Nov. 12, 1974 F. W. SCHAEFER 3,848,034

METHOD OF APPLYING REFRACTORY COVERING TO SKID RAIL

Filed June 7, 1972

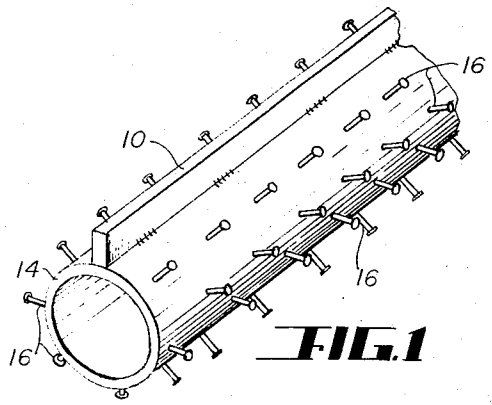


FIG. 1

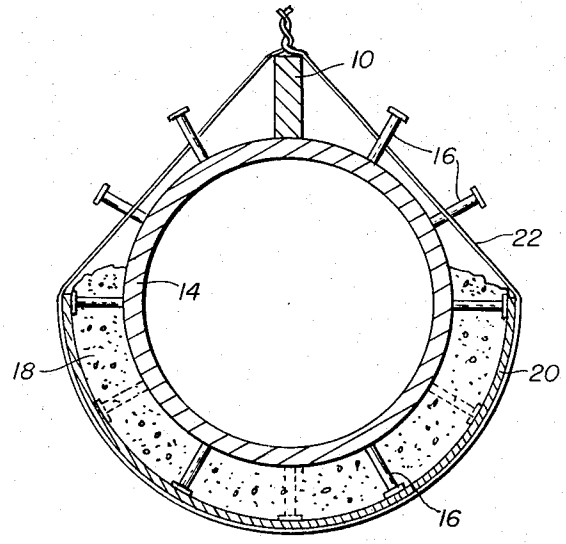


FIG. 2

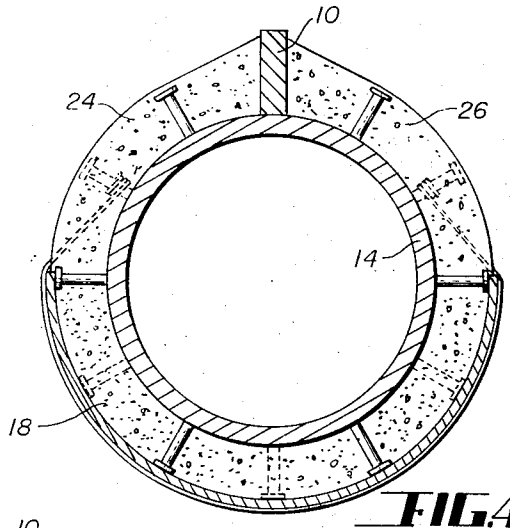


FIG. 4

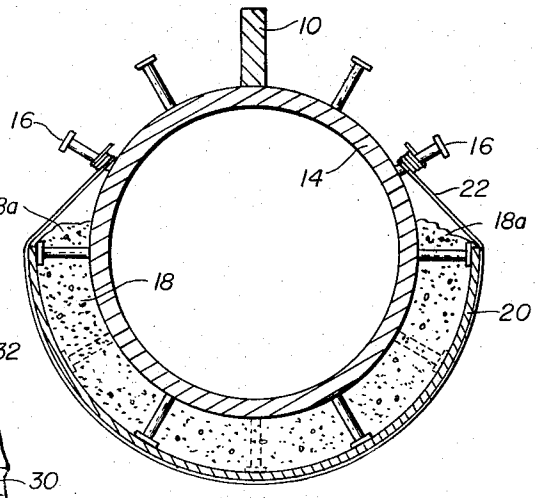


FIG. 3

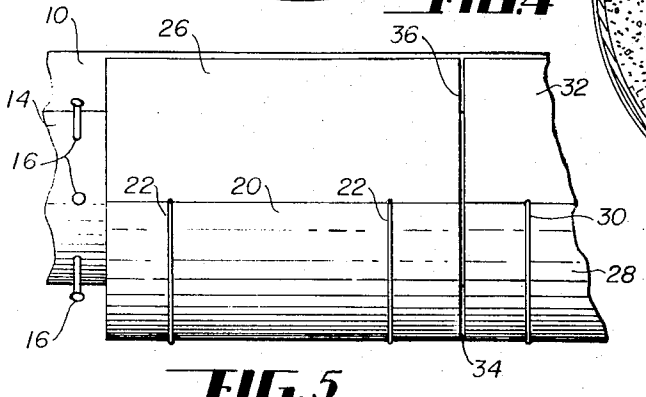


FIG. 5

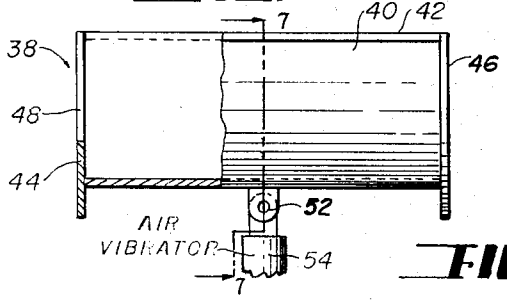


FIG. 6

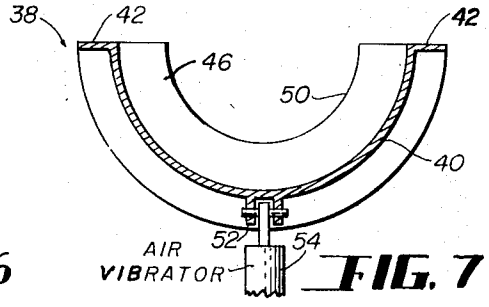


FIG. 7

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3,848,034

METHOD OF APPLYING REFRACTORY COVERING TO SKID RAIL

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U.S. Cl. 264—30 2 Claims

ABSTRACT OF THE DISCLOSURE

The undersides of sections of horizontal pipes in heat treating furnaces are covered with refractory insulation material by a molding process. An air vibrator is used to agitate the refractory material mix as the mold is advanced toward the pipe. A liner is used to retain the mix against the pipe as it hardens, whereupon the rigid part of the mold may be immediately reused. The areas of the pipe left exposed are then covered in any suitable fashion such as by troweling.

BACKGROUND OF THE INVENTION

This invention relates to a pipe insulation method and more particularly to the molding of castable refractory material to horizontal water cooled pipes for use in heat treating furnaces.

Several methods have been developed to provide insulation for water cooled pipes used in heat treating furnaces. For example, the following U.S. patents disclose such processes: 2,022,649; 2,436,452 and 2,693,352. Also pertinent to the general problem of applying coverings to pipes or the like are U.S. Pats. 2,150,830 and 3,020,618.

The known processes are not entirely satisfactory. Processes in which a refractory material mix is applied directly to the pipes and permitted to harden in place have not been generally used because of the difficulty in applying the refractory material to the undersides of the pipes. The use of molds has not been accepted, apparently because of the expense and long furnace down time required.

Until this invention, the preferred procedure for insulating the pipes involved the use of precast refractory material since precast material can be applied to the pipes in a relatively short time. However, precast material is quite expensive. Also, some difficulty has been encountered with the life of precast insulation, apparently due to the fact that an embedded wire mesh is used to anchor the precast material and the wire mesh either provides an insufficient anchor or there is inadequate cooling of the wire mesh material since much of it is insulated from the water cooled pipe it surrounds.

