June 6, 1933. K. SLIDELL 1,912,544

METHOD FOR TIGHTLY PACKING MATERIALS AND PRODUCT FORMED THEREBY

Filed Nov. 2, 1929

Fig. 1.

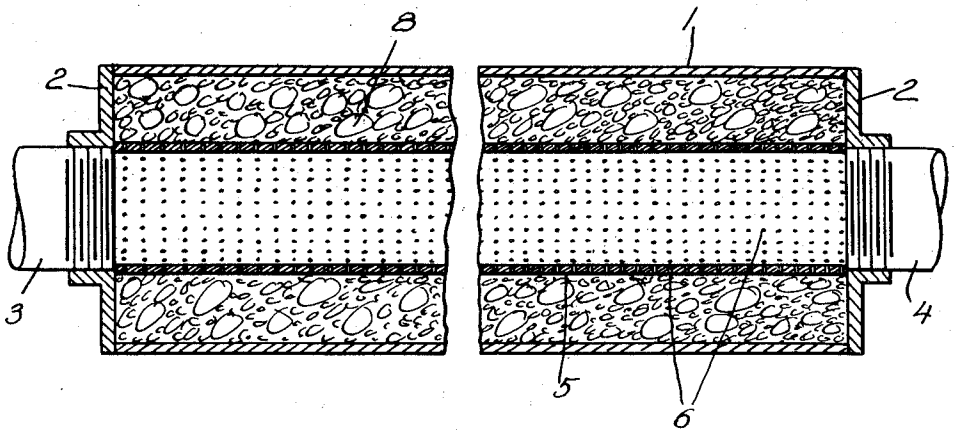
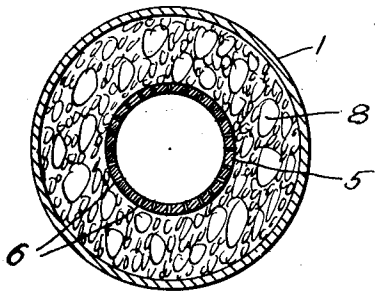


Fig. 2.



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UNITED STATES PATENT OFFICE

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METHOD FOR TIGHTLY PACKING MATERIALS AND PRODUCT FORMED THEREBY

Application filed November 2, 1929. Serial No. 404,527.

My invention relates to a tightly packed granular material, and methods of making the same, and more particularly to methods of packing exfoliated vermiculite into a closed container.

It is an object of this invention to provide a pressure-exerting means in the interior of a container filled with a granular or similar filler so that the filler will be held tightly in place.

It is a further object to produce a filling material which will have the attrition decreased to a minimum when it is exposed to gas pulses and especially the pulses of the exhaust gas of an internal combustion engine.

Another object of this invention is to provide a gas-pressure and sound absorbing material of granular materials and especially exfoliated vermiculite which does not disintegrate rapidly when used without a binder in gas engine mufflers.

The explosion within the cylinder of an internal combustion engine creates tremendous pressure therein. The steam or vapor in the cylinder of a steam engine is also under very high pressure. Upon the opening of the exhaust port, the gas emerges at high velocity, very quickly reducing the pressure in the cylinder. By the word gas, I mean to embrace both gas and vapor. The result is a succession of pulses of gas at high pressure traveling through the exhaust manifold or pipe or any other type of exhaust system at a high velocity. Upon the emergence of the gas pulse into the atmosphere an additional spurt in velocity is probably acquired by reason of expansion, and a sharp sound results. The greater the pressure gradient between the pulses of gas and the atmosphere the greater the velocity and the sharper the sound. In order to silence exhaust noises successfully the muffler must suppress the pressure peaks and thus even the flow of the escaping gas pulses to the point where a sound is not created. In addition the sound communicated to or generated within the muffler should be silenced. In the co-pending application of my co-worker, Frederick H. Schnell, Serial No. 361,376, filed May 8, 1929, now Patent 1,811,762, issued June 23, 1931, there is described and claimed a muffler for absorbing the gas-pressure peaks and sound of gas engine exhausts without appreciably increasing the back-pressure on the engine in which the exhaust gases are passed along the surface of a gas-pressure and sound absorbing material such as mineral wool, metallic wool, crushed mineral matter, mica, exfoliated vermiculite such as zonolite, blown slag, coke, pumice, or other porous aggregates or built-up units of such aggregates. For silencing blow-off gases, air compressor intake and exhaust noises, and noises produced by gases at room temperature, flammable sound-absorbing materials such as wool, cotton, or other cellulosic fibers may be used. The built-up units may be faced with a foraminous retaining wall which may be of perforated sheet metal. Such a wall is necessary with granular or other fillers in which a binder is not used.

Where a granular material and especially exfoliated vermiculite is packed into a container or other confined space without a binder to form such a gas-pressure and sound absorbing material it is often difficult to pack it properly into such a space so as to completely fill it without much hand labor at high cost especially if the space is of intricate shape. Furthermore, if the device is subjected to vibration, as during shipping and use, the particles tend to rearrange themselves and occupy a smaller volume. During this rearrangement there is abrasion between the adjacent particles which results in marked attrition. This is especially true if the material is used to absorb gas-pressure peaks and sound in a gas engine muffler. It is subjected to violent pulsations which cause rapid attrition if there is any movement of the particles by these pulses. It is difficult to pack these fillers mechanically so that they will not move.

