

[54] **EXHAUST GAS TREATING DEVICE AND AIR CHARGER**

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[52] **U.S. Cl.**..... 23/277 C; 23/288 F; 55/DIG. 30; 60/303; 110/8 R; 123/169 PA; 123/169 PH; 261/DIG. 9; 317/79.96; 431/202; 431/263  
[51] **Int. Cl.**<sup>2</sup>..... **F01N 3/14; F23G 7/06**  
[58] **Field of Search**..... 23/277 C, 288 FT; 110/8 E, 110/8 R; 431/254-258, 263, 264, 202; 261/DIG. 9; 55/DIG. 30; 123/169 PA, 169 PH; 317/79.96; 60/39.82 S, 303

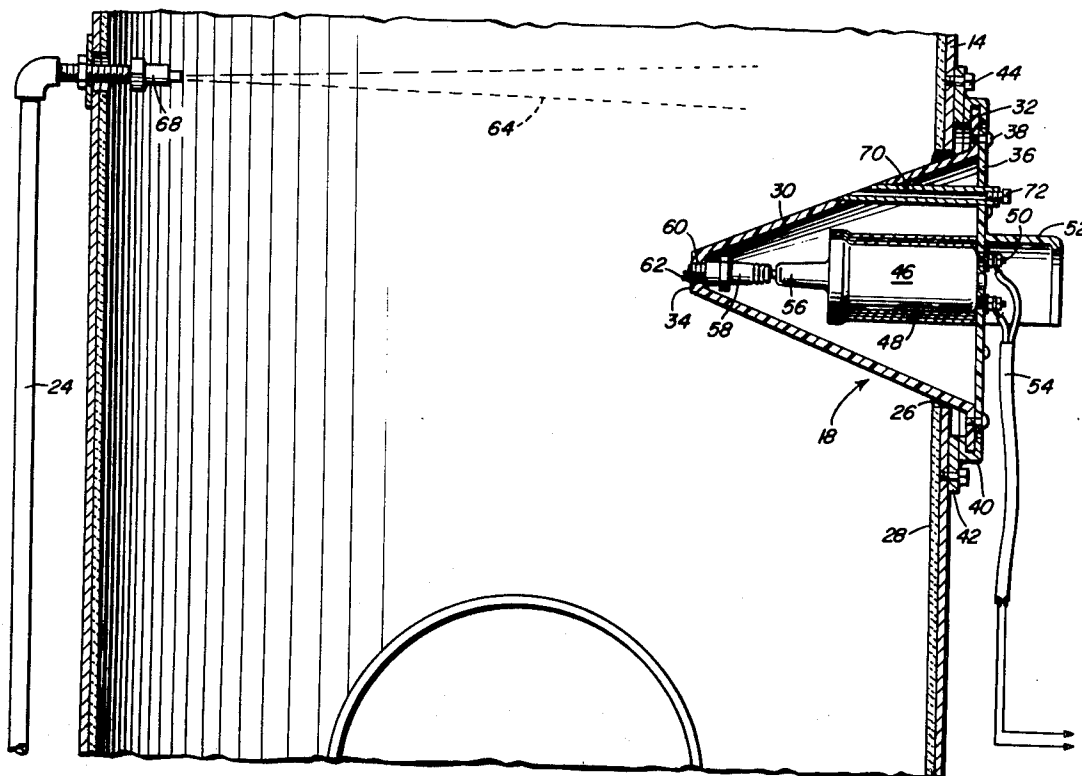
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[57] **ABSTRACT**

Heated, exhaust gas is conducted through a chamber into which a protective conical housing is inserted exposing the tip of a spark plug. An ignition coil assembly is fixedly mounted within the conical housing having a high voltage contact in engagement with the spark plug to ignite the exhaust gas for pollution reducing combustion. The housing is heat resistant to protect the coil assembly from heat and a liquid spray may be directed into the heated exhaust gas.

