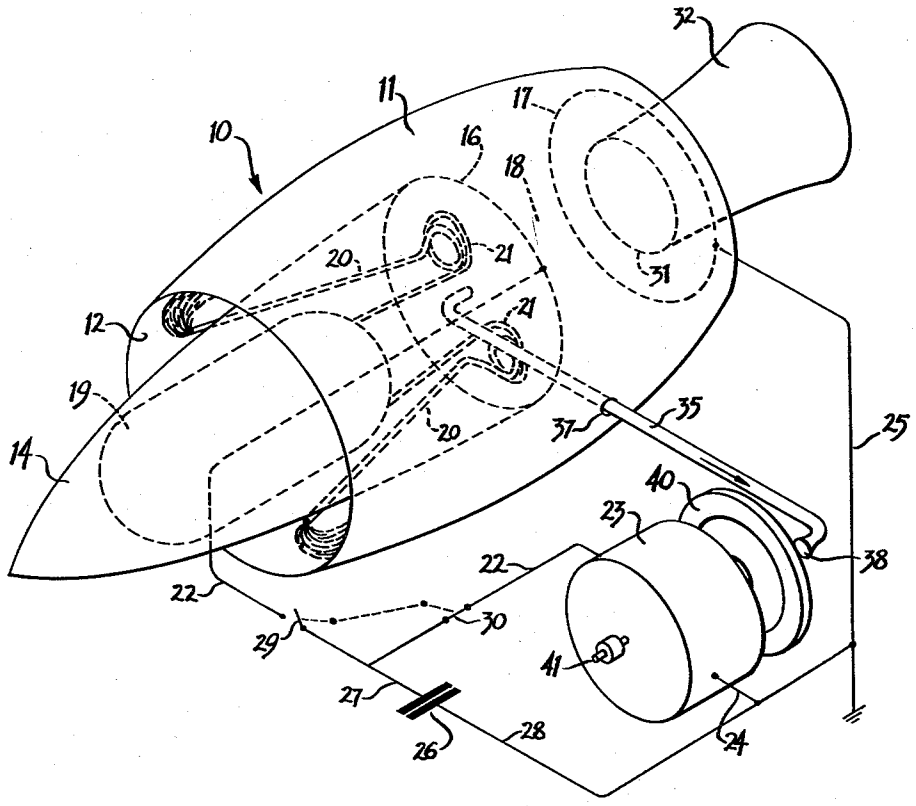
May 8, 1962 A. E. KUNEN 3,032,978

MAGNETIC COMPRESSION ENGINE

Filed Nov. 6, 1958 4 Sheets-Sheet 1

Fig. 1



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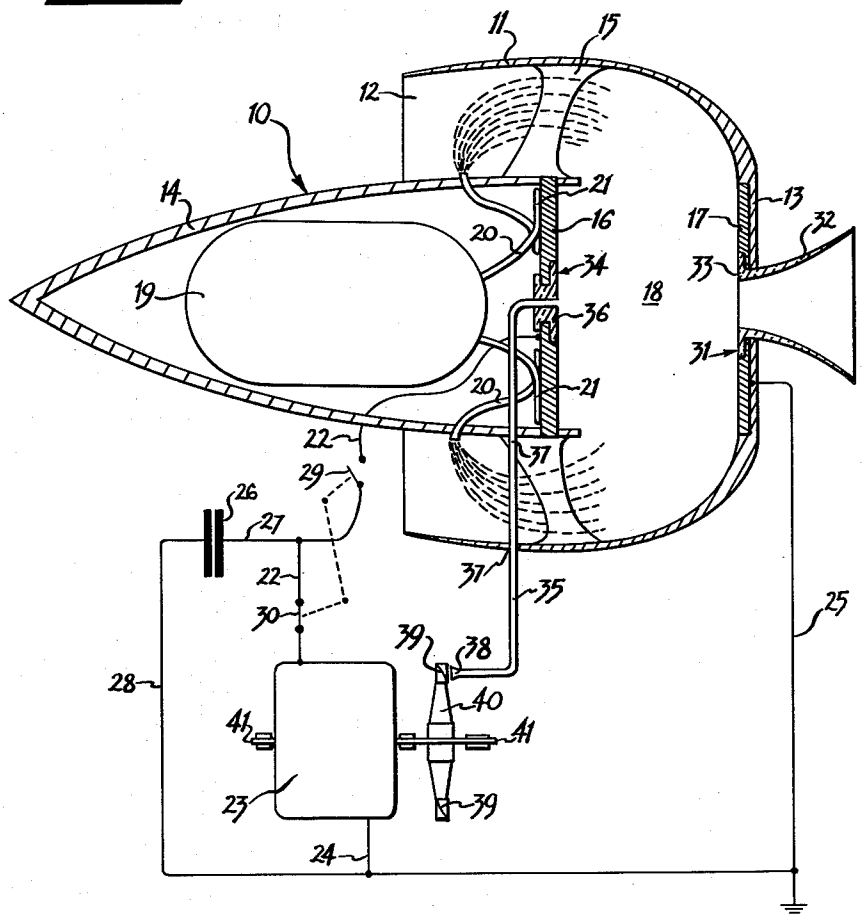
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MAGNETIC COMPRESSION ENGINE

