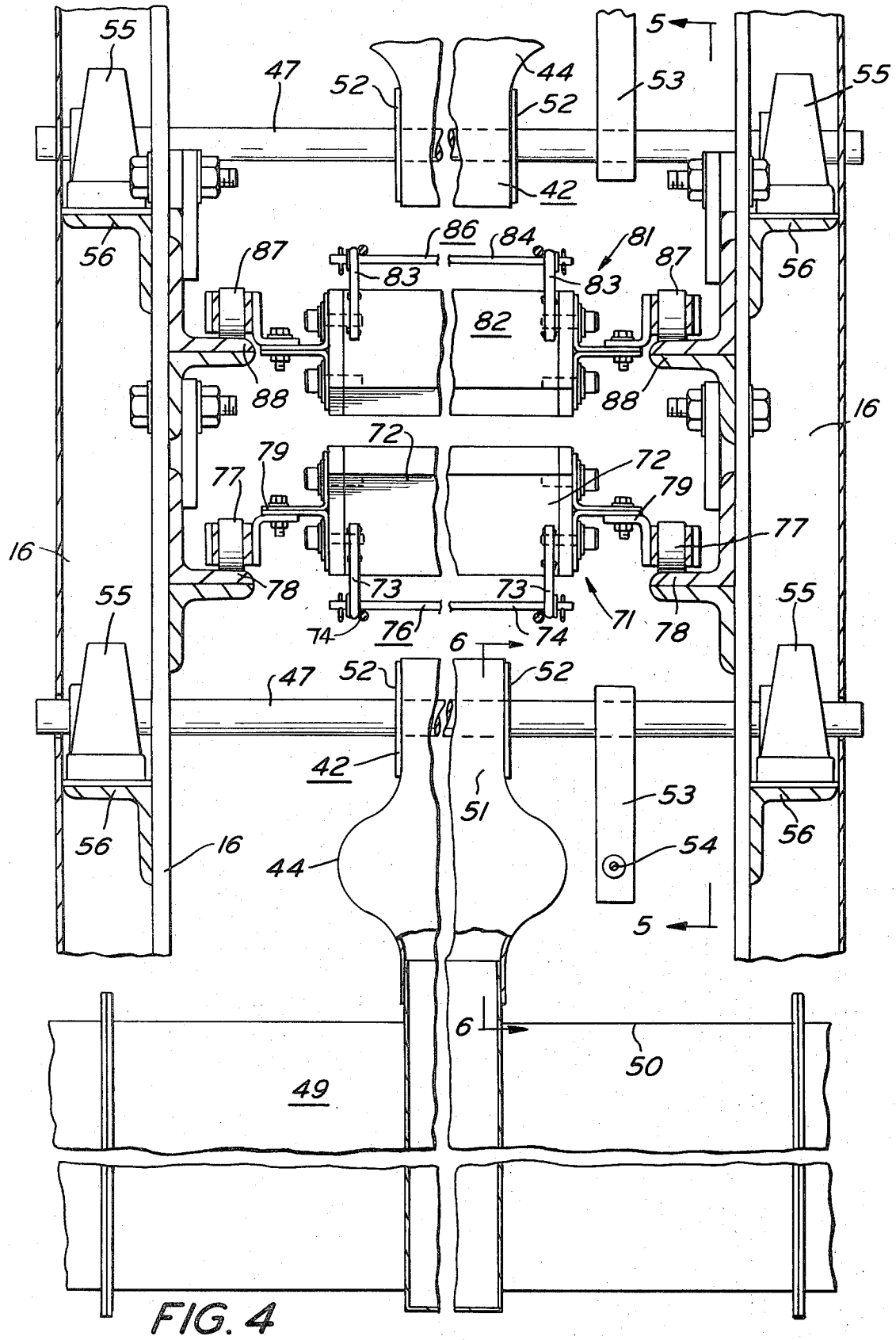

55
47
52
44
52
5
53
55
42
56
86
84
81
87
83
83
87
56
82
88
88
16
72
79
77
72
79
77
16
78
73
73
71
78
55
74
76
74
55
6
47
52
52
42
51
53
56
16
44
54
56
5
6
50
49

