

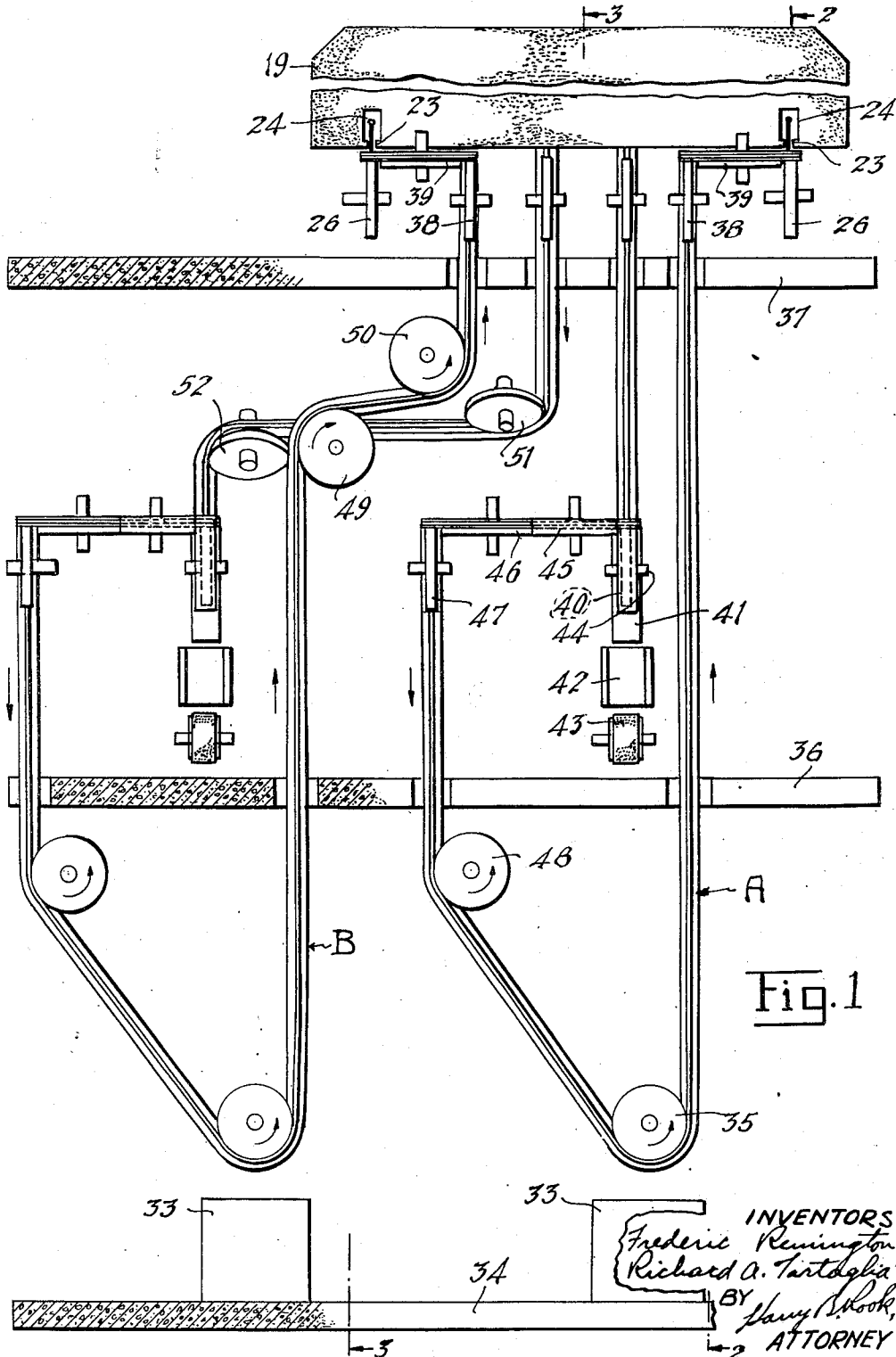
April 10, 1951

F. REMINGTON ET AL
ANNEALING FURNACE AND CONVEYER

2,548,683

Filed Aug. 16, 1946

