May 18, 1943 W. FERGUSON 2,319,591

METHOD OF TREATING IMPERFECTLY COMBUSTIBLE LIQUIDS OR SEMI-LIQUIDS

Filed May 9, 1941

Fig. 1.

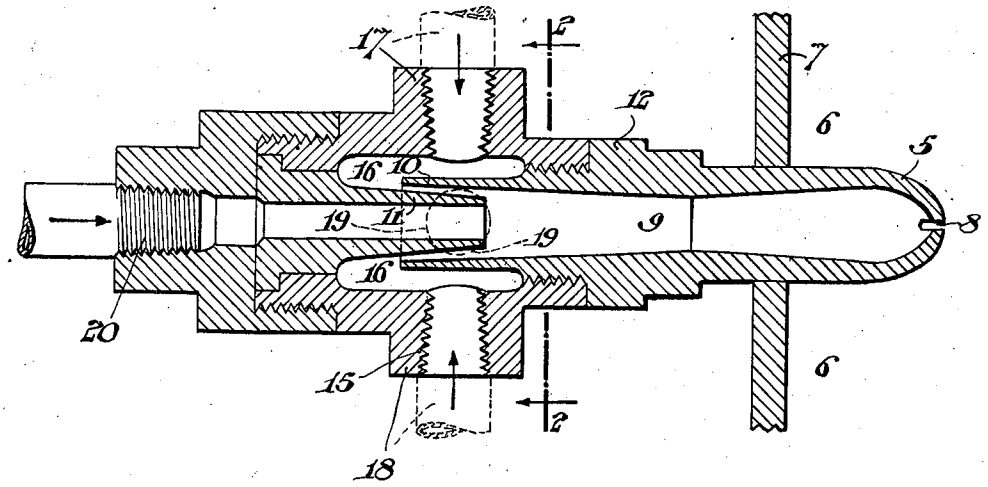


Fig. 2.

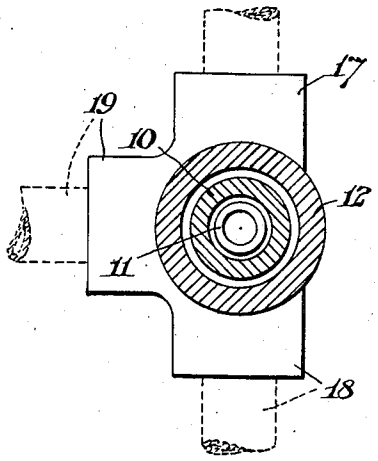
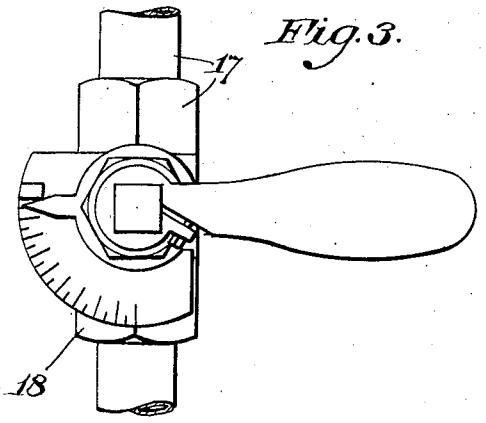


Fig. 3.



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METHOD OF TREATING IMPERFECTLY COMBUSTIBLE LIQUIDS OR SEMILIQUIDS

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Application May 9, 1941, Serial No. 392,631

2 Claims. (Cl. 158—117.5)

The invention relates to an improved method of treating imperfectly combustible liquids.

The object is to deliver simultaneously two or more liquids in such manner that the more perfectly combustible liquid will facilitate the complete combustion or consumption of liquid or semi-liquid which is less perfectly or less completely combustible, and thus prevent the clogging of the burner, or passages leading thereto, by substances which are normally non-combustible.

The invention also comprises a method whereby undesirable constituents of the liquid are consumed, and thus prevented from contaminating the surrounding atmosphere.

