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F. S. HONBERGER

METHOD OF TREATING CONCRETES

Filed Feb. 3, 1923

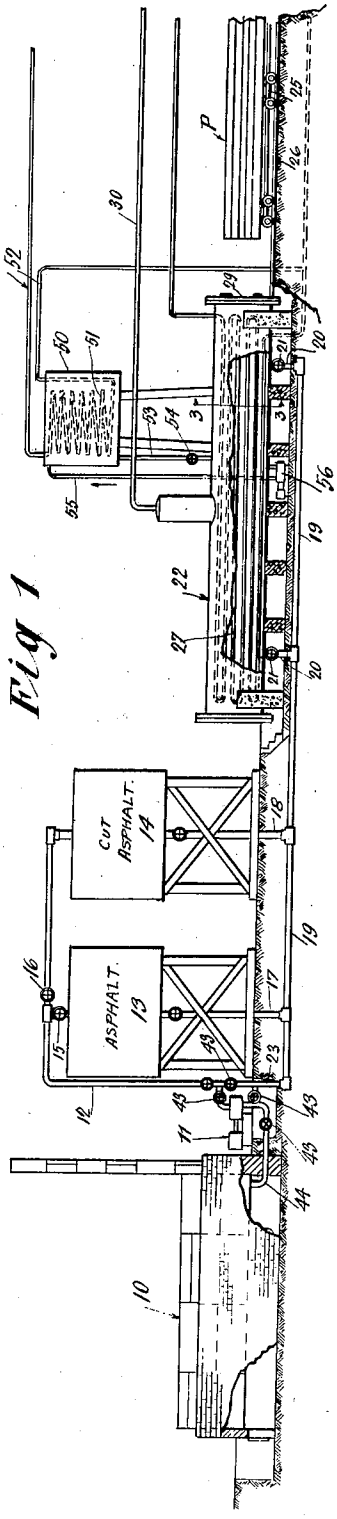


Fig 1

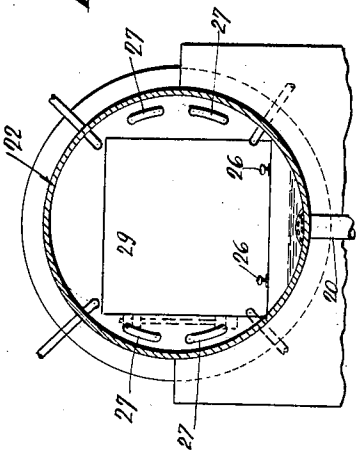


Fig. 3.

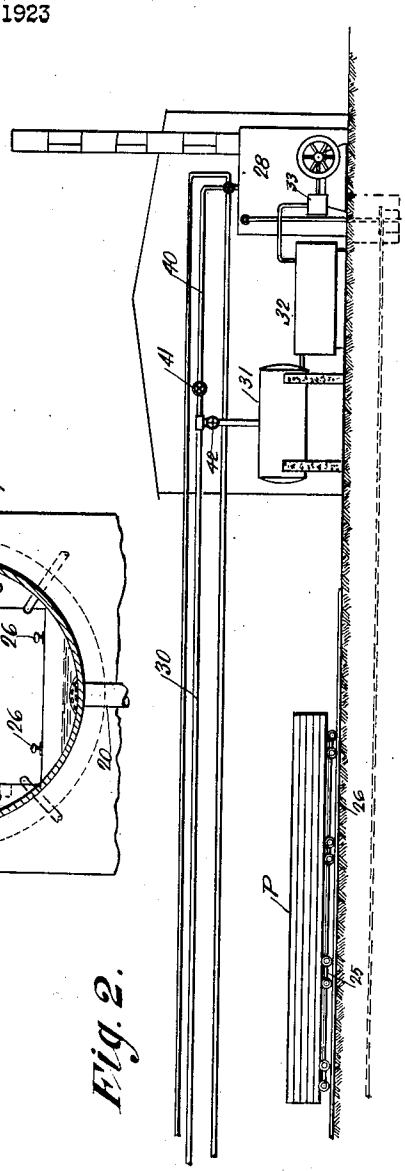


Fig. 2.

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UNITED STATES PATENT OFFICE.

FRANK S. HONBERGER, OF LOS ANGELES, CALIFORNIA.

METHOD OF TREATING CONCRETES.

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To all whom it may concern:

Be it known that I, FRANK S. HONBERGER, a citizen of the United States, residing in Los Angeles, county of Los Angeles, State of California, have invented new and useful Improvements in Methods of Treating Concretes, of which the following is a specification.

This invention relates to the treatment of porous bodies, such for instance as of cement concrete; and although the invention is not necessarily limited specifically to the treatment of concrete, or to the treatment of any specific concrete article, it may perhaps be best explained as applied to a concrete pile. Also the process relates generally to impregnating such a body with an impregnating substance; and although the invention is not necessarily limited to impregnation for the purpose or with the result of water proofing the body, the invention will be best understood from a description of its application to a concrete pile for the purpose of impregnating it with a water proofing substance. Of such substances asphalt may be taken as typical, and is perhaps the one most commonly used. Further, in its more specific aspects, as hereinbefore described, the invention is designed particularly to impregnate a concrete body with asphalt or similar water proofing substance.