5 Sheets-Sheet 1



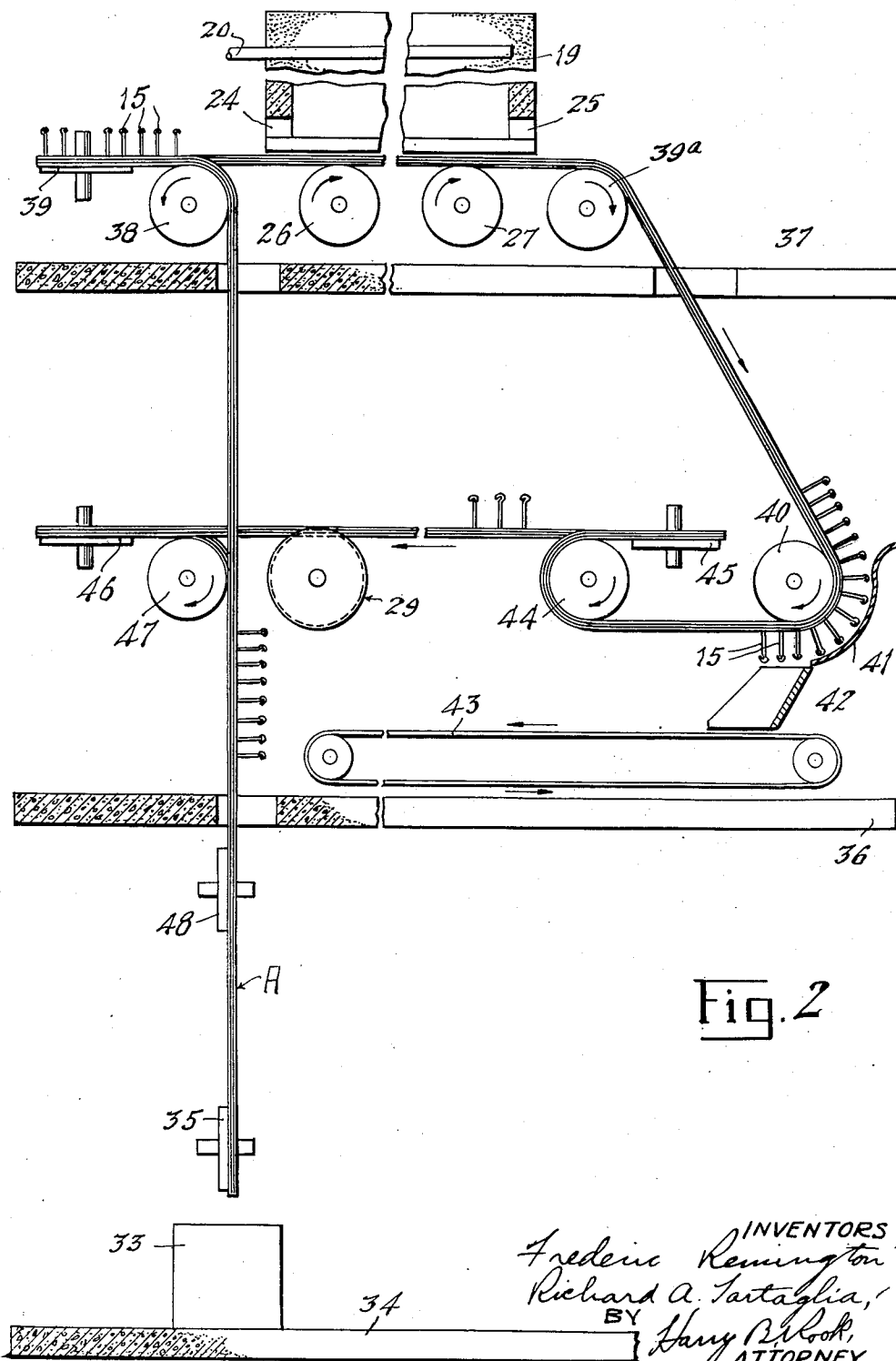
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