FILE NAME: Pfizer (PFIZ)

DATE: 1951

DOC#: PFIZ043

DOCUMENT DESCRIPTION: US Patent - Plaster and Method of Plastering

106-88

Patented June 5, 1951 XR 2,556,031

UNITED STATES PATENT OFFICE

2,556,031

PLASTER AND METHOD OF PLASTERING

Ralph H. Bickley, Shaker Heights, and Chester H. Austin and Arnold E. Pavlish, Columbus, Ohio, assignors to The Kelley Island Lime and Transport Company, Cleveland, Ohio, a corporation of Ohio

Original application April 21, 1942, Serial No. 439,376. Divided and this application August 1, 1945, Serial No. 608,270.

2 Claims. (Cl. 72—123)

106-119X

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This invention relates to an improved plaster having high sound-absorbing properties, and to a novel wall or ceiling construction using the same as an acoustical plaster.

This application is a division of our earlier application Serial No. 439,376, filed April 21, 1942, now abandoned.

An object of our invention is to provide a low cost acoustical plaster which can be delivered to the job either in a dry condition to be mixed by the plasterer or in a ready-mixed condition, and can be applied to metal lath or other backing by the usual hawk and trowel method, and which has a sound-absorbing capacity comparing favorably with that of many higher priced acoustical plasters which require special handling and methods in their preparation or application.

Another object of our invention is to provide an improved acoustical plaster for direct application to a wall or ceiling structure and having a porous or cellular characteristic obtained by aerating a mixture of cementitious material and fibrous binder.

A further object of this invention is to provide an acoustical plaster which is of a cellular structure from the face to the back thereof and which has spaced, open channels extending a substantial distance into the plaster for admitting sound vibrations to cells inwardly of its face.

Still another object of our invention is to provide a novel wall or ceiling structure embodying our cellular plaster.

Other objects and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying sheets of drawings, in which:

Fig. 1 is a plan view showing a portion of a wall or ceiling having our improved plaster thereon and showing different stages of application;

Fig. 2 is a cross-section taken through the structure of Fig. 1 as indicated by section line 2—2;

Fig. 3 is a reproduction of a photograph of the outer face or surface of our improved plaster;

Fig. 4 is a reproduction of an enlarged photograph of the outer face or surface of the improved plaster;

Fig. 5 is a reproduction of a photograph of a cross-section taken through a structure embodying the improved plaster;

Fig. 6 is a reproduction of an enlarged photograph of a portion of the cross-section shown in Fig. 4; and

Figs. 7 and 8 are sectional views taken through other forms of a wall or ceiling structure embodying our improved plaster.

In Fig. 1 we show a wall or ceiling structure 10 embodying our improved acoustical plaster. This wall or ceiling structure comprises a suitable backing 11, which may be metal lath as

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shown in this instance, and a covering or facing 12 thereon of acoustical plaster. The composition of the plaster and its characteristics which give rise to its acoustical properties will be described hereinafter.

The plaster 12 can be applied to the metal lath or other backing directly, that is, without the need for first applying a base such as a so-called "scratch coat" or a so-called "brown coat" of conventional or non-acoustical plaster. Of course, it is not imperative that our plaster be applied directly to the backing, but there are important advantages in doing so because the use of a preliminary coat or base such as the above-mentioned scratch and brown coats requires additional material and labor and usually must be permitted to dry before the acoustical plaster can be applied thereto. The application of our plaster to the metal lath or other backing can be done by the usual hawk and trowel method and does not require any special skill other than that possessed by a competent plasterer. Our plaster can be applied as a single layer or coating, or, if preferred, in multiple layers as in cases where an increased thickness of the plaster may be desired for a very high sound-absorbing capacity.

In the structure illustrated in Fig. 1 we show the plaster 12 as having been applied to the metal lath 11 in two coats or layers 12a and 12b. The plaster is applied in a plastic and workable condition which can be conveniently handled by hawk and trowel. The first coat or layer 12a is applied with sufficient pressure to force enough of the plaster through the metal lath to form retaining keys 13 which project from the back of the lath as shown in Figs. 2 and 5. This coat 12a may have a depth or thickness of about one-quarter of an inch measured from the face of the lath or backing, although this thickness can be varied. This coat need have only a reasonably or generally smooth surface, and it is not necessary that all of the trowel marks be smoothed out.

Very shortly after the first coat 12a has been applied, that is, within a period of about twenty minutes, the second coat 12b can be applied by troweling it directly onto the first coat. The second coat may also have a thickness of about one-fourth of an inch and may be troweled sufficiently to give it a smooth finish and to cause moisture and fine material to come to the surface so that somewhat of a surface crust will be formed on the plaster when it has set. This crust is desirable because it strengthens the plaster and renders it better able to resist cracking, crumbling, or dusting.

When our improved plaster is applied as a single layer, it is troweled onto the backing 11 so that some of the plaster is forced through the

lath to form the retaining keys 13. The troweling is carried out sufficiently to give the plaster a relatively smooth surface and to cause moisture and fine material to come to the surface so as to form a crust, as mentioned above. The subsequent treatment of the surface can be the same for plaster applied in a single layer as for plaster which has been applied in multiple layers.

The applied plaster can be left with its surface in the relatively smooth condition or can be given further treatment, as will be explained hereinafter. When the surface is left smooth or plain, as represented by the strip or section 14 of Fig. 1 and as shown also in Fig. 7, our acoustical plaster has somewhat the appearance of conventional lime plaster but, due to characteristics to be later described, possesses a relatively high sound-absorbing and sound-deadening capacity, as well as a relatively high heat-insulating capacity. This smoothly troweled plaster can be painted or otherwise coated to improve its appearance and its ability to be washed or cleaned.

Instead of leaving our plaster with a smooth or plain surface, it can be roughened or stippled for the purpose of improving its appearance and increasing its sound-absorbing ability. The section or portion 15 of Fig. 1 represents the plaster after it has been stippled. Figs. 3 and 4 are reproductions of actual photographs of the surface of the stippled plaster, Fig. 3 being normal size and Fig. 4 being magnified or enlarged ten times. The stippling can be carried out in different ways and with various implements. We prefer to do the stippling in two operations, the first being executed with a stippling brush or the like and the second being executed with a pronged or nail type stippler. One method of procedure which we have found to be satisfactory is to brush stipple the smoothed plaster promptly after it has been applied to the backing and then nail stippling the plaster after an appropriate intervening drying period which may be from sixteen to sixty-four hours depending upon the condition of the plaster. It is desirable that the nail stippling have the effect of breaking the cells in the plaster at the points or areas penetrated by the nails. If the nail stippling is carried out before the plaster has dried sufficiently, the nails may have a troweling effect which produces undesirable crusts or shell-like linings in the holes or passages left by the nails.

Figs. 2 and 3 illustrate the surface appearance of the plaster after it has been subjected to the two stippling operations just referred to. The brush stippling operation imparts a more or less uniformly distributed pebble-like roughness or texture to the plaster surface, which is produced by the combined penetrating and mincing action of the bristles of the stippling brush. This roughness includes numerous small and relatively shallow holes or indentations 16 which have been formed by the ends of the bristles being poked into the plaster. These shallow holes are relatively closely, but somewhat irregularly or haphazardly, spaced and are distributed over the entire surface.

The nail stippling may be carried out with a device having a number of projecting nails or pins spaced about one-half inch apart. The nails may be four-penny nails which are on the order of a scant one-sixteenth of an inch in diameter, but the spacing and size of the nails can be varied if desired. The pointed ends of the nails preferably project from the base or holder a distance somewhat greater than the thickness of the plaster to be stippled so that the nails can strike the lath 11 and prevent the base or holder of the stippling device from contacting and marking the plaster surface. The nail stippling produces the holes 17 in the plaster which are the open outer ends of channels or passages 17a left by the nails and which extend into the plaster a substantial distance inwardly of its surface and preferably to a point at or adjacent the backing or lath 11. One or more of the channels or passages 17a can be seen in Fig. 5 which is a photographic reproduction at full or normal scale of a cross-section through our acoustical plaster. One of the passages 17a also appears in the photographic reproduction of Fig. 6 which shows a portion of the same cross-section enlarged ten times. The purpose of the open holes 17 and the channels 17a leading inwardly therefrom will be further explained hereinafter.

We will next describe our acoustical plaster composition and explain our method of preparing the plaster. Our acoustical plaster comprises a plastic cementitious material of a creamy consistency formed by mixing water with hydrated lime and then aerating the mixture. Our plaster composition has a foaming agent incorporated therein which will be further identified hereinafter and which makes possible the aeration of the mixture by a mechanical mixing or agitation thereof for the period of time hereinafter specified.

