

[72] Inventor **Lawrence H. Chenault**
3840 West Thirteen Mill Road, Royal Oak,
Mich. 48072
[21] Appl. No. **836,264**
[22] Filed **June 25, 1969**
[45] Patented **Mar. 9, 1971**

FOREIGN PATENTS

404,826 1/1934 Great Britain..... 237/69

Primary Examiner—Edward J. Michael
Attorney—Harness, Dickey & Pierce

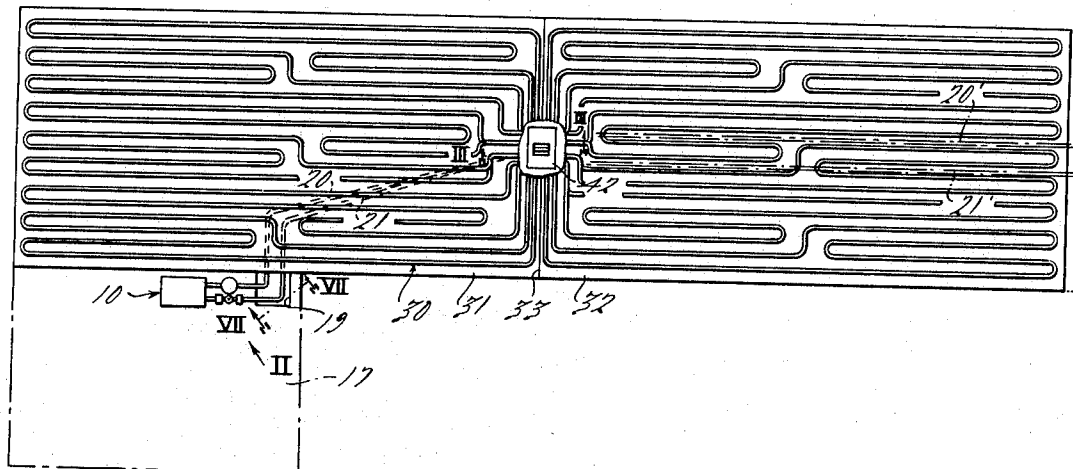
[54] SNOW MELTING SYSTEM 11 Claims, 7 Drawing Figs.

