Nov. 21, 1950 R. H. STUART ET AL 2,531,009

TUBE END BRUSHING APPARATUS

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FIG. 1

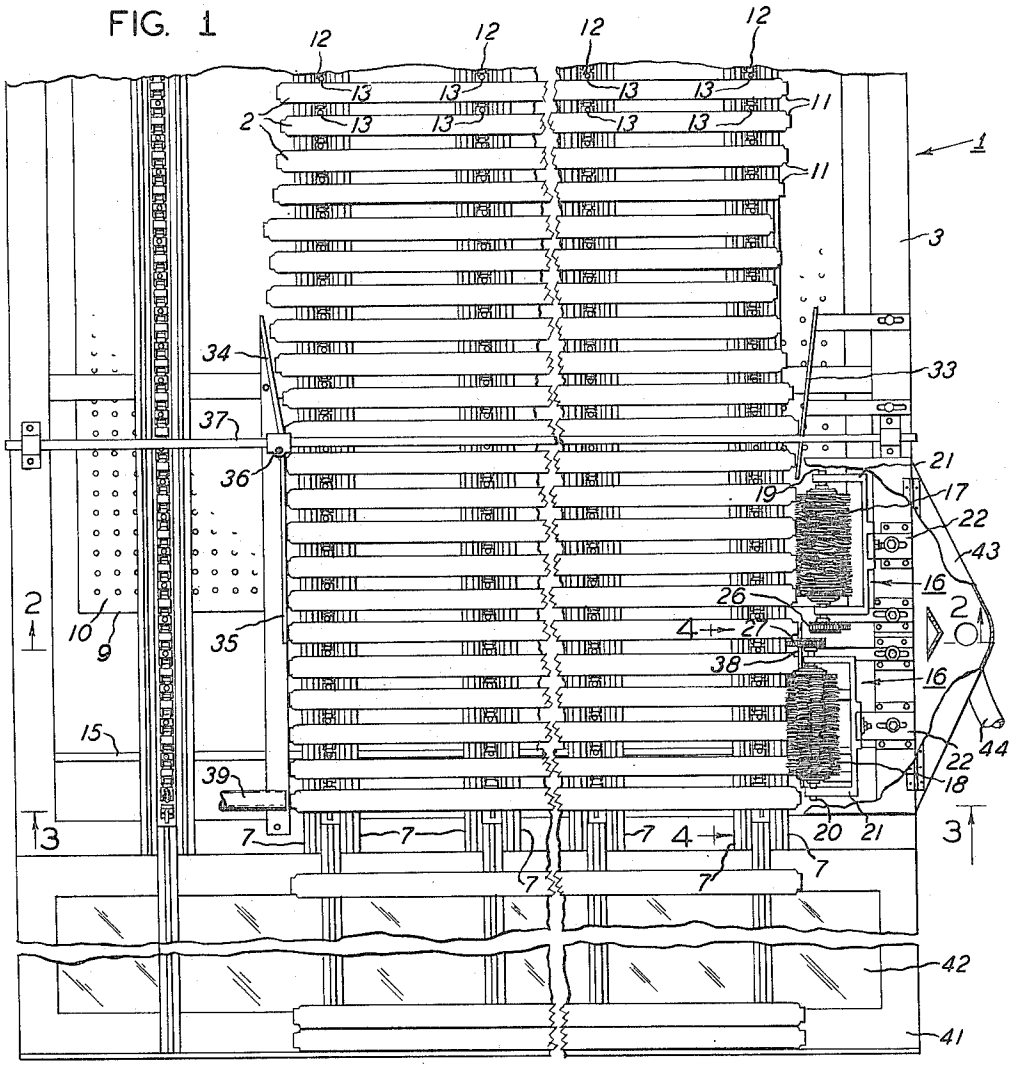
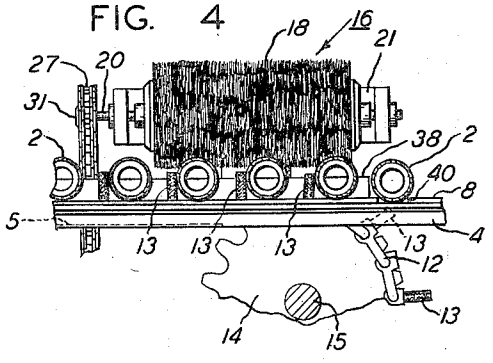


