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CATALYTIC HEATING APPARATUS

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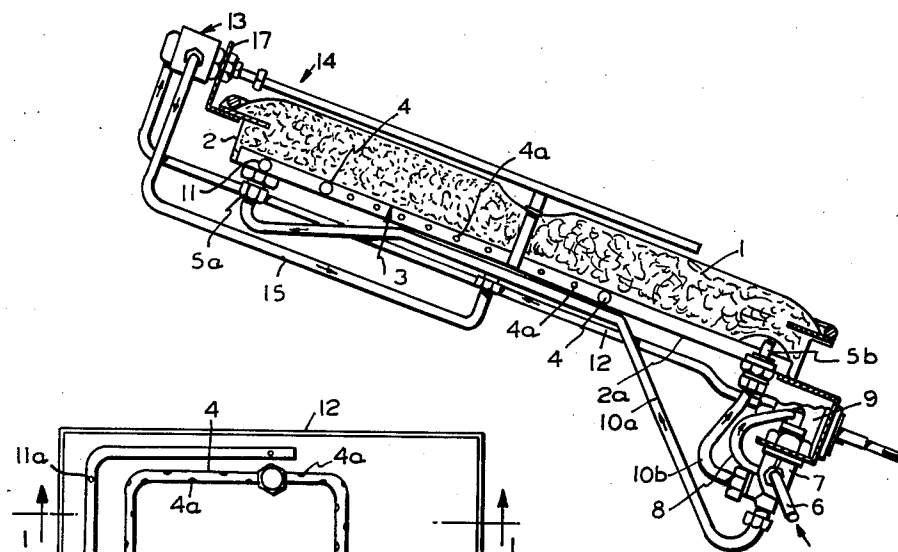


FIG. 1

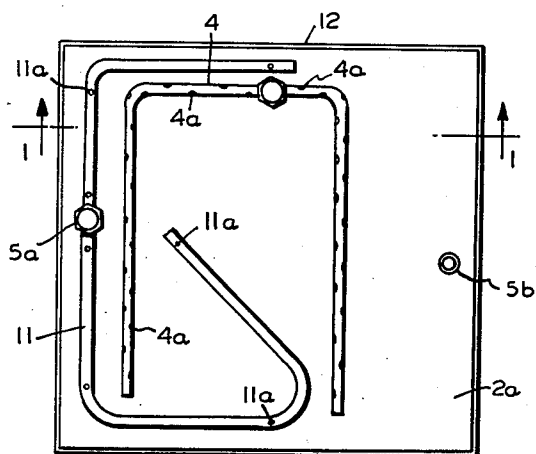


FIG. 2

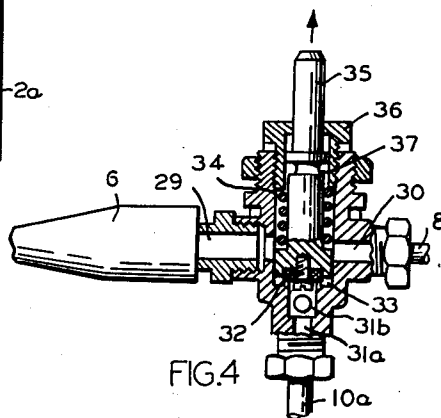


FIG. 4

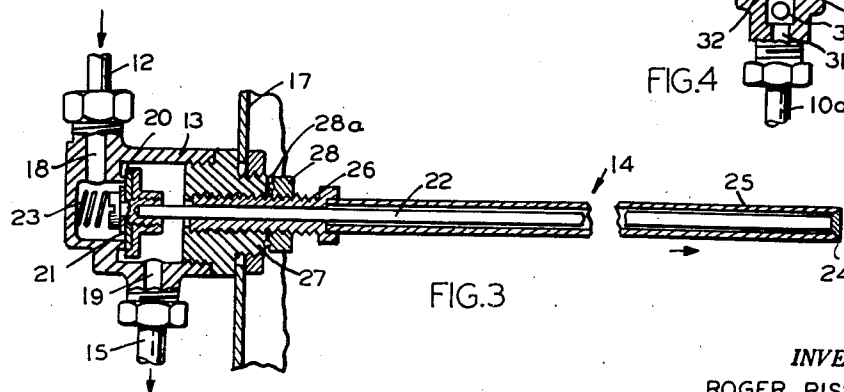


FIG. 3

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CATALYTIC HEATING APPARATUS

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2 Claims. (Cl. 158—140)

The considerable advantages shown by heating apparatus operating in accordance with the principle of catalytic combustion of hydrocarbons are well known from the standpoints of efficiency and safety as concerns the risks of fire and poisoning.

