

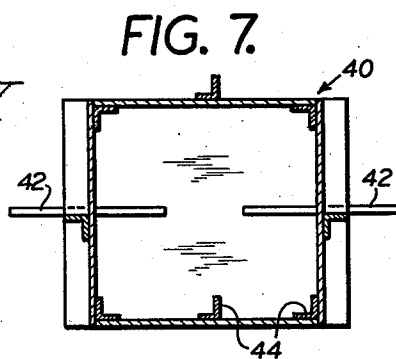
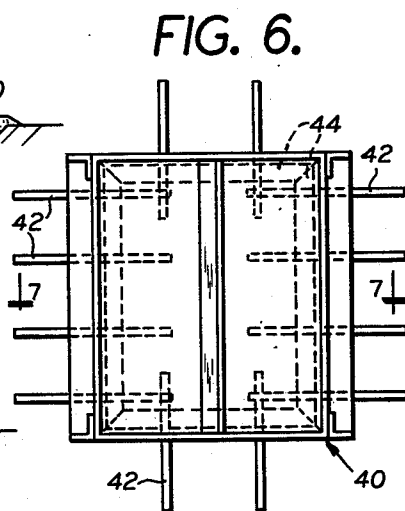
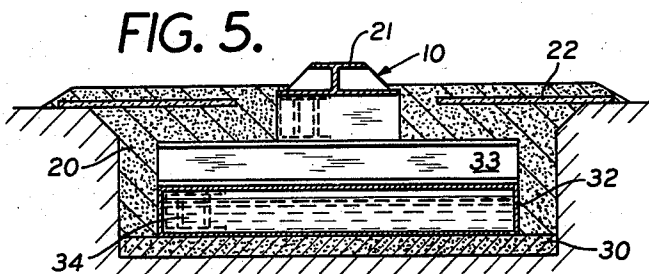
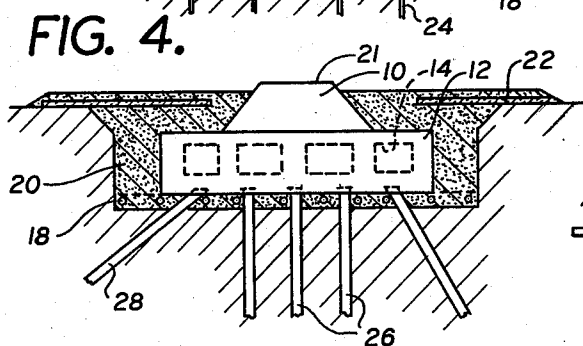
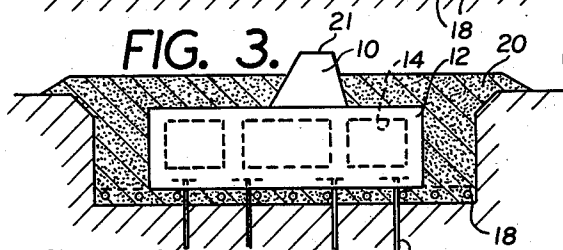
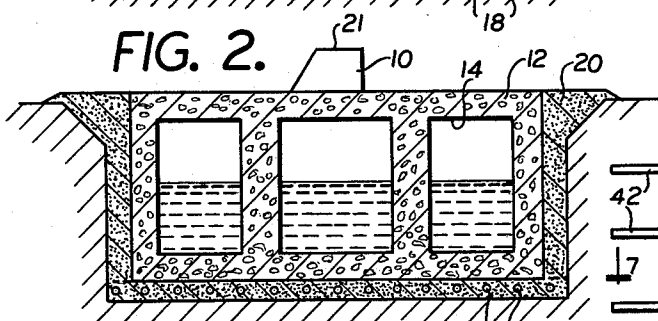
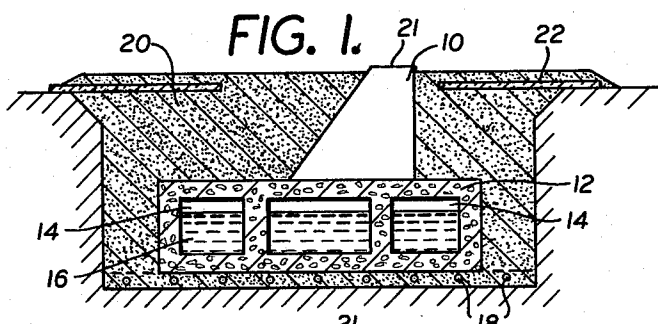
June 2, 1964

M. SCHEINBERG
INSULATED FOUNDATION

3,135,097

Filed July 26, 1960

2 Sheets-Sheet 1



INVENTOR
MARTIN SCHEINBERG
BY *Hubbell and Cohen*
ATTORNEYS.