SUMMARY OF THE INVENTION

In accordance with this invention, cooling pipe can be insulated substantially as fast as it can be using precast materials. Suitable metal anchors are connected to the pipe, the anchors thus being cooled and failures thereby minimized. A mixture of refractory material and water is loaded into a substantially semi-cylindrical mold assembly including a rigid form and an inexpensive, flexible liner on the inside face of the form.

As the mold assembly is advanced toward a section of the pipe, the mix is agitated by a vibrator attached to the form. The anchors, therefore, do not impede the movement of the mold assembly toward the pipe. As soon as the mix is in intimate contact with the pipe, the vibration is stopped and the liner is secured to the pipe as by wires and the form removed so that the process may be repeated upon an adjacent section of the pipe. Thereafter the upper portion of the pipe may be insulated by troweling the refractory material thereon.

An inexpensive form suitable for use in the method may consist of a piece of sheet material formed as a semi-circular trough against which the liner is laid. End plates connected to the ends of the trough are provided, the end plates having axially aligned semi-circular recesses with diameters matching the pipe diameters. An air vibrator can conveniently be attached to the center of the underside of the trough.

Utilizing the aforedescribed method and mold assembly two workmen can rapidly and efficiently cover a length of pipe with insulating material. Because liners are used to support the refractory material once it is in place on the pipe, there is only one form needed and the workmen are not delayed while waiting for the refractory material to harden.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a portion of pipe and a skid rail such as is common in heat treating furnaces. The portion of pipe in FIG. 1 is shown provided with anchoring studs.

FIG. 2 is a cross sectional view of the pipe of FIG. 1 and a liner supporting refractory material covering approximately the lower half of the pipe.

FIG. 3 is a view similar to FIG. 2 but showing an alternate mode of attaching the liner to the pipe.

FIG. 4 is a view similar to FIG. 3 after insulating material has been troweled onto the upper portions of the pipe.