It is unnecessary for me to state the reasons why it is desirable to water proof concrete bodies, or particularly concrete piles that are subject for instance to the action of sea water. It is desirable, in order thoroughly to protect pile, to impregnate it throughout with the water proofing substance, so that its interstitial voids are completely filled with the substance resulting both in efficient water-proofing and in substantial increase in strength in the concrete. My invention accomplishes these desirable things and does so in a simple and effective manner without deteriorating the concrete in any way.

In order to explain a preferred and specific form of the process and apparatus, illustrative of the invention, I now refer to the accompanying drawings in which—

Fig. 1 is a diagrammatic elevation illustrating a part of a plant adapted to carry on the process;

Fig. 2 is a similar view showing the remainder of the plant; and

Fig. 3 is an enlarged detail section on line 3—3 of Fig. 1.

The general features of the method I am about to describe comprise the exhaustion of air and moisture from the interstitial spaces of the concrete by means of vacuum; and then the application of the water proofing substance, sufficiently fluid to be drawn into the interstitial spaces by the vacuum or partial vacuum thus formed in them. In order to facilitate the withdrawal of the contained air and moisture, and to facilitate the evaporation of the moisture so that it may be effectively withdrawn by vacuum action, I may preferably somewhat heat the concrete body. And in using a water proofing substance such as asphalt I preferably apply it hot so as to maintain it in fluid condition. The preliminary heating of the body, prior to the application of the asphalt, thus not only aids in freeing the interstitial spaces but also gradually brings the concrete body up to the temperature at which the asphalt may be applied, thus avoiding any possibility of strains or ruptures being developed by unequal expansion. Also I may utilize external pressure on the asphalt that aids the internal vacuum to make the asphalt penetrate the concrete body. These are the general features of the method; and there are other features of it that are best explained in connection with the apparatus.

In the drawings I show a typical apparatus wherein the numeral 10 designates an asphalt heater of any suitable kind, its function being merely to heat the asphalt preliminarily to a temperature high enough to make it liquid. This heated liquid asphalt is pumped by a pump 11 through pipe 12 into either tank 13 or 14 under control of valves 15 and 16. From these two tanks discharge pipes 17 and 18 lead to a main discharge pipe 19 that communicates through branches 20, under control of valves 21, with impregnating chamber 22. The outlet of pump 11 also communicates through pipe 23 with the asphalt feed line 19 so that hot asphalt may be pumped directly into the feed line as desired. The two tanks 13 and 14 may be used to hold either hot asphalt or hot "cut" asphalt—cut with a distillate or some equivalent asphalt solvent that will make the asphalt liquid at a suitable temperature. I find it desirable to use an impregnating sub-

stance that will be sufficiently fluid at a temperature under the normal boiling point of water; say in practice, at a temperature not to exceed substantially 200° F. or so. Accordingly, I here use an asphalt that is freely fluid at such a temperature and cut the asphalt with a small proportion of distillate to make the mixture freely fluid at such a temperature.

Impregnating chamber 22, for the purposes of treating concrete piles, is a chamber large enough to contain a pile or a number of them at one time. Such piles, as illustrated at P, may be loaded on a truck 25 running on rails 26, the rails continuing into the impregnating chamber. Means are provided to heat the impregnating chamber, as for instance, coils 27 fed with steam from boiler 28 or fed with any other suitable heating fluid. One end of the chamber may be provided with a door 29 through which the truck, carrying its pile or piles, may be introduced into the chamber. The door is preferably so constructed as to close fluid tight. The interior of the chamber and the piles are heated by the steam coils and are gradually brought up to the desired temperature; but preferably always a temperature less than the normal boiling point of water. At the same time a suction action is set up on the chamber, creating a vacuum in the chamber for the purpose of drawing air out of the interstitial spaces of the concrete and also drawing out the free moisture. This action of voiding the interstitial spaces may be facilitated by soaking the pile in water prior to heating and vacuum action. This may be done by putting a charge of water in the chamber when the pile is first put in, allowing the piles to take up water and then withdrawing the charge of water before starting the heating and vacuum action. At the reduced pressure maintained the free moisture in the piles is easily and quickly evaporated at the temperature maintained, although this temperature may be considerably below the normal boiling point. The vacuum may preferably be maintained through a pipe line 30 that leads to a condenser 31 that in turn is connected with a vacuum and water separating tank 32 in which a vacuum is maintained by a vacuum pump 33. The vacuum in the impregnating chamber is thus the result of both the action of the vacuum pump and the condensing action in condenser 31; and this vacuum may be maintained preferably as low as economically practicable, say down to a few inches of mercury.

