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APPARATUS FOR CURING A CYLINDRICAL FIBER GLASS AND BINDER CASING

Filed Oct. 27, 1958 2 Sheets-Sheet 1

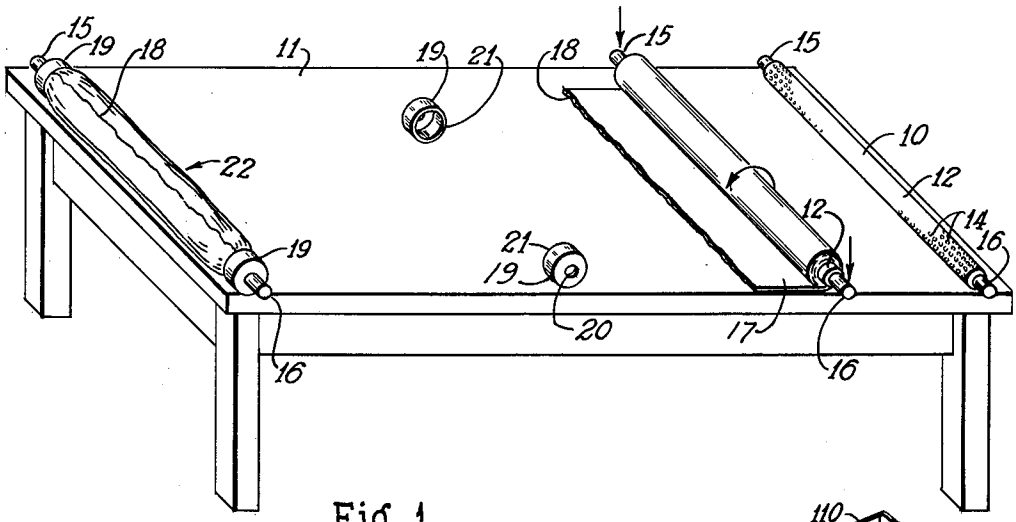


Fig. 1

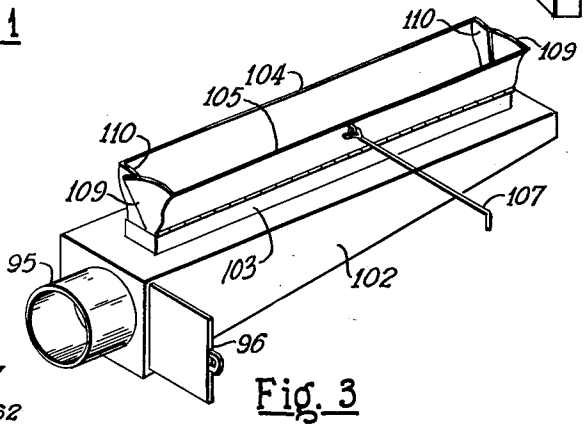


Fig. 3

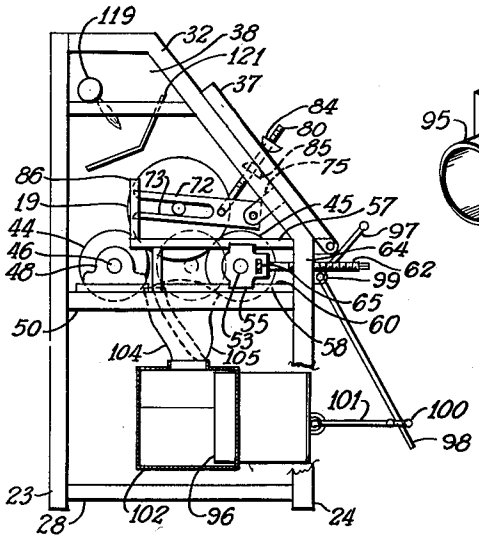


Fig. 2

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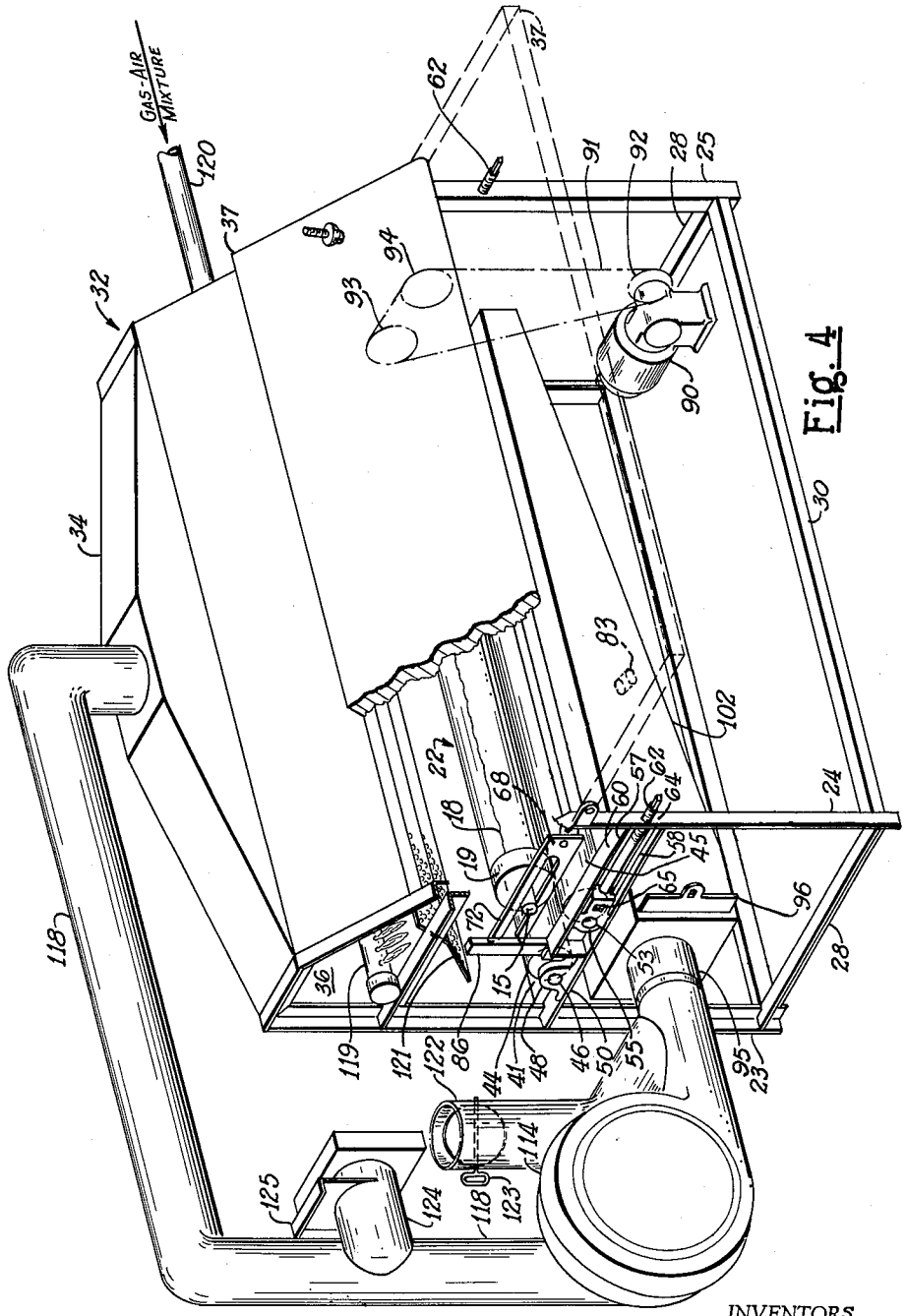


Fig. 4

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APPARATUS FOR CURING A CYLINDRICAL FIBER GLASS AND BINDER CASING

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7 Claims. (Cl. 18—6)

This invention relates to cylindrical casings of fibrous glass intended primarily for positioning around pipe as a heat insulating cover but also capable of serving as independent ducts of self-insulating capacity. More particularly this invention relates to apparatus for producing such tubular bodies of fibrous glass.