As the result of the aeration, the plastic mass of cementitious material will be found to contain numerous minute air bubbles or hollow cells which are distributed throughout the entire mass. These bubbles or cells are so small that they are not readily broken but remain in the plastic material after it has been applied to the metal lath or other backing. The bubbles form interconnecting minute cells in the dried plaster which extend from the front to the rear surfaces thereof and impart to the plaster a porous or a spongy characteristic. These cells serve to entrap and dampen sound waves or vibrations and thus enable the plaster to absorb and deaden sound or noise. These cells also constitute voids which enable the plaster to retard the transfer of heat.

Instead of using only hydrated lime in forming our acoustical plaster, as above explained, we may add a suitable fibrous material which serves as a filler and reinforcing medium or binder. Asbestos of medium length fiber is very satisfactory for this purpose, although other fibrous materials can be used such as sisal, bagasse, wood fibers, animal hair, or rock wool. The use of such a fibrous binder is desirable because it reinforces the plaster and tends to prevent shrinking or cracking thereof. Some of these fibrous materials, particularly the asbestos, also serve as a plasticizer which holds water and adds to the workability of the plaster.

The following composition is given as an example of an acoustical plaster which we have found to be very satisfactory and which comprises the following ingredients in the approximate amounts specified:

	Pounds
Hydrated lime	89½
Asbestos fiber	10
Foaming agent	½
Water	140

The hydrated lime, asbestos, and the foaming agent may be premixed in a dry state and may be

transported in this condition in bags to the job or construction work where the plaster is to be used. At this point the dry material may be mixed with water and the mixture may be aerated to produce the cells or bubbles therein. Although it may be generally preferable to supply our acoustical plaster composition to the job in a dry state, it may, in some cases, be desirable to deliver the composition to the job in a ready-mixed wet condition.

The hydrated lime may be a regular or conventional hydrated lime of the kind used by the building trades, or, preferably, may be a finishing grade of hydrated lime such as a Dolomitic lime having about 92% of the total oxides hydrated. In our improved plaster the amount of hydrated lime used is substantially greater than 50 per cent by weight of the solid content as indicated in the above example and, conversely, the amounts of asbestos fiber and foaming agent used are individually and also collectively substantially less than 50 per cent by weight of the solid content. The hydrated lime constitutes the main ingredient of the composition and the improved plaster can accordingly be defined as comprising hydrated lime in a major proportion and asbestos fiber and foaming agent in a minor proportion.

The lime should be in a fine condition, preferably such that 95% will pass through a 100 mesh screen and 100% will pass through a 30 mesh screen.

The asbestos may be in the form of medium length fibers, as mentioned above, although asbestos of various other fiber lengths could be used. We could also use any one of the other fibrous materials mentioned above or various combinations of these fibrous materials. The amount of the fibrous material to be used can be more or less than the 10% indicated in the above example, depending upon the characteristics desired in the plaster and the use to which the plaster is to be put.

The foaming agent is a material which will serve to decrease the surface tension and facilitate the formation of cells or bubbles in the plastic mass. A material which we have found especially suitable for this purpose is the substance known commercially as "Duponol WA" and which is a sodium salt of an alcohol sulphate, more specifically a sodium sulphate of technical lauryl alcohol. The amount of foaming agent to be used may be greater or less than that specified above depending upon the degree of aeration required, the time of aeration, and the character of aerating equipment used.

Depending upon the degree of workability and other characteristics desired in the plaster composition, the amount of water to be used may be greater or less than that mentioned in the above example.

The above-described composition is aerated by mechanical mixing or agitation as indicated above. For this purpose the composition may be mixed or beaten for a period of two to fifteen minutes, after which it will usually be found that the plastic mass has increased considerably in volume and has minute air cells or bubbles distributed throughout and that the composition is now of a creamy consistency. The mixture can be agitated or beaten for a period somewhat longer than fifteen minutes, if this is necessary to obtain the desired consistency and degree of aeration, but the agitating or beating should be stopped before the air cells or bubbles begin to break down.

In aerating the composition by mechanical agitation, we prefer to use a mixer having blades and in which a folding action is imparted to the plastic mass by such blades. We have found that very satisfactory results are obtained when the above-described composition is aerated by agitation for about fifteen minutes or somewhat longer in a Jaeger plaster mixer, type #6–SV, operating at a speed of about 48 R. P. M. Although we have mentioned this particular mixer, it will be understood, of course, that various other mixing devices could be used and that the period of agitation may be varied somewhat in accordance with the particular mixing apparatus employed.

The acoustical plaster resulting from the above-described composition and method operations is of a readily workable creamy consistency and after drying has a density of about 18 to 25 pounds per cubic foot. This density value comes within the range of 14 to 25 pounds per cubic foot and this fact may be taken as an indication that our plaster is a good acoustical plaster. Likewise this density value falls within the range of 18 to 25 pounds per cubic foot which may be taken as an indication that our plaster is also a good workable plaster.

The plaster 12 shown in the photographic reproductions of Figs. 3 to 6, inclusive, represents a set plaster which has been produced in the manner above explained and applied directly to the metal lath 11. This plaster contains the above-mentioned minute cells or air bubbles which are distributed throughout the plaster from the front to the back thereof and which serve to entrap and dissipate sound waves or vibrations and also retard the transfer of heat. The ability of our plaster to absorb sound is materially increased by the surface stippling thereof and particularly by the formation of the passages or channels 17a in the plaster by the nail stippling operation. The holes 17 at the outer ends of these passages or channels remain open and readily admit the sound waves or vibrations. Since the passages or channels 17a extend into the plaster a substantial distance beyond the outer face thereof, they will serve to conduct the sound waves or vibrations into the plaster and will enable these waves or vibrations to reach many more of the small cells. The high sound-absorbing capacity of our above-described stippled cellular acoustical plaster is indicated by the fact that by careful test it has been shown to have a noise reduction coefficient of .55 or higher as compared with .03 which is usually taken as the noise reduction coefficient of conventional plaster.

A wall or ceiling to which our acoustical plaster has been applied can be left in the condition obtained by the above-mentioned brush and nail stippling or, if desired, the stippled surface can be painted to further improve its appearance or to obtain certain color effects. When paint is applied to our stippled plaster, it should be applied by spraying and, although various kinds of paints can be used, we prefer a cold-water or casein paint.

As indicated above, our improved plaster can be applied to backing material other than a reticulated backing as represented by the metal lath 11. For example, it may be applied to plain or imperforate backings formed of poured concrete, concrete block, cinder block, old painted plaster surfaces, gypsum lath, insulating board, clay tile, gypsum tile, or brick and to backings formed of various other materials. In applying our acoustical plaster to the other backings just

mentioned, we find it desirable to first treat or cover the surface with a thin coat of calcined-gypsum plaster and water, and after this coat has been permitted to dry for a short time, our acoustical plaster can be applied directly to the backing by the usual hawk and trowel methods. Instead of using a calcined-gypsum plaster and water coating, we can use a similar coating comprising water and either Portland cement, Keene cement, Lumnite cement, or magnesium oxychloride cement.

In Figs. 7 and 8 we show our improved cellular plaster 18 applied to an imperforate backing 19 to provide a structure having good sound-absorbing and heat-insulating properties and which is usable for ceilings but is especially suitable for side walls. In this case the backing 19 is poured concrete the face of which has been treated or covered with a thin coat 20 formed of calcined-gypsum plaster and water or any of the other cementitious materials mentioned above. The coating or layer 18 of our improved plaster may be approximately one-fourth of an inch thick and may be applied over the coat 20 by the usual hawk and trowel operations.

The surface of the plaster layer 18 in Fig. 7 can be roughened, as by the stippling herein disclosed, or can be troweled smooth and can be finished by applying paint or wallpaper thereto. As shown in Fig. 8, a finish coat or layer 21 about an eighth of an inch thick of conventional finishing lime can be applied over our improved plaster 18. The coat 21 can be troweled smooth and paint or wallpaper can be applied thereto. The plaster used in the layer 18 of Figs. 7 and 8 can be according to the example given above, but we prefer to decrease the specified amount of asbestos fiber to 3% by weight or thereabouts, particularly where a high degree of workability of the plaster is not required such as when the composition is to be applied to a side wall structure. In the structures of Figs. 7 and 8 the plaster layer 18 is of the cellular character above described for our improved plaster and has the minute cells dispersed throughout the same from front to back thereof and has good sound-absorbing and heat-insulating characteristics.