In particular, the heating apparatus resorting to the catalytic combustion of liquid hydrocarbons have been developed to a considerable extent both in the field of domestic heating and for various applications, such as the preliminary heating of vehicle engines, heating of hot-houses, goods-conveying railroad cars and trucks and the like.

In contradistinction, the use for this catalytic combustion of hydrocarbons supplied directly to the users in a gaseous form such as butane, propane, natural or the like gases adapted to be catalytically treated has always met a major difficulty: the necessity of equipping such apparatus with an adaptable and efficient safety device capable of cutting off the admission of gas whenever the conditions for a proper catalytic combustion are no longer satisfied, whatever may be the reason therefor, in particular when the catalytic sieve is at a temperature lower than that required for starting the catalytic reaction. A first partial solution for said problem has been disclosed in the French Patent No. 992,224 dated May 31, 1944, entitled "Safety Arrangement for the Direct Use of Gasiform Hydrocarbons in Catalytically Heated Apparatus."

The present invention has for its object means for the practical execution of heating apparatus which resort to the catalytic combustion of gasiform hydrocarbons, while ensuring a perfect safety for the user, together with very convenient conditions of use.

Said means include chiefly an arrangement for starting the catalytic reaction as provided through the inflammation over the surface of the catalytic sieve of the gas intended for the normal feeding of the apparatus in its operative condition. This starting is controlled by means providing complete safety for the user and it is completed by another, thermostatic arrangement cutting off the admission of gas, whenever the sieve is not at the temperature allowing the obtention of the catalytic combustion.

The improved apparatus is characterized by the fact that it includes in combination the following parts:

A catalytic sieve into the bottom of which open one or more ignition jets and one or more pipes feeding the fuel for normal operation.

A thermostatic safety device located in the immediate proximity of the upper surface of the sieve and controlling a flap valve providing for the cutting off of the admission of gas as soon as said sieve is no longer at a sufficiently high temperature ensuring a proper catalysis of the gas passing through it, said device allowing furthermore an adjustment of the throughput of gas within a broad range of values.

The present invention covers also various auxiliary features and in particular:

The starting jet or jets and the feed pipes provided for normal operation are positioned underneath the actual catalyst and open inside a free space of a reduced height forming a diffusion and expansion chamber bounded by a metal grid positioned in proximity with a fluidtight bottom.

The thermostatic safety device is constituted by a

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spring-urged flap valve associated with a metal tube having a large coefficient of expansion such as brass, inside which is housed a rod having a very small coefficient of expansion so as to define an unvarying position for the valve with reference to the outer end of the tube.

The starter is controlled by delaying means providing for a cutting off of the admission of gas into the starting jet or jets as soon as sufficient time has elapsed for the sieve to be brought to the desired temperature, said starter being provided for this purpose either with a hand-operated control and returned automatically by a return spring into its closed position as soon as the operator has released the starter or else the starter may be controlled by a time switch or the like means.

The apparatus is obviously associated with a cock or needle valve or the like closing means which allow ensuring the adjustment of the throughput between a maximum opening and a closed position.

A particularly novel feature of the invention consists in that the gas sent into the starting jet or jets upon operation of the starter expands in the bottom of the sieve and spreads out into the shape of a sheet before it passes through the catalyst, whereby it can be ignited throughout the extent of the upper surface of the sieve, which leads to a very quick starting of the apparatus, say after one minute, without any objectionable smell arising, the thermostatic arrangement providing for the feeding of the pipes ensuring normal operation as soon as said sieve has been brought to a temperature sufficient for obtaining catalytic combustion.

Obviously, the number, the diameter and the position of the starting jet or jets are selected so as to allow a proper ignition of the gas over the surface of the sieve, taking into account the thickness and the area of said sieve.

