Dec. 11, 1956 M. S. BURK 2,773,512

METHOD OF INSTALLING UNDERGROUND HEATING PIPE SYSTEMS

Filed June 14, 1955 2 Sheets-Sheet 1

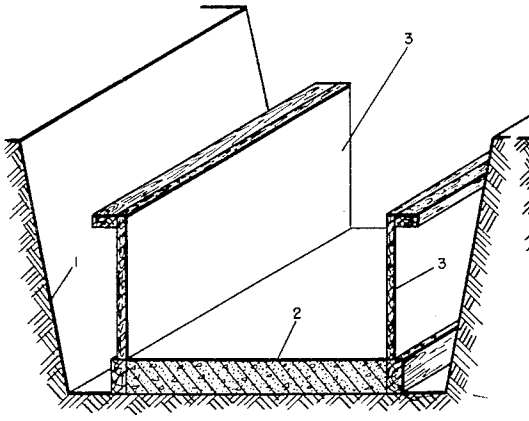


FIG. 1

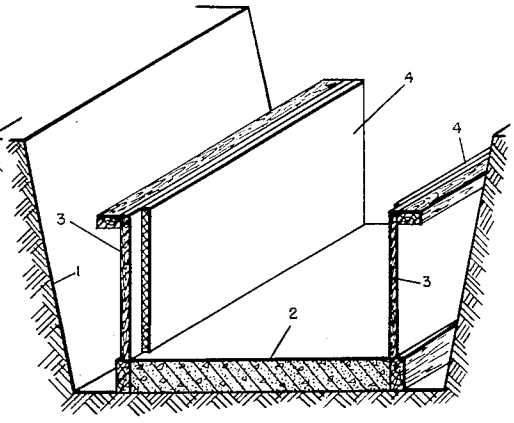


FIG. 2

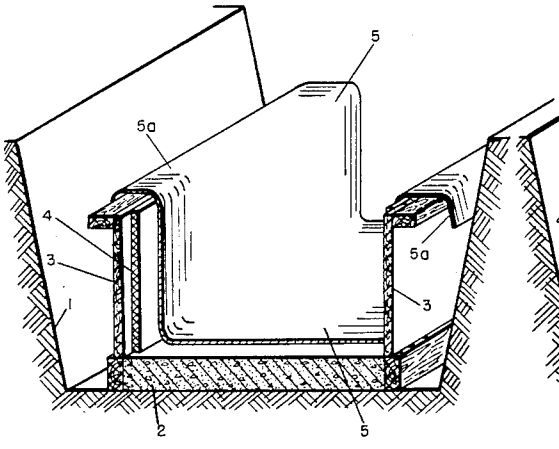


FIG. 3

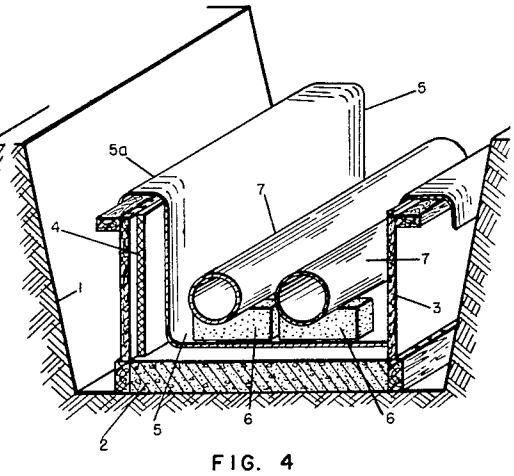


FIG. 4

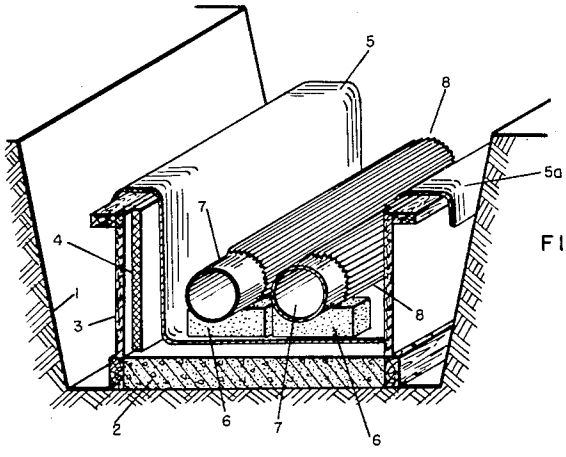


FIG. 5

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METHOD OF INSTALLING UNDERGROUND HEATING PIPE SYSTEMS

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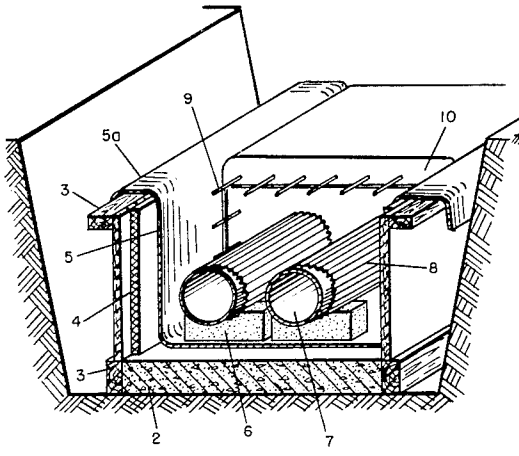


FIG. 6

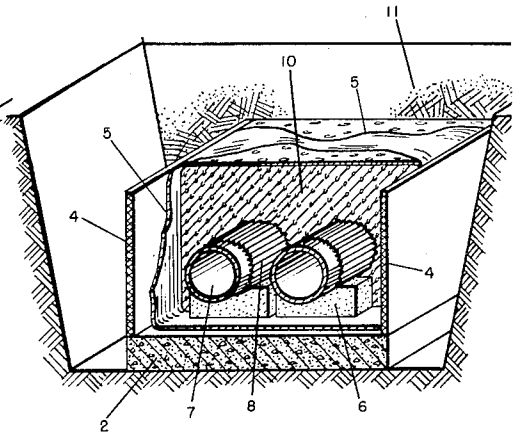


FIG. 7

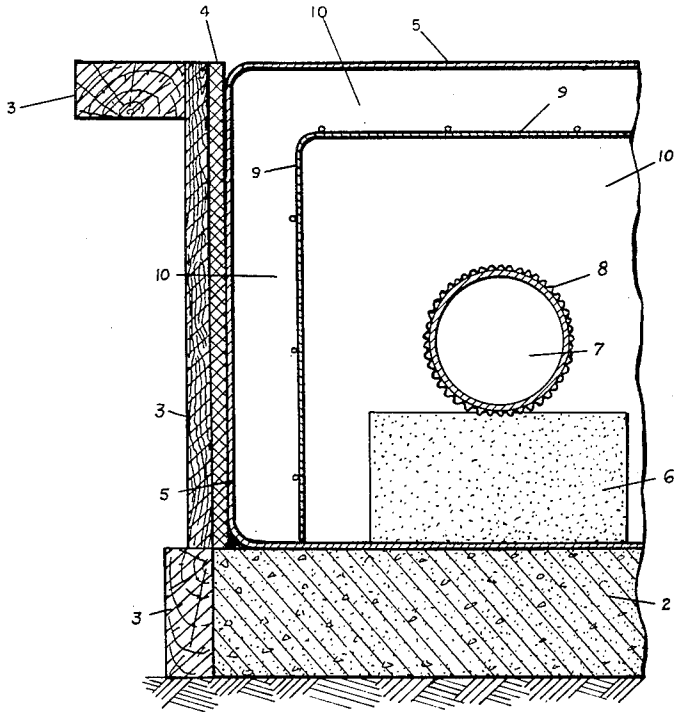


FIG. 8

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METHOD OF INSTALLING UNDERGROUND HEATING PIPE SYSTEMS

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Application June 14, 1955, Serial No. 515,349

7 Claims. (Cl. 138—48)

The present invention relates to systems for underground transmission of fluids and more specifically to underground lines for heating systems and to the methods of installation of such heating system.

There has been considerable effort hertofore made toward developing a satisfactory method of installing underground transmission pipes, and possibly the best of these prior methods are disclosed in U. S. Patent No. 2,355,966 to D. C. Goff on August 15, 1944, and in U. S. Patent No. 2,663,323 to L. E. Thomas on December 22, 1953.

