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APPARATUS FOR IGNITING CATALYSTS

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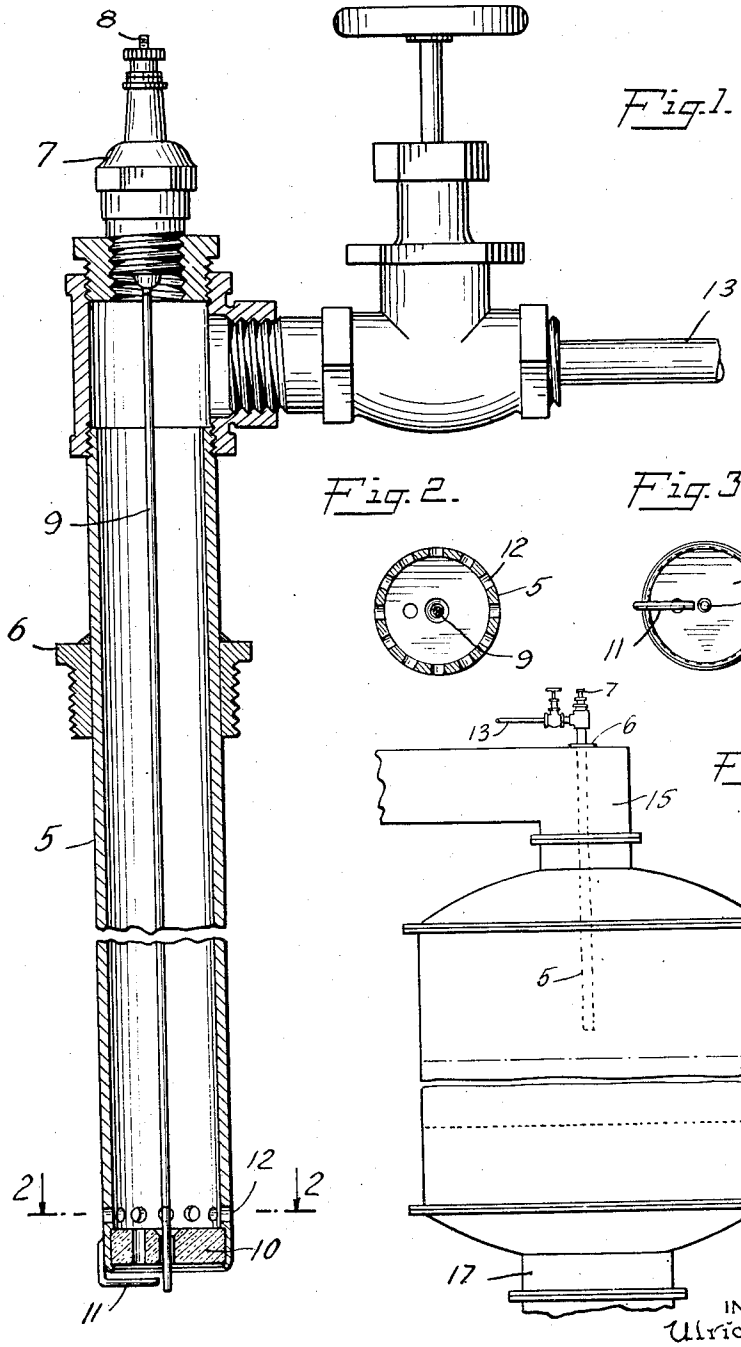

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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APPARATUS FOR IGNITING CATALYSTS

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5 Claims. (Cl. 23—288)

This invention relates to starting catalytic reactions and has for its object the provision of an improved igniter apparatus particularly adapted for starting catalytic reactions. More particularly, the invention aims to provide improvements in raising the bed of catalyst to the kindling temperature, where the catalytic reaction initiates.

It is known that the catalytic body may be raised to the kindling temperature by burning in the entering gas a combustible or inflammable material. In thus igniting a catalyst by the procedures heretofore carried out a single flame has been used for providing the necessary heat. This has entailed a careful control of the size of the flame to prevent deleteriously affecting the catalyst by unduly heating portions thereof before the catalyst as a whole was brought to the desired temperature. The methods heretofore used have, therefore, required a relatively long time for initiation of the catalysis reaction. This disadvantage I have found may be overcome by providing means for so burning the combustible gas that the whole stream of entering gas is raised to such a temperature that when the stream of mixed gas and the products of combustion contact with the catalyst, the surface layer of the catalyst is rapidly raised to the kindling temperature and the reaction is quickly initiated without deleteriously affecting the catalyst. As soon as the catalyst attains the kindling temperature, the supply of material burning in the gas stream is interrupted and the reaction is self-sustaining.

The combustible material burned in the entering stream of mixed gases should not poison the catalyst. There should be an investigation to determine whether any impurity in the material is injurious to the catalyst or whether any of the products of combustion or a reaction product of any of the constituents of the entering stream is toxic to the catalyst.