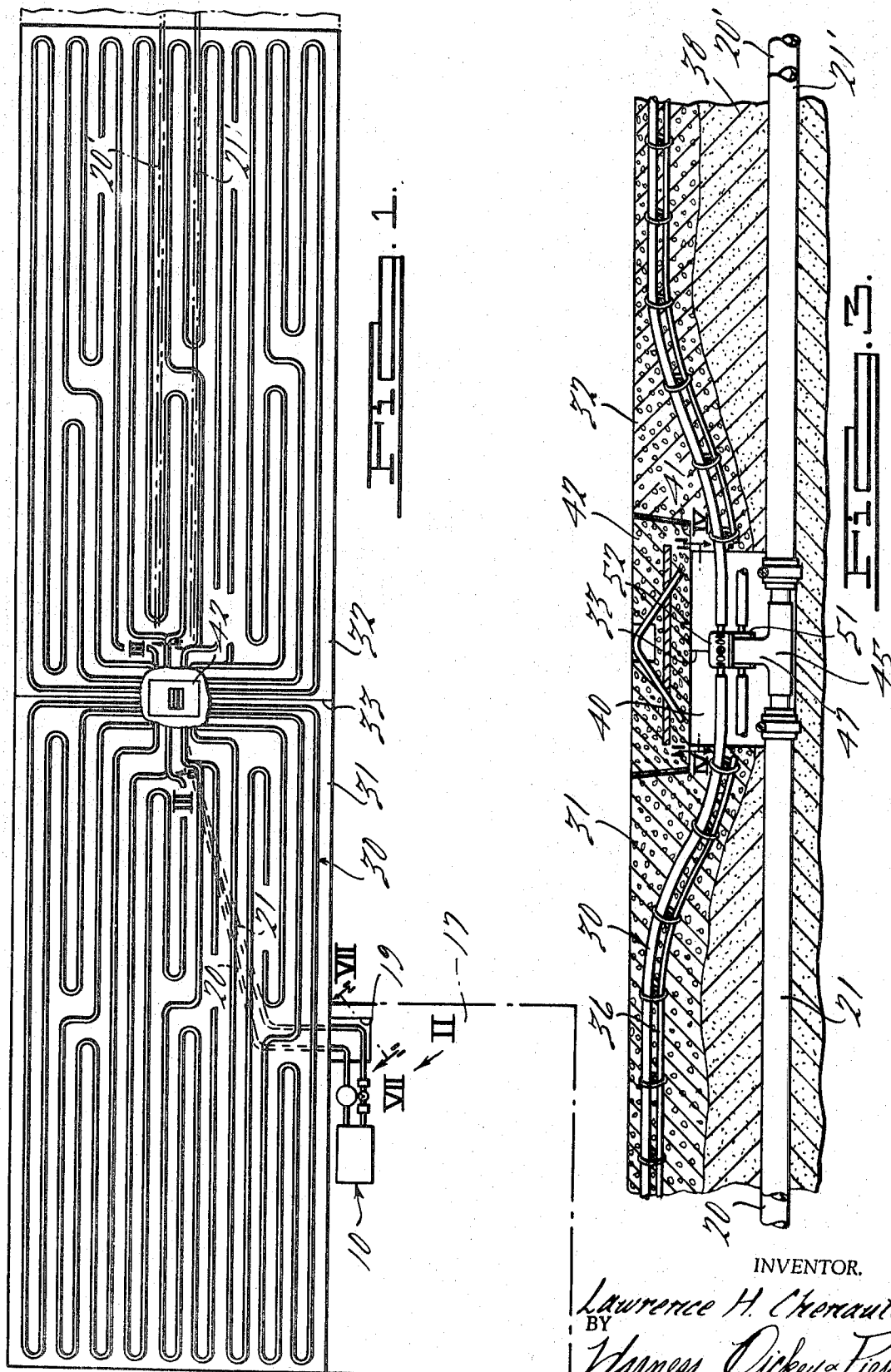
[52] U.S. Cl..... 237/1,
237/69, 237/8
[51] Int. Cl..... F24d 3/02
[50] Field of Search..... 237/1, 69,
8; 62/235

[56] References Cited UNITED STATES PATENTS

2,570,226	10/1951	Gerringer.....	237/69
2,769,315	11/1956	Meadows.....	62/235
2,997,770	8/1961	Beltz.....	62/235X

ABSTRACT: A system for melting snow and ice from paved surfaces consisting of flexible plastic tubing imbedded in the pavement is supplied with a circulatory liquid heating agent via supply mains beneath the pavement and which feed the tubing through risers located in pits positioned at expansion joints in the pavement. All joints and connections are located in the pits together with freely flexible inlet and outlet sections of the tubing, none of which bridges the expansion joint. The liquid heating agent circulates in closed loop circuits and the system is charged through filling means located in a return line close to the heating source and which includes a check valve located between two access openings.





