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CONCRETE FORM LINING

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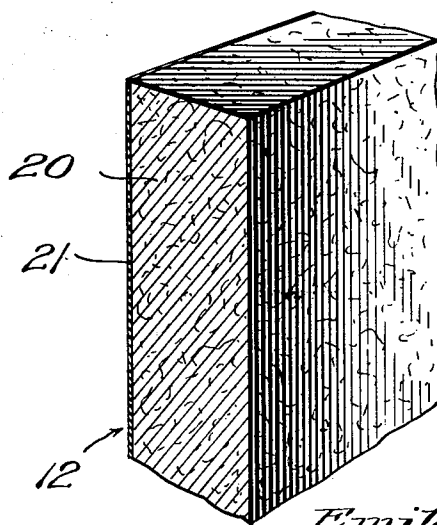
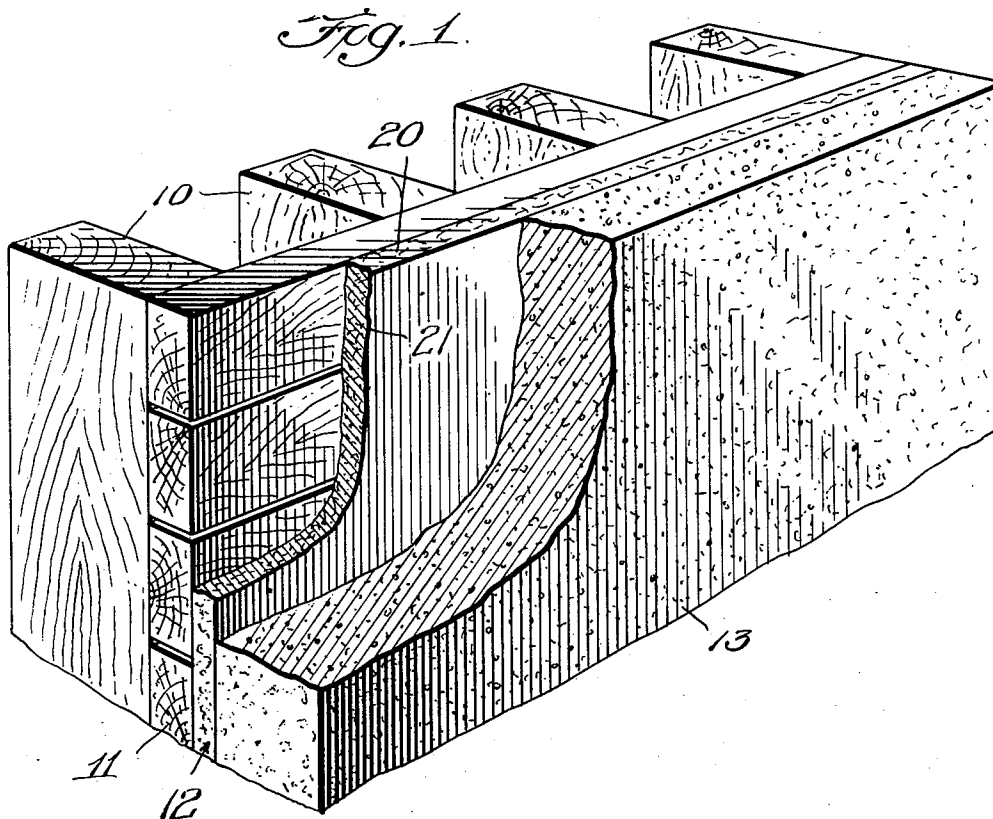


Fig. 2.

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CONCRETE FORM LINING

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The invention hereof relates to a new and improved concrete form lining material which is a composite material comprising essentially a sheet of the general nature of a sheet of fiber insulation board having mounted thereon a facing sheet composed of fiber and generally corresponding to a sheet of porous paper. It will, of course, be understood that the general description just given concerning the product is illustrative only to convey a general idea concerning the invention and that subsequently herein the invention will be described in detail. The concrete form lining comprising the invention hereof is a product which may be used in connection with the casting of various concrete forms or structures and the particular purpose of the use of such concrete form lining is to, in particular, produce on the surface of such concrete cast thereagainst, face portions or surfaces which are greatly improved as compared with those obtained in the processes of current methods of concrete construction.

In connection with the casting or erection of various concrete structures, as for example—dams, buildings, bridges and the like, or concrete blocks or slabs or like structural elements, it is common practice to provide forms in which the concrete is cast, which forms serve as molds to result in the desired structural form of the concrete after it has been placed in such molds and allowed to set and the molds are removed, that is, upon the removal of the molds the resultant concrete structure is of a form in accordance with the contour of the forms or molds in which such concrete has been cast.