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Fig. 2



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MAGNETIC COMPRESSION ENGINE

Filed Nov. 6, 1958 4 Sheets-Sheet 3

Fig. 3

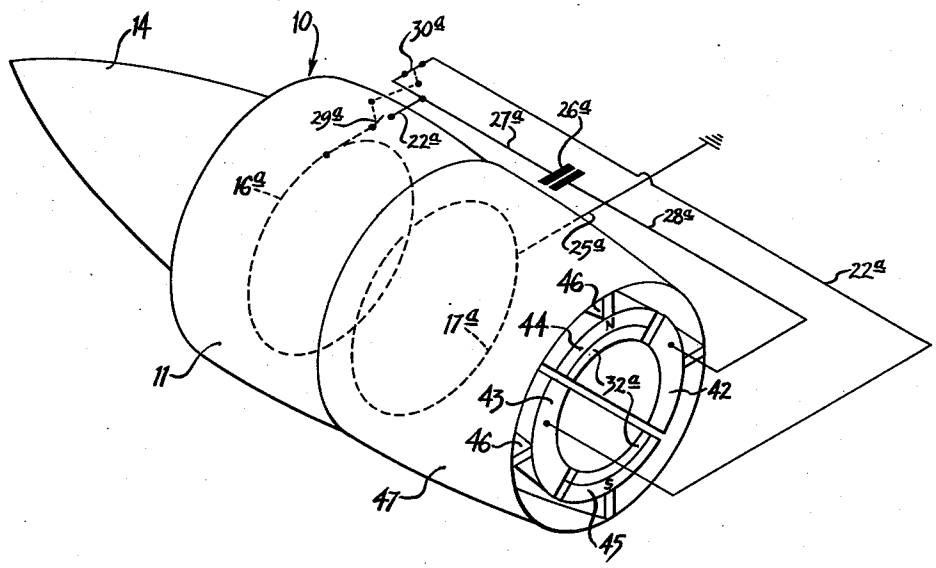
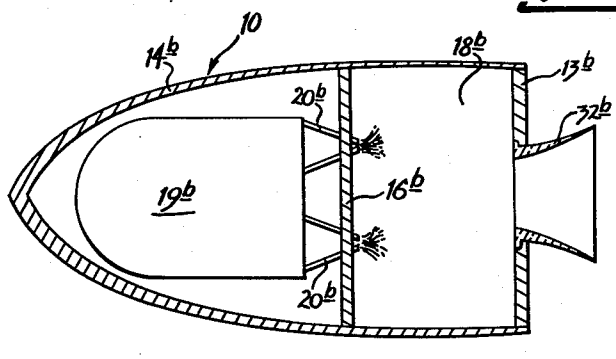


Fig. 5



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MAGNETIC COMPRESSION ENGINE

Filed Nov. 6, 1958 4 Sheets-Sheet 4

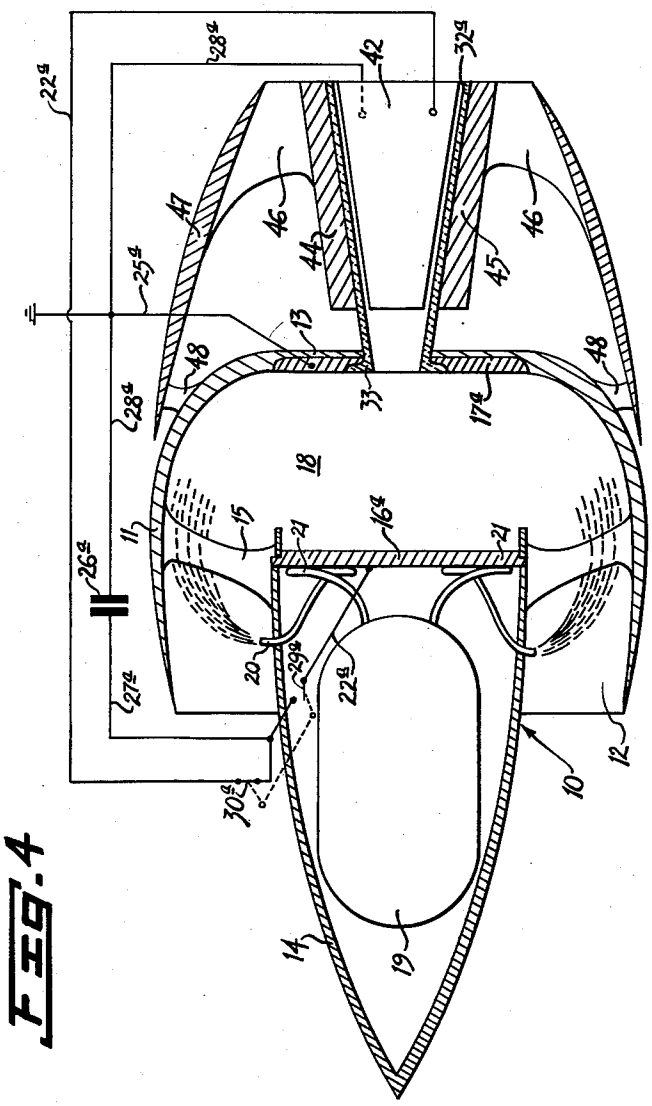


FIG. 4

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United States Patent Office 3,032,978 Patented May 8, 1962

3,032,978

MAGNETIC COMPRESSION ENGINE

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Filed Nov. 6, 1958, Ser. No. 772,654
20 Claims. (Cl. 60—35.6)

This invention relates generally to propulsion systems and more particulraly to an engine wherein a fluid is electromagnetically compressed and then ejected to produce or develop thrust. This application is a continuation in part of applicant's co-pending application for a Magnetic Compression Engine, Serial No. 708,441, filed January 13, 1958, now abandoned.