FIG. 5 is a side elevational view of the pipe of FIG. 4 shown partially insulated.

FIG. 6 is a side elevational view, with parts broken away and in cross section, of a form in accordance with this invention.

FIG. 7 is a transverse sectional view of the form of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, a portion of a skid rail **10** is illustrated welded to the top of a horizontal pipe **14** through which coolant water is pumped. In order to anchor refractory material to the pipe **14**, plural anchors in the form of headed studs **16** are welded to the outside of the pipe **14**. The particular form of studs **16** is unimportant to this invention. For example, pairs of hook-like studs are commonly used for anchors and could be used for this purpose instead of the headed studs **16**.

In accordance with this invention, the lower, approximate one-half of a section of the pipe **14** is first covered with a mixture of refractory material and water such as that illustrated at **18** in FIG. 2. While the refractory material is drying, thus hardening, it is supported by a sheet of cardboard or other flexible, inexpensive liner material **20** secured to the pipe **14** by one or more wire strands **22** extended around the pipe and over the top of the skid rail **10**. As an alternative, which would be used whenever slabs or the like are supported by the skid rail **10** while the pipe **14** is being covered by refractory material, the ends of the wire strands **22** may be twisted about conveniently accessible studs **16**. Such mounting of the liner **20** is illustrated in FIG. 3.

The liner **20** must be sufficiently stiff to retain the mass of refractory material mix against the pipe **14** and in surrounding relation to the studs **16**. Very stiff cardboard, however, is undesirable because it is heavy and difficult to use in the molding or casting operation which will be described below. Ordinary cardboard or the like material can easily be formed to the desired contour, that is the semi-circular shape illustrated, and because of the cohesive nature of the refractory mix cardboard is sufficient to support the mix after it is secured by the wires **22** to the pipe **14**.

Mixtures of refractory material and water suitable for insulating pipes in heat treating furnaces are typically highly viscous and have a low slump similar to concrete mixes. The anchoring studs **16** are essential to retaining the refractory material after it hardens since the hardened material is quite brittle. Any form of anchor, however, presents a problem in that anchors act as abutments preventing the highly viscous refractory mix from being moved into engagement with the surface of the pipe.

The problem presented by the anchors blocking the application of the mix to the underside of the pipe is overcome by agitating the refractory mix as it is being applied. The liner **20** is located in a form **38** to produce a mold assembly. The form **38**, which is described in detail below, is provided with a high speed vibrator **54**. The mold assembly thus formed is loaded with the refractory mix. As the loaded mold assembly is advanced toward the pipe, the vibrator **54** is energized to agitate the mix. During such agitation or vibration of the mix, the cohesive nature of the mix is apparently so diminished that the form **38** loaded with the mix can be moved toward the pipe **14** during the period of vibration as if there were no anchoring studs **16**. It is believed that the vibration or agitation may also hasten the hardening process because it tends to drive the water out of the mix. As soon as the mold assembly and the refractory mix are placed firmly against the pipe, the vibrator **54** is de-energized. The wires **22** are then secured to the pipe as previously described. As illustrated in the drawing, it is believed that the agitation of the mix averts the formation of air pockets which otherwise might form in the vicinity of the studs **16**.

In practice, after refractory material has been applied to the underside of the first section of pipe **14** and the liner **20** fastened in place to the pipe, refractory material would be applied in the same manner to the underside of a second, adjacent section of pipe, the process being repeated until the refractory material has been applied to the underside along substantially the entire length of the pipe. A new liner is used for each section of pipe, the liner previously used being left in position to permit the mix of refractory material to harden in situ.

Thereafter the upper portions of the pipe **14** between the skid rail **10** and the ledges, designated **18***a*, formed by the exposed upper ends of the molded refractory material **18** are covered with refractory material as indicated at **24** and **26** in FIG. 4. Preferably the portions of refractory material at **24** and **26** are simply troweled onto the portions of the pipe **14** uncovered by material **18**.

FIG. 5 shows a length of pipe **14**, sections of which have been completely insulated. One end of the pipe in FIG. 5 is shown uncovered so that the relationship of the insulating material to the pipe may be better understood. As noted above, however, the preferred practice would be to first completely cover the lower half of the pipe before covering the upper half. In FIG. 5 it will be noted that the wires **22** and the liner **20** are left in place. These elements will usually be burned off when the heat treating furnace is in operation.