The apparatus of this invention suitable for igniting catalysts will be better understood from the following description taken in conjunction with the accompanying drawing, in which

Figure 1 is an elevation, partly in section, of the igniter and control valve;

Fig. 2 is a section on the line 2—2 of Figure 1;

Fig. 3 is an end view of the igniter; and

Fig. 4 is an elevation of the oxidizer and igniters.

The apparatus illustrated in the drawing comprises a tube 5 fitted in the oxidizer by means of the threaded bushing 6. (See Fig. 1.) Into the upper end of the tube 6 is fitted a spark plug 7. The insulated core 8 of the spark plug is extended by a rod 9 to the lower portion of the tube 5 and insulated therefrom by an air gap. Adjacent the upper end of the tube 5 in the portion external of the oxidizer, there is provided a valved inlet pipe 13.

The lower end of the tube 5 is closed by an insulating plug 10 of any appropriate material such as "transite". In the center of the insulating plug 10, there is a hole adapted to receive the end of the rod 9. Midway between the center hole and the tube 5, another hole is provided in the insulating plug.

A bent wire 11 is secured to the lower extremity of the tube 5, so that the end thereof approaches but does not contact with the portion of the rod 9 extending below the insulating bushing. The wire 11 may be attached in any appropriate manner such as by welding or brazing to the lower extremity of the tube 5, and is placed on the same side of the tube as the off-center hole in the insulating plug, so that the extension of the wire 11 is superimposed over the off-center holes in the insulating plug. Adjacent to the insulating plug, a series of radial orifices 12 is drilled in the tube 5.

In the operation of the apparatus, a high tension current is supplied to the insulated core 8 and at another point grounded to the apparatus in any appropriate manner. The current forms a spark across the gap between the portion of the rod 9 extending below the insulating plug 10 and the bent wire 11, which is grounded to the apparatus. When this spark is established, a valve in the valved inlet pipe 13 is opened admitting a combustible gas to the inner portion of the tube 5. This gas under an appropriate pressure, escapes from the tube 5 by means of the orifices 12 drilled radially in the lower portion of the tube. At the same time, a portion of the gas escapes through the two holes drilled in the insulating plug 10. This gas in the presence of the reaction or catalysis gases or suitable combustion supporting gas admixed therewith is ignited by the spark between the wire 11 and the rod 9, which in turn, ignites the gas escaping through the radial orifices 12.

The flame produced by the igniting of the gas escaping from the tube 5 mingles with a stream of reacting or catalysis gas entering the oxidizing chamber, and at a predetermined distance from the bed of catalytic material. The orifices 12 and holes in the plug 10 are so dimensioned and located that the combustion of the gas flowing through the holes forms a pilot flame which in

turn ignites the main body of gas issuing from the orifices to produce a laterally and radially extending flame parallel with and in close proximity to the surface of the catalyst bed. Loss of heat by radiation is thus prevented and a relatively large area of catalyst is rapidly and uniformly heated. When the surface layer of catalyst has reached the kindling temperature the catalytic reaction is self-sustaining and the supply of inflammable fluid through tube 5 is shut off at 13.

An apparatus in which the igniters of the invention have proven satisfactory is illustrated in Fig. 4 of the drawing. The igniter tube 5 is inserted in the oxidizer 14 and secured thereto by the threaded bushing 6. The valved inlet pipe 13 is connected to a source of inflammable fluid. The spark plug 7 is connected to an appropriate source of electric current. The air-ammonia mixture for catalysis is conducted to the oxidizer through a feed pipe 15 and is heated by an open flame extending laterally at the lower end of the igniter tube 5.

The heated gases and products of combustion pass through a catalytic bed 16 raising the surface layer of the bed to the ignition temperature. The exiting vapors are withdrawn from the oxidizer through an outlet 17. One igniter is shown in the oxidizer in Fig. 4 but any appropriate number determined by the size of the oxidizer and other conditions may be used to furnish sufficient heat to raise the entering stream of gas to an appropriate temperature. The igniters may be placed as indicated in the drawing or in any other appropriate location, to heat the entering stream of catalysis gas.

In the practice of the invention, when ammonia is being oxidized, the stream of mixed ammonia and air is turned on and adjusted to the proper flow prior to the turning on of the igniting gas in the tube 5. When the igniting gas in the tube 5 is ignited, a certain portion of the ammonia in the entering stream will be burned along with the gas exiting from the tube 5, but enough of the ammonia will be unconsumed so that the catalytic reaction starts as soon as the catalyst has attained an appropriate temperature.

The supply of gas entering through the valved inlet pipe 13 may be controlled by the valve so that the desired temperature may be attained in the entering stream of gas. If the stream of gas is heated by the igniter at a considerable distance above the catalytic bed, it is found desirable to raise the temperature at this point higher than otherwise to compensate for the loss of heat by radiation.

