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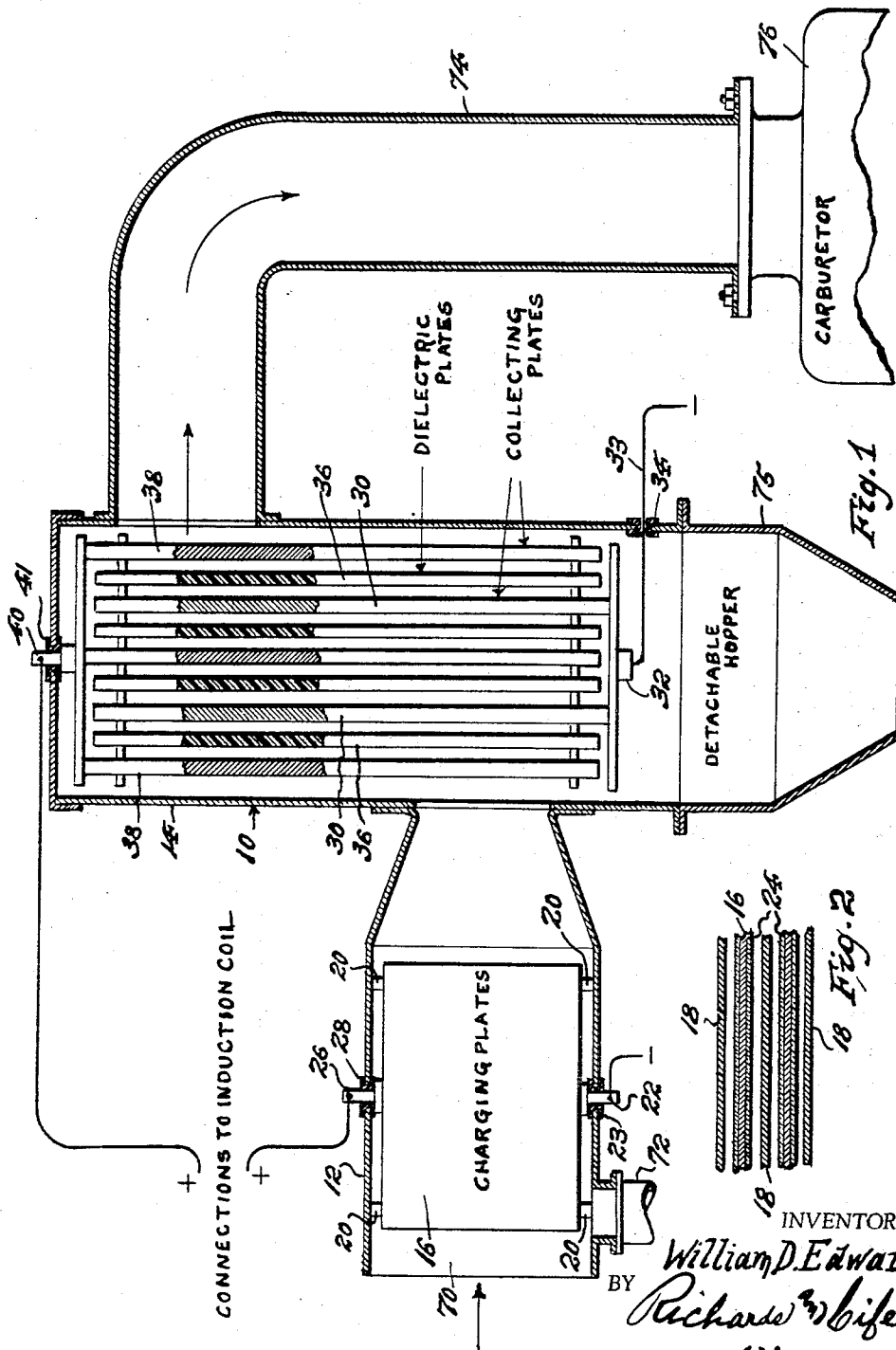
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CRANKCASE VENTILATION SYSTEM

