Dec. 17, 1935. D. FINLEY ET AL 2,024,727

COVERING FOR CURING CONCRETE

Filed May 1, 1931

Fig. 1

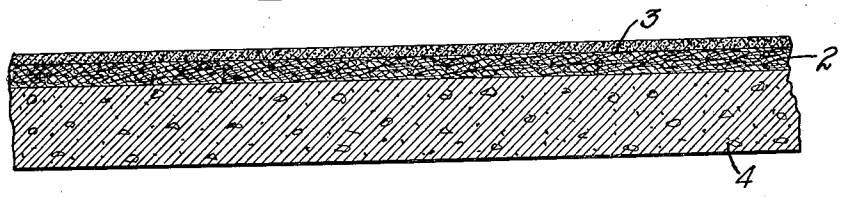


Fig. 2

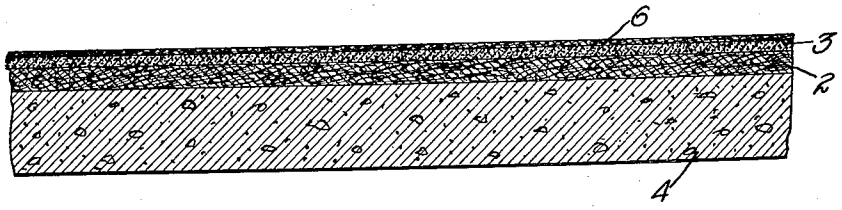
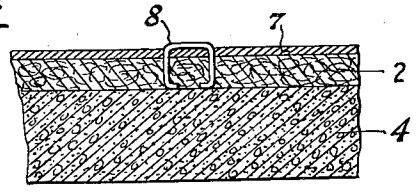


Fig. 3



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COVERING FOR CURING CONCRETE

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16 Claims. (Cl. 154—50)

Our invention relates to a covering to be used on concrete during the curing or drying state to preserve the desired moisture content.

It is among the objects of our invention to provide a covering that will maintain a body of concrete in a moist state during the drying or curing process and supply water in addition to that in the original mix where it is desirable or necessary.

Another object of our invention is the provision of a covering that is in convenient form for use, and that is capable of repeated use.

A further object of our invention is to provide a covering that will improve the surface quality of concrete by preventing chilling of the surface by evaporation of moisture therefrom.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of our invention. It is to be understood that we do not limit ourselves to this disclosure of species of our invention, as we may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is a section taken through the covering material of our invention, illustrating in section a portion of the base on which the covering is laid.

Figure 2 is a view similar to Figure 1 but showing a variant construction which is particularly applicable to the floor slabs of buildings.

Figure 3 is a view similar to Figure 1 showing another variant form embodying the covering material of our invention.

In terms of broad inclusion the covering of our invention comprises a suitable water absorbent base such as rag felt which is coated on its upper side by a waterproof material such as blown asphalt, or other bituminous compounds. This material is laid on the finished concrete surface in a moist or wet condition, being held in place by any suitable means such as piles of dirt. The moisture impervious covering prevents any material evaporation of moisture from the concrete and the moist base, supplies additional water needed for curing, and thus develops practically the ultimate strength obtainable by complete water curing. The color of the top coating may also assist in controlling curing temperatures. If the covering is to be used in a comparatively cool climate it may be desirable to use a black colored top surface to absorb the maximum amount of heat; or if it is to be used in an excessively hot climate the top surface may be suitably colored to reflect heat and thus keep the concrete at a lower temperature than would otherwise obtain. As the ultimate strength is a function of curing temperature it is thus possible to improve the quality of concrete in areas of climatic extremes. It is to be noted further that, by preventing evaporation from the surface of the concrete, the covering prevents localized chilling of the surface by evaporation of moisture therefrom, which is a frequent cause of surface cracking.

We are aware that concrete surfaces have been protected in the past by putting down a layer of moist felt or burlap and protecting the surface of the moist layer by a second layer of a moisture impervious material such as tar paper. Such materials fail to accomplish the desired result however, because the wrinkles that form in the tar paper or similar covering permit a circulation of air over the wetted material and also form inverted channels along which condensed moisture may flow away. Such materials are also rather expensive to use as they are usually torn to pieces in the course of one application. The felt becomes very fragile when wet and the tar paper is easily torn in handling so that as a rule no attempt is even made to use such materials the second time. Burlap is strong when new, but deteriorates quickly after the first use, and is relatively expensive. The material of our invention remedies those defects since the asphalt covering saturates the felt sufficiently to form a fairly tough integral material that may be used repeatedly and that can be repaired, if minor ruptures do occur, by swabbing additional asphalt onto the surface. Despite its improved strength this material is sufficiently pliable to hug the concrete surface closely, particularly when wet; and the unitary structure precludes the formation of wrinkles between the layers through which moisture would be lost.

For use in bulidings a variant construction is provided in which the surface of the asphalt coating is in turn protected by a layer of tough flexible material such as kraft paper, joined integrally with the sheet. This permits a nearly perfect cure of the concrete and at the same time permits light traffic on the floor before it is finally set.