**13 Claims, 8 Drawing Figures**



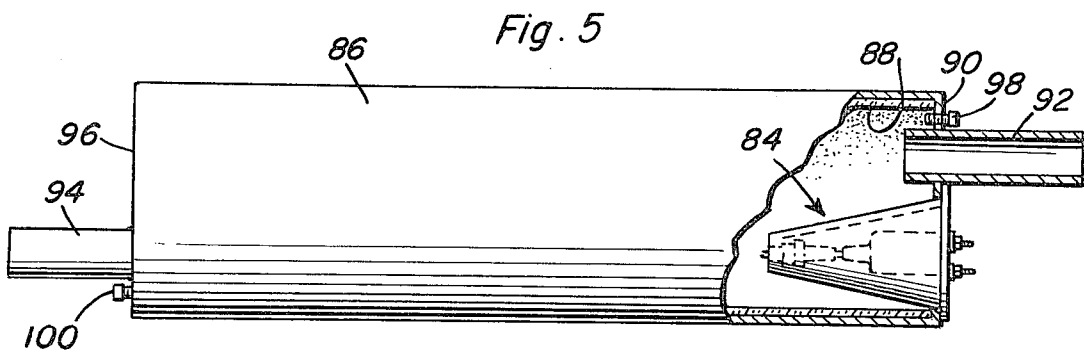
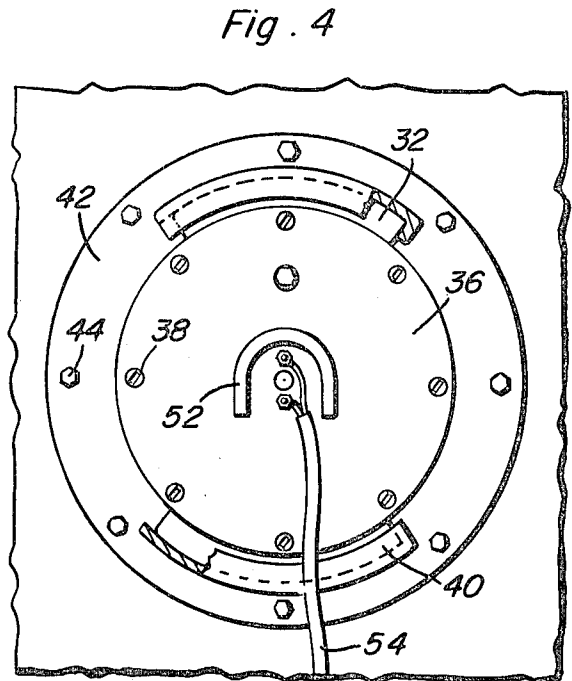
