A Practical Guide to 'Free Energy' Devices

Part D11: Last updated: 28th July 2006 Author: Patrick J. Kelly

Inert Gas Engines

The Hungarian **Josef Papp** invented an unusual engine system which genuinely appears to be very nearly "fuel-less". His design modifies an existing vehicle engine to operate on a fixed amount of gas. That is to say, the engine has no air intake and no exhaust and consequently, no inlet or exhaust valves. The engine cylinders contain a mixture of gasses which have an Atomic Number below 19, specifically, 36% helium, 26% neon, 17% argon, 13% krypton, and 8% xenon by volume. The control system causes the contained gas to expand to drive the pistons down the cylinders and then contract to suck the pistons back up the cylinders. This effectively converts the engine into a one-stroke version where there are two power strokes per revolution from every cylinder.

Suitable engines must have an even number of cylinders as they operate in pairs. Josef's first prototype was a four-cylinder, 90 horsepower Volvo engine. He removed the intake and exhaust components and replaced the engine head with his own design. During a thirty-five minute test in a closed room, the engine generated a constant 300 horsepower output at 4,000 rpm. The electrical power needed to run the engine was produced by the standard engine alternator, which was also able to charge the car battery at the same time. Interestingly, an engine of this type, quite apart from having zero pollution emissions (other than heat), is quite capable of operating under water.

Josef, a draftsman and ex-pilot, emigrated from Hungary to Canada in 1957 where he lived until his death from cancer in April 1989. There is solid evidence that Josef built an engine of over 100 horsepower (75 kilowatts) that was "fuelled" by a mixture of inert (or "noble") gases. With no exhaust or cooling system, it had huge torque even at low rpm (776 foot-pounds at only 726 rpm in one certified test). Dozens of engineers, scientists, investors and a Federal judge with an engineering background saw the engine working in closed rooms for hours. This would not have been possible if the engine had been using fossil fuel. There was absolutely no exhaust and no visible provision for any exhaust. The engine ran cool at about 60°C (140°F) on its surface, as witnessed by several reliable observers. All these people became convinced of the engine's performance. They all failed to discover a hoax. Ongoing research in the United States (totally independent of Papp) has proved conclusively that inert gases, electrically triggered in various ways, can indeed explode with fantastic violence and energy release, melting metal parts and pushing pistons with large pressure pulses. Some of the people performing this work, or who have evaluated it, are experienced plasma physicists. Contemporary laboratory work has established that inert gases can be made to explode

In a demonstration on 27th October 1968 in the Californian desert, Cecil Baumgartner, representing the top management of the TRW aerospace corporation and others witnessed the detonation of one of the engine cylinders. In full public view, just a few cubic centimetres of the inert gas mixture was injected into the cylinder using a hypodermic needle. When the gas was electrically triggered, the thick steel walls of the cylinder were burst open in a dramatic way. William White, Edmund Karig, and James Green, observers from the Naval Underseas Warfare Laboratory had earlier sealed the chamber so that Papp or others could not insert explosives as part of a hoax. In 1983, an independent certification test was carried out on one of the Papp engines.

Joseph Papp was issued three United States patents for his process and engines:

U.S. 3,680,431 on 1st August 1972 "Method and Means for Generating Explosive Forces" in which he states the general nature of the inert gas mixture necessary to produce explosive release of energy. He also suggests several of the triggering sources that may be involved. It appears that Papp is not offering full disclosure here, but there is no doubt that others who have examined this patent and followed its outline have already been able to obtain explosive detonations in inert gases. Caution: Anyone who tries to duplicate this process must be very careful about safety issues.

U.S. 3,670,494 on 20th June 1972 "Method and Means of Converting Atomic Energy into Utilisable Kinetic Energy" and

U.S. 4,428,193 on 31st January 1984 "Inert Gas Fuel, Fuel Preparation Apparatus and System for Extracting Useful Work from the Fuel". This patent shown here, is very detailed and provides information on building and operating engines of this type. It also gives considerable detail on apparatus for producing the optimum mixture of the necessary gasses.

At the time of writing, a web-based video of one of the Papp prototype engines running on a test bed, can be found at http://video.google.com/videoplay?docid=-2850891179207690407 although it must be said that a good deal of the footage is of very poor quality, having been taken many years ago. The video is particularly interesting in that some of the demonstrations include instances where a transparent cylinder is used to show the energy explosion. Frame-by-frame operation on the original video shows energy being developed outside the cylinder as well as inside the cylinder.

It is not clear where the excess energy is coming from. It may be Radiant Energy or it may be some form of nuclear energy or perhaps, something entirely different. In the video, one presenter states that the engine is entirely safe and it produces no harmful radiation at all. However, it should be noted that Josef Papp died of colon cancer, and it has been suggested by some, that the cancer was caused by his standing beside the engine for lengthy periods when it was running.

I have recently been contacted by one man who attended some of the engine demonstrations run by Papp and he vouches for the fact that the engine performed exactly as described.

US Patent 4,428,193 **31st January 1984** **Inventor: Josef Papp**

INERT GAS FUEL, FUEL PREPARATION APPARATUS AND SYSTEM FOR EXTRACTING USEFUL WORK FROM THE FUEL

ABSTRACT

An inert gas fuel consisting essentially of a precise, homogeneous mixture of helium, neon, argon, krypton and xenon. Apparatus for preparing the fuel includes a mixing chamber, tubing to allow movement of each inert gas into and through the various stages of the apparatus, a plurality of electric coils for producing magnetic fields, an ion gauge, ionises, cathode ray tubes, filters, a polarise and a high frequency generator. An engine for extracting useful work from the fuel has at least two closed cylinders for fuel, each cylinder being defined by a head and a piston. A plurality of electrodes extend into each chamber, some containing low level radioactive material. The head has a generally concave depression facing a generally semi-toroidal depression in the surface of the piston. The piston is axially movable with respect to the head from a first position to a second position and back, which linear motion is converted to rotary motion by a crankshaft. The engine's electrical system includes coils and condensers which circle each cylinder, an electric generator, and circuitry for controlling the flow of current within the system.

BACKGROUND OF THE INVENTION

This invention relates to closed reciprocating engines, i.e., ones which do not require an air supply and do not emit exhaust gases, and more particularly to such engines which use inert gases as fuel. It also concerns such inert gas fuels and apparatus for preparing same.

Currently available internal combustion engines suffer from several disadvantages. They are inefficient in their utilisation of the energy present in their fuels. The fuel itself is generally a petroleum derivative with an ever-increasing price and sometimes limited availability. The burning of such fuel normally results in pollutants which are emitted into the atmosphere. These engines require oxygen and, therefore, are particularly unsuitable in environments, such as underwater or outer space, in which gaseous oxygen is relatively unavailable. Present internal combustion engines are, furthermore, relatively complex with a great number of moving parts. Larger units, such as fossil-fuel electric power plants, escape some of the disadvantages of the present internal combustion engine, but not, inter alia, those of pollution, price of fuel and availability of fuel.

Several alternative energy sources have been proposed, such as the sun (through direct solar power devices), nuclear fission and nuclear fusion. Due to the lack of public acceptance, cost, other pollutants, technical problems, and/or lack of development, these sources have not wholly solved the problem.
Moreover, the preparation of fuel for nuclear fission and nuclear fusion reactors has heretofore been a complicated process requiring expensive apparatus.

SUMMARY OF THE INVENTION

Among the several objects of the present invention may be noted the provision of an engine which is efficient; the provision of an engine which does not require frequent refuelling; the provision of an engine which develops no pollutants in operation; the provision of an engine which is particularly suited for use in environments devoid of free oxygen; the provision of an engine which requires no oxygen in operation; the provision of an engine having a relatively small number of moving parts; the provision of an engine of a relatively simple construction; the provision of an engine which can be used in light and heavy-duty applications; the provision of an engine which is relatively inexpensive to make and operate; the provision of a fuel which uses widely available components; the provision of a fuel which is relatively inexpensive; the provision of a fuel which is not a petroleum derivative; the provision of relatively simple and inexpensive apparatus for preparing inert gases for use as a fuel; the provision of such apparatus which mixes inert gases in precise, predetermined ratios; and the provision of such apparatus which eliminates contaminants from the inert gas mixture. Other objects and features will be in part apparent and in part pointed out hereinafter.

Briefly, in one aspect the engine of the present invention includes a head having a generally concave depression in it, the head defining one end of a chamber, a piston having a generally semi-toroidal depression in its upper surface, the piston defining the other end of the chamber, and a plurality of electrodes extending into the chamber for exciting and igniting the working fluid. The piston can move along its axis towards and away from the head, causing the volume of the chamber to alter, depending on the position of the piston relative to the head.

In another aspect, the engine of the present invention includes a head which defines one end of the chamber, a piston which defines the other end of the chamber, a plurality of magnetic coils wound around the chamber for generating magnetic fields inside the chamber, and at least four electrodes extending into the chamber for exciting and igniting the working fluid. The magnetic coils are generally coaxial with the chamber. The electrodes are generally equidistantly spaced from the axis of the chamber and are each normally positioned 90 degrees from the adjacent electrodes. Lines between opposed pairs of electrodes intersect generally on the axis of the chamber to define a focal point.

In a further aspect, the engine of the present invention includes a head which defines one end of a chamber, a piston which defines the other end of the chamber, at least two electric coils wound around the chamber for generating magnetic fields inside the chamber, and a plurality of electrodes extending into the chamber for exciting and igniting the working fluid. The electric coils are generally coaxial with the chamber. And the working fluid includes a mixture of inert gases.

The apparatus of the present invention for preparing a mixture of inert gases for use as a fuel includes a chamber, electric coils for generating predetermined magnetic fields inside the chamber, tubing adapted to be connected to sources of preselected inert gases for flow of the gases from the sources to the chamber, and ionisers for ionising the gases.

The fuel of the present invention includes a mixture of inert gases including approximately 36% helium, approximately 26% neon, approximately 17% argon, approximately 13% krypton, and approximately 8% xenon by volume.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a side elevation of an engine of this invention:
Fig.2 is a rear elevation of an engine of this invention:

FIG.1

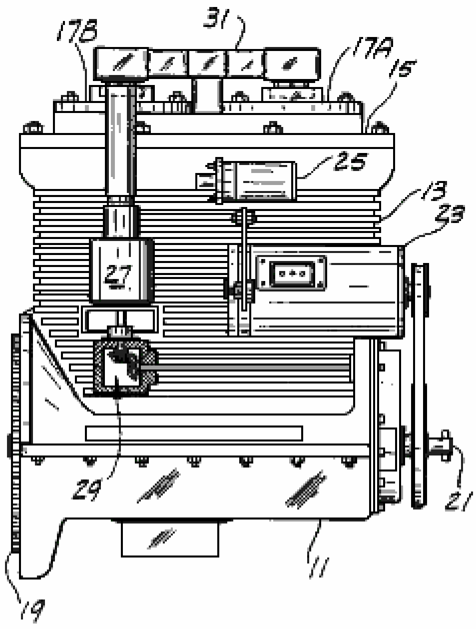


FIG.2

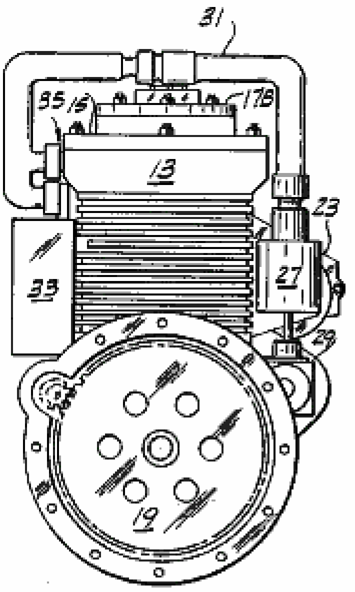


Fig.3 is a top plan of an engine of this invention:

FIG.3

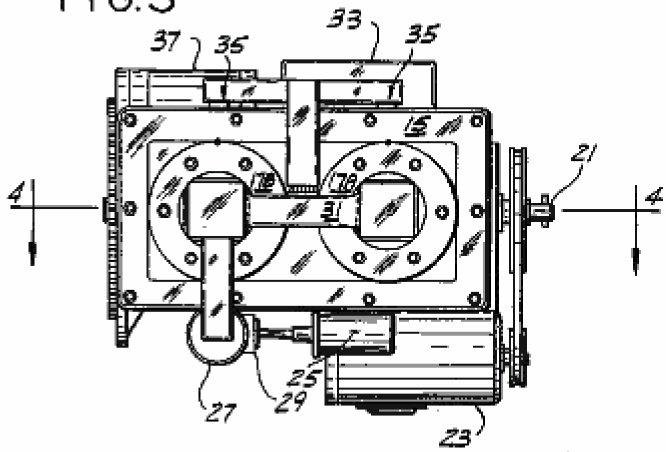


Fig.4 is a cross-sectional view generally along line **4--4** of **Fig.3** of an engine of this invention:

FIG. 4

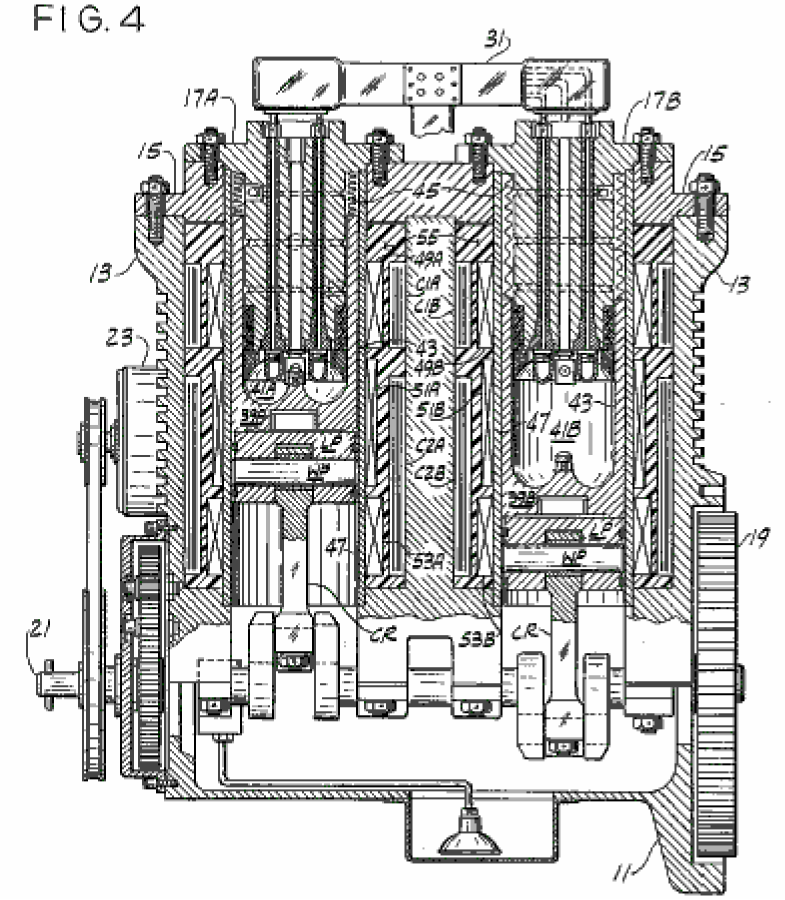


Fig.5 is a cross-sectional view of a cylinder of an engine of this invention:

FIG.5

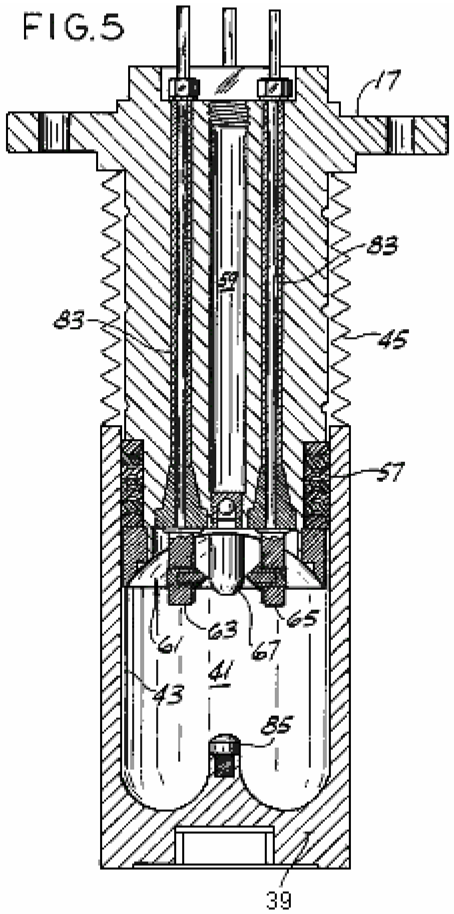


Fig.6 is a plan of the base of a cylinder head of an engine of this invention:

FIG.6

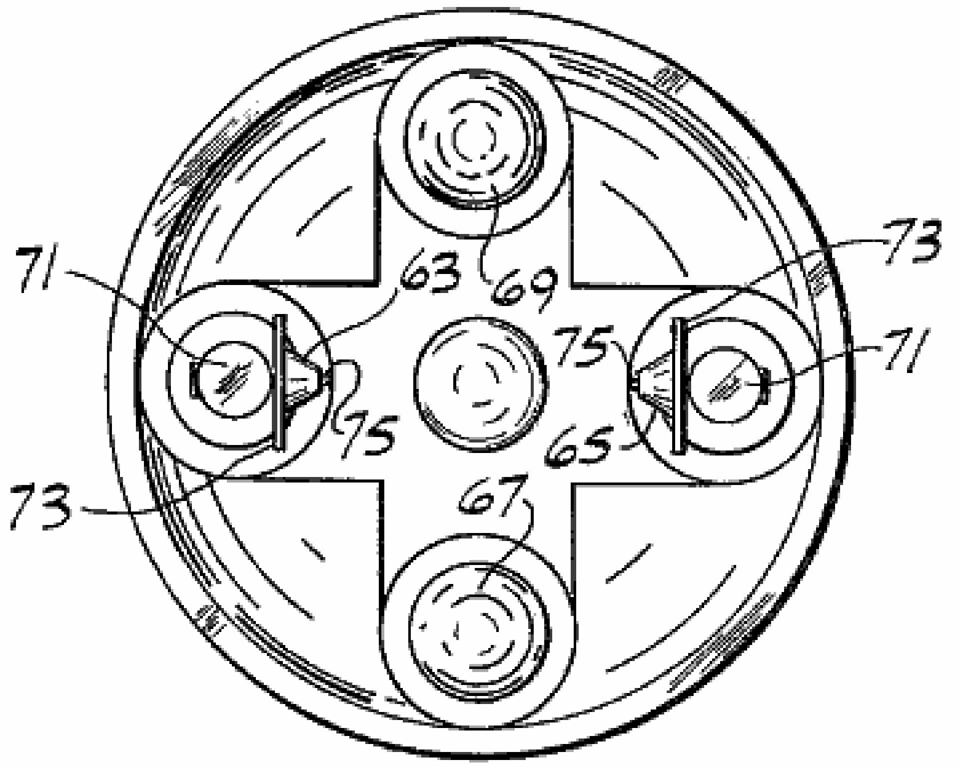


Fig.7 is an elevation of an electrode rod of an engine of this invention:

FIG.7

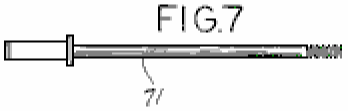


Fig.8 is an elevation, with parts broken away, of one type of electrode used in an engine of this invention:

FIG. 8

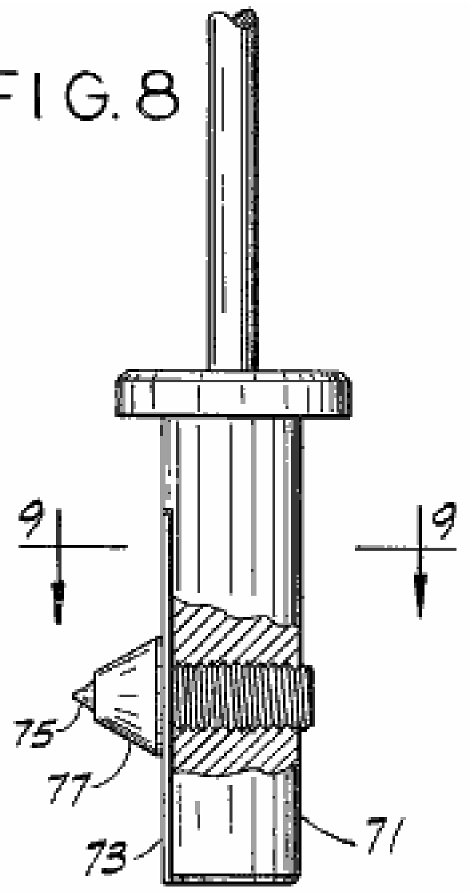


Fig.9 is a view taken generally along line **9--9** of **Fig.8**:

FIG.9

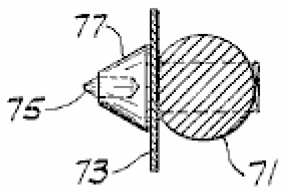


Fig.10 is a cross-sectional view of a second type of electrode used in an engine of this invention:

FIG.10

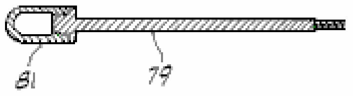


Fig.11 is a cross-sectional view similar to **Fig.5** showing the piston in its uppermost position:

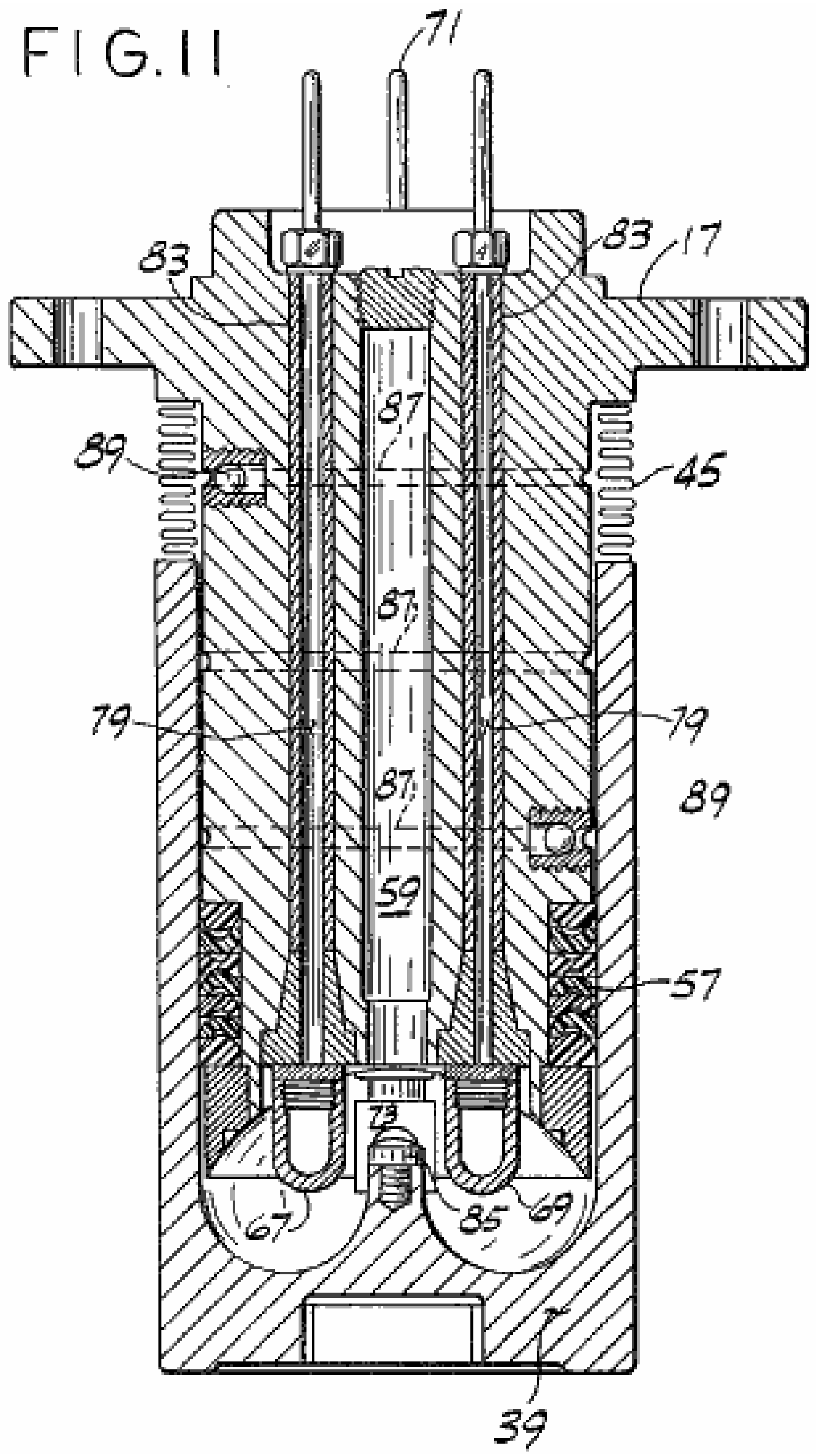


Fig.12 is a cross-sectional view similar to **Fig.5** showing an alternative cylinder used in an engine of this invention:

FIG.12

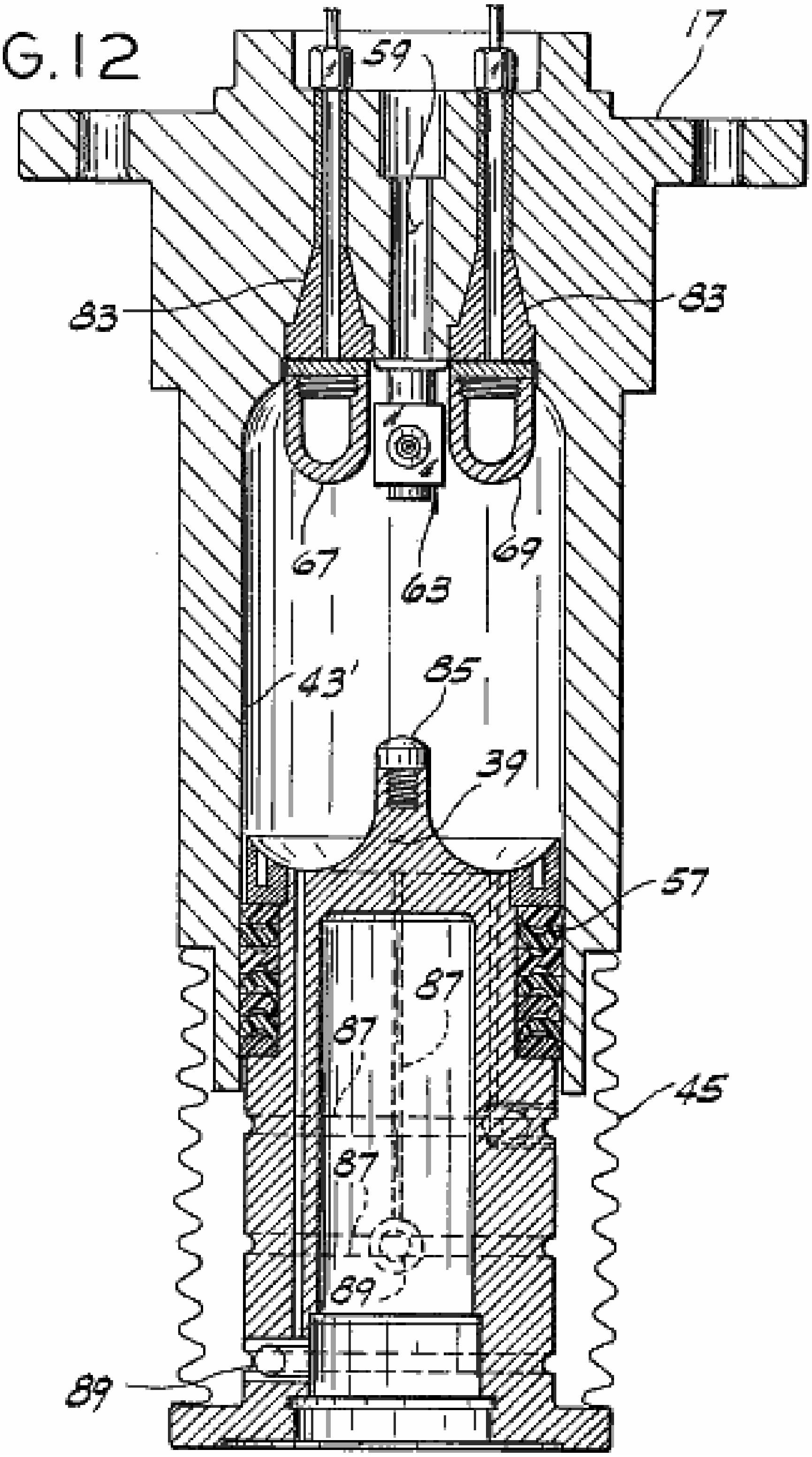


Fig.12A is a cross-sectional view similar to **Fig.5** and **Fig.12**, but on a reduced scale and with parts broken away, showing an additional embodiment of a cylinder head used in an engine of this invention:

FIG.12A

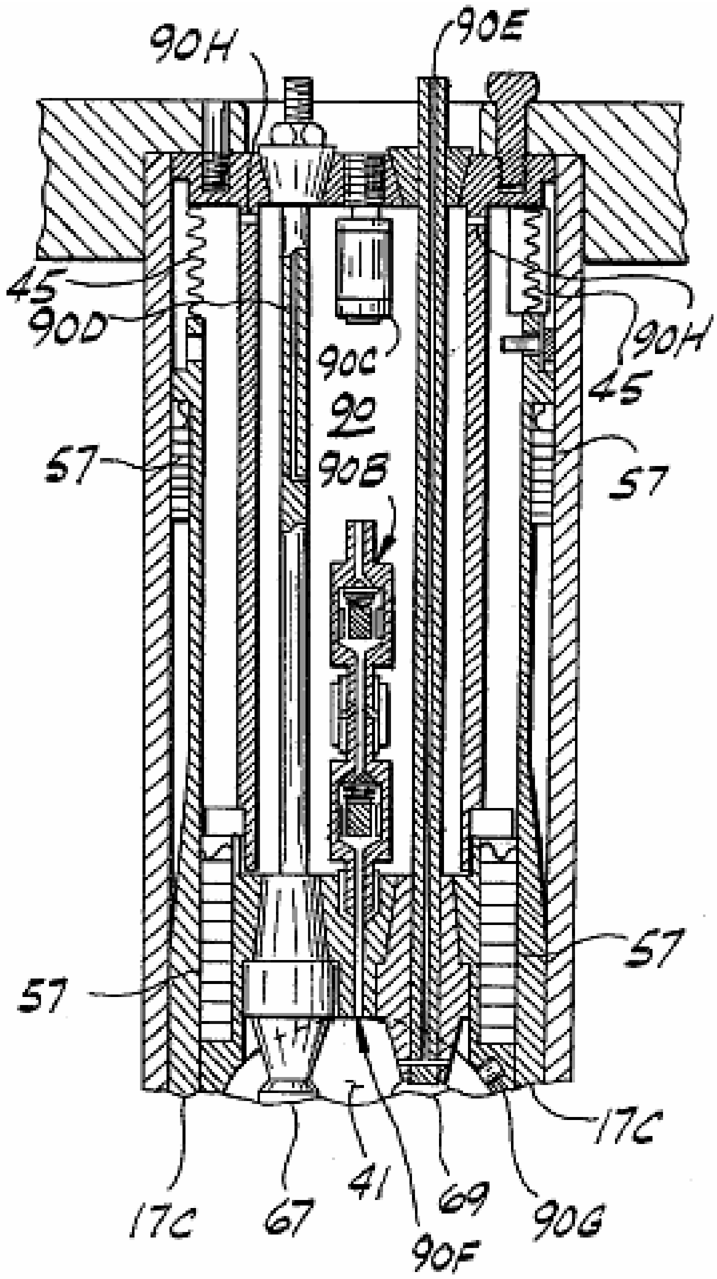


Fig.13A and **Fig.13B** are schematic diagrams of the electrical circuitry for an engine of this invention:

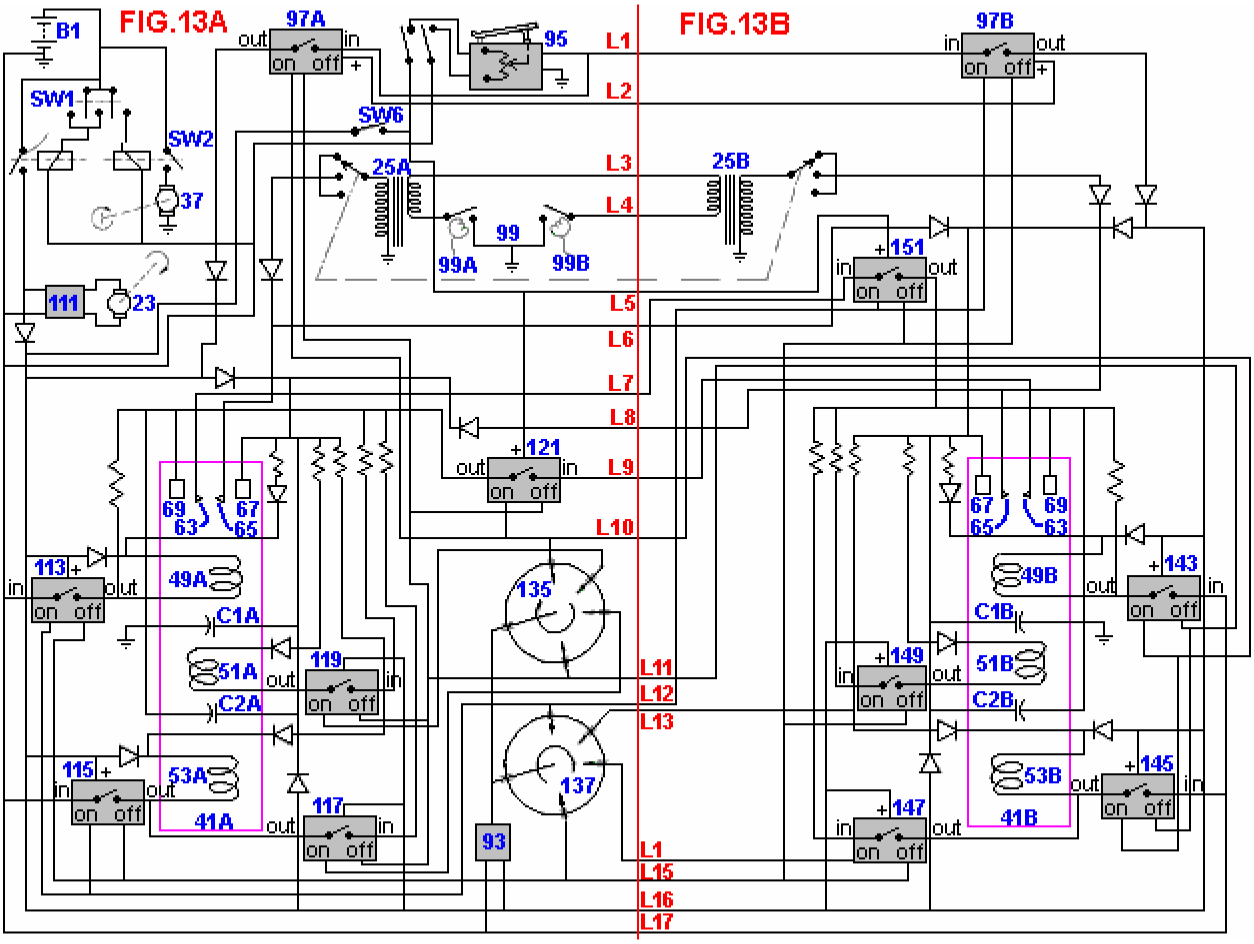


Fig.14 is a schematic diagram of an alternative high-voltage ignition system for an engine of this invention:

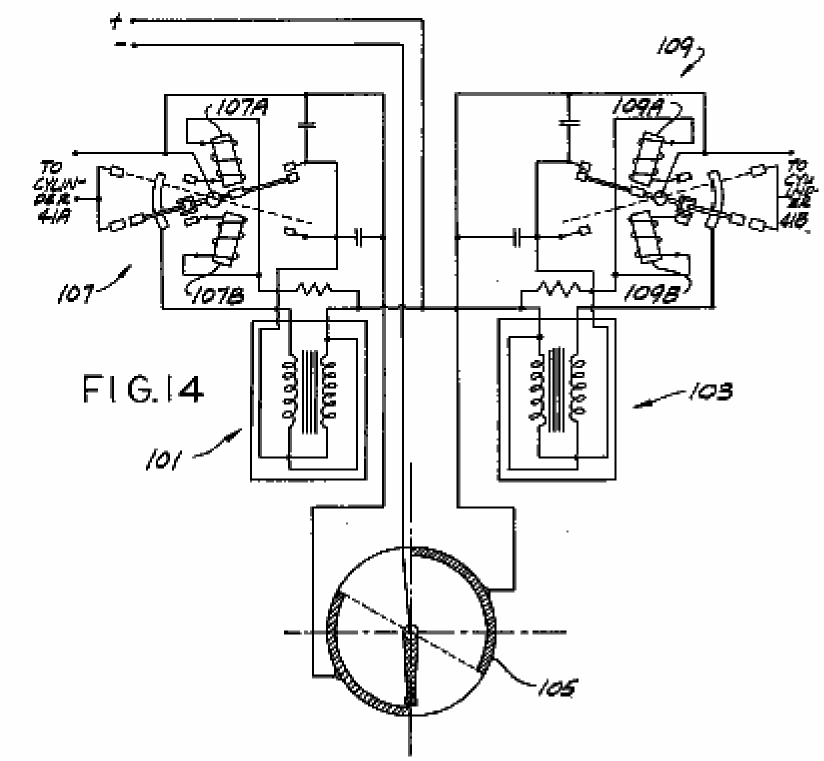


Fig.15 is a schematic diagram of an electronic switching unit for an engine of this invention:
Fig.16 is a schematic diagram of a regulator/electronic switching unit for an engine of this invention:

FIG.15

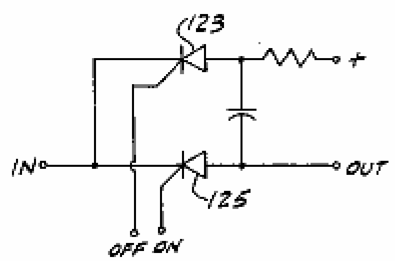
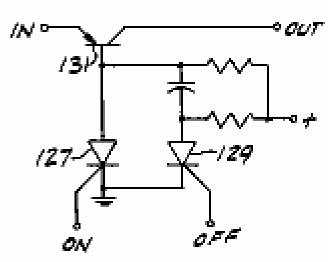
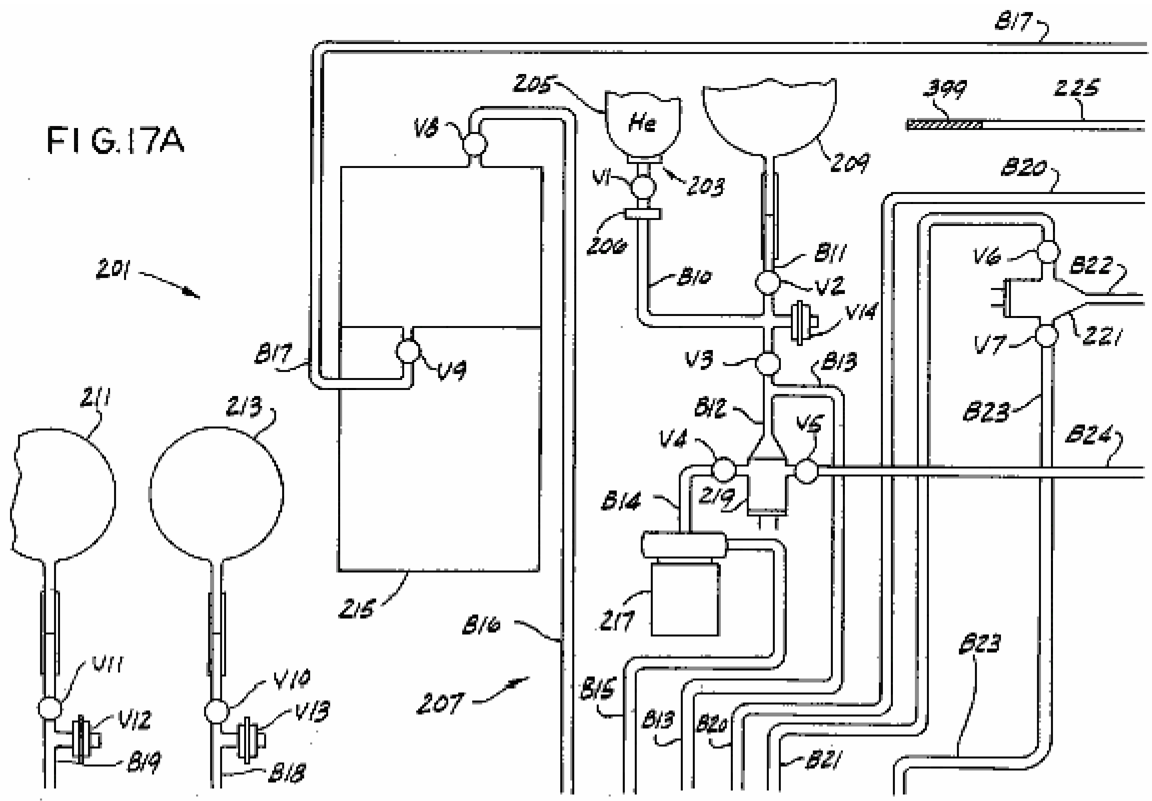


FIG.16



Figs.17A-17D are schematic diagrams of a fuel mixer of the present invention:

FIG.17A



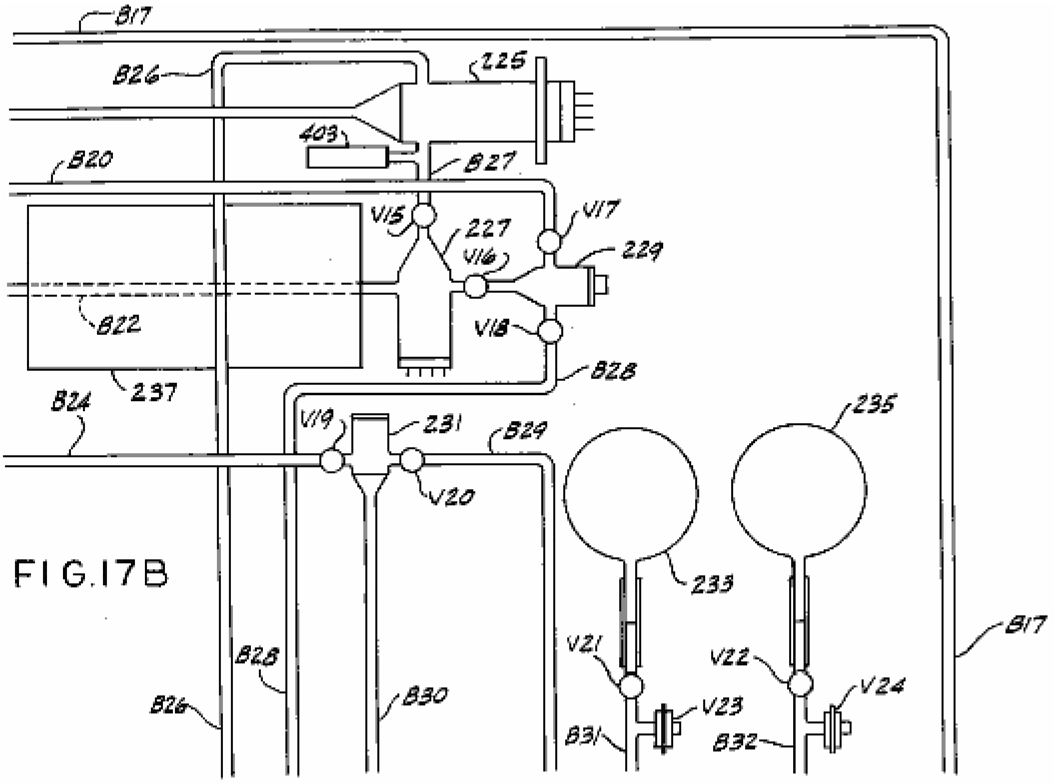


FIG.17B

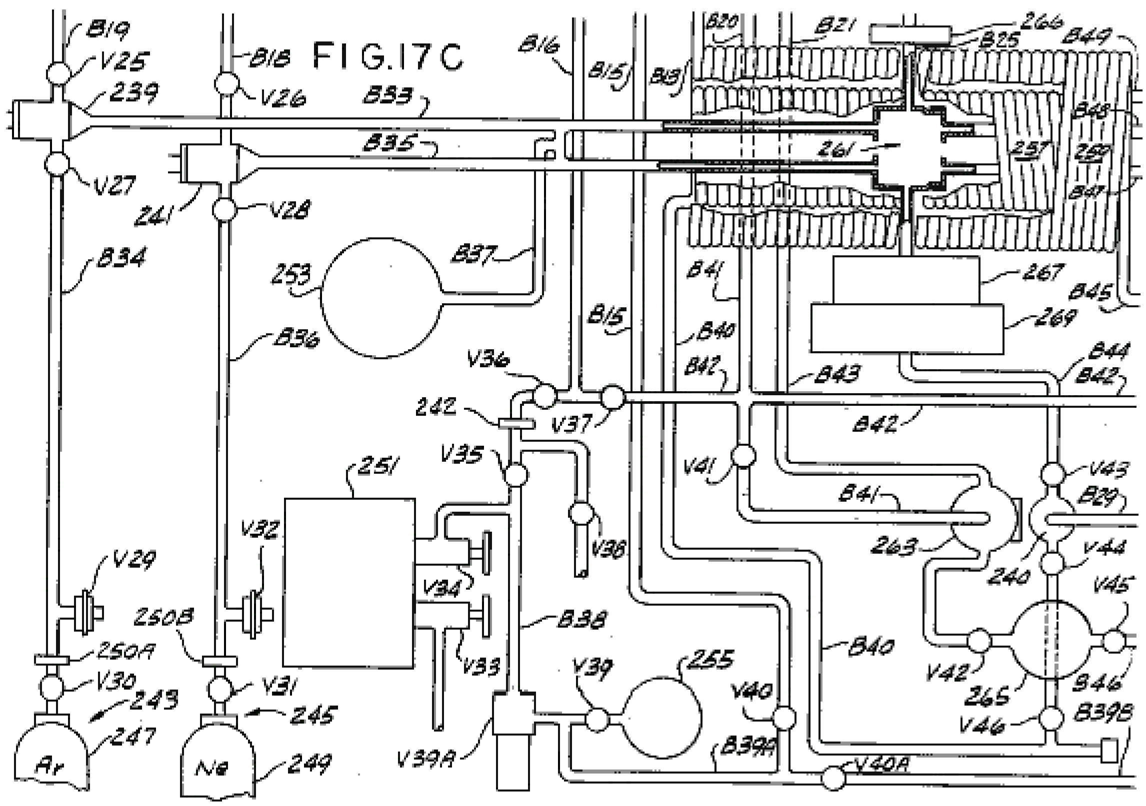


FIG.17C

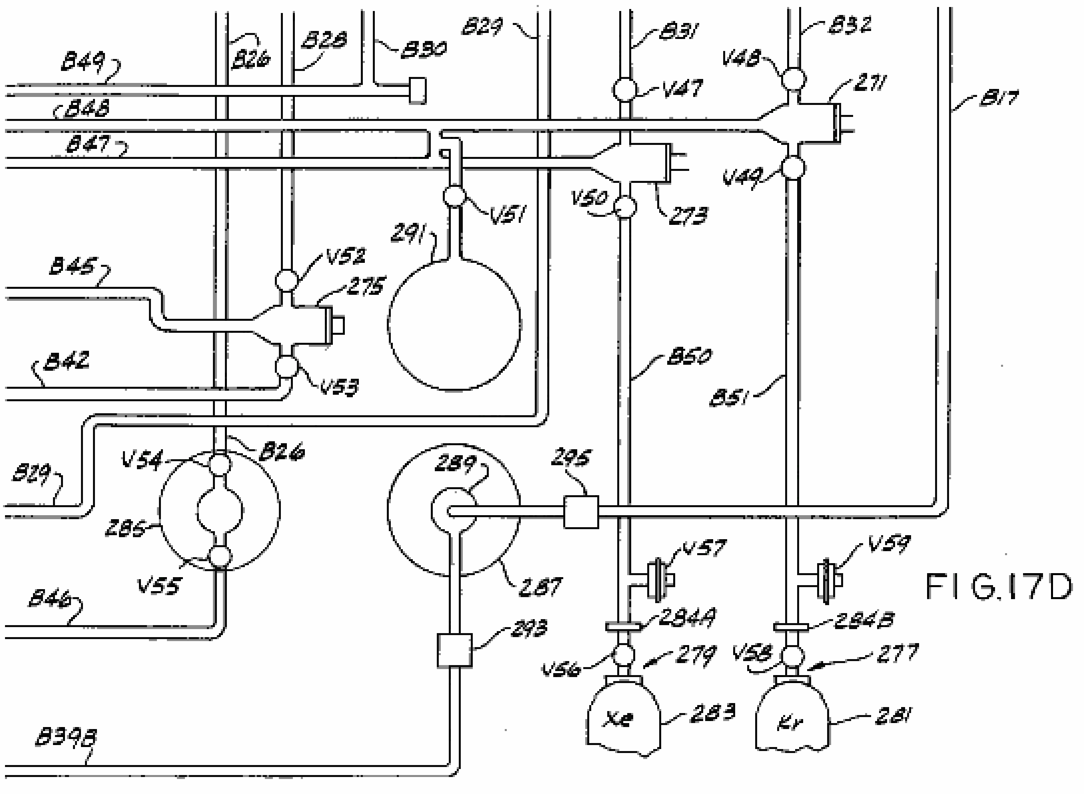
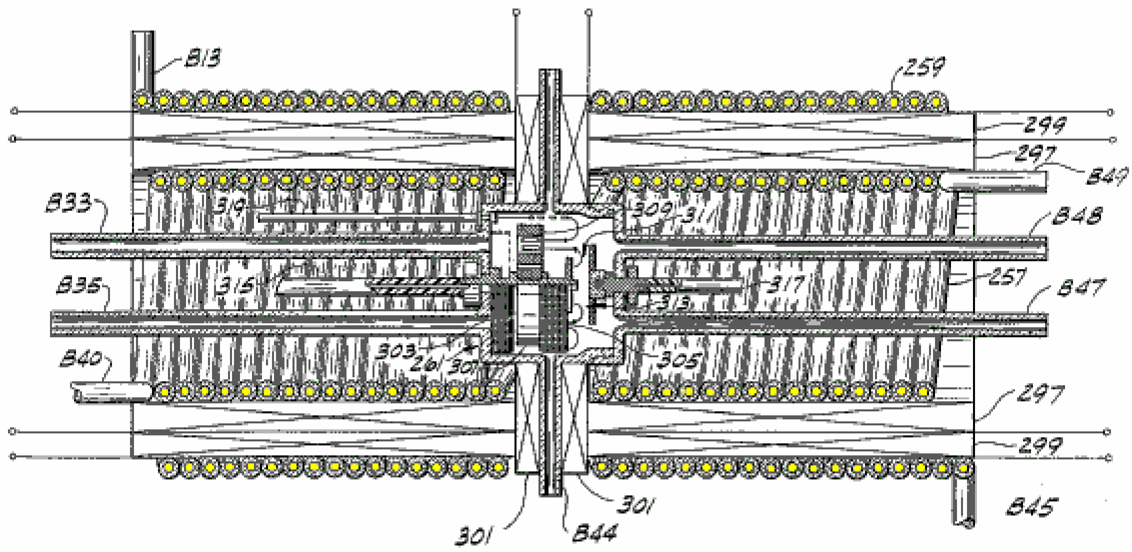


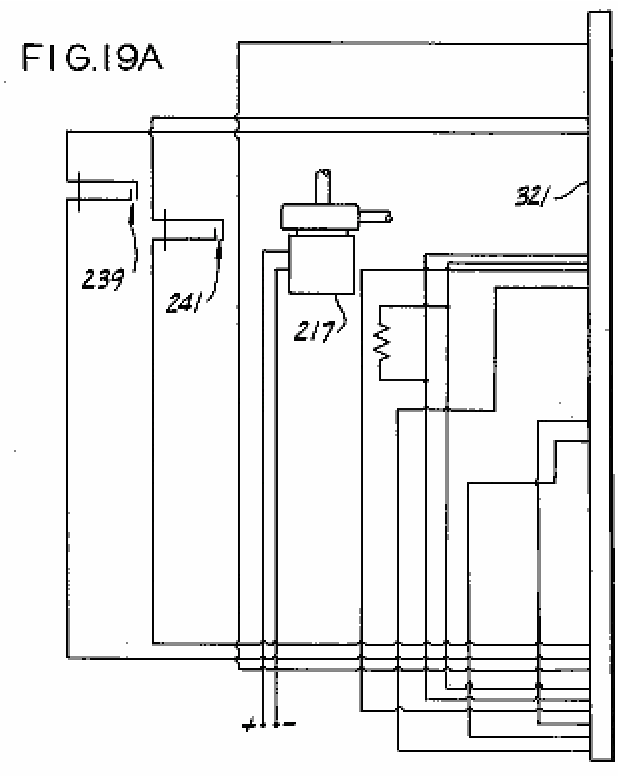
FIG.17D

Fig.18 is a schematic diagram of the mixing chamber portion of the fuel mixer shown in **Figs.17A-17D**:

FIG.18



Figs.19A-19E are schematic diagrams of a portion of the electrical circuitry of the fuel mixer shown in **Figs.17A-17D**:



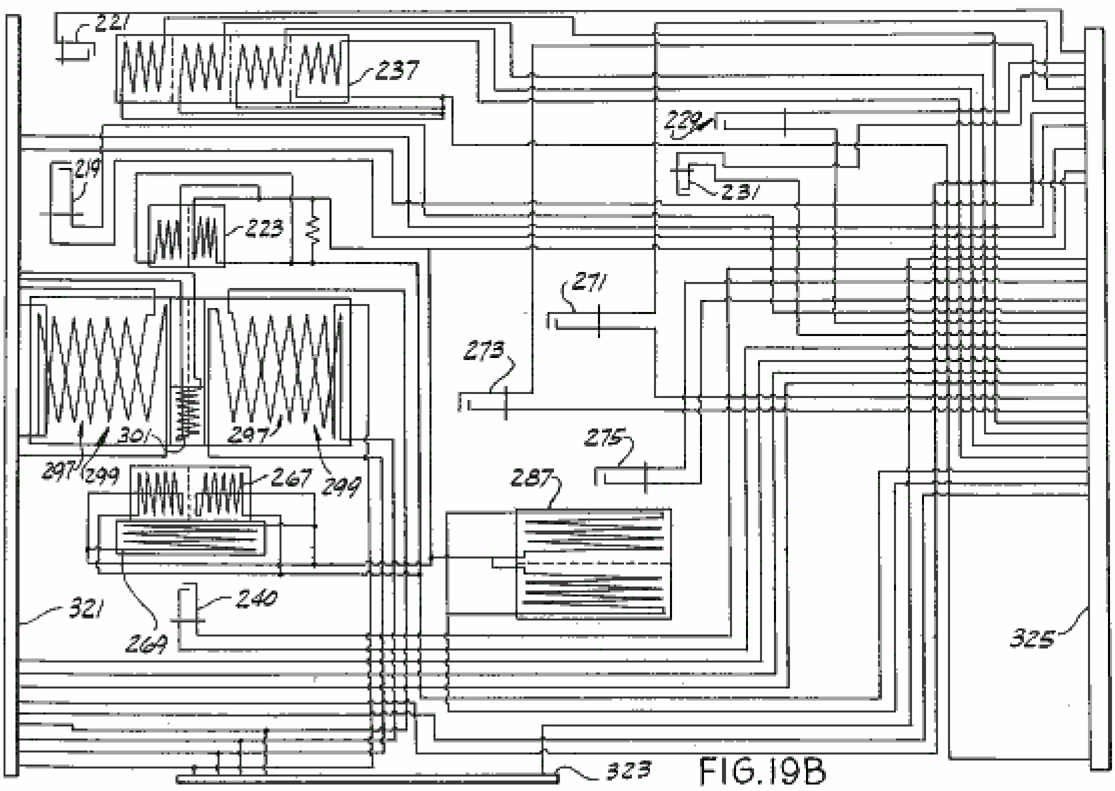
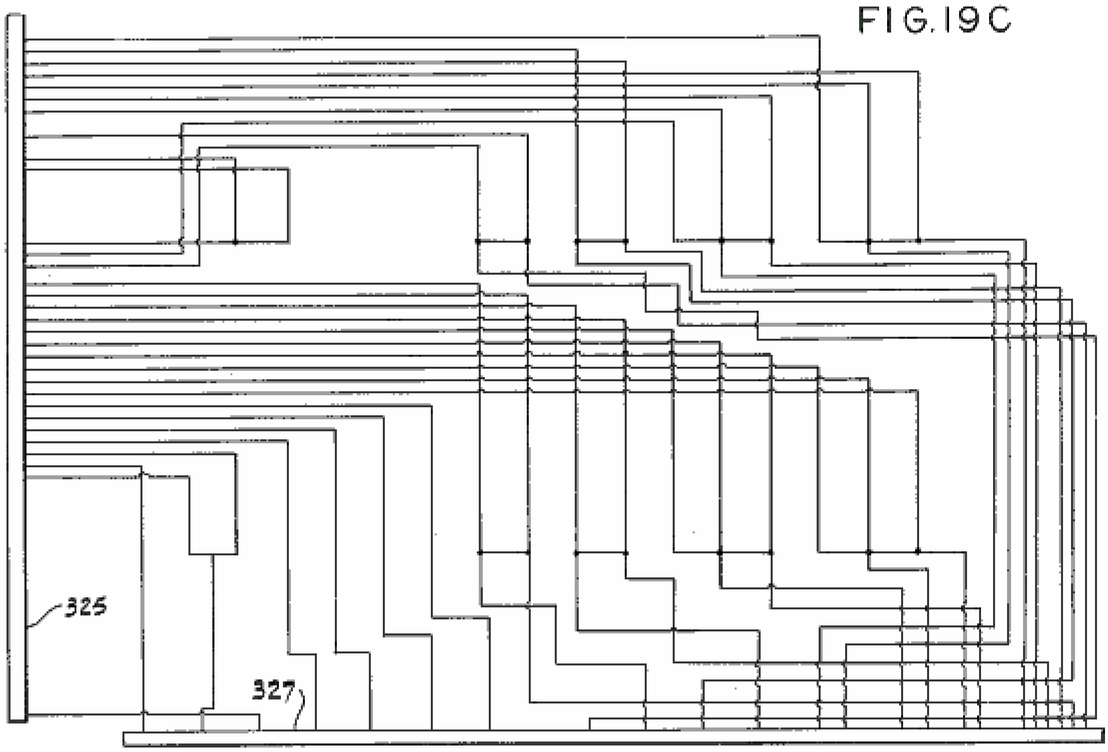


FIG. 19C



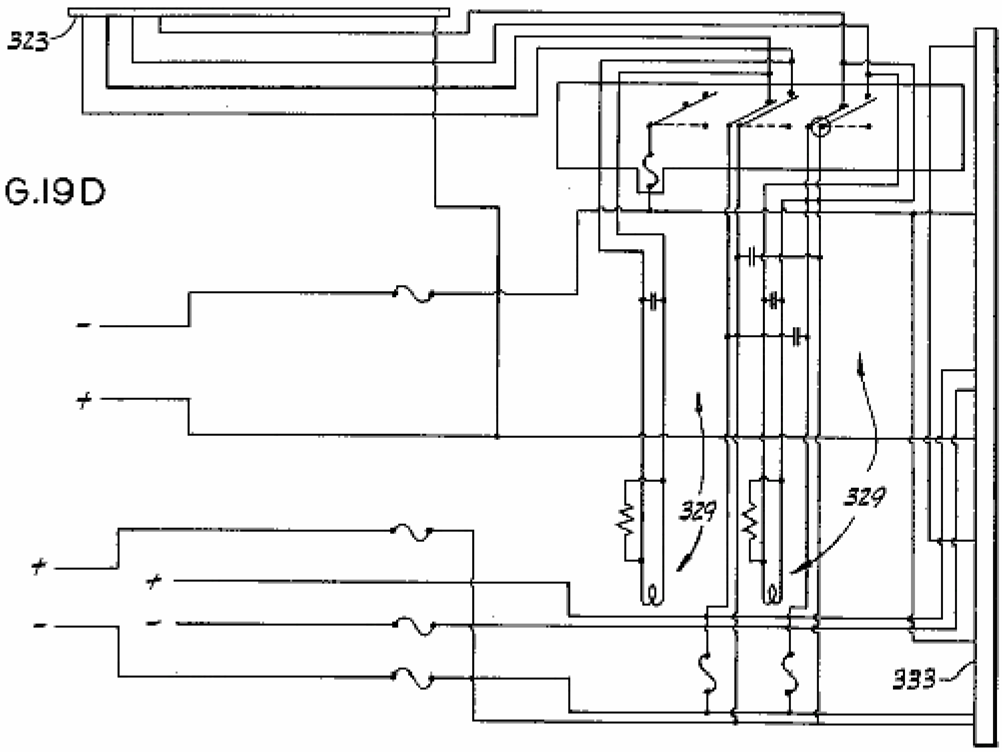


FIG. 19D

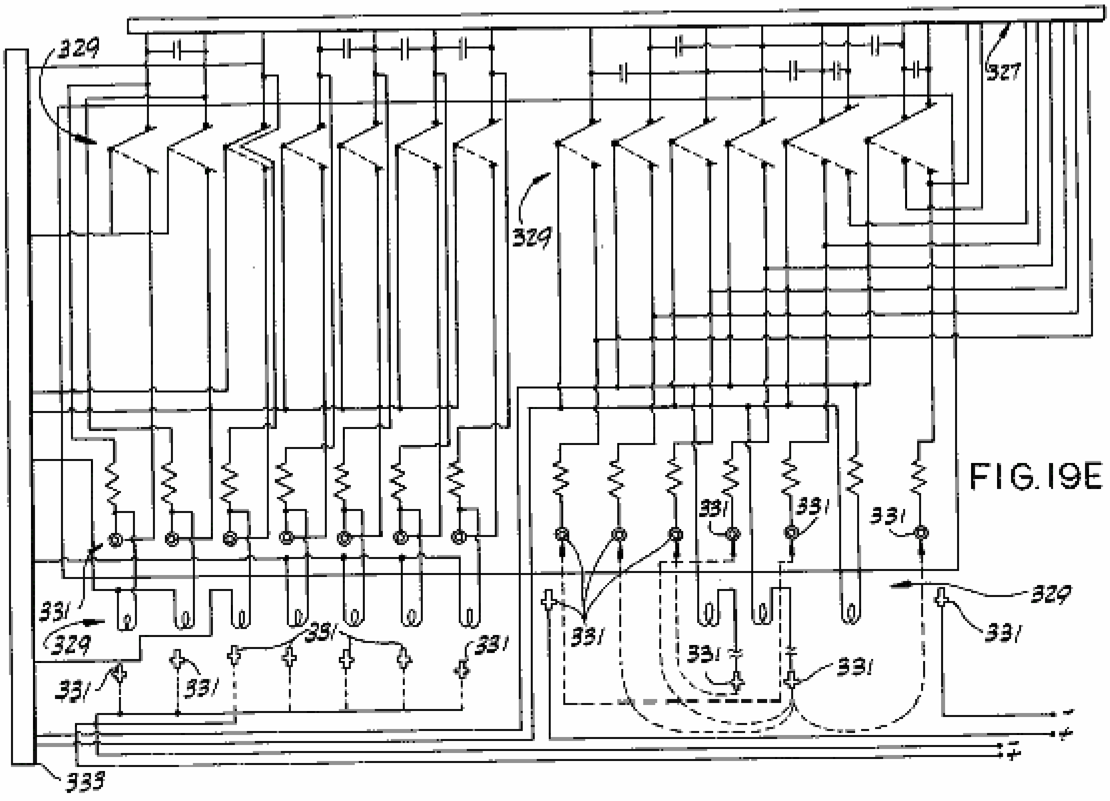


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FIG. 19E

Figs.20A-20F are schematic diagrams of the rest of the electrical circuitry of the fuel mixer shown in **Figs.17A-17D**:

FIG.20A

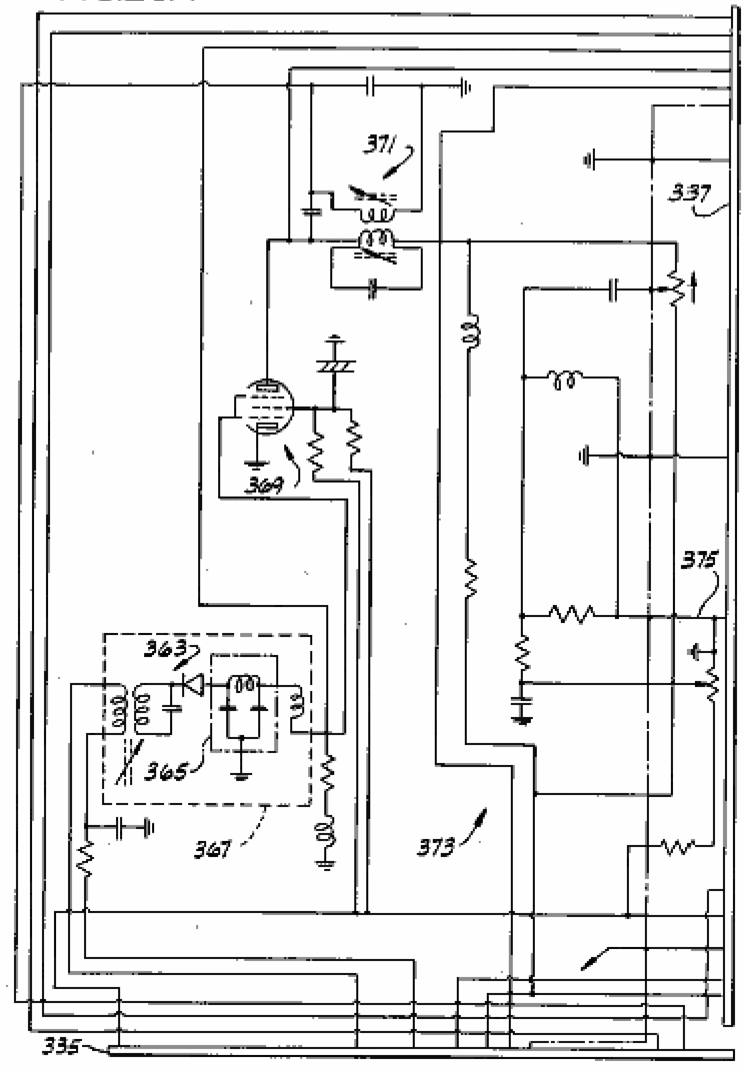


FIG. 20B

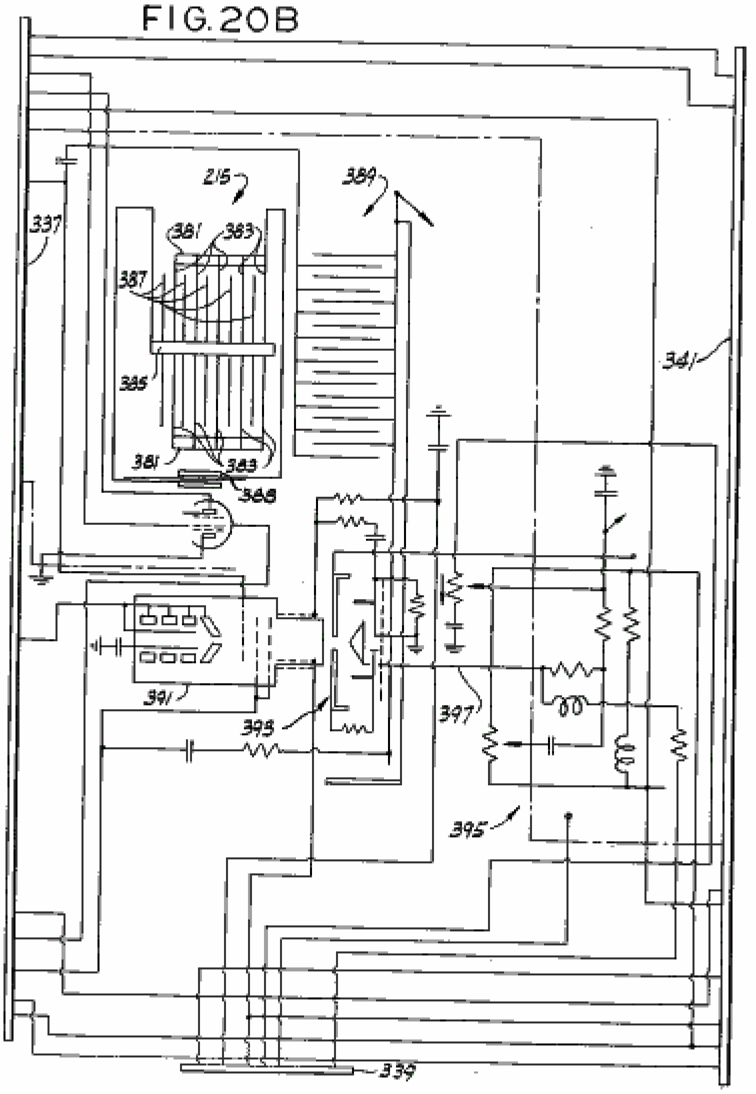
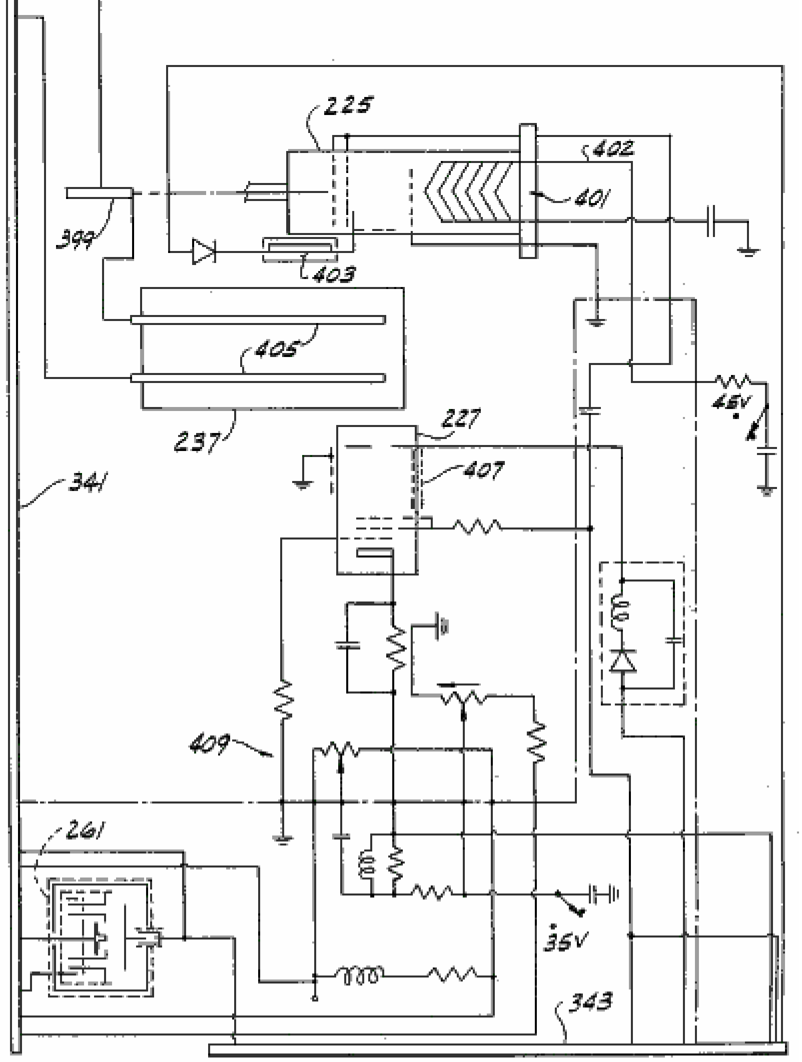


FIG. 20C



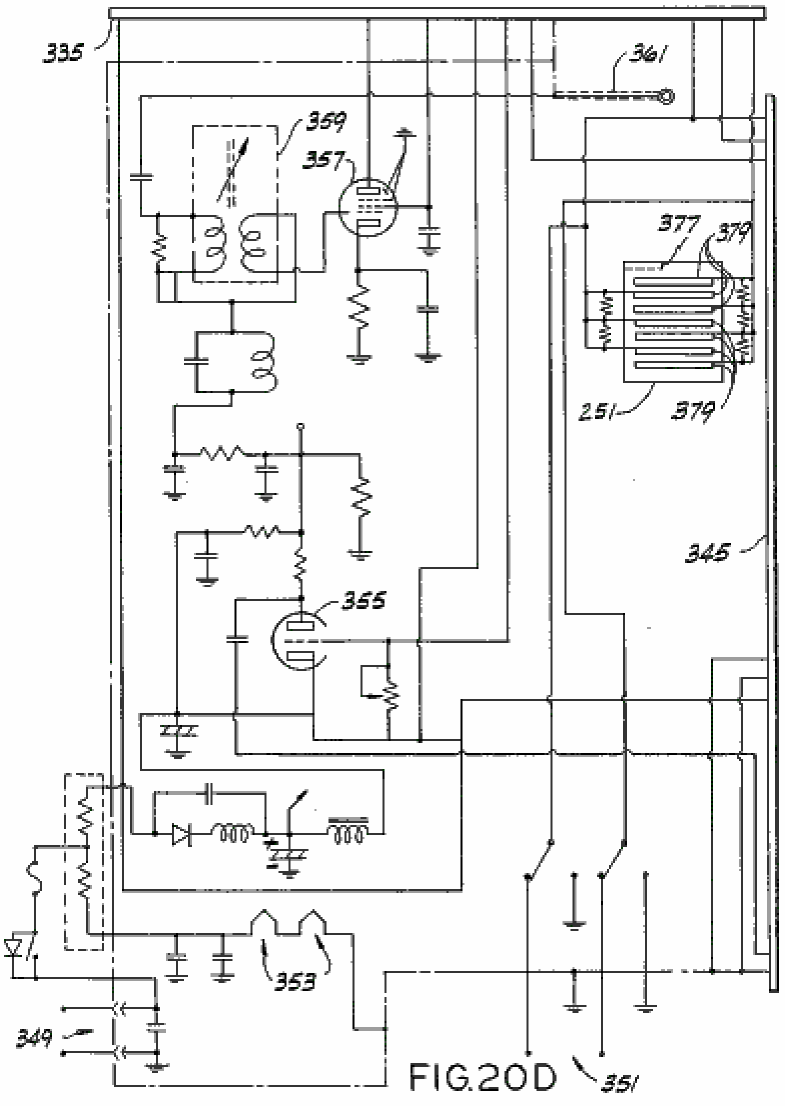
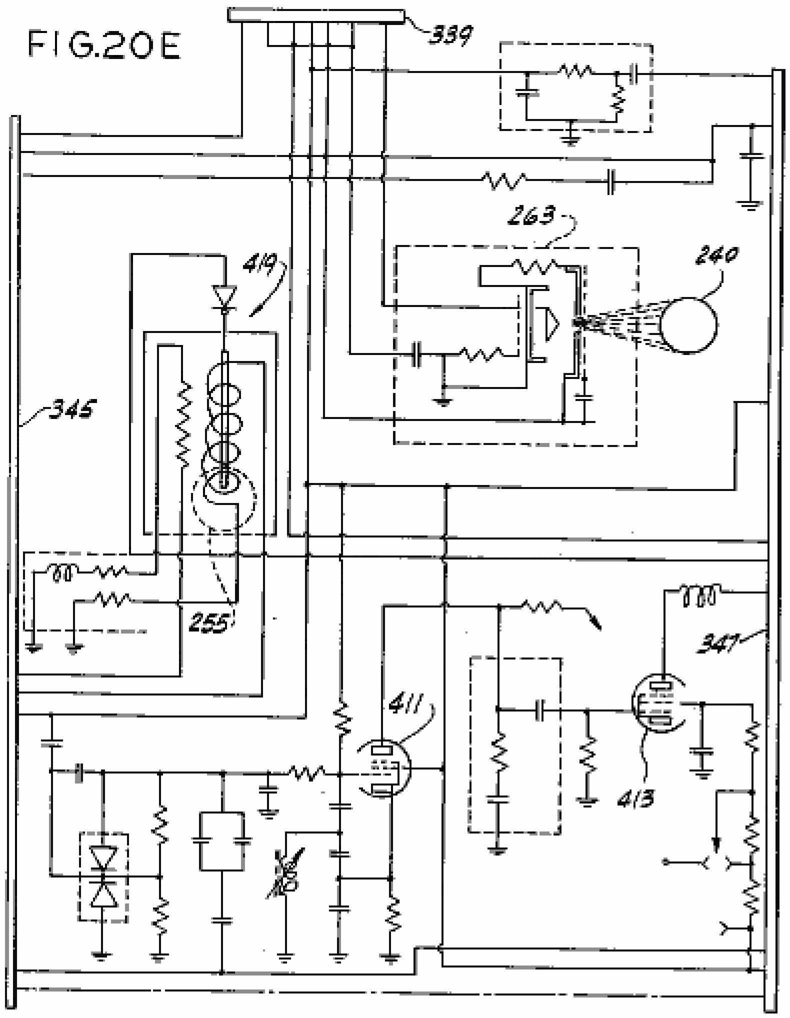


FIG.20D

FIG.20E



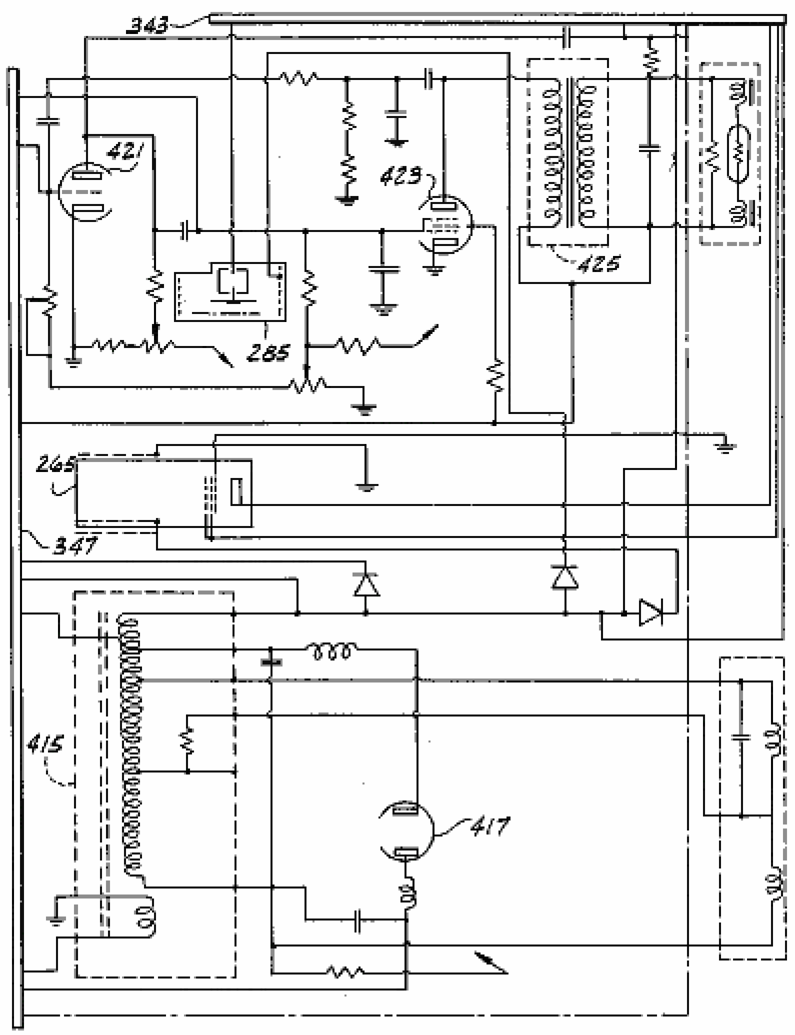


FIG. 20F

Note: Corresponding reference characters indicate corresponding parts throughout all of the views of the drawings.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings, there is shown in **Fig.1** a two-cylinder engine **11** comprising a block **13** preferably of a nonmagnetic material such as aluminium, a nonmagnetic head **15**, and a pair of cylinder heads **17A** and **17B** of a magnetisable material such as 0.1-0.3% carbon steel. Also shown in **Fig.1** is a flywheel **19** attached to a crankshaft **21**, a generator **23**, a high-voltage coil **25**, a distributor **27** attached by a gear arrangement shown in part at **29** to the crankshaft, and an electrical cable **31** which is connected to the distributor and to both cylinders. Cable **31** (see **Fig.2**) is also electrically connected to a switching unit **33** which preferably comprises a plurality of silicon controlled rectifiers (SCRs) or transistors. Also shown in **Fig.2** is a second electrical connection of the cable to the cylinders, which connection is indicated generally at **35**. Turning to **Fig.3**, there is shown a starter motor **37** as well as a clearer view of the connections **35** to each cylinder.

A cross section of the engine is shown in **Fig.4**. The cylinder heads have associated with them, pistons marked **39A** and **39B**, respectively, the heads and pistons define opposite ends of a pair of chambers or cylinders **41A** and **41B** respectively. The pistons are made of a magnetisable material. Although only two chambers are shown, the engine can include any number. It is preferred, however, for reasons set forth below, that there be an even number of cylinders. Pistons **39A** and **39B** move axially with respect to their corresponding heads from a first position (the position of piston **39A** in **Fig.4**) to a second position (the position of piston **39B**) and back, each piston being suitably connected to crankshaft **21**. As shown in **Fig.4**, this suitable connection can include a connecting rod **CR**, a wrist pin **WP**, and a lower piston portion or power piston **LP**. The connecting rods and/or power pistons must be of non-magnetisable material. When a split piston is used, pistons **39A** and **39B** are suitably connected to lower piston portions **LP** by bolting, spring-loaded press fitting, or the like. Pistons **39A** and **39B** are attached 180 degrees apart from each other with respect to the crankshaft so that when one piston is at top dead centre (TDC) the other will be at bottom dead centre (BDC) and vice versa. Additional pairs of cylinders may be added as desired but the pistons of each pair should be attached to the crankshaft 180 degrees from each other. Of course, the relative position of each piston with respect to its respective head determines the volume of its chamber.

Integral with the piston bodies are walls **43** which form the walls of the chambers. Preferably, a set of air-tight bellows **45**, of similar construction to that sold under the designation ME 197-0009-001 by the Belfab Company of Daytona Beach, Fla., are suitably secured between walls **43** and cylinder heads **17A** and **17B** respectively to form an airtight seal between each piston and its cylinder head. While walls **43** and piston **39** can be made of one magnetisable piece, a preferable and more efficient construction has walls **43** separate from piston **39** and made of a non-magnetisable material. The length of time that a given engine will run is a function of the efficacy of its sealing system. Means, such as bellows **45**, for hermetically sealing the cylinders will optimise said length of time. Such a hermetic seal should be secured between walls **43** and cylinder heads **17** to form an airtight seal between them. This seal could be the airtight bellows system shown or some other sealing system such as an oil sealing system.

Cylinder bodies **47** (see **Fig.4**), made of nonmagnetic material such as stainless steel, extend from the point of attachment of each bellows to its cylinder head to the base of the corresponding pistons, forming sleeves for each piston in which each piston moves. Three sets of electric coils **49A, 49B, 51A, 51B**, and **53A, 53B**, are wound around sleeves **47**, and hence around chambers **41A** and **41B**, respectively, for generating magnetic fields in the chambers, those coils being generally coaxial with their respective chambers. Each of these coils has an inductance of approximately 100 mH. It is preferred that 14-19 gauge wire be used to wind these coils and that the coils be coated with a suitable coating, such as #9615 hardener from Furane Plastics, Inc., of Los Angeles, California, or the coating sold by the Epoxylite Corp. of South El Monte, California under the trade designation Epoxylite 8683. Each chamber is also surrounded by a pair of capacitors, **C1A**, **C1B** and **C2A, C2B** wound around it, capacitors **C1A**, **C1B** having a capacitance of approximately 1.3 microfarads and capacitors **C2A, C2B** having a capacitance of approximately 2.2 microfarads. The coils and capacitors are potted in hardened epoxy of fibreglass material **55**. The epoxy resin and hardener sold under the designations EPI Bond 121 and #9615 hardener by Furane Plastics, supra, are satisfactory, but other epoxy material which will remain stable at temperatures up to 200 degrees F would probably also be acceptable. It is preferred that a small amount of graphite such as that sold under the trade designation Asbury 225 by Asbury Graphite, Inc. of Rodeo, Calif., be included in the epoxy potting to prevent nuclear particles formed in the chamber from escaping from the apparatus. Ten to 15% graphite to epoxy by weight is more than enough.

A typical cylinder is shown in section in **Fig.5**, showing the piston in its fully extended position with respect to the head and showing many details on a somewhat larger scale than that of **Fig.4**. A set of seals **57**, made of a material such as that sold under the trade designation Teflon by the DuPont Company of Delaware, is positioned between the cylinder head and wall **43** to prevent escape of the working fluid from chamber **41**. A filler tube **59** with a ball valve at its lower end is used in filling the chamber with the working fluid but is closed during operation of the engine.

The cylinder head has a generally concave depression therein, indicated at **61**, which defines the top end of the chamber. A plurality of electrodes for exciting and igniting the working fluid extend through the cylinder head into the chamber. Two of those electrodes, shown in section in **Fig.5** and labelled **63** and **65**, have tungsten points **75**, while the other two, labelled **67** and **69** (see **Fig.6** for electrode **69**) are containers called, respectively, the anode and the cathode. The electrodes are generally equidistantly spaced from the axes of their chambers and are generally coplanar to each other, their mutual plane being perpendicular to the axes of their chambers. Each electrode is positioned 90 degrees from adjacent electrodes in this embodiment and are generally positioned so that a line from the anode to the cathode and a line between the other two electrodes intersect at a focal point generally on the axis of the chamber. The radial distance of each electrode from the focal point is fixed for a reason discussed below. The general construction of electrodes **63** and **65** is shown in **Fig.6** to **Fig.9**. These electrodes include a conductive rod **71** (see **Fig.7**) preferably of brass or copper; a conductive, generally rectangular plate **73** (see **Fig.6**, **Fig.8** and **Fig.9**); and tungsten point **75** mounted in a conductive base **77** generally at right angles to the plate (see **Fig.8** and **Fig.9**).

The construction of the anode and cathode is shown in **Fig.10**. Each includes a conductive rod **79** and a container **81**. The cathode container is substantially pure aluminium. If desired, aluminium alloys with, e.g., less than 5% copper, 1% manganese and 2% magnesium may be used. In one embodiment, the cathode container contains approximately four grams of thorium-232 and is filled with argon. In this same embodiment the anode container is copper or brass and contains approximately two grams of rubidium-37 and approximately three grams of phosphorus-15 hermetically sealed in mineral oil. In a second embodiment, the cathode is still aluminium, but it contains at least two grams of rubidium-37 in addition to the approximately four grams of thorium-232 in either argon or mineral oil. In this second embodiment, the anode is also aluminium and contains at least 4 grams of phosphorus-15 and at least 2 grams of thorium-232 in argon or mineral oil. Alternatively, mesothorium may be used for the thorium, strontium-38 may be used for the rubidium, and sulphur-16 may be used for the phosphorus. Rods **71** and **79** extend through cylinder head **17** to the exterior where electrical connections are made to the electrodes. Each rod is surrounded by one of four insulating sleeves **83**, the lower portion of each of which being flared outwards to seat firmly in the cylinder head.