In the formation or molding of concrete structures it is current practice to use forms composed of natural matched lumber, rough lumber, plywood, hard and dense fiber board, known as hard board, or other generally like or similar materials or various combinations thereof. In the use of such form materials they are usually either fabricated as prefabricated forms, or are directly erected where the concrete is to be cast, but in either case the such concrete form materials are suitably fabricated and erected to mold the concrete to the desired form for the resulting concrete structure and they are constructed in accordance with the contour desired for the finished structure. In general, in the use of these concrete form materials they are erected or used in connection with suitable braces, supports or reinforcements or the like, so that the complete forms will be retained in the desired shape or contour and will properly support the concrete which may be cast therein or thereagainst.

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Concrete forms prepared in the manner such as is now common, using the usual materials as above mentioned for the face portions thereof, are suitable for more or less rough work such as foundation work or surfaces which will eventually be covered, but they are not particularly suitable for concrete forms where the face, which will be cast thereagainst, will be exposed to view. It is more or less common to all of the concrete form materials now used that the face of concrete cast thereagainst is more or less honeycombed, has so-called bug holes, shows washing or erosion, shows joint marks or wood grain if lumber or plywood is used, and other more or less like or similar surface imperfections. Furthermore, the surface of concrete cast against such forms is more or less porous throughout, due to the fact that concrete as poured always contains more water than that actually necessary for the hydration of the cement, so that the particles of the composition are more or less surrounded by films of water which after the concrete has hardened and the excess water has evaporated results in a concrete which is more or less porous, of course, largely dependent upon the amount of such excess water which was incorporated in the concrete when it was cast in the forms.

It is a particular object of this invention to provide a concrete form lining material which obviates many of the defects, particularly surface defects of concrete cast thereagainst as compared with concrete cast against the usual form materials as above referred to. In particular, it is an object of the invention hereof to provide a concrete form lining material, the use of which will result in production of concrete structures in which the surface portions cast against such form lining are of pleasing appearance, that is, substantially without the various surface imperfections as above referred to, and, in particular, will result in a concrete structure in which the surface portions which are cast against such form lining material are more dense and harder than the surface portions of concrete which is cast in conventional concrete forms.

In connection with the above particular objects of the invention hereof and in conjunction therewith, it is further an object of this invention to provide a form lining material which is of lightweight, which may be utilized in the form of large sheets, for example, as sheets four feet by twelve feet or thereabouts, or even in larger sheets, although of course, if such is to be used for the lining of forms for the casting of concrete blocks, such may be used in small sheets, say as small as eight inches by eight inches or sixteen inches

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according to the size of the face of the block which is to be formed. Still further objects of the inventions hereof are the provision of a form lining material which is porous to air and to water and which in fact has some suction tendency, that is, such a material of a character which tends to actually draw from the face of the concrete cast thereagainst any entrapped air and the excess water, in connection with which feature of the invention it will be apparent that by the removal of entrapped air from the surface of the concrete cast against such form lining material and of the excess water, that the formation of honeycombs and bug holes at the surface of such concrete structure will be largely or entirely obviated, and that due to the removal of the films of water from between the particles of concrete mix, in particular, at or adjacent the surface, that the particles will be more closely packed or compacted and therefore, that the surface will be harder and more dense than such resulting from conventional practice. Still further, and in particular it is an object of the invention to provide a complete form lining material, which at the surface of the primary or principal portion thereof carries a thin and relatively fragile layer of material, which in the use of such form lining material is relatively readily separable therefrom for the purpose which will hereafter be more fully described and the function of which will become clearly apparent upon further reading of the following specification.

The invention hereof may be described briefly and generally as comprising a concrete form lining material made up of a sheet, which is in general the form of a sheet of fiber insulation board, on a surface of which is mounted a sheet of porous paper, or equivalent. The backing or substantial portion of the composite form lining material, that is, that portion in the form of a sheet of fiber insulation board may conveniently be a sheet of fiber insulation board such as is generally available on the market under various trade names, such as Celotex Cane Fiber Insulation, Insulite, Nu-Wood, and under other trade names all of which fiber insulation boards are made according to the same general procedure wherein ligno-cellulose fiber, suitably prepared, is suspended in dilute water suspension and then felted therefrom as a sheet which is subsequently dried and cut to convenient size. This material generally in its process of manufacture is sized with alum and rosin size, or equivalent water repellent sizing, and while the various such boards may differ with respect to the specific sizing and in other minor details of their manufacture or properties, they are in all essentials similar products.

