Sept. 6, 1949. R. L. LINDEMUTH 2,481,130

DRIER FOR THERMAL PIPE INSULATION

Filed May 5, 1945 5 Sheets-Sheet 1

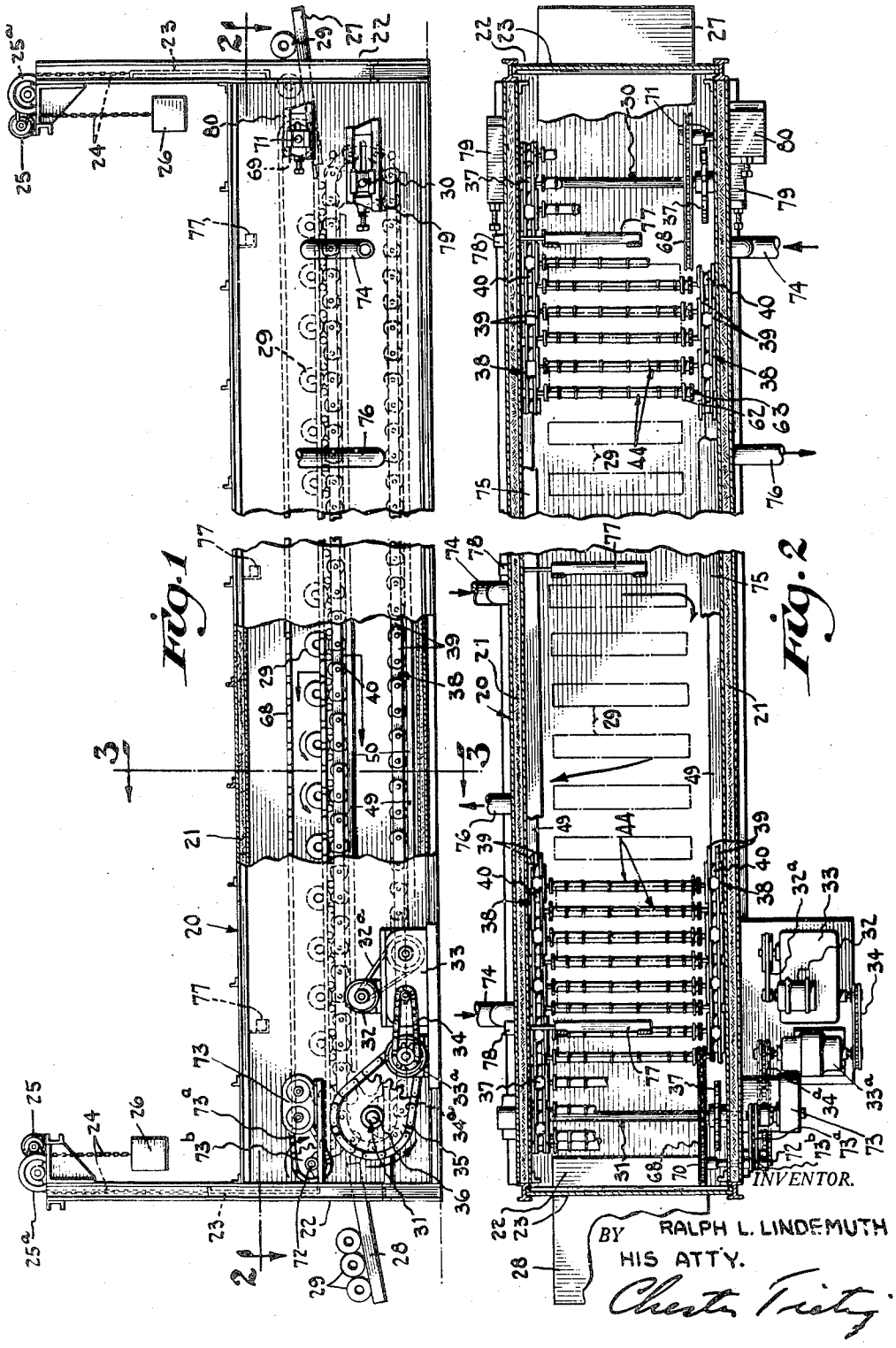


Fig. 1

Fig. 2

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DRIER FOR THERMAL PIPE INSULATION