FIG. 4

FIG. 5

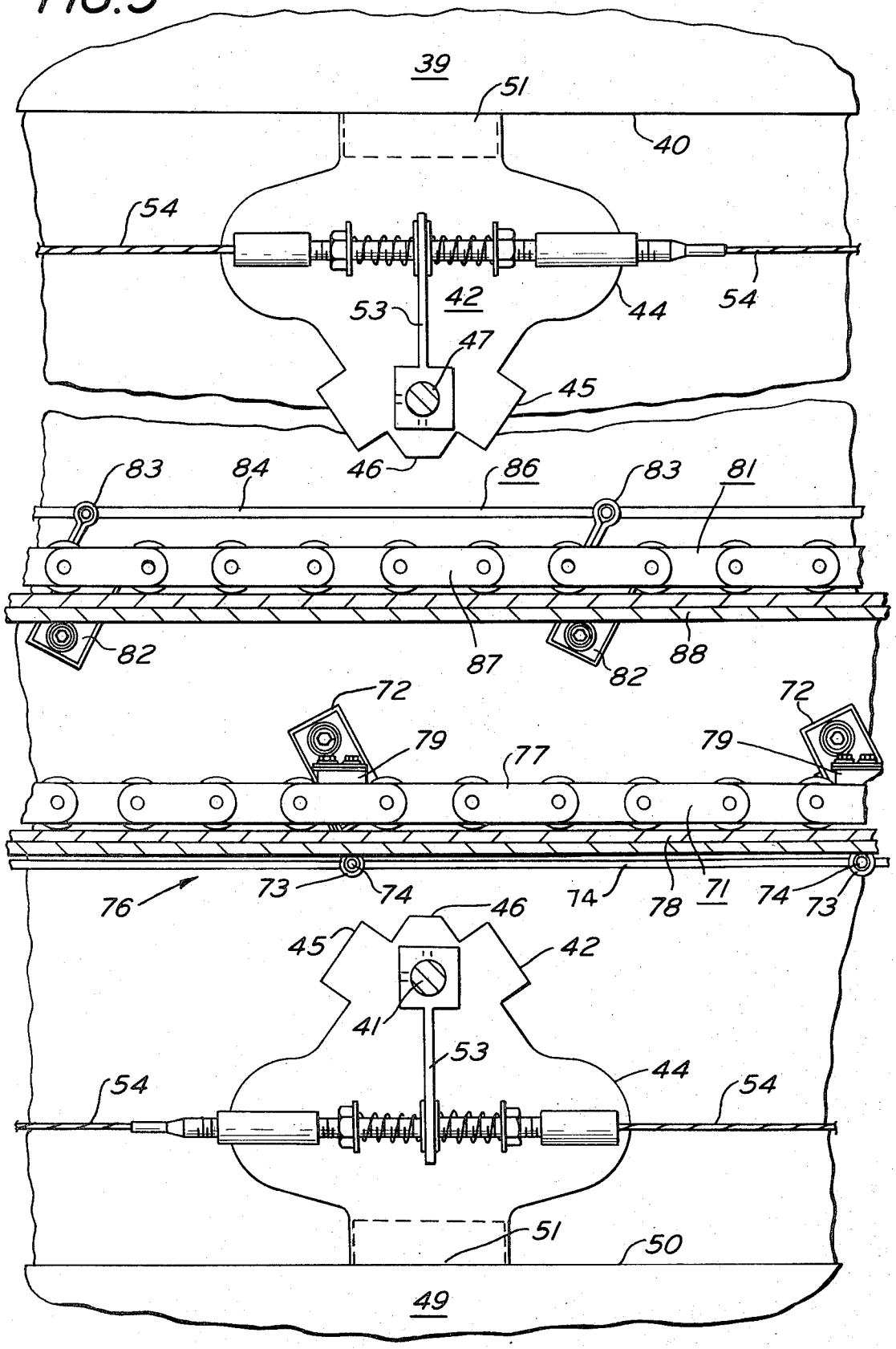
