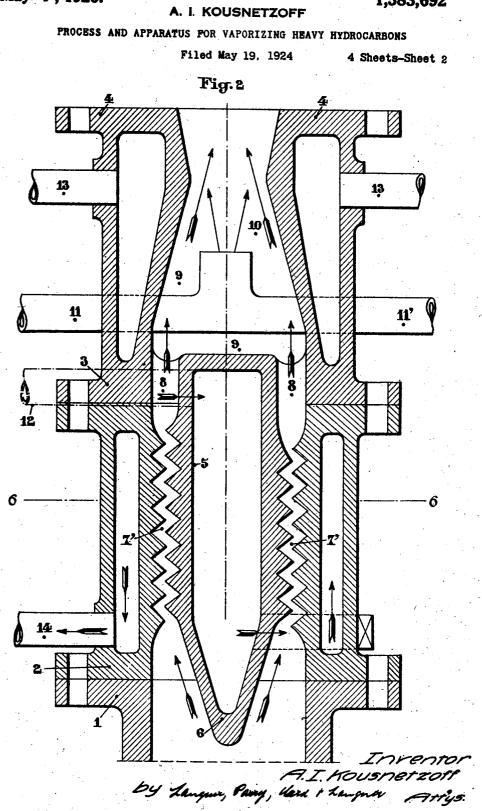


May 4, 1926.

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A. I. KOUSNETZOFF

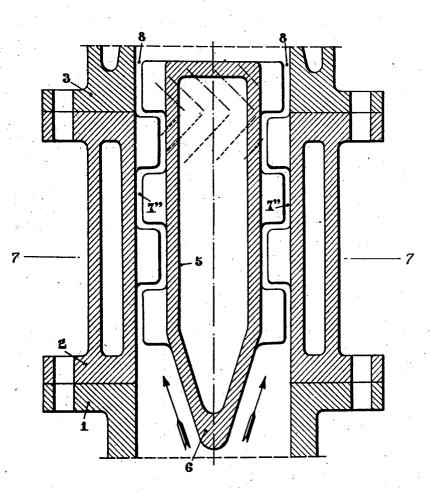
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PROCESS AND APPARATUS FOR VAPORIZING HEAVY HYDROCARBONS

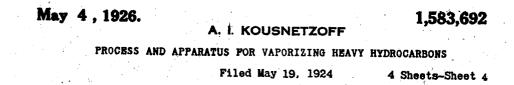
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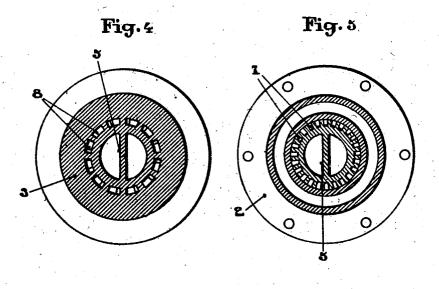
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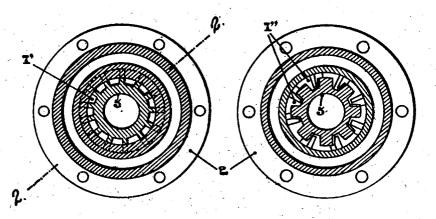
Inventor A. I. KOUSNetzoff by Langnur, Pang Hard + Sampun Attys











Inventor T. HOUSDETZOFF by Janja Card 20 Attys

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UNITED STATES PATENT OFFICE.

ALEXANDER IVANOVITCH KOUSNETZOFF, OF LONDON, ENGLAND.

PROCESS AND APPARATUS FOR VAPORIZING HEAVY HYDROCARBONS.

Application filed May 19, 1924. Serial No. 714,517.

To all whom it may concern:

Be it known that I, ALEXANDER IVANOvitch Kousnetzoff, a citizen of the Russian State, residing at 51 Marlborough Crescent, Bedford Park, London, England, have in-vented certain new and useful Improve-

- ments Relating to a Process and Apparatus for Vaporizing Heavy Hydrocarbons, of which the following is a specification.
- It is well known that in order to effect rapid and complete combustion of a liquid 10 fuel it is absolutely necessary to supply this fuel in a state of gas or saturated vapor while the vapors do not contain any drops 15 of hydrocarbon in suspension.
- It is also necessary for the vapors to be intimately mixed with the quantity of air necessary for combustion. The solution of this problem does not pre-

20 sent any great difficulties in the case of light hydrocarbons, such as petrol or benzene, which are characterized by a high vapor tension even at low temperatures.

In the case of heavy hydrocarbons, such 25 as petroleum, solar oil, gas oil, alcohol, and so forth the problem becomes very complex and its solution difficult.

Various processes have already been sug-

gested for atomizing such fuels, some of the 30 processes being based on the pulverization of the fuel and others on the intense heating

of the hydrocarbon. Experience, however, has shown that neither of these processes separately are effi-

- cient as they do not enable the central por-35 tion of the fluid jet, which it is desired to introduce into the grate of a generator or into an engine cylinder, being brought into a state of saturated vapor.
 - By means of the known pulverizing processes a finely divided liquid is obtained, but it is always in the form of drops, whilst when heating intensely or even superheating the desired effect is only obtained in the

peripheral layers of the jet of fuel which are 45 in the immediate vicinity of the heated surface.