FIG. 4



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FIG. 2

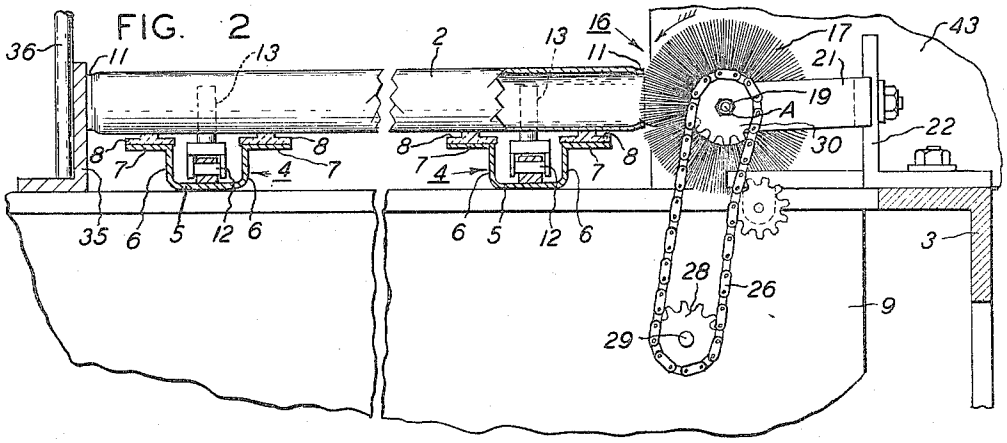
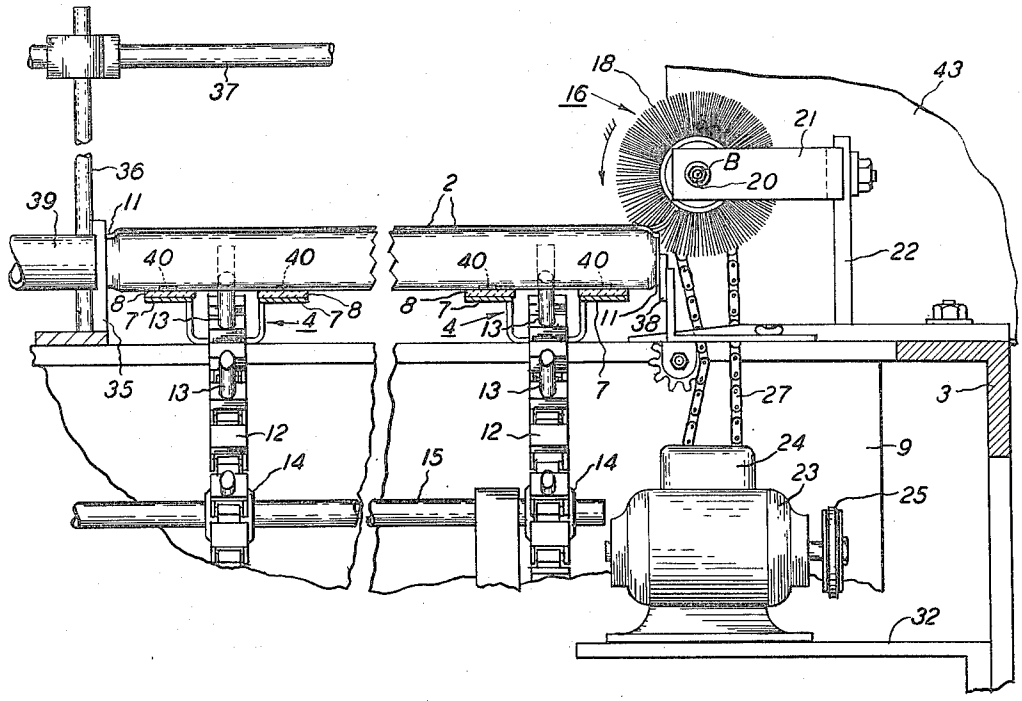


FIG. 3



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TUBE END BRUSHING APPARATUS

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Application August 10, 1946, Serial No. 689,780

5 Claims. (Cl. 15—304)

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Our invention relates to apparatus for removing coating material from the end portions of tubular articles and more particularly for removing fluorescent powder coating from the end portions of glass tubes such as are used for the envelopes of fluorescent lamps.