Filed May 5, 1945 5 Sheets-Sheet 2

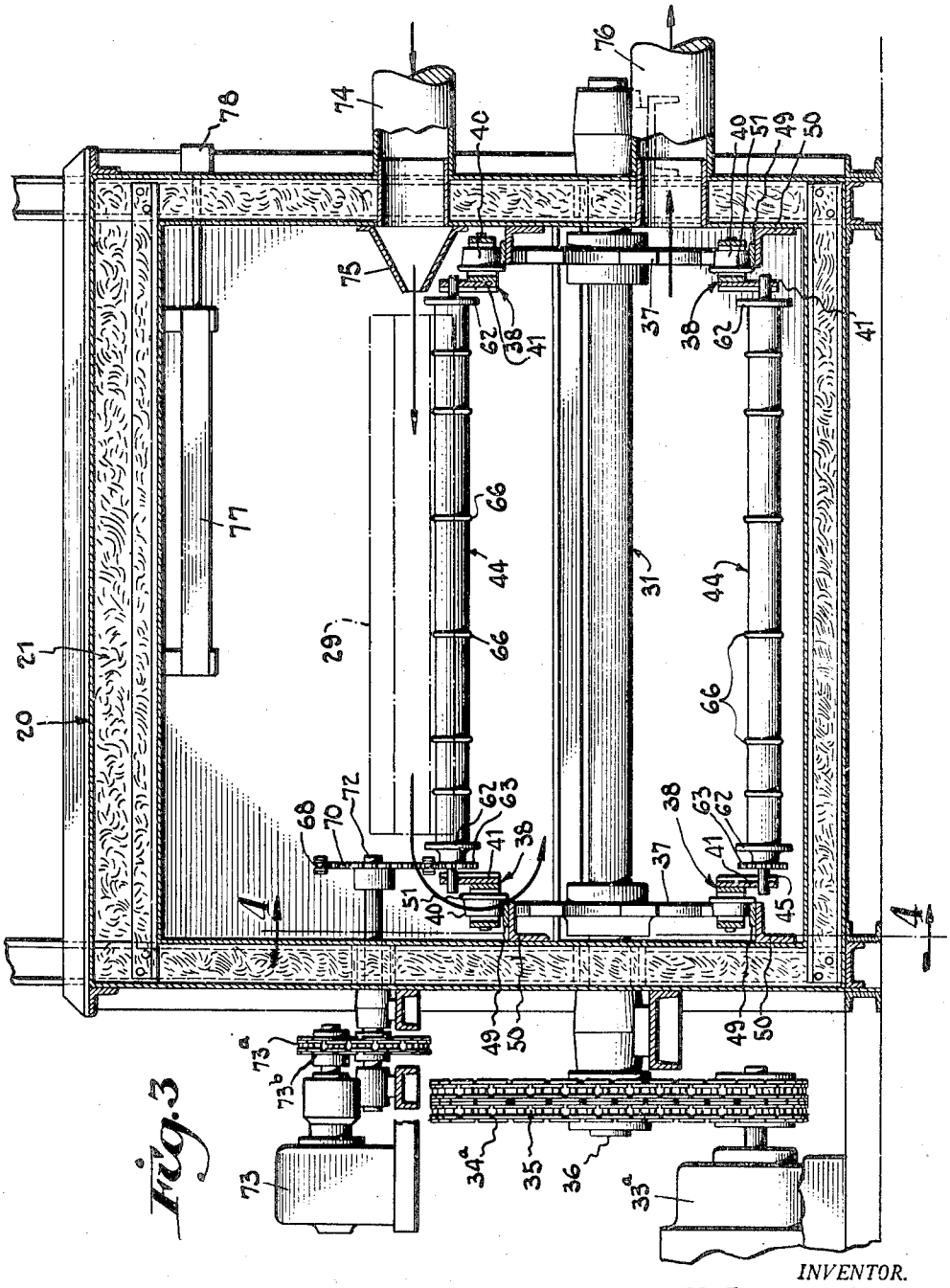


Fig. 3

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DRIER FOR THERMAL PIPE INSULATION