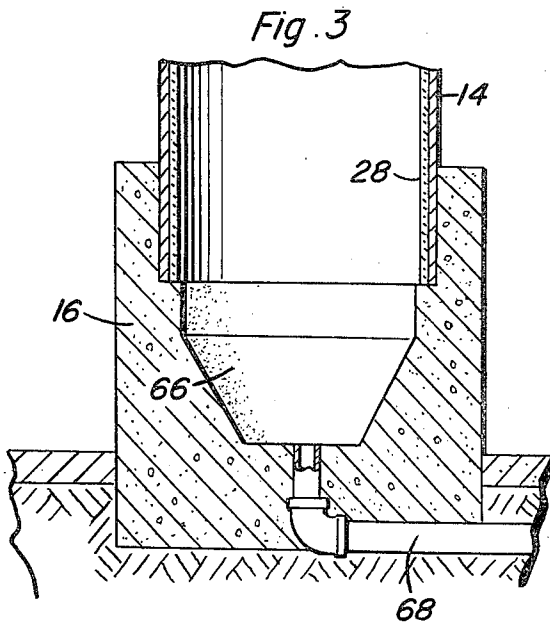
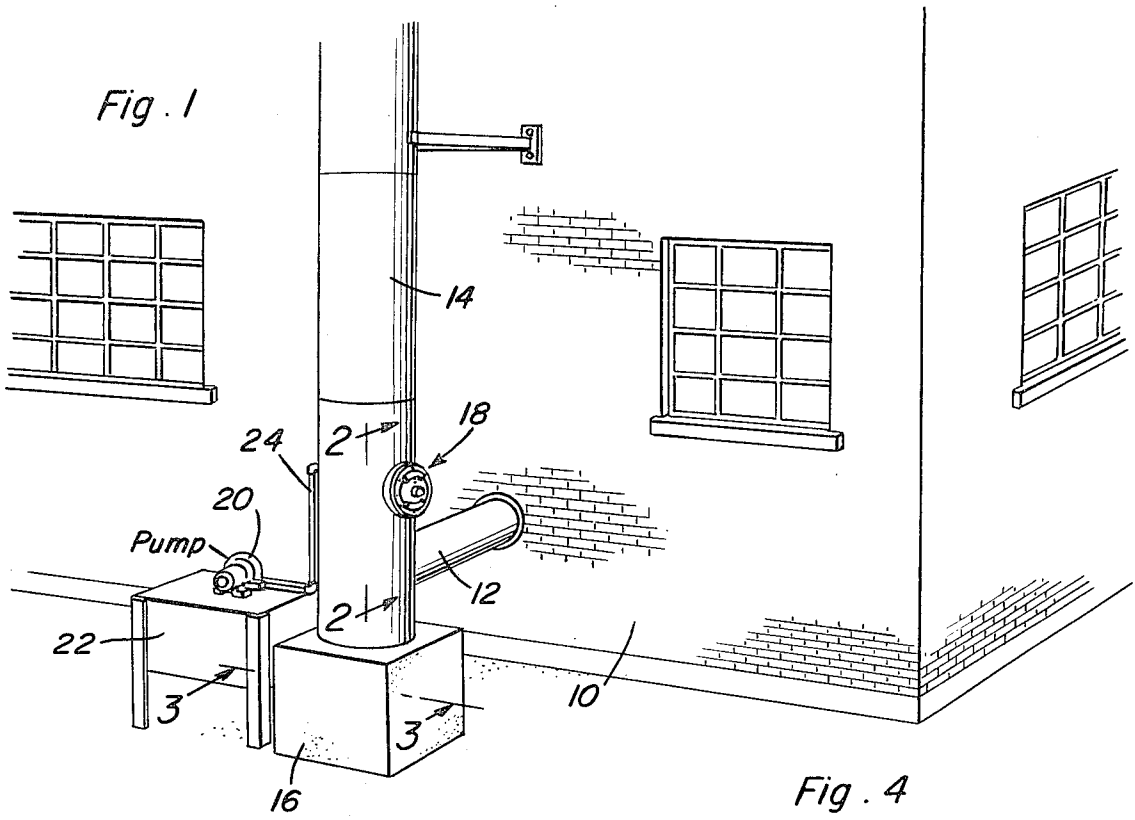
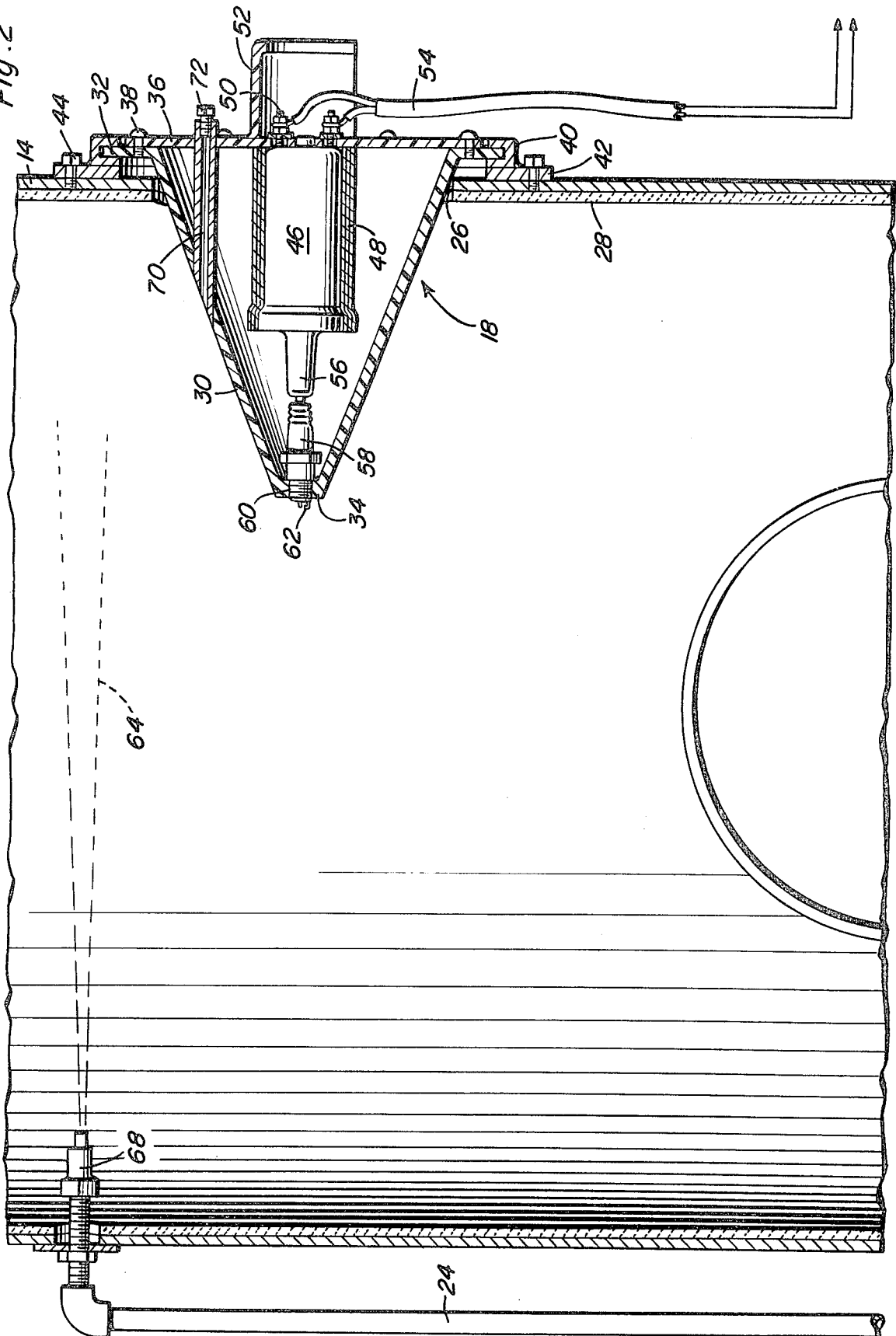


