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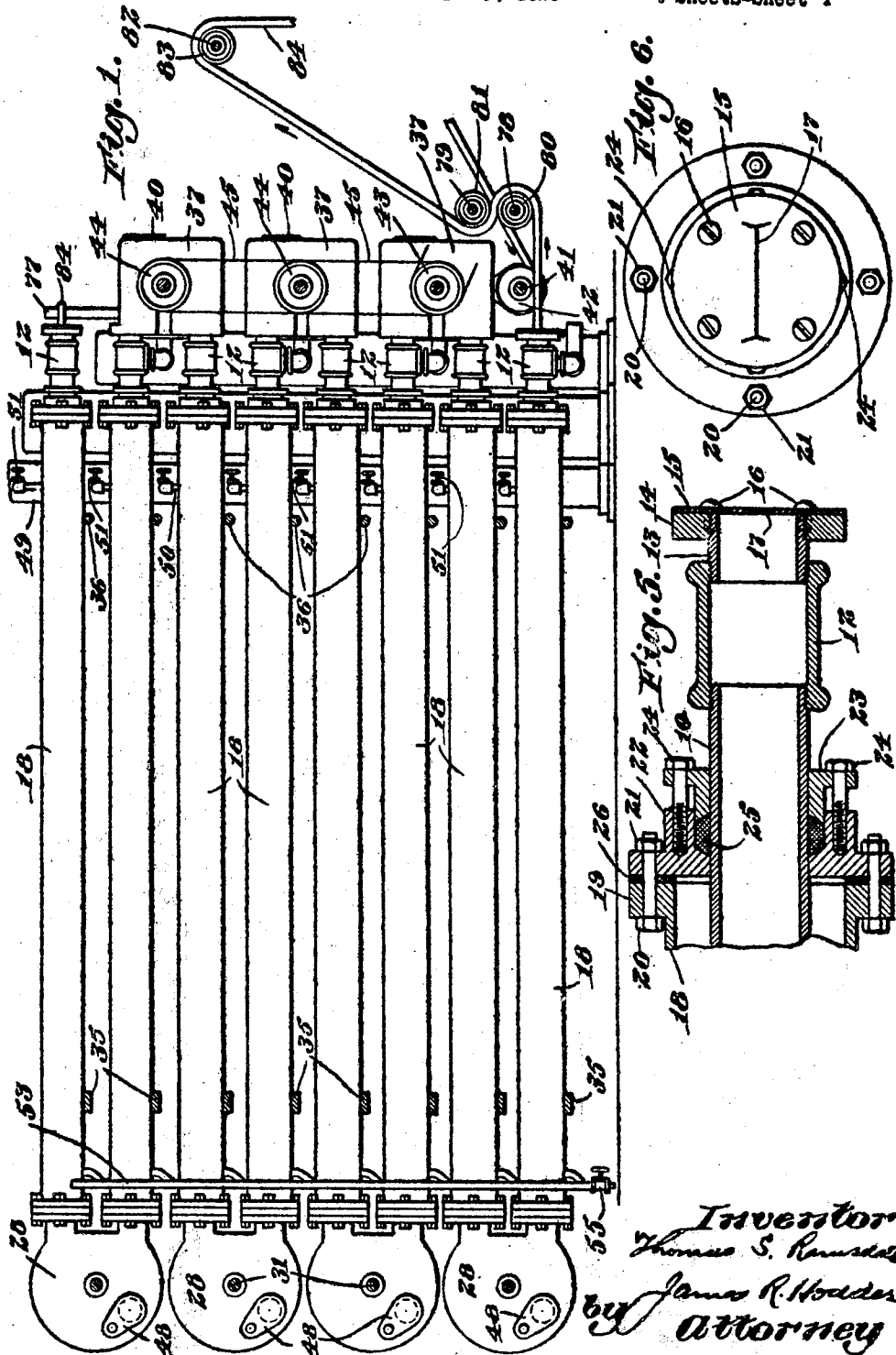
T. S. RAMSDELL