In terms of greater detail, the covering of our invention comprises a sheet 2 of fibrous material such as an unsaturated roofing felt having a weight preferably of between thirty to sixty pounds per 480 square feet. A moisture impervious layer 3 is fixed on the upper side of the

sheet in a manner suitable to the material employed. This unitary covering may then be laid, preferably in a wet condition, on a concrete slab 4 to preserve the moisture content during the curing period.

There are numerous bituminous compounds that can be used, but we have found a very satisfactory coating can be obtained by applying an asphalt having a softening point of between 160 and 200 degrees F. and a penetration of between 12 and 24, 100 grams, 5 seconds, 77 degrees F., by the method of the American Society for Testing Materials, Standards of 1927. This asphalt may be applied by coating rollers in a manner well known to those skilled in the art.

If a fairly dense felt or like material is employed some difficulty may be encountered in obtaining a satisfactory bond between the felt and the top coating. This may be overcome by applying a softer preparatory coating to the felt before the harder top coating is applied. A satisfactory material for this purpose comprises an asphalt having a softening point of 110° F., and a penetration of 200 at 77°, 100 grams, 5 seconds by the methods of the American Society for Testing Materials, Standards of 1927. This bonding material is applied in sufficient quantity to merely wet the surface of the felt, a slight penetration being obtained by passing the wetted material over heating rolls in the well known manner.

The completed material is flexible and may be conveniently formed into rolls for storage and transportation with resulting economy in handling. The rolls also facilitate applying the material in the field as they may be mounted on suitable journals supported over or adjacent the concrete surface to be covered so that the material may be wetted, unreeled and laid in place all in one operation.

We prefer to use felt because it is inexpensive, forms a uniform bond with the top covering, and presents a uniform smooth surface to the concrete. We do not limit ourselves to such material, however, as any fibrous material, such as burlap, spongy paper, or cotton fabrics or fibres, that is water absorbent will meet the requirements. Neither do we limit ourselves to asphalt as the coating material as such substances as coal tar pitch, stearine pitch, metal foils or even sheet rubber may be used. The desirable characteristics of this top material is that it be moisture impervious, or relatively so, of moderate mechanical strength, and of a color suitable for temperature control, if that factor need be considered. Neither do we limit ourselves to a material that coheres to the water absorbent material, as the materials might be fastened together mechanically as by sewing or stapling to preserve close contact and form a practically unitary structure.

Figure 3 shows a construction in which a metal sheet 7 is mechanically fastened to the water absorbent sheet 2 by suitable staples 8.

When used to cure the lower slab on the interior of buildings, it becomes desirable to protect the top surface of the covering material with a third material better able to resist abrasion. One such construction is shown in Figure 2 in which a sheet of kraft paper 6 or similar material is cemented or otherwise fixed to the upper surface of the asphaltic covering.

A covering built up in this manner serves several purposes. The water absorbent layer 2 supplies the additional water required by the surface of concrete during its curing process; the moisture impervious layer 3 prevents evaporation from the layer 2, improves the temperature condition and contributes to the mechanical strength of the covering; and the top layer 6 resists the scuffing and abrasion of traffic, as well as also contributing to the mechanical strength of the covering.

Of recent years it has been found that the ultimate strength of concrete is closely dependent on its moisture content at the various stages of curing, and in part on the temperature during curing, and modern specifications are frequently as much concerned with moisture content and method of curing as they are with other ratios and qualities. To secure the highest strength and most economical combination of materials, and to obtain the complete hydration of the cement it has been the practice to keep the newly laid concrete in a wet condition by sprinkling or ponding to insure a proper cure. In arid regions water for ponding may be expensive or not available, and on inclined or vertical surfaces sprinkling or ponding treatment is difficult if not impossible because the water flows away by gravity. Accordingly various attempts have been made to utilize existing covering materials including waterproof paint to prevent loss of moisture.

A moisture impervious covering alone has been tried, but, without means for holding additional moisture, it does not operate satisfactorily because the moisture evaporated from the surface of the concrete condenses on the surface of the impervious covering and flows down along the unavoidable wrinkles and away from the areas where it is needed; and furthermore, such a covering permits some circulation of air beneath it and cannot make up water needed for hydration, or for loss of moisture from the concrete due to seepage into the forms or sub-base. Merely placing a secnd layer of moisture absorbent material beneath the moisture impervious layer does little to correct these defects since the top covering cannot be held in sufficiently intimate contact with the moisture absorbent covering to prevent the loss of moisture and circulation of air from occurring as described above.

Such separate coverings are also more expensive to apply than our unitary covering because of the extra time required to lay two coverings; and the further expense due to the fact that such coverings are so weak mechanically they can ordinarily be used but once. It is to be noted further that using a paint on the surface is defective in that it precludes replacing the water lost by seepage into the forms and sub-base, and supplying the water needed for hydration.

Burlap used alone is quite strong when new, but decreases in strength rapidly when subjected to the combined action of moisture and alkalis in the cement, is expensive, and must be wetted frequently to make up for its high rate of evaporation. Felt alone, of a quality cheap enough to be used in such service, tears very easily when wet, must be wetted frequently and deteriorates so that it cannot be used more than once unless handled with exceptional care—and expense.

