July 29, 1930. E. H. HAMILTON 1,771,626

ATOMIZING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed March 16, 1925 2 Sheets-Sheet 1

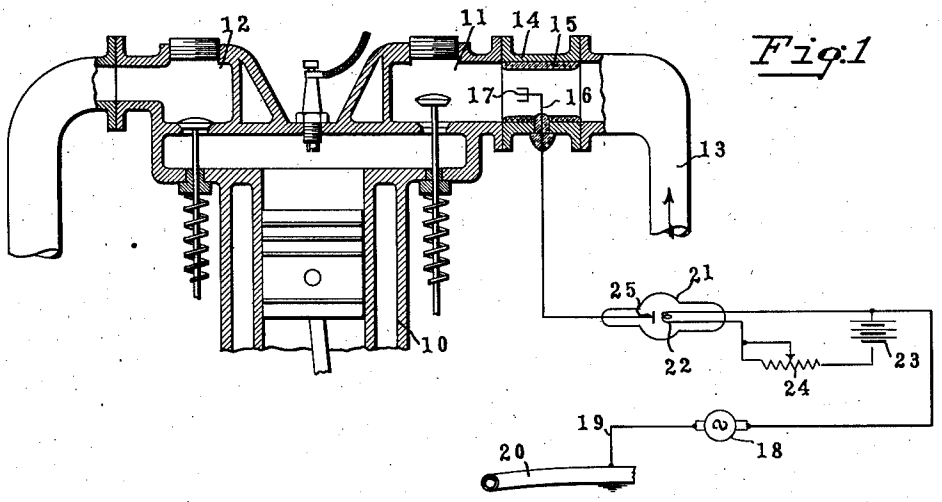


Fig. 1

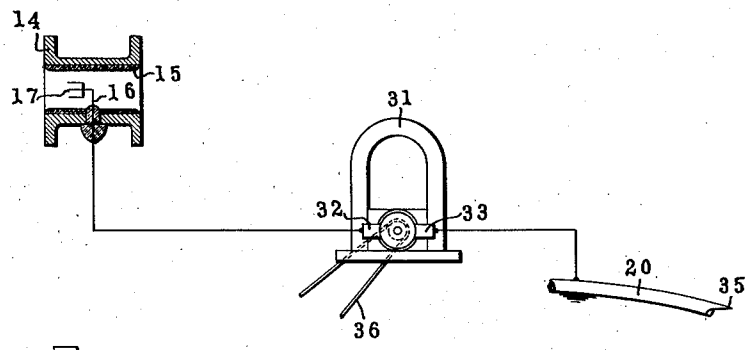


Fig. 2

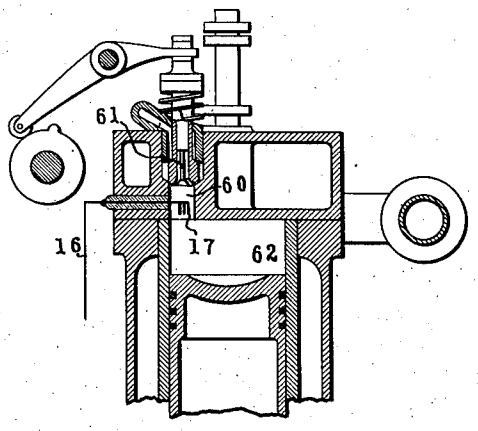


Fig. 3

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ATOMIZING DEVICE FOR INTERNAL COMBUSTION ENGINES

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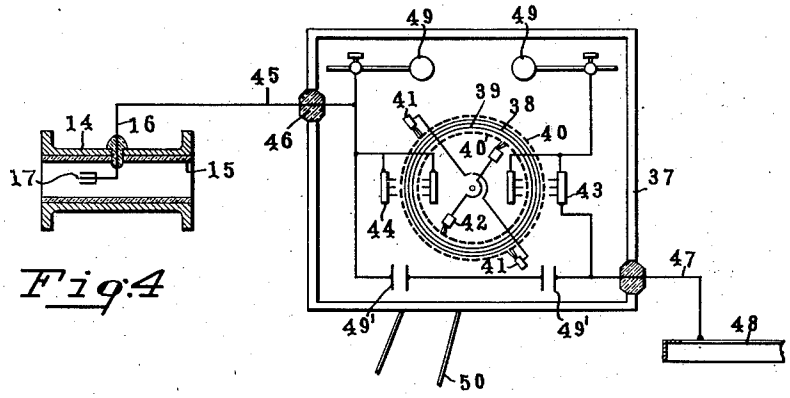


Fig. 4

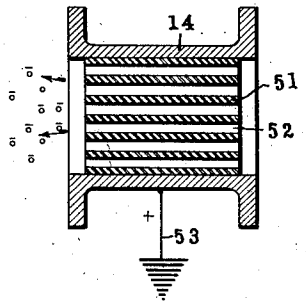


Fig. 5

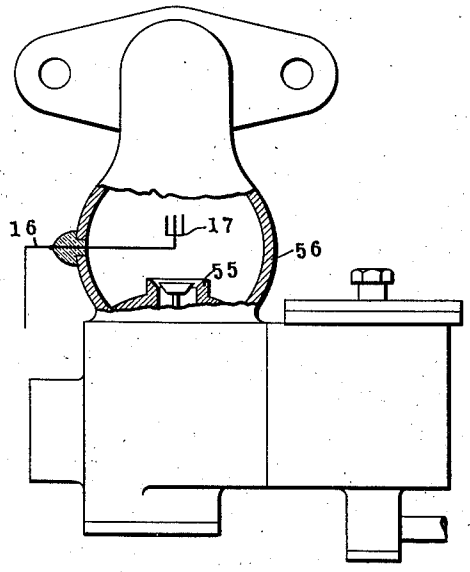


Fig. 6

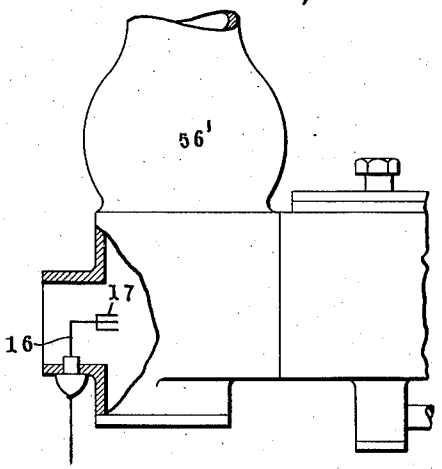


Fig. 7

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UNITED STATES PATENT OFFICE

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ATOMIZING DEVICE FOR INTERNAL-COMBUSTION ENGINES

Application filed March 16, 1925. Serial No. 15,742.

This invention relates to the atomization of fuel for internal combustion engines, and more particularly to atomizing devices adapted for use as an auxiliary in conjunction with the standard equipment of internal combustion engines.

This invention has for its object generally an improved construction and arrangement of parts of the character referred to, which is efficient, economical and readily manufactured.

More specifically an object of the invention is to provide an arrangement of parts adapted to sustain a relatively high degree of atomization of fluid fuels, particularly hydrocarbons such as are commonly supplied for combustion purposes in internal combustion engines.

Another object is to provide an arrangement of apparatus adapted for use as an auxiliary for effecting the maintenance of a relatively high degree of atomization of fluid fuels, particularly hydrocarbons over a comparatively large range of gravities, thereby making available for fuel purposes in internal combustion engines fluid fuels of relatively high specific gravities.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 shows, partly in section and partly diagrammatically, an arrangement of parts constructed in accordance with the invention;

Fig. 2 shows mainly diagrammatically an arrangement embodying a modification of the invention shown in Fig. 1;

Fig. 3 shows still another modification adapted for use in conjunction with Diesel-type internal combustion engines;

Figs. 4 and 5 show still further modifications for use in connection with four-cycle internal combustion engines; while

Figs. 6 and 7 show modifications adapted for use in conjunction with carburetors commonly employed with four-cycle internal combustion engines.