The invention also comprises the method whereby fuel oil is delivered into a substantially closed chamber, and an adjusted counterbalancing pressure is created in the chamber to modify the delivering of said oil to a combustion zone.

The invention also comprises the method of treating an imperfectly combustible liquid or semi-liquid by introducing said liquid into a substantially closed chamber, simultaneously introducing into said chamber a fuel oil, and regulating or controlling the flow of the fuel oil by creating and maintaining an adjustable counterbalancing pressure in said chamber by the introduction thereto of compressed air or steam.

In numerous and varied industries, certain by-product or waste liquors are available, some as semi-liquids, which have in several cases little or no net heating value. In some the flash point or ignition temperature is so high as to require the use of a supplementary fuel of a more volatile character to sustain combustion. In others the primary object is one of disposing by heat of such undesirable constituents as acid and alkali residuums obtained from petroleum refining processes, also refuse products from chemical plants which, if not properly consumed in a furnace, will contaminate the surrounding atmosphere with obnoxious fumes.

Among the by-products fuels, semi-fuels, and refuses are (most of which are liquids or semi-liquids):

Sludges from the bottoms of oil storage tanks.

Some sludges from sewerage plants.

Paper mill liquors.

So-called colloidal fuels comprising a mixture of coal dust and oil.

Petrolatum or petroleum wax.

Spent cutting and lubricating oils.

Tars and pitches from petroleum refineries, gas works, and wood chemical plants.

Waste liquid greases, fats, and oils from paint works, chemical plants, soap factories and abattoirs.

Although some of these by-products can be burned satisfactorily by first mixing them in the storage tank with a more volatile oil such as the commercial grades of fuel oil either hot or cold, this introduces certain disadvantages such as the necessity of continuous agitation to keep the fuels well mixed to avoid sedimentation, precipitation, and coagulation. Another objection is the cost of the relatively expensive commercial fuel oil for blending. A few of the refuse fuels are not soluble in the commercial oil.

In the drawing, which shows by way of example, a suitable device for utilizing the invention;

Fig. 1 is a longitudinal section of a well-known type of oil burner, which, with slight modifications, has been found suitable for realizing my object.

Fig. 2 is a cross-section on line 2—2 of Fig. 1.

Fig. 3 is a detail of a valve provided with an indicator scale.

Similar numerals refer to similar parts throughout the several views.

In Fig. 1, the burner tip 5 is shown projecting into the combustion space 6 through a wall 7 of a furnace or the like.

Fig. 2 shows three inlets 17, 18 and 19 associated with the burner body 12, for the purpose herein described.

An inlet 20 is also provided for the atomizing medium, such as steam.

The burner tip 5 is provided with the slot or opening 8, through which the atomized fuel is projected into the combustion space or zone. This opening or vent 8 is shaped suitably for the shape of the flame desired—flat, round or cone-shaped. The flat flame tip has given the best results with the greatest variety of fuels.

The thre inlets delivering to chamber 16, are as follows; the inlet 17 for liquid fuel, the inlet 18 for more readily combustible fluid, and the inlet 19 for compressed air or gas.

At the rear of the burner body 12, is also provided the inlet 20 for the atomizing medium, such as steam, which is projected through nozzle 11 into passage 9 where the mediums become atomized to issue through opening 8 into the combustion zone.

It will be noted that nozzle 11, which projects into the annular flange 10, is spaced from the flange so as to provide an annular channel between chamber 16 and passage 9.

Suitable valves similar to that shown in Fig. 3, are provided for each of the respective inlets, for controlling the flows therethrough. These valves are preferably provided with indicator scales as shown in said Fig. 3, whereby said valves may be adjusted to secure the relative flows to suit the respective combustion characteristics of the several mediums.

The important features of the method are the simultaneous introduction of the different mediums in proper relative volumes, into a space such as chamber 16 for thorough mixing therein. The composite mixture then delivers to passage 9 for atomization and prompt delivery to the burner tip, before any accumulation of deleterious substances can take place.

