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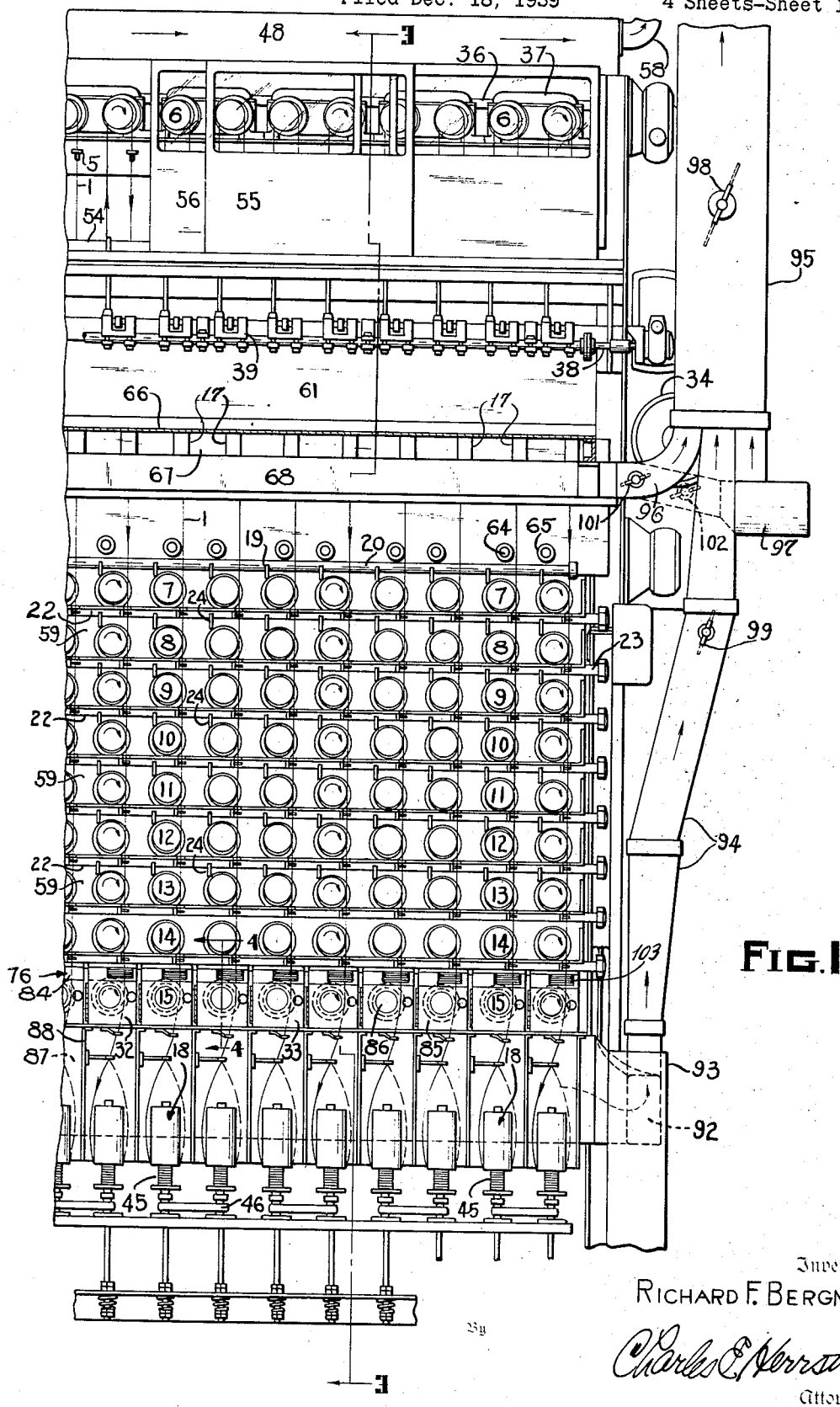
R. F. BERGMANN

2,303,697

APPARATUS FOR MANUFACTURING THREAD OR THE LIKE

Filed Dec. 18, 1939

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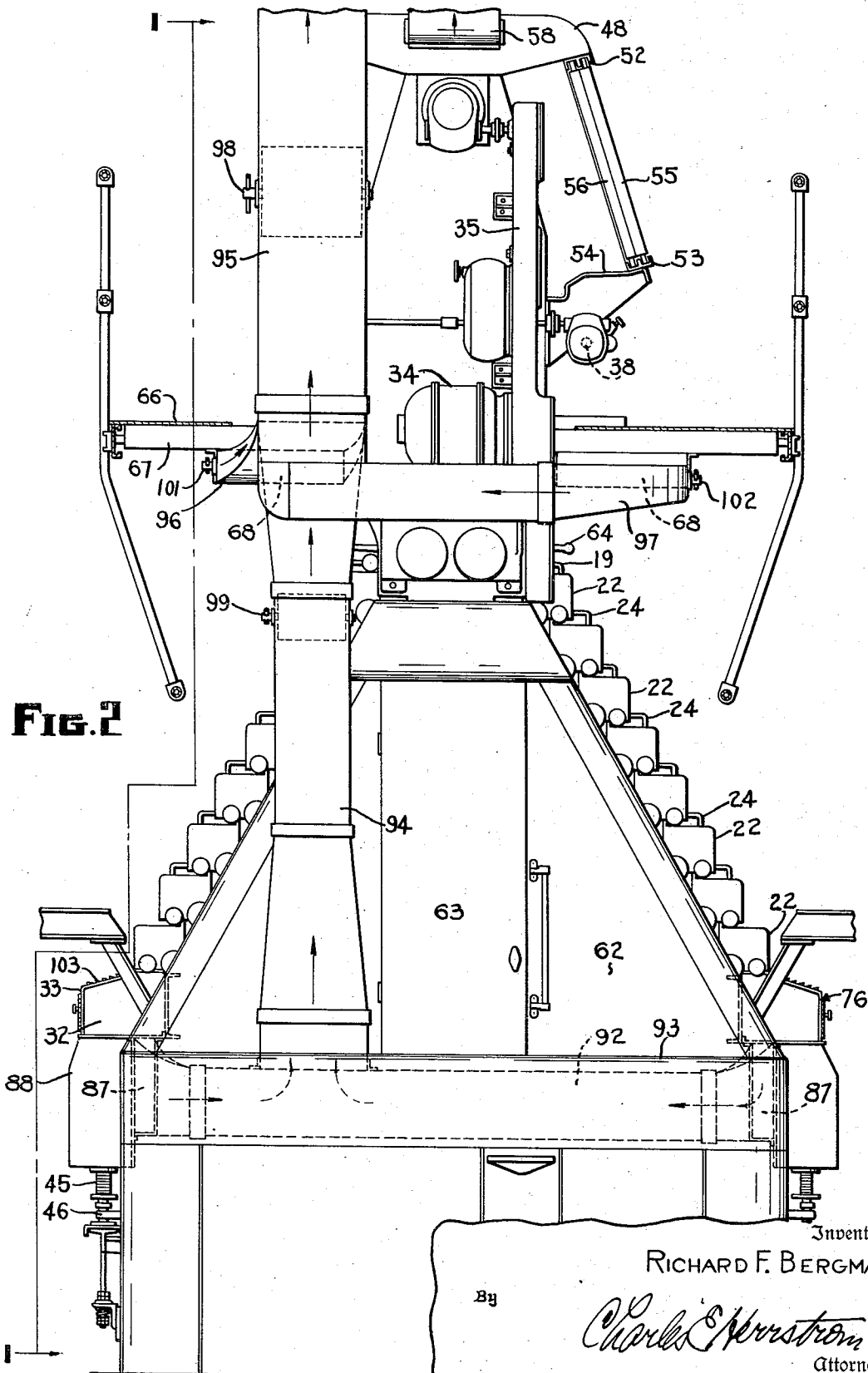
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APPARATUS FOR MANUFACTURING THREAD OR THE LIKE