The piston has a generally semi-toroidal depression in its upper surface (see **Fig.4**, **Fig.5** and **Fig.11**) and carries a conductive discharge point **85** of copper, brass or bronze generally along the axis of the chamber. When the piston is generally extended, the discharge point is a substantial distance from the electrodes. But when the piston is in its upper position (see **Fig.11**), the discharge point is positioned generally between all four electrodes and close to them, there being gaps between the electrodes and the discharge point. When the piston is in this upper position, the electrodes extend somewhat into the semi-toroidal depression in the piston's upper surface and the chamber is generally toroidal in shape. The volume of the chamber shown in **Fig.11** can be from approximately 6.0 cubic inches (100 cc) or larger. Given the present state of the art, 1500 cubic inches (25,000 cc) appears to be the upper limit. A plurality of ports **87** and one-way valves **89** return working fluid which escapes from the chamber back into it, so long as a sealing system such as bellows **45** is used.

An alternative cylinder head/piston arrangement is shown in **Fig.12**. The main difference between this arrangement and that of **Fig.5** is that the chamber walls, here labelled **43'** are integrally formed with the head. As a result seals **57** are carried by the piston rather than by the head, the attachment of bellows **45** is somewhat different, and the fluid-returning valves and ports are part of the piston rather than of the head. Otherwise these arrangements are substantially the same. Preferably, the cylinders of both arrangements are hermetically sealed.

An additional embodiment of a cylinder head/piston arrangement used in the present invention is shown in **Fig.12A**. In this arrangement, a tapered sleeve **17C** mates between cylinder head **17** and piston **39**, a plurality of seals **57** are provided, and electrodes **67** and **69** have a somewhat different shape. Also, in this embodiment, a chamber **90** is provided in cylinder head **17** for storing additional working fluid, i.e., the purpose of chamber **90** is to extend the operating time between refuelling by circulating the working fluid, viz. the mixture of inert gases described, between cylinder **41** and chamber **90** as needed so that the reactions in cylinder 41 are not adversely affected. To accomplish this, this embodiment further includes a two-way circulation valve **90B**, a relief valve **90C**, and duct or passageway **90D** for evacuating and filling chamber **90**, a duct or passageway **90E** for evacuating and filling cylinder **41**, a passageway **90F** between chamber **90** and cylinder **41** in which two-way valve **90B** is disposed, a sensor **90G** and a plurality of small pressure relief holes **90H**. Relief holes **90H** serve to relieve the pressure on bellows **45** as the piston moves from BDC to TDC.

In larger engines holes **90H** should be replaced with one way valves. Two-way valve **90B** is either controlled by sensor **90G** or is manually operated, as desired, to allow the circulation of gases between chamber **90** and cylinder **41**. The sensor itself detects a condition requiring the opening or closing of valve **90B** and signals that condition to the valve. For example, sensor **90G** can measure pressure in cylinder **41** while the piston is at top dead centre. A predetermined cylinder pressure can cause a spring to compress, causing the valve to open or close as appropriate. A subsequent change in the cylinder pressure would then cause another change in the valve. Another sensor (not shown) could measure the physical location of the piston by a physical trip switch or an electric eye, or it could measure angular distance from top dead centre on the distributor or the crankshaft. The sensor must keep the gas pressure in chamber **90** at one atmosphere, plus or minus 5%, and at top dead centre, cylinder **41** should also be at that pressure. If gas is lost from the system, it is more important to maintain the proper pressure in cylinder **41**. Alternatively, a small passage between cylinder **41** and chamber **90** could function in a passive manner to satisfactorily accomplish the same result. From the above, it can be seen that this embodiment utilises the hollowed out centre of the cylinder head for storing additional working fluid, which fluid is circulated between chamber **90** and cylinder **41** through a valve system comprising valve **90B** and sensor **90G** with the moving piston causing the gases to circulate.

The electrical circuitry for engine **11** includes (see **Fig.13A**) a 24 V battery **B1**, an ignition switch **SW1**, a starter switch **SW2**, starter motor **37**, a main circuit switch **SW4**, a step-down transformer **93** (e.g., a 24 V to 3.5 V transformer), a switch **SW6** for supplying power to ignition coil **25** (shown in **Fig.13A** and **Fig.13B** as two separate ignition coils **25A** and **25B**), and various decoupling diodes.

The circuitry of **Fig.13A** also includes a high frequency voltage source or oscillator **95** for supplying rapidly varying voltage through two electronic current regulators **97A, 97B** (see **Fig.13B** for regulator **97B**) to the anode and cathode electrodes of each cylinder, and a high-voltage distributor **99** for distributing 40,000 volt pulses to the cylinders. Distributor **99** has two wipers **99A** and **99B** and supplies three pulses to each cylinder per cycle. Wipers **99A** and **99B** are 180 degrees out of phase with each other and each operates to supply pulses to its respective cylinder from TDC to 120 degrees thereafter. More pulses are desirable and therefore a better distributor arrangement (shown in **Fig.14**) may be used. The arrangement shown in **Fig.14** includes two ignition coils **101**, **103**, a simple distributor **105** and a pair of magnetic ignition circuits **107** and **109**, described below. Of course many other ignition systems could also be developed. For example, a single circuit might be used in place of circuits **107**, **109**, additional induction coils might be added to the ignition coils to assist in starting or a resistor could be added to the ignition coils to ensure a constant 40,000 volt output regardless of engine rpm. Also, a solid-state distributor could be used instead of the mechanical distributor labelled **99**.

Referring back to **Fig.13A**, for engines of more than 1000 hp a high frequency source **95** could be used to control engine RPM. The output frequency is controlled by a foot pedal similar to an accelerator pedal in a conventional vehicle. The output frequency varies through a range of from approximately 2.057 MHz to approximately 27.120 MHz with an output current of approximately 8.4 amps. The speed of engine **11** is controlled by the output frequency of source **95**. The high frequency current, as described below, is directed to each cylinder in turn by circuitry described below. For engines producing from 300 to 1000 hp (not shown), a high frequency source having a constant output of 27.120 MHz with a constant current of 3.4 amps which is continually supplied to all cylinders could be used. In this case an autotransformer, such as that sold under the trade designation Variac by the General Radio Company, controlled by a foot pedal varies the voltage to each cylinder from 5 to 24 volts DC at 4.5 amps, using power from the batteries or the alternator. The DC current from the Variac is switched from cylinder to cylinder by two small electronic switching units which in turn are controlled by larger electronic switching units. For the smallest engines (not shown), a high frequency generator could supply a constant output of 27.120 MHz with a constant current of 4.2 amps to the cylinders during starting only. Speed control would be achieved by a Variac as described above which controls the DC voltage supplied to the cylinders in turn within a range of from 5 to 24 volts at a current of 5.2 amps. In this case, once the engine is running, the full voltage needed to ignite the (smaller) quantity of gases is obtained from the electrodes in the other cylinder of the pair.

The circuitry of **Fig.13A** also includes the generator, a voltage regulator and relay **111**, five electronic switching units **113, 115, 117, 119** and **121**, electrodes **63** and **65** associated with chamber **41A** (hereinafter chamber **41A** is sometimes referred to as the "**A**" cylinder and chamber **41B** is sometimes referred to as the "**B**" cylinder), anode **67**, cathode **69**, magnetic coils **49A, 51A** and **53A**, capacitors **C1A** and **C2A**, and various decoupling diodes. The electronic switching units can take a variety of forms. For example, one simple form (see **Fig.15**) includes a pair of SCRs **123** and **125**. The switching unit is connected at terminal IN to the corresponding line on the input side and at terminal OUT to the corresponding line on the output side. When a voltage of 3.5 volts is supplied from the battery through a distributor, for example, to the ON terminal, SCR **125** conducts, thereby completing a circuit through the switching unit. Conversely, when 3.5 volts is applied to the OFF terminal, SCR **123** conducts and the circuit is broken. Likewise, the circuit for regulators **97A** and **97B** (see **Fig.16**) includes two SCRs **127** and **129** and a PNP transistor **131**. In this circuit when SCR **127** is gated on, it forces transistor **131** into conduction, thereby completing the circuit through the regulator. When SCR **129** is gated on, the circuit through transistor **131** is broken. A number of other configurations may be used in place of those of **Fig.15** and **Fig.16** and not all would use SCRs. For example, one triode could be used to replace two main SCRs, or transistors could be used instead of SCRs.

A pair of low-voltage distributors **135** and **137** are also shown in **Fig.13A**. Distributors **135** and **137** provide gating pulses for the electronic switching units of **Fig.13A** and **Fig.13B**. Of course, solid-state distributors could also replace mechanical distributors **135** and **137**.

In addition, the engine circuitry includes (see **Fig.13B**) five electronic switching units **143, 145, 147, 149** and **151** corresponding to units **113, 115, 117, 119** and **121** of **Fig.13A**, electrodes **63** and **65** of the "**B**" cylinder, anode **67**, cathode **69**, electric coils **49B, 51B** and **53B**, capacitors **C1B** and **C2B**, and various decoupling diodes. The circuitry of **Fig.13B** is generally the same as the corresponding portions of **Fig.13A**, so the description of one for the most part applies to both. Of course, if more than two cylinders are used, each pair of cylinders would have associated with them, circuitry such as that shown in **Fig.13A** and **Fig.13B**. The circuitry of **Fig.13A** is connected to that of **Fig.13B** by the lines **L1-L17**.

The working fluid and the fuel for the engine are one and the same and consist of a mixture of inert gases, which mixture consists essentially of helium, neon, argon, krypton and xenon. It is preferred that the mixture contain 35.6% helium, 26.3% neon, 16.9% argon, 12.7% krypton, and 8.5% xenon by volume, it having been calculated that this particular mixture gives the maximum operation time without refuelling. Generally, the initial mixture may contain, by volume, approximately 36% helium, approximately 26% neon, approximately 17% argon, approximately 13% krypton, and approximately 8% xenon. This mixture results from a calculation that equalises the total charge for each of the gases used after compensating for the fact that one inert gas, viz. radon, is not used. The foregoing is confirmed by a spectroscopic flashing, described below, that occurs during the mixing process. If one of the gases in the mixture has less than the prescribed percentage, it will become over-excited. Similarly, if one of the gases has more than the prescribed percentage, that gas will be under-excited. These percentages do not vary with the size of the cylinder.

Operation of the engine is as follows: At room temperature, each cylinder is filled with a one atmosphere charge of the fuel mixture of approximately 6 cubic inches (100 cc) /cylinder (in the case of the smallest engine) by means of filler tube **59**. The filler tubes are then plugged and the cylinders are installed in the engine as shown in **Fig.4**, one piston being in the fully extended position and the other being in the fully retracted position. To start the engine, the ignition and starter switches are closed, as is switch **SW6**. This causes the starter motor to crank the engine, which in turn causes the wiper arms of the distributors to rotate. The starting process begins, for example, when the pistons are in the positions shown in **Fig.4**. Ignition coil **25** and distributor **99** (see **Fig.13A**) generate a 40,000 volt pulse which is supplied to electrode **65** of chamber **41A**. Therefore, a momentary high potential exists between electrodes **63** and **65** and the plates on each. The discharge point on piston **39A** is adjacent these electrodes at this time and sparks occur between one or more of the electrodes and the discharge point to partially excite, e.g. ionise, the gaseous fuel mixture.

The gaseous fuel mixture in cylinder **41A** is further excited by magnetic fields set up in the chamber by coil **49A**. This coil is connected to the output side of electronic switching unit **121** and, through switching unit **113**, to the battery and the generator. At this time, i.e., between approximately 5 degrees before TDC and TDC, distributor **135** is supplying a gating signal to unit **121**. Any current present on the input side of unit **121**, therefore, passes through unit **121** to energise coil **49A**. Moreover, high frequency current from oscillator **95** is supplied via regulator **97A** to coil **49A**. This current passes through regulator and relay **97A** because the gating signal supplied from distributor **135** to unit **121** is also supplied to relay **97A**. The current from switching unit **121** and from oscillator **95** also is supplied to the anode and the cathode. It is calculated that this causes radioactive rays (x-rays) to flow between the anode and the cathode, thereby further exciting the gaseous mixture.

As the starter motor continues cranking, piston **39A** begins moving downward, piston **39B** begins moving upward, and the wiper arms of the distributors rotate. (Needless to say, a solid-state distributor would not rotate. The distributor could utilise photo cells, either light or reflected light, rather than contact points). After 45 degrees of rotation, distributor **135** supplies a gating pulse to electronic switching unit **119**, thereby completing a circuit through unit **119**. The input to unit **119** is connected to the same lines that supply current to coil **49A**. The completion of the circuit through unit **119**, therefore, causes coil **51A** to be energised in the same manner as coil **49A**. After an additional 45 degrees of rotation, distributor **135** gates on electronic switching unit **117** which completes a circuit to the same lines. The output terminal of unit **117** is connected to coil **53A**, and so this coil is energised when unit **117** is gated on. All three coils of the "**A**" cylinder remain energised and, therefore, generating magnetic fields in chamber **41A** until piston **39A** reaches BDC.

As piston **39A** moves from TDC to BDC, two additional 40,000 volt pulses (for a total of three) are supplied from distributor **99** to the "**A**" cylinder. These pulses are spaced approximately 60 degrees apart. If more pulses are desired, the apparatus shown in **Fig.14** may be used. In that case, the solenoids indicated generally at **107A, 107B** and **109A, 109B** are energised to create a number of rapid, high-voltage pulses which are supplied as indicated in **Fig.14** to the cylinders, distributor **105** operating to supply pulses to only one of the pair of cylinders at a time.

As piston **39A** reaches BDC, distributor **135** sends a pulse to the OFF terminals of electronic switching units **121, 117** and **119**, respectively, causing all three coils **49A, 51A** and **53A** to be de-energised. At about the same time, i.e., between approximately 5 degrees before TDC and TDC for piston **39B**, distributor **137** supplies a gating pulse to the ON terminals of electronic switching units **113** and **115.** The power inputs to units **113** and **115** come from the generator through regulator **111** and from the battery, and the outputs are directly connected to coils **49A** and **53A**. Therefore, when units **113** and **115** are gated on, coils **49A** and **53A** are reenergised. But in this part of the cycle, the coils are energised with the opposite polarity, causing a reversal in the magnetic field in chamber **41A**. Note that coil **51A** is not energised at all during this portion of the cycle. Capacitors **C1A** and **C2A** are also charged during the BDC to TDC portion of the cycle. (During the TDC to BDC portion of the cycle, these capacitors are charged and/or discharged by the same currents as are supplied to the anode and cathode since they are directly connected to them).

As piston **39A** moves upwards, electrodes **63** and **65** serve as pick-up points in order to conduct some of the current out of chamber **41A**, this current being generated by the excited gases in the chamber. This current is transferred via line **L7** to electronic switching unit **151**. The same gating pulse which gated on units **113** and **115** was also supplied from distributor **137** via line **L12** to gate on switching unit **151**, so the current from the electrodes of chamber **41A** passes through unit **151** to the anode, cathode and capacitors of chamber **41B**, as well as through switching units **147** and **149** to coils **49B, 51B** and **53B**. Thus it can be seen that electricity generated in one cylinder during a portion of the cycle is transferred to the other cylinder to assist in the excitation of the gaseous mixture in the latter. Note that this electricity is regulated to maintain a constant in-engine current. It should be noted, that twenty four volts from the generator is always present on electrodes **63** and **65** during operation to provide for pre-excitement of the gases.

From the above it can be seen that distributors **135** and **137** in conjunction with electronic switching units **113, 115, 117, 119, 121, 143, 145, 147, 149** and **151** constitute the means for individually energising coils **49A**, **49B, 51A, 51B, 53A** and **53B**. More particularly, they constitute the means to energise all the coils of a given cylinder from the other cylinder when the first cylinder's piston is moving from TDC to BDC and operate to energise only two (i.e., less than all) of the coils from the alternator when that piston is moving from BDC to TDC. Additionally, these components constitute the means for energising the coils with a given polarity when the piston of that cylinder is moving from TDC to BDC and for energising the first and third coils with the opposite polarity when that piston is moving from BDC to TDC.

As can also be seen, switching units **121** and **151** together with distributors **135** and **137** constitute the means for closing a circuit for flow of current from chamber **41A** to chamber **41B** during the BDC to TDC portion of the cycle of chamber **41A** and for closing a circuit for flow of current from chamber **41B** to chamber **41A** during the TDC to BDC portion of the cycle of chamber **41A**. Oscillator **95** constitutes the means for supplying a time varying electrical voltage to the electrodes of each cylinder, and oscillator **95**, distributors **135** and **137**, and regulators **97A** and **97B** together constitute the means for supplying the time varying voltage during a predetermined portion of the cycle of each piston. Moreover, distributor **99** together with ignition coils **25A** and **25B** constitute the means for supplying high-voltage pulses to the cylinders at predetermined times during the cycle of each piston.

The cycle of piston **39B** is exactly the same as that of piston **39A** except for the 180 degree phase difference. For each cylinder, it is calculated that the excitation as described above causes the gases to separate into layers, the lowest atomic weight gas in the mixture, namely helium, being disposed generally in the centre of each chamber, neon forming the next layer, and so on until we reach xenon which is in physical contact with the chamber walls. The input current (power) to do this is the calculated potential of the gas mixture. Since helium is located in the centre of the chamber, the focal point of the electrode discharges and the discharges between the anode and cathode is in the helium layer when the piston is near TDC. As the piston moves slightly below TDC, the electrons from electrodes **63** and **65** will no longer strike the tip of the piston, but rather will intersect in the centre of the cylinder (this is called "focal point electron and particle collision") as will the alpha, beta and gamma rays from the anode and cathode. Of course, the helium is in this exact spot and is heavily ionised at that time. Thus the electrodes together with the source of electrical power connected thereto constitute the means for ionising the inert gas.

It is calculated that as a result of all the aforementioned interactions, an ignition discharge occurs in which the helium splits into hydrogen in a volume not larger than 2 or 3 x 10^{-6} cubic millimetres at a temperature of approximately 100,000,000 degrees F. Of course this temperature is confined to a very small space and the layering of the gases insulates the cylinder walls from it. Such heat excites the adjacent helium so that a plasma occurs. Consequently, there is a minute fusion reaction in the helium consisting of the energy conversion of a single helium atom, which releases sufficient energy to drive the piston in that chamber toward BDC with a force similar in magnitude to that generated in a cylinder of a conventional internal combustion engine. Electrodes **63** and **65** extend into the argon layer while each piston is in its BDC to TDC stroke so as to pick up some of the current flowing in that layer. It may take a cycle or two for the gases in the cylinders to become sufficiently excited for ignition to occur.

Once ignition does occur, the electrical operation of the engine continues as before, without the operation of the starter motor. Distributor **99** supplies three pulses per cycle (or more if the magnetic ignition system of **Fig.14** is used) to each cylinder; and distributors **135** and **137** continue to supply "on" and "off" gating pulses to the electronic switching units. The rpm of the engine is, as explained above, governed by the frequency of the current from oscillator **95** (or in the case of smaller horsepower units, by the DC voltage supplied to the cylinders from the Variac).

Because of the minute amount of fuel consumed in each cycle, it is calculated that a cylinder can run at 1200 rpm approximately 1000 hours, if not more, on a single charge of gas. Note that even at 1200 rpm, there will be intense heat occurring only 0.002% of the time. This means that input power need be applied only sporadically. This power can be supplied to a cylinder from the other cylinder of its pair by means of electronic switching units which, in the case of SCRs, are themselves triggered by low voltage (e.g. 3.5 V) current. Thus, since electrical power generated in one cylinder is used to excite the gases in the other cylinder of a pair, it is practical that the cylinders be paired as discussed above. Capacitors are, of course, used to store such energy for use during the proper portion of the cycle of each cylinder.

From the above, it should be appreciated that the engine of this invention has several advantages over presently proposed fusion reactors, such as smaller size, lower energy requirements, etc. But what are the bases of these advantages? For one, presently proposed fusion reactors use hydrogen and its isotopes as a fuel instead of inert gases. Presumably this is because hydrogen requires less excitement power. While this is true, the input power that is required in order to make hydrogen reactors operate makes the excitation power almost insignificant. For example, to keep a hydrogen reactor from short circuiting, the hydrogen gas has to be separated from the reactor walls while it is in the plasma state. This separation is accomplished by the maintenance of a near vacuum in the reactor and by the concentration of the gas in the centre of the reactor (typically a toroid) by a continuous, intense magnetic field. Accordingly, separation requires a large amount of input energy.

In the present invention, on the other hand, the greater excitation energy of the fuel is more than compensated for by the fact that the input energy for operation can be minimised by manipulation of the unique characteristics of the inert gases. First, helium is the inert gas used for fusion in the present invention. The helium is primarily isolated from the walls of the container by the layering of the other inert gases, which layering is caused by the different excitation potential (because of the different atomic weights) of the different inert gases, said excitation being caused by the action of the electrodes, anode and cathode in a magnetic field. This excitation causes the gases each to be excited in inverse proportion to their atomic numbers, the lighter gases being excited correspondingly more. Helium, therefore, forms the central core with the other four gases forming layers, in order, around the helium. The helium is secondarily isolated from the walls of the container by a modest vacuum (in comparison to the vacuum in hydrogen reactors) which is caused partially by the "choking" effect of the coils and partially by the enlargement of the combustion chamber as the piston moves from TDC to BDC. (Unexcited, the gases are at one atmosphere at TDC). Second, argon, the middle gas of the five, is a good electrical conductor and becomes an excellent conductor when (as explained below) it is polarised during the mixing process. By placing the electrodes such that they are in the argon layer, electrical energy can be tapped from one cylinder for use in the other. During a piston's movement from BDC to TDC, the gases are caused to circulate in the cylinder by the change in the polarity of the coils, which occurs at BDC.

