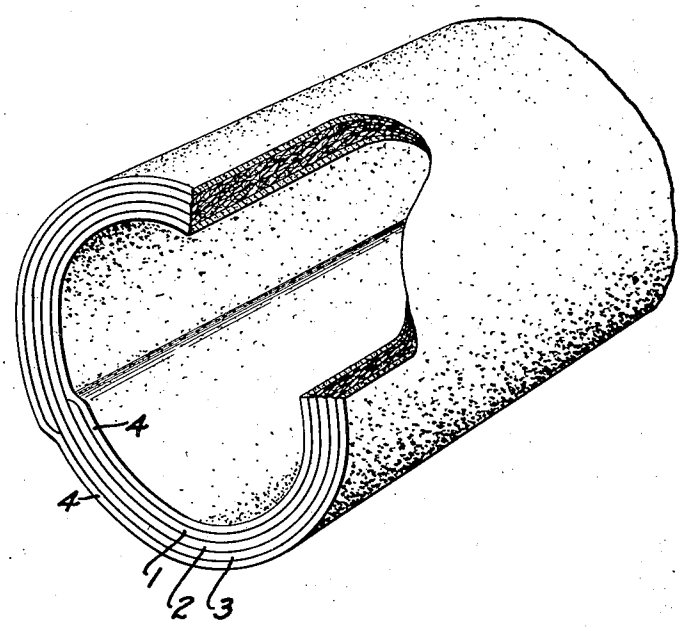
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FLUE OR VENT

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UNITED STATES PATENT OFFICE

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FLUE OR VENT

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My invention relates to pipes for carrying off the products of combustion arising from appliances such as furnaces, heaters, ovens, and smelters; and especially to flues and vents for carrying off the products of combustion arising from appliances employing carbonaceous or hydrocarbon fuel.

An object of the invention is the provision of a flue, of the character described, which is light, durable, heat-insulating and acid-resistant.

Another object of the invention is the provision of a flue which is of low heat conductivity, so as to preclude cooling of gases passing therethrough, and thereby permit such gases to pass readily through the flue.

Another object of the invention is the provision of a flue which is of economical construction, and which can be conveniently and readily manufactured.

My invention possesses other objects and valuable features, some of which will be set forth in the following description of my invention which is illustrated in the drawing forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said description and drawing, as I may adopt varying forms of my invention within the scope of the claims.

Referring to the drawing:

The figure is an isometric view of a portion of the flue of my invention; a portion of the structure is omitted from the view to show more clearly its construction.

Pipes for carrying off products of combustion have heretofore been made of such materials as galvanized iron, copper and terra cotta. Metal pipes, most commonly used, are very good heat conductors and furthermore react readily with dilute acid. Because of these properties they cannot be effectively used as flues or vents, since water vapor, which is usually present in the products of combustion, is quickly condensed on their inner walls. Moisture so condensed then reacts with the sulphur content present in the products of combustion to form sulphurous acid; and the acid eats away the interior of the pipes. Not only is the life of the pipes decreased, but the pin holes first formed, by action of the acid or corrosion, are decidedly objectionable inasmuch as they permit the poisonous gases carried by the pipes to escape into the furnace rooms and basements of the buildings so equipped.

An additional disadvantage of metal pipes is the fact that their high heat conductivity cools the gases conveyed therein, so rapidly, that their rate of travel is materially diminished. This causes the cool gases to act as a stopper for the column of gases beneath them. This stopper effect creates a back draft which forces the products of combustion through the above mentioned pin holes and through the air registers of the furnaces.

Lead and Monel-metal pipes are prohibitive because of their costs; and they do not prevent moisture condensation nor the consequent stopper action due to the too rapid cooling of the gases. The objectionable physical characteristics of metal pipes when used for the purposes described are therefore twofold, their high heat conductivity and their non-resistance to the action of sulphurous and other acids. Because of these objections, some city ordinances now require the installation of terra cotta or cement flues and vents.

Terra cotta and cement tile flues are fairly good insulators when dry, but readily absorb moisture and thereby become fairly good conductors. On becoming saturated with moisture, there is a consequent formation of dilute sulphuric acid which, in the case of cement pipe, soon breaks down the flue. Once having become good conductors, the same stopper effect takes place within them as with the metal flues. Another objection to these flues is that since the various sections are joined by cement and since it is practically impossible to use a cement which has a coefficient

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of expansion equal to that of the flues, a tight joint cannot be maintained. Furthermore the weight of these pipes increases transportation cost.

My invention is designed to obviate the above difficulties, by the provision of a light, but yet heat-resistant, heat-insulating and acid-resistant flue. In terms of broad inclusion, the flue of my invention comprises a tube of fibrous material impregnated with a heat-insulating and acid-resistant binder. Preferably, the tube is provided with a coating of a character similar to that of the binder.

In greater detail, the flue of my invention is made by impregnating a flexible sheet of suitable fibrous material, such as asbestos paper or felting such as so-called roofing felt, with a cementitious binder which is rendered solid, moisture-proof, heat-insulating and acid-resistant upon baking. Asbestos paper is preferred due to the well known insulating and fire-resistant properties thereof.

The impregnating composition or cement employed, preferably comprises a homogeneous mixture of the following ingredients in substantially the proportions stated:

Water glass (40% solution of sodium silicate in water)	12 lbs. (1 gal.)
Silica (preferably finely divided particles)	13 lbs.
Zinc oxide (commercial)	2 lbs.
Lead sulphate (contained as impurity in 2 lbs. of commercial zinc oxide)	.02 lbs.