It has been found heretofore that when a voltage is impressed across a pair of spaced electrodes to cause an electrical discharge therebetween, a fluid disposed in the space between the electrodes is ionized or converted into a plasma, in whole or in part, and the initial current flow of the electrical discharge produced by the impressed voltage occurs only between the adjacent peripheral or outer edge portions of the electrodes. Thus, where the electrodes comprise a pair of spaced discs, the initial current is in the form of a thin cylindrical shell extending between the outer edge portions of the electrodes and the longitudinal axis thereof is substantially coincident with an axis normal to the centers of the electrodes. This is generally known as the "skin effect" of transient electrical currents. Moreover, this cylindrical shell of current encloses the ionized fluid or plasma between the electrodes.

The initial current also gives rise to, or induces, a magnetic field that encircles or surrounds the cylindrical current shell and which interacts therewith to drive it radially inward toward its longitudinal axis. In effect, therefore, the electrical discharge between the spaced electrodes produces an electromagnetic cylindrical piston defined and closed at its opposite ends by the electrodes and the diameter of which, and hence its volume, decreases as it is driven or moves radially inward toward its longitudinal axis. As a result, the plasma or ionized fluid disposed within this electromagnetic piston is pinched or compressed and its temperature and pressure increased. This phenomenon is generally known as "electromagnetic pinch effect" and has been used in experiments relating to thermonuclear fusion.

The present invention contemplates and has for one of its objects the provision of a novel engine wherein the electromagnetic pinch effect is utilized to compress a fluid which is then ejected to thereby develop or produce power in the form of thrust.

In general, the instant engine comprises a pair of spaced electrodes and means for cyclically causing an electrical discharge therebetween to the end that a series of electromagnetic pistons are produced, each of which serves to compress a fluid supplied to the space between the electrodes. This compressed fluid is then ejected through suitable nozzle means to develop the desired thrust from the engine.

While the engine contemplated herein has general utility and may be used wherever power in the form of thrust is desired, it is particularly adapted for use in the propulsion of land, sea, air and space vehicles. Moreover, the instant engine may be operated with either an inert, i.e., non-combustible, or a combustible fluid, depending upon its intended use. For example, a non-combustible fluid such as nitrogen or pure hydrogen may be used, or a combustible mixture of fluids such as oxygen and hydrogen, or the like may also be used. In the latter case, i.e., when a combustible mixture of fluids is utilized, the compression thereof by the electromagnetic piston also results in detonating the mixture, with the end result that its pressure and temperature is substantially increased.

With the above and other objects in view, as will be apparent, this invention consists in the construction, combination and arrangement of parts all as hereinafter more fully described, claimed and illustrated in the accompanying drawings, wherein:

FIG. 1 is a perspective view of the present engine including means for cyclically producing electrical discharges between its electrodes, and wherein either an ambient fluid alone, or combined with another fluid carried by the engine, is used in the operation thereof;

FIG. 2 is a longitudinal section (partly in elevation and partly schematic) through the engine shown in FIG. 1;

FIG. 3 is a perspective view of the instant engine showing an alternative means for cyclically producing the electrical discharges between its electrodes;

FIG. 4 is a longitudinal section through the engine as shown in FIG. 3; and

FIG. 5 is a longitudinal section through a modified form of the instant engine which may utilize either of the electrical discharge-producing means shown in FIGS. 1 through 4.

Referring now to the drawings and more particularly to FIGS. 1 and 2, 10 designates an engine constructed in accordance with the teachings of this invention. The engine 10 comprises a cylinder 11 open at one end as at 12 and closed at its opposite end by an end-wall 13 to form a cup-like housing. A substantially conical forward section 14 is mounted concentrically within the housing 11 by a spider 15, with its base disposed within the housing 11 adjacent the wall 13, and its other end or apex extending outwardly of the housing 11 to thereby partially close the open end 12 and create an annular air inlet.

The base of the conical section 14 is positioned in spaced relationship to the end-wall 13 of the housing 11 and comprises an electrode 16. A second electrode 17 is mounted on the end-wall 13 of the housing 11 and is disposed parallel to and spaced from the electrode 16. The electrodes 16 and 17, in this instance, are in the form of flat discs of substantially equal size, and are electrically insulated from the section 14 and end-wall 13, respectively, by any conventional means, not shown. As will hereinafter be more fully set forth, the space defined between the electrodes 16 and 17 serves as the compression chamber 18 of the engine 10.

The instant engine is capable of operation with either inert, i.e., non-combustible, or combustible fluids. Thus, a fluid such as ambient air, surrounding the engine and entering the housing 11 through the annular inlet 12, may be used as the fluid for operating the engine 10. However, it may be desirable to add to the ambient fluid some suitable fluid such as hydrogen, or a mixture of combustible fluids. To these ends, a tank 19 designed to hold or contain a selected fluid, such as hydrogen in its liquefied state, is mounted within the forward section 14 by any conventional means, not shown.

The tank 19 communicates by way of one or more conduits 20 with the annular inlet 12. Medially of their lengths, the conduits 20 are coiled as at 21 and disposed against, or in close proximity to, the electrode 16. The conduits 20, if made from an electrically conductive material, are electrically insulated from the electrode 16. Due to this arrangement, when the fluid contained within the tank 19 is released for delivery by any conventional valve means, not shown, it will pass through the conduits 20 to and into the annular inlet 12 where the incoming ambient fluid atomizes and sprays it into the space between the electrodes 16 and 17. The fluid in passing through

the conduits 20 and the coils 21 thereof serves to cool the electrode 16 and, at the same time, the heat thus absorbed will tend to vaporize the fluid in the conduits 20.