1,523,081

YARN DRIER AND METHOD OF DRYING

Filed Aug. 29, 1923

4 Sheets-Sheet 1



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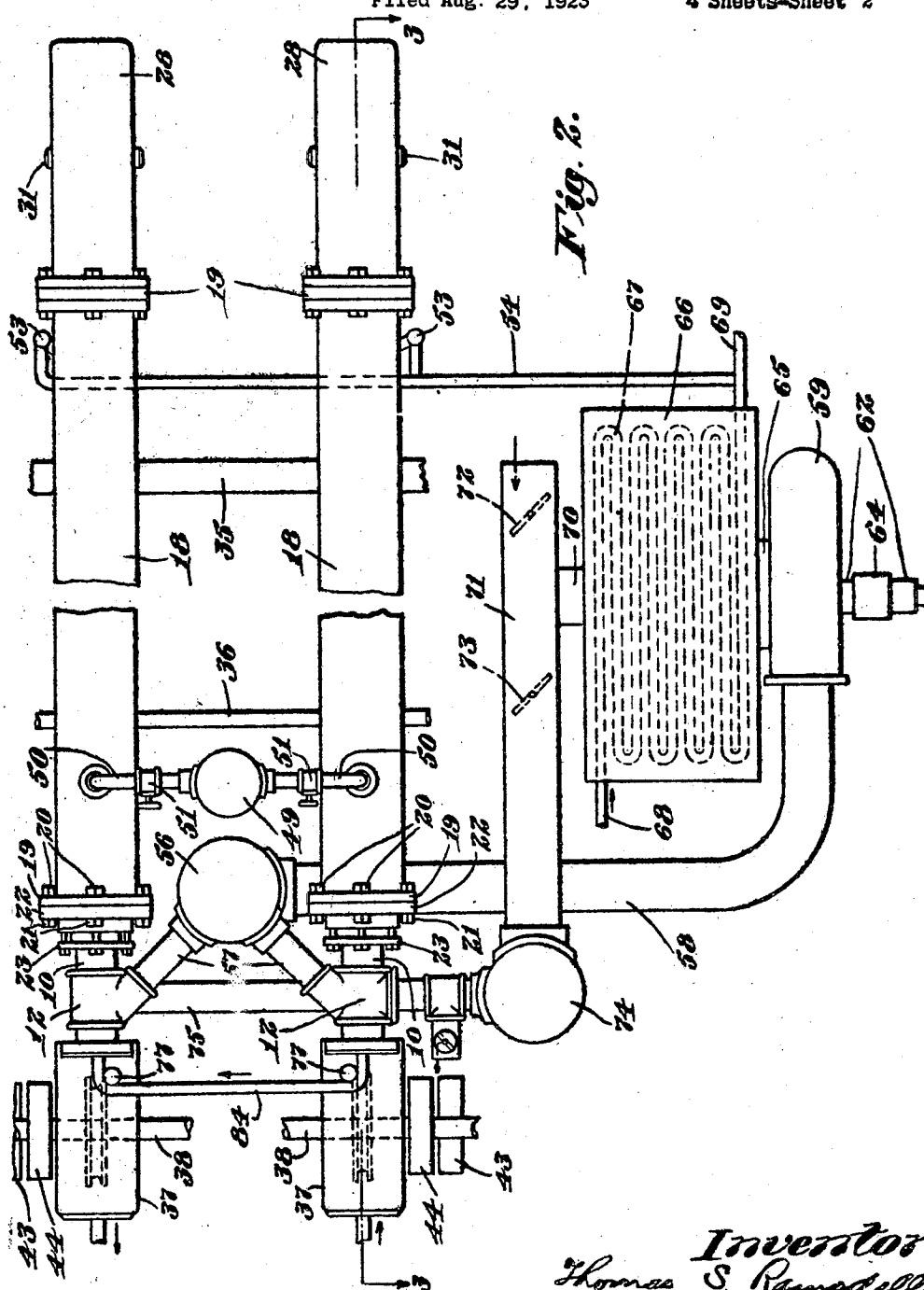
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