From the drawings and the foregoing description it will be readily understood that we have provided an acoustical plaster which, by reason of its cellular or porous nature and other characteristics, provides an efficient sound-absorbing medium for use on walls or ceilings. It will also be understood that our acoustical plaster can be economically produced and prepared and can be applied directly to metal lath or other backing by ordinary troweling methods. The cellular nature of our improved plaster and the fibrous binder embodied therein render our plaster more flexible than conventional gypsum plaster and less likely to crack as the result of movements or vibrations of the building. Because of its resistance to cracking our plaster can be applied in a relatively thinner layer and the weight of material needed to plaster a given area will be much less than if conventional plaster were used. In the foregoing detailed description it will be noted that we have emphasized the high sound-absorbing capacity of our novel acoustical plaster and have purposely employed the term "sound-absorbing" to distinguish from those acoustical plasters which retard sound transmission but have only a low sound-absorbing quality.

Having thus described our invention, we claim:

1. The method of making a plastered sound-absorbing wall or structure of the character described which comprises, forming a plastic plaster of a creamy consistency and good workability by mixing hydrated lime in a major proportion of the solid content of said plastic plaster, a fibrous filler and sodium sulphate of technical lauryl alcohol as a foaming agent in minor proportions of said solid content and water, aerating the mixture by mechanical agitation for approximately fifteen minutes to form and distribute minute hollow bubble cells throughout the plastic plaster, and then applying the plastic plaster thus produced directly to a suitable backing as a layer by troweling and permitting said layer to become dry and set.

2. A wall and ceiling material in the form of a dry mix composition which upon mixing with water and aeration by mechanical agitation produces a homogenous plastic plaster of a creamy consistency and good workability containing numerous minute hollow bubble cells distributed therethrough and adapted for direct application to walls and ceilings by conventional plastering tools and which composition in its applied and set and dry condition forms an acoustical plaster layer of a density of approximately 18 to 23 pounds per cubic foot and having said bubble cells extending therethrough in interconnecting relation from the front to the back surface thereof and providing good sound-absorbing and sound-deadening characteristics, said dry mix consisting of hydrated lime in a major proportion, a fibrous filler in a minor proportion, and sodium sulphate of technical lauryl alcohol in a minor proportion as a foaming agent and in an amount to produce said bubble cells during said mixing and aeration by mechanical agitation, said foaming agent being stable in said dry mix so as to permit storage of the dry mix or shipment thereof to a desired point of use without appreciable deterioration.

RALPH L. DICKEY.
CHESTER R. AUSTIN.
ARNOLD E. PAVLISH.

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PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 3 Sheets-Sheet 3

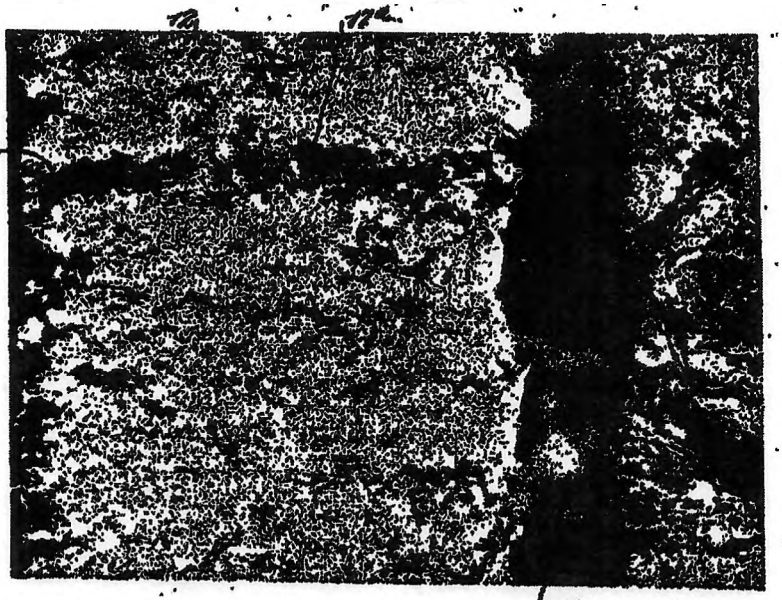

FIG. 6

FIG. 5

INVENTORS
RALPH L. DICKEY
CHESTER R. AUSTIN
ARNOLD E. PAVLISH
BY Kuris Hudson & Kent
ATTORNEYS

SAMPLE 16425

Sample PFZ 0060

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 5 Sheets-Sheet 2

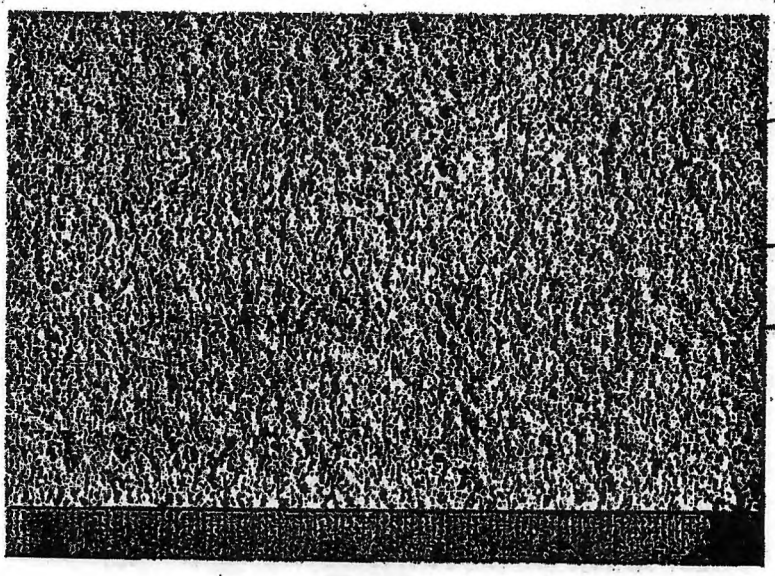

FIG. 3

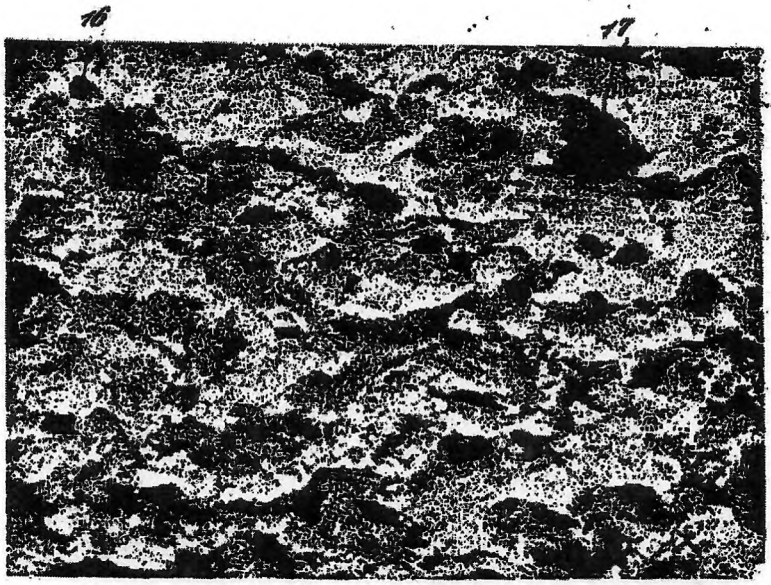

FIG. 4

INVENTORS
RALPH L. DICKEY
CHESTER B. AUSTIN
ARNOLD C. PRAYLICH
BY
ATTORNEYS

CROSS REFERENCE EXAMINER

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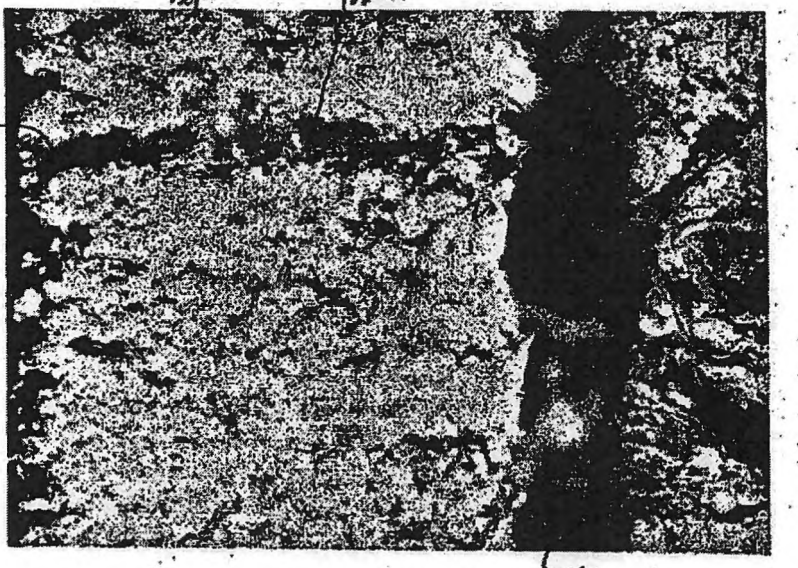