In the manufacture of fluorescent lamps of the conventional type employing an elongated tubular envelope, a coating of fluorescent powder is applied to the interior wall of the lamp envelope. As a consequence of coating methods in general use at present, one end of the envelope is usually coated with powder which frequently extends clear around the end of the envelope and onto the outer wall thereof. This powder coating on the end portions of the envelopes must be cleaned therefrom before the sealing of the lamp mounts to the said envelope ends since otherwise it would contaminate the seal.

Heretofore, the cleaning of the fluorescent powder from the ends of the envelopes has been performed by a hand brushing operation wherein an operator would grasp the envelope and hold the end to be cleaned against a rotary brush until properly cleaned. Such hand end-brushing of the envelopes is slow and introduces an added manufacturing operation as well as potential dust hazards.

One object of our invention is to provide apparatus for effectively removing coating material from the ends of tubular articles which have been previously coated with such material.

Another object of our invention is to provide apparatus for automatically removing fluorescent powder coating from the ends or collars of interiorly coated fluorescent lamp envelopes prior to the sealing of the lamp mounts to such envelope ends.

Still another object of our invention is to provide a lehr for heat treating glass tubes coated interiorly with fluorescent material and having associated therewith means for removing the coating material from the ends of the tubes.

According to the invention, the removal of the fluorescent coating from the ends of fluorescent lamp envelopes is carried out on a conveyor which, according to one embodiment of the invention, may comprise the cooling conveyor portion of a lehr such as is customarily used to heat treat the envelopes and bake the fluorescent coating thereon. For this purpose, rotary brushes are mounted alongside the conveyor, against and across which the ends of the envelopes are guided during the course of their movement on the conveyor.

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Further objects and advantages of our invention will appear from the following description of a species thereof and from the accompanying drawings in which:

Fig. 1 is a fragmentary plan view of apparatus comprising our invention; Figs. 2 and 3 are transverse cross sections taken on the lines 2—2 and 3—3, respectively, of Fig. 1; and Fig. 4 is a section on the line 4—4 of Fig. 1.

Referring to the drawings, the apparatus according to the invention comprises a linearly moving conveyor 1 on which the coated glass tubes 2 to be end cleaned are supported in a position extending transversely to the direction of movement of the conveyor. The said conveyor 1 may constitute the cooling conveyor portion of a lehr (not shown) such as is customarily used to heat treat fluorescent lamp envelopes and bake the coating thereon. Such a lehr is described in U. S. Patent No. 2,351,262, Hahn, issued June 13, 1944, and assigned to the assignee of the present invention. The conveyor 1 herein illustrated is similar to the cooling conveyor shown in the above mentioned Hahn patent and comprises an elongated stationary table or framework 3 the top or supporting surface of which comprises a plurality of parallel side-by-side channel irons 4 which extend longitudinally of the table and on which the glass tubes 2 rest. The channels 4 are mounted on the table 3 with their webs 5 (Fig. 2) resting on and secured to the table and the sides 6 upstanding therefrom. At their free upper ends, the sides 6 of the channels 4 are provided with outturned flanges or lips 7 which serve as tracks for supporting the glass tubes 2. The upper sides of the flanges 7 are lined with a layer 8 of asbestos or other suitable heat-insulating material having an inverted T-shaped cross section, such lining serving to prevent cracking of the glass tubes 2 in those cases where the tubes are in a heated condition when first placed on the conveyor 1. Mounted within the table 3 directly beneath the channels 4 and extending more or less the full length and across the full width of the table 3 is an air chamber 9 the top 10 of which is provided with a multiplicity of small apertures for directing air jets upwardly against the glass tubes 2 to cool the same.

The glass tubes 2, which are here shown as conventional fluorescent lamp envelopes coated internally with fluorescent material and provided with reduced diameter end portions or collars 11, are moved along the tracks 7 by means of a plurality of parallel extending continuous chains 12 disposed respectively in the channelways of the

channels 4 and resting on the webs 5 thereof. The chains 12 are provided with upstanding asbestos-covered fingers 13 at regular intervals therealong which project up between the glass tubes 2 resting on the tracks 7 and engage the tubes to advance them along the tracks. The chains 12 extend around sprockets 14 (Fig. 3) at the opposite ends of the conveyor, the sprockets at each end of the conveyor being mounted on common shafts 15. The chains 12 are driven at uniformly alike speeds by any suitable means, such as by a chain (not shown) engaging around a sprocket on the shaft 15 at the front or loading end of the conveyor 1 and actuated from the conveyor drive of the associated lehr, as shown in the above U. S. Patent No. 2,351,262. The chains 12 are moved at a relatively slow rate, for instance, around 5½ feet per minute, and the fingers 13 swing up through recesses or openings in the webs 5 of the channels 4, behind each tube 2 as the latter are received from the lehr, to engage and push the tube along the tracks 7. Due to the friction between the glass tubes 2 and the asbestos lining 8 on the tracks 7, the glass tubes 2 are actually rolled along the tracks 7 by the fingers 13 so that the full peripheries of the glass tubes are subjected to the flow of air from the air chamber 9.