Means is provided whereby a voltage is impressed across the electrodes 16 and 17 of sufficient magnitude to ionize, or convert into a plasma, in whole or in part, a fluid disposed between the electrodes and also to produce an electrical discharge therebetween. For this purpose, the electrode 16 is connected by a conductor or lead 22 to a source of electrical energy such as, for example, a generator 23 which, in turn, is grounded through a suitable lead 24. The electrode 17 is connected through a lead 25 to ground to the end that it is maintained at ground or zero potential. A capacitor 26 or other similar means for storing electrical energy is connected at one of its sides by a lead 27 to the lead 22, while the other side thereof is grounded through a lead 28.

A pair of switches 29 and 30 is inserted in the lead 22, the former between the capacitor 26 and the electrode 16, and the latter between the generator 23 and the lead 27 of the capacitor 26. The switches 29 and 30 are preferably of the electronic type and capable of cyclical and alternate operation to the end that at a selected time interval one opens while the other closes. Thus, when switch 30 is closed and switch 29 is open, the capacitor 26 is connected to the generator 23; whereas, when switch 29 is closed and switch 30 open, the capacitor 26 is disconnected from the generator 23 but connected to the electrode 16.

Due to the foregoing construction and arrangement, when the switch 29 is open and the switch 30 is closed and the generator 23 is operating as will be hereinafter more fully set forth, the generator 23 charges the capacitor 26. On the other hand, when the switch 30 is open and the switch 29 closed, the capacitor 26 is then connected to the electrode 16 to the end that a voltage is impressed across the electrodes 16 and 17. As a result of this impressed voltage, the fluid between the electrodes 16 and 17 is ionized and an electrical discharge is produced across the electrodes 16 and 17. In short, the switches 29 and 30 establish a control for the cyclical operation of the engine 10, whereby the capacitor 26 is alternately charged and discharged to produce a series of electrical discharges between or across the spaced electrodes 16 and 17.

The initial flow of the current occasioned by the electrical discharge between the electrodes 16 and 17 is in the form of a thin, cylindrical shell extending between the electrodes at their outer edge portions or peripheries. This current gives rise to or induces a magnetic field that encircles or surrounds the current shell and forces it radially inward toward its longitudinal axis, to the end that the fluid enclosed or contained within the cylindrical current shell is compressed and its pressure and temperature, and hence its internal energy, is substantially increased. In effect, therefore, the electrical discharge across the electrodes 16 and 17 produces a cylindrical electromagnetic piston which serves to compress and increase the internal energy of the fluid disposed in the space between the electrodes 16 and 17 and, hence, within the electromagnetic piston. In instances where the fluid supplied to the space between the electrodes 16 and 17 comprises a combustible mixture, its compression by the electromagnetic piston detonates it with the end result that its pressure and temperature and thus its internal energy are substantially increased.

It is manifest from the foregoing that the cyclical and alternate operation of switches 29 and 30 produces a series of electrical discharges across the electrodes 16 and 17, each of which, in turn, produces an electromagnetic piston that compresses the fluid disposed between the electrodes.

As heretofore set forth, the longitudinal axis of each electromagnetic piston is substantially coincident with an axis extending between and normal to the centers of the electrodes 16 and 17. Therefore, to provide means whereby the energy of the fluid compressed by the electromagnetic piston is converted into power in the form of thrust, the electrode 17 is pierced centrally by an opening 31 in which is mounted an ejector or exhaust nozzle 32 that is adapted to receive the compressed fluid from the electromagnetic piston. The nozzle 32 may be fabricated from any standard heat-resistant material, for example, a ceramic. To mount the nozzle 32 to the electrode 17, the inner end of the exhaust nozzle 32 is provided with a pair of opposed studs 33 which are engaged in and secured to complementary slots or grooves in the edge of the electrode 17 defining the opening 31. It follows from the foregoing that fluid compressed by the electromagnetic piston as hereinabove set forth is delivered to the exhaust nozzle 32 and ejected therefrom so as to produce thrust.

The fluid compressed by the electromagnetic pistons may also be used in the operation of the generator 23. To this end, the electrode 16 is provided with an opening 34 adjacent its central portion in which one end of a conduit 35 is received and mounted within a suitable liner or bushing 36 whereby it is also electrically insulated from the electrode 16. The conduit 35 extends through suitable openings in the forward section 14 and terminates in a nozzle 38 that is disposed at or adjacent to the driving vanes or buckets of a turbine 40 carried by the shaft 41 of the generator 23. Thus, a portion of the fluid compressed by the electromagnetic pistons as aforesaid is bled off through the conduit 35 and utilized to drive the generator 23.

Referring now to FIGS. 3 and 4, the engine 10 is provided with alternative means for producing the electrical discharge between the electrodes. In short, the electrical-generating means for the engine 10 shown in FIGS. 3 and 4 utilizes the ionized fluid ejected through the exhaust nozzle to generate the electrical energy required to charge the capacitor and, hence, to produce the electrical discharges between the electrodes.