As regards the other layers of the fuel jet which are more or less removed from the 50 heated surface, these always contain in suspension a number of drops which have not been vaporized.

In order to overcome these disadvantages, the process according to the present invention consists in combining together the ef- by a deflector 6. Between the outer walls of fects of pulverization and heating while the hollow body 5 and the inner walls of the 55

using at the same time the effects due to the difference in densities of the various layers of the liquid jet, the kinetic energy of the drops and also their weight. According to 60 the present process the hydrocarbon jet or the primary mixture (air-fuel or vapor-fuel) is directed against a heating body which penetrates into the central portion of the stream of liquid and divides the latter 65 into a large number of thin sprays which pass in a zig-zag manner through a number of passages so as to finally pass out with a gyratory or whirling movement in order to obtain a completely atomized and homoge- 70 neous mixture.

The invention also relates to an apparatus for carrying into effect the process above described.

This apparatus may be applied to or 75 formed integrally with an injector for liq-uid fuels as used for the heating of boilers and metallurgical furnaces, for internal combustion engines and various other uses and which consists in the combination of a 80 Venturi diffuser with a hollow body of suitable form heated internally and acting as a generator for the fuel which is injected.

In the accompanying drawings there are illustrated, by way of example and in a dia- 85 grammatic manner, three forms of construction according to the invention.

In these drawings:-

Figure 1 is a vertical section of the ap-90 paratus;

Figure 2 is a vertical section on line 2-2 of Fig. 6, of a modification, and

Figure 3 is a vertical section of a third form of construction, the upper portion of the apparatus being omitted.

Fig. 4 is a section on line 4—4 of Fig. 1. Fig. 5 is a section on line 5—5 of Fig. 1. Fig. 6 is a section on line 6-6 of Fig. 2. Fig. 7 is a section on line 7-7 of Fig. 3. As will be seen from the drawings, the ap- 100 paratus consists of three movable parts, 1, 2, 3 which can be removed easily and of which the first part 1 is adapted for the supply of the mixture and the third 3 is secured by flanges 4 to the grate or the engine to be 105 supplied.

In the interior of the apparatus is disposed a hollow body 5 of truncated conical shape which is heated internally in any suitable manner and which is extended downwardly 110

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middle portion 2 there are provided straight passages 7 or zig-zag passages 7', 7" of any suitable form as shown in Figures 2 and 3 through which pass the streams of mixture for supply to the combustion apparatus.

In the example illustrated in the drawings the passages in the hollow body have the same cross section throughout. In some cases however it may be desirable to increase 10 the cross section in the direction of movement of the fluid.

Near the upper end of the hollow body 5 the passages 7 communicate with bell shaped ports 8 of a spiral design for example which are adapted to impart a whirling 15 movement to the mixture.

Above the hollow body 5 is disposed a sec-ondary mixing chamber 9 which is formed by the inner walls 10 of the upper part 3

20 of the apparatus, thus forming a kind of diffuser in the form of a Venturi tube to which the air for combustion is supplied by means of one or more pipes 11, 11'. The walls 10 of the chamber 9 may be smooth or 25 fluted as may be desired.

The apparatus is also provided with a number of pipes 12, 12', 13, 13', 14, 14', by means of which a temperature regulating substance is supplied to the hollow walls of 30 the apparatus for the purpose of maintaining its walls at the desired temperature. The operation of the apparatus is as follows

When pulverized hydrocarbon is supplied 35 to the first part of the apparatus in the form of a spray, this fluid jet strikes by means of its central portion, containing the largest portion of drops the conical lower end 6. This conical end acts as a deflector and di-40 vides the jet into a number of streams which are conducted into the passages formed between the outer walls of the hollow body and the inner walls of the central portion of the apparatus. As these thin streams of fuel 45 are as much as possible in contact with the walls and by means of the particular shape of the passages, all the elements forming the fluid streams will be atomized, being thus freed from drops by the combined effect of gravity and kinetic energy, drops being deposited on the inner walls of the passages 50 where they evaporate and finally escape in the form of saturated vapor.

When the fuel reaches the ports 8 at the 55 end of the passages 7 a whirling movement will be imparted thereto by reason of the particular shape of the ports 8 and it then enters the secondary mixing chamber 9 where it is intimately mixed with air supplied by the pipe 11, 11' from which it is conducted 60 in the form of a completely atomized and homogenous mixture to the grate of the furnace or to the engine cylinder which is to be supplied therewith. The advantages of the

By means of this apparatus a high degree of atomization of the liquid fuel is obtained and also its intimate and the homogenous mixing of the air for combustion which leads to the complete combustion of the mixture 70 in the grate to be heated or in the engine cylinder.

The invention is not limited to the forms of construction illustrated in the drawings. It will be understood that the walls of the 75 apparatus may be formed of one or more elements and that the hollow body may be of any suitable shape such as cylindrical, prismatic or the like.

