Sept. 15, 1964 L. J. MELHART 3,148,587

MAGNETOHYDRODYNAMIC HYPERVELOCITY GUN

Filed June 27, 1962

FIG. 2

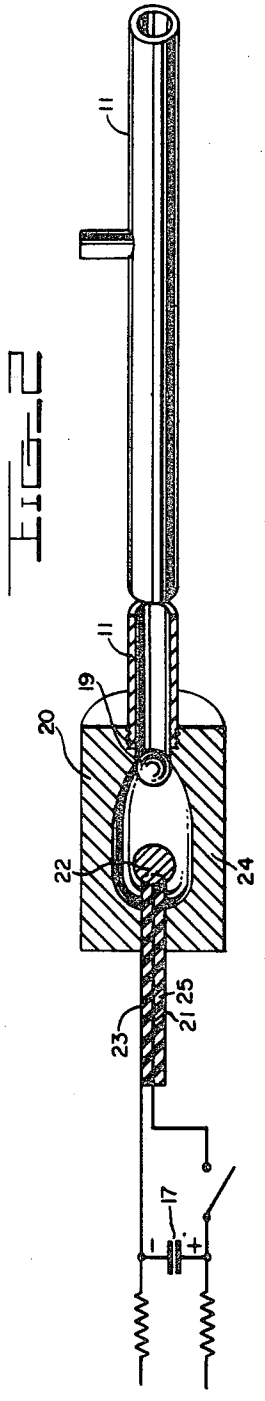
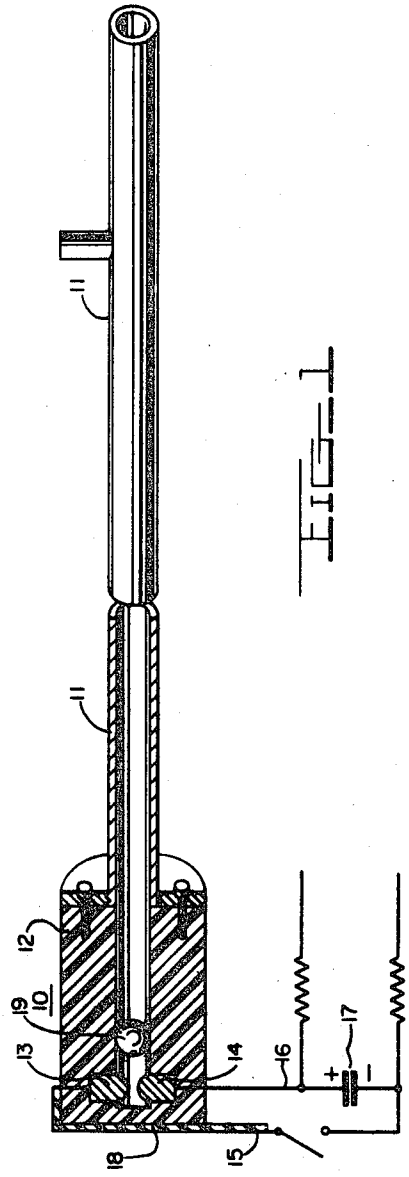


FIG. 1



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MAGNETOHYDRODYNAMIC HYPER-VELOCITY GUN

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This invention relates to high velocity guns and more particularly to a high velocity gun which makes use of magnetic forces for propelling a projectile within the gun.

Heretofore, electrically fired guns have been used wherein an electrical discharge has been used as a means of igniting gun powder in a bullet, by electrically heating or exploding an electrical wire in the bullet, which ignites the powder. Other systems have been used wherein a light gas is admitted into a gun chamber ahead of a projectile and then the gas is electrically exploded by a capacitor discharge through the gas. The exploding gas builds up high pressures which then force the projectile from the gun barrel.

Various devices have been used to study projectiles in flight in a vacuum system and to study the effects of projectile impact on various objects. The present invention provides a high velocity gun which propels projectiles in space as a kill mechanism or in a vacuum for velocity and impact studies but is not restricted either to this medium or purpose. The device makes use of a specially arranged arcing chamber having spaced electrodes with an electrical lead conductor from a capacitor to each electrode with one lead conductor backing the gap parallel with the electrodes. An electrical discharge across the electrodes produces an arc from one electrode to the other which causes thermal heating and the conductor backing the electrodes produces a magnetic field in the gap between the electrodes which forces the arc away from the electrodes. Shock waves of 1,000,000 feet per second have been generated in this manner. The gas expansion caused by thermal heating and the force of the magnetically driven arc against the projectile drives the projectile in the evacuated gun barrel at high velocities. Any suitable velocity measuring or impact study devices can be associated with a gun barrel extension for studying the projectile and the effects of the projectile on impact. Obviously, in outer space the gun barrel need not be closed since it is an evacuated environment.

It is therefore an object of the present invention to provide a simple, relatively inexpensive high velocity gun having particular reference to operation in the space medium.

Another object is to provide a high velocity gun operative with relatively little, if any, damage to the propellent chamber.