In preparing the concrete form material hereof, the backing sheet, such as has just been described, has applied to a face thereof a sheet of porous paper which is preferably an unsized sheet and has a porosity to air of around 2 to 6 seconds per 100 cc. as hereinafter more fully set out. The sheet of porous paper is adhered to a face of the fiber board backing sheet preferably with a water soluble glue used sparingly and preferably providing limited adhesion by spot, strip or line gluing or the like, as is commonly practiced in gluing operations.

Of course, in the composite concrete form lining above generally described, none of the various details or variations thereof have been mentioned since these will be more particularly pointed out in the following description.

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In the accompanying drawings, Figure 1 is a perspective view of a conventional application and use of the form lining hereof with parts broken away, and

Figure 2 is a perspective view of the composite concrete form lining.

In the drawings accompanying this application the concrete form lining hereof is shown conventionally in its use, that is, as such is used for molding or casting of concrete structure thereagainst. In the conventional showing there appear suitable supports or the like, 10, to which are secured rough form boards, 11, suitably nailed thereto or otherwise secured, and as the facing or interior face thereof, the composite concrete form lining thereof designated by numeral 12, and there is shown cast thereagainst a portion of a concrete structure designated by numeral 13.

The form lining hereof illustrated in Figure 2 of the drawing, the composite form lining designated by numeral 12 comprises two parts, one the backing sheet or sheet in the form of a sheet of fiber insulation board designated by numeral 20, and the thin surfacing or facing portion thereof, the porous paper sheet designated by numeral 21. No attempt has been made in the drawing to illustrate the gluing of the paper sheet 21 to the fiber board backing sheet 20, since such gluing is readily understood as common in gluing practice, and the illustration thereof is more or less impractical.

The fiber board backing sheet 20 of the composite form lining material 12 may be, as has been mentioned, a commercial sheet of fiber insulation board which in its manufacture has been sized with rosin and alum or equivalent sizing, whereby the fibers thereof are water repellent and which sheet is sized throughout its thickness, or such fiber board sheet may be one especially prepared for use in connection with the invention thereof. Various alternatives as regards the fiber board backing sheet, or the use of a like sheet which has not been sized, is the use of such a sheet which has been especially manufactured as two layers interlaced at their contiguous faces and wherein one of the layers is sized throughout, and the other is not sized, or composed of two separate fiber boards adhered together, one of such being sized and the other not being sized, or such sheet may be a sheet of commercial fiber insulation board, which at and adjacent one face has been treated as will be described.

Since in the use of the concrete form lining hereof it will be subjected to the condition that it is in contact with a wet concrete cast thereagainst, and as it will soak up or absorb most of the excess water from such concrete, it is not an absolute necessity, but it is desirable, that this fiber backing sheet shall be one, a portion of which, that is, a portion which will be called the rear portion is relatively water repellent, and therefore it is desirable that for such sheet the back portion shall be suitably sized so as to be water repellent, so that in the use of this concrete form lining the back portion thereof will absorb little or no water, and will therefore retain to a large degree its inherent rigidity. The retention of the rigidity of at least a portion of the concrete form lining is desirable in order that it may be handled for removal thereof subsequent to the usual period ordinarily allowed for concrete to set before the forms are torn down or removed from the set concrete structure. It will,

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of course, be understood that the retention of the inherent rigidity of the fiber sheet is not an absolute necessity, but however, it is a practical convenience, which to all intents and purposes amounts to necessity since this makes practical the ready removal of the form lining from the face of the cast concrete structure, and in many cases enables the sheet to be removed in such condition that it is reusable, at least for some purpose. If the fiber sheet were not at least in part water repellent the sheet would become more or less entirely saturated with water and have little or no strength or rigidity so that it would be impractical to remove it as a sheet, or in such condition that it could be used for any purpose whatsoever.