The starting jets may furthermore open directly each into the bottom of the sieve, or else they may diffuse the gas serving for the starting through the agency of one or more pipes positioned also at the bottom of the catalytic sieve.

Similarly, the pipe or pipes feeding the gas during normal operation may be provided with one or more gauged jets adapted to adjust the throughput of the apparatus. Furthermore, the catalytic sieve may assume different shapes, sizes and angular settings according to the desired purpose (power, direction of the desired radiation), the different elements controlling operation of the apparatus (jets or ignition pipes, feeding pipes, thermostats, etc. . .) being then designed in accordance with the arrangement of the sieve. Said sieve may also be partitioned in certain cases, so as to provide for a proper distribution of the gas passing through it.

The invention will be readily understood from the reading of the following disclosure, reference being made to the accompanying drawings wherein:

FIG. 1 is an elevational sectional view through line I—I of FIG. 2 of the catalytic sieve system equipped in accordance with the invention.

FIG. 2 is a diagrammatic plan view showing the arrangement of the pipe feeding fuel for normal operation and the location of the starting jets in the bottom of the chamber provided therefor in the frame carrying the sieve.

FIG. 3 shows in detail the parts of the thermostatic safety valve.

FIG. 4 shows the starter of a hand controlled type.

In FIG. 1, the catalytic sieve 1 is positioned in the conventional manner inside a frame or distributor 2 and it is carried at a short distance above the flat fluidtight bottom 2a of said frame by a grid 3.

Inside the gap between the sieve and the bottom of the frame are positioned, on the one hand, a pipe 4 feeding

fuel for normal operation and, on the other hand, starting jets which are constituted in the case illustrated by two jets 5a and 5b of which the former 5a opens into a pipe 11 having longitudinally spaced perforations 11a formed therein which are directed toward the catalytic sieve 1. The longitudinal axis of the pipe 11 is oriented in a plurality of coplanar directions, as shown in FIG. 2, so that the space between the sieve 1 and the flat bottom of the frame 2 is subdivided into intercommunicating compartments which enhance the uniformity of distribution of the fuel.

The main gas supply line is illustrated at 6 and opens into the starting arrangement including a starter 7 connected through the pipe 8 with a cock 9 and then through two pipes 10a and 10b with the jets 5a and 5b. The external diameter of the normal fuel supply pipe 4 and the external diameter of the starting fuel supply pipe 11 are both equal to the uniform spacing between the bottom 2a of frame 2 and the confronting flat surface of the catalytic sieve 1. The longitudinal axis of each of the pipes 4 and 11 is oriented in a plurality of different coplanar directions intermediate its ends so that the space between the bottom 2a of the frame 2 and the confronting surface of the sieve 1 is divided into intercommunicating compartments whereby the uniformity of distribution of the fuel below the sieve 1 is enhanced.

A pipe 12 connects the cock 9 with a safety valve 13 controlled by a thermostat 14 extending over the catalytic sieve 1 and very near the latter. A further pipe 15 connects the safety valve 13 with the fuel feeding pipe 4 providing for normal operation. The cock 9 ensures the stoppage and the adjustment of the flow of fuel.

As illustrated in FIG. 2, the U-shaped pipe 4 includes two arms provided with longitudinally spaced laterally directed perforations 4a centrally located between the flat bottom 2a of the frame 2 and the flat confronting face of the sieve 1. Both the U-shaped pipe 4 for normal operation and the pipe 11 associated with the starting jet 5a are so shaped as to ensure a proper distribution of the fuel.

The thermostat 14 is secured through a square-shaped lug 17 to the frame 2 of the sieve 1. It is positioned in the immediate proximity of the upper surface of said sieve and forms a unit with the safety valve. This unit including the valve and the thermostat is associated with a body 13 provided with an input port 18 and an output port 19 (FIG. 3), which ports are connected respectively with the above-mentioned pipes 12 and 15. Between said ports, is formed a seat 20 engageable by a flap valve 21 carried at the end of an elongated rod 22 made of a material having a very low expansion coefficient. Said valve carrying rod, subjected to the action of a thrust-exerting spring 23, engages permanently through its outer end the bottom 24 of a tube 25 having a large coefficient of expansion and housing said rod 22; said spring urges the end of said rod against the bottom 24 of said tube 25 which is rigid with a terminal member 26 screwed into a plug 27 fitted in the body 13 of the valve and thermostat unit. Said terminal member 26 forms the adjusting member and is provided with a locking nut 28 associated with a fluidtight packing 28a.