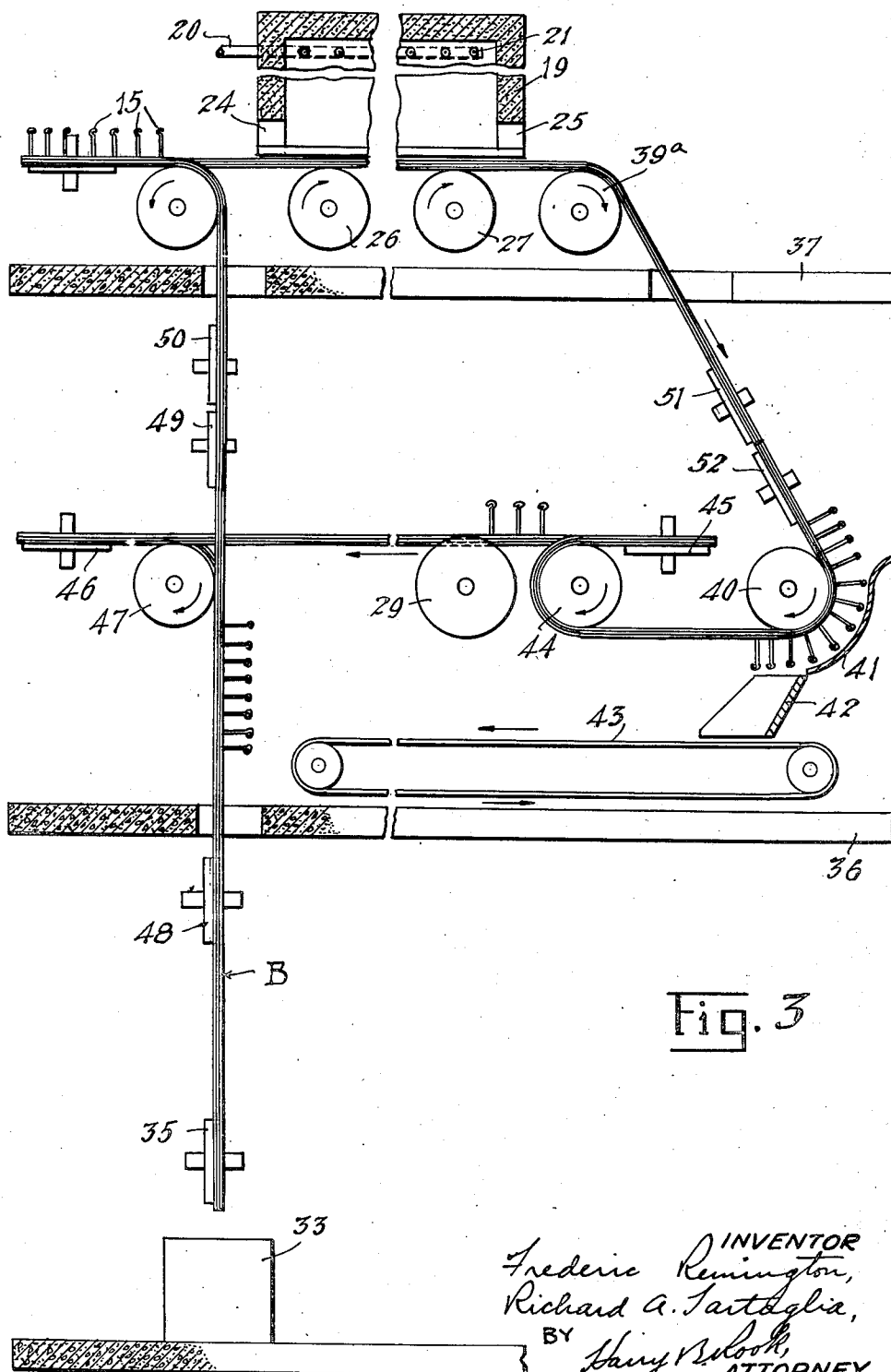
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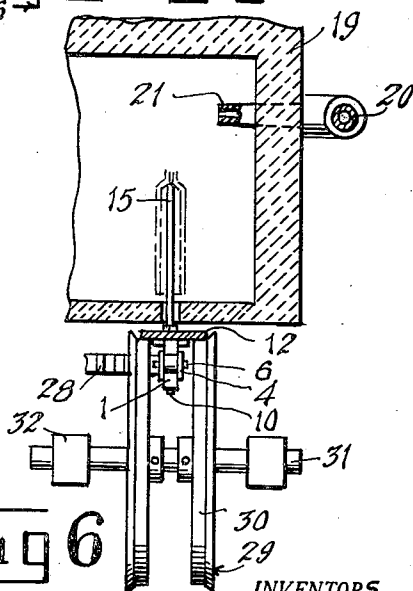