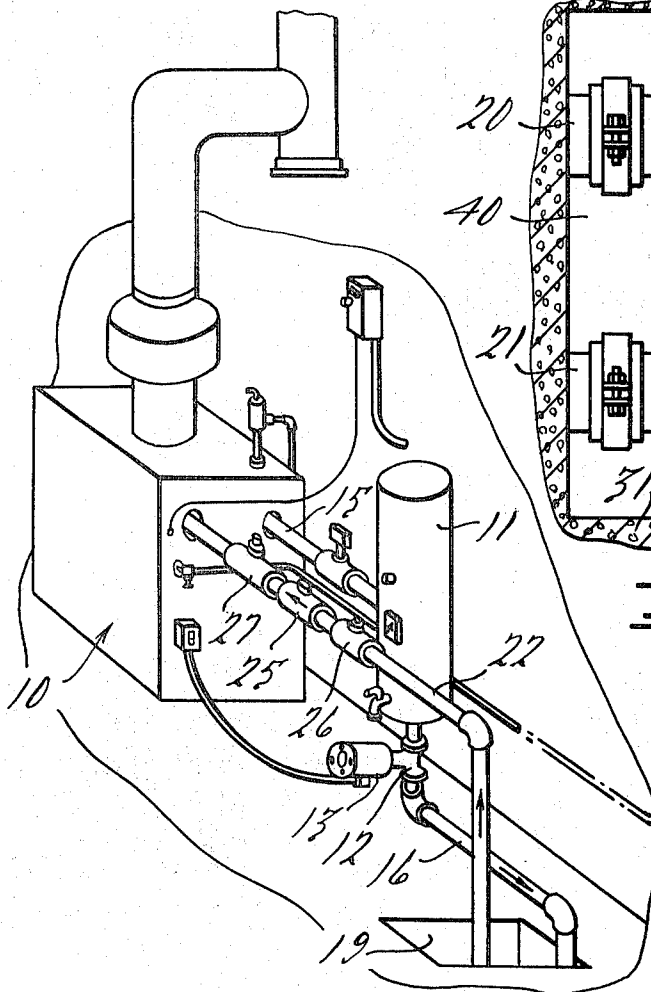


FIG. 1.

FIG. 2.

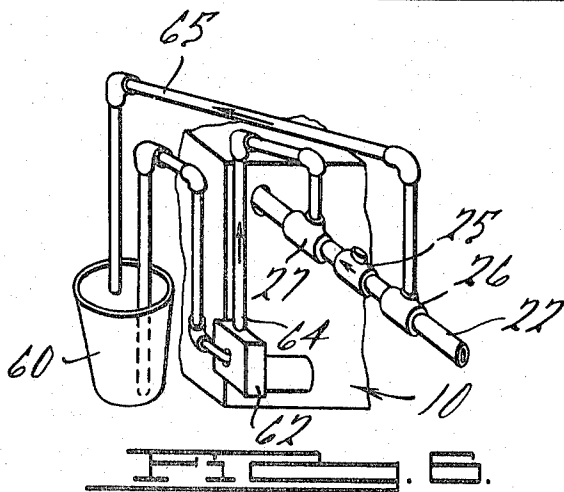


FIG. 3.

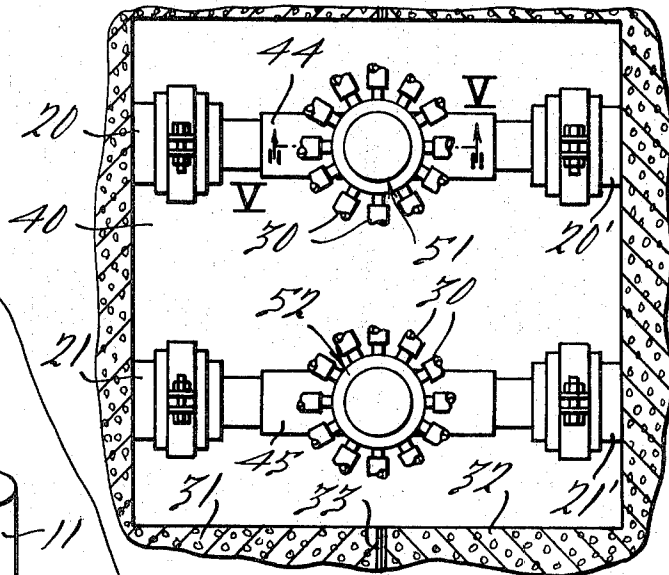


FIG. 4.