Fig. 2



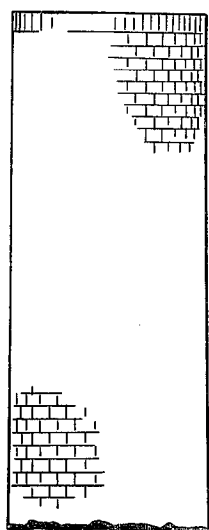


Fig. 6

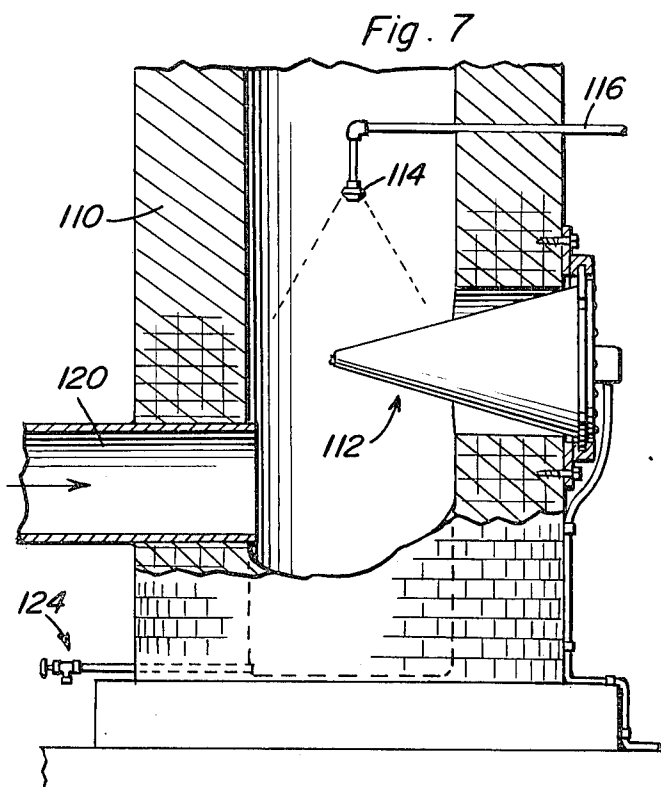


Fig. 7

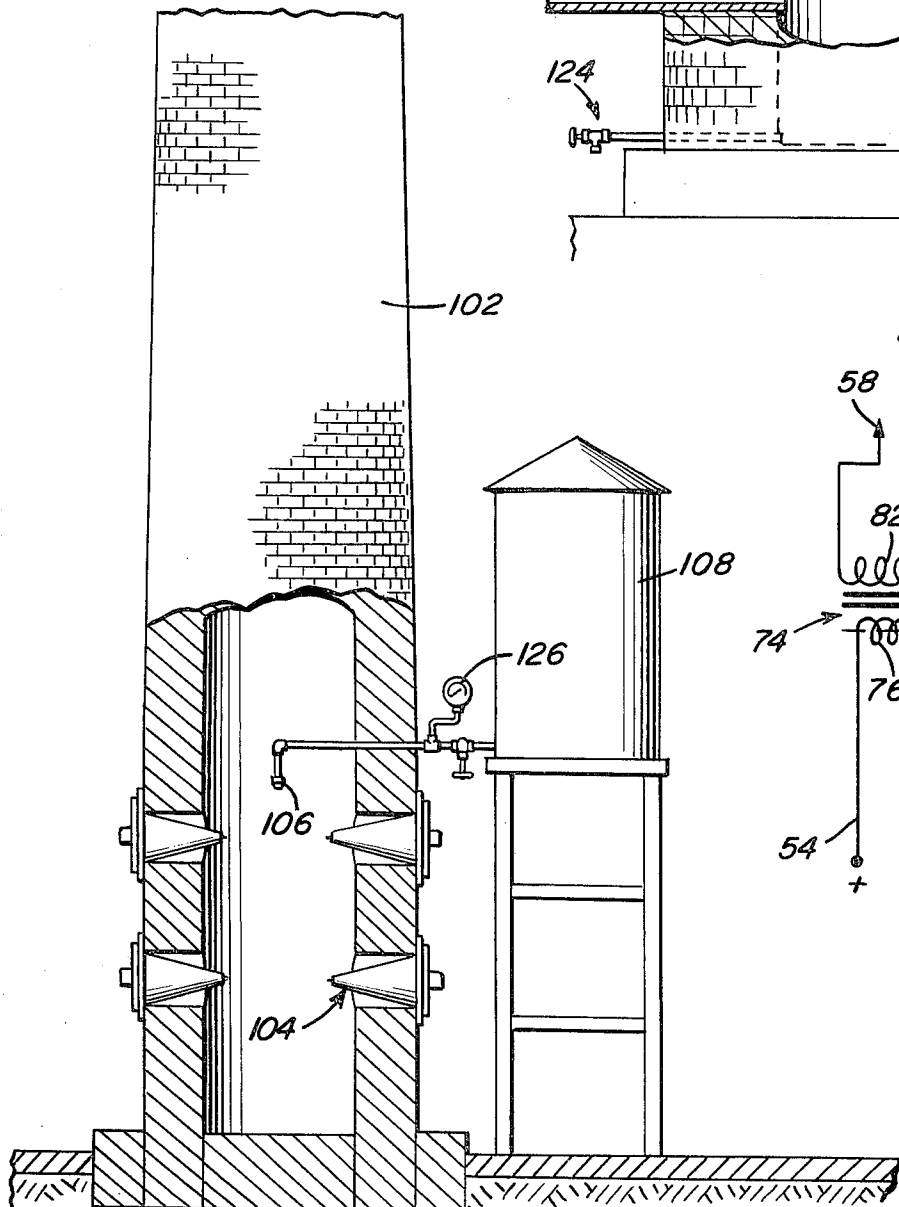
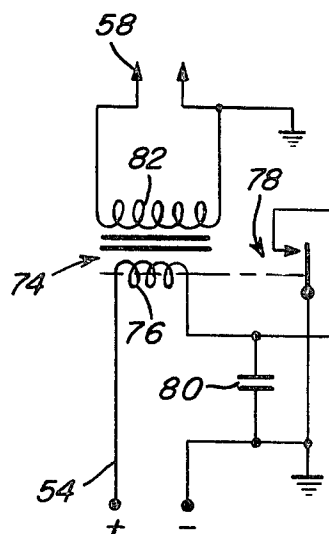


Fig. 8



## EXHAUST GAS TREATING DEVICE AND AIR CHARGER

This invention relates to an electrical igniting device for treating exhaust gases originating from different sources and in particular from industrial installations.