During such circulation, the gases remain layered, causing the argon atoms to be relatively close to each other, thereby optimising the conductivity of the argon. This conductivity optimisation is further enhanced by a mild choking effect that is due to the magnetic fields. The circulation of the highly conductive argon results in a continuous cutting of the magnetic lines of force so that the current flows through the electrodes. This production of electricity is similar to the rotating copper wire cutting the magnetic lines of force in a conventional generator except that the rotating copper wire is replaced by the rotating, highly conductive argon. The amount of electricity that can be produced in this manner is a function of how many magnetic field lines are available to be cut. If one of the coils, or all three of the coils or two adjacent coils were energised, there would be only one field with electricity produced at each end. By energising the top and the bottom coil, two separate fields are produced, with electricity produced at four points.

A five coil system, if there were sufficient space, would produce three fields with the top, bottom and middle coils energised. Six points for electricity production would result. The number of coils that can be installed on a given cylinder is a function of space limitations. The recombination of gas atoms during the BDC to TDC phase causes the radiation of electrical energy which also provides a minor portion of the electricity that the electrode picks up. Additional non-grounded electrodes in each cylinder would result in more electricity being tapped off. It should be noted that during the BDC to TDC phase, the anode and the cathode are also in the argon layer and, like the electrodes, they pick up electricity, which charges the capacitors around the cylinder. Third, inert gases remain a mixture and do not combine because of the completeness of the electron shells. They are therefore well suited to a cycle whereby they are continually organised and reorganised. Fourth, as the helium atoms are consumed, the other gases have the capacity to absorb the charge of the consumed gas so that the total charge of the mixture remains the same.

The second basis of these advantages of the present engine over proposed fusion reactors concerns the fact that hydrogen reactors develop heat which generates steam to turn turbines in order to generate electrical power. This requires tremendous input energy on a continuous basis. The present invention operates on a closed cycle, utilising pistons and a crankshaft which does not require a continuous plasma but rather an infrequent, short duration (10^{-6} second) plasma that therefore requires much less input energy. In the present invention, a plasma lasting longer than 10^{-6} second is not necessary because sufficient pressure is generated in that time to turn the engine. A plasma of longer duration could damage the engine if the heat were sufficiently intense to be transmitted through the inert gas layers to the cylinder walls. A similar heat build-up in the engine can occur if the repetition rate is increased. Such an increase can be used to increase the horsepower per engine size but at the cost of adding a cooling system, using more expensive engine components, and increasing fuel consumption. Note that even though layers of inert gases insulate the cylinder walls, there might be some slight increase in the temperature of the gas layers after a number of cycles, i.e., after a number of ignitions.

Whereas hydrogen fusion reactors cannot directly produce power by driving a piston (because of the required vacuum), the present invention uses the layered inert gases to transmit the power from the plasma to each gas in turn until the power is applied to a piston, which can easily be translated into rotary motion. The layered gases also cushion the piston from the full force of the ignition. Moreover, the fields inside the cylinder undergoing expansion cause the gases to shrink, thereby taking up some of the pressure generated by the explosion and preventing rupturing of the cylinder walls.

Turning now to **Fig.17A** to **Fig.17D**, there is shown apparatus **201** for preparing the fuel mixture for engine **11**. For convenience apparatus **201** is called a mixer although it should be understood that the apparatus not only mixes the gases which form the fuel but also performs many other vital functions as well. The five constituent inert gases are introduced in precise, predetermined proportions. The mixer extracts, filters and neutralises the non-inert gases and other contaminants which may be found in the gas mixture. It also increases the potential capacity of gas atoms, discharges the krypton and xenon gases, polarises the argon gases, ionises the gases in a manner such that the ionisation is maintained until the gas has been utilised and otherwise prepares them for use as a fuel in engine **11**. In particular, the mixer makes the gases easier to excite during operation of the engine. Mixing does not mean an atomic or molecular combination or unification of gases because inert gases cannot chemically combine, in general, due to the completeness of the outer shell of electrons. During mixing, the various gases form a homogeneous mixture. The mixing of the five inert gases in apparatus **201** is somewhat analogous to preparing a five part liquid chemical mixture by titration. In such a mixture, the proportions of the different chemicals are accurately determined by visually observing the end point of each reaction during titration. In apparatus **201**, a visible, spectroscopic flash of light accompanies the desired end point of the introduction of each new gas as it reaches its proper, precalculated proportion. (Each gas has its own distinctive, characteristic, spectroscopic display). The ends points are theoretically calculated and are determined by pre-set voltages on each of a group of ionising heads in the apparatus, as described below.

Mixer **201** includes (see **Fig.17A**) an intake port, indicated generally at **203**, which during operation is connected to a source **205** of helium gas, a gauge **206**, glass tubing **207** comprising a plurality of branches **B10-B25** for flow of the gases through the mixer, a plurality of valves **V1-V11** in the branches, which valves may be opened or closed as necessary, three gas reservoirs **209, 211** and **213** for storing small quantities of helium, argon and neon gas respectively, an ionising and filtering unit **215** for filtering undesired non-inert gases and contaminants out of the fuel mixture, for regulating the gas atom electron charge and to absorb the free flowing electrons, a gas flow circulation pump **217**, two ionising heads **219** and **221**, and three quality control and exhaust valves **V12-V14**. The mixer also comprises (see **Fig.17B**) a high frequency discharge tube **225**, a non-directed cathode ray tube **227**, two more ionising heads **229** and **231**, two additional gas reservoirs **233** and **235** for storing small quantities of xenon and krypton, a quadruple magnetic coil **237**, a group of valves **V15-V24**, valves **V23** and **V24** being quality control and exhaust valves, and a plurality of additional glass tubing branches **B26-B32.**

Turning to **Fig.17C**, mixer **201** also includes additional ionising heads **239, 240** and **241**, additional valves **V25-V46**, **V39A** and **V40A**, valves **V29** and **V32** being quality control and exhaust valves and valve **V39A** being a check valve, a vacuum and pressure gauge **242** between valves **V35** and **V36**, tubing branches

B34-B49 (branch **B39** consisting of two parts **B39A** and **B39B**), a pair of intake ports **243** and **245** which during operation are connected to sources **247** and **249** of argon and neon gas respectively, gauges **250A** and **250B**, a spark chamber **251**, a hydrogen and oxygen retention chamber **253** containing No. 650 steel dust in a silk filter, an ion gauge **255** (which can be an RG 75K type Ion Gauge from Glass Instruments, Inc. of Pasadena, Calif.) for removing excess inert gases from the mixture, inner and outer coils of glass tubing **257** and **259** surrounding a mixing chamber **261**, a focused x-ray tube **263** for subjecting the mixture flowing through it to 15-20 millirem alpha radiation and 120-125 millirem beta radiation, a directed cathode ray tube **265**, two twin parallel magnetic coils **266** and **267**, and a focusing magnetic coil **269**. It is important that coils **266** and **267** be immediately adjacent mixing chamber **261**. And (see **Fig.17D**) the mixer also comprises three more ionising heads **271**, **273** and **275**, two entry ports **277** and **279** which during operation are connected to sources **281** and **283** of krypton and xenon respectively, gauges **284A** and **284B**, a high frequency discharge tube **285**, a twin parallel magnetic coil **287** surrounding a polariser **289** for polarising the argon, said polarise containing fine steel particles which are polarised by coils **287** and which in turn polarise argon, a second hydrogen retention chamber **291**, a pair of tubing branches **B50** and **B51**, two filters **293** and **295** and a plurality of valves **V47-V59**, valves **V57** and **V59** being quality control and exhaust valves.

Inner and outer glass tubing coils **257** and **259** and mixing chamber **261** are shown in cross section in **Fig.18**. Intermediate glass coils **257** and **259** are two magnetic coils **297** and **299** having an inductance of approximately 130 mH. A yoke coil **301** is positioned in a semi-circle around mixing chamber **261**. Inside mixing chamber **261** are located a pair of screens **303** and **305**, insulators **307** and **309**, and a pair of spark gaps indicated generally at **311** and **313**. A high frequency amplitude modulated source provides 120 V AC, 60 Hz, 8.4 amp, 560 watt, 27,120 to 40,000 MHz plus or minus 160 KHz current via heavily insulated wires **315** and **317** to the chamber. These wires are about twelve gauge, like those used as spark plug wires on internal combustion engines. Additionally 95 volt Direct Current is supplied via a smaller (e.g. sixteen to eighteen gauge) insulated wire **319**. As described below, the gases to be mixed and prepared flow through chamber **261** and are suitably treated therein by the action of the various fields present in the chamber.

The magnetic coils, ionisation heads, and pump **217**, along with the required electrical interconnections, are schematically shown in **Fig.19A** to **Fig.19E**. More particularly, heads **239** and **241** are shown in **Fig.19A**, as is pump **217**. Each ionising head has two electrodes with a gap between them to cause ionisation of gases flowing through the head, the electrodes being connected to a source of electrical power. Pump **217** is directly connected to a source of power (either AC or DC as required by the particular pump being used). The connections between the circuitry on **Fig.19A** and that on **Fig.19B** are shown as a plug **321**, it being understood that this plug represents a suitable one-to-one connection between the lines of **Fig.19A** and those of **Fig.19B**.

The remaining ionising heads and all the magnetic coils are shown in **Fig.19B**. For clarity, the coils are shown in an unconventional form. Quadruple coil **237** (shown at the top of **Fig.19B**) has one side of each winding connected in common but the other sides are connected to different lines. Coil **223** consists of two windings in parallel. Coils **297** and **299**, the ones around the mixing chamber, are shown overlapping, it being understood that coil **297** is actually interior of coil **299**. Yoke coil **301**, as shown, extends half-way from the bottom to the top of coils **297** and **299**. Twin parallel magnetic coils **267** are connected in parallel with each other, both sides of focusing coil **269** being connected to one node of coils **267**. Likewise coils **287** are connected in parallel. The connections between the lines of **Fig.19B** and those of **Fig.19C** and **Fig.19D** are shown as plugs **323** and **325**, although other suitable one-to-one connections could certainly be made. **Fig.19C** shows the interconnecting lines between **Fig.19B** and **Fig.19E**. A plug **327** or other suitable one-to-one connections connects the lines of **Fig.19C** and **Fig.19E**.

A plurality of power sources, like the above-mentioned Variacs, of suitable voltages and currents as well as a plurality of relays **329**, and plugs **331** are shown on **Fig.19D** and **Fig.19E**. The connections between these two Figures is shown as a plug **333**. It should be appreciated that the Variacs can be adjusted by the operator as necessary to supply the desired voltages to the aforementioned coils and ionising heads. It should also be realised that the desired relays can be closed or opened as needed by connecting or disconnecting the two parts of the corresponding plug **331**. That is, by use of plugs **331**, the operator can control the energising of the ionising heads and magnetic coils as desired. Plugs **331** are also an aid in checking to ensure that each component is in operating condition just prior to its use. Of course, the manipulation of the power sources and the relays need not be performed manually; it could be automated.

The remaining circuitry for the mixer is shown on **Fig.20A** to **Fig.20F**. For convenience, plugs **335**, **337**, **339, 341, 343, 345** and **347** are shown as connecting the circuitry shown in the various Figures, although other suitable one-to-one connections may be used. The chassis of the apparatus is shown on these Figures in phantom and is grounded. The power supply for the apparatus is shown in part on **Fig.20A** and

Fig.20D and includes an input **349** (see **Fig.20D**) which is connected to 120 volt, 60 Hz power during operation and an input **351** which is connected to the aforementioned high frequency generator or some other suitable source of approximately 27,120 MHz current. The power supply includes a pair of tuners **353**, numerous RLC circuits, a triode **355**, a pentode **357** with a ZnS screen, a variable transformer **359**, an input control **361**, a second variable transformer **363** (see **Fig.20A**) which together with a filter **365** forms a 2.0 volts (peak-to-peak) power supply **367**, a pentode **369**, a variable transformer **371**, and a resistor network indicated generally at **373**. Exemplary voltages in the power supply during operation are as follows: The anode of triode **355** is at 145 V, the control grid at 135 V and the cathode at -25 V. The voltage at the top of the right-hand winding of transformer **359** is -5 V. The anode of pentode **357** is at 143 V, the top grid is grounded (as is the ZnS screen), the bottom grid is connected to transformer **359**, and the control electrode is at 143 V. The input to supply **367** is 143 volts AC while its output, as stated above, is 2 V (peak-to-peak). The anode of pentode **369** is at 60 V, the grids at -1.5 V, the control electrode at 130 V, and the cathode is substantially at ground. The output of resistor network **373**, labelled **375**, is at 45 V.

Also shown on **Fig.20D** is spark chamber **251**. Spark chamber **251** includes a small amount of thorium, indicated at **377**, and a plurality of parallel brass plates **379**. When the gases in the mixer reach the proper ionisation, the alpha particles emitted by the thorium shown up as flashes of light in the spark chamber.

Turning now to **Fig.20B**, ionising and filtering unit **215** includes a pair of conductive supports **381** for a plurality of conductors **383**, said supports and conductors being connected to a voltage source, an insulating support **385** for additional conductors **387**, and a ZnS screen **388** which emits light when impurities are removed from the gaseous fuel mixture. Unit **215** also includes a second set of interleaved conductors indicated generally at **389**, a cold-cathode tube **391**, and an x-ray tube indicated generally at **393**. Also shown on **Fig.20B** is an RLC network **395** which has an output on a line **397** which is at 35 V, this voltage being supplied to the x-ray tube.

High frequency discharge tube **255** (see **Fig.20C**) has a conductive electrode **399** at one end to which high frequency current is applied to excite the gases in the mixer, and an electrode/heater arrangement **401** at the other, a voltage of 45 V being applied to an input **402** of the tube. It is desirable that a small quantity of mercury, indicated at **403**, be included in tube **225** to promote discharge of the helium gas. Magnetic coils **237** have disposed therein a pair of generally parallel conductors **405** to which a high frequency signal is applied. When gas flows through coils **237** and between parallel conductors **405**, therefore, it is subjected to the combination of a DC magnetic field from the coil and high frequency waves from the conductors, which conductors act as transmitting antennas. The resulting high frequency magnetic field causes the atoms to become unstable, which allows the engine to change a given atom's quantum level with much less input power than would normally be required. The volume of each gas atom will also be smaller. Also shown on **Fig.20C** is non-directed cathode ray tube **227**. The grids of tube **227** are at 145 V, the control electrode is at ground, while the anode is at 35 V to 80 V (peak-to-peak). The purpose of non-directed cathode ray tube **227** is to add photons to the gas mixture. To generate these photons, tube **227** has a two layer ZnS coating indicated generally at **407**. Chamber **261**, described above, is also shown schematically on **Fig.20C**, along with an RLC network **409**.

The power supply for the mixer (see the lower halves of **Fig.20E** and **Fig.20F**) also includes two pentodes **411** and **413**, a transformer **415**, and a diode tube **417**. The control electrode of pentode **411** is at 5 V to 40 V (peak-to-peak), the grids are at 145 V, the anode is at 100 V, and the cathode is at 8 V to 30 V (peak-to-peak). The control electrode of pentode **413** is at 115 V, while its grids and cathode are at -33 V. The anode of tube **413** is connected to transformer **415**. Also shown on **Fig.20E** are a relay **419** associated with ion gauge **255**, and focused x-ray tube **263** associated with ionisation head **240**. The upper input to tube **263** is at 45 V to 80 V (peak-to-peak).

Turning to **Fig.20F**, there is shown tubes **265** and **285**. Directed cathode ray tube **265** is a pentode connected like tube **227**. High frequency discharge tube **285** includes a phosphor screen and is connected to a high frequency source. Also shown on **Fig.20F** is a triode **421** with its anode at 30 V, its cathode at ground, and its control grid at -60 V; a pentode **423** with its anode at 135 V to 1000 V peak to peak, its cathode at ground, its control electrode at 143 V, its grids at 20 V; and a transformer **425**. It should be understood that various arrangements of electrical components other than those described above could be designed to perform the same functions.

The operation of the mixer is best understood with reference to **Fig.17A** to **Fig.17D** and is as follows: Before and during operation, the mixer, and particularly chamber **261** is kept hermetically sealed and evacuated. To begin the mixing process, helium is admitted into the mixer via intake port **203**. Then a vacuum is again drawn, by a vacuum pump (not shown) connected to valve **V38**, to flush the chamber. This flushing is repeated several times to completely cleanse the tubing branches of the mixer. The mixer is now ready. The ionisation heads next to mixing chamber **261** are connected to a voltage corresponding to approximately 36% of the calculated total ionising voltage, DC current is allowed to flow through magnetic coils **297** and **299** around chamber **261**, and high frequency current is allowed to pass through the mixing chamber. Helium is then slowly admitted, via port **203**, into the mixer. From port **203**, the helium passes through ionisation head **219** into glass tubing coil **259**. This glass coil, being outside magnetic coils **297** and **299**, is in the diverging portion of a magnetic field. The helium slowly flowing through glass coil **259** is gently excited. From coil **259**, the helium flows through branch **B45** to ionisation head **275** and from there, via branch **B28**, to ionisation head **229** (see **Fig.17B**). From head **229**, the gas flows through non-directed cathode ray tube **227** to high-frequency discharger **225**. The high frequency discharger **225**, with heating element, discharges, separates or completely neutralises the charge of any radioactive and/or cosmic particles that are in the helium atom in addition to the protons, neutrons and electrons.

The gas exits discharger **225** via branch **B26** and passes to high-frequency discharger **285**. The high frequency discharger **285**, without heating element, disturbs the frequency of oscillation which binds the gas atoms together. This prepares the helium atoms so that the electrons can more easily be split from the nucleus during the excitation and ignition process in the engine. Discharger **285** includes a phosphorus screen or deposit (similar to the coating on a cathode ray tube) which makes discharges in the tube visible. From discharger **285**, the helium passes through directed cathode ray tube **265** and focused x-ray tube **263**. Directed cathode ray tube **265** produces cathode rays which oscillate back and forth longitudinally underneath and along the gas carrying tube. After that, the helium passes successively through branch **B21**, ionisation head **221**, branch **B23**, twin parallel magnetic coil **266**, and branch **B25** into mixing chamber **261**. Helium flows slowly into and through apparatus **201**. The helium atoms become ionised as a result of excitation by magnetic force, high frequency vibrations and charge acquired from the ionisation heads. When sufficient helium has entered the apparatus, the ionisation energy (which is approximately 36% of the total) is totally absorbed. A spectroscopic flash of light in the mixing chamber signals that the precise, proper quantity of helium has been allowed to enter. The entry of helium is then immediately halted by the closing of valve **V3**.

The next step in preparing the fuel is to add neon to the mixture. The potential on the relevant ionisation heads, particularly head **241** (see **Fig.17C**), is raised by the addition of approximately 26% which results in a total of approximately 62% of the total calculated potential and valve **V31** is opened, thereby allowing neon to slowly enter the mixer via port **245**. This gas passes through branch **B36**, ionisation head **241**, and branch **B35** directly into the mixing chamber. Since the previously admitted helium is fully charged, the neon absorbs all of the increased ionisation potential. As soon as the neon acquires the additional charge, a spectroscopic flash of light occurs and the operator closes valve **V31**.

In the same manner, the potential on the ionisation heads is increased by the addition of approximately 17% for a total of approximately 79% of the total calculated potential and then valve **V30** is opened to admit argon into the mixer via port **243**. This gas passes through branch **B34**, ionisation head **239**, and branch **B33** into mixing chamber **261**. Again, when the proper amount of argon has been admitted, it emits a spectroscopic flash of light and the operator closes valve **V30**. Next, the potential on the ionisation heads is increased by the addition of approximately 13% to result in a total of approximately 92% of the total calculated potential and valve **V58** (see **Fig.17D**) is opened to admit krypton into the system. The krypton gas passes through branch **B51**, ionisation head **271** and branch **B48** into chamber **261**. Upon the emission of a spectroscopic flash of light by the gas, the operator closes valve **V58**. Finally, the potential on the ionisation heads is increased by the addition of approximately 8% which brings the ionisation potential to the full 100% of the calculated ionisation voltage and valve **V56** is opened to admit xenon into the mixer via port **279**. This gas passes through branch **B50**, ionisation head **273** and branch **B47** to the mixing chamber. When the proper amount of gas has been admitted, a spectroscopic flash of light occurs signalling the operator to close valve **V56**. Note that there are two filter/absorber units, labelled **253** and **291**. Unit **253** is connected to the neon and argon inlet branches **B33** and **B35** while unit **291** is connected to the krypton and xenon inlet branches **B47** and **B48**. These two units absorb hydrogen residue and immobilise the water vapour created when the pump circulates the gases and generates vacuum states.

After all the gases are admitted in the desired proportions, all the valves are closed. (The mixture in the mixing chamber and in the adjacent tubing is at one atmosphere pressure at this time). Once this is done, the interval valves of the system are all opened (but the inlet and outlet valves remain closed) to allow the mixture to circulate throughout the tubing as follows: branch **B44**, magnetic coils **267** and **269**, ionisation head **240**, branch **B29**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39A**, ionisation gauge **255**, branches **B38** and **B42**, ionisation head **275**, branch **B28**, ionisation head **229**, non-directed cathode ray tube **227**, quadruple magnetic coil **272**, ionisation head **221**, branch **B23**, twin parallel magnetic coil **266**, branch **B25** and mixing chamber **261**. When this circuit is initially opened, the pressure of the mixture drops 40-50% because some of the tubing had previously been under vacuum. Pump **217** is then started to cause the gases to be slowly and evenly mixed.

Because of dead space in the tubing and the reaction time of the operator, it may occur that the proportions of the gases are not exactly those set forth above. This is remedied during the circulation step. As the gas flows through ionisation gauge **255**, excess gas is removed from the mixture so that the correct proportions are obtained. To do this the grid of gauge **255** is subjected to 100% ionisation energy and is heated to approximately 165 degrees F. This temperature of 165 degrees F is related to xenon's boiling point of -165 degrees F in magnitude but is opposite in sign. Xenon is the heaviest of the five inert gases in the mixture. As the gas mixture flows through ionisation gauge **255**, the gas atoms that are in excess of their prescribed percentages are burned out of the mixture and their charge is acquired by the remaining gas atoms from the grid of the ionisation gauge. Because the gases are under a partial vacuum, the ionisation gauge is able to adjust the gas percentages very precisely. (Note: The steps described in the last two paragraphs are repeated if the finished gases are rejected in the final quality control step described below).