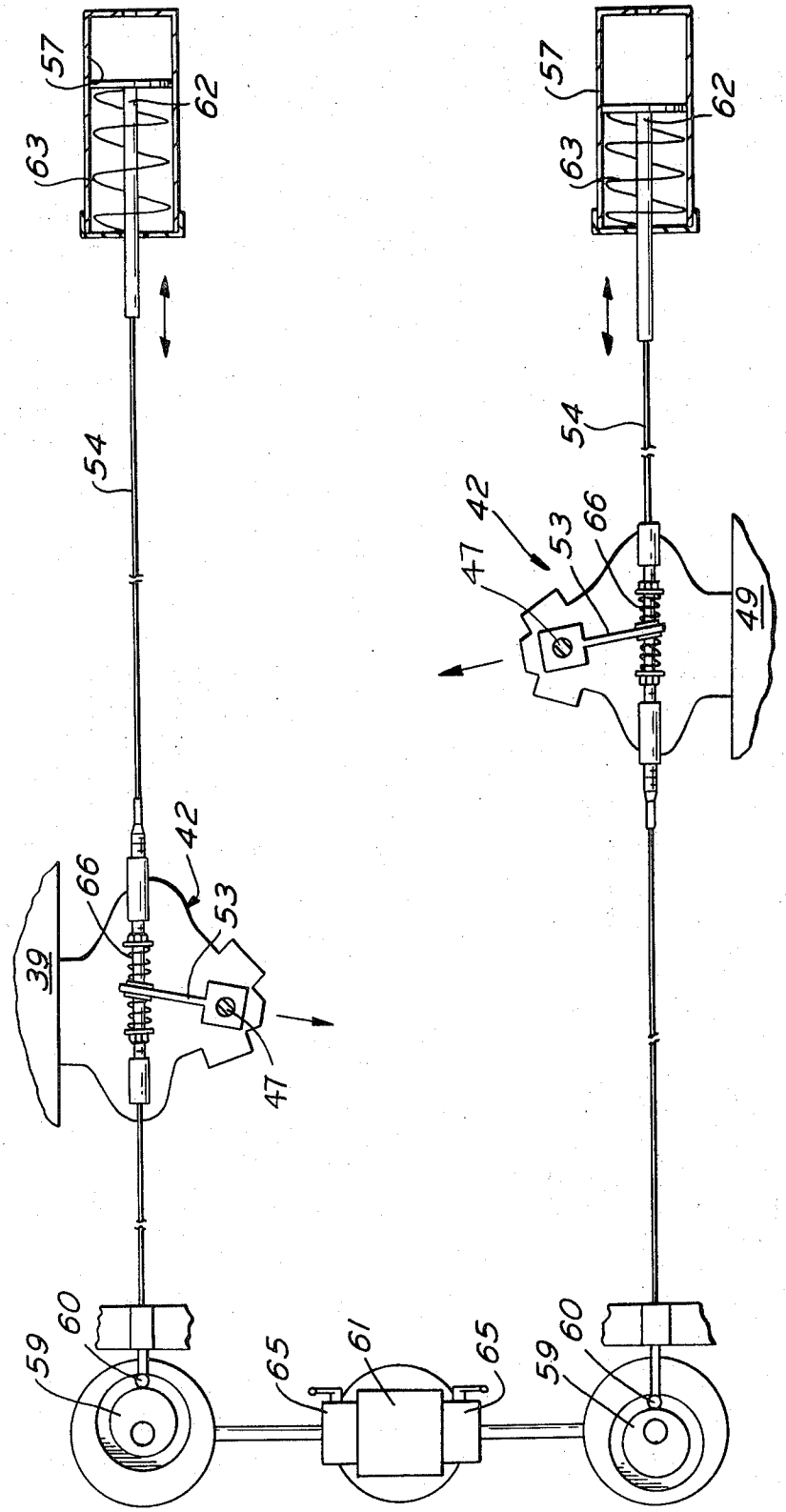