FIG. 6

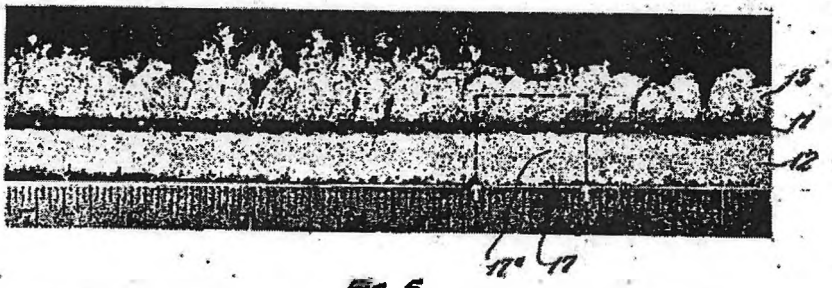

FIG. 5

INVENTORS
RALPH L. DICKEY
CHESTER R. AUSTIN
ARNOLD E. PAVLISH
BY Kuris Hudson & Kent
ATTORNEYS

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

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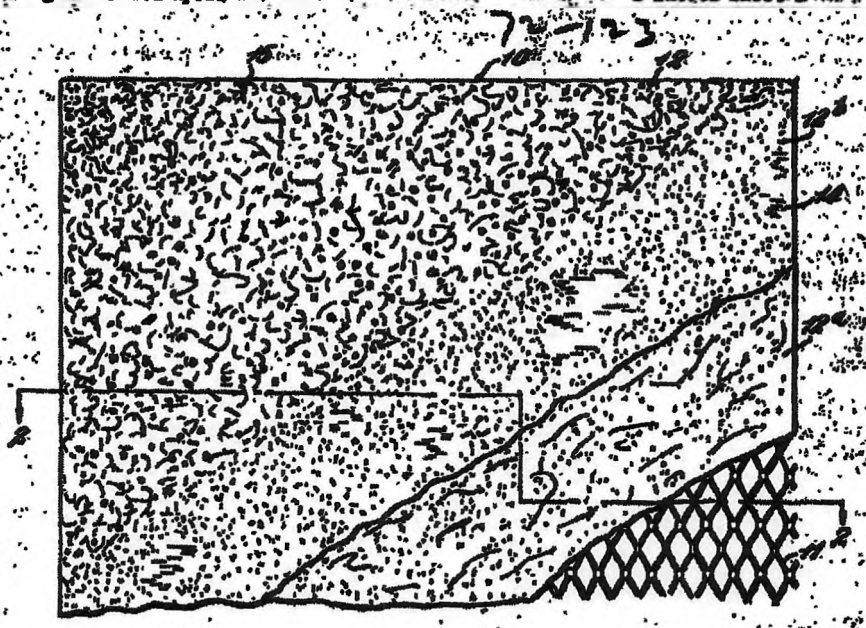

FIG. 1

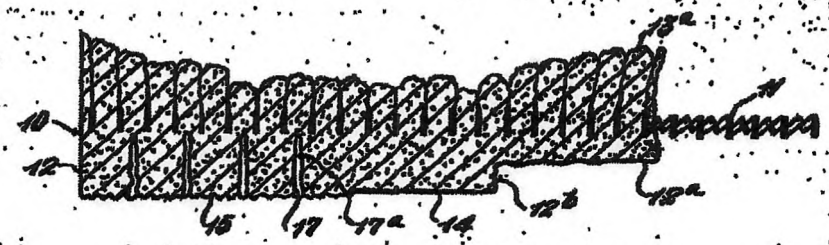

FIG. 2

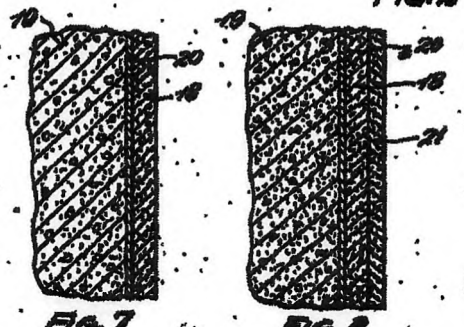

FIG. 7

FIG. 8

INVENTORS
RALPH L. DICKEY
CHESTER E. AUSTIN
ARNOLD E. PAVLISH
BY Kerr, Hudson & Kent
ATTORNEYS

SAMPLE 16427

Sample PFZ 0062

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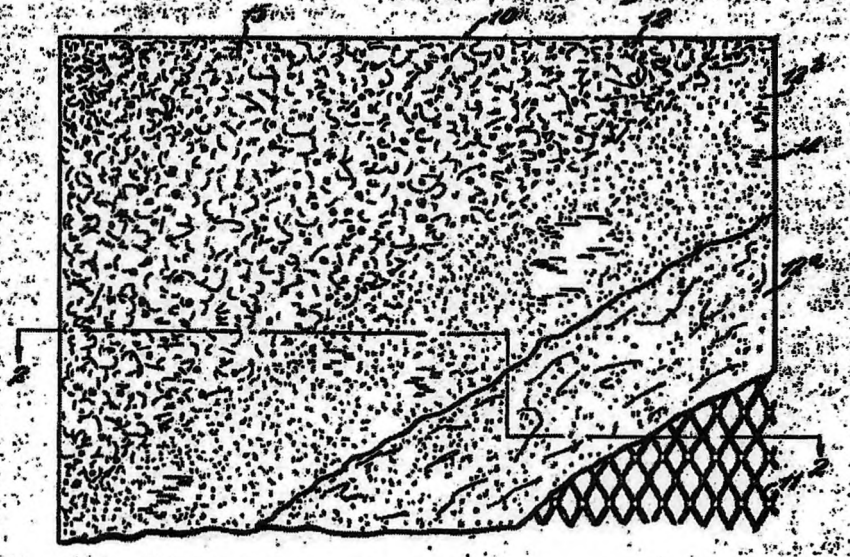

FIG. 1

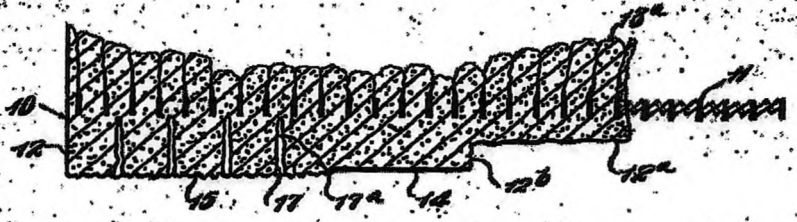

FIG. 2

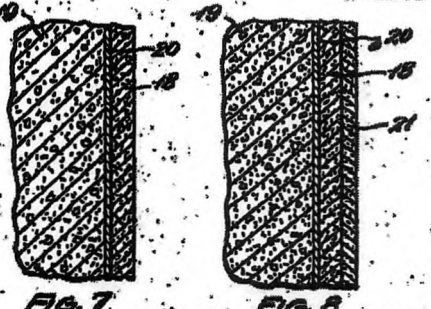

FIG. 7

FIG. 8

INVENTORS
RALPH L. DICKEY
CHESTER E. AUSTIN
ARNOLD E. PAVLISH
BY Davis Hudson & Hunt
ATTORNEYS

SAMPLE 16418

Sample PFZ 0053

BONDING AGENTS: We do not recommend the use of Kilnoise over asphalt emulsions or similar bonding agents. Products such as 'Plaster-Weld-, 'Link', and 'Duraweld' are best suited for this purpose. When applied in strict accordance with these manufacturers' specification, and used in full strength, such bonding agents will hold Kilnoise to any surface except those covered with water soluble paints. Always apply Kilnoise directly over the bonding agent -- never use a gypsum brown coat between them.