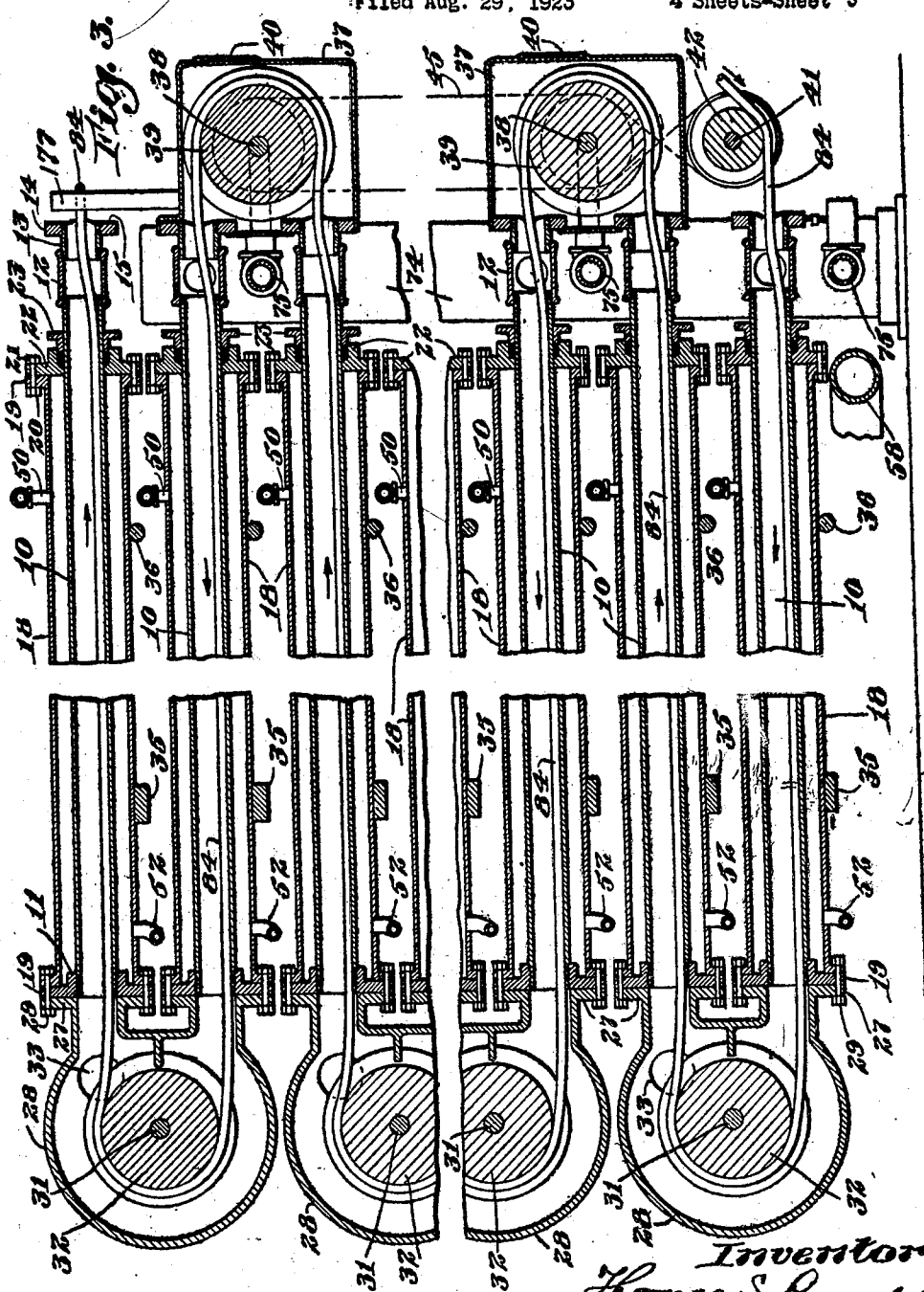
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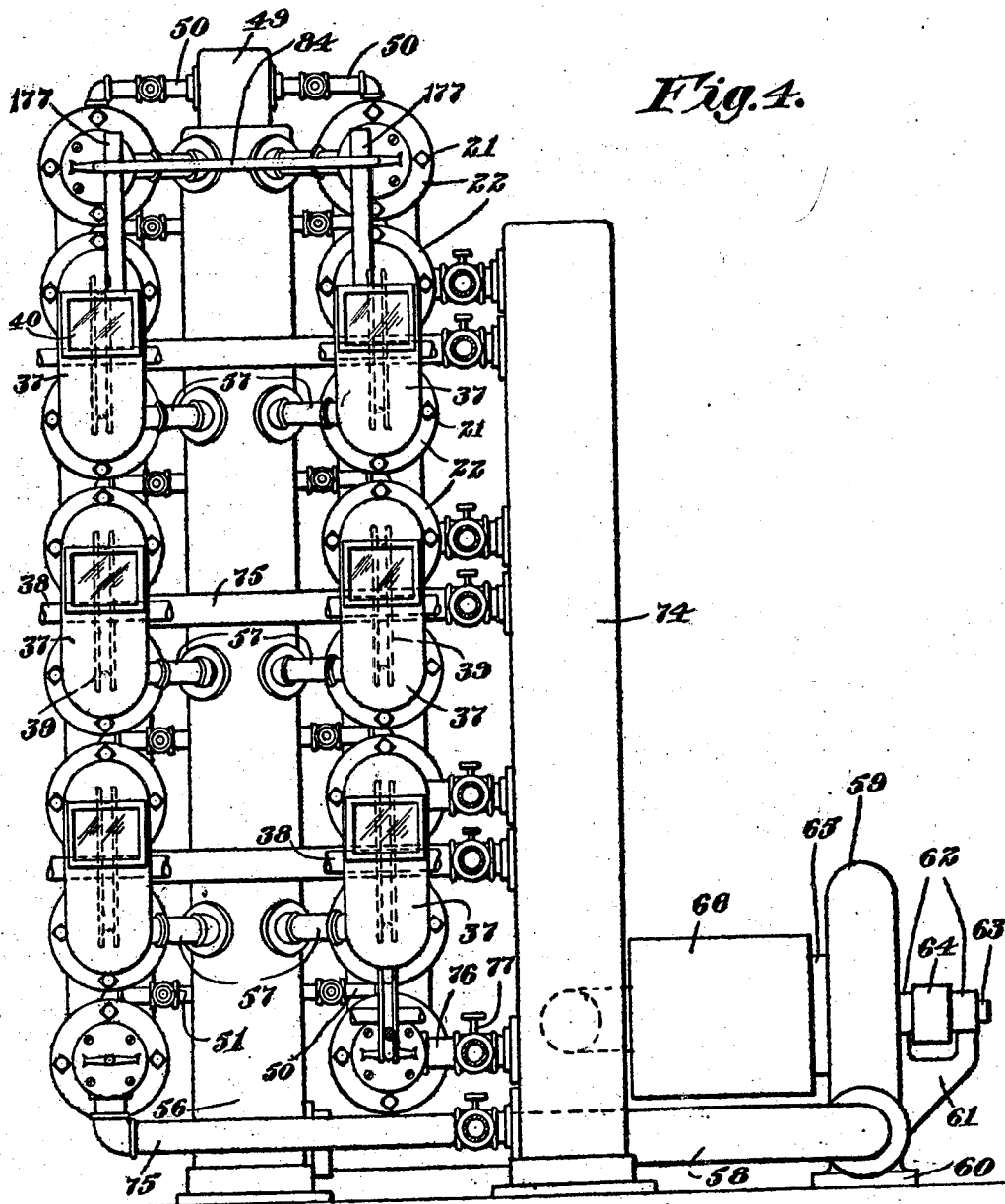
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T. S. RAMSDELL