It is apparent that when the apparatus is inoperative and the catalytic sieve is cold, the tube 25 holds through the agency of its bottom 24 and of the rod 22 engaging the latter the flap valve 21 on its seat, so as to cut out the throughput of gas.

In contradistinction, when the temperature of the sieve 1 rises, the tube 25 expands and its length increases in the direction of the arrow, whereby the rod 22 is allowed to move in the same direction under the action of the thrust exerted by the spring 23; the flap valve moves then away from its seat 20 and allows the gas to flow past it and to feed the pipe 4.

The apparatus is adjusted so that when the temperature of the sieve sinks again for any reason whatever

underneath the temperature for which the catalytic reaction is no longer initiated, the corresponding reduction in length of the tube 25 returns the flap valve 21 into its closed position.

The ignition starter 7 illustrated in detail in FIG. 4 includes an input end 29 connected with the pipe 6 feeding the gas and three output ports 30, 31a and 31b. The output port 30 feeding the cock 9 through the pipe 8 is permanently connected with the input end 29. On the other hand, the ports 31a and 31b feeding the pipes 10a and 10b leading to the jets 5a and 5b are separated from the input of gas by a flap valve 32 resting normally on a seat 33 as provided by the thrust exerted by the spring 34.

The stem 35 of said valve 32 extends out of the body of the starter through a plug 36 provided with a fluid-tight packing 37, so that said stem may be drawn out by hand in the direction of the arrow.

At a standstill and even if the cock 9 is open, the gas cannot reach either the pipe 15 since the safety valve 13 is closed or the jets 5a, 5b since the flap valve 32 rests on its seat.

For ignition of the arrangement, it is sufficient for the operator to exert through one hand a traction on the stem 35 so as to shift the flap valve 32 off its seat and consequently to feed the jets 5a and 5b, while his other hand holds a match over the sieve 1 so as to light the gas passing through the latter. This traction stress exerted on the stem 35 is continued during about one minute and after this lapse of time, the sieve has reached a temperature such that the thermostat has opened the safety valve 13, which allows feeding the pipe 4 providing for normal operation. The stem 35 may then be released and the spring 34 provides for the closing of the flap valve 32 and consequently for the cutting out of the feeding of the starting jets 5a and 5b which have thus finished playing their part and are no longer connected with the gas feeding circuit. The flames are extinguished and the catalytic reaction is initiated.

Obviously, and as apparent from the preceding disclosure, my invention is by no means limited to the sole embodiment described hereinabove and illustrated in the accompanying drawings and it covers in contradistinction all its embodiments and modifications falling within the scope of the accompanying claims.

What I claim is:

1. Heating apparatus of the class described, comprising: a supporting frame having a flat fluidtight bottom; a catalytic sieve having a flat surface uniformly spaced from and confronting said bottom; an elongated distribution pipe having longitudinally spaced laterally directed perforations formed therein which are centrally located between said flat surface and flat bottom within the space between said flat surface and said bottom for delivering a gaseous fuel into said space, the external diameter of said distribution pipe being equal to the spacing between said flat surface and said bottom, the longitudinal axis of said pipe being oriented in a plurality of different coplanar directions intermediate its ends to subdivide said space into a plurality of intercommunicating compartments which enhance the uniformity of distribution of said fuel to said sieve; and controllable means for supplying gaseous fuel to said distribution pipe.

2. Heating apparatus according to claim 1, further comprising a further perforated pipe extending in said space and having the same external diameter as said distribution pipe, the longitudinal configuration of said further pipe additionally subdividing said space; means including a normally closed valve for separately supplying gaseous fuel to said further pipe; and a thermostatically controlled valve responsive to the temperature of said sieve and interposed between said controllable means and said distribution pipe, said thermostatically controlled valve being open only when the temperature of said sieve

is at least a predetermined minimum operating temperature.

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