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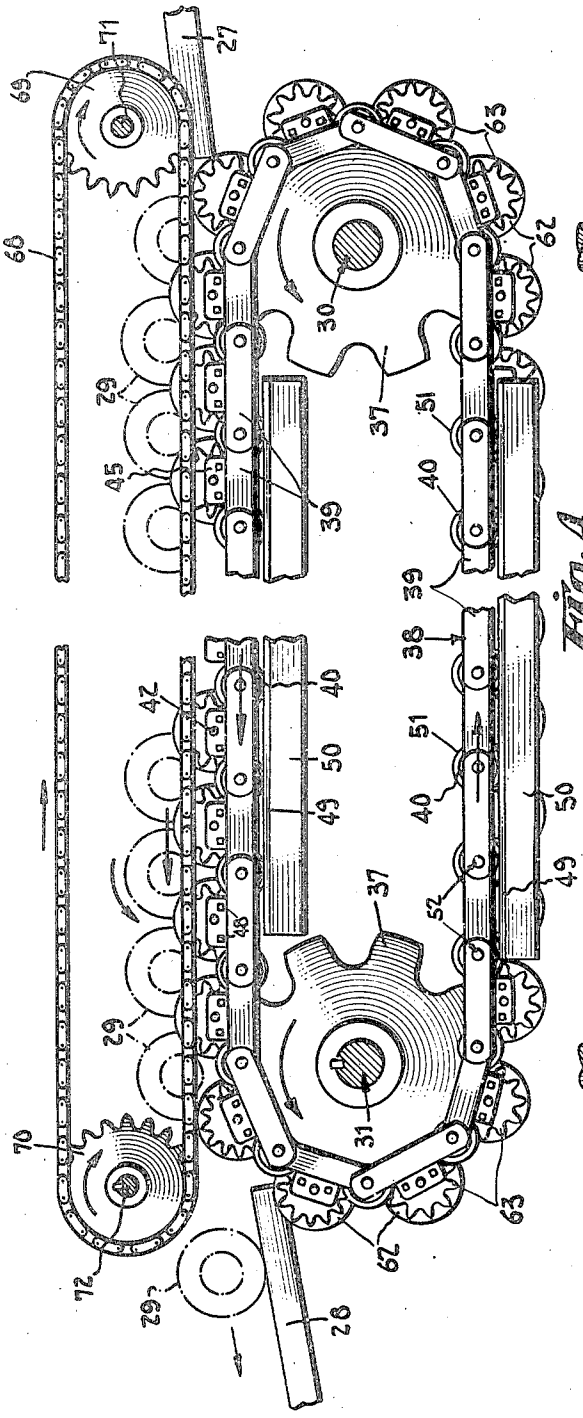


Fig. 4

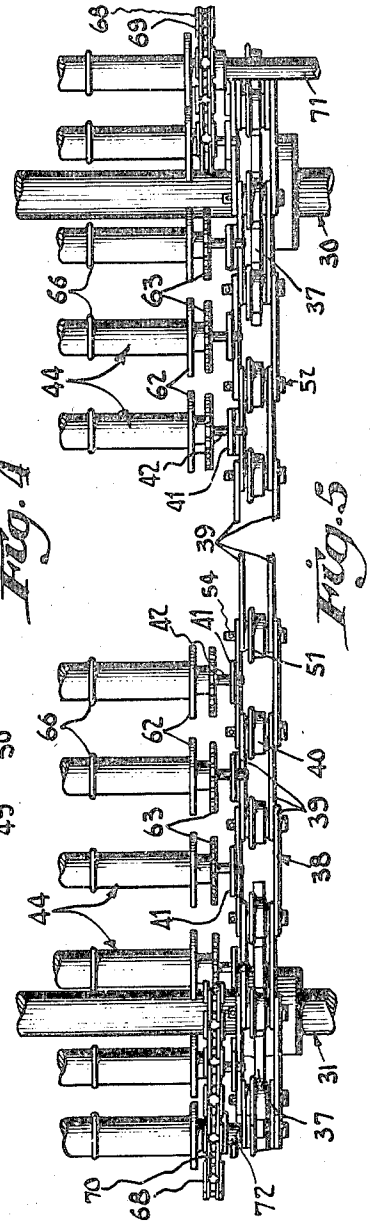


Fig. 5

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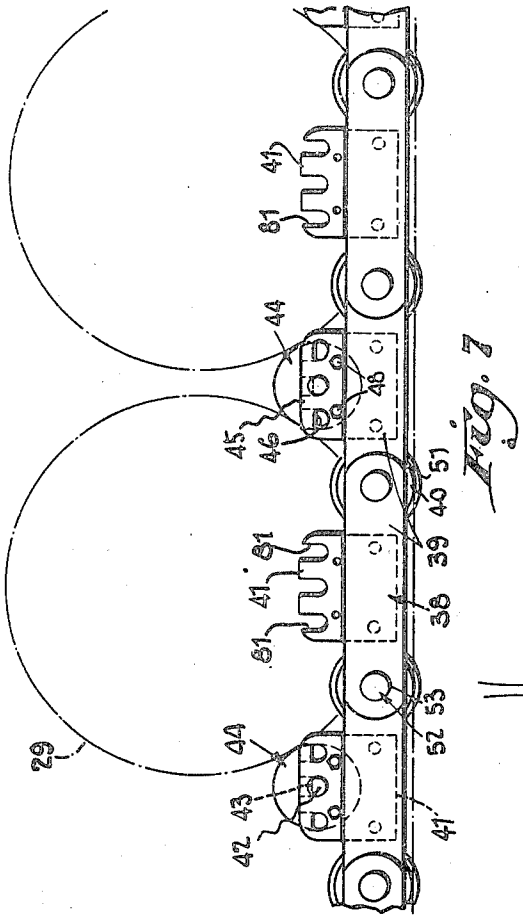