4/2/65

CROSS REFERENCE EXAMINER

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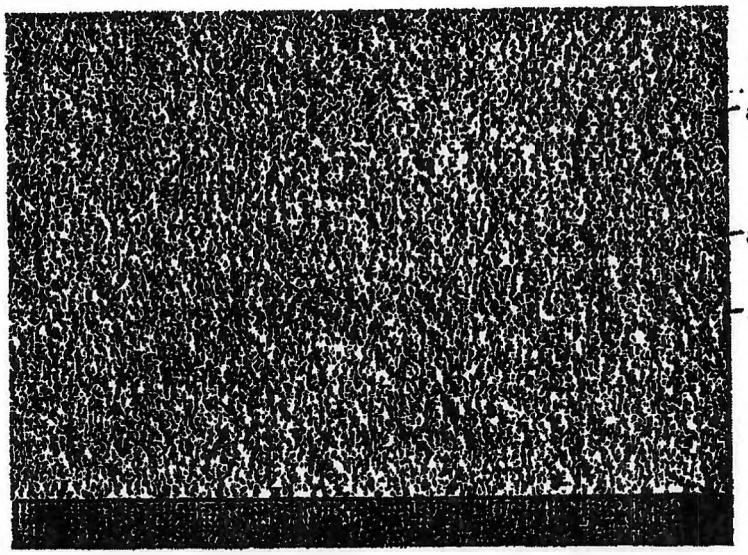

FIG. 3

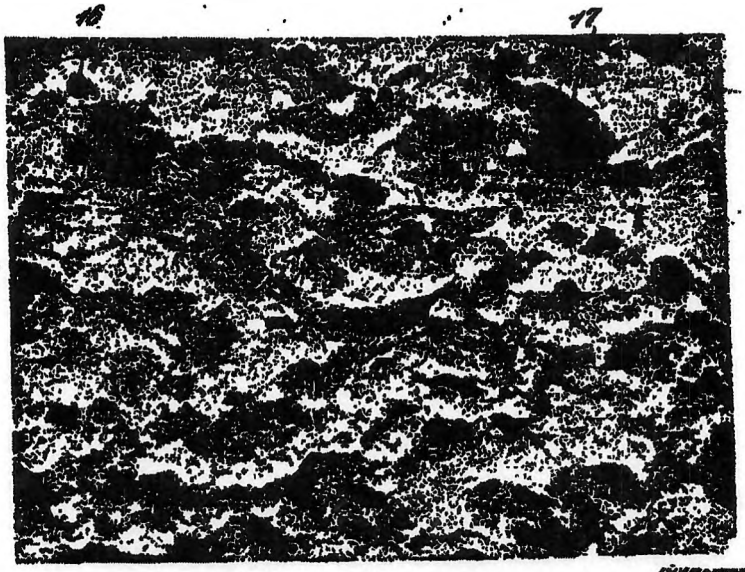

FIG. 4

INVENTORS
RALPH L. DICKEY
CHESTER B. AUSTIN
JOHN G. CRYDER
BY
ATTORNEYS

SAMPLE 16419

Sample PFZ 0054

CROSS REFERENCE EXAMINER

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

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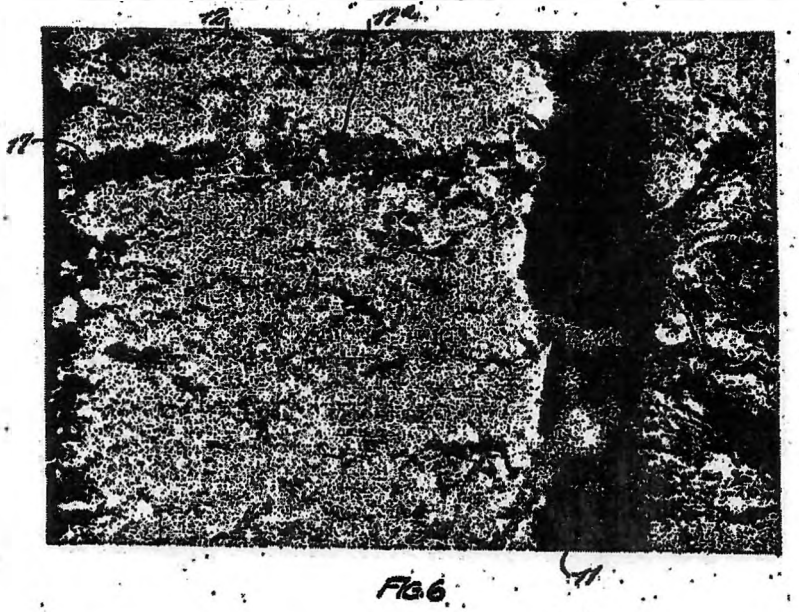

FIG. 6

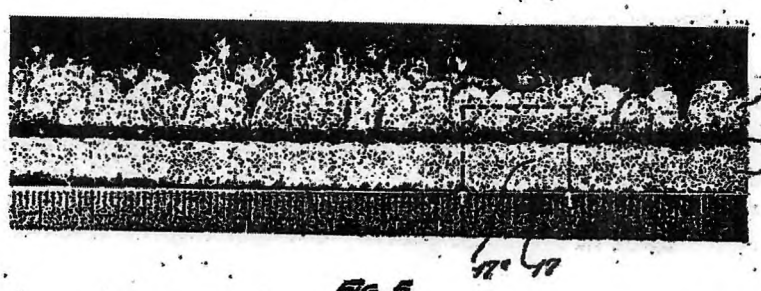

FIG. 5

INVENTORS
RALPH L. DICKEY
CHESTER R. AUSTIN
ARNOLD E. PAVLISH
BY Kurtz Hudson & Hunt
ATTORNEYS

CROSS REFERENCE EXAMINER

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 5 Sheets-Sheet 2

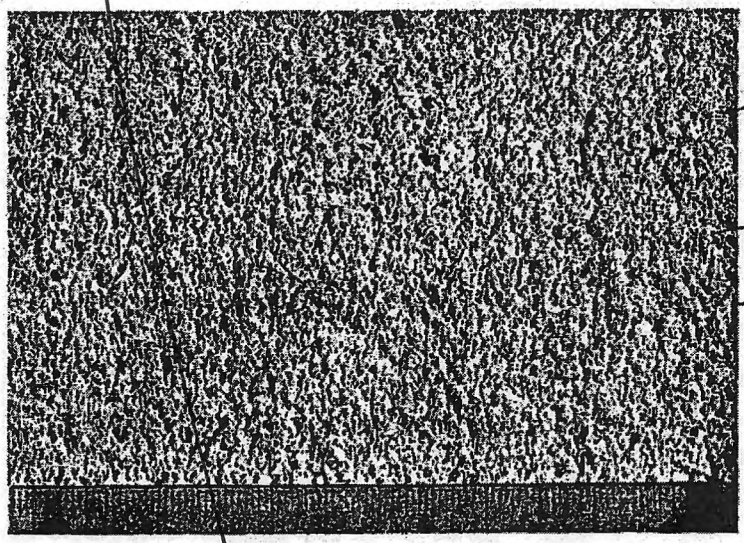

FIG. 3

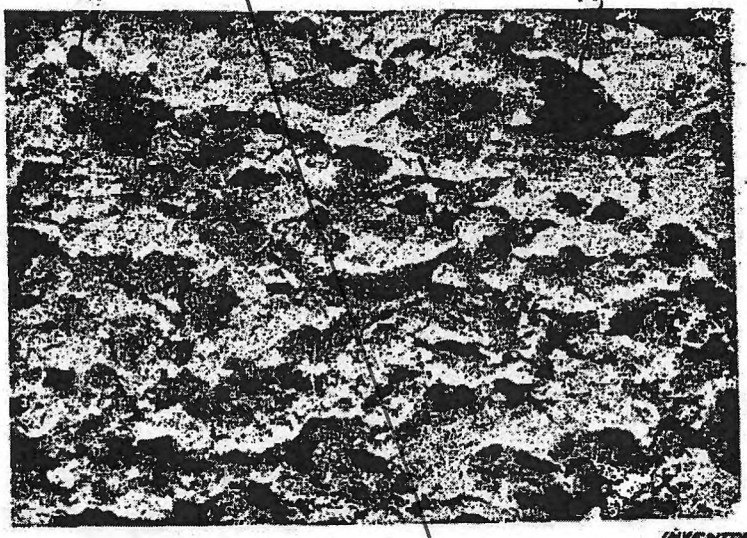

FIG. 4

INVENTORS
RALPH L. DICKEY
CHESTER B. AUSTIN
ARNOLD E. PRYLICH
BY
ATTORNEYS

106-88

Patented June 5, 1951 Re. X R 2,556,031

UNITED STATES PATENT OFFICE

2,556,031

PLASTER AND METHOD OF PLASTERING

Ralph H. Hickey, Shaker Heights, and Chester E. Austin and Arnold E. Pavlish, Columbus, Ohio, assignors to The Kelley Island Lime and Transport Company, Cleveland, Ohio, a corporation of Ohio

Original application April 21, 1942, Serial No. 439,876. Divided and this application August 1, 1945, Serial No. 608,270.