More particularly, a pair of electrodes 42 and 43, formed to follow the contour or outer surface of the ceramic exhaust nozzle 32*a*, is disposed on or adjacent to and at diametrically opposite sides of the exhaust nozzle 32*a*. The nozzle 32*a* is slotted at opposite sides to receive the electrodes 42 and 43 to thereby permit the ionized fluid ejecting through the nozzle 32*a* to come into contact with adjacent surfaces of electrodes 42 and 43. Thus, the electrodes 42 and 43 serve as electrical contacts or brushes. Interposed between the electrodes 42 and 43 and electrically insulated therefrom is a pair of similarly formed permanent magnet plates 44 and 45. Thus, as shown in FIG. 3, the electrodes 42 and 43 are disposed horizontally with respect to each other, with one on either side of the exhaust nozzle 32*a*, while the permanent magnet plates 44 and 45 are disposed vertically with respect to each other, with one on the upper side and the other on the lower side of the exhaust nozzle 32*a*. The electrodes 42 and 43 and plates 44 and 45 are held in their respective positions as above set forth by a plurality of webs 46, secured at one end thereto and at the other end to the inner surface of an aft section or housing 47 that is in the form of a tubular shell or casing adapted to surround the nozzle 32*a*. The webs 46 are made from a suitable dielectric material whereby the electrodes 42 and 43 and the magnetic plates 44 and 45 are insulated from the structure of the aft section 47. If desired, the exhaust nozzle 32*a* may be formed directly by the electrodes 42 and 43 and the magnetic plates 44 and 45. Thus, the electrodes 42 and 43 and magnetic plates 44 and 45 may be constructed and arranged to comprise a divergent exhaust nozzle similar in construction and function to the ceramic nozzle 32*a*. In that instance, the electrodes 42 and 43 and the magnetic plates 44 and 45 are secured to and insulated from the end-wall 13 of

the housing 11 and the electrode 17*a*. Adjacent its forward or leading edge the aft section 47 is secured to the housing 11 by a plurality of webs 48. As shown more particularly in FIG. 4, the aft housing section 47 forms an aerodynamic continuation of the outer surface of the housing 11.

An electrode 16*a*, similar in form to the electrode 16, save that it is imperforate, is connected by a lead 22*a* to the electrode 43, while an electrode 17*a*, similar to the electrode 17, is connected by a lead 25*a* to ground. The capacitor 26*a* is connected at one of its sides through a lead 27*a* to the lead 22*a* and at its opposite side through a lead 28*a* to the electrode 42 and through the leads 28*a* and 25*a* to ground. Switches 29*a* and 30*a*, inserted in the lead 22*a*, are similar in construction and operation to the switches 29 and 30 heretofore described.

The magnetic plates 44 and 45 are constructed and arranged to be of opposite polarity; for example, the plate 44 is of positive or north polarity, while the plate 45 is of negative or south polarity, to the end that a magnetic field is produced between the plates 44 and 45, the flux or lines of force of which extend across the exhaust nozzle 32*a* and normal to its longitudinal axis. When the switch 29*a* is open and the switch 30*a* is closed, the electrode 43 is connected through the lead 22*a*, switch 30*a* and the lead 27*a* to one side of the capacitor 26*a*, while the electrode 42 and the opposite side of the capacitor 26*a* are connected through the leads 28*a* and 25*a* to ground. Therefore, as the ionized fluid compressed by the electromagnetic pistons is ejected or exhausted through the nozzle 32*a*, it passes or cuts through the magnetic field produced by the magnetic plates 44 and 45 and at the same time passes over the exposed electrodes 42 and 43 to the end that a voltage or potential is produced across the electrodes 42 and 43 which results in a current in the circuit above described that charges the capacitor 26*a*. Upon the opening of the switch 30*a* and the closing of the switch 29*a*, the electrical energy stored in the capacitor 26*a* is impressed across the electrodes 16*a* and 17*a* thereby causing an electrical discharge therebetween. Thus, the cyclical alternate operation of the switches 29*a* and 30*a* produces a series of electrical discharges across the electrodes 16*a* and 17*a* which, in turn, form a series of electromagnetic pistons, each of which compresses the fluid disposed therein and ejects it through the exhaust nozzle 32*a* to produce thrust.

As shown in FIGS. 1 through 4, the operating fluid for the engine 10 is drawn from an external source, i.e., the fluid surrounding the engine, and this ambient fluid may, if desired, be augmented or added to form an internal source of fluid stored within the engine. To these ends, the engine 10 is provided with a housing 11 whereby the movement of the engine 10 through an ambient fluid forces it into the space between the electrodes 16 and 17 or 16*a* and 17*a* and the tanks 19 are provided for containing a fluid that may be added to the ambient fluid. However, as shown in FIG. 5, the engine 10 draws its operating fluid solely from an internal source carried by the engine. Therefore, the housing 11 is not needed and the structure of the engine 10 is modified accordingly.

More particularly, the forward section 14*b* is provided with an end wall, viz., electrode 13*b*, that is disposed parallel to and spaced from an electrode 16*b*. The electrode 16*b* is similar in construction and function to either of the electrodes 16 or 16*a*, save that it is pierced by a plurality of openings adjacent its central portion in each of which is mounted one end of a conduit 20*b*, the opposite end of which is connected to a tank or container 19*b*. The tank 19*b* is carried within the forward section 14*b* and is designed and constructed to hold or store the fluid selected for the operation of the engine 10. Thus, for example, the tank 19*b* may be adapted to hold an inert or non-combustible fluid such as pure hydrogen, or nitrogen, or a mixture of combustible fluids, in either their gaseous or liquefied forms.

The end wall, electrode 13*b*, serves in the same capacity as either the electrode 17 or the electrode 17*a* and is provided with, or has mounted thereto, an exhaust nozzle 32*b* that is adapted to receive the fluid compressed between the electrodes 16*b* and 13*b* in the compression chamber 18*b* and to convert its energy into power in the form of thrust.

As in the case of the electrodes 16, 16*a*, 17, and 17*a*, the electrodes 16*b* and 13*b* are electrically insulated from the other structure of the engine 10 by any suitable means, not shown.