Although the preceding proportions of ingredients have been found to give the best results, it has been found that the ingredients of the composition may be varied, with satisfactory results, within the following ranges:

	Pounds
Water glass (of the same consistency as in the preceding formula)	8 to 20
Silica (preferably finely divided particles)	7 to 25
Zinc oxide (commercial)	1 to 10
Lead sulphate (contained as impurity in the commercial zinc oxide)	.01 to .1

If so desired between .1 to 1 lb. of lead carbonate may be also incorporated in the cement.

In place of the sodium silicate, equivalent quantities of other aqueous solutions of an alkali metal silicate may be employed, such as potassium silicate. For the silica, which serves as a filler, equivalent quantities of other fillers such as kieselguhr, diatomaceous earth, infusorial earth, fossil flour, ground glass, and/or powdered asbestos may be used. Also chemically equivalent quantities of metal compounds, such as calcium oxide, manganese dioxide, lead oxide and/or lead sulphate have been found satisfactory in place of the zinc oxide; and if so desired C. P. zinc oxide may be employed instead of the commercial oxide which contains lead sulphate as an impurity.

The fibrous sheet is subjected to the impregnating mixture in any suitable manner, and preferably until the sheet is thoroughly saturated, which may be facilitated by passing the sheet through any suitable squeeze rollers, according to well known practice for impregnating fibrous sheet material.

After saturation, the sheet is then wound on a mandrel so as to form a laminated tube; the size of the mandrel being predetermined in accordance with the size of the tube desired, and the width of the sheet being predetermined in accordance with desired number of laminations. As illustrated in the drawing, I have found that for most purposes three laminations, 1, 2 and 3, will provide a sufficiently rigid and efficacious pipe. The tube, thus formed, is slipped from the mandrel and is allowed to air dry for sufficient time, so as to enable handling of the tube without it being distorted. From 20 to 24 hours of air drying is generally sufficient. When air dried, the tube is baked; preferably in a muffle furnace, at a temperature of between 240° to 300° F. for from 4½ to 6 hours, or until the binder has become sufficiently solid and vitrified.

The baking process affects a chemical reaction between the alkali metal silicate and metal compounds in the cementitious binder, to produce a water insoluble metal silicate in which is uniformly entrained the filler, thus providing a light, rigid, acid-resistant and heat-insulating binder.

In order to enhance the wearing qualities of the pipe and insure its efficacy, it is provided with a coating 4 of material similar to that of the binder. After the first baking process above described, the pipe is allowed to cool; and it is then dipped in or passed through a mixture similar to that employed in the impregnating process, but thinned down to dipping consistency with an aqueous solution of an alkali metal silicate such as sodium silicate. The coating is allowed to set sufficiently by air drying to enable handling of the pipe; and the pipe is then passed through or dipped in a bath, preferably of calcium chloride and water, mixed in the proportions ½ to 1¼ lbs. of the salt to each gallon of water. After this, the pipe is again baked at a temperature of between 175° F. and 225° F. for approximately four hours; after which baking the pipe is allowed to cool, and is ready for use.

The second baking effects a chemical reaction between the calcium chloride and excess of alkali metal silicate employed in the second treating mixture, and between the other metal compounds in said mixture and the al-

kali metal silicate, to form a coating which is similar in properties to that of the binder.

As a substitute for calcium chloride employed after the pipe is coated with the thinned bath of cementitious mixture, chemically equivalent quantities of other water soluble salts such as magnesium chloride or calcium nitrate may be used.

The temperatures mentioned for baking, are those which have been found most satisfactory although the pipe may be baked at temperatures as high at 800° F., for relatively short periods. The latter is not generally desirable, however, as it might burn the fibrous material and destroy the strength of the pipe. As related above, after each treatment with the cementitious mixture, the pipe is allowed to air dry so as to permit handling thereof. This air drying generally takes approximately 24 hours. If it is desired to save time, I have found that in place of air drying for the purposes described, the pipe may be dried at around 125° to 150° F. for about 1¼ to 1¾ hours.

For joining sections of pipe of my invention, a short sleeve, of the same construction as the pipes, is telescoped over abutting ends, and cemented thereto with a cement having substantially the same composition as the impregnating cement used in the manufacture of the pipes. For all practical purposes, such cement solidifies sufficiently on air drying to make a solid joint having a coefficient of expansion equal to that of the flue itself.

Pipes constructed in accordance with the teachings of my invention are good heat insulators; therefore, flues constructed therefrom convey away products of combustion without allowing them to cool sufficiently, so as to cause a condensation of their moisture content. As a direct result of this, as previously explained, the so-called stopper action or back draft caused by flues made of good heat conductors is eliminated, or materially reduced.

What little acid that is formed by the reaction between the sulphur content in the products of combustion and any water vapor which might possibly condense on the walls of the flue, can do no harm, since as previously explained, the pipes of my invention are acid-resistant.

The pipes may be readily cut to desired size by an ordinary cross cut saw, and being materially lighter than either metal or terra cotta pipes, their cost of transportation is proportionately lower.

I claim:

1. As a new article of manufacture, a pipe for carrying off products of combustion comprising a tube of fibrous material hardened and compacted by a vitrified binder permeating its fibres to provide a unitary rigid flue structure capable of self-support.

2. As a new article of manufacture, a pipe for carrying off products of combustion comprising a tube of asbestos hardened and compacted by a vitrified binder permeating its fibres to provide a unitary rigid flue structure capable of self-support, said binder comprising the products resulting from the combination of an alkali metal silicate and a metal compound.

In testimony whereof, I have hereunto set my hand.

JACOB A. STADTFELD.