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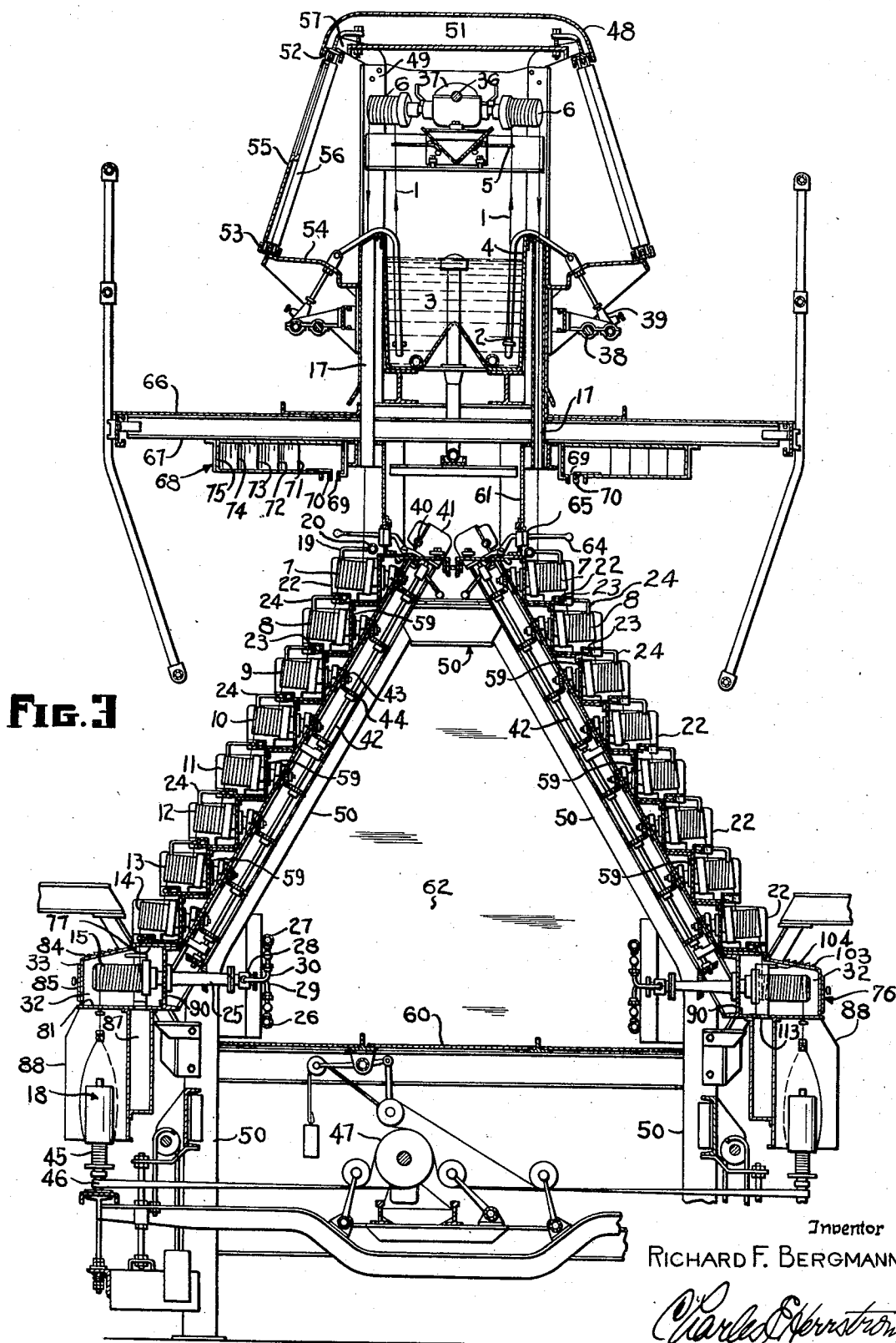
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APPARATUS FOR MANUFACTURING THREAD OR THE LIKE