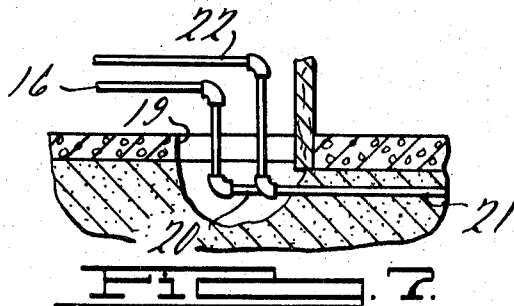
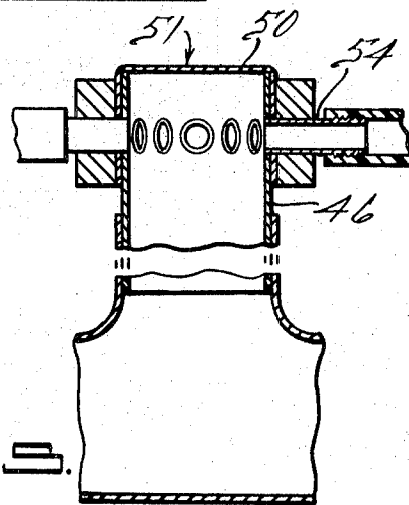


FIG. 6.

INVENTOR.

Lawrence H. Chenault.

BY

Harness, Dickey & Tice

ATTORNEYS

SNOW MELTING SYSTEM

BACKGROUND OF THE INVENTION

Various systems have been produced for heating paved surfaces to melt snow and ice, including buried heating pipes, buried electric heating systems, and external sources of hot air and radiant heat. Most such systems have been so expensive that they have not been put to general use. Difficulties have also been encountered with many of the buried systems because of damage to the system which occurs if the pavement breaks, heaves or settles. The overall objective of the present invention may be summarized as comprising the provision of a buried-type system which is relatively low in first cost and in cost of operation and which is highly resistant to damage in event of breakage or movement of sections of the pavement.

Another object of the invention is to provide a system which is easily serviced.

Other objects and advantages will become apparent upon consideration of the present disclosure in its entirety.

BRIEF DESCRIPTION OF THE FIGURES OF DRAWING

FIG. 1 is a diagrammatic plan view of the principal components of a pavement heating system constructed in accordance with the present invention;

FIG. 2 is a somewhat diagrammatic perspective view of the heater and adjacent portions of the apparatus;

FIG. 3 is a cross-sectional view on a larger scale taken substantially on the line III-III of FIG. 1 and looking in the direction of the arrows;

FIG. 4 is an enlarged plan view of the manifold pit of the system shown in FIG. 1;

FIG. 5 is a cross-sectional view of a distribution manifold on a larger scale;

FIG. 6 is a fragmentary perspective view of a portion of the apparatus shown in FIG. 2 arranged for charging the system with liquid; and

FIG. 7 is a sectional detail taken substantially on the line VII-VII of FIG. 1 and looking in the direction of the arrows.

DETAILED DESCRIPTION OF PREFERRED FORM OF THE INVENTION

Referring now to the drawing, my improved system consists basically of a source of supply of a circulatory heating liquid, and network of buried plastic tubing embedded in the pavement and through which the liquid is circulated. The heating source is shown as water heater 10, and the embedded tubing is generally designated 30. The heater 10 is shown as a gas-fired water heater. Circulation is induced by a centrifugal pump 12. The output pipe 15 from the heater leads to an expansion tank 11 from the bottom of which an output pipe 16 leads to the underground supply main 20. Pipe 16 incorporates the circulating pump 12 powered by electric motor 13. The return main 21 is connected to the heater input by piping 22. Piping 16, 22 and all other components between these pipes and the heater are formed of metal and may be contained in a floored enclosure or equipment room 17 having a pit 19 through which the piping 16-22 extends downwardly for connection to the plastic supply and return mains 20-21. The system is preferably filled with a nonfreezing solution such as a mixture of water and ethylene glycol.

The return line 22 contains at a position close to the heater a check valve 25 which blocks reverse flow through the system. On either side of the check valve is a tee 26, 27. Tees 26, 27 have their straight through sections in the return line, and normally plugged top openings. The check valve 25 and tees 26, 27 may be formed as a preassembled unit and these components are preferably located at a high point of the system. Of course if it is not feasible to locate them at a high point, valves may be used to close off the top openings of the tees.