Fig. 7

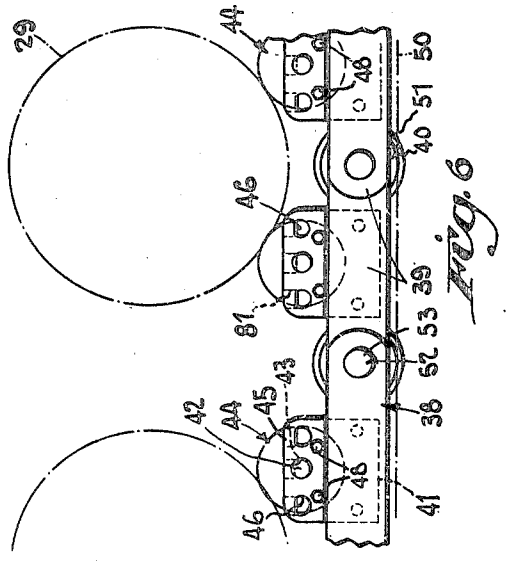


Fig. 6

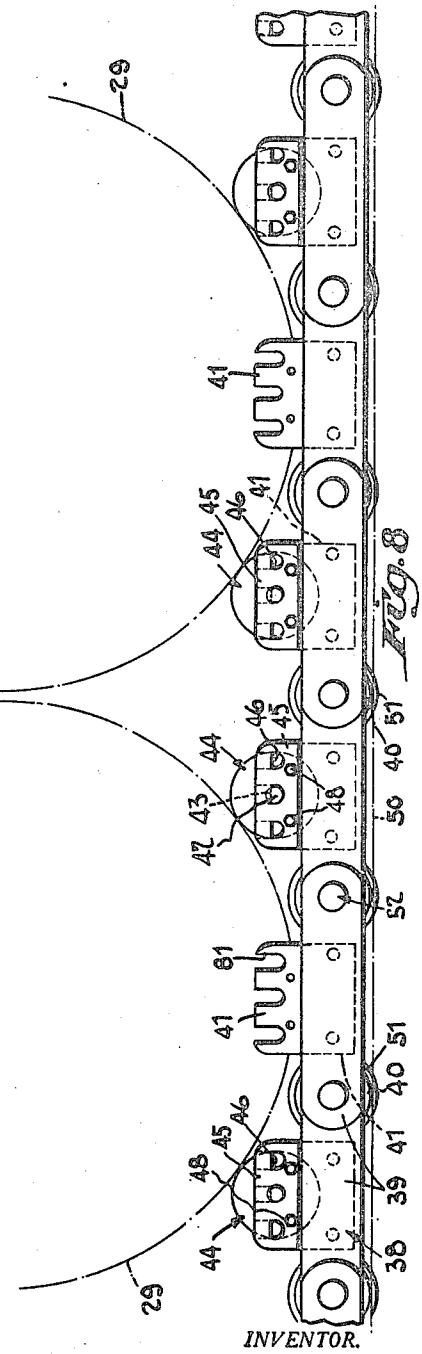


Fig. 8

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DRIER FOR THERMAL PIPE INSULATION

