WALL CONSTRUCTION AND METHOD OF MAKING SAME

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This invention relates to an improved wall construction, and particularly to a wall construction including a plastered or stuccoed surface characterized by high resistance to cracking when subjected to stresses of compression or tension and by freedom from spalling when nails are driven into it for supporting heavy objects, such as picture frames, works of art and other objects requiring for their exhibition that they be displayed against an extended wall surface.

In art museums, exhibition halls, manufacturers' display rooms of various kinds and in private residences there has been a long existing problem of devising a relatively inexpensive wall surface into which nails may be driven to support objects for display and artistic purposes without causing spalling or other damaging or marring of the wall surface and which will permit of the removal of the nails and the re-location of the object to be exhibited without leaving unsightly broken or marred areas. This problem is particularly acute in museums and the like where it is frequently necessary to drive heavy nails and use picture hooks capable of supporting 100 pounds or more without cracking of the wall or surface on driving and without failure of the wall or surface when weight is applied to the nail or hook in the usual way. There is also the further problem that the material of the prior plaster wall constructions tends to spall when the nail is withdrawn.

The most satisfactory material heretofore employed for achieving the desired result has been wood, which has been applied either to a masonry wall or by using an all-wood construction. The kinds of wood that must be employed are very expensive compared to other building materials such as are employed in practicing the present invention. Heretofore, in the museums which could not afford the more expensive wooden walls, resort has been had to the use of picture molding and practically all pictures, other than light prints, have been suspended therefrom by unsightly wires, rods and other devices that not only detract from the exhibit but are not in keeping with the spirit of modern decorative design.

It has also been proposed to glue fabrics to plaster walls, and this has afforded some help when only small nails and tacks are employed. However, such a wall finish will not support heavy objects and at best the fabric hides the crushed and damaged plaster underneath.

I have found that the above indicated deficiencies and drawbacks of the wall constructions heretofore employed in this field may be overcome by the use of an improved surfacing composition and by applying certain treatments thereto, all with a view to producing a wall surface having characteristics of toughness combined with a measure of resiliency rather than hardness and brittleness, all as more particularly hereinbefore described with reference to the attached drawing.

In the drawing there is shown a vertical section of the wall construction of my invention, in which 10 represents a supporting wall of cinder blocks or similar porous material adapted to furnish the desired structural support and at the same time having sufficient porosity to permit of the penetration of nails driven through the superimposed surface coating 12. The coating 12 is made up of one or more, preferably at least two, coats of a plaster or stucco composition having distributed therein a fibrous material adapted to cooperate with the other components in forming a coating that is soft enough to permit driving of nails therein without cracking and that is of low crystalline composition and possesses sufficient porosity or compressibility to insure that the material displaced by the entering nail will compress against and into adjacent material without rupture of the coating or setting up of undue internal strains. At the same time the composition is so adjusted as to possess sufficient resiliency and strength to resist effectively the stresses of tension and compression that may be expected in the course of normal setting or vibration of the supporting base, or caused by shrinkage of the coating composition in drying and setting. The surface coating is impregnated in its outer surface portions as at 14 with a penetrating liquid or other suitable penetrating agent adapted to impart to the material in the impregnated area additional desirable characteristics of the kind and for the purpose explained below.

A nail driven into a vertical or inclined surface and supporting a weight behaves as a cantilever beam the maximum shearing force of which is exerted at the surface of the material into which it is driven or embedded. It follows that if the surface and the material adjacent to it are rendered capable of resisting the shearing force of the nail, the remaining material will not fail. Likewise cracking, spalling and failures of like nature generally commence at the surface and penetrate inwardly. Therefore, if the surface and adjacent material are rendered resistant to such stresses, failures are to a great
measure prevented. In impregnating the surface and the adjacent portions of the coating in my wall construction, I aim to impart sufficient rigidity and strength to resist effectively any tendency of nails driven into the surface to shear downwardly through the material when a weight is suspended thereon, while at the same time preserving in the impregnated areas sufficient penetrability to permit nails to be driven through and withdrawn from the material without spalling or cracking.

By way of example, I will describe the invention as applied in forming a wall surface for nailing as in museums, display rooms and the like. The supporting wall is laid up with porous nailable blocks, e.g., cinder blocks, in the usual way with mortar. However, before the mortar has set, it is desirable to rake out the joints to a depth of at least ¼" to promote firm anchorage of the cementitious or plaster coating.

The cementitious coating is then made up by first mixing together in the dry Portland cement and sand previously screened through a 14 mesh sieve in the proportions of 1 part of Portland cement to 2 parts of sand by weight. Dry asbestos fibers are added to this mixture in the proportion of 1 to 10 parts of the combined mixture of cement and sand, by weight. A grade of asbestos that I have found to be very satisfactory is that sold by Johns-Manville Corporation known as "Grade 47", conforming to a guaranteed test identified by the symbol "0-2-10-4". Sufficient water is added to form a plastic mix, preferably made as stiff as possible and yet capable of being worked and spread with a plasterer's trowel or other suitable tool of the masons' and plasterers' trades.