In accordance with the invention, moving brush means 16 are mounted at one side of the conveyor 1 in a position adjacent the path of travel of the glass tubes 2 thereon and engageable with the adjacent ends of the advancing glass tubes to brush the fluorescent coating off both the inner and outer walls of the tube ends or collars 11. The moving brush means 16 preferably comprises a pair of rotary wire brushes 17 and 18 spaced longitudinally of the conveyor 1 and mounted to rotate about horizontal axes A and B, respectively, which extend longitudinally of the conveyor and therefore transversely of the advancing glass tubes 2 thereon. The rotary brushes 17, 18 are mounted on shafts 19 and 20, respectively, which are supported in the arms of U-shaped brackets or yokes 21 which are fastened to the upstanding arms of L-shaped brackets 22 secured to the table 3. The rotary brushes 17, 18 preferably have a diameter of around 4 inches or thereabouts and are of appreciable width, for instance around 7 to 8 inches so, in order to provide a sufficient period of engagement of the brushes with the ends or collars 11 of the advancing rotating tubes 2 to insure the brushing of the tube ends around their entire circular extent. The brushes 17, 18 are rotated in a direction such as to brush downwardly against and across the tube ends 11, as indicated by the arrows in Figs. 2 and 3. The rotation of the brushes 17, 18 may be effected by any suitable means, such as by an electric motor 23 driving a speed reducer 24 through a belt drive 25. The speed reducer in turn drives the rotary brushes 17, 18 through chains 26 and 27, respectively, engaging around sprockets 28 on the speed reducer output shaft and corresponding sprockets 30, 31 on the brush shafts 19, 20. The motor 23 and speed reducer 24 are mounted beneath the top of the table 3 on a bracket 32 secured to the table. The brushes 17, 18 are rotated by the drive means at a suitable speed, for instance, around 200 R. P. M. or thereabouts.

As shown in Figs. 2 and 3, the two rotary brushes 17, 18 are located at different elevations relative to the advancing glass tubes 2 so that one (17) brushes the inside wall of the tube ends 11 and the other (18) brushes the outside wall thereof. The first or "inside" brush 17 is more or less horizontally aligned with the glass tubes 2 on the conveyor tracks 7 so as to lie approximately opposite the adjacent ends 11 of the glass tubes during their travel past the brush. Preferably, however, the said brush 17 is offset a slight distance downwardly (for instance, ⅛ inch or so) relative to the axis of the glass tubes on the conveyor tracks 7 so that the axis A of the brush is located above the tread of the tracks 7 a distance (around ⅝ inch in the particular case shown) slightly less than the outside radius (¾ inch in this instance) of the glass tubes 2 to be end brushed. The amount of downward offset of the brush 17 relative to the glass tubes 2 is preferably so selected that for a given depth of insertion of the tube ends or collars 11 into the brush, the bristles thereof will just clear the upper sides of the tube collars 11 and will freely enter the interior thereof (as shown in Fig. 2) so as to brush against the inside wall of the tube collars at the bottom sides thereof for a distance approximating $\frac{1}{16}$ to ⅛ inch or so inwardly from the ends of the tubes.