Present developments in the heating field now tend toward the use of high-temperature hot-water under-pressure in place of the steam predominantly used in the past. These systems utilize water with temperatures around 400° F. and pressure of about 250 pounds. With these extremely high temperatures in and immediately adjacent to the pipes, the problem of water-proofing the insulating concrete distribution systems assumes a much greater importance than with past systems where the temperatures were much lower. The Goff system, which has had considerable usage with a fair amount of success in connection with steam distribution, has fallen far short, if not failed entirely, when used with the high-temperature high-pressure system described above. This failure stems principally from the fact that it was extremely difficult, if not impossible, to completely and properly waterproof an installation made in accordance with Goff's invention. The reason for this difficulty is the fact that the insulating concrete must be poured and allowed to cure and dry for quite a considerable period of time before the waterproof covering of tar or asphaltic felt can be applied to the sides of the insulating concrete. During this curing period the insulating concrete is exposed in the bottom of the trenches to the action of atmospheric elements and gets covered with a film of dust and mud. This film, which is impossible to prevent or entirely remove, prevents a proper or complete bonding of the waterproofing layer to the sides of the insulating concrete. In addition, the operation of backfilling and tamping the earth in and around the waterproofed system presents the opportunity of tearing or damaging the thin waterproof membrane. Many leaks thus occur and when water infiltrates the insulating concrete and comes in contact with the 400° F. pipes, steam is instantly formed. This steam then further deteriorates the waterproof membrane over a considerable area and causes a breakdown of the system of insulation.

In the Thomas system, the insulating concrete blocks of the underground installation are also exposed to the elements before the sides of the waterproofing membrane can be completed, although the time interval of exposure is less than with the Goff system. However, the advantage that the Thomas system presents, namely, that of being able to work in freezing weather, is not an important one since the structural concrete base, which is also required in the Thomas system, would be entirely at the mercy of the elements. Under usual conditions, the Thomas system is both too slow and too costly to achieve widespread acceptance.

It is therefore an object of my invention to provide a completely sure and perfect waterproofing means for enclosing the concrete insulated high-temperature pipe distribution system.

A further object of my invention is to provide protection for the special concrete used as insulation for the concrete-incased high temperature pipe distribution system until the concrete has achieved sufficient strength.

It is a further object of my invention to provide protection both for the waterproofing and the special insulation concrete during the backfilling and tamping of the trench excavation around same.

It is also an object of my invention to speed up and thereby make more efficient the installation of an underground insulated pipe system by eliminating the long period, previously necessary under other methods, for drying and curing the insulation before it could be waterproofed.

It is still another obect of my invention to provide an underground pipe installation which is fireproof and which will safely withstand temperatures up to 1,000° F. without causing deterioration of the waterproof membrane.

With these and other objects and features in view, the invention consists in the method of installation of underground conduits and in the construction and arrangement of the parts hereinafter more fully described. The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, wherein like reference numerals indicate like parts throughout the several figures and in which:

Figure 1 is an isometric view of a typical trench excavation with a structural concrete base slab in place and wood or metal side forms in position.

Figure 2 is a view similar to Fig. 1 but showing the fiberboard liner in place.

Figure 3 is an isometric view similar to Fig. 2 and showing the tar or asphalt and felt membrane hot-mopped in place and completed.

Figure 4 shows the piping in position on the insulating bearing blocks.

Figure 5 shows the additional step of having the pipes wrapped with corrugated paper or asbestos.

Figure 6 is an isometric view showing the insulating-concrete or cell-concrete filling the space between the side forms.

Figure 7 shows the next step wherein the side forms have been removed, the fiberboard liner remaining as a part of the waterproof membrane, and the membrane completed across the top of the insulating-concrete or cell-concrete, and

Figure 8 is a partial cross section on a much larger scale showing the forms, liner, membrane, insulating bearing blocks, corrugated wrapping, pipe, and insulating-concrete or cell-concrete.