39
51
40
54
53
42
44
54
47
45
46
83
84
86
83
81
82
87
82
88
72
79
77
79
72
76
73
74
74
78
71
74
73
46
45
42
41
53
44
54
54
51
50
49

FIG. 7



APPARATUS FOR TREATING MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to methods and apparatus for use in connection with the manufacture of fabrics so as to reduce shrinkage of these fabrics when they are subsequently incorporated into garments and laundered. More particularly, the invention relates to a material drying apparatus for encouraging the material being dryed to return to the dimensional state occupied prior to being processed.

For years attempts have been made to produce fabrics which upon subsequent incorporation into wearing apparel, would resist shrinkage due to laundering. As is well known in the art, shrinkage results from stretching, during manufacture, of constituent fibers and stitch formations which are used in the construction of the garment. As a consequence of laundering the garment and particularly during the drying stage of the laundering process, the garment seeks to return to its original unstretched dimensional state with consequent shrinkage.

The tensional forces exerted on the constituent yarn and fabric during wet processing thereof is known to be a prime source of stretching, these tensional forces being generated during the various wet processing steps. Prior art apparatus aimed at reducing shrinkage in garments have attempted to eliminate, as much as possible, these tensional forces by maintaining the fabric in a tensionless as possible state during these wet processing and drying steps. In addition, the prior art techniques have included means for slowly working the fabric in various directions in order to encourage its return to an untensioned state. Other prior art apparatus have included mechanical rotating fingers for thrusting the fabric forward and backward to encourage this return to an unstretched dimension. These latter mentioned dryers have the disadvantage of being cumbersome, mechanically complex and impractical from the standpoint of their drying capacities.

SUMMARY AND OBJECTS OF THE INVENTION

A principal object of the invention is to provide a dryer which reduces shrinkage in fabrics subjected to stretch generating processing and subsequently incorporated into garments which are laundered.

A further object is to provide a treating apparatus which dries a web material and concurrently vigorously agitates the material in order to encourage the return to its original unstretched condition so as to substantially reduce subsequent shrinkage.

A further object to the provision of agitating and drying apparatus for accomplishing the above noted objectives which is simple in construction and design and has a minimum of moving parts to accomplish vigorous agitation of the treated material.

A further object is the provision of air directing nozzles in a dryer which are continuously oscillated to thereby increase the drying capacity of the dryer.

A still further object is the provision of air directing means which concurrently dries the treated fabric and vigorously agitates the fabric back and forth between two spaced barriers.

In order to accomplish the above noted and other objects, the invention provides a treating apparatus for moving a fabric through a treating chamber in a substantially untensioned condition and concurrently vigorously agitating the fabric by means of air jets which force spaced portions of the fabric alternately upward and downward with respect to the plane of travel of the fabric and into and out of abutment with limiting barriers disposed above and below the fabric.

The foregoing and other objects of this invention, the principles of this invention and the best modes in which I have contemplated applying such principles will more fully appear from the following description and accompanying drawings in illustration thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the dryer of the invention with a portion of the top wall broken away to expose the interior of the dryer;

FIG. 2 is a side elevation view of the dryer with the side wall of the housing partly broken away to expose the interior of the dryer;

FIG. 3 is a view taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged view showing the details of the bottom run of the upper apron and top run of the lower apron and the support structure therefor, with the interior portions thereof omitted, for clarity;

FIG. 5 is an enlarged view taken along the line 5—5 of FIG. 4 with the upper row of nozzles shown displaced longitudinally for illustrative purposes.

FIG. 6 is an enlarged view of one of the movable nozzles of the dryer; and

FIG. 7 is an illustrative side view of the drive arrangement for continuously oscillating the movable nozzles of the invention.

DETIALED DESCRIPTION OF THE INVENTION

Referring to the drawings, the material treating apparatus of the invention is seen to comprise generally a substantially closed outer housing **10** through which an elongated material **11** is continuously moved between a feed end **13** and a delivery end **14.** The housing **10** is of the usual construction comprising a framework of interconnected structural beams **16** to which is applied the usual rectangular covering and insulating panels **17,** the panels forming in combination with the floor a more or less air-tight enclosure.

The panels **17** combine to form side walls **20** and **21,** an entrance wall **22** and an exit wall **23.** The entrance and exit walls **22** and **23** contain openings across substantially their entire width to permit unobstructed continuous movement of the conveyors which move the material **11** through the dryer. Flexible baffles (not shown), well known in the art, may be provided in connection with the entrance and exit openings to maintain a substantially air-tight enclosure while permitting the movement of the material **11** into and out of the housing **10.**

The housing is further defined by a top wall **24** through which are formed openings **26** to permit an exchange of air between the interior of the housing **10** and the outside thereof.

The top wall of the housing **10** has mounted thereabove an enclosure **30,** FIGS. **2** and **3,** which contains a centrifugal blower **31** driven by a motor **32** mounted thereabove. Air is taken into the blower via a filter unit **34** and a conventional air heating unit **35.** The enclosure **30** may be supported by the structural beams **16** of the framework, as is well known in the art.

When the blower 31 is operating, air from the interior of the housing 10 is drawn through filter unit 34 and heating unit 35, driven by the moving blades of the blower 31, and channeled by the interior of the enclosure 30 and the feed ducts 36 into an upper plenum chamber 39 and a lower plenum chamber 49. The upper plenum chamber 39 is defined by an upper main duct 40 which extends over substantially the entire face or front side of the moving material 11. The upper duct 40 has input openings 37 on opposed sides thereof which are in communication with the enclosure 30 by means of the feed ducts 36 so as to allow the hot air moved by the blower 31 to enter into the upper plenum chamber 39.