YARN DRIER AND METHOD OF DRYING

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

THOMAS S. RAMSDELL, OF GREAT BARRINGTON, MASSACHUSETTS.

YARN DRIER AND METHOD OF DRYING.

Application filed August 29, 1923. Serial No. 659,919.

To all whom it may concern:

Be it known that I, THOMAS S. RAMSDELL, a citizen of the United States, and resident of Great Barrington, in the county of Berkshire and State of Massachusetts, have invented an Improvement in Yarn Driers and Methods of Drying, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My present invention relates to a novel method of drying a cotton yarn chain, or equivalent device, and is directed to an improved type of apparatus enclosing the article to be dried while it is fed continuously therethrough, thus utilizing a continuous and progressive drying method.

In the handling of yarn, particularly cotton yarn, preparatory to winding the same, it is customary to form the yarn into a "chain", running the same through dyeing vats, sizing troughs or the like, and thereupon it is necessary to subject the cotton yarn chain to a drying operation. Heretofore it has been customary to lead or wind this cotton chain about a series of steam drums, arranged in staggered relation and which drums were rotated, acting as feeding devices, and around which the cotton chain was rove, extending around the outside of each drum, and thus being only partially in heat receiving or drying relation to each drum. Various attempts have been made to improve this steam drum type of drier, but such prior devices have not proven satisfactory in commercial use. It has further been attempted to effect a drying of such cotton chain by leading it through an enclosure either on a travelling apron or the like, through which a blast of heated air was drawn.

All these prior efforts, processes and apparatus, however, were very cumbersome, expensive, wasteful of heat, and unsatisfactory under many conditions, nor were they efficient in the heat units supplied to the length of chain being treated. One of the objects of my present invention is to conserve the heat supplied to effect the drying action, to eliminate waste by radiation or the like, and also to maintain the yarn being treated under a substantially continuous drying action, eliminating intermittent drying and cooling, such for example as is the

effect on the yarn chain when being led from one steam drum to another.

An important feature of my present process and apparatus is that I combine as heating and drying elements a fixed steam heated member through which the yarn is fed, but without necessarily contacting therewith, although it may lie against a portion of the steam heated member, in combination with an air current which is in direct contact with the yarn. Thus I secure the benefits and advantages of a steam heated drum, together with an air current which latter positively carries away the moisture from the yarn chain. I believe that this combination of a fixed indirect heating and drying, together with a positive air current, heated or not as desired, and of any velocity, constituting a direct contacting and positive moisture removing medium, is a distinct novelty in this art and I wish to claim the same herein broadly.

A further important feature of my present invention consists in the fact that by having the steam heating members fixed, I eliminate the escape of steam and waste thereof, incident to a rotating steam drum, and this greatly reduces the power required, as the only driving elements requisite in my process and apparatus are sufficient power to rotate one or more sheaves which will feed the yarn chain itself through the drier.

Still further important features consist in the fact that I provide means to supply a constant control of both the steam heating element and the air current. The simple valve arrangement, together with automatic outlet to remove condensed steam, controls the heat desired in the steam heating portions of my apparatus, while a plurality of fresh air inlets and outlets enable me to remove the moisture laden air at any point or points desired, supply fresh non-moisture-laden drying air currents wherever desired, and thus I secure a desirable, complete and efficient control of the heating and drying elements. This control is most important, as it is well known that wet yarn will receive a higher degree of drying heat without injury to the fibres than when the chain is practically dry. Therefore I provide means to supply a maximum of drying and moisture removing air current as the wet yarn chain enters the drier, reducing or varying the drying instrumentalities as desired, giving

ing a tempered heat and current to the yarn during the last stages of its travel through the apparatus.