Referring now to the drawings in detail and more specifically to Figs. 1–7, which illustrate in sequence the steps of installation of the underground heating pipe system, Fig. 1 shows the first steps in making my installation, a trench **1** is excavated to the proper depth and width. At the bottom of this trench, a base slab **2** is poured of structural concrete. Wood or metal side forms **3**, **3** are then erected on either side of the base slab **2** to the full height required for the pipe installation.

To the inside surface of the forms **3**, **3**, a liner **4** is then lightly attached, by tacking or by means of tape, as shown in Fig. 2. The liner **4** may comprise either a fiberboard or a body made of laminated tar or asphaltic

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impregnated composition material and can vary in thickness to suit conditions of the terrain. The liner generally varies from ¼" to 1" in thickness.

Base slab **2** is then flooded with hot tar or asphalt and the inside surface of the liner **4** is mopped with the same hot tar or asphalt. Two or more plies of tarred or asphaltic felt are mopped to the base slab **2** and liner **4**, in the usual manner, to form a membrane **5**, Fig. 3. Membrame **5** is extended loosely over the top portions of the forms **3**, **3** to provide overhanging portions *5a*, *5a*, for a purpose to be described later. The inside surface of the top layer of the tarred or asphaltic felt is then mopped with a final coat of tar or asphalt as is customary in waterproofing procedure.

Referring now to Fig. 4, bearing blocks **6**, **6** of insulating material are placed in position on top of membrane **5**, which membrane now covers the base slab **2**, and the pipe or pipes **7**, **7** are placed on said blocks. Any welding or fitting necessary to complete the line installation is done at this time. Next, the pipes **7** are covered with a layer of corrugated paper or asbestos **8**, as shown in Fig. 5. This paper or asbestos covering **8** may vary in thickness but should be at least ¼" thick all around the pipe **7**. If necessary, two or more layers of corrugated paper or asbestos may be used to constitute the covering **8**. The object of this covering is to provide sufficient space around each pipe to prevent the insulating concrete, to be later described, from tightly or solidly encasing the pipes; such an encasing would hinder or prevent proper longitudinal movement of the pipes during the normal expansion and contraction of said pipes which necessarily occurs in such pipe systems.

Referring now to Fig. 6, a wire-mesh reenforcement **9** of suitable length, size and shape, surrounding but not contacting the pipes **7** is put in place and the insulating media **10** is next poured or placed in the forms **3**, **3** in sufficient quantity and in a proper manner to completely fill the necessary space. The insulating media **10** may comprise: (*a*) any lightweight insulating concrete having proper thermal conductivity; (*b*) a chemically expanding cell-concrete; or (*c*) a cell-concrete made with preformed bubbles or foam.

When the insulating media **10** has set and dried, it bonds to the waterproof membrane **5** on the bottom and sides of the installation, thus providing a positive and permanent waterproofing for the insulating media **10**. Furthermore, as soon as the insulating concrete has been poured or placed inside the forms **3**, **3** it can be fully protected against the elements by placing a temporary covering across the top of the forms. The bottom and sides of the insulating media are already completely waterproofed as soon as poured or placed in the forms.

After the insulating media **10** has hardened sufficiently, the forms **3**, **3** are removed. The liner **4** remains in position by virtue of its being securely attached to membrane **5** by the hot-tar or asphalt mopping. The top surface of the insulating media **10** is now flooded with hot asphalt or tar and the overhanging portions *5a*, *5a* are then folded into this tar or asphalt and over the top of the insulating media **10**. The top surface then receives a final mopping with hot tar or asphalt, and the membrame **5** is then completed across the remaining area of the top of the insulating concrete **10**, thus completing the waterproofing of the underground installation on its all four sides, as shown in Fig. 7. The trench is then backfilled, as shown at **11** in Fig. 7, and properly tamped. During this final stage of the process, the liner **4** serves as a protection for the tar or asphalt felt membrane **5**, thus assuring a perfect waterproofing for the system upon its completion.

Fig. 8 shows a partial cross-section of the concrete slab **2**, side form **3**, liner **4**, asphalt felt membrane **5**, insulating bearing block **6** upon which rests pipe **7**, corrugated wrapping **8** for the pipe and insulating media **10** reinforced by the mesh **9**.