In some cases it may be advisable to pro- 80 vide the walls of the hollow body with a number of orifices of any suitable shape in order to place the inner chamber of this hollow body in communication with the remainder of the apparatus. In such cases 85 compressed air or steam circulated in the hollow body will mix with the hydrocar-bons whilst these are being atomized.

Moreover the passages for the streams of fluid may be of any suitable shape. They 90 may be rectangular, circular, straight, arranged in the form of spirals and so forth. The passages may also be independent or be formed integrally with the hollow body or with the central portion of the apparatus 95 or may even be provided in both of these without departing from the scope of the invention.

Moreover the cross sections of the various passages disposed around the hollow body 100 may vary from one passage to the next for the purpose of increasing the mixing.

It will be seen that the various modifications of the passages which have been described produce considerable advantages in 105 three respects, viz, manufacture, inspection and cleaning.

The apparatus forming the subject of the present invention may not only be used for supplying the grates for furnaces or inter- 110 nal combustion engines but it is also applicable in other branches of industry where it is desired to obtain the complete combustion of liquid hydrocarbons.

In some cases it may be advisable to re- 115 place the hollow body by a solid body which is not heated and which then only serves as a deflector. Finally when heating is effected by means of an electric current it is also possible to replace the hollow body by solid ¹²⁰ body which is heated externally.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:-

1. A process for atomizing heavy hydro-¹²⁵ carbons, comprising, heating the central portion of a stream of carbureted fuel, then dividing the stream up into a plurality of smaller, diverging streams, and heating each apparatus above described are as follows. of the diverging smaller streams, then 130

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bringing the diverging streams together and at the same time imparting to each a whirling motion, then adding auxiliary air to the united streams in a direction parallel to their axis of flow, and meanwhile heating such streams and auxiliary air.

2. A vaporizer comprising, a hollow walled chamber, gas inlet and outlet ports in the chamber, a hollow conical spreader

in the chamber, a hollow conical spreader
10 within the chamber with its apex directed toward, and concentric with, the inlet, the chamber being formed to leave an annular space between the inner wall and the outer wall of the spreader and means for heating

15 the inner wall of the chamber and the outer wall of the spreader, partitions dividing the annular space into a plurality of separate divergent channels, and means at the exit ends of the channel to impart a whirling mo20 tion to the material flowing through the

channels. 3. A vaporizer comprising, a hollow walled chamber, gas inlet and outlet ports

in the chamber, a hollow conical spreader 25 within the chamber with its apex directed toward, and concentric with, the inlet, the chamber being formed to leave an annular space between its inner wall and the outer wall of the spreader and means for heating 30 the inner wall of the chamber and the outer

wall of the spreader, a mixing space in the chamber beyond the spreader, an auxiliary air inlet in the mixing space with an outlet port parallel to the axis of the chamber, 35 the heating means including conduits for

circulating fluid through the hollow spaces of the chamber wall and the spreader.

4. A vaporizer comprising, a hollow walled chamber, gas inlet and outlet ports

40. in the chamber, a hollow conical spreader within the chamber with its apex directed toward, and concentric with, the inlet, the chamber being formed to leave an annular space between its inner wall and the outer
45 wall of the spreader and means for heating

the inner wall of the chamber and the outer wall of the spreader, partitions dividing the annular space into a plurality of separate divergent channels, and means at the exit

ends of the channel to impart a whirling ⁵⁰ motion to the material flowing through the channels, a mixing space in the chamber beyond the spreader, an auxiliary air inlet in the mixing space with an outlet port parallel to the axis of the chamber, the heating ⁵⁵ means including conduits for circulating fluid through the hollow spaces of the chamber wall and the spreader.

5. A vaporizer comprising, a hollow walled chamber, gas inlet and outlet ports 60 in the chamber, a hollow conical spreader within the chamber with its apex directed toward, and concentric with, the inlet, the chamber being formed to leave an annular space between its inner wall and the outer 65 wall of the spreader and means for heating the inner wall of the chamber and the outer wall of the spreader, the spreader being formed with walls of uniform thickness throughout except for its tip end which is 70 of greater thickness, and an inner deflector to direct heating fluid against the thickened tip end to raise its temperature above that of the rest of the spreader.

vaporizer comprising, a hollow 75 6. A walled chamber, gas inlet and outlet ports in the chamber, a hollow conical spreader within the chamber with its apex directed toward, and concentric with, the inlet, the chamber being formed to leave an annular 80 space between the inner wall and the outer wall of the spreader and means for heating the inner wall of the chamber and the outer wall of the spreader, partitions dividing the annular space into a plurality of separate 85 divergent channels, and means at the exit ends of the channel to impart a whirling motion to the material flowing through the channels, the spreader being formed with walls of uniform thickness throughout ex- 90 cept for its tip end which is of greater thickness, and an inner deflector to direct heating fluid against the thickened tip end to raise its temperature above that of the 95 rest of the spreader.

In testimony whereof I have signed my name to this specification.

ALEXANDER IVANOVITCH KOUSNETZOFF.

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