The treatment of exhaust gases by electrical igniting devices for the purpose of reducing the polluting effect of such exhausts on the atmosphere, is well known. Such anti-pollution devices generally suffer from rapid deterioration and require frequent replacement or repair. This is particularly true in connection with combustion producing ignition devices for treating exhaust gases within a liquid or moisture laden atmosphere having highly corrosive constituents. It is therefore an important object of the present invention to provide an exhaust gas treating device of the electrical ignition type that is readily installed or replaced in different types of installations requiring anti-pollution treatment of exhaust gases. A further object is to provide such a pollution treating device that will require less frequent replacement.

The prior art hereinbefore referred to includes the disclosures in U.S. Pat. Nos. 1,605,484, 2,038,567, 3,031,824, 3,037,344, 3,654,093, 3,741,730, 3,768,258 and 3,769,799.

In accordance with the present invention, a protective housing of conical shape is inserted into a chamber through which heated exhaust gas is conducted. The conical shape of the protective housing facilitates insertion or withdrawal of the device through an opening formed in the chamber enclosure adjacent to the inlet or inflow end. An annular base portion of the protective housing is externally mounted on the chamber enclosure which may be a muffler housing, a tank, a vertical chimney stack or exhaust gas treatment container depending upon the exhaust gas producing source or installation. An ignition coil assembly is fixedly mounted within the protective housing with its high voltage contacts in direct engagement with a spark plug thereby eliminating the use of any high voltage cables. The low voltage terminals of the ignition coil assembly project from the housing externally of the chamber for connection to a DC voltage source. The spark plug on the other hand is adjustably mounted by the apex portion of the protective conical housing in order to establish electrical contact with the high voltage terminals of the ignition coil assembly and to expose its arc producing tip to the flowing exhaust gas. In those installations in which the exhaust gas is treated by an injected liquid for removal of sulfur and other such contaminants for example, the conical housing enclosing the spark plug and ignition coil assembly, is located just upstream of the liquid injection nozzle. The liquid may be supplied to the nozzle by a pump or by gravity feed. Controlled inflow of air to the exhaust flow chamber may also be accommodated through the protective housing of the gas treating device.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

FIG. 1 is a perspective view showing a typical installation for the apparatus of the present invention.

FIG. 2 is an enlarged partial section view taken substantially through a plane indicated by section line 2—2 in FIG. 1.

FIG. 3 is an enlarged partial sectional view taken substantially through a plane indicated by section line 3—3 in FIG. 1.

FIG. 4 is a partial elevational view of the external end portion of the exhaust gas treating device shown in FIGS. 1 and 2.

FIG. 5 is a side elevational view with parts broken away and shown in section of another installation for the exhaust gas treating device of the present invention.

FIG. 6 is a partial elevational view with parts broken away and shown in section of another installation for the apparatus of the present invention.

FIG. 7 is a side sectional view of another installation arrangement in accordance with the present invention.

FIG. 8 is a simplified electrical circuit diagram corresponding to the ignition coil assembly associated with the device of the present invention.

Referring now to the drawings in detail, a typical installation for the present invention is shown in FIG. 1 wherein exhaust gas resulting from operation of some equipment such as a furnace or an internal combustion engine, is discharged from a building 10 through an outlet conduit 12 into a vertical chimney stack 14 which rises above a concrete base 16. The polluting effect of the exhaust gas on the atmosphere in accordance with the present invention is reduced by combustion of hydrocarbons in the exhaust gas by means of an electrical igniting device generally referred to by reference numeral 18 mounted on the tubular chimney stack 14 adjacent to the location at which the inflow into the vertical chimney stack 14 occurs from the outlet conduit 16. Also, in the installation illustrated, the exhaust gas is treated by a liquid such as water injected into the exhaust gas flow stream by means of a pump 20 drawing the liquid from a reservoir tank 22. The outlet of the pump 20 is accordingly connected to a liquid supply conduit 24 for introducing the liquid into the gas flow stream.

Referring now to FIG. 2 in particular, the electrical igniting device 18 is shown mounted within an opening 26 formed within the cylindrical wall of the chimney stack 14 which is internally lined with a heat resistant material 28 such as asbestos. The device 18 includes a protective housing 30 also made of a heat resistant material. The housing 30 is conical in shape including a flanged base 32 from which the housing converges toward an apex portion 34. A cover plate 36 is secured by fasteners 38 to the flanged base 32 externally of the tubular chimney stack adjacent to the opening 26. The flanged base 32 is received within arcuate locking receiver members 40 as more clearly seen in FIGS. 2 and 4 by means of which the protective housing 30 is supported on the chimney stack. The receiver members 40 project from an annular mounting ring 42 secured by fasteners 44 to the stack 14 in concentric relation to the opening 26 into which the housing 30 projects.