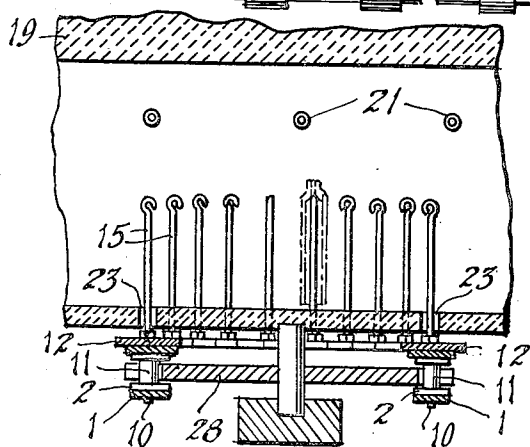
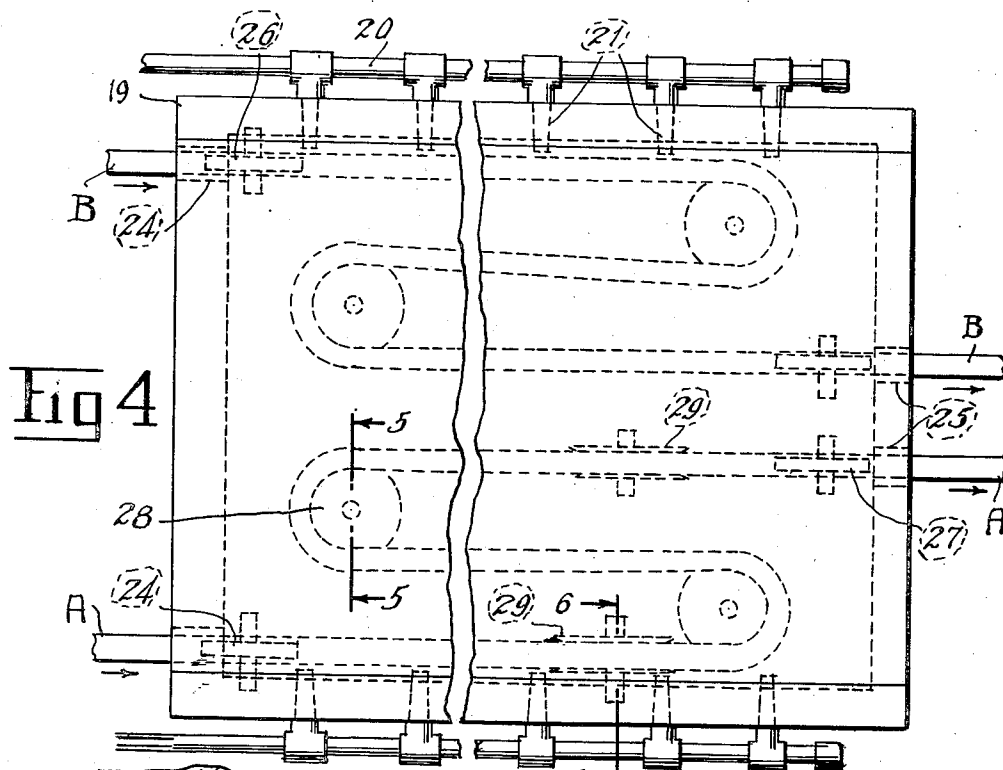
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Fig. 7