Filed Dec. 14, 1966

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

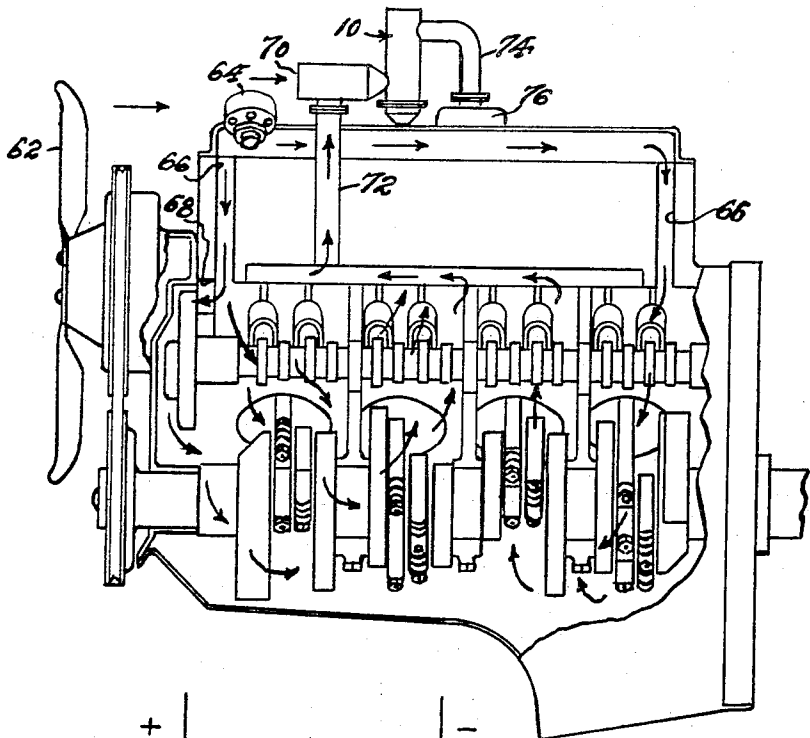


Fig. 3

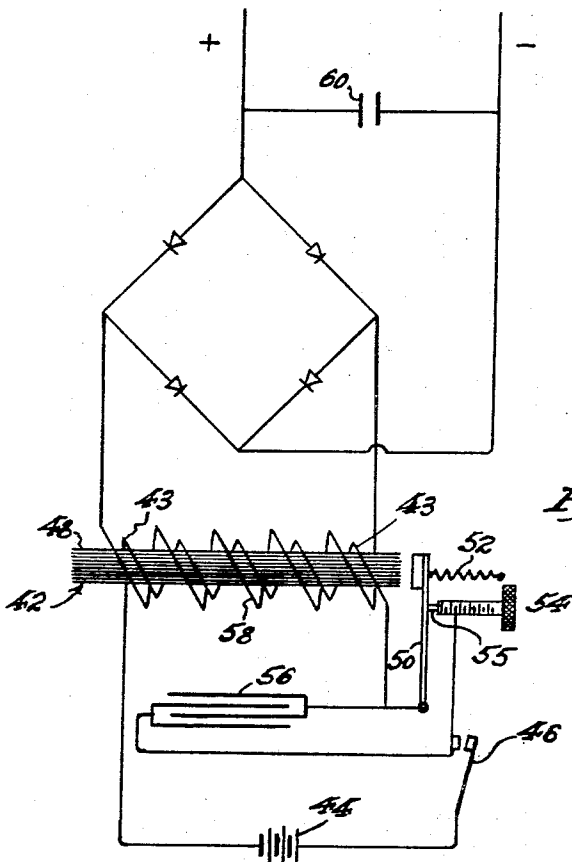


Fig. 4

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CRANKCASE VENTILATION SYSTEM
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ABSTRACT OF THE DISCLOSURE

An internal combustion engine provided with a closed circuit crankcase ventilation system. Gases emanating from the crankcase are cleaned in an electrical precipitator deriving power from a storage battery. The cleaned gases from the precipitator are passed into the carburetor, or directly into the intake manifold of the engine and burned.

Background of the invention

The present invention relates to a method for reducing the air pollution that results from fumes and vapors emanating from the crankcase of an internal combustion engine and more particularly to a means of cleaning the crankcase vapors so that they may be burned in the engine.

As more and more automobiles have crowded the highways, the fumes and vapors from their engines have increased to such an extent that some of the more populous areas have been troubled with smog and an increase in respiratory diseases. This has led to legislation requiring automobile engines to be provided with devices that reduce air pollution.

While it is well known that the exhaust gases of internal combustion engines contribute to air pollution the extent to which fumes escaping from the crankcase contribute to fouling the atmosphere is less generally recognized. When gasoline is burned in the cylinders of any internal combustion engine, one of the by-products is water vapor.

