April 12, 1938. C. L. NEWPORT ET AL 2,113,924

SOUND ABSORBING WALL TREATMENT

Filed Dec. 6, 1937 2 Sheets-Sheet 1

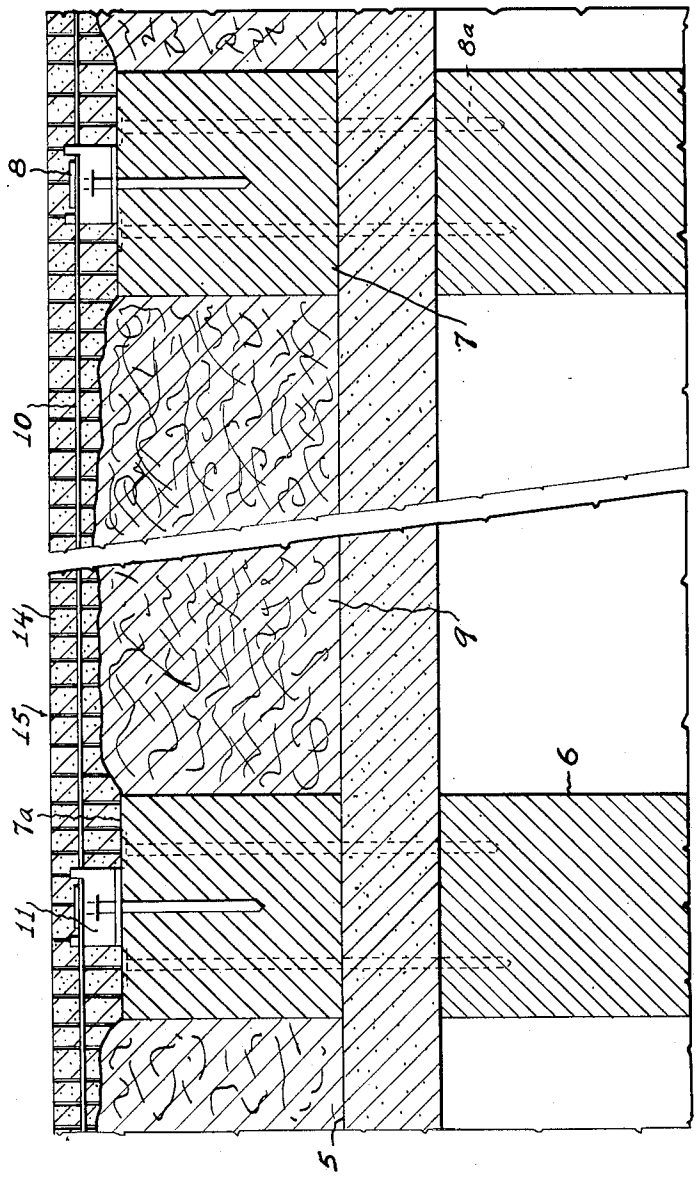


FIG. 1.

INVENTORS:
Charles L. Newport
Hubert C. Smith

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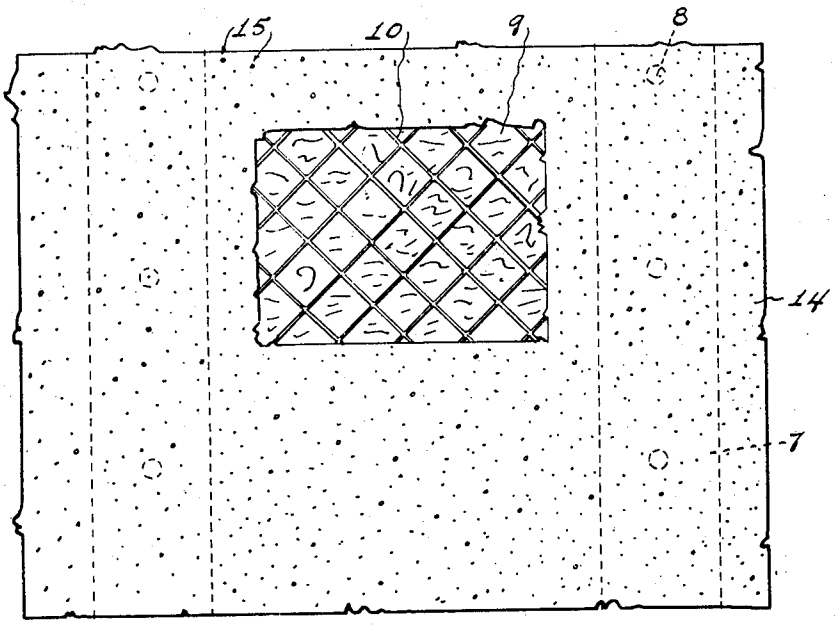


FIG. 2.