By means of my invention I am enabled to produce an extremely economical and efficient drying apparatus, capable of producing the desired drying effect on a yarn chain throughout a relatively short extent of its length and in a minimum amount of time required for the travel through the apparatus, conserving the heat necessary, eliminating waste, requiring only slight amount of power for the drying operation, readily assembled, easily controlled and capable of great speed in its drying effect, while it is practically automatic and continuous in operation.

In carrying out my invention I prefer to utilize a conduit or tube, and preferably a plurality of such tubes, linked together as units and arranged in series or tiers, either vertically or horizontally, preferably horizontally at a slight inclination or angle to facilitate flow of the condensed steam therefrom, such conduits or tubes comprising an outer steel or iron tube, an inner brass, composition or other non-corrosive tube, through which latter the yarn is fed, and with suitable packing joints at the ends thereof, so that the outer steam drum or jacket surrounds the non-corrosive tube through which the yarn is drawn. Then I provide a current of air, preferably heated or dry air, and arranged either in a closed circuit or otherwise, and preferably with a plurality of exhaust or outlet openings to conduct moisture laden current into the open air, and with a plurality of inlets to conduct freshly heated or dried air into contact with the yarn, thus insuring means to vary the drying action produced on the yarn, together with the air current which itself constitutes a positive moisture removing agent. With this air current operating on the yarn, while both are in the presence of a steam heated jacket, which latter can be covered with any desired heat insulating material, asbestos, magnesia or the like, it will be appreciated that I have developed a drier and a method of feeding and drying a cotton yarn chain or the like by a continuous process, which will conserve the heat supply, will produce a very great and yet a perfectly controlled drying action on the yarn and all during its continuous travel through the drier, permitting very great speed in its operation. I may supply as many sets, series or units of these jacket tubes as may be requisite for the speed of travel and time required for drying the yarn as it passes there-through. Preferably I have sheaves or pulleys of non-corrosive material around which the yarn is led from one jacketed tube to the adjacent one and all these are enclosed, so that the yarn is subjected to a continuous,

progressive, and uniform drying action, thus eliminating the difficulties involved in an intermittent drying action as is obtained around rotating steam drums. Only the slight power required to draw the cotton yarn chain over the pulleys or guiding sheaves is required to operate the entire apparatus.

Various features and novel devices are utilized, including means to insure a predetermined conformation in the yarn chain, preferably having the same slightly flattened by passing it through a yielding gate, guard, diaphragm, mechanism or the like between one or more of the guiding pulleys and the jacketed tubes, thus further facilitating and expediting the drying action, spreading out the threads of the chain and preventing it from becoming matted and rolled, while also permitting the chain to pass into and out of the inner tubular members through which the air supply is maintained at a desired pressure.

Other details, novel features, advantages and combinations will be hereinafter more fully pointed out and claimed.

In the accompanying drawings illustrating a preferred embodiment of my apparatus and by means of which my novel method may be practiced,

Fig. 1 is a side elevation;

Fig. 2 is a plan view;

Fig. 3 is a vertical section on the line 3—3 of Fig. 2;

Fig. 4 is an end elevation taken from the right of Fig. 1 and with certain parts removed for clearness of illustration;

Fig. 5 is a vertical sectional elevation through the right hand end of one of the drier tubes, and

Fig. 6 is an end elevation of Fig. 5.

My improved apparatus includes, as necessary elements, a plurality of pairs of tubes or chambers arranged in vertically arranged groups, and as all the pairs of tubes employed are similar in construction, a description applied to one pair of such tubes will be sufficient for a clear understanding of the apparatus. Referring to the drawings, therefore, 10 designates an inner heating chamber or tube threaded at one end to screw into an internally threaded flange 11 and at the other end to thread into a Y-coupling or elbow 12 and on the main portion of the Y elbow 12 is screwed a nipple 13 which has threaded onto its other end a flange 14, this flange 14 being provided on its outer face with a cover 15 of resilient material, this cover being secured to the flange 14 by a plurality of screws 16 and diametrically arranged in the cover 15 is a slit 17 and through which the article to be dried is drawn, the form of the slit 17 insuring a practically air tight joint to prevent cold air being drawn into the heating tube 10.

Surrounding the inner tube 10 is a tube 18 of considerably greater diameter than the tube 10 and the space between such tubes constitutes a heating chamber for heating fluid by means of which the interior of the tube 10 is heated and kept heated. The ends of the tube 18 are flanged, as shown at 19, and at the right hand end of the tube is secured by means of bolts 20 and nuts 21 a stuffing box 22 through which the inner tube extends, as clearly shown in Fig. 3, and cooperating with the stuffing box 22 is a stuffing nut 23, bolts 24 being utilized to draw the stuffing nut 23 into association with the stuffing box 22 and between the stuffing box 22 and stuffing nut 23 is placed the usual packing 25. Also between the flange 19 of the tube 18 and the stuffing box 22 it is desirable to place a gasket 26 to insure a tight joint. Considering a tube 10 and a tube 18 assembled together in the manner above described as a unit and referring to Fig. 3, it will be noted that a pair of such units are arranged in a group, one above the other, and have their left hand ends secured to flanges 27 formed integral with a hollow casing 28, bolts 29 and nuts 30 being utilized to hold the casing and pipe units together. Arranged in the casing 28 is a horizontal shaft 31 on which is rotatably mounted a grooved pulley 32 for a purpose to be hereinafter described. On one of the faces of the casing 28 is arranged an opening 33 which may be utilized to assist in reeving the article to be heated through the tubes 10 and such opening is provided with a pivotally mounted closure 48. The pairs of tubes assembled as above described are arranged in a plurality of vertical rows, as shown in Figs. 2 and 4, and are supported on a suitable framework (not shown) by means of cross bars 35 and 36. Two forms of supporting bars are shown, the one, 35, rectangular in cross section while the other, 36, is circular in cross section, and it is, of course, within the scope of the invention to utilize either or both of such forms.