In the preferred form of the invention hereof the composite concrete form lining 12 is made from a commercial fiber insulation board, for example, Cane Fiber Insulation Board, but, however, using a particular grade thereof, which as compared to the ordinary structural insulation is somewhat less dense but of a density between about 0.20 and 0.24, preferably of a density of about 0.21 to 0.22 as compared to that of the usual structure insulation which generally is of a density of about 0.30. This fiber sheet is preferably one which has been sized with rosin and alum or equivalent sizing so that it is water repellent, the sizing being a so-called integral sizing, that is, one applied during the process of the manufacture of such sheet so that the fibers throughout the sheet are sized and consequently water repellent. For the purposes of the preferred form of the invention hereof, the described sheet of fiber board is treated at or adjacent one of its faces with a surface tension reducing agent so that at and adjacent such surface the water repellent property of the facing is destroyed, and this portion of the sheet at and adjacent such treated surface becomes in fact water absorptive rather than water repellent. A surface tension reducing agent which may be used for such purpose is Aquasol, a sulfonated castor oil, or there may be used for bringing about a lowering of surface tension other surface tension depressant as for example, saponin or soap bark, sulfonated long chain alcohols or other of the well known and commercially available wetting agents, numerous of which have been tabulated in an alphabetical list which appeared in Industrial and Engineering Chemistry, vol. 33, No. 1, January 19, 1941, pages 16 to 22. In using an alternative surface tension depressant in lieu of Aquasol, it is of course understood that the quantity used should be so applied that the surface tension depressing effect is the same as that which is achieved by the use of Aquasol as is herein set out.

When Aquasol is used as a wetting agent, it is preferably prepared for application as a 4 to 6 per cent solution by volume as representing a suitable concentration for use. This solution is applied to a face of the fiber board in any desired manner, as by spraying, rolled coating or the like and for the reasons as have been above stated, it is of course desirable that such shall penetrate only to a limited depth from the face to which it is applied, preferably not more than one-half the way through the thickness of the board.

The effect of the application of the wetting agent to the surface of the board and to a limited depth through the thickness is to destroy in that part of the board the effectiveness of the size

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which was previously applied to the fibers, the surface tension is lowered and the portion of the board to which the wetting agent has been applied becomes readily wettable as compared to its previous condition of being water repellent. The remainder of the board to which the wetting agent does not penetrate remains water proofed or water repellent and this portion in use constitutes a suitable uneffected portion of the board whereby the board remains readily handleable and has in general some salvage value.

The Aquasol solution or equivalent amount of other wetting agent is applied to a surface of the sheet in an amount so that the surface tension of the surface portion of the board is reduced to the point where $\frac{1}{2}$ cc. of water applied with a pipette will be completely absorbed by the board in from one to forty-five minutes instead of requiring a period of something like ten hours or thereabouts which would be the time required for such absorption were such surface untreated, that is, merely having a good degree of water repellent sizing but without the application of the surface tension reducing agent.

The fiber board, in the form of a sheet of fiber insulation board, and having a density of about 0.21 to 0.22, is as manufactured, relatively porous and open in structure and relatively penetrable by air, that is, to obtain a fiber board of this density in the preferred thickness of about one-half inch, the fibers which are used are, as compared to paper fibers relatively coarse and the structure of the sheet is sufficiently open that something like 50 per cent of the sheet constitutes voids and openings between the fibers thereof. Such a fiber sheet will have an air resistance of the order of 4 seconds per 100 cc., that is, under controlled testing conditions 100 cc. of air will flow through the sheet in 4 seconds. Of course, this air resistance of 4 seconds per 100 cc. is not critical at this particular point and a reasonable variation therefrom is permissible within the practical limits of about 2 seconds to about 6 seconds per 100 cc. The air resistance of the sheet as stated is that determined by a method which will be briefly described although the apparatus and method of determination is substantially that covered in tentative specification D 202-32 T of the American Society for Testing Materials. For the testing of the sheet which forms the basis of the form lining of this invention, certain details of the testing procedure as set out in such tentative specifications are varied as follows to adapt the test, which is one for testing felts, to the testing of a fiber board sheet.

Standard procedure as covered in the tentative specification referred to is modified so that the sample tested is $1\frac{1}{8}$ inch square and 0.3 inch thick. If the sheet to be tested is of greater thickness it can be sanded down to the thickness of the standard specimen. When the sample is clamped down in the apparatus $\frac{1}{4}$ inch stops are provided so that final contact of the sample is obtained and the test will be made on a sample which is exactly $\frac{1}{4}$ inch thick as limited by the stops and which is tested in a condition of slight compression. The standard procedure of testing then proceeds to determine the air permeability of the sample, such procedure being in accordance with the test specification above referred to and determining the time required under controlled conditions for 100 cc. of air to penetrate the specimen.