I have found that it is possible to provide a pressure-exerting means within the filling material confined in space by introducing some pieces of raw vermiculite or partially exfoliated vermiculite therein and then heating these pieces to exfoliate them. The exfoliating vermiculite expands into aggre-

gates of separate leaves which exert an outward pressure. This pressure seems to continue after the exfoliating operation is complete probably due to a certain resiliency of the exfoliated product. Mufflers containing a mixture of granular material such as particles of puffed clay or the like or exfoliated vermiculite and these pressure-exerting exfoliated pieces or aggregates of vermiculite show a small attrition loss. In gas engine mufflers the exhaust gases are hot enough to exfoliate any unexfoliated vermiculite which is adjacent to the surface or wall along which these gases pass. This is a distinct advantage since any unexfoliated vermiculite continues to expand for some time after the muffler is put into service. Even after long continued service there may be continued exfoliation which keeps the filler packed tightly in the muffler. This same condition exists where such a mixture of raw or partially exfoliated vermiculite and other filler material is used to insulate an oven wall. When the oven is put into serivce after being shipped to the buyer the exfoliation of the vermiculite will pack the filler tightly although it may have been shaken down somewhat in transit. This insures uniform insulation around the oven. All of the unexfoliated vermiculite is not exfoliated by this treatment since only that adjacent the hot wall is affected. The unexfoliated product need not be distributed through the filling material but may be concentrated next to the wall which is to be heated.

Porous packed exfoliated vermiculite (without a binder) forms an excellent insulating material and also an excellent gas-pressure and sound absorbing material. It is possible to mix pieces of either raw or partially exfoliated vermiculite with granular material or exfoliated vermiculite since on further heating the partially exfoliated product continues to expand. All of the vermiculite filler may be partially exfoliated so that it is not necessary to add any of the raw material. Often the interior portions of larger pieces of raw vermiculite fail to exfoliate and this material is classified as partially exfoliated.

Although I refer specifically to vermiculite in this specification I do not wish to be limited to that mineral which is found in Montana but comprehend any mineral of that type which exfoliates similarly on heating. By granular material I include any granular product such as slag or stone particles including mica, unexfoliated vermiculite, and any other granular product which resists the heat of exfoliation and may be used to form a gas-pressure and sound absorbing composition. For gas engine mufflers exfoliated vermiculite passing through a 3 mesh screen and retained on a 10 mesh screen gives excellent results though coarser and finer material may be used. I have found that for such mufflers that if about 5 to 25 percent by volume of raw vermiculite is added to the exfoliated product good results are obtained.

As hereinbefore noted when the granular material or exfoliated vermiculite is used as a gas pressure and sound absorbing material as in exhaust mufflers the confining wall of the container exposed to these gases should be foraminated. A perforated metal wall gives excellent results for this purpose.

In the accompanying drawing I have illustrated a muffler in which the herein described material is employed as a gas-pressure absorbing and sound absorbing material. In the drawing,

Fig. 1 is a longitudinal, sectional view; and

Fig. 2 is a transverse, sectional view.

The muffler consists of a substantially imperforate outer casing 1 which may be cylindrical in shape as shown or may be of any other desired form. The casing is provided with end walls 2 having alined openings therein and these openings are adapted to receive the ends of an inlet pipe 3 connected to the exhaust manifold of the engine (not shown) and an outlet pipe 4. Within the casing and between the two openings in the end walls, there is provided a duct 5. The duct is foraminous to permit gas pressure peaks to pass into the space surrounding the duct and may be formed of a sheet metal tube having perforations 6 formed therein. The perforations may vary in size or may be of uniform size throughout. In place of perforated sheet metal a wire screen or other foraminous material may be employed. The space between the duct and the outer casing 1 is filled with the gas-pressure absorbing and sound absorbing material as indicated at 8.

I claim:

1. The method of tightly packing particles of materials in a confined space which comprises filling said space with particles of material and pieces of unexfoliated vermiculite and heating at least some of said pieces of vermiculite to produce exfoliation.

2. The method of tightly packing granular materials in a confined space which comprises filling said space with granular material and pieces of unexfoliated vermiculite, and heating at least some of said pieces of vermiculite to produce exfoliation.

3. The method of tightly packing exfoliated vermiculite in a confined space which comprises filling said space with a mixture of exfoliated vermiculite and pieces of unexfoliated vermiculite, and heating said mixture to produce exfoliation of at least some of said pieces of unexfoliated vermiculite.

4. The method of tightly packing exfoliated vermiculite in a container which comprises filling a container with partially exfoliated vermiculite and heating said vermiculite to produce additional exfoliation of

at least some pieces of said partially exfoliated vermiculite.

5. In combination with confining walls, a tightly-packed mixture of granular particles and pressure-exerting aggregates of exfoliated vermiculite.

6. In combination with confining walls, a tightly-packed mass of a mixture of completely and partially exfoliated vermiculite having pressure-exerting aggregates of exfoliated vermiculite distributed therein.

7. In combination with confining walls, a gas-pressure and sound absorbing material comprising a porous tightly-packed mixture of granular particles and pressure-exerting aggregates of exfoliated vermiculite.

8. In combination with confining walls, a gas-pressure and sound absorbing material comprising porous tightly-packed mixture of completely and partially exfoliated vermiculite having pressure-exerting aggregates of exfoliated vermiculite distributed therein.

9. In combination with confining walls, a gas-pressure and sound absorbing material comprising a porous tightly packed mixture of particles of material and pressure exerting aggregates of exfoliated vermiculite, said vermiculite having been exfoliated in situ, a portion of the area of a confining wall being perforated.

10. In combination with confining walls, a gas-pressure and sound absorbing material comprising a tightly packed mixture of completely and partially exfoliated vermiculite, at least a portion of an area of a confining wall being foraminated.

In testimony whereof I affix my signature.

KEMPER SLIDELL.