Actually, more than one gallon of water is produced for every gallon of gasoline burned. Most of this water vapor is blown out through the exhaust system. Some of it, however, leaks down into the crankcase where it can have very destructive effects through the formation of sludge and acid. The acid is formed when the water combines with sulphur dioxide, which is another by-product of combustion. Adequate crankcase ventilation evaporates the moisture and carries it, as well as the combustion gases, out of the engine. It is customary to vent such gases from the crankcase directly into the atmosphere.

Summary of the invention

It is an object of the present invention to provide means for removing from the crankcase gases suspended particles and materials that would damage the engine so that the crankcase gases can be recirculated to the engine and burned.

In accordance with the present invention, an electrical precipitator powered by the automobile storage battery is provided and acts to clean the gases emanating from the crankcase so that they may be recirculated to the engine.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, which show, by way of example, a preferred embodiment of the inventive idea.

Brief description of the drawings

Referring now to the drawings:

FIGURE 1 is a vertical section through an electrical precipitator embodying the principles of the invention;

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FIGURE 2 is a fragmentary sectional view of charging plates.

FIGURE 3 is a diagrammatic view of an internal combustion engine and illustrates the flow of air through the crankcase; and,

FIGURE 4 is a circuit diagram of a vibrator induction coil and associated rectifier.

Description of the preferred embodiment

Referring now to FIGURE 1, there is shown an electrical precipitator 10 constructed of metal comprising an ionization chamber 12 and a precipitating chamber 14. The ionization chamber contains discharging electrodes (charging plates) 16 and opposed complementary non-discharge electrodes 18 mounted on insulators 20. The non-discharge electrodes are at negative potential being connected to the terminal 22 which passes through the wall of the ionization chamber and is connected to the negative lead of the power supply shown in FIGURE 4. The terminal 22 is insulated from the wall of the ionization chamber by the rubber bushing 23. Preferably the ionization chamber will contain about 5 to 8 plates.

The discharging electrodes (charging plates) are coated on both sides with a baked ceramic enamel 24, the conductance of which is sufficiently high to permit the flow of corona current but sufficiently low to prevent arc-over. The discharging electrodes are connected to a source of high electrical potential through the terminal 26 which is insulated from the wall of the chamber 12 by the rubber bushing 28.

The precipitating chamber contains from about 2 to about 4 non-discharge electrodes 30 that are at negative potential being connected to the terminal 32 from which a conductor 33 insulated from the wall of the precipitation chamber by the rubber bushing 34 leads to the power supply (see FIGURE 4). Separated from the negative electrodes 30 by dielectric plates 36 are opposed non-discharge electrodes 38 that are at positive potential being connected to the terminal 40 which passes through the wall of the precipitation chamber and is connected to the positive lead of the power supply. The terminal 40 is insulated from the wall of the precipitation chamber by the rubber bushing 41. The dielectric plates 36 may be constructed of mica or a plastic material having a high dielectric constant. The total number of plates present in the discharge chamber will depend upon the size, and geometry of the plates and the distance between adjacent plates.

The operation of the power supply for the electrical precipitator is conventional and will be readily understood from the circuit diagram of FIGURE 4. A vibrator induction coil 42 having a primary winding 43 in series with the automobile storage battery 44 may be used to generate the high voltage necessary for operation of the electrical precipitator. The switch 46 is in parallel with the ignition switch of the automobile and closes the primary circuit when the ignition switch is on. The iron core 48 of the induction coil is magnetized when the primary circuit is closed and moves the vibrator blade 50 against the tension of the spring 52 away from the vibrator screw 54, opening the primary circuit between platinum contact 55 on the vibrator blade and the vibrator screw. Thereupon the core loses its magnetism and vibrator blade is released; the spring returning the vibrator blade to its original position and again closing the primary circuit. This action takes place repeatedly and the blade vibrates back and forth as long as the ignition switch is on. A condenser 56 across the interruptor points prevents the spark that would otherwise occur.

When the primary circuit is opened and closed by the magnetism of the core, produced by current flowing through the primary winding, a very high electromotive

force is induced into the secondary winding 58, which is wrapped around the primary winding. This induced electromotive force in the secondary winding causes an alternating current of very high voltage to flow in the secondary winding, which current is rectified and applied to the electrical precipitator 10. The condenser 60 smooths out the alternating component of the rectified direct current. The voltage applied to the terminal 26 may be in the neighborhood of 11,000 to 13,000 volts: if the plates are spaced about 1/2-inch apart. Preferably a lower voltage, about 8,000 volts, is applied to the terminal 40 as appreciably higher voltages may shorten the life of the dielectric.