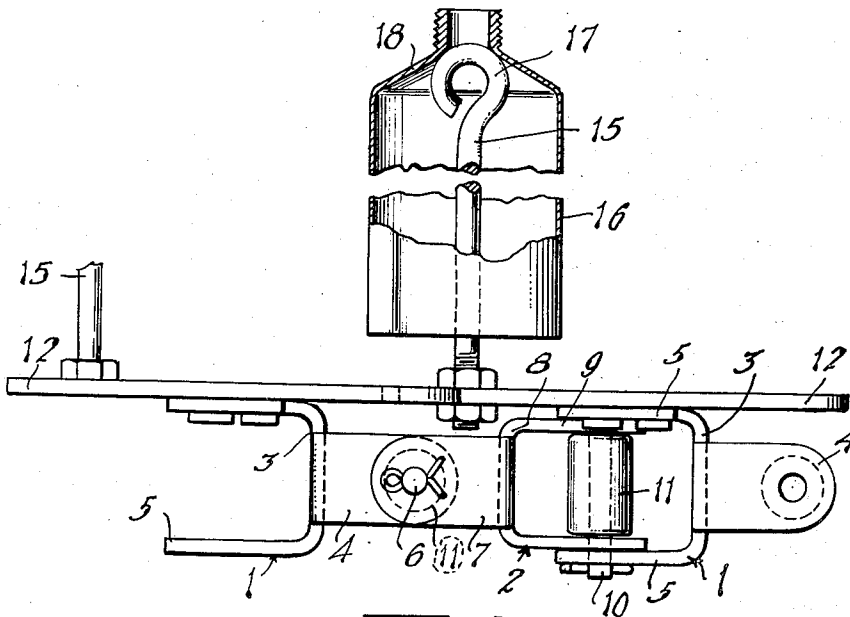
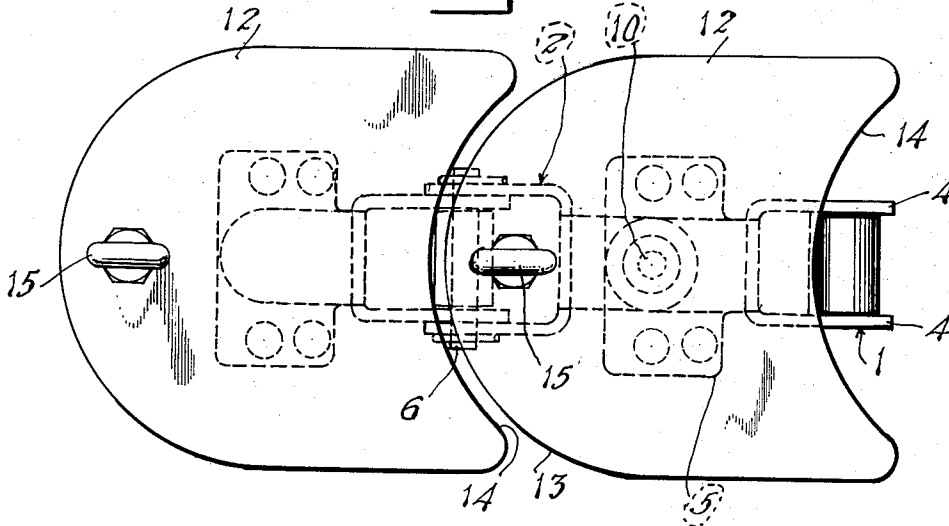