Referring now to the drawing and particularly to Fig. 1, 10 denotes the cylinder of an internal combustion engine having an intake connection 11 and an exhaust connection 12. The intake connection is adapted to be supplied with a fuel mixture, for example a mixture of air and an atomized hydrocarbon vapor, through the supply connection shown at 13. Between the intake 11 and the supply connection 13 is disposed a nipple or intermediate connection 14 having an insulating lining 15 through which is carried a properly insulated electrode 16. This electrode as shown has pronged discharge terminals 17. The electrode 16 is connected for an electric discharge of current at a relatively high potential and current density, and arranged so that there is a preponderance of discharged electricity of one polarity over that of the opposite polarity. The preferred arrangement is one employing a unilateral discharge. To this end, the arrangement here shown comprises an alternating current generator 18, having one terminal 19 grounded in any convenient manner, for example, grounded on the end of the exhaust pipe shown at 20. The potential difference maintained across the generator while preferably high, may be as low as 100 volts. In series with the other terminal of the alternating current generator, and leading to the electrode 16, is connected a thermionic discharge tube 21. This thermionic discharge tube 21 has a cathode 22 of the incandescent type, arranged to be heated for electronic discharge from any constant source of E. M. F., for example, the battery shown at 23 connected across the terminals of the cathode filament; in series with the cathode filament is also preferably located a regulating resistance as shown at 24. The anode of the ther-

mionic discharge tube 21 is shown in plate form at 25 and is directly connected to the electrode 16. The alternating current generator is preferably coupled mechanically so as to be actuated when the internal combustion engine is running.

The operation of the invention thus far described is as follows:

The engine having once been started, sets the alternating current generator 18 into operation; the current therefrom is rectified by means of the thermionic discharge tube 21 so that a unilateral discharge of sufficient magnitude passes from the pointed terminals 17 onto the globules of atomized fuel received from the supply connection 13 into the combustion chamber. The globules of atomized fuel as they pass the discharging terminals 17, thus become electrified with like charges and ionized, and repel one another, so that there is no longer a tendency to coalesce subsequently into large globules under the influence of the compression in the combustion chamber. A high state of atomization is thus sustained substantially until the instant at which combustion takes place. The charges thus attained by the hot gases are dissipated through the cylinder walls or in the exhaust through the grounded connection 19.

In Fig. 2 the means for supplying the electrode 16 with a preponderance of electric charges of one polarity is shown in the form of a high potential direct current magneto 31, i. e., the generated current is mechanically rectified. One brush 32 of the magneto is directly connected to the electrode 16. The other brush 33 is shown as grounded on the exhaust pipe 20.

In the form of the invention shown in Fig. 1, the arrangement of connections is such that a discharge of negative electricity takes place from the pronged terminals 17. This is generally preferable since the negative electricity discharges or leaks off more readily from pronged terminals such as shown at 17, but it is by no means essential, and the connections may be reversed; the direct current magneto shown at 31 may consequently be connected as shown in Fig. 2 irrespective of the polarity of the brushes 32 and 33. Also alternating current source, may in some instances be used without a rectifying means, since the selective leakage may of itself be sufficient to provide the desired preponderance of charges of one polarity. By a suitable choice and arrangement of materials this selective leakage may be made to yield a preponderance of either positive or negative electricity.

In order that some of the charge accumulating on the exhaust pipe 20 shall be readily dissipated to the atmosphere, the exhaust pipe in Fig. 2 is shown as provided with a prong 35. This enables the hot gases issuing therefrom to carry off a portion of the electric charge into the atmosphere. The magneto 31, as indicated in the drawing, is preferably connected to be driven mechanically by the internal combustion engine, for example, through the instrumentality of the belt shown at 36.