As they approach the first brush 17, the advancing glass tubes 2 are guided into a predetermined "brushing" position laterally of the conveyor 1 by suitable guide means which may comprise a pair of converging guide tracks or strips 33, 34 mounted on the top of the table 3 at either side of the conveyor and engageable with the opposite ends of the glass tubes to guide them into their said brushing position. The near guide 33, i. e., the one at the same side of the conveyor as the brush 17, extends approximately to the said brush 17. The far guide 34, however, is provided with an extension 35 which extends approximately parallel to the axis A of the brush 17 (i. e., longitudinally of the conveyor) from a point slightly in advance of the said brush to a point at least slightly beyond the said brush so as to guide the tubes 2 in a fixed endwise position during the entire period of their engagement with the brush. The far guide 34 is adjustable laterally of the conveyor 1 to enable the setting thereof in proper guiding position for the particular length glass tubes 2 being passed through the conveyor during a given run. For this purpose, the far guide 34 may be fastened to one or more upstanding support arms or bars 36 which are slidably mounted on, and may be clamped in any given position on overhead slide rods 37 extending transversely of the conveyor 1 and supported from the table 3 thereof. The far guide 34 is set to a guiding position so correlated to the downward offset of the brush 17 relative to the particular tubes 2 being processed as to cause insertion of the tube collars 11 into the said brush to the depth required to produce the previously described brushing action of the brush wherein its bristles just clear the upper side of the tube collars 11 and enter the interior of the tube.

The second or "outside" brush 18 is elevated relative to the glass tubes 2 on the conveyor tracks 7 so as to partially overlie the tube ends or collars 11 and brush the outer sides thereof, as shown in Fig. 3. Thus, in the particular case illustrated wherein the brush 18 is of about 4 inches diameter and the tubes 2 are of about 1½ inches diameter, the brush 18 is mounted with its axis of rotation B located around 2½ inches above the tread of the tracks 7 and around 1 inch or so outwardly of the plane of the adjacent ends of the brushed tubes 2 as fixed by the far guide 34. To guide the tubes 2 in a fixed endwise position dur-

ing their travel across the width of the elevated brush 18 and also prevent their being drawn under the brush by the downward and outward movement of the brush on the tubes, additional guide or stop means are provided which may comprise an upstanding guide track or strip 38 secured to the top of the table 3 beneath the brush 18 and engageable with the ends of the tubes 2 which contact the brush 18. The guide 38 extends longitudinally of the conveyor (i. e., parallel to the axis of the brush 18) in substantial alignment with the adjacent ends of the glass tubes 2 as they approach the brush 18. The guide 38 extends from a point intermediate the two brushes 17, 18 to a point a short distance beyond the second brush 18.

Upon leaving the second brush 18, the glass tubes 2 are subjected to an air jet or current from an air nozzle 39 to expel loose powder particles within the glass tubes. The air nozzle 39 is mounted adjacent the path of travel of the glass tubes in a position to direct a blast of air into the end of and through the advancing tubes. As shown, the air nozzle 39 is preferably located at the side of the conveyor opposite to the brushes 17, 18 so as to expel the powder particles from the same end of the glass tubes as is cleaned by the brushes. The interval during which the advancing tubes 2 are subjected to the air blast from the nozzle 39 is preferably increased by providing laterally aligned notches or indentations 40 in the asbestos lining 8 on the tracks 7 into which notches the glass tubes drop as they roll along the tracks. The notches 40 are located just beyond the point where the fingers 13 on the chains 12 disengage the tubes at the unloading end of the conveyor by reason of the passage of the chains around the sprockets 14 at the said conveyor end. The advancing glass tubes 2 successively drop into the said notches 40 which thus hold the tubes stationary in a position opposite the air nozzle 39 until they are pushed out of the notches by the succeeding glass tube, causing the tubes to roll onto an inspection table 41 having a glass top 42 illuminated from beneath. After inspection, the glass tubes 2 are then removed from the inspection table by an operator.

Suitable means are preferably provided for collecting the fluorescent powder particles brushed off the glass tubes by the rotary brushes 17, 18. For this purpose, the brushes 17, 18 may be enclosed within a hood 43 communicating with suitable suction apparatus (not shown) through a tube 44.

In the operation of the apparatus, the glass tubes 2 are simply placed on the conveyor 1 with the ends thereof to be cleaned located at the same side of the conveyor as the rotary brushes 17, 18. Then as they move past the brushes 17, 18 they are guided into proper brushing engagement therewith by the guides 33, 34, 35 and 38. The rolling movement of the tubes 2 along the tracks 7 while in engagement with the brushes 17, 18 serves to insure the brushing of the tube ends or collars 11 around their entire circular extent.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with a conveyor comprising means to receive and support a series of glass lamp tubes in horizontally arranged side-by-side relation extending transversely of the conveyor but without regard to alignment of the tube ends and including means to transport said tubes along the conveyor and simultaneously rotate them about their axes, a pair of rotary brushes mounted outwardly adjacent and spaced along the path of travel of one end of the tubes and rotatable about axes extending in the general direction of advance movement of the tube transporting means, one of said brushes being approximately aligned horizontally with the tubes and the other of said brushes being offset upwardly with respect to said tubes, means connected with said brushes to rotate them downwardly against the said one end of the advancing tubes, and tube guiding means on said conveyor comprising opposed guide tracks converging in the direction of travel of the tubes and engageable with the opposite ends of the advancing tubes to shift them endwise into predetermined endwise relation to the brushes and a pair of stop guide tracks abreast of and extending parallel to the axis of rotation of respective ones of said rotary brushes, the stop guide track abreast of the upwardly offset brush being engageable with the said one end of the tubes and the stop guide track abreast of the aligned brush being engageable with the other end of the tubes to thereby hold them in said predetermined endwise brushing relation to the brushes during their travel past the same.