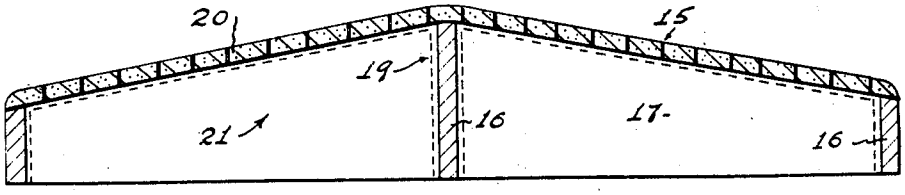


FIG. 3.

INVENTORS:

Charles L. Newport

Herbert C. Smith.

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UNITED STATES PATENT OFFICE

2,113,924

SOUND ABSORBING WALL TREATMENT

Charles L. Newport and Herbert C. Smith, Los Angeles, Calif.

Application December 6, 1937, Serial No. 178,310

5 Claims. (Cl. 72—17)

Our invention relates to sound absorbing treatments for walls and more particularly for those walls, such as the back walls of theatres, where high efficiency is required over a wide range of frequencies.

An object of the invention is to provide an acoustical treatment adapted for absorbing both high frequency and low frequency sounds, and for this reason to provide for employing appreciable thicknesses of rock-wool, or the like, properly protected by a durable and decorative covering which is fire-proof but non-metallic.

For high absorptivity over a wide range it has been the custom to cover rock-wool or felt with screening, perforated metal, fabric and the like; the latter being unsuited for fire resistance and the metallic coverings being non-absorptive. It has also been proposed to cover felt, rock-wool and the like with a perforated covering of ordinary plaster but such covering is not of itself suitably absorptive while the difficulties encountered in perforating the plaster has confined this construction to pre-fabricated articles of manufacture.

It is an object of this invention to provide for covering rock-wool or the like with a readily applied and readily perforated covering which in addition to passing sound to be absorbed by the underlying layer is given to absorption through diaphragm action as well as to absorption by reason of its cellular and foraminous characteristics and which tends to transmit, rather than to reflect.

Rock wool is known to have high predeterminable efficiency for absorption of given frequencies when its density is known and it is a particular object of this invention to provide for retaining rock wool within a wall under a compression which is predetermined during construction.

Another object of the invention is to provide a construction for carrying out the foregoing objects and which is readily applied to existing walls.

In carrying out our invention we provide, in contact with the wall, co-extensive pads of rock wool, felt or the like, held under predetermined compression and held against settling by coarse wire mesh or the like stretched over the outer surface thereof. By building the wool up to a predetermined thickness before the mesh is stretched over it, and by properly furring the mesh with respect to the wall, we are able to closely predetermine the density and the sound absorbing characteristics of the wool. Naturally too low a density gives ample porosity but insufficient total fibre-surface. Too high a density gives ample fibre surface but insufficient porosity or penetrability. Therefore by applying wool of known physical characteristics to a given depth on the wall, and then compressing it a known degree when applying the mesh, the final result is predetermined.

The wire mesh may be relatively light weight, inexpensive, and non-decorative since it is to be totally obscured, but we cause the mesh to serve a dual function by employing it as an anchor and reenforcement for the final covering. When the mesh has been applied the rock wool or like material actually contacts the mesh and even projects slightly through the large openings provided in the coarse mesh.

The next step in our method consists in applying over the mesh an acoustical plaster, as distinguished from non-absorptive coverings, and preferably this plaster is of such nature that when fully dried it will prove suitably flexible. Another requirement is that the plaster, as it is applied by usual means, will be capable of displacing the wool slightly so that the plaster will flow behind the wire mesh and will become anchored or keyed thereto so that the final covering is a layer of wire-reenforced plaster of suitable resistance combined with suitable flexibility and absorption. The plaster employed may be that described in the Patent No. 1,960,880, issued to one of the applicants, Herbert C. Smith.