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4 Sheets-Sheet 4

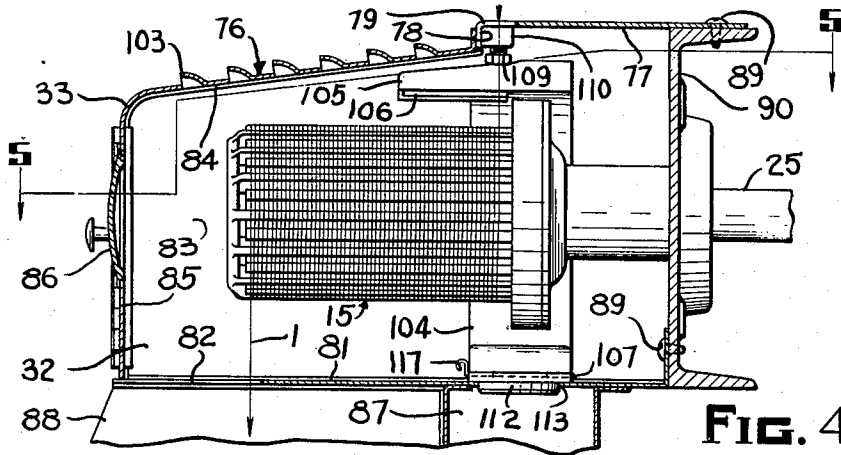


FIG. 4

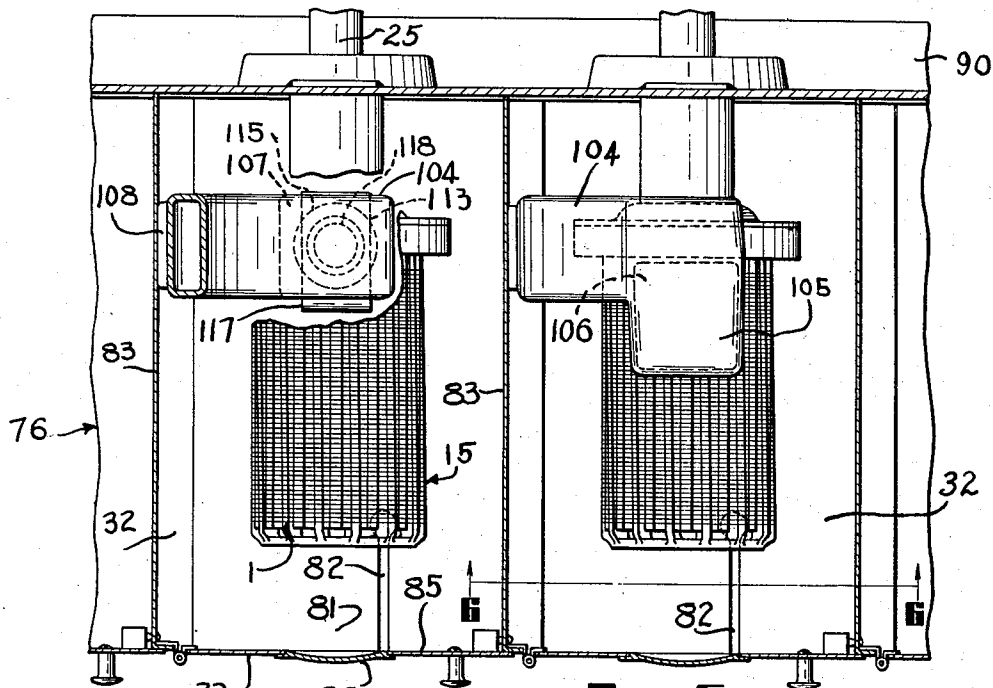


FIG. 5

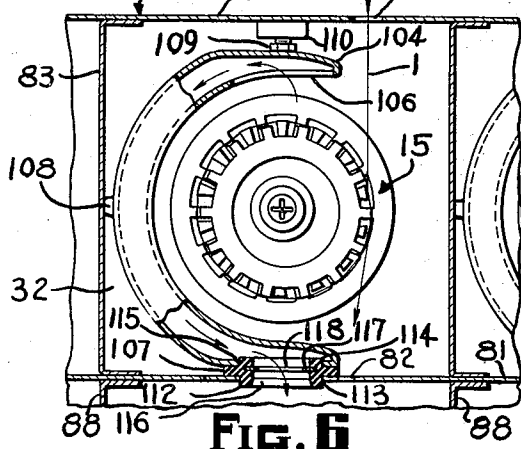


FIG. 6

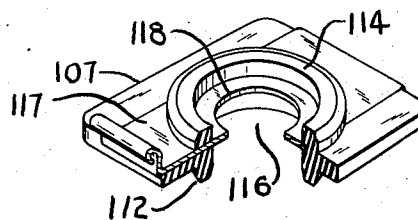


FIG. 7

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APPARATUS FOR MANUFACTURING
THREAD OR THE LIKE

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Application December 18, 1939, Serial No. 309,834

11 Claims. (Cl. 18—8)

This invention relates to apparatus for the continuous processing of strip material such as thread or the like, hereinafter referred to as "thread." More particularly, it relates to means for ventilating such apparatus. For convenience, but in no sense of limitation, the invention will be described hereinafter in connection with apparatus for the manufacture of viscose artificial silk thread by a continuous process generally similar to that shown, described and claimed in application No. 7,114, filed February 18, 1935, by Walter F. Knebusch and Alden H. Burkholder (Patent 2,225,642).

In such a machine, a plurality of threads are formed by extrusion of viscose into a coagulating bath. Each thread is withdrawn from the bath and passed to a downwardly extending series of thread-advancing thread store reels on each of which a long length of thread is continuously but temporarily stored in a plurality of generally helical turns. The thread is subjected to the action of a processing liquid on each of a plurality of reels, dried on another reel, and finally collected, as by a cap twister. The reels are arranged in banks one of which is disposed on each side of the machine.

As will appear, it is important that such apparatus be adequately ventilated.