Still another object is to provide a high velocity gun operative by use of magnetic fields developed by an electrical discharge.

The nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing, in which:

FIG. 1 illustrates a simplified form of a gun made according to this invention; and

FIG. 2 is a modification of the electrical discharge of the device of FIG. 1.

Now referring to the drawings, there is shown by illustration in FIG. 1 a representative high velocity gun **10** adapted to be evacuated and connected with suitable equipment for studying projectiles "fired" thereby. The gun includes a gun barrel **11** connected to a larger body **12** made of any suitably strong insulating material such as nylon with the bore of the barrel in alignment with a bore in the body **12**. At the end of the body **12**, removed from the gun barrel, there are positioned on opposite sides of the bore and perpendicular thereto opposing elongated electrodes **13** and **14** each having semi-circular ends that extend with the opposing ends in alignment with the bore such that a spacing approximating the diameter of the bore remains between the opposing electrodes. The electrodes are fastened to the insulated gun body **12** which is also the arcing chamber and connected with suitable electrical conductors **15** and **16** respectively. Conductor **16** is connected directly from electrode **14** to one side of a capacitor **17** whereas conductor **15** is constructed such that it parallels the electrodes and separated therefrom by suitable insulation **18** and then is connected electrically with the other side of capacitor **17**.

The bore in body **12** adjacent to the electrodes is slightly smaller in diameter than the bore of the body in alignment with the gun barrel such that a projectile **19** may be held therein under very little friction and yet pass freely through the gun barrel.

In the modification shown by illustration in FIG. 2, the gun has the same arrangement with exception of the electrodes and the conductors connected to the electrodes. The incoming electrical conductors connected to the electrodes are in the form of a coaxial cable. The center conductor **21**, covered by insulating material **25**, connects with the center electrode **22** and the outer conductor **23** of the coaxial cable connects with an outer cup shaped electrode **24** that extends outwardly of and along the center electrode toward the barrel forming a spaced electrode arrangement, as shown in FIG. 2. The arrangement and operation of the electrical discharge circuitry of FIG. 2 is similar to that of FIG. 7 of Patent Number 2,909,695.

In operation in an atmospheric surrounding the projectile is positioned within the gun barrel in place, the gun barrel, etc., are sealed and evacuated, the capacitors are charged and readied for firing. Any test equipment, etc., is arranged ready for making test, either prior to, while preparing, or after the gun is readied for firing. The control switch is closed and the capacitor discharges across the electrodes in the gun. When the capacitor discharges across the electrodes, an arc is caused between the electrodes which produces thermal expansion in the chamber and gases in the area of the electrodes. The current through the backing wire of the device of FIG. 1 and the current through the center conductor and in the cup shaped electrode of FIG. 2, produce an axial magnetic field which forces the hot gases away from the electrodes, the hot gases are forced against the projectile which produces an axial force on the projectile and consequently forces the projectile down the gun barrel. As pointed out in Patent Number 2,936,390, the gas velocities depend on the current produced by the capacitor discharge; therefore, the velocity of the projectile depends on the magnetic field produced by the current flow from the capacitor discharge. The total impetus given to the projectile depends on:

(1) The rapidity of the capacitor discharge.
(2) The amount of energy delivered from the capacitors.
(3) The mass of the projectile.
(4) The degree of vacuity.
(5) The efficiency in coupling the magnetically driven arc to the projectile.

The hot gases will expend their energy in forcing the projectile along the barrel with the device requiring reloading after each firing. In space, the operation is the same, only the barrel need not be evacuated.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed is:

A high velocity gun which comprises a gun barrel, means for securing a projectile in said gun in alignment with said gun barrel, oppositely disposed dish shaped and spherical shaped coaxially aligned electrodes secured in axial alignment with said gun barrel, said spherical shaped electrode positioned in spaced relationship with said means for securing said projectile within said gun, a coaxial cable connected with said electrodes and extending from said gun and adapted to be connected to a capacitor discharge source, whereby current through said dish shaped electrode and the inner conductor of said coaxial cable produces a magnetic field about said dish shaped electrode forcing gases produced in the vicinity thereof toward said means for holding said projectile within said gun.

References Cited in the file of this patent

UNITED STATES PATENTS

2,783,684	Yoler	Mar. 5, 1957
2,790,354	Yoler et al.	Apr. 30, 1957
2,899,864	Bloxsom	Aug. 18, 1959
2,909,695	Melhart	Oct. 20, 1959
2,936,390	Melhart	May 10, 1960

OTHER REFERENCES

American Rocket Society, NASA Research on Plasma Accelerators, by W. E. Moeckel and W. D. Rayle, presented at the ARS 14th annual meeting, Nov. 16–20, 1959.

American Rocket Society Journal, Recent Advances in Magnetohydrodynamic Propulsion, by M. C. Gourdine, December 1961, pp. 1670 to 1676.

Astronautics, Introducing Magnetohydrodynamics, by Arthur Kantrowitz, vol. 3, No. 10, October 1958, pp. 18–20 and 74–77.