The surface of the wall blocks previously set is then wetted down and the plastic mixture is applied thereto to form a coating of about ½" thickness. This coating is allowed to take an initial set after "scratching" or roughening the surface to facilitate the adherence of the next coating. After not less than 24 hours, the surface of the first coating is wetted down and then a second coating is applied to a depth sufficient to give the two coats a total thickness of about ¾". The second or final coat is not "scratched" but is lightly smoothed on the surface with the trowel or other suitable tool, care being taken not to work to such an extent as to bring too much cement to the surface.

After the second coat has set, but preferably not less than 48 hours, the skin rich in cement brought to the surface by the trowel is removed by abrasion with steel wool, stiff brushes or the like, to prepare the surface for the final treatment. If the skin rich in cement were not removed it would ultimately become hard, brittle and imperious, a condition that is to be avoided in practicing my invention. Following this last treatment, the wall coating is kept damp for several days and then left to dry or harden for a period of ten days.

After the wall surface prepared as above has dried and hardened, a suitable drying oil is applied to the surface in successive coats their number depending upon the degree of penetration required by the use to which the wall is to be put. For example, five coats will give a penetration of about ½" and impart sufficient strength to insure adequate support for nails required to support weights of around 100 pounds.

After about ten days, the drying oil will have dried and formed a tough strong substance on the surfaces of the cementitious coating material in the pores and interstices of the impregnated zone as well as on the face of the wall. Because of the penetration of the drying oil into the pores and interstices of the impregnated zone, it serves to bond the asbestos fibers and the cement-sand mortar associated therewith into a strong, tough integral mass very resistant to shearing stresses and to cracking when subjected to stresses either of compression or tension. At the same time, the impregnated area is anchored to the body of the surface coating by the asbestos fibers and the nail penetrability of the material is not impaired.

While I have described the invention with reference to the use of Portland cement as the cementitious ingredient of the coated material, it is to be understood that other hydraulic cements may be used, such as natural cements, slag cements, or any of the various masonry cements on the market. Likewise, the use of other fibrous materials than asbestos to promote the bonding of the cementitious material is not precluded. In fact, any cementitious or plaster composition may be employed that will produce the desired nail penetrability, adherence and strength, and at the same time is capable of surface impregnation with a toughening and strengthening agent.

It will be understood that the proportions of the cementitious and fibrous bonding ingredients may be varied considerably without departing from the invention; for example, when dealing with shorter fiber asbestos or other fibrous material it may be necessary to increase the proportion of this constituent and vice versa.

As is well known, drying oils, in passing to the hardened and toughened state resulting from "drying", undergo the chemical change known as polymerization, but the possibilities of reactions between acid components of the drying oil and lime or other components of the cementitious material is not to be dismissed. It will be understood that this feature of the invention in its broader aspects is in no sense dependent upon chemical reactions of a specific kind, and the desired penetration and ultimate toughening and strengthening of the surface portions of the coating may be attained in other ways. For example, the penetrating agent may consist of a liquid mixture one or more of the components of which is present for the purpose of imparting fluidity and penetrability into the pores of the cementitious or plaster coating, but which evaporates or is otherwise removed from the impregnated layer leaving a solid or semi-solid residue that serves to effect the desired bonding, strengthening and toughening of the impregnated zone.

In addition to mixtures of drying oils and thinners, of which latter turpentine is a representative example, mixtures of various natural or artificial resins with suitable solvents may be employed. In the case of example, the copal resins, kauri gums, and dammar in admixture with thinners or solvents imparting the desired fluidity and permeability may be used. Appropriate solutions of various cellulose derivatives, such as cellulose nitrate and cellulose acetate will also serve the purpose.

A drying oil that I have found to be particularly useful in effecting the impregnation treatment is raw Chins-wood oil. The penetrability of the oil and its application may be facilitated by adding thereto a suitable thinner such as turpentine. This mixture is more watery, is ab
sorbed almost instantly in successive coats, and is generally easier to apply. By way of a specific example, I have employed a mixture composed of equal parts of China-wood oil and turpentine in the earlier coats and a final coat of pure China-wood oil. I have also employed mixtures of China-wood oil, crystalline dammer varnish, and turpentine with highly satisfactory results. Examples of various other drying and semi-drying oils that may be employed are linseed oil, soy bean oil and perilla oil.

Various other thickeners may be substituted for turpentine. Furthermore, any of the usual drying agents may also be added when it is desired to further expedite the impregnating treatment.