Each machine may embody as many as several hundred reels in a relatively small space; in a single room, several score machines may be disposed. Liquids some of which may be acid and some of which may be alkaline are applied to the thread on the reels. Vapors are emitted by such liquids, particularly if, as is desired, such liquids are caused to spread in a thin layer over the thread on each reel. It is the practice to heat certain or all of the liquids to temperatures above room temperature, this in order to increase the speed of reaction induced by such processing liquids. Both of said factors tend to increase the rate of evaporation and hence increase the dissemination of vapors.

Moreover, if the fullest benefits of the continuous processing operations are to be achieved, it is necessary to maintain as nearly uniform as possible the processing conditions to which the thread is subjected on each reel. This requires not only uniformity of the rates of application of the processing liquids and uniformity of the concentrations and temperatures of such liquids, but also uniformity of the atmospheric conditions surrounding the reels. For example, if the temperature or the humidity of the air surrounding the reels varies, the processing conditions are

correspondingly modified. Such variations in atmospheric conditions can easily occur as the result of vagrant air currents.

The condition of the air supplied to the room in which the apparatus is disposed will obviously have an effect upon processing conditions. Consequently, it is desirable, if not necessary, that the air supplied to the room in which the reels are disposed be subjected to a conditioning operation so that it is in a predetermined condition as regards initial temperature and moisture content. It is desirable that the air in the room in which the machines are disposed be maintained at a relatively high temperature and a substantial moisture content since this facilitates the handling of the thread on the apparatus. For purposes of economy in the air conditioning operation, it is desirable that such air be recirculated, wherefore it should be recovered when it has served its purpose of ventilating the machines.

The present invention satisfies all of these requirements. Among other things, it provides efficient means for removing vapors from each machine. It provides means for efficiently maintaining predetermined atmospheric conditions in the vicinity of the reels on which processing operations are performed on the thread. By providing for the recovery of the air, it makes it possible to recirculate such air, wherefore machines embodying the present invention may be efficiently and economically employed in connection with air conditioning apparatus.

The present invention accomplishes these results by making possible a controlled flow of air across the bank of reels on each side of the apparatus, thereby helping to provide the high degree of uniformity of processing conditions desirable in continuous processing operations. Moreover, the invention provides for a controlled flow of air in the vicinity of each of the drying reels employed in the apparatus. This facilitates the uniformity of the drying operation, which to a large extent determines the uniformity of the finished thread.

These aspects of the invention and the advantages flowing therefrom, as well as other advantages of the invention, will be apparent from the following description, in which is described the preferred embodiment of the invention.

In the drawings Figure 1 is a side elevation of a machine for the manufacture of viscose artificial silk thread embodying the invention, said machine operating generally on the principle disclosed in the above-identified application. Fig-

ure 2 is an end elevation of the machine of Figure 1. Figure 3 is a sectional elevation of said machine, the section being taken along line 3—3 of Figure 1. Figure 4 is an enlarged sectional elevation, corresponding generally to line 4—4 of Figure 1, of the drying reel and associated apparatus of said machine. Figure 5 is a plan from line 5—5 of Figure 4. Figure 6 is a sectional elevation of the apparatus shown in Figures 4 and 5 corresponding generally to line 6—6 of Figure 5, parts being broken away to show more clearly the manner in which the duct is mounted. Figure 7 is a partial perspective on a larger scale of the sealing member employed in the drying chamber.

In the illustrated apparatus, each thread 1 is produced by extrusion of viscose from a spinneret 2 into a coagulating bath 3 contained in a trough 4 which extends longitudinally of the upper portion of the apparatus. Each of said threads 1 is drawn upward from the bath 3 through a guide 5 to a thread-advancing reel 6 disposed above the bath. Said reel, as are all the other reels on the apparatus, is of cantilever form in that it is supported and driven from one end only. As does each of the other reels in the illustrated apparatus, it advances the thread lengthwise thereof toward its unsupported end in a large number of closely spaced, generally helical turns. Each reel 6, of which one is provided for each thread, is disposed so that its supported end, on which the thread starts, is substantially above the spinneret 2 and so that the point at its unsupported end from which the thread leaves the reel is disposed beyond the lateral limits of the trough 4.

The thread passes downward from reel 6 to the first reel 7 of a series of reels, nine in the embodiment of the invention illustrated, bearing reference numerals 7 to 15, inclusive. A tubular passage 17 is provided for each thread at the edge of the trough 4, this in order to provide a protected passageway for the thread from a point above to a point below the trough 4. The thread passes in sequence to each of said reels 7 to 15, inclusive, being stored on each reel in a large number of generally helical turns which are advanced toward the unsupported end of the reel during rotation thereof. A downwardly extending series of such reels is provided for each thread, each reel in the series being employed to perform a desired step in the sequence of processing operations.

The illustrated machine produces a plurality of threads on each side thereof, the coagulating trough 4 being common for the threads produced on both sides of the apparatus. On each side, corresponding reels in the plurality of downwardly extending series of reels are arranged in series extending longitudinally of the apparatus, as shown in Figure 1. Thereby the problems otherwise presented in constructing the apparatus, driving the reels, and supplying and removing processing media are greatly simplified.

Reels 6 to 15, inclusive, of each downwardly extending series are disposed in stepped arrangement, as shown, with the discharge end of each preceding reel in opposite relation to the receiving end of the succeeding reel. The axes of the reels are horizontal or substantially horizontal, so that the unsupported ends of all reels extend in the same direction. On each side of the apparatus the discharge ends of the reels are presented to the operator, this feature providing advantages in the manipulation of the thread on the

reels. The stepped arrangement of reels makes it possible for the thread to pass directly from each preceding reel to each succeeding reel without the necessity of bending the thread, which feature eliminates the necessity of providing guides which change the direction of the thread.

Accordingly, the illustrated machine comprises two inclined banks of reels on the opposite sides of the apparatus at the upper portion of which are disposed the thread-forming means and between which is a substantially unobstructed interior space.