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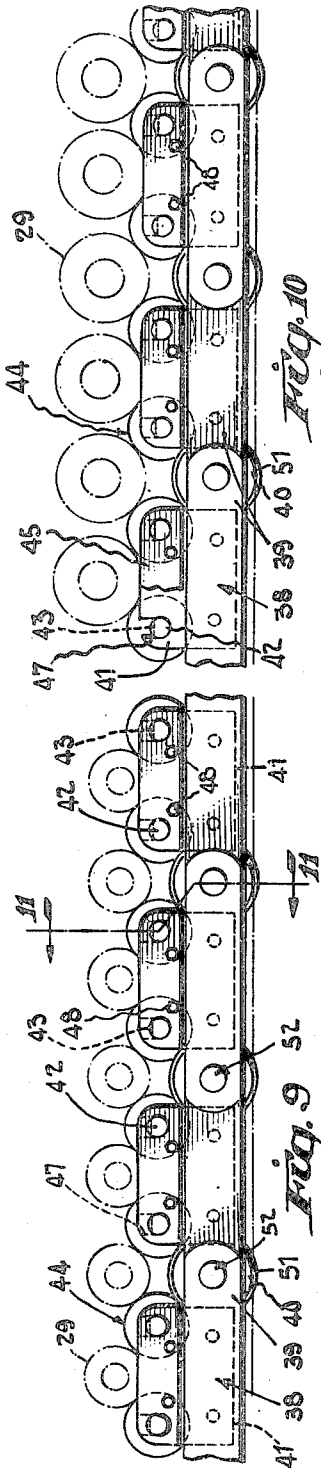


Fig. 10

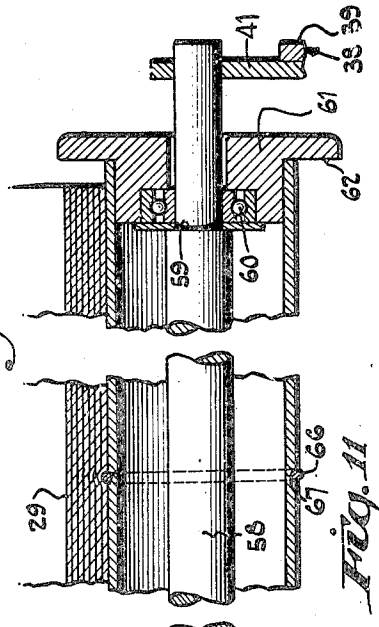


Fig. 11

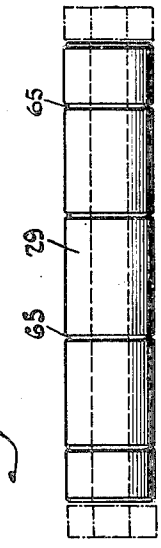


Fig. 13

Fig. 9

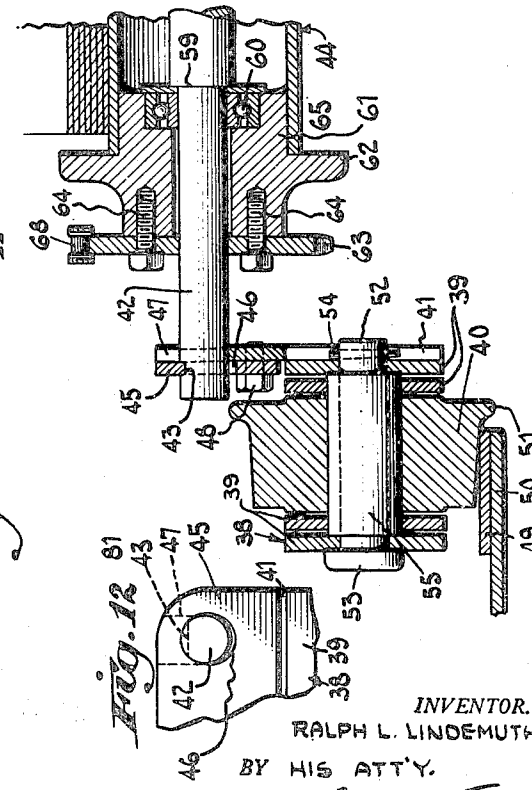


Fig. 12

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2,481,130

UNITED STATES PATENT OFFICE

2,481,130

DRIER FOR THERMAL PIPE INSULATION

Ralph L. Lindemuth, Joplin, Mo., assignor to The Eagle-Picher Company, Cincinnati, Ohio, a corporation of Ohio

Application May 5, 1945, Serial No. 592,228

1 Claim. (Cl. 34—105)

1

This invention relates to a dryer for the continuous drying of hollow cylinders of thermal insulating material which is intended for covering pipes.

Among the objects of the invention are the continuous drying of such cylinders while they are rotating upon travelling rolls and are being subjected to the action of a hot air blast both inside and out. While my dryer may be used upon any cylindrical covering of this character, it will be described with particular reference to coverings made from mineral wool and coated on the outside with a toughening protective coat which partially closes the pores of the outer layers of the wool. Such coating is of a thermoplastic or a thermosetting nature.