While the invention has been described hereinbefore with particular reference to its application in situations where it is desired to produce a wall surface that is nail penetrable and at the same time adapted to hold a nail firmly in place even when the nail is required to sustain a heavy weight suspended therefrom, it is to be understood that the invention has a wider application in that the non-cracking feature may be employed in many situations where the ability to receive nails and sustain heavily loaded nails is not required. For example, in dwellings of wooden frame construction it has always been a problem to prevent cracking of the interior plastered surfaces. Likewise the cracking of exterior stuccoed surfaces in wooden frame buildings and as well in steel frame constructions is troublesome.

My invention may be employed to advantage in these situations, and when it is not desired that the wall shall be called upon to carry heavily loaded nails, the extent of the surface impregnation may be considerably curtailed, the desired result being effected with a lesser number or even with a single coat of the impregnating agent. In these situations it will frequently not be necessary to build up such a thick coat of the plaster or other cementitious coating as has been described in the specific example. Furthermore, the application of the coating directly to a metal or wooden lath supporting background or other suitable supports, as for example a brick wall, is practical. I claim my invention as applicable in all of these fields.

The impregnated wall surface of my invention may be painted by any oil or other ordinary paint in the usual way.

Where I have used the term "plaster composition" in the claims it is to be understood that I have used this term broadly to include not only a plaster as this term is sometimes used technically, but also various cementitious coating compositions that may be applied by the methods used in the plasterers' and masons' trade, or by stuccoing. The term "plastered wall" as used in the claims is similarly intended to include any wall having a plaster composition as above defined applied thereto and possessing the limiting characteristics recited in the claims.

I claim:

1. In a wall construction, a plastered wall characterized by high resistance to cracking when subjected to stresses of compression or tension and by freedom from spalling under impact or when nails are driven into or withdrawn from the same, said wall surface comprising a tough, resilient, nail penetrable plaster composition essentially of a hydraulic cement, sand and a fibrous material and having the outer surface portion thereof impregnated with a solidified reinforcing agent.

2. In a wall construction, a plastered wall characterized by high resistance to cracking when subjected to stresses of compression or tension and by freedom from spalling under impact or when nails are driven into or withdrawn from the same, said wall surface comprising a tough, resilient, nail penetrable plaster composition essentially of a hydraulic cement, sand and a fibrous material and having the outer surface portion thereof impregnated with a solidified reinforcing agent comprising the polymerized residue of a drying oil.

3. In a wall construction, a plastered wall characterized by high resistance to cracking when subjected to stresses of compression or tension and by freedom from spalling under impact or when nails are driven into or withdrawn from the same, said wall surface comprising a tough, resilient, nail penetrable plaster composition essentially of a hydraulic cement, sand and a fibrous material and having the outer surface portion thereof impregnated with a solidified reinforcing agent comprising a drying oil.

4. In a nailing wall construction, a supporting base composed of cinder blocks or the like and a surface coating thereon consisting of a tough, resilient, nail penetrable plaster composition, said coating being hardened and toughened in its outer portion by an impregnation of a liquid reinforcing agent.

5. In a nailing wall construction, a supporting base composed of a nail penetrable material, a surface coating thereon consisting of a tough, nail penetrable plaster composition composed essentially of a hydraulic cement, sand and a fibrous material, said coating being hardened and toughened in its outer portion by an impregnation comprising China-wood oil, turpentine and a natural resin.

6. The method of forming a plastered wall surface characterized by high resistance to cracking when subjected to stresses of tension or compression and by freedom from spalling when nails are driven into the same, which comprises forming a plastic mass consisting principally of a hydraulic cement, sand, a fibrous material and water, applying said mass as a coating upon a supporting base, allowing the plaster to set, then removing the outer surface portion of the plaster coating, and thereafter impregnating the surface of said plaster coating with a liquid adapted to solidify in the pores thereof and to harden and toughen the surface layer.

7. The method of forming a plastered wall surface characterized by high resistance to cracking when subjected to stresses of tension or compression and by freedom from spalling when nails are driven into the same, which comprises forming a plastic mass consisting principally of a hydraulic cement, sand, and asbestos fibers, applying said mass as a coating upon a supporting base, allowing the resulting coating to set, then removing the outer surface portion of said coating, and thereafter impregnating the thus prepared surface with a drying oil.
9. The method of forming a plastered wall surface characterized by high resistance to cracking when subjected to stresses of tension or compression and by freedom from spalling when nails are driven into the same, which comprises forming a plastic mass consisting principally of a hydraulic cement, sand and asbestos fibers, applying said mass as a coating upon a supporting base, allowing the resulting coating to set, then removing the outer surface portion of said coating, and thereafter impregnating the thus prepared surface with a liquid comprising China-wood oil and a thinner.

10. In a wall construction, a plastered wall characterized by high resistance to cracking when subjected to stresses of compression or tension and by freedom from spalling under impact or when nails are driven into or withdrawn from the same, said wall comprising a tough resilient nail penetrable plaster composition having the outer surface portion thereof impregnated with a bonding agent.

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