The present invention will be particularly described in its application to dissociation accelerators for liquid fuels and particularly for either gaseous or solid fuels which may be and are converted into finely divided or gaseous form so that they will flow in a non-liquid fluid form to a point or place of combustion.

Although not limited thereto, the present invention will be particularly described in its application to the feeding of gaseous fuels to various types of combustion processes such as blast furnaces, open hearth furnaces or the like, or less preferably to the feeding of gaseous non-liquid fluidized fuels to internal combustion engines.

A particular object of this invention is to provide highly luminous energy of dissociation in fuels that burn with non-luminous radiation, such as liquid and gaseous hydrocarbon or methane fuel, when supplied with normal atmospheric air in proper proportion.

Another object is to provide gaseous fuels while burning to acquire highly luminous energy of dissociation when admixed with atmospheric air.

Another object is to provide solid fuels to create highly luminous energy of dissociation when burned in atmospheric air.

Another object is to establish highly luminous radiant energy throughout the mass of combustion gas body to achieve maximum heat transfer from flame to absorbent surfaces as compared with limited radiant transfer from flame envelopes where the great proportion of flame mass is non-luminous.

Another object is to eliminate the hazardous smokes currently being discharged into atmosphere by space heating burners, particularly those using combustion air with liquid or solid fuels for domestic heating purposes.

Another object is to reduce the rates of consumption of gaseous fuels which achieve superior heating effects now widely used for high-intensity industrial process heating.

Another object is to provide combustion air so that it will create highly luminous energy of dissociation when admixed with gasified fuels.

Yet another object is to eliminate the hazardous invisible incompletely burnt gases being exhausted into atmosphere by internal combustion engines operating on gaseous fuels admixed with atmospheric air.

Another object is to greatly reduce the proportion of scale formation losses on metal materials, particularly steel, while being heated to high temperatures for processing in metallurgy.

Another object is to accomplish highly effective combustion by the use of low-cost procedures.

Still further objects and advantages will appear in the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

It has now been found that by including small amounts of catalysts in the proportion of less than 1% and desirably less than 0.2% and preferably from 0.01% to 0.1% by weight, it is possible to greatly enhance the burning properties with greatly increased effective heat value and with assurance that the combustion will be complete without the formation of intermediate combustion products and without the discharge of unburnt residues into the air, with resultant pollution.

Although this effect may sometimes be achieved by adding the catalyst to the solid or gaseous fuels before they are passed to the combustion zone, it has been found most satisfactory to cause the incoming combustion air to carry the catalyst in finely divided form.

The catalyst has been found desirably to be a sodium or calcium salt, or a combination of both, of a high molecular weight aliphatic acid, such as stearic, oleic, lauric, limonie, ricinoleic, palmitic or myristic acid.

It has been found that when these sodium or calcium salts are finely divided in particles having a size varying from 1 to 5 microns in an incoming stream of combustion air that the sodium salts and the calcium salts will give an emission in the combustion zone of 5900 angstrom units for the sodium salt and 6200 angstrom units for the calcium salt.

It has been found that this radiation varying from 5500 to 6500 angstrom units has the effect of eliminating the final production of aldehyde or acid or even alcoholic incomplete combustion products.

Apparently what happens is that the combustion which originally takes place creates due to heat a number of uncombined radicals due to limited radiation energy the resultant combustion of wave-length 4600 Angstrom units of emission. These radicals may be —OH, —H, —OH and CO groupings which recombine under the combustion conditions to establish partial products of combustion in the forms of formaldehyde, ketone and acrylaldehyde which are off-enders as hachymatories, and oxidize further into acetic acid.

In the applicant's process the radiation of 5900 or 6200 Angstrom units will result in a secondary phase of reassociation in the combustion process, in order that no pollutants be discharged to atmosphere.

It has been found that this can not be accomplished by heat alone and actually the normal combustion will quickly result in a decline in temperature with the combination of these intermediate products being halved for each 18° Fahrenheit decline in temperature of reaction. This effect is greatly increased where there is only low radiation emission below 5000 and in the neighborhood of 4600 Angstrom units. These large temperature drops have the effect of resulting in rather high production of these undesirable incomplete combustion products which cause pollution and result in destructive effect both upon building structures as well as upon the human tissues.

Surprisingly, the provision of radiation at the level of 5900° A. or 6200° A. carried over from the luminous dissociation phase sustains the temperature level of primary reassociation throughout the secondary phase of accelerated fuels to arrive at water vapor and CO2.

It has, however, been found that to achieve the best results the distribution in size of the sodium and calcium salts must be carefully controlled. The distribution, however, should be throughout the incoming air and in very small size particles ranging from 1 to 5 and at the most 10 microns and this can only be achieved by vaporizing certain types of solutions of these sodium or calcium salts into the atmospheric air being fed into the gaseous or fluidized fuel stream.

It has been found that this is best achieved by dissolving the calcium or sodium soap in an organic solvent solution containing 1 to 5% of the soap with the preferred solvent being benzene, toluene or xylene.

Although in certain cases dried powdered sodium or calcium soaps may be introduced into a stream they are not most satisfactory.

The preferred range of fatty acids are those which have
from 8 to 22 carbon atoms with the best acids having 16 to 20 carbon atoms and the preferred salts are the oleate, stearate, palmitate and linolate.

To achieve the best results it has been found that there should be at least 1 to 10 micron sized sodium or calcium particles for every thousand to ten thousand molecules of air or gaseous fuel and these particles should be of such small size that they are subject to Brownian movement.

The best preferred method of achieving the result is to disperse 0.01% by weight of a sodium fatty acid salt in the atmospheric air stream at a temperature in the stream of 200 to 350°F, so that there will be substantially immediate volatilization of the organic solvent carrier.

It has also been found in some instances that it is possible to use sodium salts of alkyl, phenyl sulfonic acid where the alkyl group contains from 5 to 15 carbon atoms.

Less preferably the result may be achieved by adding to a slurry of pulverized coal or coke or a mixture thereof with petroleum fuel oil, 0.01% to 0.02% of the sodium salt which is thoroughly dispersed and dissolved therein.

Usually the most satisfactory additive, however, is the sodium or calcium stearate, oleate or palmitate dissolved until it has been saturated in benzene, toluene or xylene.

A less preferred combination consists of dissolving the soap to a saturated solution in water and then spraying the water into incoming atmospheric air or less desirably onto the solid fuel or into the incoming gaseified fuel.

To achieve desirable results with heavier fuels and particularly with calcium salts, the fatty acid may have a carbon chain of 20 to 40 carbon atoms and in this case 0.01% to 0.02% of the sodium salt may be coated onto the pulverized coal or coke or blown into the air or gas stream. Desirably, however, the saturated benzel, toluol or xylol solution may be employed.

Having now particularly described and ascertained the nature of the invention, and in what manner the same is to be performed, what is claimed is:

1. A combustion fuel carrying an additive consisting of 0.01% to 0.1% of a combination of a calcium soap of a high molecular weight saturated fatty acid and selected from the group consisting of stearic acid, lauric acid, palmitic acid or myristic acid dissolved in an organic solvent solution, the solvent of which is selected from the group consisting of benzene, toluene and xylene, said soap being in a 1 to 5% solution, said fuel, when burned, giving rise to an emission in the dissociation zone of a radiation of 6200 Angstrom units.

2. The fuel of claim 1, in which the combustion air carries said additive finely divided in disperse particles having a size varying from one to five microns.

3. The fuel of claim 1, in which the combustion air carries said additive, finely divided in dispersed particles having a size varying from one to five microns, said combustion air having a temperature of 200 to 350°F.

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