In the drawings, Figure 1 is a side elevation of the dryer, partly in section.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1.

Figure 3 is a cross section taken on the line 3—3 of Figure 1 and shows the path of air blown into the dryer.

Figure 4 is a side elevation of the means for advancing and simultaneously rotating the pipe coverings in their progress through the dryer. It is taken on the line 4—4 of Figure 3.

Figure 5 is a fragmentary detail view, in plan, showing the rotating and advancing means also illustrated in Figure 4.

Figures 6, 7 and 8 are diagrammatic views in side elevation of the advancing and rotating means, each adapted, by the removal of rolls, to a successively larger size of pipe covering than shown in the preceding figures.

Figures 9 and 10 are side elevations corresponding to Figures 5, 6, 7 and 8, which show the handling of other sizes of pipe covers than are shown in the three preceding figures.

Figure 11 is a cross section taken on the line 11—11 of Figure 9, and shows a rotatable roll mounted upon a dual chain type of conveyor. A section of a pipe cover is shown resting between this roll and its neighboring identical roll.

Figure 12 shows a roll mounting and a locking means for the roll shaft contained in said mounting.

Figure 13 is a side elevation of a pipe covering of the kind which is to be handled. Grooves made by this dryer in the thermoplastic or thermoset covering by means shown in Figure 11 are also illustrated.

Referring now to Figures 1 and 2, 20 is a box-like structure which forms the frame and container for the travelling parts of the dryer. The

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walls of frame 20 are made double and preferably contain thermal insulating material 21, although the double construction and the insulating material are not essential to the practice of the invention. At each end of the frame 20, there is an opening 22 which is closable by a door 23 which is vertically traversable within the frame 20 by means of a chain 24, motor 25, pulleys 25a and a counterweight 26 to close the openings 22. The frame ends are interiorly free from insulating material to allow the travel of the doors. During operation the doors are set to close as much of the openings as possible, while still allowing the ingress of formed pipe covers, minus their forming mandrels, by means of incline 27 which may be seen at the right end of Figures 1 and 2. A similar incline 28 is provided at the exit end, seen at the left side of Figures 1 and 2. Both inclines are shown with cylinders of pipe covering 29 upon them.

Supported by the frame 20 there are shafts 30 and 31 mounted transversely of the frame. The latter is a drive shaft which is energized by an electric motor 32, which is connected by a V-belt drive 32a through a variable speed transmission 33 and 33a connected together by a chain 34 and by means of a drive 34a to a large sprocket 35 which is mounted on a projecting extension 36 of the shaft 31 exteriorly of the frame 20. Both shafts 30 and 31 bear large sprockets 37 over which a heavy drive chain 38 passes.

Chain 38 is dual so as to form a conveyor and is of the roller type, comprising the standard stiff links 39 and free rotating rollers or wheels 40. It is specialized, however, by the addition of upwardly projecting side plates 41 on the sides of links 39. It is of course, dual, that is, there are two chains, one on each side, traveling in register. The plates, as can be seen by Figures 4 and 5 and detailed views 6 to 11 inclusive, are pierced by openings in the middle portions, for the accommodation of a shaft 42 which has a grooved neck 43, see Figures 11 and 12. Each shaft 42 does not rotate, but supports a rotatable roll 44. The grooved neck extends exteriorly of the side plate 41 and is locked against endwise displacement as will be seen by Figures 11 and 12 by means of an auxiliary locking plate 45. The auxiliary plate 45 bears an opening 46 which is somewhat eccentric to the opening or slot 47 in the side plate 41 when the locking plate is held down fully in the shaft groove 43 by means of cap screws or bolts 48, of which there are two per side plate 41. The shaft 42 is therefore held down by the inner rim of opening 46 in the lock-

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ing plate 45, and supported by the lower rim of opening 47 in the side plate 41. Such sockets are provided in both sides of the chain 38 so that the roll 44 is supported on both ends.

Chain 38 may bear either one roll 44 per link 39, as shown in Figures 4 and 5, or may bear two rolls as shown in Figures 9 and 10. It is, therefore, evident that two forms of side plate 41 may be applied to the same chain 38 at different times, depending upon the size of pipe covering cylinder 29 which is to be dried. Generally, the small sizes of covering will necessitate larger side plates; i. e., those which bear two rolls instead of one. The three-hole side plates extend the use of the rolls to a wider field of intermediate cover sizes, as shown in Figures 6, 7 and 8.