While there are numerous plasters which will suggest themselves to the minds of those skilled in the art, we have found that a plaster composed of a large percentage by bulk of rock wool is well suited. For instance, a mixture of granulated rock-wool and a binder such as one of the magnesium cements, makes an ideal plaster for the purposes of this invention. Such a plaster by reason of the large bulk of water-saturated rock wool pellets, adds enough moisture to the originally installed rock wool to insure its being suitably displaced during the application of the plastic covering. Also this plaster may be troweled with appreciable pressure to insure its proper application over the rock wool fill, while providing the required final porosity when dry. A further object and advantage of the rock wool plaster is that it is peculiarly adapted for subsequent steps.

This plaster, in being applied, or shortly after being applied is preferably stippled by being impressed throughout its surface to provide a suitably decorative texture. However, whether this texture is required or not, the final step in our

method consists in forcing very small diameter penetrating instruments into the plaster before it has taken a final set and to thus provide the plaster with myriads of inconspicuous apertures penetrating both surfaces thereof to convey sound waves from the outer surface of the covering into the wool or felt underlying this covering. By forming these openings with a common wire stippling brush the openings are inconspicuous, suitably numerous and yet so irregularly distributed as to avoid the stereotyped appearance common to mechanically perforated wall surfaces.

Obviously, by filling shallow open-face pans, boxes, tile, or the like with rock wool; stretching wire mesh over the now filled receptacle; applying the plaster, and then finally stippling the same all according to our invention, a pre-fabricated sound-absorbing tile may be produced. We have found, however, that lower cost results where the complete combination can be produced directly upon the wall by artisans of ordinary skill.

In some instances where characteristic absorption is required, we propose to substitute for the wool a removable core, which may be withdrawn when the plaster has set, or after the plaster has been perforated, so as to leave an air space only behind the plaster. The result is a diaphragm of acoustic plaster of suitable strength and which provides absorption partly by reason of its diaphragm action, partly by reason of its porous nature, and partly by reason of the air space behind it.

To illustrate one application of our invention we have shown in the accompanying drawings a wall treated according to our invention.

In the drawings:

Figure 1 is a horizontal sectional view of the wall.

Figure 2 is face view of a fragment thereof.

Figure 3 is a cross section of a pre-fabricated tile embodying features of our invention.

The numeral **5** indicates a common reflective wall surface to be treated, this being, for example, a hard-wall plaster surface backed by common studding **6**. To the surface of this wall is applied a plurality of spaced furring strips **7**; one for and alined with each stud **6** and held directly thereto by a long nail or spike such as **8** so that the complete acoustical treatment about to be described becomes a substantially integral part of the old wall.

Between the furring strips the rock-wool **9** is provided, this being readily applied in batt or roll form and built up to an original thickness such that it extends beyond the outer surfaces *7a* of the furring strips, as indicated in Figure 3. The depth to which this wool is built up depends upon the normal density of the rock wool as ordinarily applied, as compared with the final density required.

The wire mesh is indicated at **10** and may be common hex-mesh or "chicken-wire" stretched tightly across the furring strips and co-extensively of the entire surface being treated. This wire is held in place by the aforesaid nails **8** but with the aid of any well known furring device, such as indicated at **11**, this wire is furred away from the strips **7**. Despite this furring of the wire from the strips **7**, the rock-wool contacts the wire mesh and is actually held under compression thereby; this method of holding the wool also serving to prevent the wool from settling, and, without the aid of any other means for holding the wool in place.

Figure 2, however shows the wool as having been displaced slightly inwardly from the wire mesh and compressed to the predetermined final density; the manner in which this wool becomes displaced having been explained in connection with the above general description of the method peculiar to this invention.

The final covering or plaster is indicated by the numeral **14** and is here shown as extending inwardly through the wire mesh so as to become keyed thereto and re-enforced thereby. In plastering large wall surfaces so treated it is found that the workman of usual skill can apply the plaster with suitable economy and can produce a decorative layer fully obscuring the furring strips, the wire mesh, the nails, and the wool respectively and can provide predetermined thickness to the finished plaster.

It will be noted that the resiliency of the wool at spaces intermediate of the studs results in the plaster at points intermediate of the furring strips being only of the required thickness while directly over the furring strips the plaster is of greater thickness.

Since the furring strips are not covered with wool it is decidedly advantageous that the higher reflectivity of the furring strips be offset by increased thickness of plaster, while to employ over the wool this same thickness would not only prove wasteful of plaster but would partially defeat the purpose of the underlying layer of rock-wool, felt or the like.

The plaster is shown as provided with a great multiplicity of small diameter holes **15** extending entirely through it from the outer surface, except where the plaster overlies the furring strips and here the apertures extend the full depth of the increased thickness of plaster.