The superior qualifications of fibrous glass masses as insulating media are well known. They possess not only high resistance to heat transfer but also the individual glass fibers have exceptional strength, and are chemically inert which enables them to withstand exposure to the corrosive action of moisture, mildew, and of other destructive elements.

An established method of making fibrous glass insulating elements of this type involves the winding of a continuous web of fibrous glass, impregnated with a heat curable binder, about a hollow, perforated mandrel until the desired thickness is secured. If not previously cut to the desired length, the wound section is severed from the balance of the web by a cutting blade, and then the binder of the cylindrical mass of the wound web is cured by forcing hot air through the hollow mandrel and the mass or by letting hot air within an oven slowly permeate the porous aggregation.

The web of fibrous glass of similar mineral fibers derived from fusible rock or slag of the general type employed in this fabricating procedure is usually produced by attenuating minute streams of the molten base material with blasts of steam or air and collecting the filaments thus formed, with an admixture of binder particles, upon a foraminous conveyor. For the various uses for which they may be intended, the individual fibers thus drawn may have diameters anywhere from two hundred thousandths to eighty ten-thousandths of an inch and be in lengths of one half to ten inches. The rate of travel of the conveyor may be adjusted to control the thickness of the deposit of fibers and the continuous web thus created.

The web of fine fibers here involved is of a light, fluffy nature, easily elongated and compacted, and so readily adapts itself to the wrapping action. The winding of the web upon itself over the mandrel has a compressing effect increasing the density of the stock many times from an original weight per cubic foot which may be as low as one third of a pound to a final weight usually not exceeding eight pounds.

The web may be directly wound on a mandrel or first cut to the lengths predetermined as suitable for building the cylindrical bodies of the selected size. These cut lengths may then be used immediately, or temporarily stocked for later processing. The length of the insulating sections formed are substantially the same as and limited by the width of the basic web. This dimension usually ranges between thirty-six and seventy inches.

The high order of thermal protection which these fibrous glass casings provide arises from the great number of small air cells or pockets disposed between the fine fibers. However, this desired quality in the final product is one that slows up the binder curing by resisting the penetration of hot air or the conduction of heat to the interior of the formed casings.

Where, in prior practices, heated air has been forced through the wrapped casing, it has generally been directed axially into or drawn endwise from a hollow mandrel having a ported surface. The necessarily limited diameter of the mandrel provides a narrow path capable of handling only a low volume of air. Also if air at high velocity is directed against the fibrous casing in its uncured state the surface is subject to ruffling and final end flap of the wrapped web is likely to be raised away from the surface of the casing. For these reasons the curing step has been time consuming and a main factor in restricting the rate of production.

A principal object of this invention is to overcome these limitations and difficulties by the provision of apparatus for more expeditious curing of the binder.

Another point of dissatisfaction with conventional methods of building these insulating bodies has involved irregularity in the final cylindrical shape of the product. There is some undulation in thickness of the basic web and this is frequently responsible for bulging or depressed effects in the wound masses. Also the weight of the mandrel may have a deforming effect upon the wrapped fibrous glass product during the binder curing.

A further object of this invention is accordingly to provide apparatus for creating insulating casings which are more symmetrical in their cylindrical contours.

A more specific object of the invention is to provide an improved mandrel upon which a web of fibrous glass may be wound to form a cylindrical unit and upon which the wound cylindrical unit may be held during the curing of the fibrous glass binder.

Another object of the invention is the provision of a binder curing oven for receiving a mandrel carrying a cylindrical unit of fibrous glass and means for placing the loaded mandrel into a station within the oven and for removing it therefrom.

The recited objects as well as other objects and advantages, which will later be made apparent, are attained at least in part by first curing the binder in the surface of the wrapped web assembly against rotating heated rollers and by curing the main body of the wrapped unit by directing hot air laterally therethrough in a controlled path and at high velocity.