The adjustment of the flows through ports 17, 18 and 19 will depend upon the specific characteristics of the refuse and of the fuel oil.

The two liquid fuels may be introduced into chamber 16 under relatively low pressure or they may be under vacuum pressure due to the syphoning or induction action of the atomizing jet through nozzle 11.

In the burning of some residuum, refuse and composite fuels of liquid or semi-liquid characteristics, difficulty is frequently experienced in maintaining a constant rate of fuel flow to the combustion zone because of the presence of larger particles of coke or other solid matter in the fuel causing a clogging of the port opening in the valve controlling inlet 17, especially at the lower ratings. I have found that satisfactory results may be achieved by having this valve opened wide for the maximum desired burning rate with a commensurate fuel pressure that may be as high as two hundred pounds or as low as two pounds per square inch, although twenty-five pounds would seem to be the most satisfactory for a commercial installation of a normal type.

Since a burner, in practice, necessarily must work through a wide range of capacity, say from a maximum rate down to 10% of this maximum, it becomes necessary to adjust the flow of fuel without incurring the trouble caused by the solid particles clogging the opening of the valve at the lower rate.

For this purpose I reduce said maximum flow of fuel by admitting a fluid, such as compressed air, from any convenient source of supply, not shown, through a valve controlled inlet, as at 19, in a volume substantially equal to the amount of reduction in capacity required; that is, by admitting air to reduce the percentage of the maximum burning rate that is not needed.

In other words, assuming that the burner is of such size as to have a maximum capacity of 75 U. S. gallons, or equal to ten cubic feet of oil per hour at 25 pounds pressure, and it is desired to reduce the burning rate by one-half or to 37½ gallons per hour, it is only necessary to admit compressed air at a rate of approximately five cubic feet per hour through port 19. This air would usually be supplied at a slightly higher pressure than that of the oil, perhaps two pounds higher. Since air can be supplied physically clean, it can be accurately regulated in either larger or smaller volumes manually, or by some system of automatic control actuated by pressure or temperature variation of the heat absorbing vessel.

In my practice of the invention, the volume of air required fluctuated from 75% to 150% of the reduction in the volume of the fuel, depending on such factors as the relative temperature and pressures of the air and fuel. I have also had encouraging results when using a combustible gas in place of air as the regulating medium through port 19.

Taking for example, the case where a non-volatile acid fuel refuse is being admitted to the burner at the same time that good fuel is being admitted in the same proportion: when it is necessary to reduce the total amount of the composite fuels to the burner, some compressed air may be admitted through port 19 to reduce the flow of fuels simultaneously without necessitating individual readjustment of each of the two fuel valves.

On the same installation, the supply of low volatile fuel may suddenly cease, which is often the case, the operator may then wish to substitute a dirty, cokey fuel which has a high heat, high volatile value. Therefore, he does not need any of the supplementary fuel oil, but he does, because of the coke, need some means of control other than a fuel valve. In this case, the compressed air admitted through port 19 would be used to retard or control the flow of the cokey fuel to the burner, as above indicated.

What I claim is:

1. The method of treating imperfectly combustible liquid, which consists in the simultaneous introduction, into a substantially closed chamber, of the imperfectly combustible liquid, a fuel oil, and a gaseous medium, to form a mixture in said chamber, and projecting a stream of atomizing medium to act inductively upon the mixture in the chamber in causing the projection of the mixture to a place of combustion.

2. The method of treating imperfectly combustible liquid or semi-liquid, which consists in the simultaneous introduction, into a substantially closed chamber, of the imperfectly combustible liquid, a fuel oil, and a gaseous medium to form a mixture in said chamber, controlling the flow of the liquid fuel by regulating the flow of said gaseous medium, and projecting a stream of atomizing medium under pressure to act inductively in causing the projection of the mixture to a place of combustion.

WILLIAM FERGUSON.