No processing liquid is applied to the thread on the reel 6, which is employed to provide a period for coagulation of the thread. Mildly acid liquids are applied to the thread on the succeeding reels 7 and 8 to harden the thread, one or both of these liquids being heated considerably above room temperature to promote the reaction. On reel 9, desulphurizing liquid is applied to the thread for the purpose of removing sulphur formed during the regeneration of the cellulose content of the viscose; on reel 10, wash water is applied to the thread. A suitable bleaching liquid is applied to the thread on reel 11. Wash water is again applied to the thread on reel 12. If desired, an oiling or soaping liquid is applied on reel 13. No treating liquid is applied to the thread on reel 14, this reel being employed to permit excess liquid to drip therefrom before the thread is dried on reel 15. The liquids applied on reels 9 to 13, inclusive, are preferably heated somewhat above normal room temperatures.

On each reel 7 the liquid is applied from a tube 19 communicating with a conduit 20 extending longitudinally of the apparatus and serving like reels in adjacent series. Said conduit is connected to a suitable source of liquid (not shown). A collecting trough 22 is disposed below a plurality of reels 7 extending in a longitudinal series to receive the liquid dripping therefrom. A plurality of said troughs 22, suitably interconnected, may extend lengthwise of the machine under all reels 7 on each side thereof and the liquid received therein may be recirculated, if desired, by suitable means not shown. The liquid applied to the thread on each reel 8 is shown as supplied from a conduit 23 formed integrally with a similar collecting trough 22 for the preceding reel, a distributing tube 24 communicating with said conduit 23.

In a similar manner, liquid is applied to each of the succeeding reels on which liquid is applied to the thread from a tube 24 communicating with a conduit 23 formed integrally with the collecting trough 22 for the preceding reel.

Each of the reels on which a processing liquid is applied to the thread is inclined slightly from the horizontal, its unsupported end being elevated somewhat above its supported end. The liquid may then be applied to the unsupported end of the reel, as shown, since the inclination of the reel will cause the liquid to flow over the entire thread-bearing surface of the reel. This makes for economy in the use of the processing liquid and provides a countercurrent flow of liquid, the direction of travel of the liquid being opposite to the direction of travel of the thread.

Each drying reel 15 on the same side of the apparatus is internally heated by means of a suitable heating fluid circulated through its drive shaft 25 (Figures 4 and 5) from supply and drain conduits 26 and 27 (Figure 3) extending longitudinally of the apparatus and serving all drying reels in the same horizontal series. A suitable

fitting 28 and pipes 29 and 30 are provided to conduct the heating fluid to and remove it from the drive shaft 25 for each reel. An enclosure 32 surrounds each of the drying reels 15 to aid in maintaining the desired drying conditions in the vicinity of the reel. Each of said enclosures has a hinged door 33 which, when opened, exposes the front and top of each reel 15 to permit access thereto.

The drive mechanism comprises a motor 34 mounted at the end of the apparatus. By means of a chain contained in housing 35, such motor 34 drives the upper drive shaft 36. The latter extends longitudinally of the apparatus and is common to and drives the upper reels 6 on both sides of the apparatus. It passes through gear boxes 37 containing gears and clutch means for driving said reels 6 from said drive shaft. Through said chain drive mechanism in housing 35 motor 34 also drives shafts 38 for spin pumps 39. Motor 34 also drives shafts 40 one of which extends longitudinally of the apparatus at the top of the inclined bank of reels on each side of the apparatus. Each of said shafts 40 passes through gear boxes 41 containing gears and clutch means for driving inclined shafts 42 each of which, through gears 43 and 44, rotates a downwardly extending series of reels.

The bobbins 45 of the cap twisters 18 are reciprocated in the usual way and rotated by belts 46 from drum 47.

In the machine shown, the space above the coagulating trough 4 is substantially completely enclosed. The longitudinally extending hood 48 is mounted above the coagulating trough 4 and reels 6, being supported by the spaced uprights 49 which carry the coagulating trough 4 and which are supported from the main frame 50 of the apparatus. As shown in Figure 3, a duct 51 is formed in the upper portion of said hood.

Uprights 49 also support an upper longitudinally extending track 52 on each side of the apparatus. A corresponding lower track 53 is mounted on the apron 54 carried on each side of the apparatus adjacent the coagulating trough 4 by said uprights 49. Sliding doors 55 and 56 are slidably mounted in said upper track 52 and lower track 53 on each side of the apparatus in overlapping relation so that they can be opened, as shown in Figure 1, to permit access to coagulating trough 4, spinnerets 2, reels 6, and associated apparatus. In ordinary operation, after the threads are started from the spinnerets 2 to and from the reels 6, the doors are kept closed.

Vapors emanating from the coagulating bath 3 are drawn upward through slots 57 into duct 51 from which they are exhausted by duct 58 a negative pressure being maintained in duct 58 by an exhaust fan.

In the illustrated apparatus, the space between the banks of reels 7 to 15, inclusive, is substantially enclosed by walls formed by the back portions 59 of the collecting troughs 22, the back portions of the drying enclosures 32, flooring 60 supported by the frame 50 of the apparatus, partitions 61, and panels 62 at the ends of the apparatus. The panel 62 at the drive end of the apparatus, shown in Figure 2, is provided with a door 63 through which operators may have access to the interior of the apparatus. Entrance of the vapors produced on the machine into the interior of the apparatus is thus prevented. To aid in preventing the entrance of such vapors into the interior of the apparatus, the handles 64 for the clutches contained in gear boxes 41

which connect the inclined drive shafts 42 to the longitudinally extending drive shafts 40 are provided with flexible sealing means 65 at the points where such handles project through partitions 61.

Since the illustrated machine is of considerable height, it is necessary to provide platforms 66 for the operators supported by spaced beams 67 fixed to the uprights 49 which in turn are fixed to the frame 50 of the apparatus.

