UNITED STATES PATENT OFFICE.

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SMOKE-FILTERING MEDIUM.

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To all whom it may concern:

Be it known that I, ALBERT L. CLAPP, a citizen of the United States, residing at Danvers, in the county of Essex and State of Massachusetts, have invented new and useful Improvements in Smoke-Filtering Mediums, of which the following is a specification.

The object of the present invention is to provide a medium for filtering smoke-laden air, so as to remove the smoke. Such a medium should possess certain optimum characteristics; that is, it should be pervious to air, should offer a minimum resistance to the passage of the air, and should filter therefrom all traces of smoke. After long continued experimentation, I have provided a filtering medium which has, to a high degree, the optimum characteristics herein mentioned, and which I shall now proceed to describe.

It consists of a fabricated vehicle or sheet, the body of which may be formed of any suitable fibrous material ordinarily used in the manufacture of paper. Preferably I employ manila rope pulp, although I have secured excellent results with the fibers of cotton or woolen rags, and also with sulphate and sulphite fiber. Such raw materials, when formed into a sheet after the beating operation and with the aid of any suitable paper-making machinery, is too closely matted to permit the free passage of air therethrough, so that I provide especial means for separating and spacing the fibers, to render the sheet highly pervious to air, as I shall subsequently explain. I have discovered that kieselguhr or "cellite" so-called has the property of removing smoke from air, possibly because of its minute irregular cellular structure, and it entangles or causes the deposit of the finely divided particles which constitute the smoke. This may be demonstrated by enclosing a layer of kieselguhr between two layers of material pervious to smoke, and forcing a current of smoke-laden air therethrough, and, as a result, it will be found that the smoke will be entirely removed, depending of course to some extent upon the thickness of the layer. Because of its state of fine division, the kieselguhr must be sustained by a vehicle or body, and hence I employ a fibrous sheet such as hereinbefore referred to. The kieselguhr may be beaten into the pulp in as great proportion as the pulp will carry, and its microscopic jagged points cause it to mat with the fibers. Because of its structure, its retentive properties are very great, and from 75% to 100% by weight of kieselguhr may be added to and retained in paper, when made in accordance with the otherwise usual process. A sheet of only paper pulp and kieselguhr, however, while satisfactory under some conditions for the filtration of smoke, is too resistant to the passage of air to permit its employment where a free flow of air is required. Consequently, I have overcome this difficulty by employing spacing material, preferably of a fibrous nature, the function of which is to create voids and interstices between the fibers of the sheet or to prevent the fibers from matting too closely together. So far as I am aware, the best material for this purpose is very fine hardwood sawdust or wood flour, the particles of which, however, as compared with particles of kieselguhr, are relatively coarse, and their intimate mixture with the pulp ensures a loosely-matted sheet of paper felt—when dry.

As an example, for the production of a light loosely-matted smake-filtering medium, I proceed as follows:

50 parts of manila rope pulp, 25 parts of the sawdust or wood flour, and 25 parts of kieselguhr (8 pounds per cubic foot) are placed in a beater with sufficient water to secure a proper circulation. For purposes to be explained, to 100 parts of the dry raw materials I add 2% to 5% of caustic soda (which tests 76% Na_2O). After the mass is beaten into thorough admixture, so that it is physically substantially homogeneous,—this usually being accomplished with light beating for five or six hours,—it is formed into a sheet by a Fourdrinier machine or any other type of web-forming machines, such as a wet machine so-called. In case of the employment of a Fourdrinier machine, the flow is regulated to secure a sheet of the desired thickness, or, in using a wet machine, a sheet of the proper thickness is secured by the number of layers. For certain physical purposes, I prefer to form a single sheet of 0.075 to 0.015 inch arranged in layers to secure a resultant sheet of the same approximate thickness.

Certain smokes or fumes have an acid reaction, and consequently, in forming my fil-

tering medium, I make it slightly alkaline, i. e., approximately to the degree stated, to neutralize the acid and prevent deterioration of the fibrous vehicle or body.

A filtering medium, such as herein described, has an especial value in the construction of gas masks, for use by firemen or troops in warfare. I have found that a sheet, formed as herein described, will remove from 95% to 100% of smoke from air, and at the same time, because of its loosely-matted structure, will afford a negligible resistance to the free flow of air therethrough.

I do not limit myself to any particular fibrous material, nor to the particularly named spacing material, in forming the loosely-matted vehicle, nor to the exact proportion of the kieselguhr, as substitutions and variations may be made without departing from the spirit and scope of my invention as defined in the appended claims.

So far as I am aware, no one had previously discovered the peculiar properties of kieselguhr as a filtering medium for a smoke-laden atmosphere, although it has been proposed to use kieselguhr and charcoal in admixture with paper pulp in forming a relatively absorbent wrapper for meat.

Having thus explained my invention and discovery, and described a particular embodiment of the invention, without attempting to explain all of the possible embodiments thereof of all of its applications or all of the modes of its use, what I claim is:

1. A medium for filtering smoke from air comprising a paper sheet having kieselguhr distributed therethrough.

2. A medium for filtering smoke from air comprising a fibrous loosely-matted flexible sheet containing kieselguhr distributed therethrough.

3. A smoke-filtering medium consisting of a highly-porous loosely-matted fibrous flexible sheet consisting of a vehicle formed of pulp fiber and kieselguhr distributed throughout the mass.

4. A smoke-filtering medium consisting of a porous loosely-matted flexible sheet consisting of paper pulp, kieselguhr and a fibrous spacing material, all in intimate admixture.

5. A smoke-filtering medium consisting of a porous loosely-matted sheet consisting of manila rope pulp, kieselguhr and comminuted wood in intimate admixture.

6. A smoke-filtering medium consisting of a porous loosely matted sheet consisting of manila rope pulp, kieselguhr and comminuted wood in intimate admixture and in the following proportions, to wit, about 50 parts pulp, 25 parts kieselguhr and 25 parts comminuted wood.

7. A medium for filtering smoke consisting of kieselguhr, an alkali, and a fibrous vehicle in which the kieselguhr and alkali are uniformly distributed.

8. A medium for filtering smoke consisting of a loosely-matted fibrous felt-like sheet loaded with kieselguhr and having an alkaline reaction.

In testimony whereof I have affixed my signature.

ALBERT L. CLAPP.