From the foregoing, and from the existing knowledge of perforated acoustical plaster, it will be apparent that that portion of the treatment directly overlying the furring strips will show very appreciable absorption while that portion of the treatment between the furring strips provides novel results.

To apply a stippling brush or the like (not shown) to provide the through apertures, it is preferable to allow the plaster to take an initial set so that the apertures do not close over as the penetrating instruments are withdrawn. While the plaster is then harder than when first applied, we find that a rock-wool composition plaster is readily penetrated while the compressed resilient backing of rock wool permits of rapid penetration without damage to the covering as a whole.

While the manner and locale of absorption of the various frequencies by this improved construction defies description, it is now apparent that we have provided: (1) a perforated acoustical plaster as the sound receiving side of the treatment, (2) a wire re-enforced diaphragm of relatively slight depth and which is reenforced and damped by an underlying layer of rock wool; (3) a suitably decorative outer surface having the general appearance or surface texture common to accepted acoustical plasters, (4) an inner concealed layer of felt or rock wool of controlled density but which is in suitably direct communication with the source of sound, (5) a highly reflective backing behind the wool and in the form of a hard plaster wall which being damped by the wool will not tend to transmit appreciable

sound and which will thereby act to reflect undissipated energy back through the wool to the undersurface of the plaster covering.

In Figure 3 we have shown a prefabricated tile embodying features of our invention. This tile is shown of pyramidal shape for breaking up the usual sound patterns and includes a frame composed respectively of transverse end walls 16, vertical ribs 17, and a wire mesh 18 stretched over the outer face of the frame and properly furred. Broken lines 19 indicate removable cores which are in place only during manufacture and which are removed when the plaster web 20 is suitably set and finished. The resultant product has only the air space 21 behind the originally plastic, wire reenforced diaphragm, although it is obvious that rock wool or other sound absorbing filler may be added to the air space 21 if required.

In practice we have found that the acoustical treatment hereindescribed shows its maximum absorption at about 512 d. v. and is therefore peculiarly suited to treatment of the back walls of sound-picture theatres. With this fact in view, care is exercised in applying the acoustical plaster and in predetermining the compression to which the rock wool is subjected, so that the plaster is built up to just the right thickness to have what we believe to be a diaphragm action in contact with the wool so that the plaster and wool co-operate to show high absorption of the strong low frequency sounds. While such a combination shows unexpected absorption at low frequencies it would ordinarily be expected that the combination would be so inefficient at higher frequencies as to be quite impractical in theatres where music is produced in addition to speech. However, our product does show suitable absorption at the higher frequencies and this we believe to be due to our having provided the apertures extending through the plaster which at their margins produce some absorption of high frequencies, and which apertures allow other portions of the high frequency energy to pass through to the rock wool.

Therefore the product is unique in that while the acoustical plaster in contact with the wool shows higher absorption at low frequency than would the plaster alone, the high frequency efficiency of the underlying wool is not reduced as much as would be expected by reason of the plaster acting to transmit appreciable percentages of high frequency energy rather than reflecting same to disadvantage.

We claim:

1. In combination with a wall having spaced projections thereon and a covering of relatively highly compressible sound absorbing material between said projections, a meshed fabric covering said sound absorbing material and spaced from the wall by said projections, and a layer of sound absorbing plaster covering and keyed to said fabric, said layer of plaster being sufficiently flexible to transmit sound by diaphragmatic action.

2. In combination with a wall having spaced furring strips on its face, a filling of low density sound absorbing material covering the wall face between the strips, a wire mesh stretched over said material and spaced from the wall by said strips, and an outer layer of acoustical plaster covering and keyed to said wire mesh, said outer layer being sufficiently flexible to be capable of transmitting sound by diaphragmatic action.

3. The combination of claim 2 in which said outer layer of acoustical plaster has perforations therethrough capable of passing sound.

4. In combination with a wall having spaced furring strips on its face and spaced projections on the outer face of said strips, a filling of low density sound absorbing material covering the wall face between said strips, a wire mesh secured to said projections and covering said sound absorbing material, and a layer of sound absorbing plaster covering and keyed to the wire mesh, said layer of plaster being relatively thicker over the furring strips than between said strips.

5. The combination of claim 4 in which the said layer of sound absorbing plaster has perforations therethrough capable of passing sound.

CHARLES L. NEWPORT.
HERBERT C. SMITH.