In the apparatus illustrated, a ventilating duct 68 is disposed beneath the platform 66 on each side of the machine. Each of said ducts is provided with a longitudinal slot 69 extending throughout the length of the duct. The slot 69 in each duct 68 is provided with an adjustable closure 70 by means of which the width of the slot 69, and consequently the volume of air drawn therethrough, may be varied. The slot 69 is preferably positioned as shown near the innermost reels 7 and 8 of each bank, since from these reels are emitted the most undesirable vapors. Because the reels are disposed in an inclined bank on each side of the machine, a current of air is caused to sweep over the bank of reels on each side of the machine and into the ventilating duct 68.

Each duct 68 increases in width in the direction of travel of the air to provide a uniform rate of flow of air through the duct. The increasing width of the duct compensates for the fact that the volume to be handled increases lengthwise of the duct because of additional air drawn into the duct through longitudinal slot 69. Each duct 68 is therefore formed with a plurality of portions of different widths, the widest portion being adjacent the discharge end of the duct. In Figure 3, the walls 71 to 75, inclusive, define the portions of increasing width. If desired, the width of the slot 69 also may vary from one end of the duct to the other, as by decreasing in width toward the discharge end thereof, to compensate for any pressure drop in the duct occurring from the discharge end thereof to the remote end thereof. Such variation in the width of the slot 69 may be readily obtained by suitable adjustment of the closure portion 70.

In the embodiment of the invention shown, a plurality of enclosures 32 for drying reels 15 are formed in a housing unit 76 which may be readily mounted upon and removed from the machine. As shown in Figures 1 to 6, inclusive, said housing unit 76 comprises a stationary upper wall member 77 having a downwardly bent lip portion 78 and suitably spaced slots 79 through each of which a thread 1 may pass to the corresponding drying reel 15 in the housing unit. The housing unit 76 also comprises a bottom wall member 81 extending beneath several adjacent reels 15 and provided with suitably spaced slots 82 through each of which a thread may leave the corresponding reel.

The enclosure 32 for each reel 15 is defined by spaced partitions 83 fastened to the top member 77 and bottom member 81. Similar partitions 83 are provided at the ends of the housing unit 76 to form the enclosures 32 for the end reels 15. The door 33 provided for each housing 32 is hingedly mounted on a corresponding partition 83 and is so formed that when it is opened, the entire unsupported end of the reel and substantially all of the upper thread-bearing periphery of the reel are exposed. The upper wall 84 of the door 33 extends to and contacts the lip portion 78 of the upper member 77 of the housing unit, while the front wall 85 of the door 33 con-

tacts the edge of lower member 81 of the housing unit 76. The front wall 85 of each door 33 is provided with a window 86.

The housing unit 76 enclosing several adjacent drying reels 15 also comprises a duct portion 87 which extends longitudinally of and beneath said unit and communicates with the interior of the enclosure 32 in which each drying reel 15 is disposed. Also formed as part of said housing unit 76 are spaced shields 88 rigidly fixed to the duct portion 87 and to the bottom wall member 81 of the housing unit, which shields are disposed between adjacent cap twisters 18 to which threads pass from the reels 15. The housing unit 76 as a whole is mounted by bolts 89 on the beam 90 which supports the drying reels 15. The entire housing unit 76 including the twister shields 88 may be readily removed and replaced by removal of bolts 89.

Depending upon the length of the apparatus, a plurality of said housing units 76 may be disposed lengthwise of the apparatus to enclose the adjacent drying reels 15 along one side of the apparatus, in which case the ducts 87 for said units may be connected together. As shown in Figure 2, the ducts 87 on opposite sides of the apparatus are connected together by a cross duct 92 contained within the sheathing 93 at said end of the apparatus. Said duct 92 communicates with an intermediate upwardly extending duct 94, which in turn communicates with a main upwardly extending duct 95.

The ducts 68 disposed below the platforms 66 also communicate with said main upwardly extending duct 95, as through connecting ducts 96 and 97. If desired, a damper 98 may be provided in the main duct 95. Similarly, a damper 99 may be provided in the intermediate upwardly extending duct 94 and dampers 101 and 102 may be respectively provided in connecting ducts 96 and 97. These dampers may be adjustable from the exterior of their corresponding ducts by suitable handle means, whereby the flow of air there-through can be easily regulated.

When main duct 95 is connected to means inducing a negative pressure therein, such as an exhaust fan, air is exhausted from the longitudinally extending ducts 68 and 87 into main duct 95. Ducts 68 draw air through the slot 69 on each side of the apparatus, causing a flow of air over the inclined bank of reels on said side. The vapors rising therefrom are thus entrained and conducted into ducts 68, from which they are exhausted as described above. External air is also drawn into the drier housings 15 in each drier unit through the louvres 103 in the top wall 84 of each door 33 and thence into longitudinally extending ducts 87, through ducts 92 and 94, and into main duct 95.

The use of housing 32 about reel 15 affords numerous advantages. Since the thread is dried at the speed at which it is produced, which may be from 150 to 200 meters a minute, variations in drying conditions will cause corresponding variations not only in the rate of drying but in the characteristics of the thread. By means of an enclosure it is possible to prevent stray air currents from striking the reel, to provide a controlled uniform flow of air in the vicinity of the reel, and to conserve heat which would otherwise be radiated from the reel.

Without the benefit of certain hereinafter described features of the invention, still other disadvantages characterize the drying of thread on a reel disposed in an enclosure. Such disad-

vantages arise out of the fact that during the drying operation the moisture which rises from the thread in the form of vapor condenses on the under side of the top wall of the enclosure and drips back onto the partially dried thread on the reel. Portions of partially dried thread rewet by the condensate do not become completely redried before the thread leaves the reel and tend to break in succeeding winding operations; e. g., the cap twisting operation, since their strengths are lower than the completely dried portions of the thread.

The present invention overcomes such difficulties by means of a ventilating member 104 associated with reel 15 which member 104 serves to remove vapors which would otherwise condense in enclosure 32. Such member 104 takes the form of a hollow member supported by the bottom wall 81 of the housing 32 curving around the reel and terminating in a projecting portion 105 having an opening 106 in its bottom. Opening 106 is preferably disposed directly above that portion of the reel from which most vapors are released. Over the remaining portion of the reel, the amount of water vapor released is so small that it does not condense on the interior top wall of the housing.