As shown in FIG. 2, an ignition coil assembly generally referred to by reference numeral 46 is fixedly mounted concentrically within the conical housing 30 protectively wrapped within a triple layer aluminum foil laminate 48 with its low voltage terminals 50 projecting through the base cover 36 below an arcuate shield formation 52 projecting from the cover exter-

nally of the stack 14. Electrical power cable 54 is connected to the low voltage power terminals 50 for supplying electrical energy to the igniting device 18. A high voltage contact end portion 56 of the ignition coil assembly engages the rear connecting end of a spark plug device 58 that is threadably mounted in operative position within the housing 30 by an internally threaded bore 60 in the apex portion. The arc producing tip 62 of the spark plug is thereby exposed to the exhaust gas flow stream within the stack 14 just upstream of a spray of liquid 64 injected into the gas flow stream by a nozzle device 66 to which the liquid supply conduit 24 is connected. Thus, when connected to a source of electrical energy, the igniting device 18 will produce combustion of the heated exhaust gas flowing upwardly through the chimney stack 14 as a result of thermal updraft. The liquid injected will furthermore treat the exhaust gas for removal of certain contaminants such as sulfur. Any slag or slurry of liquid and particulate combustion products will be accumulated within a collection chamber 66 formed in the concrete block 16 as shown in FIG. 3. The accumulated slurry is withdrawn from the collection chamber through a drain pipe 68.

In order to enhance conversion of the exhaust gas into a relatively non-polluting outflow, a controlled inflow of air is conducted into the flow chamber enclosed by the chimney stack 14 by means of an inlet conduit 70 as shown in FIG. 2 which extends through the housing 30 in parallel spaced relation to the centrally aligned ignition coil assembly 46 and spark plug 58. The inlet end of the inlet conduit 70 which projects through the base cover 36, is closed by an orifice plug 72 admitting a restricted inflow of air in accordance with installational requirements.

One of the advantages associated with the present invention resides in the fact that both the ignition coil assembly 46 and the spark plug 58 are protectively enclosed within the conical housing 30 thereby eliminating the use of any high voltage connecting cables. This arrangement furthermore facilitates installation of the present invention. The ignition coil assembly as shown by way of example in FIG. 8, includes an ignition transformer 74 having a primary winding 76 connected to a DC source of electrical energy through the power cable 54 and a vibrator 78 including capacitor 80 by means of which high energy pulses are generated. The high energy pulses are transmitted through the secondary winding 82 of the transformer to the high voltage contact end of the ignition coil assembly.

A combustion producing, igniting device 84 similar to the igniting device 18 hereinbefore described, may be installed within a cylindrical type of muffler casing 86 as shown in FIG. 5 in order to treat exhaust gas emerging from an internal combustion engine. The casing 86 is also internally lined with a heat resistant lining 88 and has an end wall 90 at one axial end into which an inlet conduit 92 projects. An outlet conduit 94 extends from the opposite axial end wall 96 of the casing. The electrical igniting device 84 which is similar in construction and operation to the igniting device 18 except for size and operating voltages, projects into the casing through an opening in the end wall 90 adjacent the inlet conduit 92. The end wall 90 may also be provided with an orifice intake plug 98 while an atmospheric vent plug 100 is mounted on the opposite end wall 96 in order to regulate the inflow and outflow of air support-

ing the anti-pollution treatment effected by the electrical igniting device 84.

In FIG. 6, an industrial chimney stack 102 is shown wherein a plurality of electrical igniting devices 104 are mounted adjacent the lower inflow end for the exhaust gases. The sizes of the igniting devices and the associated electrical operating parameters are selected in order to effect the desired anti-polluting effect in combination with the injection of a liquid through a nozzle device 106 located just downstream of the igniting devices 104. Liquid may be supplied to the nozzle device 106 by gravity feed from a liquid containing tank 108. It will of course be appreciated that feed of liquid to the nozzle device 106 may alternatively be accomplished by a pump.

