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UNITED STATES PATENT OFFICE.

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HEAT-INSULATING MATERIAL.

No Drawing. Application filed September 30, 1918. Serial No. 256,286.

To all whom it may concern:

Be it known that I, HERBERT MILLS SMITH, a citizen of the United States, residing at Great Barrington, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Heat-Insulating Materials, of which the following is a specification.

This invention relates to a composition of matter which is to be employed in the vacuous spaces of vacuum bottles and other receptacles and devices, as for instance, the bottle described in the United States Patent to William Stanley No. 1,071,817. The sort of articles described in that patent comprise two metallic shells, an outer shell and an inner container, held in spaced relation, the space being filled with finely divided material which will absorb gas at ordinary temperatures and reduce pressures, the said space being exhausted to such a degree as to greatly reduce the conductivity for heat between the two shells. The composition of this finely divided material is most important because it must be as light as possible so that the weight of the complete article may be kept to a minimum; in the second place there must enter into the composition a sufficient quantity of material which will absorb gas, while the remainder of the ingredients should be material which will not give off gas to the space at ordinary temperatures and in a partial vacuum. Again, the material must be such that it may be compressed to a reasonable extent without caking or solidifying, which latter conditions would of course destroy its usefulness as a heat-insulator without adding to its capacity as a mechanical support or shock absorber. I have accordingly invented a heat-insulating material which when placed in a vacuous space will absorb any free molecules of gas that may be in the space or may erupt into it from the surfaces of the metallic walls; which will not, under ordinary temperatures of use and under the low pressures prevailing in the vacuous space, give off gases on its own account (that is to say it is substantially inert); which may be compressed to a point where it will afford mechanical support to the device as a whole, eliminating the necessity for other spacing or connecting devices between the two shells except at one end; which will have excellent shock-absorbing qualities; which, particularly in its properly compressed condition, will improve the heat-insulating qualities of the device because of its interruption to the path of a free gas molecule seeking to travel from one wall to the other; which, when properly dried, will not cake or solidify under reasonable compression; which is substantially opaque to radiation; which can be compressed to a very high density without changing its thermal conductivity; and which, with all, is exceedingly cheap to manufacture and harmless to handle.

The ingredients and proportions at which I have arrived after innumerable experiments with all sorts of materials are as follows:—

Materials.	Parts by volume.
Kieselguhr, or diatomaceous earth, preferably in powdered form	7
Charcoal (preferably made from soft wood)	1
	8

I prefer that the kieselguhr or diatomaceous earth, should be rolled in a tumbling barrel for approximately one-half hour with flint pebbles to break all packed lumps. The rolled kieselguhr or diatomaceous earth should then be passed through a revolving retort and heated to red heat, 700° to 800° centigrade in order to fracture the walls of the diatoms, and dehydrate the mass. The charcoal, (preferably made from soft wood) should be ground to a very fine powder. This can be accomplished in a tumbling barrel with flint pebbles or any hard stones. A standard make of ball mill is preferable. The ground charcoal should be well mixed with the dehydrated kieselguhr or diatomaceous earth by rolling in a ball mill, and the mixture again heated to a temperature of 300° centigrade by slowly passing it through a revolving retort as low in oxygen as possible in order to prevent combustion of the charcoal. The insulation should be kept from the atmosphere and packed into the space to be exhausted as quickly as possible, preferably just as it comes from the retort.

The resulting material is light in weight, possesses the advantages enumerated above and is cheap to manufacture, involving no

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articles which are expensive in themselves or which require expensive treatment in order to make them available for my purposes.

I regard it as a perhaps important characteristic of the invention that it includes the use of diatomaceous earth. This is easily dehydrated and kept dry, and on account of the rounded or curved shape of the particles lends itself readily to the necessary amount of compression without compaction. And of course the material is light and cheap.

I claim:

1. A finely divided heat-insulating material comprising a mixture of a gas-absorbing material and an inert material, with the latter preponderating in the proportion of about seven to one.

2. An insulating composition consisting of a mixture of a gas absorbing material and an inert material with the latter preponderating.

3. A heat insulating composition consisting of a mixture of finely divided gas absorbing material and a finely divided inert material with the latter preponderating.

4. An insulating composition consisting of a mixture of a gas absorbing material and a diatomaceous earth with the latter preponderating.

5. An insulating composition consisting of a mixture of a finely divided gas absorbing material and a finely divided diatomaceous earth with the latter preponderating.

6. A heat insulating composition consisting of a mixture of dehydrated diatomaceous substance and a small proportion of dry ground charcoal.

In testimony whereof I affix my signature.

HERBERT M. SMITH.