2 Claims. (Cl. 72—123)

106-119X

1

This invention relates to an improved plaster having high sound-absorbing properties and to a novel wall or ceiling construction using the same as an acoustical plaster.

This application is a division of our earlier application Serial No. 439,876, filed April 21, 1942, now abandoned.

An object of our invention is to provide a low cost acoustical plaster which can be delivered to the job either in a dry condition to be mixed by the plasterer or in a ready-mixed condition, and can be applied to metal lath or other backing by the usual hawk and trowel method and which has a sound-absorbing capacity comparing favorably with that of many higher priced acoustical plasters which require special handling and methods in their preparation or application.

Another object of our invention is to provide an improved acoustical plaster for direct application to a wall or ceiling structure and having a porous or cellular characteristic obtained by aerating a mixture of cementitious material and fibrous binder.

A further object of this invention is to provide an acoustical plaster which is of a cellular structure from the face to the back thereof and which has spaced open channels extending a substantial distance into the plaster for admitting sound vibrations to cells inwardly of its face.

Still another object of our invention is to provide a novel wall or ceiling structure embodying our cellular plaster.

Other objects and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying sheets of drawings, in which:

Fig. 1 is a plan view showing a portion of a wall or ceiling having our improved plaster thereon and showing different stages of application;

Fig. 2 is a cross-section taken through the structure of Fig. 1 as indicated by section line 2—2;

Fig. 3 is a reproduction of a photograph of the outer face or surface of our improved plaster;

Fig. 4 is a reproduction of an enlarged photograph of the outer face or surface of the improved plaster;

Fig. 5 is a reproduction of a photograph of a cross-section taken through a structure embodying the improved plaster;

Fig. 6 is a reproduction of an enlarged photograph of a portion of the cross-section shown in Fig. 4; and

Figs. 7 and 8 are sectional views taken through other forms of a wall or ceiling structure embodying our improved plaster.

In Fig. 1 we show a wall or ceiling structure 10 embodying our improved acoustical plaster. This wall or ceiling structure comprises a suitable backing 11, which may be metal lath as shown in this instance, and a covering or facing 12 thereon of acoustical plaster. The composition of the plaster and its characteristics which give rise to its acoustical properties will be described hereinafter.

2

The plaster 12 can be applied to the metal lath or other backing directly, that is, without the need for first applying a base such as a so-called "scratch coat" or a so-called "brown coat" of conventional or non-acoustical plaster. Of course, it is not imperative that our plaster be applied directly to the backing, but there are important advantages in doing so because the use of a preliminary coat or base such as the above-mentioned scratch and brown coats requires additional material and labor and usually must be permitted to dry before the acoustical plaster can be applied thereto. The application of our plaster to the metal lath or other backing can be done by the usual hawk and trowel method and does not require any special skill other than that possessed by a competent plasterer. Our plaster can be applied as a single layer or coating, or, if preferred, in multiple layers as in cases where an increased thickness of the plaster may be desired for a very high sound-absorbing capacity.

In the structure illustrated in Fig. 1 we show the plaster 12 as having been applied to the metal lath 11 in two coats or layers 12a and 12b. The plaster is applied in a plastic and workable condition which can be conveniently handled by hawk and trowel. The first coat or layer 12a is applied with sufficient pressure to force enough of the plaster through the metal lath to form retaining keys 13 which project from the back of the lath as shown in Figs. 2 and 5. The coat 12a may have a depth or thickness of about one-quarter of an inch measured from the face of the lath or backing, although this thickness can be varied. This coat need have only a reasonably or generally smooth surface, and it is not necessary that all of the trowel marks be smoothed out.

Very shortly after the first coat 12a has been applied, that is, within a period of about twenty minutes, the second coat 12b can be applied by troweling it directly onto the first coat. The second coat may also have a thickness of about one-fourth of an inch and may be troweled sufficiently to give it a smooth finish and to cause moisture and fine material to come to the surface so that somewhat of a surface crust will be formed on the plaster when it has set. This crust is desirable because it strengthens the plaster and renders it better able to resist cracking, crumbling, or dusting.

When our improved plaster is applied as a single layer, it is troweled onto the backing 11 so that some of the plaster is forced through the

106-88

Patented June 5, 1951 XR 2,556,031

UNITED STATES PATENT OFFICE

2,556,031

PLASTER AND METHOD OF PLASTERING

Ralph H. Dickey, Shaker Heights, and Chester E. Austin and Arnold E. Pavlish, Columbus, Ohio, assignors to The Kelley Island Lime and Transport Company, Cleveland, Ohio, a corporation of Ohio

Original application April 21, 1942, Serial No. 439,878. Divided and this application August 1, 1945, Serial No. 608,270.

2 Claims. (Cl. 72—123)

106-119X

This invention relates to an improved plaster having high sound-absorbing properties, and to a novel wall or ceiling construction using the same as an acoustical plaster.

This application is a division of our earlier application Serial No. 439,878, filed April 21, 1942, now abandoned.

An object of our invention is to provide a low cost acoustical plaster which can be delivered to the job either in a dry condition to be mixed by the plasterer or in a ready-mixed condition, and can be applied to metal lath or other backing by the usual hawk and trowel method, and which has a sound-absorbing capacity comparing favorably with that of many higher priced acoustical plasters which require special handling and methods in their preparation or application.

Another object of our invention is to provide an improved acoustical plaster for direct application to a wall or ceiling structure and having a porous or cellular characteristic obtained by aerating a mixture of cementitious material and fibrous binder.

A further object of this invention is to provide an acoustical plaster which is of a cellular structure from the face to the back thereof and which has spaced open channels extending a substantial distance into the plaster for admitting sound vibrations to cells inwardly of its face.

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Fig. 3 is a reproduction of a photograph of the outer face or surface of our improved plaster;

Fig. 4 is a reproduction of an enlarged photograph of the outer face or surface of the improved plaster;

Fig. 5 is a reproduction of a photograph of a cross-section taken through a structure embodying the improved plaster;

Fig. 6 is a reproduction of an enlarged photograph of a portion of the cross-section shown in Fig. 4; and

Figs. 7 and 8 are sectional views taken through other forms of a wall or ceiling structure embodying our improved plaster.

In Fig. 1 we show a wall or ceiling structure 10 embodying our improved acoustical plaster. This wall or ceiling structure comprises a suitable backing 11, which may be metal lath as shown in this instance, and a covering or facing 12 thereon of acoustical plaster. The composition of the plaster and its characteristics which give rise to its acoustical properties will be described hereinafter.

The plaster 12 can be applied to the metal lath or other backing directly, that is, without the need for first applying a base such as a so-called "scratch coat" or a so-called "brown coat" of conventional or non-acoustical plaster. Of course, it is not imperative that our plaster be applied directly to the backing, but there are important advantages in doing so because the use of a preliminary coat or base such as the above-mentioned scratch and brown coats requires additional material and labor and usually must be permitted to dry before the acoustical plaster can be applied thereto. The application of our plaster to the metal lath or other backing can be done by the usual hawk and trowel method and does not require any special skill other than that possessed by a competent plasterer. Our plaster can be applied as a single layer or coating, or, if preferred, in multiple layers as in cases where an increased thickness of the plaster may be desired for a very high sound-absorbing capacity.

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Very shortly after the first coat 12a has been applied, that is, within a period of about twenty minutes, the second coat 12b can be applied by troweling it directly onto the first coat. The second coat may also have a thickness of about one-fourth of an inch and may be troweled sufficiently to give it a smooth finish and to cause moisture and fine material to come to the surface so that somewhat of a surface crust will be formed on the plaster when it has set. This crust is desirable because it strengthens the plaster and renders it better able to resist cracking, crumbling, or dusting.

When our improved plaster is applied as a single layer, it is troweled onto the backing 11 so that some of the plaster is forced through the

transported in this condition in bags to the job or construction work where the plaster is to be used. At this point the dry material may be mixed with water and the mixture may be aerated to produce the cells or bubbles therein. Although it may be generally preferable to supply our acoustical plaster composition to the job in a dry state, it may, in some cases, be desirable to deliver the composition to the job in a ready-mixed, wet condition.