The lower plenum chamber 49 is defined by a lower main duct 50 which extends beneath substantially the entire back side of the material 11. The lower duct 50 also has input openings 38 on each side thereof which are in communication with the enclosure 30 via the feed ducts 36 for allowing the hot air moved by the blower 31 to enter the lower plenum chamber 49.

Both the upper and lower main ducts 40 and 50 have rectangular openings 51 in their walls adjacent the moving material 11 through which they are in communication with upper and lower rows of nozzles 42 extending substantially across the width of the main ducts and spaced apart along the length of the housing 10. The nozzles 42 located below the material 11 are not directly opposed with the nozzles 42 located above the material, but rather are offset longitudinally approximately half the distance between nozzles, as seen in FIG. 2.

Each of the nozzles 42 includes a flexible, air impervious conduit 44 which is open on two ends, one of the open ends being in air tight communication with an associated rectangular opening 51 in the wall of one of the ducts 40 or 50 adjacent the moving material for allowing air from the plenum chambers to enter into the conduit 44 via the openings 51. The other open end of each of the flexible conduits is coupled to a nozzle head 45 which functions to direct heated air from the plenum chambers 39 and 49 against the moving material 11.

Each of the nozzle heads 45 is generally V-shaped in cross-section and has an exit opening or mouth 46 at the apex of the V. The heads 45 extend substantially across the width of the upper and lower ducts and are closed by suitably shaped end walls 52. Air is thus channeled from each of the upper and lower plenum chambers 39 and 49 into the nozzle heads 45 by means of the flexible conduits 44 and escapes through the mouth 46 of the nozzle heads 45 in the direction of the material 11.

The air directing heads 45 are mounted on shafts 47 passing widthwise of the housing through openings in the end walls 52 of the heads 45 and are movable in response to rotation of the shafts 47, to thereby change the direction of the air passing out of the mouths 46 of the nozzles 42. The shafts 47 are carried in bearings 55 which are supported by suitable brackets 56 from the structural beams 16 of the framework.

The heads 45 may remain fixed at preselected angles with respect to the material or may be moved in an oscillatory fashion by means of a drive arrangement. The drive arrangement, FIG. 7, consists of a plurality of crank arms 53 attached to the shafts 47, the crank arms 53 being interconnected by means of upper and lower cables 54 running longitudinally of the housing 10.

The upper and lower cables 54 are coupled on one end to upper and lower biasing devices each comprising a cylinder 57, a piston 62 and a spring 63 for continuously biasing the piston 62 in the direction away from the nozzles 42. The other ends of the upper and lower cables 54 are attached to the followers 60 which are driven by a variable speed motor 61 through appropriate conventional gear boxes 65 and cams 59. As the cams 59 are rotated by the motor 61, the followers 60 and cables 54 attached thereto are reciprocated back and forth as indicated by the arrows in FIG. 7 due to the combined action of the cams 59 and biasing pistons 62. The cables 54 are first moved forwardly in a longitudinal direction away from the cylinders 57 by the action of the rotating cams 59, and thereafter allowed to move backwardly toward the cylinders 57 by the continued movement of the cams 59 and the force applied by the biasing cylinders 57.

The reciprocating motion of the cables 54 is transmitted to the nozzles 42 via the crank arm 53, to thereby oscillate the nozzles back and forth across the face and back sides of the material 11. The transmittal of the reciprocating motion of the cables 54 to the crank arms 53 may be cushioned slightly by means of absorbing springs 66.

The gear boxes 65 may be used to vary the phase relationships between the oscillations of the upper and lower rows of nozzles. It is apparent that various size cams 59 may also be used to change the magnitude of oscillation of the nozzles 42 about a central axis.

The material 11 is moved through the housing 10 from the feed end 13 to the delivery end 14 between th top run of a lower endless conveyor 71 and the bottom run of an upper endless conveyor 81. The material 11 is delivered onto the top run of the lower conveyor 71 at a preselected rate by means of a delivery roller 18 driven by a suitable variable speed motor 19. The lower conveyor 71 comprises a series of parallel spaced-apart supporting bars 72. The bars 72 are rectangular in cross section and extend across substantially the entire width of the duct 40. A plurality of anchors 73 (FIGS. 4 and 5), each having an eyelet or opening therein, are attached to the bars 72 at spaced intervals across the width of each bar in a symmetrical configuration. Strands of wire 74 are passed or interwoven through the eyelets in these anchors in a zig-zag pattern, as shown in FIG. 1, to form a foraminous, substantially open lower apron 76 located between the various nozzles heads 45 and the material 11. As will be explained more completely hereinafter, the portion of the lower apron 76 within the housing 10 acts as a limiting barrier to the movement of the material 11 downwardly as a result of the pressure caused by the air from the upper nozzles 42 against the front face of the material 11, while simultaneously allowing the air from the lower nozzles 42 to pass therethrough into contact with the back side of the material 11, FIGS. 4 and 5, and the exact configuration of the apron may vary so long as it serves these purposes.

