

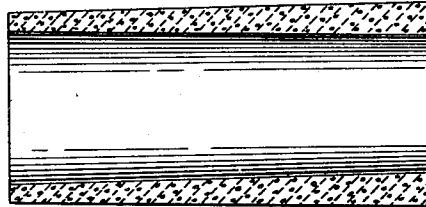
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METHOD OF LINING COMBUSTION TUBES AND THE LIKE

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METHOD OF LINING COMBUSTION TUBES
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The invention relates to a method of making a porous refractory liner for a combustion tunnel or tube for a liquid fuel and particularly a fuel oil burner.

The invention is a division of the invention set forth in my prior application for United States Letters Patent, Serial No. 686,950, filed July 29, 1946, which relates to a liner construction for fuel burners, and more particularly to a porous refractory liner composition for a combustion tunnel associated with the burner or atomizing tip of a fuel oil burner.

Said application, Serial No. 686,950, also sets forth an invention which relates to a method of burning fuel oil in a porous refractory burner combustion tunnel.

In burning liquid fuels, particularly fuel oil, if the atomized liquid fuel comes in contact with a metal surface, smoke and fumes are produced because of the deposition or release of carbon at or adjacent the metal surface; only incomplete combustion is obtained; and burner efficiency is exceedingly low.

These difficulties have been sought to be overcome by providing a combustion tunnel formed of refractory material into which air is discharged and atomized liquid fuel is also discharged from a fuel oil atomizing burner tip. Ordinarily the operation of such prior refractory combustion tunnels for fuel burners is in accordance with the well known principles of surface combustion. However, the refractory materials heretofore used are not of such nature as to withstand the high temperatures developed within the combustion tunnel for long periods of time without cracking, powdering, flaking, melting, or otherwise breaking down.

Moreover, although in refractory tunnels as compared with metal tunnels higher burner efficiency is obtained due to attainment of substantially complete combustion when the combustion tunnel is heated and when operated at high rates of fuel consumption; nevertheless, burners with prior refractory tunnels are difficult to start when cold, and are inefficient, producing smoke and fumes, at low fuel consumption rates.

Accordingly, a primary object of the invention set forth and claimed in my said prior application, Serial No. 686,950 is to provide a new porous, refractory, combustion tunnel material for a fuel oil burner.

It is an object of the present invention to eliminate contact of the atomized liquid fuel or products of combustion thereof with any metal parts in the combustion tunnel of a fuel oil burner by

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providing an improved method of lining the combustion tunnel or tube.

Also it is an object of the lining produced by the method of the present invention to prevent the formation of fumes and smoke or the deposition of carbon, in the operation of a fuel oil burner.

Furthermore, it is an object of the present invention to provide a method of making a refractory liner material for the combustion tunnel of a fuel oil burner which is porous and absorbent such that a portion at least of the atomized fuel is absorbed within the body of the refractory liner and thereafter released therefrom in gaseous state in varying amounts depending upon the liner temperature.

Furthermore, it is an object of the present invention to provide a method of making a porous, absorbent, refractory, liner material for the combustion tunnel of a fuel oil burner which has exceedingly high heat resistance such that the material does not crack, powder, flake, melt or otherwise deteriorate during continued or extended operation of the burner, or as a result of high temperature existing in obtaining complete and efficient combustion.

Also, it is a general object of the present invention to improve the method of making the lining composition, construction, and manufacture, of the combustion tunnel of a fuel oil or liquid fuel burner so as to attain in operation and use high burner and combustion efficiency, a long burner combustion tunnel life, and simplicity and ease of burner operation, not only in ignition, but in all stages of a wide range of burner fuel consumption rates.

Finally, it is an object of the present invention to provide a new method of making a combustion tunnel liner composition for fuel oil burners which avoids the prior art difficulties, which satisfactorily solves existing problems in the art, which incorporates the foregoing advantages in a simple and effective manner, and which is inexpensive to manufacture and safe and efficient in operation.

These and other objects and advantages apparent to those skilled in the art from the following description and claims may be obtained, the stated results achieved, and the described difficulties overcome by the methods and steps which comprise the present invention, the nature of which are set forth in the following general statements, preferred embodiments of the lining made by the methods hereof—illustrative of the best modes in which applicant has contemplated

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applying the principles—are set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improvements in fuel burner liner composition made by the methods hereof may be stated in general terms as preferably including a liner formed of firebrick or the like, and a binder of silicon-carbide or the like, to which crushed firebrick and binder is added a dry mixture of plaster of Paris, alum, permanganate of potash and salicylic acid.