The covering of our invention remedies these defects in that the wetted unitary structure conforms readily to and intimately with the contour of the underlying concrete; the intimate contact between the water absorbent layer and the impervious top covering holds the moisture where it is needed even on inclined or vertical surfaces; the water stored in the material con-

tributes to the complete hydration of the cement; and the improved mechanical strength of the unitary structure permits repeated use.

This material is particularly useful for curing concrete highways in arid or desert regions where water is expensive and scarce; for curing the inclined side walls of concrete irrigation ditches; and for curing the floor slabs, columns, or walls of buildings, including walls covered with cement, stucco or plaster.

When used on highways the material can be wetted and laid in one operation, by a machine if desired, and a practically perfect cure obtained. Even where water is so plentiful that ponding or sprinkling might be employed the covering of our invention produces a concrete of improved and more uniform strength because of the closely controlled temperature and moisture conditions, and at a saving in expense.

It is to be noted also that even when water is plentiful the ponds or slabs will run dry due to leaky dikes, and water sprinkled on may be evaporated in a few minutes by a hot dry wind whereas the covering of our invention insures the continued presence of water after being once placed. And, if water is scarce, the use of the covering of our invention becomes an item of major importance. Many millions of dollars have been spent in recent years repairing and replacing concrete highways laid in the arid regions of the west.

These highways were defective largely because of improper curing, particularly at the surface which spalls off under traffic. The use of the covering of our invention will prevent a repetition of such waste, since actual tests under the severest of conditions have demonstrated that when cured under our covering a concrete road slab will develop practically its full standard water cured strength. This means that a thinner slab can be used that will develop as much strength as those previously employed, and that will also have a superior surface. This will effect a tremendous saving for the tax payers, and particularly for those in arid States.

These remarks apply with equal force when the curing material of our invention is used on irrigation ditches and the floor slabs of buildings. In the latter case the effect is multiplied since by lightening the floor slabs in the upper stories the entire frame structure down to and including the foundation can also be lightened proportionately. It is thus feasible to save as much as ten percent of the cost of concrete materials used in a tall building.

We claim:

1. A covering for curing concrete, comprising a sheet of water absorbent material, and a reinforcing sheet of tough fibrous material adhesively secured to one side of the water absorbent sheet.

2. A covering for curing concrete, comprising a sheet of water absorbent material, and a reinforcing sheet of tough fibrous material adhesively secured to one side of the water absorbent sheet with a moisture impervious cement.

3. A covering for curing concrete, comprising a sheet of water absorbent material, a bonding material impregnated in one side of the sheet, and a moisture impervious coating bonded to the sheet and the bonding material.

4. A covering for curing concrete, comprising a sheet of water absorbent material, a coating of moisture impervious material adhesively secured to one side of the sheet, and a sheet of traffic resistant material fixed on the coating.

5. A covering for curing concrete, comprising a sheet of felt, a bonding coat of soft bituminous material in one side of the felt, and a coating of harder bituminous material fixed to the bonding coat.

6. A covering for curing concrete, comprising a sheet of water absorbent material, a coating of moisture impervious material adhesively secured to one side of the felt, and a sheet of paper fixed on the coating.

7. A covering for curing concrete comprising a sheet of water absorbent material, and a moisture impervious layer secured over said sheet and including a reinforcing sheet of tough fibrous material.

8. A covering for curing concrete comprising a sheet of water absorbent material, a coating of bituminous material on one side of said sheet, and a reinforcing sheet secured over said coating.

9. A covering for curing concrete comprising a sheet of water absorbent material, a waterproof sheet of traffic resistant material overlying the water absorbent sheet, and means providing a mechanical tie for securing said sheets together.

10. A covering for curing concrete comprising a sheet of water absorbent material, and a metallic sheet overlying the water absorbent sheet.

11. A covering for curing concrete comprising a sheet of water absorbent material, a metallic sheet overlying the water absorbent sheet, and means providing a mechanical tie for securing said sheets together.

12. As an article of manufacture, an integrally formed covering for curing concrete comprising a layer of water absorbent material, and a waterproof layer of traffic resistant material adjacent one side of the water absorbent layer.

13. As an article of manufacture, an integrally formed flexible covering for curing concrete, said covering being adapted to be wound in a roll and comprising a layer of water absorbent material, and a waterproof layer of traffic resistant material adjacent one side of the water absorbent layer.

14. A flexible pad for curing concrete comprising a relatively thick water absorbent layer of loosely felted fibrous material, said layer being adapted to hold on the surface of the slab enough water to keep the concrete thereunder moist throughout the curing period covered with a relatively thin evaporation-preventative layer secured thereto.

15. A pad for curing concrete comprising a layer of burlap material and a covering of material impervious to water secured to the burlap material.

16. A roll of flexible material for curing concrete roads consisting of an elongated strip that comprises a thick inner water-holding layer and a thin outer layer permanently connected together, said inner layer comprising fibrous material felted together loosely enough to yield free water and trap same on the surface of the concrete to be cured, and said outer layer consisting of material that will prevent evaporation.

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