Fig. 8

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ANNEALING FURNACE AND CONVEYER

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2 Claims. (Cl. 263—8)

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This invention relates in general to the combination of an annealing furnace for collapsible tubes and a conveyor for conveying the tubes to the furnace from machines for operating upon the tubes prior to the annealing operation, such as threading and trimming machines.

One object of the invention is to provide a novel and improved combination of the character described whereby the annealing furnace may be located out of the regular working zones of the factory so that the heat from the furnace will not interfere with the atmospheric condition in the working zones where frequently it is necessary to maintain moderate temperatures and a certain degree of humidity.

Another object is to provide such a combination which shall include novel and improved constructions and arrangements of the parts whereby the annealed tubes can be conveniently conveyed long distances and through zones in the factory, the temperature in which may be availed of to cool the tubes after the annealing operation so that the necessities for special cooling arrangements may be eliminated.

A further object is to provide, in such a combination, a novel and improved conveyor chain for supporting the tubes and permitting them to be moved while in either horizontal or vertical position, whereby conveying of the tubes over long distances, with the chain moving in both vertical and horizontal directions, shall be facilitated.

Another object is to provide a novel and improved construction and combination of such a chain and an annealing furnace whereby the chain shall be effectively protected against the heat of the annealing furnace and at the same time tend to prevent the escape of heat from the furnace.

Other objects are to provide a combination of the character described whereby the tubes can be easily and quickly removed by an operator from a tube-working machine such as a trimmer, and immediately deposited by said operator upon the conveyor, after which the tube may be conveyed, without the attention of any operator, over long distances through an annealing furnace and to a point of discharge, where the tubes can be automatically removed from the conveyor; and to obtain other advantages and results that will be brought out by the following description, in conjunction with the accompanying drawings in which:

Figure 1 is a schematic front elevational view of an annealing furnace and two conveyors constructed and arranged in accordance with our invention.

Figure 2 is a side elevational view of one of the conveyors and the annealing furnace, with portions of the latter broken away and shown in section.

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Figure 3 is a similar view of the other conveyor.

Figure 4 is an enlarged schematic top plan view of the annealing furnace and the portions of the conveyor that move therethrough.

Figure 5 is an enlarged fragmentary transverse vertical sectional view on the plane of the line 5—5 of Figure 4.

Figure 6 is a similar view on the plane of the line 6—6 of Figure 4.

Figure 7 is an enlarged fragmentary top plan view of the conveyor chain; and

Figure 8 is a side elevational view of the parts shown in Figure 7 and also illustrating a collapsible tube mounted on the chain.

For simplicity and clearness in illustration in Figures 1 to 4 inclusive, we have shown the combination of the conveyor and annealing furnace schematically, with supports and bearings for the sprockets of the conveyor omitted.

The invention contemplates a conveyor chain or belt which is adapted to curve about a horizontal or a vertical axis and which will support and convey collapsible tubes in vertical or upright position while the conveyor is moving around a vertical axis, and which will support the tubes in horizontal position while the conveyor is moving around a horizontal axis. More specifically, the conveyor includes a plurality of chain links which are so associated that alternate pins or rollers extend in directions perpendicular to each other, whereby certain of the pins or rollers may cooperate with sprockets rotating around vertical axes, while other pins or rollers may cooperate with sprockets rotating about horizontal axes.

As shown, the chain includes links 1 which are arranged in alternate relation to links 2. Each link 1 includes a main portion 3 from which a pair of parallel arms 4 projects in an opposite direction from another pair of parallel arms 5. In the arms 4, is mounted a pin 6 which pivotally connects similar arms 7 that project from the main portion 3 of the adjacent link 2 in opposite directions from a pair of arms 9. The arms 5 of each link 1 are connected to the arms 9 of the adjacent link 2 by a pin 10. Thus the axes of the pins 6 and 10 are disposed at right angles to each other and, preferably, a roller 11 is rotatably mounted on each of the pins.

With this construction, the pins 6 and associated rollers will cooperate with sprockets rotating about horizontal axes, while the pins 10 and associated rollers 11 will cooperate with sprockets rotating about vertical axes.

Rigidly secured to each of the links 1, is a tube-supporting and link-guard plate 12 whose plane is perpendicular to the axes of the pins 10, and one end of the plate is convexly curved concentrically with the pin 10 as indicated at 13, while the other end of the plate is concavely curved

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concentrically with the axis of the next adjacent pin 10 as indicated at 14. With this construction, when the chain is moving around the sprockets, the plates 12 may rotate about the axes of the pins 10 and at the same time remain in the same common plane with each other.

Rigidly secured to and projecting perpendicularly from each of the plates 12, is a pin 15 for supporting a collapsible tube 16 which has thin side walls and an open bottom end, the end of the pin preferably having an enlarged head 17 which will abut the shoulder 18 at the relatively thick neck 4 nozzle end of the tube when the tube is slipped over the pin so that the tube will be suspended on the pin, as most clearly shown in Figures 5 and 8. With this construction, when the chain is moving about vertical axes, the plates 12 will be in horizontal planes and the pins 15 and collapsible tubes thereon will be vertically disposed, while when the chain is moving around horizontal axes, the plates will be in vertical planes and the pins 15 and tubes 16 will extend horizontally, with the tubes in effect hung on the pins and with the relatively thick neck ends uppermost.