The nature of the present improvements in methods of making a porous refractory fuel burner liner may be stated in general terms as preferably including the steps of crushing or pulverizing burned firebrick or the like to approximately pea size, adding thereto and mixing therewith a ceramic binder material, such as silicon-carbide or flint clay, thoroughly mixing the same together with the addition of water until the mass becomes stiff; then ramming this mixed firebrick and binder material into a burner housing a little at a time while interposing layers therein of a dry mixture of plaster of Paris, alum, permanganate of potash and salicylic acid, and then air or heat setting the same.

The nature of the improvements in fuel burner combustion operations resulting from making a lining by the methods of the present invention may be stated in general terms as preferably including the steps of providing a burner combustion tunnel of porous, absorbent, refractory material formed of firebrick, silicon-carbide, plaster of Paris, powdered alum, permanganate of potash, and salicylic acid, discharging atomized liquid fuel and air into such tunnel, absorbing at least a portion of the atomized liquid fuel in the porous liner, discharging or releasing gaseous fuel from atomized fuel particles absorbed in the liner, and burning the fuel to substantially complete combustion, thereby preventing the formation of smoke, fumes and the like.

Most fuel burner combustion tunnels, tubes, or furnaces require for construction, strength and installation, a metal housing; and by the method of the present invention this metal housing is lined internally with a combustion tunnel block of improved porous refractory material. All inside surfaces of the metal housing are covered preferably with at least three-fourths of an inch in thickness of the improved liner material.

The refractory tunnel liner block has an opening or openings at one end into which air for combustion is drawn and through which the fuel oil atomizing tip of the burner discharges. The other end of the tunnel block communicates with a furnace or other chamber to be heated by the burner or into which the products of combustion are to be discharged.

The present method of making the improved liner material is to form a composition of firebrick or the like crushed or pulverized to pea size, to which is added and mixed a ceramic product binder such as silicon-carbide, flint clay, dolomite, or other clay or clays having high fusion properties and high heat resisting characteristics. A mixture of plaster of Paris, powdered alum, permanganate of potash, and salicylic acid is added to the firebrick and binder.

For example, in the construction of a liner, one-third part dry measure of crushed firebrick,

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and two-thirds parts dry measure of silicon-carbide are thoroughly mixed together, water is added, and the mixing is continued until the mass becomes stiff. A quantity of this mixed mass is then rammed or pressed within a burner housing around a removable core in a thin layer, and sprinkled with a dry mixture of the following materials in the following proportions:

	Parts
Plaster of Paris.....	16
Powdered alum.....	1
Permanganate of potash.....	1
Salicylic acid.....	1

Alternate layers of the stiff mixed firebrick and binder mass and of the dry mixture are added and rammed into the burner housing around the core until the complete liner has been formed. The core then is removed immediately and the rammed liner is permitted to air dry or set, or may be heated to reduce the time of drying and setting.

It is important that the plaster of Paris, alum, permanganate of potash, and salicylic acid be used as a dry mixture and introduced in thin layers between firebrick and binder layers as the liner is formed, as a solution of these materials cannot be used to produce the desired or required results.

It is to be understood, that the proportions given for the firebrick and binder mass, and for the dry mixture, are preferred to attain the best results but that these proportions may be varied somewhat to produce liners having different degrees of porosity and heat resistance. The preferred proportions given in the above example have been found to produce the most desirable degree of porosity and the highest heat resistance in the finished liner.

A liner of the foregoing composition and produced in the described manner has a porous and absorbent structure and has extremely high heat resistance. The liner instantly absorbs a portion of atomized liquid fuel or fuel oil discharged thereinto from the atomizing tip of the fuel burner and gives off or releases completely gasified fuel which mixes with air and other portions of the atomized fuel to provide instantaneous and complete combustion resulting in a characteristic incandescent flame.

Burners equipped with the improved liner composition will light instantaneously when cold without preheating, because of the charge of fuel retained within the porous structure of the liner wall after previous use has been discontinued. When air is introduced through the cold liner of a burner, gas from the fuel retained in the porous liner is drawn into the combustion tunnel and mixed with the air to form a combustible mixture which immediately ignites on contact with a flame or other ignition means.