Each ventilating member 104 is mounted, as hereinafter explained, on a gasket 107, resistant to heat, which may be made of natural or synthetic rubber or some similar material. Member 104 bears against one of the partitions 83 by means of the boss 108 and is urged downward against gasket 107 and held firmly in place in the enclosure 32 by means of bolt 109 threaded into a part 110 fixed to the upper member 77 of the housing unit 76. It is desirable that the bolt 109 be located above the lower supporting portion of member 104, since thus the pressure of said bolt holds member 104 firmly in place.

As shown in Figure 7, gasket 107 is formed with an annular rib 112 projecting through a corresponding opening 113 in the bottom wall member 81 of the housing. Such rib 112 serves to locate gasket 107 and the lower portion of ventilating member 104 in place. Gasket 107 is provided on the upper surface thereof with an annular rib 114 fitting into a corresponding opening 115 in the bottom of ventilating member 104. Gasket 107 thus serves as locating and supporting means; also, as sealing means to insure that air passing through ventilating member 104 is drawn into the duct 87.

The size of the opening 116 through said gasket 107, and consequently the amount of air passing through ventilating member 104, may be adjusted by means of a plate 117 disposed in a slot passing through the top annular rib 114 of said gasket. Said plate 117 is provided with an opening 118 therethrough the area of which controls the volume of air. The amount of air can be varied either by removing plate member 117 and substituting for it one with an opening 118 of a larger or smaller area or by moving plate 117 to various positions in said gasket 107 in which opening 118 is partially obstructed by the gasket itself.

During the operation of the apparatus as a whole, a negative pressure is maintained in duct 87. This causes air to be drawn through opening 118 in gasket 107 and through ventilating member 104. All of the air in the enclosure 32 surrounding drying reel 15 is drawn into ventilating member 104 through opening 106. Consequently, vapors emanating from the reel which

would tend to condense on the upper wall of the enclosure and drop back on the reel are drawn through said opening. Air to replace the air exhausted by ventilating member 104 is drawn into each enclosure 32 through louvres 103 so positioned that they cause a countercurrent flow of air across the reel 15.

The present invention thus provides a controlled, uniform flow of air in the vicinity of each drying reel 15 and thereby obviates certain of the causes tending to make for non-uniformity of the thread. In addition to these features, as already explained, the invention provides simple means for removing various other vapors formed during the liquid processing operations. In both cases, the means provided by the present invention may be easily adjusted to provide the desired degree of ventilation for any one of numerous different operating conditions.

The air exhausted through duct 58 from the hood 48 above the coagulating bath and the air exhausted from the lower portions of the apparatus through duct 95 may, if desired, be combined. It may then be cleaned, conditioned and recirculated. However, because of the higher percentage of impurities in the air from above the spin bath, which air represents but a small fraction of the total ventilating air, it is better practice to discard it and recirculate only the air from ducts 68 and 87. According to the invention, all of the air supplied to the room in which one or more of the machines of the invention are disposed may be exhausted through the machines themselves, which makes for particularly high efficiency of ventilation.

It is apparent that the above-described embodiment of the invention is purely illustrative and that various changes may be made therein without departing from the spirit of the invention. Moreover, it is possible that the invention may be applied to apparatus other than that for the manufacture of viscose artificial silk thread by a continuous process and to apparatus of a design different from that illustrated. For example, it is not necessary that aqueous vapors only be removed according to the present invention; other gases, such as heated air which might arise in the processing of strip material, may be removed according to the present invention. The term "vapors" in the appended claims is intended to include all gaseous substances which it is desired to remove.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. Apparatus for the processing of thread comprising a source of thread; a thread-advancing thread store device which continuously but temporarily stores the thread and advances it lengthwise thereof in a plurality of generally helical turns; means substantially enclosing the thread turns on said thread store device, said means having a top wall and a bottom wall; a curved duct in said enclosing means having a lower portion which bears against the bottom wall of said enclosing means, an opening communicating with an opening in the bottom wall of said enclosing means, and, bearing against the top wall of said enclosing means at a point substantially directly above the lower portion of said duct, an upper portion having an opening directly over said thread store device; and means communicating with the opening in the bottom

portion of said duct for maintaining a pressure in said duct different from that in said enclosing means.

2. Apparatus for the manufacture of thread comprising a frame structure; a bank of thread-advancing thread store devices supported by said frame structure, said thread store devices being presented to a common operating face in the form of at least one series of devices from one to another of which the thread proceeds in sequence; a wall behind said bank of thread store devices; a first duct supported by said frame structure, said duct being disposed on the same side of said wall as said bank of thread store devices; an opening in said duct adjacent said bank of thread store devices; means enclosing at least one thread store device located at a point spaced from said first duct; a second duct communicating with said enclosing means; a third duct connecting together said first and second ducts; and means for simultaneously creating a flow of air into said opening in a direction opposed to the direction of travel of the thread along said series of thread store devices and drawing air through said enclosing means into said second duct.

3. Apparatus for the manufacture of thread comprising a frame structure; an upright longitudinally extending bank of thread-advancing thread store devices supported by said frame structure, said thread store devices being presented to a common operating face in the form of a plurality of adjacent downwardly extending series of thread store devices along each of which a thread proceeds in sequence from one thread store device to another; a wall behind said bank of thread store devices; a first duct extending longitudinally of said bank of thread store devices; said duct being supported by said frame structure on the same side of said wall as said bank; air inlet means in said duct adjacent the upper end of said bank; means associated with each of said series of thread store devices enclosing at least one thread store device adjacent the end of said series remote from said first duct; a second duct extending longitudinally of said bank, said duct communicating with each of said enclosing means; means connecting together said first and second ducts; and means for simultaneously creating a flow of air into said air inlet means in a direction opposed to the direction of travel of the thread along said series of thread store devices and drawing air through each of said enclosing means into said second duct.