As above arranged in vertical rows, I may take the lower tube 10 of the upper pair of tubes and the upper tube 10 of the next succeeding lower pair and enclose the flanges 14 with a casing 37 and in this casing 37 rotatably mount a horizontal shaft 38 and on such shaft within the casing 37 is secured a grooved pulley 39. This arrangement is continued with the lower tube 10 of one pair and the upper tube of the next succeeding lower pair, as clearly shown in Fig. 3. In the end face of the casing 37 is arranged a sight or window 40 through which may be observed the interior of the casing and the article passing therethrough to determine whether or not the apparatus is functioning properly. Below the lower casing 37 and adjacent the lower tube 10 of the lower pair is arranged a rotatably mounted horizontal shaft 41 parallel to the shafts 38 and on this shaft 41 is secured a grooved pulley 42. Secured to the lowermost shaft 38 near one end thereof is a drive pulley 43 and by means of which power is transmitted to the shaft 38 from any suitable source of power. Also secured to the lowermost shaft 38 is a pulley 44 that is in vertical alinement with a corresponding pulley secured to the next higher shaft 38 and a belt 45 extends over the pulleys 44 to thereby transmit power from the lowermost shaft 38 to the shafts 38 located above.

The vertically arranged pairs of tubes or chambers 10 are arranged in pairs and any desired number of pairs may be utilized, the pairs being spaced apart from each other any suitable distance, as shown in Fig. 2, and between each pair is arranged at a point adjacent the right hand end of the tubes 10 a vertical manifold 49 tapped at various points along its length with pipes 50, these pipes in turn being tapped into the top of the enclosing tubes 18, as shown in Fig. 3, a valve 51 being arranged in each of the tubes 50 and by means of which passage of heating fluid contained in the manifold 49 to the chamber formed by the tubes 10 and 18 may be controlled. At the end of each of the tubes 18 remote from the point of entrance of the tubes 50 and on the lower side of such tubes 18 is arranged an exit pipe 52, each of which communicate with a vertically arranged pipe 53, each of which communicates at its lower end with a horizontal pipe 54 leading to a heating apparatus to be hereinafter described, the flow of spent heating fluid being controlled by a valve 55.

Located between the vertical pairs of groups of pipes 10 and adjacent the manifold 49 is a manifold 56 which manifold is connected by pipes 57 with each of the upper inner tubes 10 of each of the pairs of vertically arranged pipes in each series through the Y elbows or couplings 12, as clearly shown in Figs. 2 and 4. The lower end of this manifold 56 has connected thereto one end of a feed pipe 58, the other end of which is connected to the outlet end of a pressure blower 59 that is mounted on a base 60. On the casing of the blower 59 is a bracket 61 in which are formed bearings 62 rotatably supporting a shaft 63 carrying the rotor (not shown) of the blower and on the shaft 63 is secured a drive pulley 64 and by means of which power may be supplied to rotate the shaft 63. Attached to the blower is an inlet casing 65 which is connected to a closed receptacle 66 in which is arranged a coil of pipe 67 the inlet end 68 of which is connected to a boiler or like heating plant while the outer end 69 thereof is connected to a drain or by any suitable sort of return to

the boiler. The return pipe 54 to which is connected the upright pipes 53 is connected to the outlet end 69 of the coil of pipe 67 and the spent heating fluid, such as steam, passing through the pipes 53 and 54 may thus be led to the drain above referred to (but not shown) or return to the boiler. The end of the closed receptacle 66 is provided with an inlet pipe 70 that is, in turn, connected to a pipe 71 at a point intermediate the ends of such pipe and in said pipe 71 and on either side of the inlet pipe 70 is arranged a butterfly valve 72 and 73 respectively, the butterfly valve 72 being adjacent the open end of such pipe 71. The other end of said pipe 71 is connected to the lower end of a vertically arranged manifold 74, that is tapered at intervals along its length to receive pipes 75 and 76 that communicate respectively with the lower ones of each of the pairs of tubes 10 in each vertical series of such tubes, by means of the Y elbows 12, both the pipes 75 and 76 being provided with controlling valves 77 and by means of which the exit of heating fluid from the lower inner tubes 10 to the outer atmosphere may be controlled. This arrangement provides a complete circulatory system from the heating apparatus located within the closed receptacle 66 through the pipe 58, the manifold 56, through the upper inner tubes 10 of each pair of tubes, through the lower inner tubes 10 of each pair of tubes through the pipes 75 and 76, through the manifold 74, through the pipe 71, and back to the heating apparatus within the closed receptacle 66 by means of the inlet 70, the butterfly valve 73 controlling the flow of heating fluid. The butterfly valve 72 acts as an auxiliary control means for regulating the temperature of the heating fluid with relation to the heating apparatus 67 located within the closed receptacle 66.