The support bars 72 may be tilted as shown in FIG. 5 and attached at their ends by suitable fastening devices 79 to a pair of roller chains 77 which engage the sprocket wheels 80 and ride in tracks 78 running longitudinally of the housing adjacent the sides thereof. The roller chains 77 are driven in the directions indicated

at a preselected speed by the variable speed motor 90 via a suitable conventional belt and gear assembly 91.

The upper conveyor 81 is similar in construction and function to the lower conveyor 71 and comprises a series of spaced apart, parallel support bars 82. The bars 82 are identical with the bars 72 and likewise have attached thereto anchors 83 which support an upper apron 86 composed of strands of wire 84 interwoven in a zig-zag fashion (as can be best seen in FIG. 1). The portion of the lower run of the apron 86 within the housing, limits the movement of the material 11 upwardly while allowing the air to pass from the upper nozzles 42 downwardly into contact with the material 11. The bars 82 are attached at their ends by suitable fasteners to a pair of roller chains 87, the latter moving in tracks 88 and driven via sprocket wheel 93 by the motor 90 and the belt and gear assembly 91.

In operation, wet processed material 11 is delivered to the dryer at the feed end 13 in a substantially stretched and tensioned state. This condition is a result of the various tensional forces applied to the material 11 during the course of the previous wet processing stages. The overall purpose of the apparatus of the invention is to remove the moisture from the material 11 while at the same time encouraging the return of the material to a dimensional condition occupied prior to its procssing or to a more relaxed condition.

In order to accomplish this purpose, the elongated material 11 is delivered via the driven roller 18 initially onto the upper conveyor 81 which moves the material onto the top run of the lower conveyor 71. During the remainder of its travel through the dryer, the material 11 is held in a containment area, defined by the upper run of the lower conveyor 71 and the lower run of the upper conveyor 81, which serves to limit the movement of the material 11 in directions perpendicular to its path of movement through the housing.

The peripheral speed of the roller 18 is selected to be in excess of the linear speed of the conveyors 71 and 81 so as to deposit the material 11 at the feed end 13 of the dryer in a relaxed or untensioned condition characterized by a rippled configuration. The slack resulting from this rippled configuration of the material 11 permits the shrinkage of the material 11 during its movement through the dryer, without any consequent increase in tension on the material.

The material 11 deposited at the feed end 13 of the dryer is transported by the moving conveyors 71 and 81 into the housing 11 and subjected to the high velocity heated air emitted from the nozzles 42 located on opposed sides of the material 11. The air from the nozzles dries the material 11 and also is of sufficient velocity to agitate or thrust the material 11 repeatedly into contact with the lower and upper aprons 76 and 86. The air escaping from the upper nozzles 42 passes through the upper apron 86 and into contact with the face side of the material 11 thereby tending to thrust it downwardly into abutment with the apron 76. In a similar fashion air jets from the lower nozzles 42 facing the back side of the material 11 tend to thrust the material upwardly into abutment with the upper apron 86. Since the nozzles 42 are preferably being oscillated continuously, the pressure on opposed sides of the material 11 is never exactly balanced for any appreciable length of time, resulting in th movement of a first segment, running widthwise of the material 11, into engagement with the lower apron 76 and a second segment spaced therefrom along the length of the material into engagement with the upper apron 86. This unbalanced pressure on opposed sides of the material, together with the previously described slack of the material, gives the material a wave-like configuration during its movement through the housing with the peaks of the waves being in abutment with the upper and lower conveyors 71 and 81.

The nozzles 42 may alternatively be held stationary with the air escaping therefrom at an angle approximately perpendicular to the direction of travel of the material 11. They may also be arranged at various different angles to create the same unbalanced pressures and resulting wave configuration of the material 11. The velocity of the air escaping from the nozzles 42 is maintained sufficiently high to thrust the segments of the material 11 briskly into abutment with the appropriate apron.