This conveyor is associated with an annealing furnace 19 that may be constructed of any suitable material, for example fire brick, and suitably insulated. The furnace heating chamber may be heated in any suitable manner, but as shown has gas burners adjacent the top of the furnace and including manifold pipes 20 having a plurality of burner tubes 21 that extend into the heating chamber so that the flame jets will be projected across the top portion of the heating chamber above the collapsible tubes 16 as best shown in Figures 4 and 5. The bottom of the furnace is shown as provided with slots 23 through which the pins 15 on the conveyor project, said slots also opening through the front and rear ends of the furnace as indicated at 24 and 25, respectively, for the entrance and exit of the collapsible tubes.

As shown, there are two conveyors A and B associated with the furnace and there is one slot 23 for each conveyor. At the entrance end of the furnace, each conveyor passes over a sprocket 26 which rotates about a horizontal axis, and at its exit end each conveyor runs over a sprocket 27 also rotatable about a horizontal axis. Preferably, the conveyor will have a plurality of horizontal reaches within the furnace so as to insure that each tube shall be subjected to the heat of the furnace an adequate period of time and, as shown, each conveyor passes over a sprocket 28 rotating about a vertical axis at the end of each reach.

Between the sprockets and along the horizontal reaches of the conveyor, the conveyor is preferably supported by grooved rollers or spaced rabbeted discs such as shown in detail in Figure 6. As shown, there is one disc 29 at each side of the chain and formed with a rabbet or groove 30 in its periphery which underlies the corresponding edges of the plates 12 on the conveyor so that the weight of the conveyor and the tubes on the horizontal reaches is sustained by the discs 29. Each pair of discs is mounted on a shaft 31 that may be journaled in suitable bearings 32, and it will be understood that the various sprockets 26, 27, 28, etc., will also be mounted in suitable bearings.

It is desirable that the annealing furnace be located in distantly spaced relation to the tube-working machines and that the conveyor be of

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sufficient length to permit cooling of the tubes after they leave the furnace and before they are removed from the conveyor. Generally, it is preferable that the furnace be on the upper floor of a building so that the heat therefrom will have a minimum effect on the working conditions on the lower floors, and the tube-working machines may be located on different floors.

As shown in Figure 1, a tube-working machine such as a threader or trimmer 33 is mounted on the first floor 34 of the building for each conveyor, and the conveyor chain passes around a sprocket 35 rotating about a horizontal axis in such relation to the machine 33 that the operator may remove the collapsible tubes from the machine and manually slip each one upon one of the pins 15 of the conveyor. At this point it will be noted that the pins will be horizontally disposed so that the tubes may be conveniently slipped over them.

The conveyor then moves directly upwardly through the second and third floors 36 and 37 to the annealing furnace 19, the conveyor running over a sprocket 38 rotating on a horizontal axis adjacent the entrance end of the furnace, and then running around a sprocket 39 rotating on a vertical axis outside and adjacent said entrance end of the furnace so that the tubes are disposed vertically. The conveyor then passes beneath the furnace, with the plates 12 outside of but closely adjacent the bottom wall of the furnace and overlying the respective slots 23, as best shown in Figures 1 and 6. The pins project upwardly through the slots 23 into the furnace and the tubes enter the furnace through the enlarged end portions 24 of the slots.

After the tubes have been conveyed through the several reaches of the conveyor within the furnace, they are conveyed out of the furnace over the sprockets 27 and 39a, the conveyor then moving downwardly through the upper floor 37 and around a sprocket 40 rotating about a horizontal axis on the next lower floor 35.

As the tubes pass around the sprocket 40, they are turned upside-down so that their nozzle ends engage a guide plate 41 which is concentrically spaced from the sprocket for a portion of the periphery thereof. Then the tubes are moved off the guide plate 41 and dropped by gravity from the pins 15 into a chute 42 upon an endless belt conveyor 43 from which the tubes are picked up by an operator or deposited into a truck to be transported to a coating machine or other tube-working machine.