Secured to the upper casing 37 of each series and extending upwardly therefrom to a point above the slit 17 in the member 15 is a rod 177, preferably circular in cross section, or, if desired, a roller may be mounted on such rod and the purpose of this rod will be apparent when the manner of operation of the apparatus is described. Arranged adjacent the shaft 41 and parallel thereto are shafts 78 and 79 on which are rotatably mounted the idler grooved pulleys 80 and 81 respectively while above such shafts 78 and 79, but also parallel thereto, is arranged a shaft 82 on which is rotatably mounted a grooved idler pulley 83.

The operation of my improved apparatus and whereby my improved method may be practiced is as follows: A cotton yarn chain or other article it is desired to dry, this article being indicated by the numeral 84, is fed under the idler pulley 42 from a reel, basket, or other container, the cover 48 rotated on its pivot point to uncover the holes 33 in the sides of the casing 28 and a fishing tool inserted therethrough to catch the end of the chain 84 which is thus reeved through the lower inner tube 10 in one of the vertical series of tubes around and over the pulley 33, through the upper inner tube 10 of the lower pair, around, up, and over the pulley 39, through the lower inner tube of the next higher pair, and so on, being finally led out through the upper tube of the upper pair of tubes, around the rod 177 associated with the upper casing 37 of this vertical series, around the rod 177 of the next or associated series and then the operation of reeving the chain 84 through the tubes 10, as above described, is reversed with respect to the associated vertical series, the end of the chain being brought out from such lower tube around and between the idler pulleys 80 and 81, over the idler pulley 83 to a suitable winding device or receptacle. Steam is turned into the heating apparatus 67 contained within the closed receptacle 66, the butterfly valves 72 and 73 properly operated to control the flow of air, the blower 59 started in operation, the valves 51 opened to allow steam to pass into the heating chamber between the inner and outer tubes 10 and 18 respectively, the valves 55 opened to allow a continual passage of live steam through the heating chambers, power is applied to the pulley 43 by means of the belt associated therewith to rotate in unison the various drive pulleys 39 and the chain 84 is thus drawn from the source of supply into the lower inner tube 10 of one series of tubes and out from the lower tube of the associated series of tubes, over the idler pulley 83 and into a container or onto a reel, as may be desired. The operator may look through the window or sights 40 to ascertain if the device is operating properly or this condition may be observed at the exposed portion of the chain 84 passing over the rods 177. Dry heated air passing in a stream through the inner tubes 10 (and it will be observed from an inspection of the drawings that such dry heated air passes through the inner tubes 10 in a direction opposite to the direction of travel of the chain 84) will drive the moisture from the chain 84 and the now moisture laden heated air is passed through the closed receptacle 66 where it is again heated. If the moisture content of this heated air becomes too great, the operator, by controlling the valves 77 in the pipes 75 and 76, may discharge a portion thereof into the outer atmosphere and a fresh supply of air is admitted to the closed receptacle 66 by the proper operation of the butterfly valve 72 and the proper degree of moisture content of the heated air may be readily determined by the operator after a short experience. In addition to the

chain 84 being subjected to the dry heated air passing through the tubes 10, such tubes 10 are also maintained in a heated state by being surrounded with a volume of practically live steam and the degree of heat transmitted to the inner tubes 10 by such volume of live steam may be accurately determined by properly regulating the flow of steam from the manifold 49 to the outlet pipe 69. The slits 17 in the diaphragm 15 of flexible material, such as rubber, allow the free passage of the chain 84 therethrough in either direction while at the same time preventing undue escape of heated air from such tubes 10.

While I have necessarily shown and described the preferred embodiment of my invention somewhat in detail, it is to be understood that I may vary the size, shape, and arrangement of parts comprising my invention within wide limits without departing from the spirit of the invention.