After the air and moisture have been thoroughly withdrawn from the concrete, then, without relieving the vacuum in the impregnating chamber the hot impregnating liquid is admitted. As soon as the impregnating liquid is in the chamber to a level above the piles the vacuum above it may be relieved; and, if desired, steam or other pressure may be put above the hot asphalt from boiler 28, the boiler having a steam line 40 controlled by a valve 41 connecting with line 30. Valve 42 controls the connection of vacuum line 30 to condenser 31. The vacuum in the interstitial spaces, aided if so desired by the additional exterior pressure, and aided in any case by the hydrostatic pressure of the impregnating fluid, causes the asphalt to flow into and fill the interstitial spaces. The vacuum action may be increased, as penetration goes on, by allowing the pile and the asphalt somewhat to cool during the penetrating action, such cooling having the effect of contracting and further decreasing the pressure of the small amount of air and water vapor remaining in the concrete. This cooling may be hastened by passing a cooling fluid through coil 27. The length of time necessary to completely fill the interstitial voids of a concrete article depends upon the percentage of voids and their individual sizes, and also upon the size of the article itself. The time necessary may be determined by trial. After impregnation is complete the asphalt may then be withdrawn from the impregnating chamber; and for this purpose the pump 11 is provided with a valve arrangement as indicated at 43 so that its intake side may be connected with pipe 23 instead of being connected with pipe 44 that leads from the asphalt heater 10. After the asphalt is withdrawn the treated pile may be run out of the impregnating chamber and allowed to cool to the normal temperature. If the pile has been completely impregnated before being removed from the impregnating chamber, then further cooling does not cause the asphalt in the interstitial spaces to be drawn further into the pile and does not cause the outer parts of the pile to be robbed of their asphalt filling.

If a cut asphalt is used, the solvent may be evaporated from the pile by heating after the asphalt has been withdrawn from the impregnating chamber.

In filling the interstitial spaces of the pile with water before applying the vacuum, I may provide a water tank at 50 in which the water may be heated by any suitable means, as by coil 51 fed with steam or hot water through pipes 52 from boiler 28. A pipe 53 conducts the hot water from tank 50 to the impregnation chamber, under control of valve 54. After the pile has been allowed time enough to take up the water, it is pumped back to tank 50 through pipe 55 by pump 56. Hot water is preferred for this operation as it vaporizes more readily; and the heat put into the water is conserved, at least to some extent, by pumping the water back to supply tank 50. This water

may of course be also heated in the impregnation chamber.

Having described a preferred form of my invention, I claim:

1. The method of impregnating a concrete or similar body with a liquid substance, that includes exhausting the air and moisture from the interstitial spaces of the body by application of vacuum, heating the body and the impregnating liquid, submerging the body in the impregnating liquid and maintaining the vacuum on the body and liquid until the body is submerged, then relieving the vacuum on the liquid, and allowing the body to cool in the impregnating liquid, whereby the impregnating liquid is drawn into the body by the vacuum therein and by contraction of its contained gases and vapors due to cooling, and then applying pressure to the liquid during substantially the whole period of cooling.

2. The method of impregnating a concrete or similar block with a fluid impregnating substance composed of a relatively non-volatile constituent cut with a volatile liquid which includes exhausting the air and moisture from the interstices of the body by application of vacuum, heating the body and the impregnating fluid, submerging the body in the impregnating fluid, and maintaining the vacuum on the body and fluid until the body is submerged, then relieving the vacuum to allow the fluid substance to penetrate the body, permitting the body to cool in the impregnated fluid, and applying pressure to the fluid during the cooling, and heating the body to drive off the volatile liquid from the interstitial spaces, leaving the non-volatile constituent therein.

3. The method of impregnating a concrete or similar body with a normally solid substance rendered liquid by heat, that includes exhausting the air and moisture from the interstitial spaces of the body by application of vacuum, heating the body and the impregnating substance to a temperature sufficient to liquefy the substance, submerging the body in the liquid substance and maintaining the vacuum and temperature on the body and liquid until the body is submerged, then relieving the vacuum on the liquid and thereafter allowing the body and liquid to cool with the body still submerged, whereby the impregnating liquid is drawn into the body by the vacuum therein and by contraction of its contained gases and vapors due to cooling, and applying pressure to the liquid during the period of cooling prior to solidification of the impregnating substance.

4. The method of impregnating a wet concrete or similar body with a normally solid substance rendered liquid by heat below the normal boiling point of water, that includes heating the body and the substance to such temperature below normal water boiling point, subjecting the body to a vacuum sufficient to cause vaporization of the water at the temperature employed, submerging the heated body in the heated and liquefied substance while maintaining the vacuum on both, then relieving the vacuum on the liquid and after such relief of the vacuum allowing the body to cool while still submerged, and applying pressure to the liquid during substantially the whole of the cooling period prior to solidification of said substance.

In witness that I claim the foregoing I have hereunto subscribed my name this 23rd day of January, 1923.

FRANK S. HONBERGER.