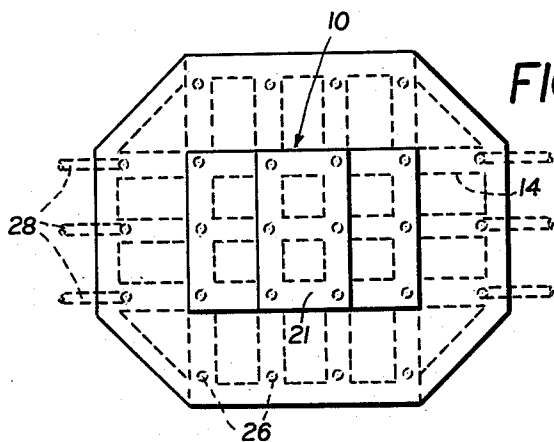
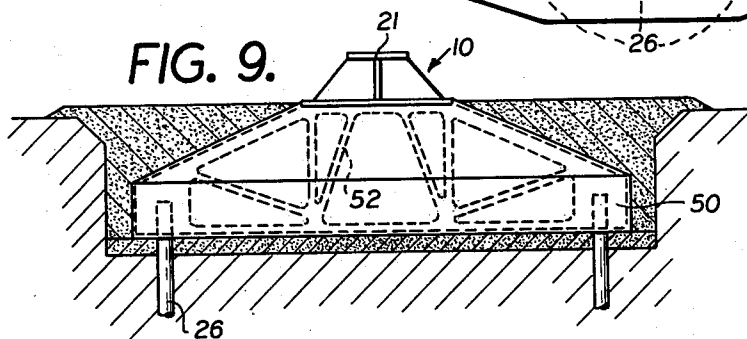
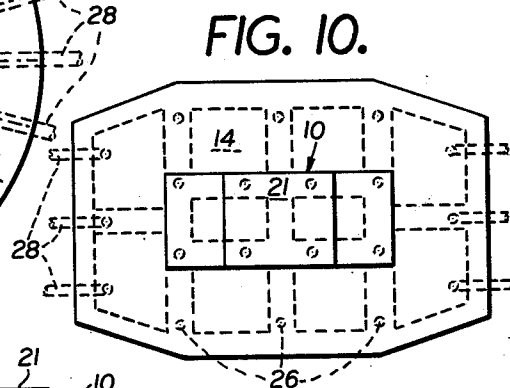
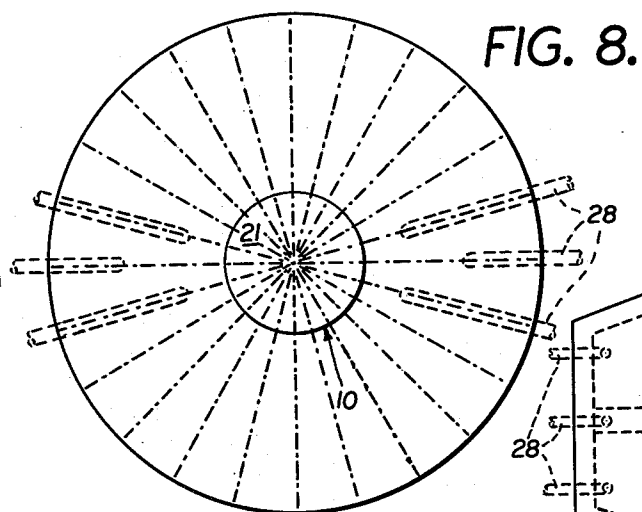
June 2, 1964

M. SCHEINBERG
INSULATED FOUNDATION

3,135,097

Filed July 26, 1960

2 Sheets-Sheet 2



INVENTOR
MARTIN SCHEINBERG
BY *Hubbell and Cohen*
ATTORNEYS.

1

3,135,097

INSULATED FOUNDATION

Martin Scheinberg, Clifton, N.J., assignor to Arde Associates, Newark, N.J., a corporation of New Jersey

Filed July 26, 1960, Ser. No. 45,444

5 Claims. (Cl. 61—50)

This invention relates to an improved building foundation construction. More particularly, my invention relates to a building foundation having an improved construction and exhibiting unusually good insulating properties as a result of that construction.