It is, of course, to be understood that if for some

reason the sheet being used is unsized, as for example, if it is immaterial whether the form lining may be readily removed or for some other reason, or if the sheet is relatively poorly sized, then the amount of surface tension reducing agent which is applied is suitably reduced, or if the sheet was not sized it is either not used at all or in only a very small amount so that in any case the water resistance of the sheet is not decreased to too low a figure and it is recommended that the water resistance should not be appreciably below the minimum, as previously stated, of $\frac{1}{2}$ cc. absorbed in from 1 to 45 minutes. The preferred base sheet, the fiber board having a water resistance of about $\frac{1}{2}$ cc. of water absorbed in 1 to 45 minutes and having an air resistance of about 4 seconds per 100 cc. now has applied to its surface, its treated surface or the one which has the preferred characteristics, a sheet of porous paper which for example may be a sheet of tissue paper of substantially the character very commonly used in stores in packing dresses and other more or less fragile articles, a sheet of ordinary newsprint paper, ordinary filter paper or other generally similar porous paper.

The paper facing sheet is preferably adhered to the surface of the fiber board sheet with a small amount of adhesive which is preferably a water soluble adhesive. The adhesive used need not be necessarily a water soluble adhesive since the adhesive may be so applied so as to offset its insolubility in water. The paper sheet is adhered to the fiber board sheet with just as little glue as possible since in gluing the sheets together it is desired that the natural porosity of the paper facing sheet should be reduced just as little as possible. Gluing is either with a very sparing application of glue, if a water soluble glue is used, or in using either the water soluble or insoluble adhesive the same effect can be substantially obtained by merely spot gluing or lime gluing the paper sheet to the fiber board sheet. Since these various methods of adhering material together by spot gluing or lime gluing and also by strip gluing are each well known procedures, no detailed description will be given except to say that in spot gluing the two materials are glued together by spaced small spots of glue, in lime gluing the materials are adhered by glue applied in very narrow spaced stripes or lines, or in strip gluing the materials are glued together by more or less narrow but spaced strips or stripes of glue applied between the materials to be adhered.

In connection with the gluing of the paper facing sheet to the backing sheet ordinary care should be used to have the paper facing sheet smooth and taut on the backing sheet and in this connection it may be advisable to moisten the facing sheet before it is applied. Such moistening will slightly expand the sheet and when it dries after application it will be taut due to shrinkage. The facing sheet if moistened is preferably moistened with water containing a small content of surface tension reducing agent, for example, 2 to 4 per cent Aquasol by volume. The purpose of the use of a wetting agent on the porous facing sheet is to assure that it will be readily wetted and penetrated by the water from the concrete and the content of wetting agent applied to the sheet is not critical. In the combination of the form lining hereof it is preferred that the facing sheet is one readily wetted or stated differently, somewhat better results can be had in the use of the form lining if the facing sheet carries a small content of a wetting agent.

Also in gluing the facing sheet it will of course be understood that if spot or strip glued, that the spacing of spots or strips of adhesive should be relatively small so that the facing sheet is well adhered over its entire area. In gluing, particularly so when a soluble adhesive is used, it is preferred that a small amount of wetting agent be incorporated, say about 2 per cent Aquasol by volume. The content of wetting agent in the adhesive prevents delay which might otherwise occur in the penetration of the water, from the concrete, through the glue line.

The composite concrete form lining board which has been described is used with suitable backing or supports, as before mentioned in lining concrete forms, and the concrete is cast against this composite concrete form lining, which in use is positioned with the paper facing sheet as that face which is exposed and against which the concrete contacts. When normally wet concrete is placed in a form lined with the concrete form lining hereof, it may be suitably vibrated or tamped, but it is of course, to be understood that such should be carried out in a manner so that the surface of the form lining is not injured. When the concrete is applied against the form lining there is always a certain amount of occluded air at and adjacent the common face of the form lining and concrete, and as has been mentioned, there is more water present than is required for the hydration of the cement content of the concrete. In concrete placed in a mold there is a hydrostatic head built up within the body of the mass, depending at any point upon the distance of such point downwardly from the surface of the mass. It is believed that due to this hydrostatic head that occluded air at the interface, since there is a slight positive pressure, flows through the paper facing sheet of the composite form lining material and then into the body of the fiber board sheet portion thereof with possibly some of such air passing through the sheet or out of its edges to atmosphere. This feature of venting any occluded air from the concrete form adjacent the interface appears to occur very quickly after the concrete is applied and then immediately following, and probably more or less overlapping such escape of the air, the excess water from the concrete, from that part adjacent to the form lining, begins passing into the form lining.

The excess water in the concrete mass of course readily penetrates the paper facing sheet of the form lining and since the glue by which it is adhered has been applied in such manner as to not interfere, or so as to interfere to only a minimum extent, this water then passes on into the porous absorptive fiber board sheet which as described was so treated as to have a water absorption of about $\frac{1}{2}$ cc. in between 1 to 45 minutes.