The mains 20-21 are laid on the grade level below the sandfill 38 and lead to one or more distribution and return manifolds which are in turn connected to the heating conduits

30 embedded in the pavement. In the installation shown in FIG. 1 the pavement comprises two sections 31 and 32 of poured concrete between which is a transverse expansion joint 33.

The conduit 30 is formed of an inert and relatively flexible plastic material such as a polyolefin homopolymer which will remain flexible at all temperatures to be encountered at the site. As best shown in FIG. 3, the tubing is preferably installed by tying it at suitable intervals to a reinforcing wire mesh 36 installed in the concrete in a conventional manner. The installation of the tubing does not interfere with conventional methods of concrete paving. In the preferred type of installation shown, after the supply and return mains 20, 21 are laid on the ground, the sandfill 38 is placed thereover, the reinforcing mesh 36 is laid on the sand, and the tubing 30 is then fastened to the mesh. Pouring of the concrete then precedes in the regular manner, the mesh being lifted as the pouring proceeds to raise it to a desired elevation within the concrete layer.

The tubing for each of the sections as 31, 32 is independent. At the expansion joint 33 a box form (not shown) going down to grade level, is inserted before the sandfill is applied. The form is shaped and positioned to define a rectangular pit 40, extending across the expansion joint so that one-half of the pit extends into each of the sections 31, 32. A ledge 41 is provided for an access cover 42. The sandfill 38 is tapered to decreasing thickness around the pit to provide a correspondingly increased thickness of concrete. In the pit 40 the mains are connected to tees 44, 45 from each of which a riser section 46, 47 extends upwardly to a distribution manifold 51, 52. The manifold construction, as shown in FIG. 5, comprises a cap 50 secured to the top of the riser and provided with a plurality of radial connecting nipples 54.

The tubing 30 is formed in a plurality of unbroken loops. In the construction shown, six loops are contained in each of the sections 31, 32. The input end of each loop is connected to the manifold 51 and the output end of each loop is connected to the manifold 52. As shown in FIG. 3, the tubing portions in the pit 40 extend through the air and approximately horizontally for a substantial distance, and since the tubing is flexible, such portions readily accommodate relative movement between the sections or between the sections and the grade. There are preferably no joints in the tubing portions embedded in the concrete, as shown, all joints being accessible at the pit 40 by removing the access cover 42. Although only two sections 31, 32 are shown, the system may typically be extended by running the extensions 20', 21' of mains 20, 21, respectively, to additional or successive pairs of sections, as shown in FIG. 3.

In filling or refilling the system with liquid, it is of course essential to remove substantially all air (with the exception of that located above the liquid in the expansion tank 11). Since the circulating pump 12 is of relatively low displacement, its output is not sufficient to sweep the air from the system during filling. My preferred method of filling the system will be explained with reference to FIG. 6. The premixed antifreeze liquid solution is pumped from a container 60 and into the system via temporary fill piping 64 and tee 27 by means of a centrifugal pump 62 of relatively high capacity. The check valve 25 prevents the solution from flowing backwards through the system and the solution is accordingly forced through the heater 10 and from the output 15 thereof and thence through the entire system, from which it returns to the tee 26. During such filling, a temporary overflow pipe 65 connected to the tee 26 leads to the air space above the container 60. The circulating pump 12 is of course operated simultaneously with the fill pump 62. Air from the system escapes from the pipe 65 during filling and the pumping is continued with a clear full flow of liquid with no entrained air is escaping continuously from the pipe 65. The temporary piping and pump 62 are then disconnected and the tees 26, 27 plugged or closed off at their fill and overflow connections.