In the arctic regions it is frequently desired to construct buildings on "Permafrost," i.e. permanently frozen soil. Heretofore the construction of a foundation upon such permanently frozen soil has posed a number of serious difficulties. For example, if the foundation is laid by the usual method without any special precautions, it has been found that after the laying of the foundation and during a subsequent period when the ambient temperature is somewhat higher, e.g. during a summer thawing cycle, the foundation will gradually become warmer by absorbing heat from the ambient atmosphere. The heat absorbed by the foundation will be gradually conducted therethrough and transmitted to the underlying "Permafrost," causing it to thaw. This thawing will cause the ground to soften, leading to a partial sinking of the foundation within the underlying thawed soil and/or to a twisting of the foundation, whereby considerable stresses will be developed. Such stresses may result in a failure of the foundation. Since a foundation is designed to provide supporting means for a suitable building to rest upon, any subsequent resettling of the foundation may cause serious damage to the superstructure erected thereon.

Accordingly, it is an object of the present invention to provide a novel foundation for arctic regions, this foundation having unique construction which confers unusual insulating properties upon the foundation, whereby any heat that ordinarily would be transmitted through the foundation to the soil beneath to thereby thaw this soil is instead dissipated upon the insulation contained within and as a part of the foundation, so that the permanently frozen soil beneath and around the foundation in fact remains permanently frozen, regardless of fluctuations in the atmospheric temperature.

Another object is to provide a novel foundation construction suitable for use in arctic regions, this foundation construction adapted to stand on permanently frozen soil and to withstand any temperature changes, so that after the foundation is properly laid there is no tendency for any slippage or readjustment to occur along with the accompanying development of stresses or strains in the foundation.

Another object of my invention is to provide a foundation having unusual insulating properties which foundation is capable of use in permanently frozen ground ("Permafrost"), and which maintains the ground upon which it rests and is embedded in permanently frozen condition even though the ambient temperature is above the freezing point of this ground.

Additional objects and characteristics of this will become apparent from the following description taken in connection with the accompanying illustrative drawings.

In the drawings:

FIG. 1 is a vertical sectional view showing one embodiment of my invention, namely a spread foundation containing ice pockets therein;

FIG. 2 is a vertical sectional view of a floating foundation;

2

FIG. 3 is a vertical sectional view of a spread foundation with tie rods;

FIG. 4 is a vertical sectional view of a pile foundation with a concrete base;

FIG. 5 is a vertical sectional view of a steel grillage foundation;

FIG. 6 is a top view of an ice container installed within the foundation of my invention;

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 6;

FIG. 8 is a top view of a pile foundation having a steel tank base;

FIG. 9 is a vertical sectional view of the pile foundation shown in FIG. 8;

FIG. 10 is a top view of the alternative foundation shown in FIG. 4;

FIG. 11 is similarly a top view of another foundation similar in structure to but differing in shape from that shown in FIGS. 4 and 10.

In accordance with one aspect of my invention the above objects are secured by providing a foundation containing therein compartments or "pockets." Into each of these pockets is incorporated a quantity of liquid, preferably water or water-anti-freeze mixture which is frozen into ice. The liquid may be introduced into the pockets of chambers in any suitable fashion as through a subsequently sealed hole or a closable valve or the like. Thereafter, the liquid may be frozen either by artificial refrigeration or by relying on ambient temperatures below the freezing point of the liquid. Sufficient pockets and sufficient ice within these pockets is provided so that in a summer thawing season there is sufficient ice to absorb any heat that the foundation takes up, thereby preventing transmission of the heat through the foundation to the underlying and surrounding frozen soil. Accordingly, such soil remains permanently frozen and is not melted. In effect, the ice pocket constitutes a thermal barrier between the incoming heat flow and the Permafrost.

It will be noted that by using ice as the insulating material I take advantage of the considerable latent heat of fusion of ice. That is, considerable heat is dissipated simply in converting the ice to water at the same temperature. Sufficient ice is provided in the compartments such that all of it will not melt during a summer thawing season. Thus, the temperature of the ice and the foundation is maintained constant throughout. Any heat that would be otherwise transmitted through the foundation to the surrounding soil is completely dissipated in thawing a portion of the ice within the ice pockets.

It should also be noted that my use of ice as the insulating material is highly advantageous as compared to such usual insulating materials as rockwool, fiberglass, and the like. The economic advantages from the use of ice are obvious. Of even greater significance is the fact that the use of such traditional insulating materials as rockwool, etc. would require a prohibitively large quantity because of the inherently low heat capacity of such materials. While it is true that such conventional insulating materials would retard the rate of heat flow through the foundation for a period of time, eventually heat would pass through the foundation and would cause the surrounding and underlying soil to thaw. In contrast, ice can be provided in such quantities that, due to its large latent heat of fusion, heat transmitted from the atmosphere to the foundation is permanently prevented from flowing through the foundation to thaw the surrounding soil, this heat being completely dissipated in melting portions of the ice.