These and other features of the invention and details thereof will be explained with reference to the drawings in which:

FIGURE 1 is a perspective view of a working table upon which the fabrication of wrapped casings of the type involved in this invention may be started by manually winding fibrous glass webs upon mandrels;

FIGURE 2 is an end elevation of a curing apparatus embodying a design by which this invention may be practiced;

FIGURE 3 is a perspective view of the inlet air duct portion of the apparatus of FIGURE 2; and

FIGURE 4 is a perspective view with parts broken away of the curing apparatus of FIGURE 2.

Referring to the drawings in more details, the bare mandrel 10 shown at the right end of the working table 11 of FIGURE 1 has a hollow, center drum section 12 with its inner chamber vented to the exterior through the closely positioned series of ports 14. Solid stub shafts 15 and 16 project from opposite ends of the center drum section 12. For purposes of this invention the stub shafts may be of a standard diameter such as one inch irrespective of the size of the drum section 12.

In the adjoining position on the table a stretch of fibrous glass web 17 of a width slightly less than the length of drum section 12 has been wound on the mandrel 10. For the tubular insulating products here involved this web or veil preferably has a minimum weight of sixteen grams per square foot with an average of eighteen grams and a one inch thickness, as uniform as possible, resulting in a density of one half pound per cubic foot.

A fairly fine fiber between fifteen and thirty hundred thousandths of an inch in diameter is recommended for creating the web. A mass of such fibers has exceptional insulating properties and is readily shaped and compacted. A specific size within the cited range which has given excellent service in twenty-four hundred thousandths.

In the forming of the web with these fibers a binder of a combination of melamine and phenolic formaldehyde resins is introduced in a proportion of eight to ten percent by weight. The melamine constituent has exceptional qualities of hardness and abrasion resistance while the phenolic has special chemical resistant properties. They both have strong binding power. Thermosetting epoxy, and either phenolic or melamine resins alone also function quite satisfactorily in the binder compositions.

A density of three and one half pounds per cubic foot in the completed tubing is thought about right, from an overall commercial standpoint. However there may be demands for weights anywhere in the region of two and one half to seven pounds which would be entirely feasible to produce. The heavier stock has considerably greater strength and would thus be better qualified to serve as self supporting conduit. In connection therewith a larger percentage of binder would aid in establishing a more impervious wall section.

For purposes of explanation it will be considered that the mandrel **10** has a drum section **12** with a diameter of two inches for building a tubular insulation of like inside diameter, and that it is desired to provide the tubular product with a wall thickness of one inch and a density of three and one half pounds.

Starting with an original web of one inch thickness and one half pound density it is determined that the stretch of web must be wound upon the mandrel seven overlapping turns and applied with sufficient tension or pressure to be compacted down to one seventh of its original thickness. On this basis the stretch of web should be approximately five and one half feet long.

In wrapping the web section upon the mandrel, rollers may be utilized for automatic processing or the operation may be taken care of by hand, using pre-cut sections as indicated in the drawings.

It is preferred that the web units be cut in a manner to give a ragged edge, such as resulting from hand tearing, as this enables a smoother joint to be made between the ends of the web section and the adjoining turns of the web at the beginning and at the finish of the winding action. It has also been found that wetting the final edge **18** with water makes it lie more evenly and merge better with the underlying web course.

To facilitate removal of the tubular casing after curing, the mandrel is given a wax coating before the web is wound thereon. With the web section **18** applied spirally upon the mandrel, because of the somewhat greater length of the drum portion **12** as compared to the web width, the extreme ends of the drum are not covered. This leaves room for reception of the end caps **19**. These have a center bore **20** through which the shafts **15** and **16** projects and an annular flange **21** fitting over the exposed ends of the drum **12**.

The flange **21** has an inner diameter of two inches and a thickness of one inch in accord with the desired one inch wall thickness of the tubular insulation. The outer diameter of the flanged portion of the caps is four inches, the desired width of the insulating product. However, the fibrous stock is inclined to expand somewhat beyond the diameter of the caps as may be noted in regard to the wrapped unit **22** lying at the left end of the table of FIGURE 1. As there shown the wrapped mandrel with the caps in place is ready for final shaping and binder setting.