The middle section of the pipe **14** illustrated in FIG. 5 has been covered with refractory material in the manner described above. The adjacent section to the right in FIG. 5 is covered by supporting wire **30**, a liner **28**, and refractory mix **32**, and refractory material supported, and hidden, by the liner **28**. It will be noted that the two liners **20** and **28**, and accordingly the refractory mix supported thereby, are separated by a gap **34**. A similar gap **36** is formed between the upper portion of material **26** and **32**. The gap **34** is formed by the form **38** used in applying the refractory material to the lower half of the pipe. The gap **36** may be formed by routing out the mix with the edge of a trowel. These gaps, which are aligned transversely of the pipe and between each section, serve as expansion gaps to prevent damage to the substantially inelastic, hardened refractory by permitting flexure of the pipe **14** which typically results from the weight of the slabs to be supported by the skid rails **10**.

The form **38** illustrated in FIGS. 6 and 7 consists of an elongate open ended U-shaped trough **40**, which determines the contour of the insulating covering and which is made from relatively rigid sheet material or the like having outwardly and longitudinally extending side flanges **42** along its upper edges. Connected to the ends of the trough are identical end plates **44** and **46**. The upper margins of the end plates **44** and **46** have semi-circular recesses designated **48** and **50**, respectively, which have substantially the same radius as the radius of the outside of the pipe to which the refractory material is to be applied. The spacing between the recesses **48**, **50** and the upper face of the trough **40** determine the depth or thickness of the refractory material to be applied to the pipe. Of course some allowance must be made for the liner **20** which is laid into the trough over wire strands **22** for the reasons already described.

The air vibrator **54** is connected, as by a clevis **52**, to the center of the underside of the trough **40** for vibrating the form **38** and thus agitating the mix **18** as described above. The vibrator **54** must be capable of vibrating the substantial mass of the form **38** and the refractory mix loaded therein at a relatively high vibrational speed. Air vibrators for this purpose are commercially available. For example, vibrators sold under Model AC, capable of operating at approximately 8000 vibrations per minute are useful for this purpose and may be obtained from Cleveland Vibrator Company, 2828 Clinton Ave., Cleveland, Ohio 44113. Such vibrators come in various sizes. For a given application the size would depend upon the mass of the form and the refractory material mix. These factors are in turn dependent upon the diameter of the pipe and the depth of the insulating covering desired.

Any of various refractory compositions may be used in the practice of the process described above. High alumina refractory material such as a product sold under the trade designation "Plicast 995" by the Plibrico Company, 1800 Kingsbury St., Chicago, Ill. 60614, is one usable material. The depth or thickness of the insulating layer applied by this process is not critical. A typical thickness would be 1½" on a 5" diameter pipe. Preferably the refractory insulation will be essentially the same depth as the length of the anchors and optionally may cover the anchors. The width of the gap **34** is determined by the thickness of the end plates **44**, **46**. The width is optional; ⅛" for 1½" thick refractory is acceptable.

Although the presently preferred method and apparatus of this invention have been described, it will be understood that various changes may be made within the scope of the appended claims.

Having thus described my invention, I claim:

1. In a method of applying low slump refractory material to form an insulating covering on a length of substantially horizontal skid rail cooling pipe having anchoring structure projecting therefrom, the molding of a first section of refractory material in situ around a lower portion of predetermined length of said cooling pipe in surrounding relation to at least a portion of said anchoring structure including the steps of taking a substantially rigid form having a trough, laying a sheet of flexible material against the upper face of said trough, placing the refractory material mix in said trough, advancing said form toward said length of cooling pipe to bring the refractory material mix into engagement with said portion of said anchoring structure, vibrating said form at relatively high speed to permit said form to be easily moved toward said length of cooling pipe and to cause said refractory material mix to completely surround said portion of said anchoring structure, moving said form toward said length of pipe until the refractory material mix is engaged therewith, securing said sheet to said length of cooling pipe, and removing said form whereby said

refractory material mix is permitted to continue to harden while held by said sheet, whereby all of the aforementioned steps may be repeated on adjacent lengths of cooling pipe using said form.

2. The method of claim 1 wherein said flexible material is connected to said length of cooling pipe by a wire laid between said form and said flexible material when said flexible material is first placed on said trough, the ends of said wire being connected alternatively either to themselves and around the pipe or to spaced portions of said anchoring structure.

References Cited

UNITED STATES PATENTS

1,910,594	5/1933	De La Mare	264—35 X
3,020,618	2/1962	Eward	264—35
3,587,198	6/1971	Hensel	264—30 X
3,217,617	11/1965	Wiswell	264—338 X
3,328,500	6/1967	Barnette	264—275 X
2,667,664	2/1954	Furell	264—72
2,295,420	9/1942	Moore	264—262 X
2,693,352	11/1954	Bloom	264—32 X
3,646,181	2/1972	Galla	264—245 X
1,941,299	12/1933	Greenidge	425—127
2,700,810	2/1955	Garni	264—71 X

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U.S. Cl. X.R.

264—32, 33, 35, 71, 262, 263, 274, 316, 317, 338; 432—3, 234