The next step involves purifying the mixture so that only the five inert gases remain, absorbing any free electrons and regulating the electrical charge in the mixture. To do this, the circuit consisting of the following components is opened: Branch **B44**, magnetic coil **267**, magnetic coil **269**, ionisation head **240**, branch **B29**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39**, magnetic coil **287** (see **Fig.17D**) polariser **289**, branch **B17**, ionising and filtering unit **215**, branches **B16**, **B42**, and **B41**, x-ray tube **263**, branch **B21**, ionisation head **221**, branch **B23**, magnetic coil **266**, branch **B25**, and mixing chamber **261**. The gases should complete this circuit at least three times.

The last step required to prepare the mixture for bottling is polarisation of the argon. The circuit required to do this consists of the following components: mixing chamber **261**, branch **B44**, magnetic coil **267**, magnetic coil **269**, ionisation head **240**, cathode ray tube **265**, branch **B40**, tubing coil **257**, branches **B49** and **B30**, ionisation head **231**, branch **B24**, ionisation head **219**, pump **217**, branches **B15** and **B39**, twin parallel magnetic coil **287** (see **Fig.17D**), polariser **289**, branch **B17**, ionising and filtering unit **215**, branches **B16**, **B42** and **B20**, ionisation head **229**, cathode ray tube **227**, magnetic coil **237**, ionisation head **221**, branch **B23** and magnetic coil **266**. This too is repeated at least three times. The key to the polarisation of argon is polariser **289** and twin parallel magnetic coil **287** that encircles it. Polariser **289** is a glass bottle which is filled with finely powdered soft iron which can be easily magnetised. The filled bottle is, in effect, the iron core of the coils. The iron particles align themselves with the magnetic lines of force, which lines radiate from the centre toward the north and south poles. The ionised gas mixture is forced through the magnetised iron powder by means of pump pressure and vacuum, thereby polarising the argon gas. Filters **293** and **295** are disposed as shown in order to filter metallic particles out of the gas.

The mixture is now double-checked by means of spark chamber **251** at atmospheric pressure since the fusion reaction in the engine is started at one atmosphere. Because the gases in mixing apparatus **201** are at a partial vacuum, sufficient gases must be pumped into spark chamber **251** to attain atmospheric pressure. To do this valves **V33**, **V36** and **V40A** are closed and circulating pump **217** pumps the gases in the mixing apparatus via branches **B15** and **B39A**, through check valve **V39A** into spark chamber **251** until the vacuum and pressure gauge **242** indicates that the gases within spark chamber **251** are at atmospheric pressure. Valve **V34** is then closed. The spark chamber is similar to a cloud chamber. Six or more high capacity brass capacitor plates are spaced 1/8" to 1/4" apart in the chamber. A small plastic container holds the thorium 232. One side of the chamber is equipped with a thick glass window through which sparks in the chamber may be observed. A potential is placed on the brass plates in the chamber and the current flowing between the plates is measured. If this current exactly corresponds to the ionisation current, the mixture is acceptable. A difference of greater than 5% is not acceptable. A lesser difference can be corrected by recirculating the gas in the mixer and particularly through ionisation gauge **255** as previously described in the circulation step. A second test is then given the gases that pass the first test. A calculated high frequency current is gradually imposed on the spark chamber capacitor plates. This excitation causes neutrons to be emitted from the thorium 232 which, if the mixture is satisfactory, can be easily seen as a thin thread of light in the chamber. If the mixture is not satisfactory, light discharges cannot be seen and the high frequency circuit will short out and turn off before the desired frequency is reached.

To bottle the mixture, valve **V33** is opened and valves **V36** and **V40** are closed. During bottling polariser **289**, twin parallel magnetic coil **287**, ionisation unit **215** and ion gauge **255** are electrically energised (all electrical circuits are previously de-energised) to improve the stability of the mixture. The prepared gases are withdrawn from the mixing apparatus via branches **B24** and **B16**, ionisation unit **215**, branch **B17**, filters

293 and **295**, polariser **289**, twin parallel magnetic coil **287**, branch **B39**, ion gauge **255**, check valve **V39A**, branch B38 and spark chamber 251. If desired, after bottling the mixer may be exhausted by opening valves **V12, V13, V14, V23, V24, V29, V32, V57** and **V59**. Of course, one can also automate the fuel preparation process to be continuous so that it would never be necessary to exhaust the gas.

In operation of mixing apparatus **201**, certain operational factors must be considered. For one, no electrical devices can be on without the pump being in operation because an electrical device that is on can damage adjacent gas that is not circulating. For another, it should be noted that directed cathode ray tube **265**, non-directed cathode ray tube **227** and focused x-ray tube **263** serve different functions at different points in the mixing process. In one mode, they provide hot cathode radiation, which can occur only in a vacuum. When gases are flowing through these devices, they provide a cold cathode discharge. For example, during argon polarisation and the circulation step, focused x-ray tube **263** is under vacuum and affects the gases flowing through ionisation head **240** by way of hot cathode radiation. During the introduction of the different gases into mixing apparatus **201** and during the recirculation step, the gases are flowing through focused x-ray tube **263**, which affects the gases by way of a cold cathode discharge.

It is preferred that each switchable electrical component in mixing apparatus **201** be wired into a separate circuit despite the fact that one of the poles of each could be commonly wired. In a common ground circuit if one device is turned on, all of the other units may also turn on because the gases in the device are conductive. In addition, if one unit on a common circuit were energised with high frequency current, the others would also be affected. In the same vein, the high frequency current cannot be used when the cathode ray tubes, the x-ray tubes or the dischargers are heated and under vacuum because the heater filaments will burn out.

Finally, the current source, the variable rectifiers and the electrical measuring instruments must be located more than ten feet from mixing apparatus **201** because the high frequency current is harmful to the rectifiers, causing them to burn out or short out.

It is hoped that a brief summary of the concepts used by the inventor in developing the above invention will be helpful to the reader, it being understood that this summary is in no way intended to limit the claims which follow or to affect their validity. The first concept is that of using an inert gas mixture at approximately one atmosphere at TDC (at ignition) as a fuel in a thermonuclear energy production process. The second concept is the layering of the various inert gases, which layering is designed to confine the input energy in the innermost layers during pre-excitement and ignition, to provide thermal insulation for the container walls during and after ignition, to transmit power resulting from the ignition through the layers in turn to the piston, to absorb the pressure generated during ignition to protect the cylinder walls, and to provide an orderly, predictable positioning of the argon layer during the BDC to TDC portion of the engine cycle. The third concept of this invention involves utilising electric current produced in one cylinder of a pair to perform functions in the other cylinder of that pair. This concept includes the sub-concepts of generating electric current by atomic recombination and of electric generation in place resulting from the rotation of layered inert gases within each cylinder because of the changed polarity of the encircling coils at BDC, from judicious placement of coils which produce magnetic field lines which are cut by a near perfect conductor (polarised argon), and from movement of said near perfect conductor through the magnetic field.

The fourth and fifth concepts of this invention are the transformation of rapid, intense, but short duration thermonuclear reactions into pressure that is transmitted from inert gas to inert gas until it creates linear kinetic energy at the piston, which energy is converted into rotary kinetic energy by a crankshaft, and the use of a shaft-driven generator to provide power to spaced field coils during the BDC to TDC portion of the cycle of each cylinder.

The sixth concept concerns adequate pre-excitement of the inert gas fuel and more particularly involves the sub-concepts of pre-exciting the fuel in the mixing process, of manipulation of the currents in the coils surrounding each cylinder, of discharging the capacitors surrounding each cylinder at predetermined times in the cycles, of causing a stream of electrical particles to flow between electrodes and a conductive discharge point on the piston, of emitting alpha, beta and gamma rays from an anode and a cathode containing low level radioactive material to the piston's discharge point, of accelerating the alpha, beta and gamma rays by the application of a high-voltage field, and of situating capacitor plates 90 degrees from the anode and cathode to slow and reflect neutrons generated during ignition. The seventh concept involves the provision of a minute, pellet-type fission ignition, the heat from which causes a minute fusion as the result of the ignition chamber shape and arrangement, as a result of the collision of the alpha, beta and gamma rays and the electrical particles at a focal point in conjunction with the discharge of the capacitors that surround the cylinder through the electrodes, and as a result of increasing the magnetic field in the direction of the movement of each piston.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above methods, constructions and products without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Robert Britt was also awarded a US patent for an engine operating on inert gasses. William Lyne remarks that this engine design may be replicated using a Chevy "Monza" 6-cylinder engine or a VolksWagen 4-cylinder engine. The heads are removed and the new heads cast using the "pot metal" used for "pseudo chrome" automotive trim. That alloy contains aluminium, tin, zinc and possibly antimony and is particularly suitable as the insides of the cavities can be polished to the high reflectivity specified in the patents.

US Patent 3,977,191 **31st August 1976** **Inventor: Robert G. Britt**

ATOMIC EXPANSION REFLEX OPTICS POWER SOURCE (AEROPS) ENGINE

ABSTRACT

An engine is provided which will greatly reduce atmospheric pollution and noise by providing a sealed system engine power source which has no exhaust nor intake ports. The engine includes a spherical hollow pressure chamber which is provided with a reflecting mirror surface. A noble gas mixture within the chamber is energised by electrodes and work is derived from the expansion of the gas mixture against a piston.

SUMMARY OF THE INVENTION

An atomic expansion reflex optics power source (AEROPS) engine, having a central crankshaft surrounded by a crankcase. The crankcase has a number of cylinders and a number of pistons located within the cylinders. The pistons are connected to the crankshaft by a number of connecting rods. As the crankshaft turns, the pistons move in a reciprocating motion within the cylinders. An assembly consisting of a number of hollow spherical pressure chambers, having a number of electrodes and hollow tubes, with air-cooling fins, is mounted on the top of each cylinder. The necessary gaskets are provided as needed to seal the complete engine assemblies from atmospheric pressure. A means is provided to charge the hollow spherical pressure chamber assembly and the engine crankcase with noble gas mixtures through a series of valves and tubes. A source of medium-voltage pulses is applied to two of the electrodes extending into each of the hollow spherical pressure chambers.

When a source of high-voltage pulses is applied from an electrical rotary distributor switch to other electrodes extending into each of the hollow spherical pressure chambers in a continuous firing order, electrical discharges take place periodically in the various hollow spherical pressure chambers. When the electrical discharges take place, high energy photons are released on many different electromagnetic frequencies. The photons strike the atoms of the various mixed gases, e.g., xenon, krypton, helium and mercury, at different electromagnetic frequencies to which each is selectively sensitive, and the atoms become excited. The first photons emitted are reflected back into the mass of excited atoms by a reflecting mirror surface on the inside wall of any particular hollow spherical pressure chamber, and this triggers more photons to be released by these atoms. They are reflected likewise and strike other atoms into excitation and photon energy release. The electrons orbiting around the protons of each excited atom in any hollow spherical pressure chamber increase in speed and expand outward from centre via centrifugal force causing the atoms to enlarge in size. Consequently, a pressure wave is developed, the gases expand and the pressure of the gas increases.

As the gases expand, the increased pressure is applied to the top of the pistons in the various cylinders fired selectively by the electrical distributor. The force periodically applied to the pistons is transmitted to the connecting rods which turn the crankshaft to produce rotary power. Throttle control valves and connecting tubes form a bypass between opposing hollow spherical pressure chambers of each engine section thereby providing a means of controlling engine speed and power. The means whereby the excited atoms are returned to normal minimum energy ground-state and minimum pressure level, is provided by disrupting the electrical discharge between the medium-voltage electrodes, by cooling the atoms as they pass through a heat transfer assembly, and by the increase in the volume area above the pistons at the bottom of their power stroke. The AEROPS engine as described above provides a sealed unit power source which has no atmospheric air intake nor exhaust emission. The AEROPS engine is therefore pollution free.

BRIEF OBJECTIVE OF THE INVENTION

This invention relates to the development of an atomic expansion reflex optics power source (AEROPS) engine, having the advantages of greater safety, economy and efficiency over those disclosed in the prior art. The principal object of this invention is to provide a new engine power technology which will greatly reduce atmospheric pollution and noise, by providing a sealed system engine power source which has no exhaust nor intake ports.

Engine power is provided by expanding the atoms of various noble gas mixtures. The pressure of the gases increases periodically to drive the pistons and crankshaft in the engine to produce safe rotary power. The objects and other advantages of this invention will become better understood to those skilled in the art when viewed in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is an elevational view of the hollow spherical pressure chamber assembly, including sources of gas mixtures and electrical supply:

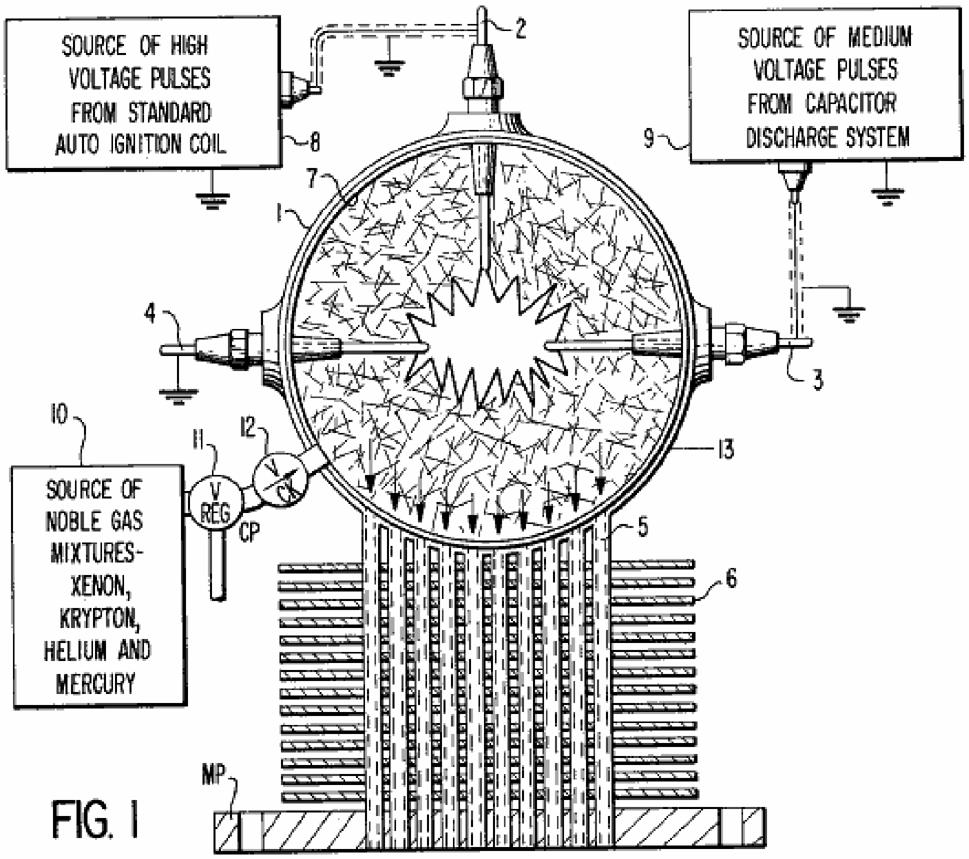
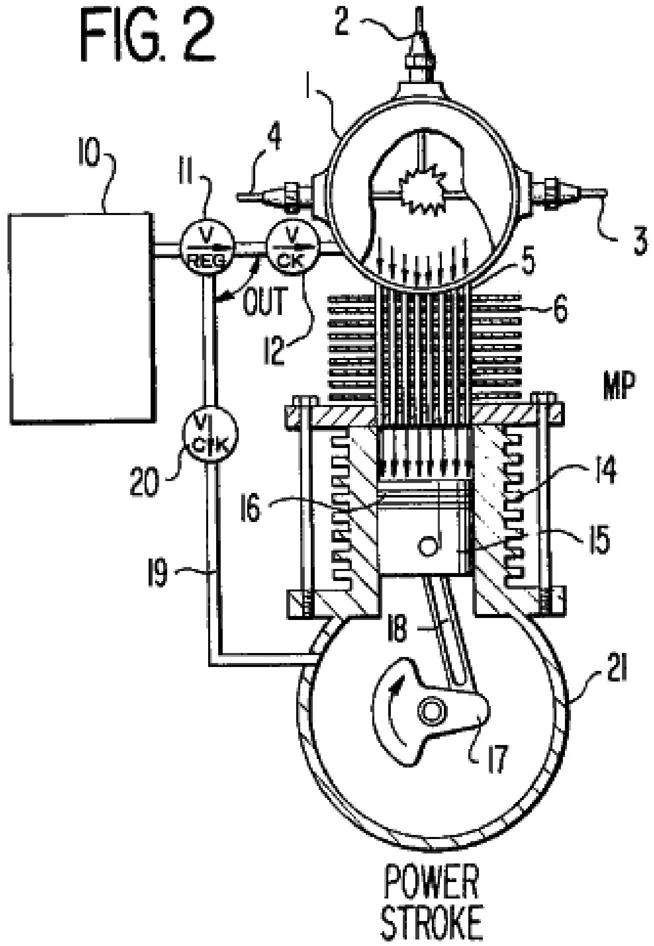


FIG. 1

Fig.2 is an elevational view of the primary engine power stroke:

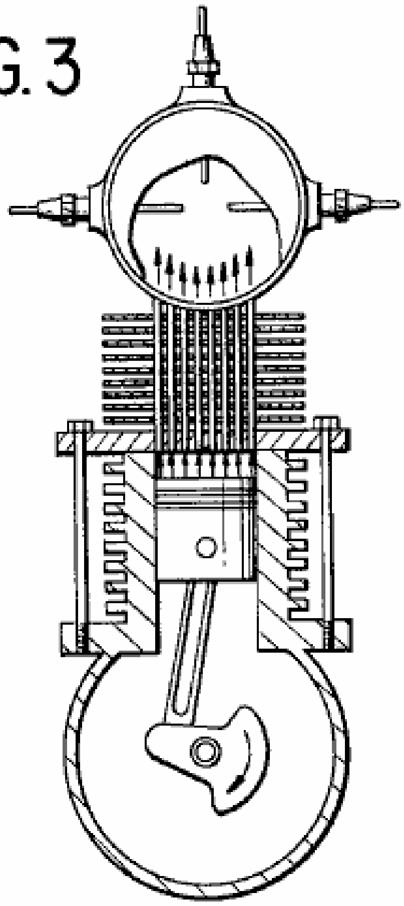
FIG. 2



2
1
4
3
10
11
V
REG
V
CK
5
6
OUT
12
MP
20
V
CK
14
16
15
19
18
21
17
POWER
STROKE

Fig.3 is an elevational view of the primary engine compression stroke:

FIG. 3



COMPRESSION STROKE

Fig.4 is a rear elevational view of a six cylinder AEROPS engine:

FIG. 4

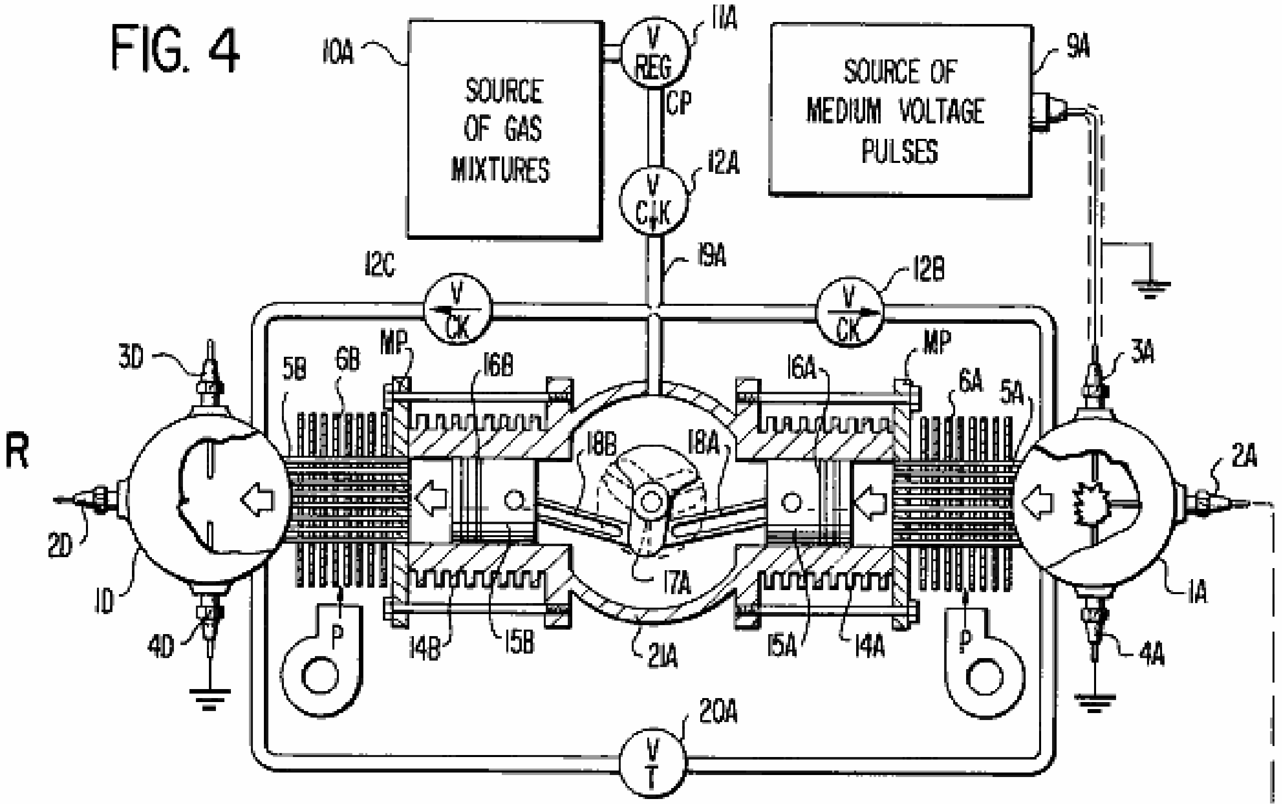


Fig.5 is a top view of the six cylinder AEROPS engine:

FIG. 5

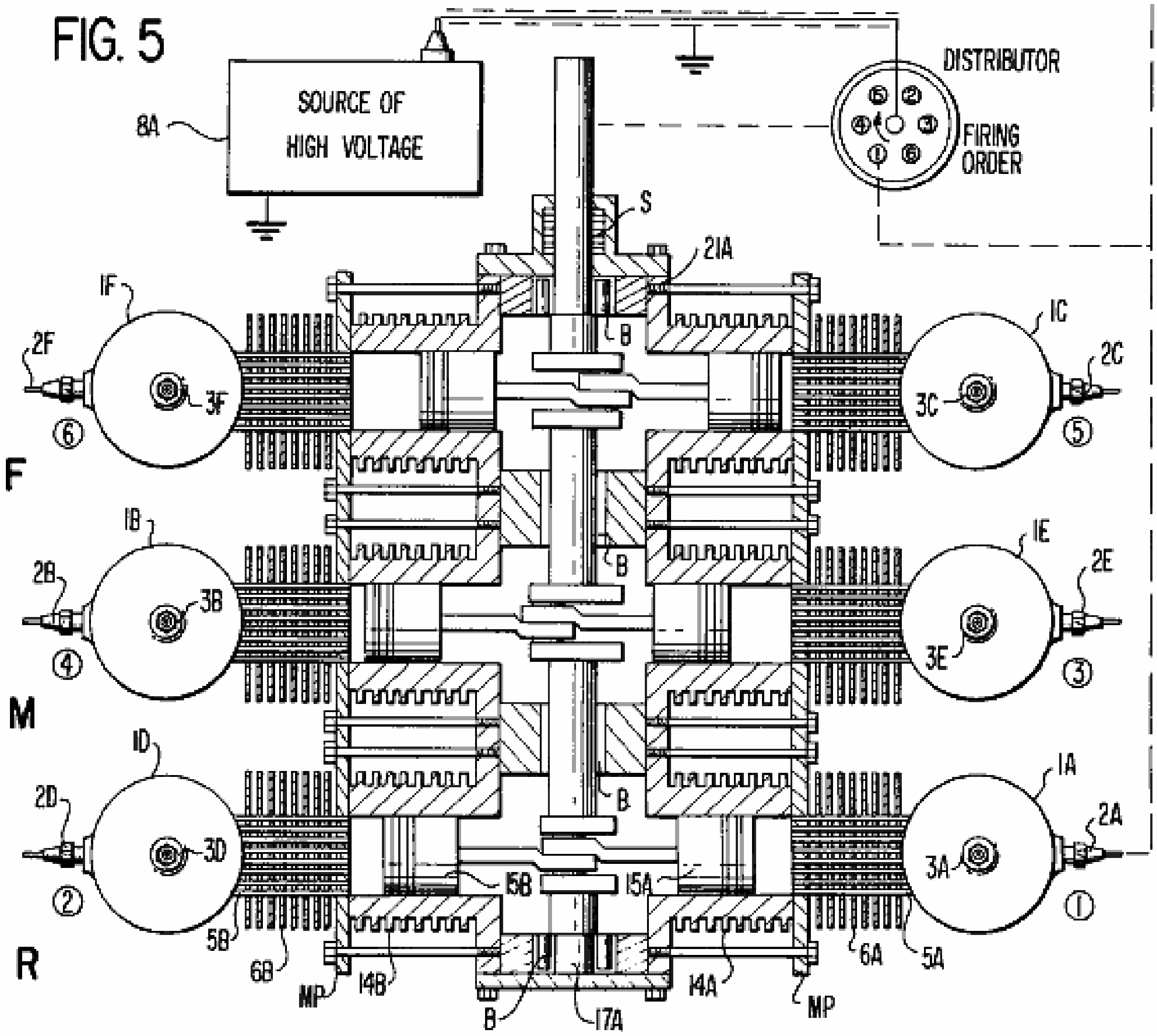


Fig.6 is an electrical schematic of the source of medium-voltage:

FIG. 6

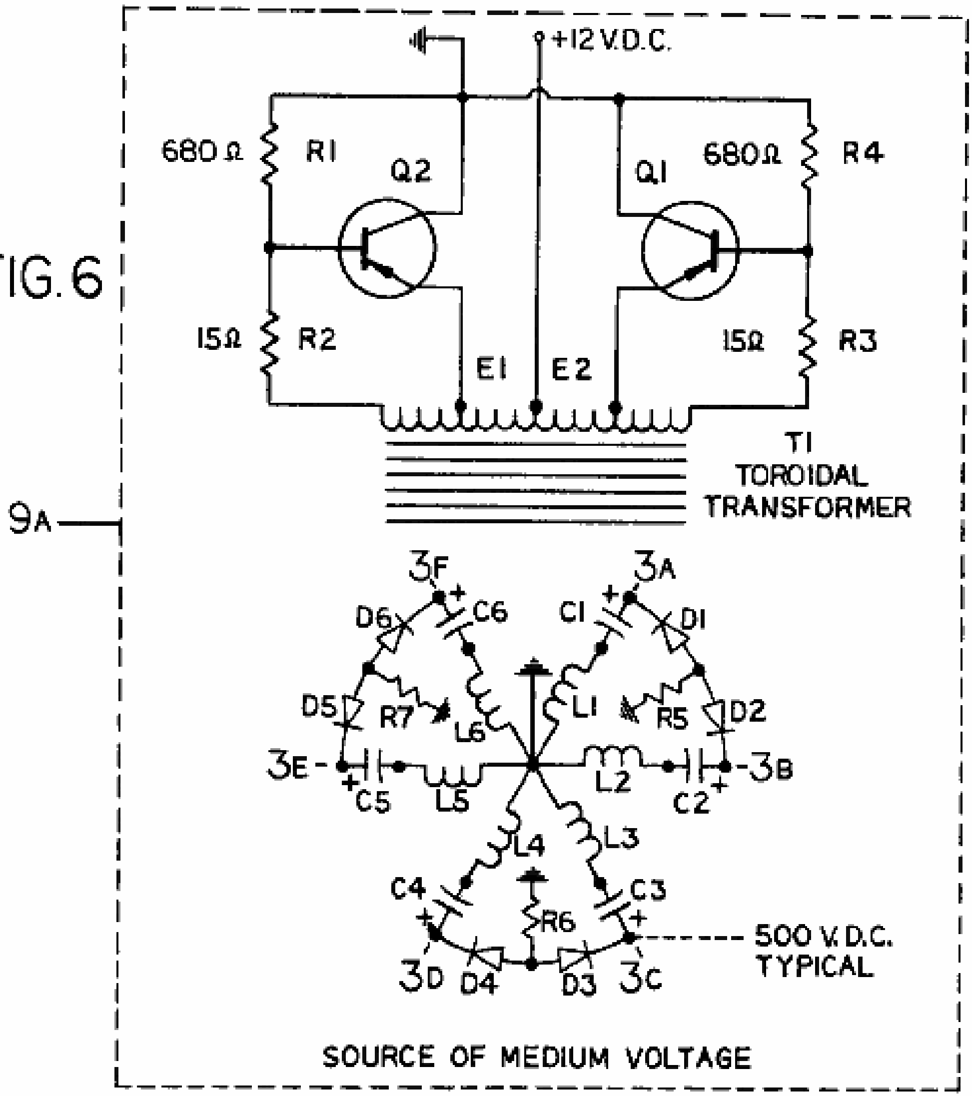
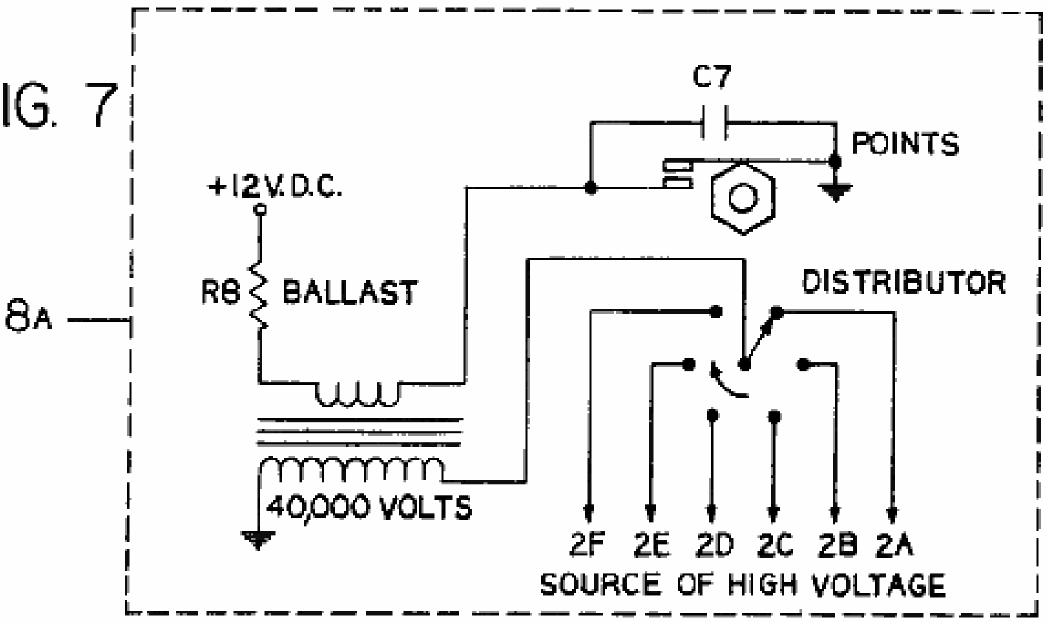


Fig.7 is an electrical schematic of the source of high-voltage:

FIG. 7



DETAILED DESCRIPTION

Referring to **Fig.1** of the drawings, the AEROPS engine comprises a hollow spherical pressure chamber **1** having an insulated high-voltage electrode **2** mounted on the top, an insulated medium-voltage electrode **3** mounted on the right, and an insulated common ground electrode **4** mounted on the left, as shown in this particular view. Electrodes **2, 3** and **4** extend through the wall of the hollow spherical pressure chamber **1** and each electrode forms a pressure seal. A plurality of hollow tubes **5** arranged in a cylindrical pattern extend through the wall of the hollow spherical pressure chamber **1**, and each hollow tube is welded to the pressure chamber to form a pressure seal. The opposite ends of hollow tubes **5** extend through the mounting plate **MP** and are welded likewise to form a pressure seal. A plurality of heat transfer fins **6** are welded at intervals along the length of said hollow tubes **5**. A bright reflecting mirror surface **7** is provided on the inner wall of the hollow spherical pressure chamber **1**. A source of high-voltage **8** is periodically connected to the insulated high-voltage electrodes **2** and **4**. A source of medium-voltage **9** from a discharge capacitor is connected to the insulated medium-voltage electrodes **3** and **4**. A source of noble gas mixtures **10**, e.g., xenon, krypton, helium and mercury is applied under pressure into the hollow spherical pressure chamber **1** through pressure regulator valve **11** and check valve **12**.

Referring now to **Fig.2** of the drawings, the complete assembly **13** shown in **Fig.1** is mounted on the top of the cylinder **14** via mounting plate **MP**. The necessary gaskets or other means are provided to seal the engine and prevent loss of gases into the atmosphere. The piston **15** located within cylinder **14** has several rings **16** which seal against the inner wall of the cylinder. The piston **15** is connected to the crankshaft **17** by connecting rod **18**. The source of noble gas mixtures **10** is applied under pressure into the crankcase **21** through pressure regulator valve **11**, check valve **12** and capillary tube **19**. The piston **15** is now balanced between equal gas pressures. Assuming that the engine is running and the piston **15** is just passing Top-Dead-Centre (TDC), a source of medium-voltage from a capacitor discharge system **9** (**Fig.6**, a single typical capacitor section) is applied to electrodes **3** and **4**. A source of high-voltage pulses from a standard ignition coil **8** (such as shown in **Fig.7**) is applied to electrodes **2** and **4** and the gases within the hollow spherical pressure chamber **1** are ionised and made electrically conductive. An electrical discharge takes place between electrodes **3** and **4** through the gases in the hollow spherical pressure chamber **1**.

The electrical discharge releases high energy photons on many different electromagnetic frequencies. The photons strike the atoms of the various gases, e.g., xenon, krypton, helium and mercury at different electromagnetic frequencies to which each atom is selectively sensitive and the atoms of each gas become excited. The first photons emitted are reflected back into the mass of excited atoms by the reflecting mirror surface **7**. This triggers more photons to be released by these atoms, and they are reflected likewise from the mirror surface 7 and strike other atoms into excitation and more photons are released as the chain reaction progresses. The electrons orbiting around the protons of each excited atom increase in speed and expand outward in a new orbital pattern due to an increase in centrifugal force. Consequently, a pressure wave is developed in the gases as the atoms expand and the overall pressure of the gases within the hollow spherical pressure chamber **1** increases. As the gases expand they pass through the hollow tubes **5** and apply pressure on the top of piston **15**. The pressure pushes the piston **15** and the force and motion of the piston is transmitted through the connecting rod **18** to the crankshaft **17** rotating it in a clockwise direction. At this point of operation, the power stroke is completed and the capacitor in the medium-voltage capacitor discharge system **9** is discharged. The excited atoms return to normal ground state and the gases return to normal pressure level. The capacitor in the medium-voltage capacitor discharge system **9** is recharged during the time period between (TDC) power strokes.

Referring now to **Fig.3** of the drawings, the compression stroke of the engine is shown. In this engine cycle the gases above the piston are forced back into the hollow spherical pressure chamber through the tubes of the heat transfer assembly. The gases are cooled as the heat is conducted into the fins of the heat transfer assembly and carried away by an air blast passing through the fins. An example is shown in **Fig.4**, the centrifugal air pump **P** providing an air blast upon like fins.

Some of the basic elements of the invention as set forth in **Fig.1**, **Fig.2**, and **Fig.3** are now shown in **Fig.4** and **Fig.5** which show complete details of a six-cylinder horizontally-opposed AEROPS engine.

Referring now to **Fig.4** and **Fig.5** of the drawings. **Fig.4** is a view of the rear section of the engine showing the crankshaft, centre axis and two of the horizontally-opposed cylinders. In as much as the rear **R**, middle **M** and front **F** sections of the engine possess identical features, only the rear **R** engine section will be elaborated upon in detail in order to prevent repetition and in the interest of simplification. The crankshaft **17A** consists of three cranks spaced 120 degrees apart in a 360 degree circle as shown. Both connecting rods **18A** and **18B** are connected to the same crank. Their opposite ends connect to pistons **15A** and **15B**, located in cylinders **14A** and **14B** respectively. Each piston has pressure sealing rings **16A** and **16B**. The hollow spherical pressure chamber assemblies consisting of **1A** and **1D** are mounted on cylinders **14A** and **14B** via mounting plates **MP**. The necessary gaskets are provided as needed to seal the complete engine assemblies from atmospheric pressure.

The source of gas mixtures **10A** is applied under pressure to pressure regulator valve **11A** and flows through check valve **12A**, through check valve **12B** to the hollow spherical pressure chamber **1A**, and through check valve **12C** to the hollow spherical pressure chamber **1D**. The gas flow network consisting of capillary tubes below point **19A** represents the flow of gases to the rear section **R** of the engine. The middle section **M** and the front section **F** both have gas flow networks identical to that consisting of capillary tubes below point **19A**, while the gas flow network above is common to all engine sections. Throttle valve **20A** and the connecting tubing form a variable bypass between hollow spherical pressure chambers **1A** and **1D** to control engine speed and power. Engine sections **R**, **M** and **F** each have this bypass throttle network. The three throttle valves have their control shafts ganged together. A source of medium-voltage pulses **9A** is connected to medium-voltage electrodes **3A** and **3D**. In one particular embodiment the medium-voltage is 500 volts. A source of high-voltage pulses **8A** is connected to electrode **2A** through the distributor as shown. Electrode **4A** is connected to common ground. Centrifugal air pumps **P** force air through heat transfer fins **6A** and **6B** to cool the gases flowing in the tubes **5A** and **5B**.

Fig.5 is a top view of the AEROPS engine showing the six cylinders and crankshaft arrangement consisting of the rear **R**, middle **M** and front **F** sections. The crankshaft **17A** is mounted on bearings **B**, and a multiple shaft seal **S** is provided as well as the necessary seals at other points to prevent loss of gases into the atmosphere. The hollow spherical pressure chambers **1A, 1B, 1C, 1D, 1E** and **1F** are shown in detail with high-voltage electrodes **2A, 2B, 2C, 2D, 2E, 2F** and medium-voltage electrodes **3A, 3B, 3C, 3E** and **3F**. The common ground electrodes **4A, 4B, 4C, 4D, 4E, 4F** are not shown in **Fig.5** but are typical of the common ground electrodes **4A** and **4D** shown in **Fig.4**. It should be noted that the cranks on crankshaft **17A** are so arranged to provide directly opposing cylinders rather than a conventional staggered cylinder design.

Fig.6 is an electrical schematic of the source of medium-voltage **9A**. The complete operation of the converter is explained as follows: The battery voltage 12 VDC is applied to transformer **T1**, which causes currents to pass through resistors **R1, R2, R3** and **R4**. Since it is not possible for these two paths to be exactly equal in resistance, one-half of the primary winding of **T1** will have a somewhat higher current flow. Assuming that the current through the upper half of the primary winding is slightly higher than the current through the lower half, the voltages developed in the two feedback windings (the ends connected to **R3** and **R2**) tend to turn transistor **Q2** on and transistor **Q1** off. The increased conduction of **Q2** causes additional current to flow through the lower half of the transformer primary winding. The increase in current induces voltages in the feedback windings which further drives **Q2** into conduction and **Q1** into cut-off, simultaneously transferring energy to the secondary of **T1**. When the current through the lower half of the primary winding of **T1** reaches a point where it can no longer increase due to the resistance of the primary circuit and saturation of the transformer core, the signal applied to the transistor from the feedback winding drops to zero, thereby turning **Q2** off. The current in this portion of the primary winding drops immediately, causing a collapse of the field about the windings of **T1**. This collapse in field flux, cutting across all of the windings in the transformer, develops voltages in the transformer windings that are opposite in polarity to the voltages developed by the original field. This new voltage now drives **Q2** into cut-off and drives **Q1** into conduction. The collapsing field simultaneously delivers power to the secondary windings **L1, L2, L3, L4, L5** and **L6**. The output voltage of each winding is connected through resistors **R5, R6** and **R7** and diode rectifiers **D1, D2, D3, D4, D5** and **D6**, respectively, whereby capacitors **C1, C2, C3, C4, C5** and **C6** are charged with a medium-voltage potential of the polarity shown. The output voltage is made available at points **3A, 3B, 3C, 3D, 3E** and **3F** which are connected to the respective medium-voltage electrodes on the engine shown in **Fig.4** and **Fig.5**.

Referring now to **Fig.7** of the drawings, a conventional "Kettering" ignition system provides a source of high-voltage pulses **8A** of approximately 40,000 volts to a distributor, which provides selective voltage output at **2A, 2B, 2C, 2D, 2E** and **2F**, which are connected to the respective high-voltage electrodes on the engine shown in **Fig.4** and **Fig.5**. The distributor is driven by the engine crankshaft **17A** (**Fig.5**) at a one to one mechanical gear ratio.

Referring again to **Fig.4** and **Fig.5** of the drawings, the operation of the engine is as follows: Assuming that a source of noble gas mixtures, e.g., xenon, krypton, helium and mercury is applied under pressure to the hollow spherical pressure chambers **1A, 1B, 1C, 1D, 1E** and **1F** and internally to the crankcase **21A** through pressure regulator valve **11A** and check valves **12A**, **12B** and **12C**; and the source of medium-voltage **9A** is applied to electrodes **3A, 3B, 3C, 3D, 3E** and **3F**; and a source of high-voltage pulse **8A** is applied to electrode **2A** through the timing distributor, the gas mixtures in the hollow spherical pressure chamber **1A** is ionised and an electrical discharge occurs immediately between electrodes **3A** and **4A**.

High-energy photons are released on many different electromagnetic frequencies. The photons strike the atoms of the various gases, e.g., xenon, krypton, helium and mercury at different electromagnetic frequencies to which each is particularly sensitive and the atoms of each gas become excited. The first photons emitted are reflected back into the mass of excited atoms by the internal reflecting mirror surface on the inside wall of the hollow spherical pressure chamber **1A**. This triggers more photons to be released by these atoms and they are reflected likewise from the mirror surface and strike other atoms into excitation and more photons are released as the chain reaction progresses. The electrons orbiting around the protons of each excited atom in the hollow spherical pressure chamber **1A** increase in speed and expand outward in a new orbital pattern due to an increase in centrifugal force. Consequently, a pressure wave is developed in the gases as the atoms expand and the overall pressure of the gases within the hollow spherical pressure chamber **1A** increases.

As the gases expand they pass through the hollow tubes **5A** applying pressure on the top of piston **15A**. The pressure applied to piston **15A** is transmitted through connecting rod **18A** to the crankshaft **17A** rotating it in a clockwise direction. As the crankshaft **17A** rotates it pushes piston **15B** via connecting rod **18B** in the direction of a compression stroke, forcing the gases on the top of the piston through hollow tubes **5B** into the hollow spherical pressure chamber **1D**. As the gases pass through the hollow tubes **5A** and **5B** the heat contained in the gases is conducted into the heat transfer fins **6A** and **6B**, where it is dissipated by a blast of air passing through said fins from the centrifugal air pumps **P**. At this point of operation the power stroke of piston **15A** is completed and the capacitor in the medium-voltage capacitor discharge system **9A** is discharged. The excited atoms return to normal ground state and the gases return to normal pressure level. The capacitor in the medium-voltage capacitor discharge system **9A** is recharged during the time period between the power strokes of piston **15A**.

The above power stroke cycle occurs exactly the same in the remaining cylinders as the high-voltage firing order progresses in respect to the position of the distributor switch. In as much as the AEROPS engine delivers six power strokes per single crankshaft revolution, the crankshaft drives the distributor rotor at a one to one shaft ratio. The complete high-voltage firing order is 1, 4, 5, 2, 3, 6, whereas, the high-voltage is applied to electrodes **2A, 2B, 2C, 2D, 2E** and **2F** respectively. A means of controlling engine speed and power is provided by a plurality of throttle control valves and connecting tubes which form a bypass between opposing hollow spherical pressure chambers of each engine section.

The AEROPS engine as described above provides a sealed unit power source which has no atmospheric air intake nor exhaust emission and is therefore pollution free.