The engine 10, shown in FIG. 5, may be associated with either form of the electrical-generating means shown in FIGS. 1 and 2, or in FIGS. 3 and 4, whereby electrical discharges are produced between the electrodes 16*b* and 13*b*, and hence, electromagnetic pistons are formed to compress the fluid supplied between the electrodes 16*b* and 13*b* by the conduits 20*b*. Thus, for example, if the electrical energy-generating means illustrated in FIGS. 1 and 2 is associated with the engine 10 shown in FIG. 5, the lead 22 is connected to the electrode 16*b*, while the lead 25 is connected to the electrode 13*b*. Moreover, the conduit 35 will be mounted through the electrode 16*b* to provide for the operation of the generator 23. On the other hand, should the electrical energy-generating means illustrated in FIGS. 3 and 4 be used with the engine 10 shown in FIG. 5, the leads 22*a* and 25*a* are associated with the electrodes 16*b* and 13*b*, respectively. Additionally, the magnetic plates 44 and 45, and the electrodes 42 and 43, are associated with the exhaust nozzle 32*b* whereby the exhausting ionized fluid is utilized to charge the capacitor 26*a*.

Thus, save for the fact that as shown in FIG. 5, the engine 10 is supplied with an operating fluid only from an internal fluid source, its operation is exactly the same as heretofore set forth with respect to engine 10 as shown in FIGS. 1 and 2, or in FIGS. 3 and 4.

In the foregoing description of the engine 10 and its operation, no specific means have been set forth for starting the engine. This may be accomplished by many different means or practices well known to those skilled in this art. For example, the capacitors 26 and 26*a* may be initially charged from any conventional source of electrical energy, such as a storage battery or power line. In the electrical energy-generating means shown in FIGS. 1 and 2, any conventional starter mechanism may be associated with the turbine 40 or its drive shaft 41 to operate the generator 23 for the initial charging of the capacitor 26.

The flow of operating fluid from either of the tanks 19, or 19*b*, may be controlled in any conventional manner and in accordance with general practices well known in this art. For example, standard valve means may be provided in the conduits 20 or 20*b* for regulating the delivery of the fluid therethrough in accordance with demand as occasioned by the formation of the electromagnetic pistons. In the alternative, the storage tanks 19 and 19*b* may be pressurized and pressure-regulating means included therein whereby the fluid will flow through the conduits 20 and 20*b* as a function of the pressure in the space between their associated electrodes. Many other means for controlling the flow of the operating fluid from the storage tanks will be manifest to those skilled in the art and the foregoing are set forth merely by way of example.

What is claimed is:

1. An engine comprising a pair of spaced disc electrodes having centers in substantial alignment, means supplying a fluid to the space between said electrodes, means for periodically discharging a voltage across said electrodes establishing a peripheral current between said electrodes whereby fluid therebetween is ionized and radially compressed, and nozzle means adapted to receive the

ionized and compressed fluid and eject it from said space.

2. An engine comprising a pair of spaced, parallely disposed disc electrodes, means for delivering a fluid to the space between the electrodes, electrical discharge means operative to pass a voltage across said spaced electrodes whereby fluid therebetween is ionized and compressed, and nozzle means communicating with the space between said electrodes to receive the ionized and compressed fluid and eject it from said space.

3. An engine comprising a pair of spaced, axially aligned disc electrodes, means supplying a fluid to the space between said electrodes, a nozzle in one of said electrodes adjacent the center thereof in open communication with the space between the electrodes, and means for producing an electrical discharge between the electrodes whereby a peripheral current is established across the electrodes and the fluid in said space is ionized, radially compressed and ejected through said nozzle.

4. An engine comprising a pair of spaced disc electrodes disposed about a common centerline, means supplying a fluid to the space between said electrodes, a nozzle at said centerline communicating with said space, a source of electrical energy, and means periodically connecting said electrical energy to said electrodes whereby a series of electrical discharges are produced between the electrodes each establishing an electromagnetic piston radially compressing the fluid in said space and discharging it through said nozzle.

5. An engine comprising a pair of spaced disc electrodes disposed about a common centerline, a source of fluid, conduit means for delivering said fluid to the space between said electrodes, a source of electrical energy, means connecting said electrical energy source to said electrodes and periodically operative to produce a series of electrical discharges across the electrodes whereby each such discharge ionizes fluid in said space and establishes a current that moves radially inwardly and compresses the fluid, and a nozzle at the center of and in communication with the space between the electrodes to receive and eject the compressed fluid.

6. An engine comprising a pair of spaced axially aligned disc electrodes, a source of combustible fluid, means for delivering said combustible fluid to the space between the electrodes, a source of electrical energy operatively connected to the electrodes for periodic discharge across the electrodes whereby combustible fluid in said space is ionized and radially compressed to thereby detonate the combustible fluid, and a nozzle adjacent the center of said electrodes in communication with said space for ejecting the resulting gases.

7. An engine comprising a pair of spaced, axially aligned disc electrodes, means delivering a combustible fluid to the space between said electrodes, ejector means communicating with said space, a source of electric energy, means operative to periodically connect said source of energy to said electrodes whereby an electrical discharge across said electrodes ionizes, compresses and ignites the fluid therebetween into said ejector means, means operative concurrently with the movement of fluid into said ejector means to regenerate said source with energy, a pair of switches one between said source and said electrodes and the other between said source and said regenerating means, and means for the simultaneous and alternate operation of said switches whereby said regenerating means is rendered inoperative and an operative connection is established between the source aforesaid and the electrodes.