4. Apparatus for the manufacture of thread comprising a frame structure; two spaced banks of thread-advancing thread store devices supported by and forming with said frame structure a substantially closed chamber, each of said banks being arranged to form at least one series of thread store devices from one to another of which the thread proceeds in sequence; two like ducts disposed adjacent to but externally of said chamber, each of said ducts being supported by said frame structure in proximate relation to one of said banks of thread store devices; an opening in each of said ducts; means enclosing at least one thread store device in each series, said thread store device being located at a point spaced from said ducts; a duct interconnecting said first-mentioned ducts and said enclosing means; and means for simultaneously creating a flow of air into said openings in a direction opposed to the direction of travel of the thread along said series

of thread store devices and drawing air through said enclosing means into said second-mentioned duct.

5. Apparatus for the manufacture of thread comprising a frame structure; two spaced banks of thread-advancing thread store devices supported by and forming with said frame structure a substantially closed chamber, each of said banks being arranged to form at least one series of thread store devices from one to another of which the thread proceeds in sequence; two laterally extending ducts disposed adjacent to but externally of said chamber, each of said ducts being supported by said frame structure toward the upper end of one of said banks; air inlet means in each of said ducts; means enclosing at least one thread store device in each series, said thread store device being remote from said ducts; two ducts, one associated with each bank communicating with said enclosing means; a duct connecting together said first-mentioned and second-mentioned ducts; and means for simultaneously creating a flow of air into said air inlet means in a direction opposed to the direction of travel of the thread along said series of thread store devices and drawing air through said enclosing means into said second-mentioned ducts.

6. A housing for enclosing a plurality of adjacent thread store devices comprising spaced longitudinally extending top and bottom members; spaced partitions connecting said members; a slot in the top member disposed between each pair of adjacent partitions and extending substantially parallel thereto; a door forming a front closure hingedly mounted on each of said partitions, said door cooperating with said top member to form the top closure for the space between the partition on which said door is mounted and an adjacent partition; air inlet means in said door; a duct fixed to and extending longitudinally of said bottom member, said duct communicating through an opening in said bottom member with the space between each pair of adjacent partitions; and means for maintaining a sub-atmospheric pressure in said duct serving to draw air through said air inlet means creating a constant flow of air through said housing.

7. Apparatus for the manufacture of thread comprising a frame structure; a bank of thread-advancing thread store devices supported by said frame structure, said thread store devices being presented to a common operating face in the form of at least one series of thread store devices from one to another of which the thread proceeds in sequence; a wall behind said bank of thread store devices; a first duct disposed on the same side of said wall as said bank of thread store devices, said duct being supported by said frame structure; an opening in said duct adjacent said bank of thread store devices; means for maintaining in said first duct a sub-atmospheric pressure creating a flow of air into said opening across a substantial portion of said bank of thread store devices in a direction opposed to the direction of travel of the thread along said series of thread store devices; means enclosing at least one thread store device in said bank, said thread store device being disposed at a point spaced from said first duct; a second duct communicating with said enclosing means; and means for drawing air into said second duct through said enclosing means.

8. Apparatus for the manufacture of thread comprising a frame structure; two spaced banks of thread-advancing thread store devices sup-

ported by and forming with said frame structure a substantially closed chamber, each of said banks being arranged to form at least one series of thread store devices from one to another of which the thread proceeds in sequence; two like ducts disposed externally of said chamber, one of said ducts being supported by said frame structure adjacent each of said banks of thread store devices; an opening in each of said ducts; means for maintaining in each of said ducts a sub-atmospheric pressure creating a flow of air into said openings in a direction opposed to the direction of travel of the thread along said series of thread store devices; means enclosing at least one thread store device in each series, said thread store device being located at a point spaced from said first-mentioned ducts; a duct communicating with said enclosing means; a duct connecting said enclosing means on opposite sides of the apparatus; and means for drawing air into said duct through said enclosing means.

9. Apparatus for the processing of thread comprising a source of thread; a thread-advancing thread store device which continuously but temporarily stores the thread and advances it lengthwise thereof in a plurality of generally helical turns; an enclosure surrounding said thread store device; an opening in said enclosure for admitting thread from said thread source to said thread store device; means for performing on the thread a processing step giving rise to a vapor; inlet means in said enclosure independent of said opening for admitting air into the interior of said enclosure; and means disposed within said enclosure for withdrawing said vapor from the vicinity of said thread store device.

10. Apparatus for the processing of thread comprising a source of thread; a thread-advancing thread store device which continuously but temporarily stores the thread and advances it lengthwise thereof in a plurality of generally helical turns; an enclosure surrounding said thread store device; an opening in said enclosure for admitting thread from said thread source to said thread store device; means for performing on the thread a processing step giving rise to a vapor; inlet means in said enclosure independent of said opening for admitting air into the interior of said enclosure; and means disposed within said enclosure adjacent one end of said thread store device for withdrawing said vapor from said enclosure.

11. Apparatus for the processing of thread comprising a source of thread; a thread-advancing thread store device which continuously but temporarily stores the thread and advances it lengthwise thereof in a plurality of generally helical turns; means for heating the thread while it is stored on said thread store device; means substantially enclosing the thread turns on said thread store device; a slot in said enclosing means for admitting thread from said thread source to said thread store device; inlet means in said enclosing means independent of said slot for admitting air into the interior of said enclosing means; a duct within said enclosing means having one opening disposed adjacent that portion of said thread store device on which the thread is initially heated and another opening leading to the exterior of said enclosing means; and means communicating with said last-mentioned opening serving to create a flow of air through said enclosing means by maintaining a sub-atmospheric pressure in said duct.

RICHARD F. BERGMANN.

over

CERTIFICATE OF CORRECTION.

Patent No. 2,303,697.

December 1, 1942.

RICHARD F. BERGMANN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 16, for "batch" read --bath--; page 2, first column, line 68, for "opposite" read --apposite--; page 6, first column, line 19, claim 5, after the word "bank" insert a comma; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of January, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.