The apparatus for truing the cylindrical shape of the web wound upon the mandrel and for setting the binder which ties the fibers of the web together and integrates the laminations into the final insulating unit is shown in FIGURES 2 and 4. It is supported upon a frame including corner posts **23**, **24**, and **25** joined across opposite ends by cross members **28** and along one side by the longitudinal beam **30**.

Above the leg members is the housing **32** for the curing oven. The housing **32** has an upper hood section **34**, a closed back **36** and a pivoted front cover **37** serving as an access door. This cover **37** is hinged along its lower edge. Panels **38**, the leftmost one of which is removed from FIGURES 2 and 4 to reveal the interior of the housing, seal the ends thereof. The bottom of the housing is defined by a plate **41**.

Immediately above plate **41** are two parallel stell rollers **44** and **45** of like dimensions. Roller **44** is mounted for rotation with its end axles **46** journalled in pillow blocks **48**. The latter are fixed upon angle irons **50** set across opposite ends of the housing **32**. Roller **45** is supported for rotation with its end axles **53** in bearing blocks **55**. These blocks **55** are fitted for horizontal adjustment between the upper and lower bars **57** and **58** of rectangular guideways **60**.

The roller **45** may be positioned closer or farther away from roller **44** by sliding movement of the blocks **55** in the guideways **60**. This movement of each block **55** is secured through rotation of a screw **62** which is threaded through the end member **64** (part of frame corner post **24**) of the rectangular guideway **60** and carries a nut **65** locked upon the screw. Nut **65** sets within a cross slot in the block **55** and by bearing against the sides of the slot forces the block to follow the axial travel of the screw **62**. The outer end of screw **62** has a square cross section for reception of a turning wrench. By moving the block **55** at each end of the roller a like distance the roller **45** may be maintained in parallel relation with roller **44**.

The spacing between rollers **44** and **45** is set to receive the particular size of pipe insulation and mandrel involved in the manufacturing schedule. The mandrel and the wrapped fibrous glass body with which it is loaded forming the unit **22** is delivered to its straddling position upon and between the rollers **44** and **45**, from a pair of holders **68** upon the side closure **37**. Because of the binder curing heat within housing **32** and the cumbersome dimensions and weight of the loaded mandrel, full hand introduction into the housing is undesirable.

For this reason the loaded mandrel **22** is first placed in holders **68** which are mounted on the inner side of door or closure **37** and project upwardly therefrom when the closure is tilted to its horizontal open position. Each of the holders includes a strap **72** with a slot **73** into which an end shaft of the mandrel fits. As all the mandrels have the same shaft diameter a slot of a single width will accommodate all sizes of mandrels. The straps **72** of the holders are pivotally supported upon brackets **75**. Each strap is held in an upright position slightly inclined from the perpendicular upon the opened closure **37** through a rod **80** fastened to strap **72** and projecting through an aperture **83** in clousre **37**. The rod is adjustably fixed to the closure **37** by nuts **84** and **85**.

By pushing rod **80** or by lifting the door **37** the associated straps **72** are forced inwardly and carry the loaded mandrel **22** over and down into position between the rollers **44** and **45**. Upright stop posts **86** prevent the mandrel axles from sliding or rolling out of the slots in the straps before the loaded mandrel comes to rest with the pipe covering and the end caps or collars **19** in contact with the rollers. The closure **37** through its connection with the straps swings therewith toward its closed position, while following the entering movement of the mandrel. Upon arrival of the loaded mandrel **22** between the rollers the latter are set in rotation by motor **90** and its chain connection **91** between sprocket **92** and sprockets **93** and **94** on the end axles of the rollers.

The nuts **84** and **85** fixing the closure **37** on the rods **80** must, of course, be adjusted to allow the loaded mandrel to be deposited upon the rollers **44** and **45** before the closure **37** reaches its final closed position. Accord-

ingly, at least a portion of the weight of the closure rests upon the ends of the mandrel through rods 80 and the straps 72. The loaded mandrel is thus held more firmly against the rollers.