8. An engine comprising a compression chamber, a pair of spaced, axially aligned electrodes forming opposed walls of said compression chamber, a nozzle piercing one of said electrodes and projecting therefrom, means for the delivery of fuel to the compression chamber, a store of electric energy adapted to be connected to the electrodes and operative to produce an electrical discharge across said electrodes whereby fuel therebetween is ionized, compressed, ignited and ejected through the nozzle, conduit means open to and receiving the ignited fuel from the compression chamber, means to convert thermal energy of the ignited fuel in said conduit means into electric energy and to deliver such electric energy to said store for the replenishment thereof, and a pair of switches one operative between said store and said electrodes and the other operative between said store and the converting means aforesaid, said switches being interconnected and synchronized for simultaneous and alternate operation at preset time intervals whereby the store discharges across said electrodes and is replenished by operation of said converting means.

9. An engine comprising a compression chamber, a pair of spaced disc electrodes concentrically disposed about and defining opposed walls of said chamber, an exhaust nozzle connected to the chamber at the center thereof, a combustible fluid source terminating in outlet means communicating with the compression chamber, a source of electric energy connected to each electrode and operative to produce an electric discharge across the electrodes whereby fluid in the chamber is ionized, radially compressed and detonated adjacent the center of said chamber and exhausted through said nozzle whereby a propulsive thrust is developed by operation of the engine, conduit means communicating with the exhaust produced within the chamber, means to convert thermal energy in the exhaust in said conduit means into electric energy and to transmit such energy to the source for the replenishment thereof, individual connecting means one normally inoperative between said source and said electrodes and the other normally operative between said source and the conversion and transmission means aforesaid, and means to render said normally inoperative connecting means operative and said normally operative connecting means simultaneously and concurrently inoperative.

10. An engine comprising a forward nose section and a compression chamber aft of said nose section, a pair of axially aligned disc electrodes one forming the aft end-wall of said nose section and the other forming the opposed wall of the compression chamber, a nozzle piercing said latter electrode at the center thereof and projecting outwardly from the compression chamber for the ejection of exhaust from the chamber whereby a propulsve thrust is developed by operation of the engine, a fluid supply within said nose section, means for the delivery of fluid from said supply to the compression chamber, a store of electric energy having different potential outputs each connected to a different electrode, conduit means in constant operative communication with said exhaust, means to convert the exhaust in said conduit means into electric energy, transmitting means to deliver such energy to the energy store for the replenishment thereof, and a pair of controls one between said store and said electrodes and the other between said store and said transmitting means for alternate operation at preset time intervals to charge said store by connecting said transmitting means for operation and to discharge said store by disconnecting said transmitting means and concurrently and simultaneously connecting said store to said electrodes.

11. An engine comprising a compression chamber, a pair of axially aligned disc electrodes forming opposed walls of said chamber, a nozzle piercing one of said electrodes at the center thereof and projecting from said electrodes for the ejection of exhaust from the chamber whereby a propulsive thrust is developed by operation of the engine, means for the delivery of fluid to the compression chamber, an electric circuit including a capacitor connected at one side to one electrode and at the other side to the other electrode, power-generating means connected to said capacitor and a pair of switches one between one of the electrodes and the capacitor and the other between said power-generating means and the capacitor for simultaneous and opposed operation, and

conduit means in operative communication with said exhaust and connected to said power-generating means whereby the exhaust in said conduit means effects the operation of the power-generating means.

12. An engine comprising a pair of disc electrodes disposed in spaced, aligned relation, a nozzle piercing one of said electrodes substantially at the center thereof and projecting from said electrodes, a store of electric power having different potential outputs each connected to a different electrode, power-generating means releasably connected to the power store and operative to replenish it after the discharge of its power, and control means to repeatedly and instantaneously establish and break connection of said outputs to said electrodes and simultaneously disconnect and reconnect respectively said power-generating means from and to said power store whereby the power within the store is discharged across said electrodes to ionize and compress fluid between the electrodes for rejection out of the nozzle while said power-generating means is operative.

13. An engine comprising a compression chamber, a pair of electrodes disposed in spaced, aligned position and forming opposed walls of said chamber, a nozzle connected to one of said electrodes and opening at one of its ends within the compression chamber and at its other end outwardly of said chamber for the ejection of exhaust from the chamber whereby a propulsive thrust is developed by operation of the engine, a source of electric power having different potential outputs one connected to one of the electrodes and the other connected to the other electrode, power-generating means releasably connected to the power source and operative to regenerate it after the discharge of its power, and sequential control means to repeatedly and instantaneously establish and break connection of said outputs to said electrodes at predetermined time intervals and simultaneously disconnect and connect respectively said power-generating means from and to said power source whereby power from the source is alternately discharged across said electrodes when said power-generating means is inoperative and not discharging when said power-generating means is operative.

14. An engine comprising a forward nose section and a compression chamber aft of said nose section, a pair of electrodes one forming the aft end-wall of said nose section and the other forming the opposed wall of the compression chamber, a nozzle connected to the latter electrode adjacent the center thereof and projecting outwardly from the compression chamber for the ejection of exhaust from the chamber whereby propulsive thrust is developed by operation of the engine, an inlet opening in said engine and communicating with the compression chamber for the delivery of air thereto, a fuel container mounted within said nose section, at least one fuel line connected to and extending from said container and terminating in said inlet for the delivery of fuel from the container to the inlet, a medial portion of each of said lines being disposed adjacent the surface of the electrode forming the end-wall of said nose section, a capacitor electrically connected to the electrodes, means for the periodic discharge of said capacitor, and power-generating means releasably connected to said capacitor for the recharging thereof when said capacitor is not discharging as aforesaid.