The passage of the water from and adjacent the interface apparently causes two actions in the concrete masses adjacent such interface. The one action is that apparently some of the very fine cement fines move along with this water to the surface of the paper facing sheet of the form lining and there they are filtered out at the surface of the concrete while the water passes on through the paper sheet into the fiber board sheet. Excess water thus being removed from the concrete adjacent the surface of the mass, it follows that the particles thereof in this portion where the excess water is removed tend to pack more closely together and thus as the result of these two actions, the one, concentration of fines

at and adjacent the surface and the other, the removal of separating water films, it results that the concrete mass is more dense and more compacted at its surface than elsewhere. When this concrete sets the skim or surface portion which has been in contact with the form lining will be found to be appreciably more dense and harder and stronger than the interior portion of the concrete mass.

The relatively thin facing sheet composed of fine fiber, paper fiber, can be made sufficiently air and water porous to pass these as the desired rates as hereinbefore set out. The finely fibrous paper fiber used in the surfacing sheet cannot be formed into a thicker unitary form lining which will be air and water pervious to the extent required and it is for this reason that the combination hereof was devised. The finely fibrous facing sheet provides a finely porous filter which efficiently filters out the fine particles of cement which would otherwise tend to enter into the more coarsely fibrous backing sheet and which would tend to bond the backing sheet to the concrete face. Also the fine fibers of the porous facing sheet are better bonded into the sheet than are the coarser fibers of the backing sheet and therefore when the paper facing sheet is used there is little or no tendency for individual fibers at the surface of the paper sheet to bond in the face of the cement cast thereagainst.

After the concrete has been allowed to set for a reasonable time, 24 hours being preferred, the forms are removed and the form lining is stripped from the face of the concrete mass. Due to the fact that a portion of the fiber board sheet of the form lining is water repellent as has been described, it follows that this portion of the sheet is relatively unaffected by the water which has been absorbed in the sheet and this unaffected portion of the sheet gives it sufficient rigidity and strength so that the lining may be readily removed from the face of the concrete mass. The paper sheet with which the form lining is faced is a relatively weak sheet which in particular when it is thoroughly wetted has little or no strength and in such case, if a water soluble glue has been used to adhere the paper sheet and the fiber board together, then upon removal of the form lining sheet from the face of the concrete the paper sheet will probably remain on the face of the concrete mass more or less firmly attached thereto depending upon conditions. If the form lining is not stripped until subsequent to 24 hours after the concrete is placed, say for 48 hours or thereabouts, the paper facing sheet will probably be fairly well adhered to the surface of the concrete and the water soluble bond to the insulating backing will have been destroyed, but if the form lining is removed in the preferred time, that is at about 24 hours after the placing of the concrete there will be relatively little bonding of the paper facing sheet to the face of the concrete, although there may be some localized bonding here and there. In either case if the paper facing sheet does come off of the fiber board sheet and remain on the face of the concrete mass, this sheet can subsequently be removed relatively readily due to the fact that it is a relatively thin and fragile sheet and further that the fibers thereof are fine and quite easy to wash off or scrub off of the surface of the concrete, or even though this paper sheet is not so removed from the surface of the concrete, if the concrete comprises an exposed structure this thin layer of fine

fiber will be weathered from the surface of the concrete in a relatively short time.

Whereas above there has been particularly referred to a porous facing paper sheet which is suitably glued to the surface of the relatively thick sheet in the form of a sheet of fiber insulation board, it is to be understood that equivalents may be used therefor. For example, as is well understood by those skilled in the art of the manufacture of paper and fiber insulation board, an equivalent such sheet may be run directly on the surface of the fiber board backing in its course of manufacture by providing suitable means for forming a thin layer of fine fibers on the surface of the fiber board as it is being manufactured. A further manner in which the fine fibered surface sheet may be applied is by depositing on the surface of the fiber board a thin layer of fine paper fiber to which there has been applied, or with which there is admixed a small amount of adhesive to in effect apply to the surface of the fiber board an adhesively bonded thin sheet of fine fiber. Other suitable methods of applying the porous fine fibered sheet to the surface of the fiber board will be apparent to those skilled in the art applicable.

It is not essential that the thin facing sheet shall be composed of paper fibers, and it will be readily understood that other fibers may be substituted therefor, as for example fine asbestos fiber, cotton fiber and other fine fibrous materials. The essential of the facing sheet applied to the surface of the fiber board sheet is that such sheet shall be composed of finely divided material, not necessarily limited to fibers but which is applied as a thin sheet and in such a manner as to be relatively readily separable from the surface of the fiber board sheet and having the characteristic of being readily penetrable by water and air and of readily being disintegrated, particularly when wet. It will also be understood, of course, that a small amount of a wetting agent may be applied to the porous sheet in general accordance with the description of the application of the wetting agent to the fiber board, should such be necessary to obtain the required wettability of the surfacing sheet.