2. In combination with a conveyor comprising means to receive and support a series of glass lamp tubes in horizontally arranged side-by-side relation extending transversely of the conveyor but without regard to alignment of the tube ends and including means to transport said tubes along the conveyor and simultaneously rotate them about their axes, a pair of rotary brushes mounted outwardly adjacent and spaced along the path of travel of one end of the tubes and rotatable about axes extending approximately parallel to the direction of movement of the tube transporting means, the first one of said brushes being approximately aligned horizontally with the tubes and the second one of said brushes being offset upwardly with respect to said tubes, tube guiding means on said conveyor comprising opposed guide tracks converging in the direction of travel of the tubes and engageable with the opposite ends of the advancing tubes to shift them endwise into predetermined endwise relation to the brushes and a pair of stop guide tracks abreast of and extending parallel to the axis of rotation of respective ones of said rotary brushes, the stop guide track abreast of the first one of said brushes being engageable with that end of the tubes remote from said brush and the stop guide track abreast of the second one of said brushes being engageable with the end of the tubes adjacent said second brush to thereby hold the tubes in said predetermined endwise relation to the brushes during their travel past the same.

3. Apparatus of the character set forth in claim 2 wherein the first one of said brushes is offset a slight distance downwardly and the second one of said brushes is offset a substantial distance upwardly with respect to the said tubes.

4. Apparatus for cleaning one end of glass lamp tubes comprising, in combination, a conveyor comprising a plurality of horizontally extending tracks arranged to support the glass tubes horizontally thereacross for rolling movement therealong and a movable endless chain mechanism mounted beneath and substantially co-extensive with the said tracks and carrying a series of fingers projecting above the tracks to define a plurality of transverse tube-receiving passageways, said fingers engaging said tubes to push them along the tracks to cause the tubes to roll therealong, moving brush means disposed at one side

of said conveyor in a position outwardly adjacent the path of travel of the said one end of the tubes, tube guiding means on said conveyor engageable with the advancing tubes to guide the said one end thereof into engagement with and across the said brush means, and air clean-out means for the tubes comprising transversely aligned notches in the upper sides of the tracks adapted to receive and temporarily hold the tubes relatively stationary as they become disengaged by the tube-advancing fingers at the discharge end of the conveyor and out of which the tubes are pushed by the succeeding tube, and an air nozzle aligned with the said notches and positioned outwardly adjacent the path of travel of the other end of the tubes to direct a blast of air into the said other end of and through each tube while temporarily positioned within the said notches.

5. Apparatus for cleaning one end of glass lamp tubes comprising, in combination, a conveyor comprising a plurality of horizontally extending tracks arranged to support the glass tubes horizontally thereacross for rolling movement therealong and a movable endless chain mechanism mounted beneath and substantially co-extensive with the said tracks and carrying a series of fingers projecting above the tracks to define a plurality of passageways for receiving the tubes and positioning them in side-by-side relation extending transversely of the conveyor but without regard to alignment of the tube ends, said fingers engaging said tubes to push them along the tracks to cause the tubes to roll therealong, a pair of rotary brushes mounted outwardly adjacent and spaced along the path of travel of the said one end of the tubes and rotatable about axes extending approximately parallel to the direction of movement of the tube-advancing fingers, one of said brushes being approximately aligned horizontally with the tubes and the other of said brushes being off-set upwardly with respect to said tubes, means connected with said brushes to rotate them downwardly against the said one end of the advancing tubes, and tube guiding means on said conveyor engageable with the opposite ends of the advancing tubes to shift them endwise into predetermined endwise brushing relation to the said brushes and to hold them in said brushing relation during their travel past the brushes.

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