In prior liquid fuel burners, the liquid fuel is sprayed from the atomizer tip into the burner tunnel and is there mixed with air and at a certain zone, flame propagation commences. Part of the atomized liquid fuel burns as a raw liquid, producing carbon monoxide, fumes and smoke so that combustion is only partially complete and the burner is thus inefficient.

The exact mechanics of operation of burning atomized liquid fuel in a combustion tunnel formed of the improved porous, absorbent, refractory material is not known. Perhaps the action of the improved combustion tunnel liner

composition is in part catalytic. However, the porous and absorbent character of the liner material, perhaps the chemical constituents thereof, its high heat resistance, and the prevention of atomized liquid fuel coming in contact with any metal in the burner, enables a completely combustible gas or gaseous air mixture to form within the combustion tunnel before any atomized liquid meets or reaches the zone of initiation of flame propagation.

The gaseous fuel given off from within the porous liner material and at the surface thereof properly mixes with air to provide for complete combustion, evidenced in operation of burners equipped with the improved liner composition, by the complete absence of fumes, smoke or carbon monoxide.

Accordingly, high burner efficiency is attained and maximum heat is developed in the furnace into which the burner discharges. Alternately, if the burner is used to supply an explosive mixture of gas and air to an internal combustion engine, a maximum amount of power will be developed by the engine.

Alternately, the improved liner composition may be used in connection with gas welding by atomizing the liquid fuel into a heated porous absorbent refractory tube of the improved composition through which air may be forced to mix with the gaseous fuel given off from the porous liner and the mixture of gas and air conducted to a welding torch where additional air or other gases may be mixed therewith to produce a suitable welding flame.

Accordingly the improved liner composition formed in the manner described provides for the absorption of liquid fuel and discharge of fuel therefrom in gaseous form, provides a material which does not deteriorate, provides a material which operates satisfactorily either when cold or heated, and provides a material which does not crack, powder, flake, melt or otherwise deteriorate.

Although the burner construction has been described as including a liner of the improved composition formed within a metal burner housing, it is to be understood that a metal housing may be eliminated if the combustion tunnel is formed of the improved composition with sufficient wall thickness to provide the required degree of strength to maintain its shape and if the outer surface thereof is sealed in some manner, as by glazing or the like, to prevent absorption of moisture, gases or other material through its outer surface.

Finally, the improvements of the present invention avoid prior art difficulties, solve existing problems in the art, and incorporate the foregoing advantages in a simple, safe, effective, inexpensive, and efficient manner.

In the foregoing description, certain terms have

been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are utilized for descriptive purposes herein and not for the purpose of limitation, and are intended to be broadly construed.

Thus when the term "silicon-carbide" is used herein and in the appended claims, that term is intended to mean and include silicon-carbide, flint clay, dolomite, or other clay or clays having high fusion properties and high heat resisting characteristics.

Moreover, the embodiments of the improved composition and methods are described herein by way of example, and the scope of the present invention is not limited to the exact details described.

By way of example, in the accompanying drawing, the figure illustrates in longitudinal section one of the improved combustion tunnels or tubes made according to the improved methods hereof.

Having now described the features of the invention, the composition of a preferred form of improved fuel burner combustion tunnel liner material, the manufacture thereof, and the operation thereof; and having described the advantageous, new and useful results attained and the existing problems in the art solved; the new and useful methods and steps, and reasonable equivalents thereof, obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. The method of making a porous refractory fuel burner liner which includes the steps of pulverizing burned firebrick to approximately pea size, adding thereto and mixing therewith a ceramic binder material selected from the class consisting of silicon-carbide, flint clay and dolomite, adding water thereto and mixing the same to form a stiff mass, and then forming a liner of desired shape by pressing layers of the mass and sprinkling between said layers a dry mixture of plaster of Paris, powdered alum, permanganate of potash and salicylic acid.

2. The method of making a fuel burner mixing tube including the steps of pulverizing burned firebrick to approximately pea size, adding silicon-carbide to the pulverized firebrick in dry measure proportions of two to one, thoroughly mixing the pulverized firebrick and silicon-carbide together with the addition of water until the mass becomes stiff, ramming layers of the mixed mass into a mold a little at a time while interposing layers therein of a dry mixture of equal parts of powdered alum, permanganate of potash and salicylic acid and sixteen parts of plaster of Paris.

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No references cited.