Thus, by the simple and practical method described, any number of conduits may be efficaciously and economically laid. Moreover, complete, sure and perfect waterproofing means is provided for enclosing the insulating concrete of the underground high-temperature, under pressure pipe distribution system. Also, proper protection for the waterproofing and the insulation concrete is provided by my novel method during the backfilling and tamping of the trench excavation around the installation.

Although a certain specific embodiment of the invention has been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What I claim is:

1. In the process of laying and heat-insulating one or more pipes for conducting heated fluid in a ground trench including laying a concrete base at the bottom of the trench, mounting one or more heat-insulated pipes longitudinally in said trench on said base and erecting form-members along and extended above said concrete base, the novel combination of steps of attaching a liner of asphaltic impregnated composition material to the form-members, applying a membrane of several plies of tarred felt to the concrete base and liner, pouring a heat-insulating concrete in the form provided by said base and form-members around and enclosing the pipes, allowing said insulating concrete to set and applying a waterproof cover on the top of the insulating concrete.

2. The novel combination of steps set forth in claim 1, and including the additional steps of extending the membrane to form overhanging portions over the liner and form-members before the insulating concrete is poured in place, folding said overhanging portions, after the concrete has set, over the top of the insulating concrete and then completing the waterproofing of the top of said concrete.

3. The novel combination of steps set forth in claim 2, and supporting said pipes in the trench above the concrete base on bearing blocks of insulating material.

4. The novel combination of steps set forth in claim 3, and covering said pipes with a layer of corrugated paper to permit for free lengthwise expansion and contraction of the pipes in the insulating concrete.

5. A method of installing underground conduit systems, which comprises forming a trench, laying a base of structural concrete at the bottom of the trench, erecting form members along either side of the base to the height required for the pipe installation, loosely attaching a liner of asphaltic impregnated composition material to the form-members, flooding the base with hot tar, mopping the exposed surface of the liner with tar, applying a membrane of two or more plies of tarred felt to the base and liner, laying lines of conduit longitudinally in the trench on the base, covering said lines of conduit with a layer of corrugated paper, placing light weight insulating concrete to completely enclose the lines of conduit, allowing said insulating concrete to set and harden, whereby said insulating concrete bonds to the waterproof membrane on the bottom and sides thereof, flooding the top surface of the insulating concrete with hot tar, applying a membrane of tarred felt to the top surface of the insulating concrete to complete the waterproofing of the insulating concrete, removing the form-members and backfilling the trench.

6. A method of installing underground pipe systems, which comprises forming a trench, laying a base of structural concrete at the bottom of the trench, erecting form-members along either side of the base, loosely attaching a liner of fiberboard to the form-members, flooding the base with hot tar, mopping the liner with tar, applying a membrane of several plies of tarred felt to the base and liner, extending said membrane to form overhanging portions

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over the liner and form-members, laying pipes longitudinally in the trench on the base, covering said pipes with a layer of corrugated paper, pouring light weight insulating concrete to completely enclose the pipes, allowing said insulating concrete to set and harden, whereby said insulating concrete bonds to the waterproof membrane on the bottom and side thereof, flooding the top surface of the set concrete with hot tar, folding the overhanging portions of the membrane over the top of the insulating concrete and completing the waterproofing of the remaining portion of the top of the insulating concrete.

7. In the process of laying and heat-insulating, in an open top ground-trench, pipe-means for conducting high-temperature under pressure fluid including laying a base of structural concrete at the bottom of the trench, mounting the pipe means on bearing blocks placed on said base and erecting form-members along the sides and extended above said base, the novel combination of the following steps: of attaching a liner of fiberboard to the form-members, flooding the base with hot tar, mopping the liner

with tar, applying a membrane of several plies of tarred felt to the base and liner, extending said membrane to overhang the liner and form-members, coating the pipe means with a layer of corrugated paper, pouring heat-insulating concrete to enclose the pipe-means, allowing the insulating concrete to set so that said concrete bonds to the waterproof membrane on the bottom and side of said concrete, folding the overhanging portions of the membrane over the top of the insulating concrete, flooding the top surface of said concrete with hot tar and completing the waterproofing of the top of the insulating concrete.

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