Furthermore, it will be readily apparent to one skilled in the art that the surfacing sheet and the fiber board sheet to which it is applied may each be utilized to in effect more or less control the properties of the other thereof as regards water absorption and air resistance. The paper surfacing sheet should not have air resistance in excess of the six seconds which has previously been mentioned, but on the other hand if the air resistance of the fiber board sheet is in the required range, it is immaterial whether the air resistance of the surfacing sheet is abnormally low. In substantially the same way the surfacing sheet should have a water absorption now enough to pass the water from the interface but it is relatively immaterial whether it will pass this water at an abnormally higher rate, providing the rate of absorption of the fiber board sheet is within the desired limits. Also, it will be readily understood that the surfacing sheet can be utilized as a control should the air resistance of the fiber board sheet be too low, in which case by using a surfacing sheet which will not allow the air to pass in excess of the desired rate then the low air resistance of the fiber board backing sheet will be compensated for. In generally like manner if the backing sheet tends to too rapidly absorb the water from the interface, the surfacing sheet may

serve as a check or control to offset such excessive rate of water absorption of the backing sheet. In any event, the porous surfacing sheet will in general have a thickness of but several thousandths of an inch, say about 2 to 4 one thousandths, but as should be apparent from the foregoing, thickness is relatively immaterial provided the other requirements for the properties of the sheet are satisfied, that is, composed of fiber material having the required minimum porosity to air and water and comprising a relatively fragile sheet.

While above the backing sheet of the composite form lining has been described as a sheet of fiber insulation board, the principles of the inventions hereof are more widely applicable. The backing sheet may be an unsaturated roofing felt or other more or less similar relatively porous and air pervious sheet. The such backing sheet should have a minimum thickness of about $\frac{1}{8}$ " so as to have sufficient body to absorb the excess water from the interface and, of course, must have the air porosity and water absorption characteristics which have been pointed out as those required. However, the original characteristics of such sheet need not necessarily correspond to those required but need only be such as can be modified, in accordance with the principles which have been herein set out, so that the composite form lining, ready for use, has the required characteristics.

A further advantage of the composite form lining hereof is that dusting of the concrete surface, such as occurs with the use of other form linings, is avoided. Various form linings, with treatments to make them suitable have a quite acid reaction. Such condition tends to cause the formation, on the face of concrete cast thereagainst, of a fine dusty layer which may dust off. When using the composite form lining hereof the surface is readily prepared with a pH of approximately pH 7 or substantially neutral and the formation of the dusty cement layer is avoided. The pH of paper fiber is substantially neutral and if a wetting agent is applied, a substantially neutral wetting agent is preferably used. A further advantage is that as the form lining is removed, the fine fibered surface usually remains more or less adhered to the face of the concrete. The sheet on the face of the concrete tends to retard evaporation and thus the cement is more completely hydrated and the face is harder or better cured as compared to a face where there has been free evaporation.

In the use of the inventions hereof there is provided a form lining sheet on one face of which, the face against which the concrete is cast, there is a thin and relatively fragile layer of finely divided material. This surface layer readily separates from the backing sheet and while the fiber or material which composes such thin surface sheet may be left on the face of the concrete it is sufficiently fragile and fine that it is either readily removed or it readily dissipates from the surface through the effects of weathering. The surfacing sheet being of fine material provides a smooth surface against which the concrete is molded or cast so that the resulting concrete surface is a smooth surface of pleasing appearance, and due to the fact that occluded air at the interface has escaped and excess water has been removed there is an entire or almost complete absence of the normal surface defects such as honeycomb, bug holes, pits and the like.

It will be readily seen that there has been above described a new and novel concrete form lining in connection with which the manner of prepar-

ing such form lining has been set out in detail together with the procedure for the use thereof in molding or forming concrete structures. This invention provides a concrete form lining which is cheap, easy to prepare and which in the use thereof results in concrete structure having at the surface thereof characteristics which cannot be obtained except by the use of the inventions hereof. The concrete resulting from the use of the concrete form lining hereof has a very smooth uniform surface, if the concrete was properly placed and is practically free of honeycomb or bug hole imperfections at the surface of the concrete and the surface portions of the concrete mass are more dense and stronger and harder than surfaces otherwise obtained.

