

Oct. 24, 1950

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2,527,337

TUBE DRIER

Filed Feb. 27, 1947

2 Sheets-Sheet 1

Fig. 1

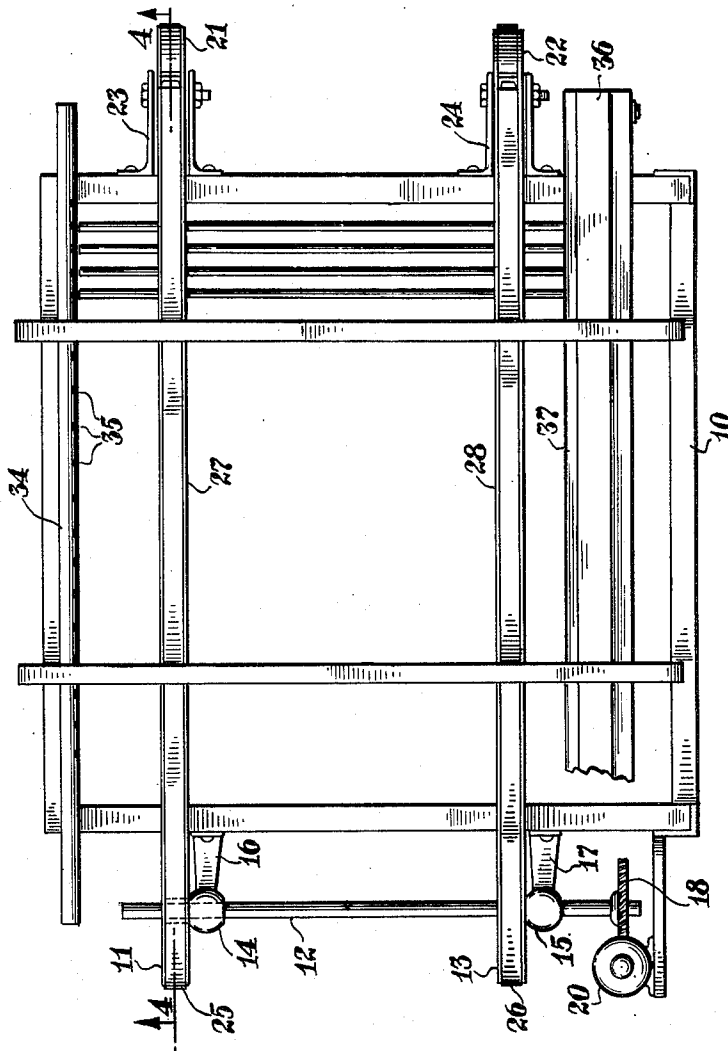
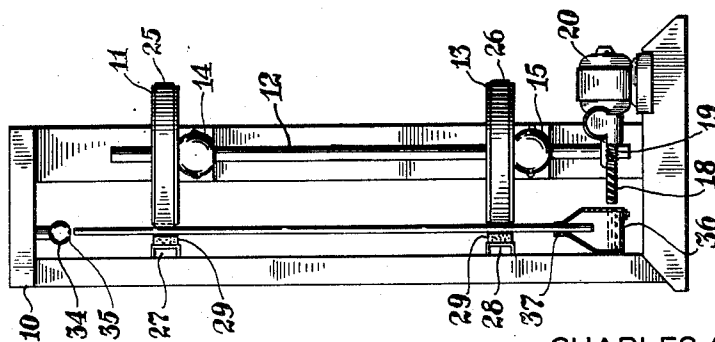