My invention is further described and defined in the form of claims as follows:

1. The improved method of drying cotton yarn, which consists in utilizing a steam jacketed heater, passing the yarn to be dried through said heater and simultaneously subjecting the traveling yarn to a drying air current.
2. The improved process of drying cotton yarn chains and the like, which consists in feeding the same continuously through a series of heated members, heating said members free of contact of the heating medium with the yarn, and supplying a direct heating medium upon said yarn as it is fed through said heaters, and varying the drying effect on the yarn at predetermined points.
3. The improved process of drying cotton yarn chains and the like, which consists in feeding the same through a series of heated drums, controlling the heat supplied to said drums, and applying a drying air current directly to the yarn and varying said current in its velocity, heat or drying effect at predetermined points throughout the travel of the yarn chain through the drums.
4. The improved process of drying cotton yarn chains and the like, which consists in passing said chain continuously and progressively through successive series of drying enclosures, leading the chain over anti-friction members to guide the same into said series of enclosures, supplying drying air under pressure through said successive series of enclosures, in direct contact with the chain, while keeping and maintaining the entire length of chain subjected to the drying action under a drying operation, while traveling over said guiding means to successive enclosures.
5. An improved drying apparatus, comprising a jacketed enclosure, means to sup-

ply heat to said jacket, and means to supply drying air current through said jacket, in combination with means to feed an article to be dried through said jacketed member and in the air current.

6. An improved drying apparatus, comprising a plurality of jacketed enclosures, means to supply heat to said jackets, and means to supply drying air current through said plurality of jackets, in combination with means to feed an article to be dried through said plurality of jacketed members and in the air current.

7. In an improved drying apparatus, the combination of a plurality of tubular jacketed chambers, heating means for said jacketed chambers, means for feeding a yarn chain through each of said chambers, continuously, and means for forcing a continuous column of air through said drying chambers successively.

8. In an improved drying apparatus, the combination of a plurality of tubular jacketed chambers, heating means for said jacketed chambers, means for feeding a yarn chain through each of said chambers, continuously, and means for forcing a continuous column of air through said drying chambers successively, including means to vary the drying action of said air current at predetermined points.

9. In an improved drying apparatus, the combination of a plurality of series of jacketed drying tubular members, means to supply heat to said members, guiding means to conduct a yarn chain through said plurality of members, and means enclosing the yarn chain and said guiding means, whereby a current of air may be forced through said entire series of chambers following the line of travel of the yarn chain through said chambers and over said guides.

10. In an improved drying apparatus, means to feed a yarn chain therethrough, in combination with yielding means at the entrance and exit of the yarn chain into and out of said apparatus, adapted to conform the cross-section of the yarn chain to substantially predetermined size.

11. In an improved drying apparatus, means to feed a yarn chain therethrough, in combination with yielding means at the entrance and exit of the yarn chain into and out of said apparatus, adapted to conform the yarn chain into relatively flat thin form, and to simultaneously maintain a partial air pressure within said apparatus, during the continual feeding of the yarn into and out of said apparatus.

12. An improved drying apparatus, comprising a plurality of series of jacketed tubular members, means to supply a heating fluid to said jackets, means to guide, conduct and feed the yarn chain through each member of said series, and means under the

control of the operator to vary the drying action upon the chain in any one of said members.

13. An improved drying apparatus comprising a pair of tubular members, a heating jacket surrounding said members, a casing secured to said members at one end thereof whereby a continuous passage is provided from one tube to the other, an inlet and an outlet arranged in said tubes to guide heating fluid through said tubes from end to end, and a closure for the open ends of said tubes.

14. An improved drying apparatus comprising a tube, a jacket surrounding said tube, a casing provided with a plurality of openings, means for securing said tube to the casing in alinement with one of said openings, a second tube, a heating jacket therefor, means for connecting said tube to the casing in alinement with the other of said openings, a closure for the other ends of said tubes comprising a diaphragm provided with a perforation in alinement with the axes of the tubes, feeding means within the casing for feeding a yarn chain through the first said tube and into the casing, and feeding means located without the casing for feeding the yarn chain from the casing through said second tube.

15. An improved drying apparatus comprising a series of horizontal tubes in vertical arrangement and parallel with each other, means for feeding a yarn chain through said tubes in a continuous line from

top to bottom of the series, a fluid heating device, pressure means associated therewith, a conduit leading from said pressure means to the alternate tubes of the series, an inlet for said heating apparatus having its other end connected to the remaining tubes of the series, the pressure apparatus for the heated fluid and the feeding means for the yarn chain being so arranged relatively to each other and to the tubes of the series that the heated fluid is forced through the tubes in a direction opposite to the travel of the yarn chain therethrough.

16. An improved drying apparatus, comprising a plurality of jacketed tubes, guiding means adjacent the ends of each tube, means to lead a yarn chain or the like over said guides and through said tubes successively, means enclosing the line of path of the yarn chain, and a plurality of air inlets and outlets operable at predetermined points throughout the line of travel of said yarn chain, and a blower to supply a current of air through the apparatus, whereby moisture laden air may be deflected from any predetermined tube, and unladen air supplied at predetermined points throughout the apparatus, during the continuous operation of the drier, whereby the drying action on the chain throughout its traverse of the apparatus is controlled.

In testimony whereof, I have signed my name to this specification.

THOMAS S. RAMSDELL.