Desirably, water is added to the ice pockets provided in the foundation during the construction of the founda-

3

tion, and this water is permitted to freeze, either by exposure to the natural prevailing coldness, or by the use of temporary refrigeration. During a subsequent summer thawing season part of the ice will melt. However, sufficient ice is provided so that not all will melt and some will always remain in the ice state. That portion of the ice which has melted during the summer thawing season will refreeze during the subsequent winter season, and is therefore again available for the following summer season.

If desired, an anti-freeze constituent may be added to the water during the construction period to thereby reduce the freezing temperature of the water-antifreeze mixture to the highest desired temperature of the underlying Permafrost. The mixture is then frozen artificially, as by refrigeration coils. The installation is then completed in the usual manner. Subsequent summer thawing cycles will not cause a rise in temperature of the Permafrost surrounding and beneath the foundation until all of the ice pockets have melted. Accordingly, so long as sufficient ice is provided in these pockets this situation will not come about.

My invention is applicable to all types of foundations. Thus, pockets can be used in conjunction with any type of foundation made of any of the usual materials of construction such as concrete, steel or the like. If steel is used, then there is no need for any lining of the compartment to render it impervious, and water can be poured directly into the steel compartment without any special precautions. In contrast, however, if concrete is used it is desirable to render each pocket impervious and resistant to leakage. This can be done in a number of ways. For example, the pocket can be lined with an impervious metal, e.g. steel. Alternatively, each pocket can be lined with an impervious plastic liner or film. Suitable plastics include polyethylene, polypropylene, vinyl resins such as polyvinylchloride, and even thermosetting resins such as urea-formaldehyde condensates and the like. Such an impervious resinous film can be applied in any of the conventional means, e.g. by spraying, by dissolving the resinous film formulation in a suitable solvent, applying the formulation to the pockets, and evaporating the solvent therefrom to thereby leave an impervious resinous film thereon, or the like.

In accordance with a preferred aspect of my invention I provide metal conductors which extend through the concrete and into the ice contained in the ice pocket, such conductors serve to rapidly transmit heat from the concrete to the ice, thereby preventing heat flow through the foundation to the Permafrost.

If an anti-freeze is added to the water, any of the usual anti-freeze materials may be used. For example, suitable materials include ethylene glycol, methanol, ethanol, and the like. The amount of anti-freeze required is quite small, e.g. approximately 6% by volume of ethylene glycol in water will reduce the freezing temperature of the water-glycol mixture to about -2 degrees centigrade, and this freezing point is sufficiently low for most arctic applications.

The size of the ice pocket may vary depending upon the overall size of the foundation and the specific application contemplated. In general, I prefer that each ice pocket be about 2 feet in depth and about 15 to 30 square feet in cross-section.

When water or water-antifreeze mixture is added to the pocket care must be taken not to completely fill the pocket, for when the water freezes the resulting ice will expand and occupy a greater volume than was occupied by the water. Accordingly, I prefer not to fill the volume of the ice pocket up to more than about 85% water in order to avoid strain on or cracking of the foundation.

As stated earlier, my invention finds application with all kinds of foundations, whether of spread type, pile type, or the like. My invention will be further understood by reference to the accompanying drawings.

4

FIG. 1 shows a spread foundation with ice pockets. The pedestal 10 rests upon a base 12 made of strong rigid material such as, for instance, concrete. This base 12 contains compartments 14 having liquid impervious walls, each of which is partially filled with water or a water-antifreeze mixture 16. Refrigeration coils 18 are placed in the lower portion of the base 12 and may be utilized in initially freezing the water-anti-freeze mixture. A compact fill 20 that is not susceptible to frost is filled in around the foundation pedestal 10 and base 12. This fill may be made up of any suitable material such as gravel or the like. Desirably, a thin band of insulation 22 is provided near the top of the gravel fill 20. This insulation stripping tends to prevent transmission of radiant heat from the sun through the gravel fill to the underlying and surrounding Permafrost. While such insulation stripping is not essential, if it is eliminated it is necessary to have a considerably deeper gravel fill in order to prevent such radiant heat transmission. The top flat plane 21 of the pedestal 10 is used as the base for whatever structure is to be erected thereupon.

FIG. 2 shows another embodiment of my invention wherein a floating foundation is used. The same reference numerals are used to designate the same features in this figure and subsequent figures as are used in FIG. 1.

FIG. 3 shows another alternative foundation, namely, a spread foundation with tie rods 24, the latter of which are preferably made of steel. These tie rods 24 are imbedded deeply into the underlying Permafrost to thereby provide additional rigidity and structural support for the foundation.