15. An engine comprising a forward nose section and a compression chamber aft of said nose section, a pair of electrodes one forming the aft end-wall of said nose section and the other forming the opposed wall of the compression chamber, a nozzle connected to the latter electrode adjacent the center thereof and projecting outwardly from the compression chamber for the ejection of exhaust from the chamber whereby propulsive thrust is developed by operation of the engine, an inlet opening in said engine and communicating with the compression chamber for the delivery of ambient fluid thereto, a container of combustible fluid mounted within said nose section, at least one feed line connected to and extending from said container and terminating in said inlet for the delivery of fluid from the container to the inlet, a medial portion of each of said lines being disposed adjacent the surface of the electrode forming the end-wall of said nose section, a capacitor having different potentials electrically connected to each electrode, means for the periodic discharge of said capacitor whereby an electrical discharge passes between the electrodes, said discharge ionizing and compressing the fluid mixture entering the chamber to the point of detonation thereof, a turbine-actuated generator connected to said capacitor for recharging it, a bleed line opening at one of its ends in the chamber and at its other end on and against the turbine of the generator whereby a relatively small portion of the products of combustion within the chamber is delivered to said turbine for operation thereof, and control means to disconnect the generator from the capacitor when said capacitor is discharging as aforesaid and to reconnect the generator to the capacitor when said capacitor is not discharging.

16. An engine comprising a forward nose section and a compression chamber aft of said nose section, a pair of disc electrodes each having an axis substantially coincident with the other and one forming the aft end-wall of said nose section and the other forming the opposed wall of the compression chamber, a nozzle connected to one of the electrodes adjacent the center thereof and projecting outwardly from the compression chamber for the exhaust from the chamber whereby propulsive thrust is developed by operation of the engine, a fuel container mounted within said nose section, at least one feed line connecting the container to the chamber, a capacitor of different potential outputs electrically connected to the electrodes, means for the periodic electrical discharge of said capacitor across the electrodes, said discharge ionizing, compressing and igniting the fuel therebetween for ejection through the nozzle, a pair of opposed magnetic plates adjacent the nozzle establishing a magnetic field transversely of the nozzle, a pair of opposed electrodes one interposed between each of said plates and each connected to a different side of the capacitor whereby the ions in the exhaust cut the magnetic field to create a current flow to the capacitor for the recharge thereof, and control means to interrupt such current flow when the capacitor is discharging as aforesaid.

17. An engine comprising a forward nose section containing a supply of fluid, a compression chamber aft of said nose section, a pair of aligned, spaced disc electrodes defining opposed ends of the compression chamber, a nozzle connected to one of said electrodes substantially at the center thereof and projecting outwardly from the chamber, at least one feed line between the nose section and the chamber for the delivery of fluid to said chamber, a capacitor electrically connected at opposite sides to each electrode respectively, means for the periodic discharge of said capacitor across the electrodes to thereby ionize and compress the fluid in the chamber and eject it through the nozzle, an electrical power source adapted to be connected to the capacitor, magnetic means disposed adjacent the nozzle establishing a magnetic field across said nozzle to be cut by the ionized fluid passing through the nozzle and thereby create a current source, a pair of spaced contacts to receive said current, and means connecting each of said contacts to a different side of the capacitor for the regeneration of said capacitor.

18. A rocket engine comprising a conical forward section containing a supply of fluid, a pair of spaced axially aligned disc electrodes at the aft end of said conical section defining a compression chamber, a nozzle piercing the rearmost electrode at substantially the center thereof and opening externally of the chamber, fluid injection means connected to the fluid supply and opening into said chamber, an electric circuit adapted to connect the electrodes one to the other and to ground, said circuit including a store of electric energy and means to periodically complete

said electric circuit whereby current passing between the electrodes and across the chamber ionizes and radially compresses the fluid therein for ejection through the nozzle.

19. A rocket engine comprising a conical forward section containing a supply of combustible fluid, a pair of axially aligned spaced disc electrodes at the aft end of said conical section defining a compression chamber, a nozzle piercing the rearmost electrode at substantially the center thereof and opening externally of the engine, fluid injection means connected to the fluid supply and opening in said compression chamber, an electric circuit adapted to connect the electrodes one to the other and to ground, a capacitor and energizing means therefor interposed in said circuit, and a pair of switches interconnected for alternate operation in unison one between the capacitor and one of the electrodes and the other between the capacitor and the energizing means whereby the capacitor is energized upon closing of the second switch and discharged upon closing of the first switch for the passage of current across the electrodes to ionize, radially compress and fire the combustible fluid within the compression chamber for ejection through the nozzle.

20. An engine comprising a forward nose section and a compression chamber aft of said nose section, a pair of spaced axially aligned disc electrodes one forming the aft end-wall of said nose section and the other forming the opposed wall of the compression chamber, a nozzle connected to the latter electrode adjacent the center thereof and projecting outwardly from the compression chamber, a fuel container mounted within said nose section, at least one fuel line connected to and extending from said container and terminating in an opening in communication with said chamber for the delivery of fuel thereto, a capacitor electrically connected to the electrodes, means for the periodic discharge of said capacitor across the electrodes radially compressing fuel in the chamber for ejection therefrom through the nozzle whereby propulsive thrust is developed, and power-generating means releasably connected to said capacitor for the recharging thereof when said capacitor is not discharging as aforesaid.

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