From the sprocket 40, the conveyor runs over a sprocket 44 rotating about a horizontal axis, and then upwardly and around a sprocket 45 which rotates about a vertical axis. Thence the conveyor runs over the idler discs 30, then around a sprocket 46 rotating about a vertical axis, thence around a sprocket 47 rotating about a horizontal axis. The conveyor then runs through the floor 36 vertically downwardly around an idler sprocket 48, back to the sprocket 35 adjacent the tube-working machine 33.

The structure and mounting is the same for each of the conveyors, with the exception that one of the conveyors must be laterally offset from the furnace and consequently requires additional sprockets 49 and 50 to guide the vertical reach of the conveyor from the tube-working machine to the furnace, and additional sprockets 51 and 52 for guiding the reach of the conveyor from the exit end of the furnace to the take-off or dis-

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charge point, that is, the discharge chute 42 and the conveyor 43.

It will thus be seen that our invention provides a rapid and effective system of operating upon collapsible tubes, annealing them and cooling them. The tubes may be removed from the working machine and deposited upon the conveyor in one continuous operation, and the tubes may be removed from the conveyor automatically. Furthermore, the long reaches of the conveyor between the annealing furnace and the take-off point provide adequate cooling time for the annealed tubes, and additional cooling time for the plates 12 and chain links is afforded by the long reaches from the take-off point back to the charging point adjacent the tube-working machine. The chain links are effectively protected by the plates 12 against the intense heat in the furnace, and only the upper portions of the pins 15 project into the furnace. Also, the plates 12 serve in effect as closures for the slots 23 in the bottom wall of the furnace, thus reducing the escape of heat and the influx of cold air.

While we have shown and described two conveyors in conjunction with one furnace, it should be understood that one or any number of conveyors may be associated with the same furnace. Also, while we have illustrated the invention as embodying certain specific constructions and arrangements of the conveyors, supporting sprockets, tube-working machines and the furnace, many changes in the details of construction and arrangements of the parts may be made within the spirit and scope of the invention.

We claim:

1. In annealing apparatus for collapsible tubes that have thin side walls, open bottom ends and relatively thick-walled necks, the combination of a plurality of floors, an annealing furnace for said tubes located on an upper floor and having a slot in its bottom wall opening through its side walls, a chain conveyor having links certain of which have tube-supporting pins each connected at one end to a link with its other end formed to engage the inner surface of the shoulder of a collapsible tube for suspending the tube on said pin, said links being so connected that the chain may move about horizontal and vertical axes with the pins projecting from said chain horizontally and vertically, respectively, a loading station on a lower floor for applying collapsible tubes to said conveyor, sprockets for supporting and guiding said chain so that it runs vertically from said loading station to said upper floor and then horizontally below said slot in the bottom wall of the furnace to move said pins through said slot with the free ends of the pins projecting vertically upwardly into said furnace for conveying the collapsible tubes through the furnace with their necks uppermost, whence the chain runs downwardly to an intermediate floor where the chain

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passes around and beneath a sprocket to cause said pins to project downwardly to discharge said tubes from said pins by action of gravity, after which the chain passes in succession horizontally and vertically downwardly to said loading station.

2. In an annealing apparatus for collapsible tubes that have cylindrical thin side walls, open bottom ends and relatively thick-walled shoulders and necks, the combination of a furnace including bottom, side, end and top walls forming a heating chamber and having a slot in its bottom wall connecting inlet and outlet openings in the end walls for the collapsible tubes, a conveyor movable horizontally beneath said bottom wall and having tube-supporting pins each connected at one end to said conveyor to loosely telescopically receive a tube thereover and formed at its other end to abut the inner surface of the shoulder of a collapsible tube for suspending the tube on the pin in vertical position with its neck end uppermost and its side walls distantly spaced from the pin, said chamber providing a substantially closed space above said slot and said inlet and outlet openings, said pins being of a length and extending through said slot into said chamber as they are moved by said conveyor so as to convey said collapsible tubes through said chamber from said inlet to said outlet opening with their bottom ends above but adjacent said bottom wall and with the interior and exterior surfaces of the tubes exposed throughout their areas to hot gases in said chamber, and means for projecting flame jets horizontally transversely of and into the upper portion of said closed space from opposite walls of the furnace across and above the necks of said collapsible tubes.

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