The combined action of the moving conveyors 71 and 81 and the high velocity jets from the nozzles 42 results in movement of the material through the housing 10 at a preselected rate while a selected portions of the material, during their movement through the housing, are thrust alternately into abutment with each of the conveyors 71 and 81. It is this active agitation of the material 11 between the limiting barriers comprising the conveyors 71 and 81 and the aprons 76 and 86, during its movement through the dryer, which accounts for the significant improvement in the shrinkage characteristics of the material. Through vigorous agitation the material 11 is encouraged to return to its original and unstretched condition. The dryed material 11 may be collected at the delivery end 14 of the dryer by a collection roller (not shown) of conventional design.

Significant improvements in the shrinkage characteristics of materials have been obtained with the use of the dryer of the invention. For example, thermal knit underwear material, which is known to have one of the worst shrinkage characteristics, was run through a dryer constructed in accordance with the invention after extracting excess water by means of conventional squeeze rollers. A shrinkage of from 15 to 20 percent was noted in the longitudinal dimension of the material along with corresponding shrinkage in the widthwise dimension. Conventional dryers when used for processing thermal knit material, far from producing any degree of shrinkage, have generally produced a 20 percent stretch in the material. This has prevented the use of these conventional dryers in connection with thermal knit material and has necessitated piece by piece manual processing of this material.

In the case of other commonly used garment materials, prior art dryers have been only able to prevent further stretching of the wet material during its passage therethrough, while the dryer according to the invention produced a shrinkage of approximately 10 percent. The greater the shrinkage of the constituent material during this early manufacturing stage, the less will be the shrinkage of the subsequently purchased and laundered garment made from this material.

In addition to improving the agitation of the material 11, the oscillation of the nozzles 42 may tend to increase the capacity of the dryer by continuously moving the air layer immediately adjacent the material 11. Dryers utilizing stationary nozzles located at spaced intervals along the length of the dryer tend to create mo-

tionless air layers contiguous the material at portions of the dryer between adjacent nozzles. These inert layers tend to retard the exchange of heat between the heated air and the material, and thereby decrease the handling capacity of the dryer. The oscillating nozzles **42** of the invention create continuous air movement which promote the heat exchange process and increase the capacity of the dryer.

Having described the invention, what I claim is:

1. Apparatus for treating elongated material comprising

a treating chamber,

means for conveying said material through said chamber in a slack condition,

means for removing moisture from said material in said chamber, and

means for agitating said material in its slack condition between two limiting barriers disposed on opposed sides of said material during its movement through said chamber,

said limiting barriers are spaced apart substantially more than the thickness of said elongated material so that said elongated material may be thrust between said limiting barriers said means for agitating said material including nozzle above and below said material, and said nozzles being arranged in staggered relationship across the longitudinal axis of said material and parallel to each other so as to move spaced portions to said material toward and away from said limiting barriers.

2. The apparatus defined in claim **1** wherein said means for conveying said material through said chamber and said limiting barriers comprise, upper and lower endless conveyors, said conveyors mounted for continuous movement through said chamber whereby said material, during its movement through said chamber is contained between the lower run of said upper conveyor and the upper run of said lower conveyor.

3. The apparatus defined in claim **2** wherein said conveyors further comprise support bars extending widthwise of said housing and narrow strands supported from said bars and interwoven to form substantially open aprons, said aprons serving to limit the movement of said material in directions perpendicular to its path of movement.

4. The combination recited in claim **2** wherein said means for agitating said material comprises air directing nozzles, and means for imparting an oscillatory motion to said nozzles.

5. The apparatus defined in claim **1** wherein air flows through said nozzles and is directed against said material and pivotal means for moving said nozzles.

6. Apparatus for drying elongated textile material comprising

a housing,

means for conveying said material through said housing in a slack condition,

means for removing moisture from said material in said housing,

upper and lower foraminous barriers located on opposite sides of said material and mounted for continuous movement through said housing, and

air circulating means for directing air through said barriers said air circulating means being disposed above and below said material and arranged in a staggered relationship across the longitudinal axis of said material and parallel to each other so as to move spaced portions of said material toward and away from said barriers.

7. Apparatus for treating elongated material comprising a housing defining

a treating chamber

transport means for conveying said material in a slack condition through said chamber including barrier means located on opposite sides of said material and mounted for movement through said housing for limiting movement of said material in directions perpendicular to the path of movement of said material, and

means for moving selected portions of said material including nozzles disposed above and below said material, and said nozzles being arranged in staggered relationship across the longitudinal axis of said material and parallel to each other so as to move spaced portions of said material successively into abutment with said barrier means during movement of the material through said housing,

said barrier means are spaced apart substantially more than the thickness of said elongated material so that said elongated material may be thrust between said barriers.