Referring again to Figures 4 and 5 and Figure 11, chain 38 travels on rolls 40 which are in turn supported by internal rails 49 and angle irons 50 which are attached to the frame 20 of the dryer. Contact to the chain is made with them through wheels or rollers 40 which are provided with flanges 51 on the inner edges. The wheels rotate upon axle pins 52 which are journalled in the links of chain 38 (see Figure 11). The axle pins include a head 53 bearing against side plates 39 of chain 38 to the outside thereof and secured at their inner ends by a cotter or taper pin 54 to hold the axle locked in the side plate 39. A sleeve 55 is journalled upon the axle pins 52 providing a bearing for roller 40. No invention is claimed for this particular style of wheel mounting, any other good mechanical practice may be substituted.

Again referring to Figure 11, shaft 42 has an enlarged portion 58 within the middle portion of roll 44. A square shoulder 59, so formed, serves to support a combination thrust and radial ball bearing 60 at each shoulder. An end piece 61 may fit into the hollow cylindrical roll 44 by means of a press fit or otherwise. This piece bears high flanges 62 and is counter bored to receive ball bearing 60. That modification of the end piece which is shown at the left side of Figure 11 also bears a sprocket 63 which is tied to the end piece 61 by means of cap screws 64.

It is evident that since sprocket 63 is tied upon end piece 61 and that piece is press fitted into roll 44, any force which tends to rotate sprocket 63 will also rotate roll 44 and also rotate any cylindrical object such as a pipe cover 29 which may lie between pairs of rolls when they are at the top of the travel of chain 38 through the dryer about the sprockets 11. It is also evident that since the pipe covers 29 are covered with a thermoplastic outer coating, it is possible at an elevated temperature to deform that coating to some extent. Advantage is taken of this property to roll grooves 65 into the exterior surface, i. e., the thermoplastic coating of the pipe covers by means of wire rings 66 which are mounted (preferably by welding) in grooves 67 about the periphery of rolls 44. The purpose of these grooves is to accommodate wire loops which are applied to hold the pipe coverings on the pipe after said coverings are split for convenience in mounting.

Rotation of the rolls 44 is accomplished by providing an upper drive chain 68 which is mounted upon upper sprockets 69 and 70, these being the driven and driving sprockets respectively. The latter are mounted upon shafts 71 and 72 respectively transverse of the dryer frame. The mounting so positioned that the lower portion of chain 68 engages sprockets 63 to rotate rolls 44. Since dual chain 38, which is the ultimate carrier of sprockets 63, is independently driven, it is evident that chain 68 may be stationary and still accomplish rotation of rolls 44, or it may travel in the same direction, but not at the same speed as chain 38. In this case it will cause a slow rotation, as indicated by arrows (see Figures 1 and 4). A third alternative is for chain 68 to travel in a direction opposite to that of chain 38, in which case a comparatively high speed of rotation of rolls 44 will be accomplished. Such a control gives an exceptional speed flexibility and range to roll revolution.

All of these alternatives lie within a purview of my invention. To this end, a separate drive for chain 68 is provided, which is energized by a separate motor and variable speed transmission, by a chain 73*a* over sprocket 73*b* as shown in Figures 1, 2 and 3.

Referring now to Figure 3, 74 is one of several air inlet ducts which extend through the frame 20 at such a level as to coincide with the openings through the pipe covers 29 as they are carried through the dryer. The degree of coincidence need not be exact, i. e., the air current need not flow through the exact center of the pipe cover. However, to aid in centering the air flow, a cone 75 may be mounted on the interior of the frame 20 so that its apex is adjacent the center of the pipe cover opening. For other sizes of pipe covers than the one illustrated, the cone may be made in such a shape as to curve the air current so that it will impinge upon any desired portion of the pipe covering or other material which is to be dried, as many inlets for air may be provided as may be desired, considering the material to be worked upon. Dampers or closures (not shown) may be provided for such air inlet ducts as are not in use or for the purpose of regulating those which are in use. Heating means (not shown) for the air may be provided either outside of the ducts 74 or within them.

At a lower level and preferably at some horizontal distance from the inlet duct 74, there is an outlet duct 76, which may be one of several. The outlet ducts are located preferably on the same side of the dryer as the inlet ducts, so that the incoming air will be compelled to take somewhat of an arcuate path, thereby exposing the material within the dryer to an air current. The general arrangement of inlet and outlet ducts is shown clearly in Figures 1 and 2, from which it may be seen that both inlet and outlet ducts may be arranged on both sides of the dryer in alternate relation, i. e., inlet and outlet.