In FIG. 7, another industrial installation is shown wherein the chimney stack 110 mounts a single electrical igniting device 112 of a suitable size both dimensionally and with respect to electrical operating characteristics. The igniting device 112 is similar in structure and operation to the igniting device 18 hereinbefore described. Hereagain, liquid is injected into the upflowing exhaust gas stream by a nozzle 114 to which liquid is supplied by conduit 116.

In the installations shown in FIGS. 6 and 7, the exhaust gases are drawn in through inlet 120 while the accumulated slurry is drawn off through drain outlet 124. The inflow rate of liquid is monitored by a meter 126. The air drawn in through the igniting devices is charged by a hydrocatalytic reaction produced by the igniting devices to cool the reaction. As a result of the igniting devices, the intake of air and injection of liquid, noxious gases detectable only by ultraviolet and infra-red sensors are removed together with the usual pollutants such as hydrocarbons, sulfur, oxides, etc.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. In combination with a heat resistant enclosure having a chamber through which a flow of heated exhaust gas is conducted to atmosphere, a pollution control device mounted on said enclosure and projecting into the chamber, comprising a conical housing of heat resistant material having a base portion supported on the enclosure externally of the chamber and converging toward an apex portion internally of the chamber, an ignition coil assembly fixedly mounted within the housing having low voltage terminals projecting through the base portion of the housing externally thereof and high voltage contact means projecting toward the apex portion internally of the housing, a spark plug device mounted in the apex portion of the housing having an exposed tip projecting into the chamber and a connector end portion in engagement with the high voltage contact means, and a source of electrical energy connected to the low voltage terminals for producing an ignition arc at the exposed tip causing combustion of the heated exhaust gas in the chamber.

2. The combination of claim 1 including an intake conduit extending through the conical housing from the base portion, and orifice plug means mounted in

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the intake conduit at the base portion for restricting flow of air into the chamber in response to inflow of the heated exhaust gas.

3. The combination of claim 2 including a source of liquid and nozzle means connected to said source for injecting said liquid in spray form into the chamber downstream of the conical housing.

4. The combination of claim 3 wherein said enclosure is a vertical stack through which an updraft flow of the exhaust gas is conducted.

5. The combination of claim 1 wherein said enclosure is a tubular casing having axially spaced end walls to which inlet and outlet conduits are connected, said conical housing being mounted on one of the end walls to which the inlet conduit is connected.

6. The combination of claim 1 wherein said enclosure is a vertical stack through which an updraft flow of the exhaust gas is conducted.

7. The combination of claim 1 including a source of liquid and nozzle means connected to said source for injecting said liquid in spray form into the chamber downstream of the conical housing.

8. The combination of claim 7 wherein said enclosure is a vertical stack through which an updraft flow of the exhaust gas is conducted.

9. The combination of claim 8 including means mounted below said vertical stack for collecting a slurry of liquid and combustion products.

10. The structure as defined in claim 1 wherein said ignition coil assembly includes an ignition coil having a wrapping of protective material thereon and being spaced from the converging portion of said housing, said spark plug having an end electrode connected directly to a high voltage terminal on the coil, and a controlled inflow passageway for air extending through

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said protective housing and including an inlet end communicating with ambient atmosphere outwardly of the base portion of the housing and a discharge end communicated with the container at the surface of the housing in spaced relation to the spark plug.

11. The structure as defined in claim 1 wherein said housing includes a controlled air passageway there-through and communicating with ambient atmosphere externally of the base portion of the housing and communicating with the exterior of the housing in adjacent, spaced relation to the apex portion thereof.

12. In combination with a source of heated exhaust gas, a gas treating device for reducing air pollution comprising an elongated container through which said heated exhaust gas is conducted, a protective housing of heat resistant material supported within the container having a base portion mounted externally on the container, spark generating means mounted in the protective housing and projecting therefrom within the container for igniting the heated exhaust gas and adapted to be connected with a source of electrical energy, said protective housing including an inner portion from which the spark generating means projects, said spark generating means including a spark plug mounted in the inner portion of the protective housing in spaced relation to the base portion, said spark generating means further including an ignition coil assembly mounted within the protective housing between the spark plug and the base portion.

13. The combination of claim 12 wherein said protective housing converges from the base portion toward an apex inner portion from which the spark generating means projects.

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