In normal operations, the burner of the heating unit 10 operates intermittently, under control of a thermostat, and the

circulating pump 12 is stopped during off cycles of the burner. At such times the residual heat in the heating unit tends to overheat the static liquid in the heater, and the liquid at such times reaches a temperature which would damage the plastic mains and tubing. The check valve 25, by preventing reverse flow, keeps such an overheated liquid from reaching the plastic components via the return line, while any overheated liquid which flows out through outlet pipe 15 is moderated in temperature by the liquid in the expansion tank 11 and so cannot by this route reach the plastic components in an overheated condition.

I claim:

1. A pavement-heating system comprising a closed conductive loop including means for heating and circulating through the loops a quantity of liquid contained therein, the heating means having overflow and return conduits, means for filling the loop with liquid and eliminating air therefrom comprising an antibackflow valve in the return conduit and a pair of access ports in said return conduit, one of said ports being located on each side of said valve.

2. In a heating system for a slab of pavement or the like, a closed conductive loop having a portion embedded in the slab, means for heating and circulating through the loop a quantity of liquid contained therein, including a heater, outflow and return conduits extending from and to the heater, respectively, and having their ends remote from the heater below the grade of the slab, a supply main connected to the outflow conduit and extending below grade to a position near an inlet end of said embedded portion, a flexible connecting conduit outside the slab and joining said supply main to said inlet end of the embedded portion, a return main below the grade of the slab and extending from a position near an outlet end of said embedded portion to a connection with said return conduit, a flexible connecting conduit outside the slab and joining said embedded portion to said return main, an antibackflow valve in the return conduit, and an expansion tank and circulating pump in the outflow conduit.

3. In a pavement-heating system as defined in claim 2, a plurality of such embedded portions and means for connecting such portions in parallel with each other and in series with the supply and return mains, comprising a supply manifold outside the slab and connecting the supply main to each flexible conduit leading to an inlet end of one of said embedded portions, and a return manifold outside the slab and connecting the outlet end of each flexible conduit leading from an outlet end of one of said portions to the return main.

4. A system as defined in claim 3 including two slabs demarcated by an intermediate expansion joint, at least one of said embedded portions being in each slab, the mains, manifolds

and flexible connecting conduits being outside of both slabs.

5. A system as defined in claim 4 including a chamber appurtenant to said joint containing said manifolds.

6. A system as defined in claim 3 wherein each manifold comprises a cylindrical body having an axial port connected to the main and radial ports connected to said flexible connecting conduits.

7. A system as defined in claim 4 wherein said chamber is formed as an opening extending entirely through one of the slabs from top to bottom and open one side toward the other slab in a direction across the expansion joint, the manifolds being spaced from both slabs.

8. A system as defined in claim 4 including metallic reinforcing in said slabs, each of said embedded portions comprising a looped conduit fastened to said reinforcing and forming an extension of two of said flexible connecting conduits, one of which flexible connecting conduits is connected to each of said manifolds.

9. The method of installing a heating system in concrete paving which comprises running a pair of mains below the finished grade of the pavement to a position appurtenant to the location to be paved, laying metallic reinforcing on the prepared grade before paving, securing flexible plastic conduit to the reinforcing with free ends thereof for connection to said mains projecting from the area to be paved, pouring concrete onto the conduit and reinforcing in the area to be paved, and lifting the reinforcing and conduit to an intermediate position in the concrete.

10. The method defined in claim 9 which also includes running said mains to a chamber position within the boundaries of the area to be paved, blocking off said position from the area to be paved to form a chamber for access to the mains, forming an expansion joint intersecting said chamber position between sections to be paved, a loop of the plastic conduit being contained in each section, said free ends thereof projecting into said chamber for connection to said mains.

11. The method of charging liquid into and removing air from a circulatory heating system of the type which includes a heater having outflow and return conduits and an antibackflow valve in the return conduit, said method comprising pumping liquid from an open container into the return conduit at a position between the valve and the heater, by means of a relatively high-capacity fill pump located outside the system, opening the return conduit at a position on the other side of but close to said valve for escape of air and overflow, and closing said opening and the connection for pumping liquid into the conduit after full flow of liquid occurs from the opening.

50

55

60

65

70

75