For the initial part of this rotation air flow into the housing is restrained by prior closing of the supply piping 95 by inward sliding of the gate 96. This movement of the gate is accomplished automatically upon the preceding opening of the access door or closure 37 through the thrust of the closure against the arm 97 of the angled rod 98 which is pivoted at 99. The lower leg of the arm passes through a ring or eye 100 at the outer end of the handle 101 which is rigidly secured to the gate 96. The forced swinging of the leg moves the gate 96 inwardly.

The caps 19 support the loaded mandrel unit upon the rollers 44 and 45 and holds the mandrel axially centered within the wound casing. The rollers are hot from heat within the housing and from heat carried by hot air previously forced upwardly between them.

In the preliminary rotation of the rollers and the loaded mandrel unit 22 thereon the rollers impress the bulging fibrous glass stock inwardly in line with the periphery of the caps 19. While the stock is in this truing and smoothing contact with the hot rollers, heat is transferred to the binder in the surface portion of the wrapped fibrous stock and the binder is almost instantaneously set to retain the stock in cylindrical configuration.

The mandrel being carried by the caps 19 upon the rollers 44 and 45 does not bear against the wrapped form of the fibrous glass but does act as a core to establish the inner cylindrical passage within the casing being produced. In this initial treatment the end flap 18 of the wound web is laid evenly in place and adhered to the underlying web portion. Also the full surface of the casing is smoothed and toughened by the transferred heat. This preliminary curing requires only a fraction of a minute during which the mandrel may make fewer than ten revolutions.

By opening gate 96 hot air at high velocity for delivering curing heat to the binder within the main body of fibrous glass is then permitted to reach the insulation body from manifold 102 placed below the chamber. This manifold as illustrated in FIGURE 3 has an elongated outlet 103 from which the heated air is guided in a positive path by the wings 104 and 105 of an upward extension of the outlet. The wing 104 is fixed in a stationary position with its top border line lying close to the cylindrical surface of the roller 44. Wing 105 is hinged along its lower edge permitting this wing to be swing by the pull rod 107 to a position closely adjacent roller 45 in whatever spacing from roller 44 it may be set. A pair of triangular fins 109 projecting from the ends of the wing 105 in association with flanges 110 on wing 104 close the openings between the ends of the wings.

The heated air reaches manifold 102 through the supply piping 95 from blower 114. Air is drawn to blower 114 through piping 118 from the hood 34. A gas heating unit 119 within the hood maintains the air at the desired elevated temperature, usually in the range between 375° and 475° Fahrenheit.

A combustible mixture of gas and air reaches the burner unit 119 through supply piping 120. The transfer of radiant heat from the burner flames to the wound casing is reduced by the interposed baffle 121. This baffle also shields the burner from the effect of the fast moving air stream.

In the air circuit, substantially the same air continues to be heated by unit 119 and to transfer the heat to the pipe insulation. The air is preferably freshened and freed sufficiently of fumes by allowing a small proportion which may amount to ten to fifteen percent to escape out the exhaust branch 122 as controlled by damper 123, and by adding a like increment of new air through inlet 124 in piping 118.

By placing the venting branch 122 with its adjustable damper in the piping on the outlet side of the blower 114 and just preceding the gate 96, the outward rush of hot air at the initial opening movement of the access door 37 is brought under partial control and may be moderated.

Instead of being forced to follow a constricted path endwise through the hollow mandrel the heated air is directed crosswise up through the full length of the wraped casing. This permits the air to be utilized in high volume. Accordingly, a greatly increased amount of heat may be transferred to the casing stock. Also because the passage for the air is confined by the rollers and the wings of the manifold outlet the air may be forced to flow at high velocity into the fibrous unit.

The protective skin provided the casing by the preliminary curing of the binder in the surface areas protects the fibrous glass stock from the disruptive effect which high velocity air ordinarily possesses. For this reason ruffling or rippling of the surface material, or loosening of the end flap 18 of the wound web does not here occur.