Referring to Figures 1, 2 and 3, 77 indicates one of a multiplicity of electric or gas heaters which are preferably divided into three batteries, i. e., a middle battery and two end batteries, which are preferably, but not necessarily, of equal length. Independent regulatory means are provided for each battery, the regulatory means being diagrammatically indicated by 78. By such means the degree of heating in each zone may be controlled.

Other refinements of engineering, such as will be discussed, are preferably used although their omission does not depart from the spirit of the invention. One of these is the use of chain tension regulators 79 and 80, the former of which is for the purpose of regulating the tension of the roll conveyor, and the latter for the purpose of regulating the tension of chain 68. Another refinement lies in the use of an automatic photoelectric control for each of the doors 23. Since no invention is claimed for the use of such a control, it is

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not illustrated, but persons skilled in the art would know how to apply it so that each door would be elevated as soon as a pipe cover was presented for the purpose of entering or leaving the dryer. Such a control would operate on the circuit of the door elevating motor **25** in connection with the pulley **25***a*, and the chain **24**.

From Figures 6 to 10 inclusive, it will be seen that this dryer possesses a pronounced flexibility for handling different sizes of pipe covers. Every roll **44** is provided with several optional sockets **81**, similar to the slots **47**, in side plates **41**, at varying horizontal distances. Since the side plates may be altered from, for example, a two-socket to a three-socket plate, it is evident that a considerable latitude is available for the accommodation of different sizes of pipe covers insofar as distances between rolls are concerned. Every second or third roll may be removed as is shown in Figures 6 to 8, so that extremely large sizes of pipe covers can be accommodated.

It is not necessary that more than one drive be employed for the traverse and the turning of the pipe covers. Suitable gearing or chain drives can be used to connect the operation of the conveyor chain **38** and the roll driving chain **68**. However, the employment of a separate drive for chain **68** makes it possible to give a complement of pipe covers an extra long drying treatment while being rotated by rolls **44**, conveyor chain **38** being altogether stationary. Such operation is useful in occasional experimental work. A separate drive is also useful, as before stated, to create an exceptionally wide range of speeds at which rolls **44**, and therefore the pipe covers **29**, may be rotated.

It is to be observed that in the operation of this machine, four actions proceed simultaneously. They are, first: the rotation of the pipe covers, second: the forward translation of the covers, third: the drying of the covers by blasts of heated air directed through as well as over them and fourth: the rolling of grooves into the exterior surfaces of the covers by means of rings **66** at an elevated temperature while the covers are still damp. Much time is saved, therefore, by doing these operations simultaneously.

The rolling of the grooves may, however, be done by other machines or even by hand before the covers enter the dryer. The rings **66** may then be omitted from the mandrels. A machine lacking rings **66** still lies within the scope of my invention.

Since the rolling of damp covers may be done by means other than the machine disclosed, the step amounts to a method. It works best with water-emulsified synthetic resins of either the urea-formaldehyde, phenol-formaldehyde or lignin types at a temperature between 300° F. and 600° F. Any length of time may be employed provided the rolling is accomplished before the resin sets permanently from the heat. A number of revolutions should be allowed before the ring **66** enters to its full depth. That is to say, in hand operations, as on a lathe, the ring **66** should be allowed to form the groove in the pipe cover gradually during several revolutions; it should not be forced in with a view to making the fully formed groove in one revolution.

I claim as my invention:

In an apparatus of the class described, a frame of a boxlike character having walls resisting the flow of heat through them, an endless dual chain conveyor having a plurality of pairs of roller mountings thereon arranged in transverse alignment, said conveyor being operatively mounted longitudinally within said frame, means for driving said conveyor operatively connected thereto, a multiplicity of rolls freely rotatably supported in said conveyor mountings, each mounting having a plurality of roll supporting sockets whereby the spacing of the rolls, one from another, may be selectively varied by positioning the rolls in different mounting sockets, sprocket driving means for said rolls carried by each roll, a chain engaging a multiplicity of said sprocket driving means simultaneously, a driving means for said chain whereby said rolls may be rotated through said sprocket driving means when said chain conveyor is in operation, air ingress and egress ducts spaced at longitudinal intervals in said frame at a level slightly higher than the highest point reached by said conveyor rolls, said ingress and egress ducts extending into said frame on both sides thereof in relation to each other and to those in the opposite side, and receiving and delivery means at respective ends of the apparatus for objects to be dried within the apparatus.

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