The hydrated lime may be a regular or conventional hydrated lime of the kind used by the building trades, or, preferably, may be a finishing grade of hydrated lime such as a Dolomitic lime having about 92% of the total oxides hydrated. In our improved plaster the amount of hydrated lime used is substantially greater than 50 per cent by weight of the solid content as indicated in the above example and, conversely, the amounts of asbestos fiber and foaming agent used are individually and also collectively substantially less than 50 per cent by weight of the solid content. The hydrated lime constitutes the main ingredient of the composition and the improved plaster can accordingly be defined as comprising hydrated lime in a major proportion and asbestos fiber and foaming agent in a minor proportion.

The lime should be in a fine condition, preferably such that 98% will pass through a 100 mesh screen and 100% will pass through a 30 mesh screen.

The asbestos may be in the form of medium length fibers, as mentioned above, although asbestos of various other fiber lengths could be used. We could also use any one of the other fibrous materials mentioned above or various combinations of these fibrous materials. The amount of the fibrous material to be used can be more or less than the 10% indicated in the above example, depending upon the characteristics desired in the plaster and the use to which the plaster is to be put.

The foaming agent is a material which will serve to decrease the surface tension and facilitate the formation of cells or bubbles in the plastic mass. A material which we have found especially suitable for this purpose is the substance known commercially as "Duponol WA" and which is a sodium salt of an alcohol sulphate, more specifically a sodium sulphate of technical lauryl alcohol. The amount of foaming agent to be used may be greater or less than that specified above depending upon the degree of aeration required, the time of aeration, and the character of aerating equipment used.

Depending upon the degree of workability and other characteristics desired in the plaster composition, the amount of water to be used may be greater or less than that mentioned in the above example.

The above-described composition is aerated by mechanical mixing or agitation as indicated above. For this purpose the composition may be mixed or beaten for a period of two to fifteen minutes, after which it will usually be found that the plastic mass has increased considerably in volume and has minute air cells or bubbles distributed throughout and that the composition is now of a creamy consistency. The mixture can be agitated or beaten for a period somewhat longer than fifteen minutes, if this is necessary to obtain the desired consistency and degree of aeration, but the agitating or beating should be stopped before the air cells or bubbles begin to break down.

In aerating the composition by mechanical agitation, we prefer to use a mixer having blades and in which a folding action is imparted to the plastic mass by such blades. We have found that very satisfactory results are obtained when the above-described composition is aerated by agitation for about fifteen minutes or somewhat longer in a Jaeger plaster mixer, type #6-SV, operating at a speed of about 48 R. P. M. Although we have mentioned this particular mixer, it will be understood, of course, that various other mixing devices could be used and that the period of agitation may be varied somewhat in accordance with the particular mixing apparatus employed.

The acoustical plaster resulting from the above-described composition and method operations is of a readily workable creamy consistency and after drying has a density of about 18 to 23 pounds per cubic foot. This density value comes within the range of 14 to 25 pounds per cubic foot and this fact may be taken as an indication that our plaster is a good acoustical plaster. Likewise this density value falls within the range of 18 to 25 pounds per cubic foot which may be taken as an indication that our plaster is also a good workable plaster.

The plaster 12 shown in the photographic reproductions of Figs. 3 to 6, inclusive, represents a set plaster which has been produced in the manner above explained and applied directly to the metal lath 11. This plaster contains the above-mentioned minute cells or air bubbles which are distributed throughout the plaster from the front to the back thereof and which serve to entrap and dissipate sound waves or vibrations and also retard the transfer of heat. The ability of our plaster to absorb sound is materially increased by the surface stippling thereof and particularly by the formation of the passages or channels 17a in the plaster by the nail stippling operation. The holes 17 at the outer ends of these passages or channels remain open and readily admit the sound waves or vibrations. Since the passages or channels 17a extend into the plaster a substantial distance beyond the outer face thereof, they will serve to conduct the sound waves or vibrations into the plaster and will enable these waves or vibrations to reach many more of the small cells. The high sound-absorbing capacity of our above-described stippled cellular acoustical plaster is indicated by the fact that by careful test it has been shown to have a noise reduction coefficient of .55 or higher as compared with .03 which is usually taken as the noise-reduction coefficient of conventional plaster.

A wall or ceiling to which our acoustical plaster has been applied can be left in the condition obtained by the above-mentioned brush and nail stippling or, if desired, the stippled surface can be painted to further improve its appearance or to obtain certain color effects. When paint is applied to our stippled plaster, it should be applied by spraying and, although various kinds of paints can be used, we prefer a cold-water or casein paint.

As indicated above, our improved plaster can be applied to backing material other than a reticulated backing as represented by the metal lath 11. For example, it may be applied to plain or imperforate backings formed of poured concrete, concrete block, cinder block, old painted plaster surfaces, gypsum lath, insulating board, clay tile, gypsum tile, or brick and to backings formed of various other materials. In applying our acoustical plaster to the other backings just

transported in this condition in bags to the job or construction work where the plaster is to be used. At this point the dry material may be mixed with water and the mixture may be aerated to produce the cells or bubbles therein. Although it may be generally preferable to supply our acoustical plaster composition to the job in a dry state, it may, in some cases, be desirable to deliver the composition to the job in a ready-mixed, wet condition.

The hydrated lime may be a regular or conventional hydrated lime of the kind used by the building trades, or, preferably, may be a finishing grade of hydrated lime such as a Dolomitic lime having about 92% of the total oxides hydrated. In our improved plaster the amount of hydrated lime used is substantially greater than 50 per cent by weight of the solid content as indicated in the above example and, conversely, the amounts of asbestos fiber and foaming agent used are individually and also collectively substantially less than 50 per cent by weight of the solid content. The hydrated lime constitutes the main ingredient of the composition and the improved plaster can accordingly be defined as comprising hydrated lime in a major proportion and asbestos fiber and foaming agent in a minor proportion.

The lime should be in a fine condition, preferably such that 95% will pass through a 100 mesh screen and 100% will pass through a 30 mesh screen.

The asbestos may be in the form of medium length fibers, as mentioned above, although asbestos of various other fiber lengths could be used. We could also use any one of the other fibrous materials mentioned above or various combinations of these fibrous materials. The amount of the fibrous material to be used can be more or less than the 10% indicated in the above example, depending upon the characteristics desired in the plaster and the use to which the plaster is to be put.

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In aerating the composition by mechanical agitation, we prefer to use a mixer having blades and in which a folding action is imparted to the plastic mass by such blades. We have found that very satisfactory results are obtained when the above-described composition is aerated by agitation for about fifteen minutes or somewhat longer in a Jaeger plaster mixer, type #6–SV, operating at a speed of about 46 R. P. M. Although we have mentioned this particular mixer, it will be understood, of course, that various other mixing devices could be used and that the period of agitation may be varied somewhat in accordance with the particular mixing apparatus employed.

The acoustical plaster resulting from the above-described composition and method operations is of a readily workable creamy consistency and after drying has a density of about 18 to 23 pounds per cubic foot. This density value comes within the range of 14 to 23 pounds per cubic foot and this fact may be taken as an indication that our plaster is a good acoustical plaster. Likewise this density value falls within the range of 18 to 25 pounds per cubic foot which may be taken as an indication that our plaster is also a good workable plaster.

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A wall or ceiling to which our acoustical plaster has been applied can be left in the condition obtained by the above-mentioned brush and nail stippling or, if desired, the stippled surface can be painted to further improve its appearance or to obtain certain color effects. When paint is applied to our stippled plaster, it should be applied by spraying and, although various kinds of paints can be used, we prefer a cold-water or casein paint.