8. The apparatus recited in claim **7** wherein said transport means comprises upper and lower endless conveyors, and said barrier means comprises the top run of said lower conveyor and the bottom run of said upper conveyor.

9. The apparatus recited in claim **6** wherein means for moving selected portions of said material into abutment with said barrier means comprises high velocity air directing nozzles located on opposite sides of said material.

10. The apparatus recited in claim **8** and further including mounting means for oscillating said nozzles.

11. Apparatus for treating elongated material comprising

a substantially closed housing,

transport means for moving said material through said housing,

said transport means including two conveying and containing aprons arranged one above the other to define therebetween a containment zone for said material while said material is moving through said housing, said containment zone being substantially wider than the thickness of said material, and

air circulating means for directing air against opposed sides of said material with sufficient velocity to agitate selected segments of said material during its movement through said housing alternately into abutment with each of said aprons.

12. In an apparatus for drying moist materials comprising a housing, first means for transporting said material through said housing, and second means including a nozzle head for directing air against said material to effect the removal of moisture from said material, the improvement comprising third means for varying the angle at which the air impinges on said material, said third means including fourth means for continuously oscillating said air directing means during the course of movement of said material through said housing.

13. The apparatus as recited in claim **12,** wherein said fourth means for continuously oscillating said air directing means comprises a shaft, said head being fixedly mounted to said shaft, and drive means for re-

ciprocally rotating said shaft during movement of said material through said housing.

14. In an apparatus for drying moist materials comprising a housing, first means for transporting said material through said housing, and second means including a nozzle head for directing air against said material to effect the removal of moisture from said material, the improvement comprising third means for varying the angle at which the air impinges on said material, said second means including a plenum chamber, said nozzle head having an exit opening, a flexible conduit coupled intermediate said plenum chamber and said nozzle head for channeling air from said plenum chamber into said nozzle head, and third means for oscillating said nozzle head in a predetermined manner during the course of movement of said material through said housing.

15. Apparatus for treating web material comprising

a housing defining a treating chamber,
a drive means for feeding said web material in a slack condition exceeding the anticipated shrinkage of said web material,
barriers within said chamber and on opposite sides of said web material,
said barriers being spaced apart substantially more than the thickness of said web material, and
air jet means for thrusting successive portions of said web material alternately against said barriers as said web material progresses through said treating chamber said air jet means being arranged in staggered relationship across the longitudinal axis of said material and parallel to each other.

16. Apparatus for treating elongated material comprising a treating chamber,
means for conveying said material through said chamber in a slack condition,
means for removing moisture from said material in said chamber, and
means for agitating said material in its slack condition between two limiting barriers disposed on opposed sides of said material during its movement through said chamber,
said means for conveying said material through said chamber and said limiting barriers comprising, upper and lower endless conveyors,
said conveyors being mounted for continuous movement through said chamber whereby said material, during its movement through said chamber is contained between the lower run of said upper conveyor and the upper run of said lower conveyor,
said conveyors further comprising support bars extending widthwise of said housing and narrow strands supported from said bars and interwoven to form substantially open aprons,
said aprons serving to limit the movement of said material in directions perpendicular to its path of movement,
said means for agitating said material comprising air directing nozzles, and means for imparting an oscillatory motion to said nozzles.

17. Apparatus for treating elongated material comprising
a housing defining a treating chamber,
transport means for conveying said material in a slack condition through said chamber including barrier means located on opposite sides of said material and mounted for movement through said housing for limiting movement of said material in directions perpendicular to the path of movement of said material,
means for moving selected portions of said material successively into abutment with said barrier means during movement of the material through said housing,
said means for moving selected portions of said material into abutment with said barrier means comprises high velocity air directing nozzles located on opposite sides of said material, and
mounting means for oscillating said nozzles.

18. The method of treating a moistened material which comprises
transporting said material through a treating chamber,
agitating said material during its movement through said chamber into abutment with limiting barriers disposed on opposite sides of said material, and
removing moisture from said material during its passage through said chamber,
said removing and agitating being accomplished by directing high velocity heated air jets into contact with opposed sides of said material, and
continuously changing the direction of said jets to vary the angle at which said jets impinge on said material.

* * * * *