Herein reference has been made to fibers of various character, as for example, insulating board fiber, paper fiber and roofing felt fiber. No attempt will be made to define these fibers in accordance with their dimensional characteristics since due to variations in the dimensions of individual fibers within each of such groups, any such attempt would be more or less meaningless. Those skilled in the various arts involved, that is, the paper art, the fiber insulating board art, roofing felt art, and similar arts will readily perceive the differentiation as between such various fibers and can readily determine the general character of the type of fiber called for. A fiber insulation board fiber is in general what might be termed coarse fiber, that is the fiber diameter is relatively large and the fiber length is relatively long. The fiber for roofing felts is predominately relatively thin fiber but relatively long. Paper making fiber predominately is a thin fiber which is relatively short. As an example of what is here referred to, a fiber insulation board fiber may be a coarsely ground groundwood used substantially as produced, whereas groundwood which is originally somewhat more finely ground and then subjected to further suitable refining to subdivide the material is used as a paper fiber from which newsprint is made. Since mere reference to fiber in accordance with the type of product which is ordinarily made therefrom is considered to be sufficient information for those skilled in the various respective arts to determine upon the general type of fiber which is to be used, it is to be understood that the description herein is to be interpreted in the light of such art distinctions.

The inventions hereof having been set out in detail, what I claim is:

1. A form lining board comprising in combination a body sheet and a surface sheet, the body sheet and surface sheet at their contiguous faces separably connected one to the other, the body sheet comprising a permeable, air porous sheet of the form of fiber insulation board of a density within the range of about 0.20 to 0.24 and throughout a portion thereof less than the entire thickness of the sheet extending from the rear face of the body sheet toward the surface sheet the fibers thereof sized and water repellent and the surface sheet comprising a thin foraminous and readily water and air pervious non-fabric particulate film surfacing on the combination form lining board.

2. As an article of manufacture a composite concrete form lining board comprising in combination a body sheet and a facing sheet, the body sheet comprising an air pervious and water

absorptive board form sheet of fiber insulation board of a porosity of between 2 to 6 seconds per 100 cc. material and the surface sheet comprising a thin foraminous but continuous non-fabric particulate sheet porous to air and water, the adjacent faces of the body sheet and facing sheet separably adhered one to the other.

3. A composite concrete form lining board comprising a major body portion thereof characterized by a high content of coarsely fibrous material and a void content of the order of 50 per cent of the mass thereof with an air porosity of between about 2 to 6 seconds per 100 cc. and a minor surface portion thereof readily air and water pervious and of a nominal thickness not exceeding about 0.01" and characterized as composed of fiber of the fineness of the order of paper forming fiber.

4. A composite form lining comprising a major body portion through the thickness thereof composed of coarsely fibrous material of the nature of fiber insulation board and which is air porous and water absorptive and has between the fibers thereof voids and passages to the extent of substantially 50% of the volume thereof and a minor surfacing portion comprising an air and water pervious portion of a porosity finer than that of the body portion but having an air resistance of not less than 2 seconds per 100 cc. and serving to control the rate of flow of air into and absorption of water by the body portion, the surfacing portion having a content of a surface tension reducing agent therein.

5. A composite form lining comprising a major body portion through the thickness thereof composed of coarsely fibrous material of the nature of fiber insulation board and which is air porous and water absorptive and has between the fibers thereof voids and passages to the extent of substantially 50% of the volume thereof and a minor surfacing portion comprising an air and water pervious portion of a porosity finer than that of the body portion but having an air resistance of not less than 2 seconds per 100 cc. and serv-

ing to control the rate of flow of air into and absorption of water by the body portion, the body portion through a portion of the thickness thereof remote from the surfacing portion having a content of a water repellent.

6. A composite form lining comprising a major body portion through the thickness thereof composed of coarsely fibrous material of the nature of fiber insulation board and which is air porous and water absorptive and has between the fibers thereof voids and passages to the extent of substantially 50% of the volume thereof and a minor surfacing portion comprising an air and water pervious portion of a porosity finer than that of the body portion but having an air resistance of not less than 2 seconds per 100 cc. and serving to control the rate of flow of air into and absorption of water by the body portion, the body portion through the thickness thereof adjacent the surfacing portion having a content of a surface tension reducing agent.

7. A composite form lining comprising a surfacing portion composed primarily of paper making fibers and a backing portion composed largely of fibers coarser than paper making fibers, each of such portions, air and water porous and such portions mutually coacting to limit the rate of porosity thereof from the surface to that of about 2 to 6 seconds per 100 cc. and the porosity to water to about 1 to 45 minutes for the passage of 1/2 cc. of water applied to the surface.

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