The crankcase ventilation system of an internal combustion engine is shown in FIGURE 3. Air from a fan 62 is forced into the engine through an oil filler cap 64 located in the rocker arm cover. Filter elements in the oil filler cap insure the circulation of clean air through the engine. Air entering the inlets circulates along the top of the cylinder head inside the rocker arm cover. Cast openings 66 at the front and rear of each cylinder head allow air to be forced down into the area of the block below the push rod cover.

Air passing down into the block at the front circulates into the timing chain cover through a hole 68 near the front of the block. The ventilating air then circulates down around the timing chain and sprockets and into the crankcase. The flow of air through the crankcase is aided by the venturi effect of air that is forced by the fan into the throat 70 of the electrical precipitator 10. This air flow creates a low pressure area at the outlet of the conduit 72 which exhausts vapors and fumes from the crankcase.

The cleaned effluent gases from the electrical precipitator may be forced through the conduit 74 into the carburetor 76 as shown in FIGURES 1 and 3, or if desired, passed directly into the intake manifold (not shown) where it is mixed with fuel and air from the carburetor and burned in the engine.

It will be understood from the preceding description of the various component parts of the present invention that suspended particles in the gases emanating from the crankcase pass through the conduit 72 and into the ionization chamber 12. In this chamber the suspended particles are charged by the corona current passing between the discharging electrodes 16 and the electrodes 18. Such charged particles are carried in the gas stream into the precipitating section and are attracted to the electrodes of opposite potential in the precipitating chamber losing their charge, and dropping into the detachable hopper 75 below the plates. The cleaned effluent gases from the precipitating chamber pass through the conduit 74 into the carburetor 76 and are mixed with gasoline and air. As will be noted from FIGURE 3, the crankcase ventilation system described herein is a closed system in that all effluent gases therefrom are directed to the intake manifold and burned in the engine.

It will be noted that the electrical precipitator 10 also cleans the air that is drawn into the engine through the throat 70. The precipitator therefore when connected to the carburetor as illustrated in FIGURE 1 replaces the conventional air cleaner which is not needed since dust and other abrasive particles that might normally be found in the air used for combustion are removed by the precipitator. The electrical precipitator is to a large extent self cleaning as the vibration of the engine will knock the particles off the collecting plates into the hopper which may be removed for further cleaning. The precipitator does not

restrict the air flow into the combustion chamber to the same extent that a conventional filter would, particularly if the conventional filter has been in use for some time and is dirty. It is an additional advantage of the present invention therefore that the power of the engine is increased and frequent cleaning and replacement of the air filter is not required.

Although the invention has been described in detail in connection with specific embodiments thereof shown in the drawings, these embodiments are merely illustrative of others that will be apparent to those skilled in the art, and are not to be construed as limiting the scope of the invention which is defined in the accompanying claims.

What is claimed is:

1. A method reducing the air pollution that results from fumes and vapors emanating from the crankcase of an internal combustion engine, which comprises; exhausting vapors from the crankcase into an ionization chamber wherein particles suspended in the effluent vapors are ionized by electrical discharges in a high tension electrical field between opposed electrodes; collecting the ionized particles in a precipitating zone wherein the air is subjected to a high tension electrical field between opposed substantially non-discharging electrodes; and, passing the effluent vapors, free of suspended particles, into the intake manifold of said internal combustion engine.

2. The method of claim 1 wherein the effluent vapors from the precipitating zone are passed through the carburetor of the internal combustion engine prior to entering the intake manifold.

3. In an internal combustion engine having an intake manifold, a crankcase and an air outlet through which vapors from the crankcase are eliminated, the improvement comprising: an electrical precipitator for separating suspended materials from the crankcase vapors, including an ionization section and a precipitating section; said ionization section being in communication with said air outlet and said precipitating section being in communication with said intake manifold; whereby vapors from the crankcase are freed of suspended particles and burned in the engine.

4. The improvement defined by claim 3 wherein the precipitating section is in communication with the carburetor of the internal combustion engine.

5. The improvement defined by claim 3 wherein the ionization section of the electrical precipitator comprises a set of discharge electrodes and a set of opposed complementary non-discharge electrodes and the precipitating section comprises opposed sets of non-discharge electrodes.

6. The improvement defined by claim 5 wherein a vibrator induction coil is provided to induce a high tension electrical field between opposed sets of electrodes in the ionization section and in the precipitation section.

7. The improvement defined by claim 5 wherein said discharge electrodes are metal plates coated with a ceramic material of low conductance.

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