Fig. 2



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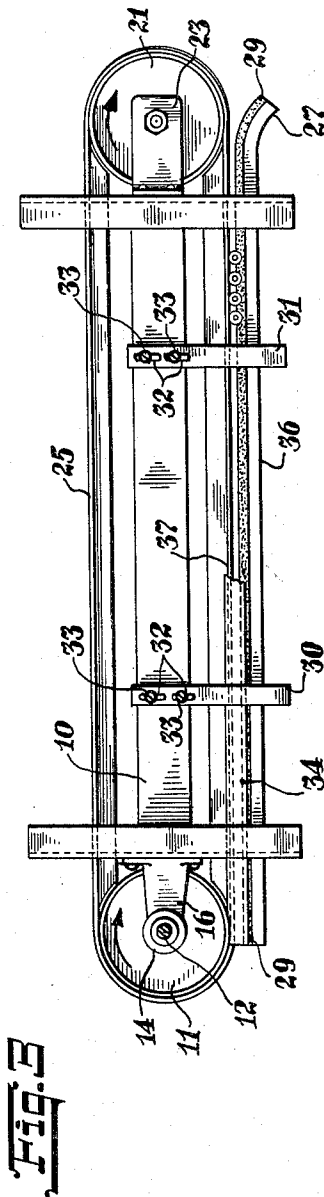
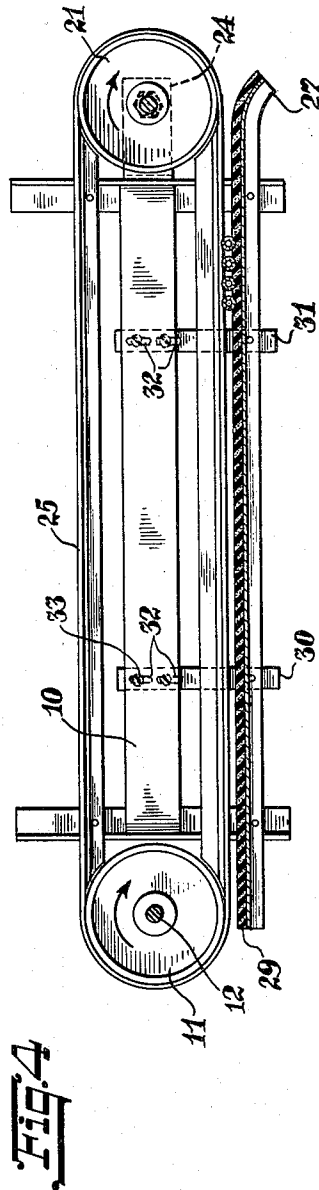
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TUBE DRIER

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1 Claim. (Cl. 34—105)

1

This invention relates to apparatus for drying the interior surface of elongated tubes. More particularly it relates to a machine for continuously rotating and conveying such tubes while they are undergoing a controlled sequence of drying rates.

While not limited thereto, this invention is especially applicable to the manufacture of fluorescent coated glass tubing of the types now widely used for fluorescent lamps and fluorescent tube signs.

In the particular manufacture just mentioned, the fluorescent powder is usually applied to the interior of the tube by means of a liquid vehicle or lacquer, the mixed powder and liquid being called a suspension. The suspension is run into the tube so that it coats substantially the entire tube. It is then necessary to drain from the interior of the tube the excess suspension over that needed to supply the desired amount of phosphor, to spread evenly over the tube wall the remaining suspension, and finally to evaporate substantially all the liquid from the remaining suspension so that the phosphor will be left deposited in a layer of solid material having the desired thickness.

The present invention comprises an automatic machine into which are fed tubes of the character just described. The tubes may be fed in immediately preceding coating, or immediately after coating and prior to the completion of draining. The machine imparts to the tube a rotary motion which promotes the uniform distribution of the desired liquid film. Simultaneously a current of any desired gas, such as air, is blown downwardly through the tube, in order to hasten evaporation of the vehicle from the film. Additionally, means are provided for recovery of the excess liquid thus removed from the tube, and also for the removal of the gas which has passed through the tube and is now laden with the vehicle in the form of vapor, it being possible to recover the liquid, if desired, from such gas by processes well known in the art.

An object of this invention is to provide a tube drying machine in which the tubes are continuously conveyed from the inlet to the outlet of the machine by an endless belt, along which the tubes may be spaced at either regular or irregular intervals, yet each tube will undergo a substantially identical draining and drying cycle.

An additional object is to provide a tube drying machine of the character just described, in which the transitional movement imparted to the

2

tubes by the endless belt automatically brings about an additional movement of axial rotation of each tube, without the necessity of employing any discrete devices for securing such axial rotation.

Another purpose of this invention is to provide a tube drying machine in which the tubes, during transit therethrough, are positively but yieldingly positioned at any given instant between retaining members having a high degree of resiliency, whereby fracture and breakage of tubes formed of glass or other easily frangible material are substantially obviated.

Yet another object of this invention is to provide a tube drying machine which may easily and rapidly be adjusted for use with tubes of varying diameter.

Additional purposes and advantages of this invention will be apparent to those skilled in the art from the following specification, and from reference to the hereunto annexed drawings, in which:

Fig. 1 is a side elevational view of one embodiment of this invention,

Fig. 2 is an end elevational view of the device of Fig. 1,

Fig. 3 is a top plan view of the device of Fig. 1, with certain elements partly broken away to show tubes passing through the device, and

Fig. 4 is a sectional view on the lines 4—4 of Fig. 1.