At the same time, with the continued rotation of the wrapped casing the moving air with the conveyed heat reaches uniformly through the body of the casing. The contact of the rollers still acts to create a product symmetrically cylindrical and with the desired outside dimensions by holding the fibrous mass in line with the cylindrical contour of the supporting end caps 19.

For best results the blower 114 and the associated piping should have a capacity in air volume and pressure to deliver air between the rollers and against the insulated casing at a minimum velocity estimated at fifty feet per minute. This low limit should, however, be only in effect with the rollers 44 and 45 separated a maximum degree to receive the largest size of insulation casings.

Where the rollers are placed closer together to hold smaller casings the velocity of the air striking the held casing would be proportionately higher and may be as high as several hundred feet per minute. This variation in the speed of the air movement is to be expected where a single apparatus is utilized for products of different dimensions. Where it is commercially feasible to install equipment for insulating casings of one size only the highest velocity of air may then be provided.

The force of the air movement propels it into the casing body with its path only slightly diverted by the rotation of the body on the mandrel. This rate of rotation is relatively so slow that the air moves in an even fanning pattern into the insulating casing with some portions of the air issuing from the casing at the sides thereof above the rollers and other portions entering the hollow center section of the mandrel and travelling from there radially to the surface of the wrapped casing.

Bypassing of the air flow in paths adjacent to the contact areas between the casing and the rollers does not occur to a serious degree as the toughened cured surface layer of the casing presents considerable resistance to such air flow. As this crust is most easily penetrated by air moving normal thereto, the air is induced to enter straight into the casing along lines later diverging to reach the exterior of the casing.

The amount of curing air that is thus forced to pass transversely through the casing body may be estimated to average at least twelve times the volume that may be directed through it when the air must enter or leave axially of a hollow mandrel. It thus may be easily understood how the subject apparatus and method will cure the binder of the wrapped casings many times faster and more effectively than have the prior devices.

Using a moderate temperature best adapted to properly cure the binder whereby its adhesive properties and durability are most thoroughly developed and with a medium rate of air flow, a section of insulating casing may be cured with the subject apparatus and method in a period

ranging somewhat upwardly, for units of large dimensions, from two to three minutes. This compares to at least twenty to thirty minutes required in older procedures. With high velocity air travelling at the speed of three hundred feet per minute and delivered under pressure equivalent to four or five inches of a water column, the curing time of the present system may be brought down as low as twenty to thirty seconds.

After the required curing interval the mandrel and insulation casing are removed from the oven. This is accomplished by outwardly swinging the access door or closure 37 to its horizontal open position. The loaded mandrel is raised and carried in the slotted straps with the opening movement of the door and then is easily lifted therefrom to be replaced with an uncured unit. The opening of the closure 37 through angled rod 98 closes the gate 96 from the air conduit 95 and thus prepares for the first rotation without air flow of the subsequent loaded mandrel.

Following extraction of the mandrel from the cured casing the ends of the latter may be trimmed and the casing slit lengthwise should it be intended as pipe covering.

It may be desirable in some circumstances to direct the air flow downwardly, diametrically through the insulating unit instead of upwardly; or it may be found unnecessary to rotate the rollers during the curing of certain types of units. In such alternate arrangements the rollers would still serve in defining between them a portion of the confined, definite path for the air directed laterally through a fibrous unit placed thereon.

In summary, it may be noted that the advantageous features of this invention include the use of a hollow mandrel having a standard size of solid end shaft whatever may be the dimensions of the drum section 12 of the mandrel and of the insulating units. This greatly facilitates the handling of the loaded mandrels. The provision of end caps of a diameter of the finished tubular insulating units provides cylindrical surfaces for accurate shaping of the casing units during both the preliminary skin curing and the final full curing. The caps further support the mandrel upon the rollers and thus prevent the weight of the mandrel from bearing upon the compressible insulating bodies.

The first setting of the surface of the casings enables high velocity curing air to be later directed against them without disrupting the surface stock. The direction of high velocity air in a confined path laterally against the full length of the insulating units greatly expedites the curing operation. During the full curing procedure each casing is rotated and held in the same location upon the revolving rollers.