Hydrogen gas has been found satisfactory for the igniting or combustible gas, and when hydrogen is used as the igniting gas, the quantity of the hydrogen required for starting a given size oxidizer is readily calculated. In the practice of the invention, it has been found that for a four foot oxidizer, a flow of 26 cubic feet of hydrogen gas per minute gives satisfactory results.

In the operation of the apparatus the air-ammonia gas stream is first started. The high tension current is then switched on and continued during the entire lighting operation. After the spark contact has been made, hydrogen is turned into the igniter. The hydrogen is permitted to burn until the bed is satisfactorily heated over its entire surface, which ordinarily will be in from two to three minutes. The flow of hydrogen is then cut off, then the spark to the igniters. From this point, the oxidizing reaction is self-supporting.

Any gas may be used in the igniters which will give a sufficient number of calories when burning to heat the entering stream of gas to the desired temperature, as long as the gas itself is non-toxic to the catalyst, or as long as the products of combustion are non-toxic to the catalyst. When hydrogen is used as the gas, it is well to determine whether the supply of hydrogen contains any foreign substance which might poison the catalyst.

When a supply of hydrogen or other suitable gas is not readily procurable, the igniters may be operated using a volatile fluid in the nature of alcohol in place of a gas. When a fluid such as alcohol or a hydrocarbon is being used in place of a gas, it is preferred to use smaller holes in the lower end of the igniter tube, so that the alcohol or fluid is sprayed out under pressure or atomized and volatilization made easier. It has been found advantageous when using a liquid as the igniting medium, to substitute for the spark gap a small heating coil. Current is supplied to the heating coil at low voltage and with sufficient amperage to thoroughly heat the coil, and thus insure the vaporization and ignition of the alcohol vapors which are being sprayed out into the oxidizer.

The heating coil is permanently connected, as by welding or the like, to the end of the rod 9 and the lower end of the igniter tube 5 in such a manner that at least one of the issuing jets of fluid contacts directly with the heated coil. While the use of a combustible gas is preferred, alcohol or similar fluids may be used for the igniting of certain types of catalytic beds where a gas supply is not readily available.

I claim:

1. Catalytic apparatus comprising a chamber, a catalyst bed within said chamber, a conduit for combustible fluid extending into said chamber and terminating adjacent the surface of the said catalyst bed, means connected to said conduit for passing a combustible fluid therethrough, said conduit having the end thereof adjacent said catalyst bed constructed and arranged to spread a fan-like flame of combustible fluid adjacent the surface of the said bed of catalyst material, and means for igniting said combustible fluid issuing from the said end of said conduit.

2. Catalytic apparatus comprising a chamber, a catalyst bed within said chamber, a conduit for combustible gas extending into said chamber and terminating adjacent the surface of the said catalyst bed, means connected to said conduit for passing a combustible gas therethrough, said conduit having the end thereof adjacent said catalyst bed provided with a plurality of uniformly spaced apertures arranged to direct a flame of combustible gas laterally of the surface of said catalyst bed, spaced electrodes placed adjacent said end of said conduit to provide a spark gap, and a means for generating a high tension current connected to said electrodes.

3. An igniter comprising a tube having one end thereof provided with a plurality of uniformly spaced apertures in the side wall thereof, an electrode for high tension current extending lengthwise of the interior of said tube and terminating adjacent said end of said tube, a second electrode spaced from the terminus of said first mentioned electrode to provide a spark gap, means connected with said tube for passing a combustible gas therethrough, and high tension current connected to said electrodes.

4. In combination in a catalytic apparatus a chamber, a catalyst bed within said chamber, and

an igniter, said igniter comprising a tube extending into said chamber and having one end provided with a plurality of uniformly spaced apertures in the side wall thereof, an electrode for high tension current extending lengthwise of the interior of said tube and terminating adjacent said end of said tube, a second electrode spaced from the terminus of said first mentioned electrode to provide a spark gap, means connected with said tube for passing a combustible gas therethrough, and means for generating a high tension current connected to said electrodes.

5. Catalytic apparatus comprising a chamber, a catalyst bed within said chamber, means for introducing a flow of combustible fluid into said chamber and discharging it therein in a zone adjacent the surface of said bed of catalyst material as jets of fluid flowing laterally of the surface of said bed, and means within said chamber for igniting the combustible material to raise the temperature of the bed of catalyst material to converting temperature by combustion of said combustible material.

ULRIC B. BRAY.

CERTIFICATE OF CORRECTION.

Patent No. 2,013,979. **September 10, 1935.**

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 72, claim 3, after "and" insert the words means for generating a; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of October, A. D. 1935.

Leslie Frazer

(Seal) **Acting Commissioner of Patents.**