Referring now to the drawings, a supporting framework 10 carries at one end thereof a pulley 11 mounted near the upper end of a drive shaft 12, and a substantially identical pulley 13 mounted near the lower end of the same shaft. The shaft is supported by, and rotates within bearings 14 and 15, these latter being mounted by brackets 16 and 17 upon the framework. Drive shaft 12 carries a gear 18, which is driven by a worm 19. The worm is in turn driven by any suitable source of mechanical energy, such as the motor shown at 20. At the opposite end of the device are mounted pulleys 21 and 22, by suitable brackets 23 and 24. Each of these last mentioned pulleys constitutes an idler. A belt 25, formed of any suitable material having sufficient resiliency, such as rubber, connects pulleys 11 and 21, while a similar belt 26 connects pulleys 13 and 22. Due to the fact that pulleys 11 and 13 are driven at identical speed, belts 25 and 26 will move longitudinally at substantially identical rates of speed.

Parallel to belt 25 is positioned a supporting member 27, having one end thereof curved away

3

from pulley 22, so as to allow the ready insertion of a tube at this point. A correspondingly positioned member 28 lies parallel to belt 26. Supporting members 27 and 28 are each lined with respective strips 29 upon the faces of the members adjacent to the belts. These linings are formed of an extremely resilient material, sponge rubber having been found suitable for the purpose. The supporting members 27 and 28 are held in the desired positions by laterally extending cross pieces 30 and 31. The cross pieces are each provided with slots 32. Adjusting screws 33 pass through these slots into the main framework 10. It is therefore possible, by loosening these screws, to alter the distance between the surface of the resilient lining 29 and the respective belts, so as to accommodate tubes of different diameters.

Extending longitudinally along the framework in a position immediately above the upper extremities of the tubes is fixed an air conduit 34, provided with a series of apertures 35, directed downwardly so that the opening at the upper end of each tube will pass directly beneath these apertures. Conduit 34 is supplied with a suitable gaseous drying medium, such as air, under a pressure sufficient to establish the desired drying circulation through the tubes. A hand valve, not shown, is sufficient to regulate the air flow to correspond with various tube diameters, tube lengths, or vehicles of different volatility.

Along the lower portion of the framework is arranged a second conduit 36. This may conveniently be formed so as to have a lower, generally rectangular portion, the lateral walls of which may be bent inwardly, as shown at 37, thus providing two lips, between which pass the tubes progressing through the machine. The liquid material draining out of the tubes flows along conduit 36, which is preferably slightly inclined, so that the liquid gathering therein will drain out of the conduit at one end of the machine, for purposes of recovery. Any suitable gas exhaust mechanism (not shown) may be connected to conduit 36, so that the vapor-laden gases also entering the conduit will be removed therefrom rather than escaping into the atmosphere, where they may constitute a fire or health hazard. A control (not shown) is used to regulate the amount of suction to control the rate of drying, and hence the coating distribution, in the manner described above for conduit 34. As

4

previously mentioned, the vaporized solvent may be recovered from such exhaust gases by any suitable means, as well known in the art.

While there have been shown and described certain embodiments of this invention it is to be understood that many variations thereof will be apparent to those skilled in the art and accordingly the scope of this invention is limited only by the hereunto appended claim.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

A device for drying the interior of vertically disposed tubing, including two horizontal belts having corresponding portions equidistant from one another, means for moving said belts at substantially identical speeds, two strips of resilient material respectively disposed at substantially equal distances from each of said belts and spaced therefrom by a distance less than the outside diameter of said tubing, means for permitting the insertion of said tubing near one end of said strips and between said strips and said belts, whereby rotation and transition of said tubing is simultaneously and solely caused by the motion of said belts, a gas conduit disposed substantially parallel to said belts and immediately above said tubing and having therein downwardly directed apertures, allowing a drying gas to be blown downwardly through said moving tubing, and also including a conduit disposed substantially parallel to said belts, immediately below said tubing, whereby fluid material leaving said tubing at the bottom thereof enters said conduit, said conduit having a cross section broader at the bottom and narrowing at the top until the two vertical sides thereof approach one another so closely as to embrace the lower end of said tubing, whereby evaporation of said fluid material is reduced.

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