FIGS. 4 and 10 show another alternative, namely, a pile foundation with a concrete base. Piles 26, here shown as steel pipe piles although other types of piles may be used, are imbedded within the base and within the underlying Permafrost. Batter piles 28 may be provided on either end to further reinforce and rigidify the foundation.

FIG. 5 shows a steel grillage foundation. Here the foundation rests upon sand 30, and is surrounded by the usual gravel fill 20. A metal tank 32 is provided for holding the water or water-antifreeze mixture. This tank is reinforced by means of beams 34 which transmit loads through the tank 32 from the overlying I-beams 33 which support the pedestal 10. As shown herein, pedestal 10 is itself formed of steel, here shown as I-beams.

FIGS. 6 and 7 show the detailed structure of a steel tank for holding frozen water or water-antifreeze mixture. It will be noted that this tank, generally designated by the numeral 40, has a number of thermal conductors 42 extending therethrough. These rod-like conductors are made of steel or of other suitable heat conductive materials and serve to conduct heat from the concrete to the ice. It will be further noted that the steel tank 42 serves as both a container for the ice and also as a form about which the concrete can be cast. The tank is reinforced as by angle irons 44 to thereby stiffen it, to prevent distortion under the weight of the cast concrete which surrounds the tank. These angle irons tend to cause the steel tank to retain its initial shape despite the considerable compression to which it is subjected.

FIG. 8 is a top view of the foundation shown in FIG. 9. This foundation is a pile foundation having a steel tank base 50, this base resting upon sand 30. Steel pipe piles 26 are also provided and are imbedded into the Permafrost and the base 50. Radial trusses 52 further reinforce the foundation. Batter piles 28 are also provided.

FIG. 11 shows a top view of an embodiment of my invention similar to FIGS. 4 and 10 wherein the foundation has a different configuration. It will, of course, be obvious that my invention is not limited to any specific type of foundation or material but rather finds application in virtually all kinds of foundations which can be designed to contain impervious water-resistant compartments therein.

While water or a water-antifreeze mixture are eminently

suited as the liquid in the box 14 of the foundations herebefore described, other freezable liquids are useable without departing from this invention. Of course, in order to take advantage of the latent heat of fusion required to melt any frozen liquid it is important that the freezing point of the liquid used be at or slightly below the freezing point of the Permafrost to be protected. It will be obvious that such liquids as molten metal would not be advantageous to use as the freezing point is so high that there would be no tendency of such material to melt at the temperatures encountered in the normal expected use on my novel foundations. Accordingly, the term "a freezable liquid" as used herein means a liquid which freezes at or near the temperatures of the softening of Permafrost which temperature is about 0° C.

While I have herein shown and described a number of embodiments of the present invention and have suggested modifications therein, various other changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of this invention.

What I claim is:

1. A foundation for supporting structures in arctic regions having permanently frozen soil, said foundation comprising a base disposed within a hole in said frozen soil, and a pedestal extending upward from said base and above said frozen soil, said base being substantially surrounded by frost resistant fill, said base having therein a chamber containing a freezable liquid some of which is in the frozen, solid state.

2. The foundation of claim 1 wherein the freezable liquid is selected from the group consisting of water and water-antifreeze mixtures, said liquid filling up less than the total volume of said chamber.

3. The foundation of claim 2 wherein said liquid fills up not more than 85% of the total volume of said chamber.

4. The foundation of claim 1 wherein said base contains a plurality of heat conducting members embedded therein and extending into said chamber for conducting heat from said base to said chamber.

5. A foundation for supporting structures in arctic regions having permanently frozen soil, said foundation comprising a base disposed within a hole in said frozen soil, and a pedestal extending upward from said base and above said frozen soil, said base being substantially surrounded by frost resistant fill, said base having therein a chamber containing a freezable liquid, some of which is in the frozen, solid state, and a layer of thermal insulating material disposed between the upper surface of said base and the upper exposed surface of said fill.

References Cited in the file of this patent

UNITED STATES PATENTS

82,651	Somes	Sept. 29, 1868
504,544	Van der Heyden	Sept. 5, 1893
1,495,310	Stromborg	May 27, 1924
1,969,187	Schutt	Aug. 7, 1934
2,101,358	Boardman	Dec. 7, 1937
2,177,859	Brice	Oct. 31, 1939
2,332,227	Jackson	Oct. 19, 1943
2,381,014	Thornley	Aug. 7, 1945
2,484,371	Bayston	Oct. 11, 1949
2,886,952	Ruff	May 19, 1959

FOREIGN PATENTS

105,614	Sweden	Sept. 29, 1942
---------	--------	----------------