The arrangement of the slotted straps 68 and associated parts provides a most convenient method for introducing and removing loaded mandrels from the oven 32.

While for purposes of illustration, particular specifications have been referred to in describing the fibrous glass material, the insulating units, the air velocity and the structure of the apparatus, such figures and data should be taken as examples only, as the invention is of course adaptable to conditions and elements of other specifications and characteristics.

We claim:

1. Apparatus for curing the binder of a cylindrical unit of fibrous glass including a mandrel upon which the cylindrical unit is axially mounted, said mandrel being closed at its ends but laterally ported for the passage of heated air transversely therethrough, a pair of rollers arranged in parallel and spaced positions adapted to receive and support lengthwise between them a cylindrical unit of fibrous glass, means providing a fully confined path for heated air, said path terminating between and in immediate proximity to the rollers, and means directing heated air at a velocity of at least fifty feet per minute along said path laterally into and through a cylindrical unit of fibrous glass supported between the rollers and through the ported mandrel upon which the cylindrical unit is mounted, and motivating elements rotating the rollers and thereby rotating a cylindrical unit supported between the rollers.

2. Apparatus according to claim 1 in which the means providing a fully confined path includes an air manifold extending below the rollers for substantially the full length thereof, and an elongated outlet from the manifold terminating close to the lower surfaces of the rollers.

3. Apparatus according to claim 2 in which there are adjustable means for varying the distance between the rollers and means for varying the width of the elongated outlet to maintain the outlet in close terminating relation with the rollers.

4. An apparatus according to claim 2 in which a first roller of said pair of rollers is in a fixed location and a second roller of said pair of rollers is mounted for slidable movement toward the first roller and the elongated outlet has a first longitudinal side stationarily set with its upper edge in approximate contact with the first roller and has a second longitudinal side hinged along its lower edge whereby it may be swung in following movement in relation to the second roller.

5. An apparatus according to claim 4 in which one of the longitudinal sides has fins at the ends extending across in planes just clearing the ends of the other side, whereby the end openings between the sides are closed.

6. Apparatus for applying curing heat to the binder of cylindrical units of fibrous glass mounted upon mandrels which have end shafts projecting from the ends of the cylindrical units, said apparatus including a normally closed oven, means including a blower and a heating element for supplying binder curing heat to the oven, means within the oven for holding a mandrel upon which a cylindrical unit of fibrous glass is mounted, an access door on the oven mounted for pivotal swinging from its lower edge to a horizontal open position, a pair of slotted holders fixed upon the normally inner face of the door and which project upwardly therefrom when the door is in its open, horizontal position, said slotted holders, when the door is in open position, adapted to receive the end shafts of the mandrel and thus support the mandrel and the cylindrical unit of fibrous glass, said holders adapted to continue this support while the door is swung upwardly toward its closed position, and to deposit the mandrel and the cylindrical unit upon the means for holding the mandrel within the oven as the door reaches its closed position.

7. Apparatus for curing the heat curable binder of a cylindrical, porous unit of fibrous glass including a mandrel upon which the cylindrical unit is axially mounted, said mandrel being closed at its ends but laterally ported for the passage of heated air transversely therethrough, support means adapted to horizontally receive said mandrel with a cylindrical unit of fibrous glass thereupon, means providing a fully confined path for heated air, said path terminating with a rectangular outlet extending lengthwise of and in immediate proximity to the underside of a cylindrical unit mounted upon said mandrel on said support means, and a blower directing heated air, for curing the binder, along said path laterally into and upwardly through the cylindrical unit of fibrous glass and the ported mandrel.

References Cited in the file of this patent

UNITED STATES PATENTS

2,331,146	Slayter	Oct. 5, 1943
2,428,653	Collins	Oct. 7, 1947
2,469,597	Guigas	May 10, 1949
2,545,030	Isenberg et al.	Mar. 13, 1951
2,778,759	Stephens et al.	Jan. 22, 1957
2,979,765	Stephens et al.	Apr. 18, 1961

FOREIGN PATENTS

327,326	Great Britain	Apr. 3, 1930