In Fig. 4, there is shown still another modification for supplying the electrode 16 in the intermediate connection 14 with a unilateral source of high potential electric current. Such source is here shown as an electrostatic machine, for example, a Wimshurst machine, shown diagrammatically within a casing 37.

The Wimshurst machine is shown as comprising two oppositely rotating discs or cylinders 38 and 39 which carry respectively conducting strips or segments 40 adapted to have charges frictionally produced thereon by means of the brushlike wipers 41 and 42. As indicated, there is a pair of brushlike wipers 41 electrically connected together, but independent of the other pair of brushlike wipers 42; these four brushlike wipers being preferably disposed in respectively different quadrants in order to facilitate the maximum production of frictionally induced electricity. The charges produced are picked up by pairs of oppositely disposed needle-point collectors indicated at 43 and 44 respectively. The collectors 44 are shown as electrically connected through the lead 45 with the electrode 16; the lead 45 passing through an insulating plug 46 in the casing 47. From the collectors 43 a similar lead 47 leads to a ground connection on the frame of the machine at 48. Within the casing 37 is a spark gap, comprising a pair of spaced ball-electrodes 49, which are connected across the collectors 43 and 44. This enables the potential difference across the collectors 43 and 44 to be stabilized and prevents it from exceeding a safe value. The discharge from the Wimshurst machine may be further stabilized by providing condensers to collect the charges connected across the collectors 43 and 44. Such arrangement is preferable, although by no means essential, and is here shown as comprising a pair connected in cascade at 49'. The Wimshurst machine thus arranged is also preferably arranged to be driven by means of a belt indicated at 50 when the internal combustion engine is set into rotation.

In Fig. 5 is illustrated a still further modification in which hydrocarbon vapors are electrified from a frictional source of electricity in a very simple manner, which may be availed of in some instances. Here the connection 14 is shown as provided interiorly with a foraminous member of dielectric material 51. The fuel globules which pass through the passages 52 in the member 51 by frictional contact with the dielectric material generate and pick up a charge, which is here indicated as negative; the positive charge leaking to ground by way of the con-

nection 53. Whether the charge picked up by the fuel globules is plus or minus, however, depends as is readily understood upon the choice of the dielectric material.

In Fig. 6 the electrode 16 is shown as leading directly to the carburetor instead of to an intermediate connection as in the foregoing instances. Here the prong terminals 17 are disposed directly over the spray nozzle 55 in the carburetor 56. In Fig. 7 there is shown still another modification in which the electrode 16 is shown as inserted in the air supply entrance. Here the pronged terminal 17 is arranged to discharge electricity into and ionize the air drawn into the carburetor 56' for combustion purposes.

In Fig. 3 there is shown an adaptation of the invention to Diesel-type engines. Here the pronged discharge terminal 17 is shown as disposed in a small chamber 60 into which the fuel injection nozzle 61 is arranged directly to discharge. By this arrangement, the atomized spray from the fuel injection nozzle, as it passes over the electrode 17, becomes electrified and the globules in consequence repel one another so that they are not likely to coalesce in the highly compressed gas within the combustion chamber 62.

While a pronged discharge terminal has been shown as the preferable form for electrifying the vapor or gas in accordance with this invention, it will be observed that any form of discharge terminal may be employed, for example, rings, discs or balls. These, however, are well known in the electrical art and illustration thereof has been avoided in the interests of clearness.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

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

1. In combination with a source of fuel supply and an ionization chamber connected thereto, of an electrode disposed therein, an insulated wall for said chamber about said electrode and means for placing a proper charge upon said electrode.

2. The combination with a source of vaporized or atomized fuel, a work chamber therefor and a connecting passage therebetween, of means in said passage and insulated therefrom to ionize said vaporized or atomized fuel, and a source of electric current connected thereto, said ionizing means constituting one terminal only of the electrical circuit.

In testimony whereof I affix my signature.

ERWIN HUGH HAMILTON.