As indicated above, our improved plaster can be applied to backing material other than a reticulated backing as represented by the metal lath 11. For example, it may be applied to plain or imperforate backings formed of poured concrete, concrete block, cinder block, old painted plaster surfaces, gypsum lath, insulating board, clay tile, gypsum tile, or brick and to backings formed of various other materials. In applying our acoustical plaster to the other backings just

CROSS REFERENCE

EXAMINER

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 3 Sheets-Sheet 3

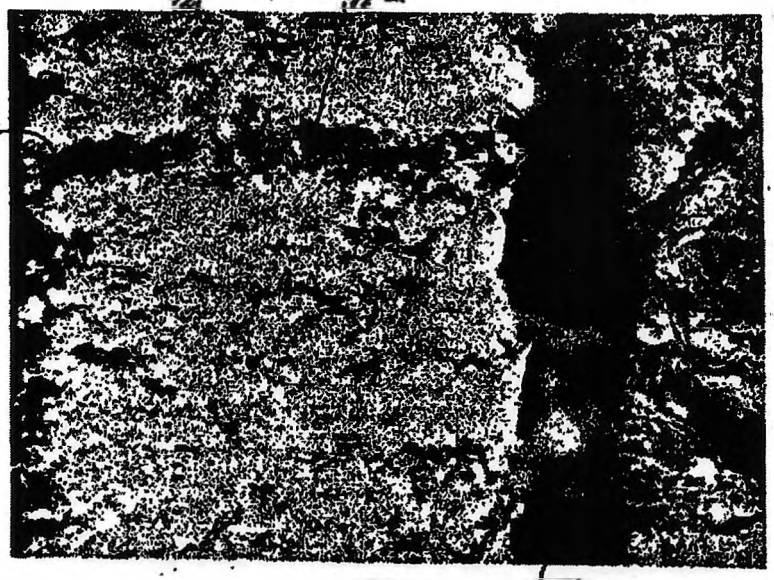

FIG. 6

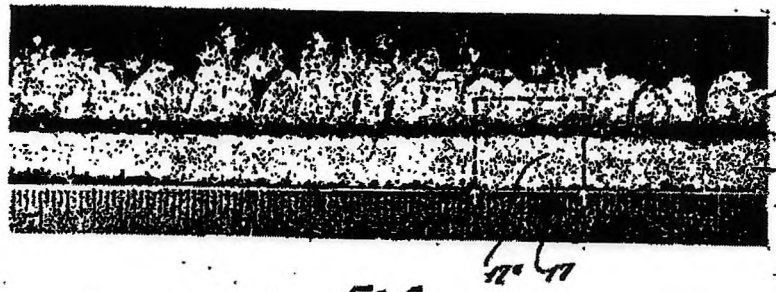

FIG. 5

INVENTORS
RALPH L. DICKEY
CHESTER R. AUSTIN
ARNOLD E. PAVLISH
BY Kuris Hudson & Kent
ATTORNEYS

June 5, 1951 R. L. DICKEY ET AL 2,556,031

PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 3 Sheets-Sheet 1

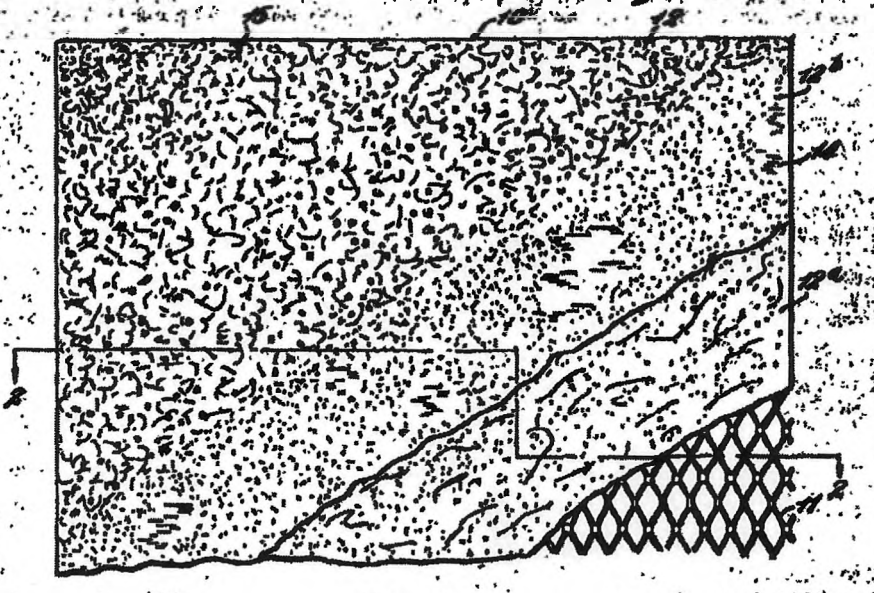

FIG. 1

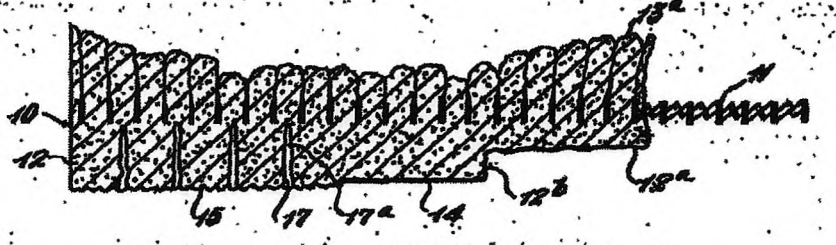

FIG. 2

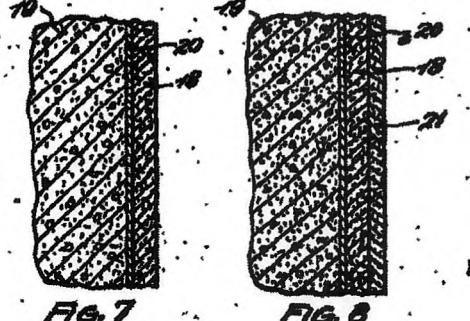

FIG. 7

FIG. 8

INVENTORS
RALPH L. DICKEY
CHESTER B. AUSTIN
ARNOLD E. PAVLISH
BY Kerr, Hudson & Kent
ATTORNEYS

CROSS REFERENCE EXAMINER

June 5, 1951 R. L. DICKEY ET AL. 2,556,031

PLASTER AND METHOD OF PLASTERING

Original Filed April 21, 1942 5 Sheets-Sheet 2

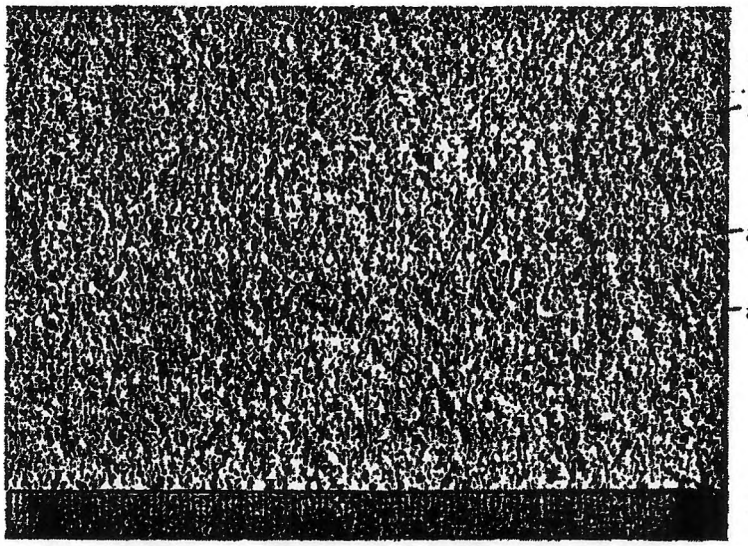

FIG. 3

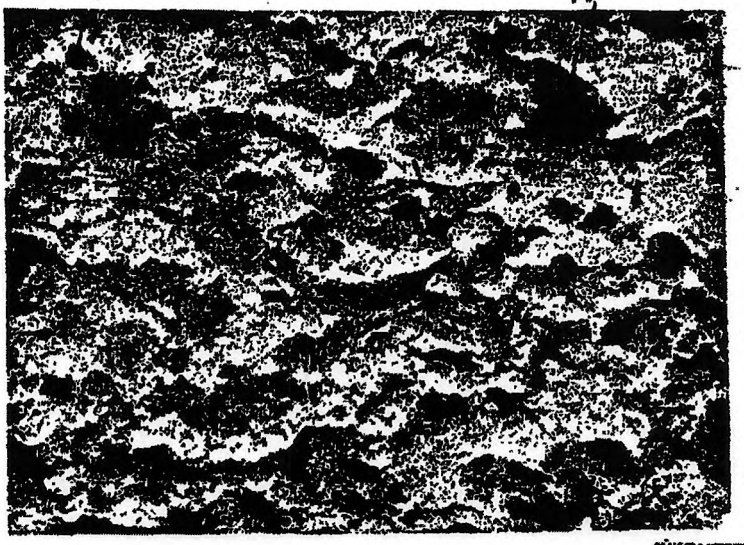

FIG. 4

INVENTORS
RALPH L. DICKEY
CHESTER B. DUSTIN
ARNOLD C. DAYTON
BY
ATTORNEYS

SAMPLE 16419

Sample PFZ 0054