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IGNITER FOR ROCKETS

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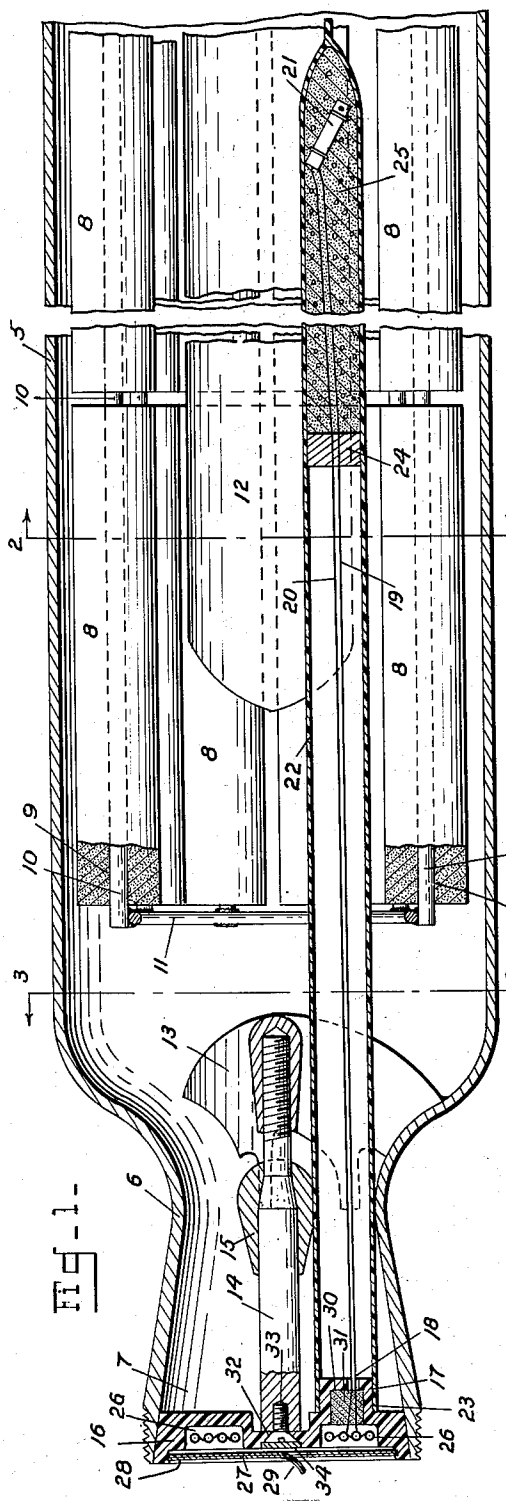


Fig. 1.

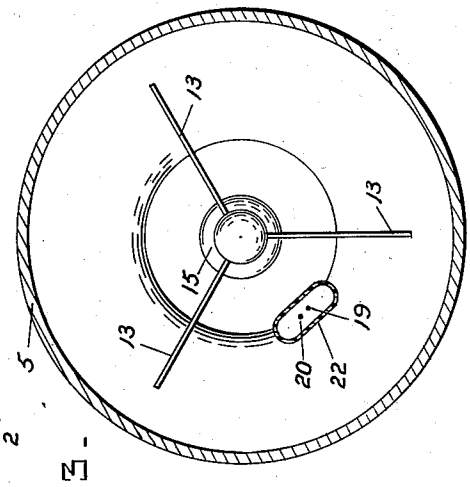


Fig. 3.

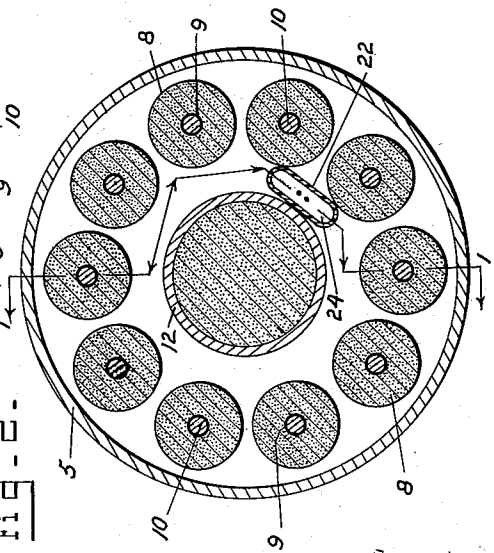


Fig. 2.

Inventors
Robert A. Appleton
Clarence N. Hickman
Carold F. Bjork
By J. W. Church & H. E. Thibodeau
Attorneys

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IGNITER FOR ROCKETS

Robert A. Appleton, Inyokern, Calif., Clarence N. Hickman, Jackson Heights, N. Y., and Carold F. Bjork, Luke, Md., assignors to the United States of America as represented by the Secretary of War

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3 Claims. (Cl. 102—49)

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This invention relates to rockets and more particularly to a new and improved igniter for rockets.

The rockets to which this invention relates consist essentially of a cylindrical combustion chamber for containing a propellant which upon ignition and burning generates a hot gaseous fluid under pressure. The forward end of the motor combustion chamber is closed off and has secured thereto a suitable "pay-load" compartment. The rear of the chamber is provided with a Venturi-like nozzle which permits the gaseous combustion products to be discharged at a relatively high velocity. A cylindrical tube filled with a high explosive extends longitudinally and concentrically of the motor chamber. It is connected with the "pay-load" compartment and its purpose is the fragmentation of the motor chamber upon detonation of the "pay-load."

The propellant consists of a plurality of cylindrical grains of singly-perforated double-base powder supported on trap wires extending longitudinally of the chamber, and prior to our invention it was generally ignited by the propagation of an ignition flame from an igniter compound contained within a plastic cup supported within the flared portion of the nozzle venturi. The base of this igniter cup is provided with concentric rings of electrically conductive material to which the leads for the electric squib are connected. These rings are supposed to make contact with spring fingers extending into the projector when the rocket is loaded therein, but frequently poor electric contact is made. Non-uniform ignition is obtained since the propagation of the ignition flame is in a direction opposite to the gas flow, delaying the ignition of the propellant in the forward portion of the ignition chamber and producing non-uniform burning of the propellant throughout the total burning time.

The advantages of an igniter disposed forwardly in the combustion chamber have been known for some time, and various igniter designs permitting forward ignition have been proposed by those working in the art, but most of these ideas have been difficult to put into practice. Furthermore, these igniters which are supported in the forward portion of the chamber have to be inserted when the propellant and projector are assembled, with the result that hazards of premature ignition are increased.

A principal object of this invention is to provide an igniter which may be inserted through the nozzle of the rocket and which will lie between the burster tube and the powder charge.

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Another object of the invention is to provide a new and improved method for making the electrical connections necessary for conducting the firing current to the electric squib of the conductor.

A further object of the invention is to provide an igniter casing of sufficient flexibility in one direction to allow the casing to bend around the burster tube and the powder grains, having at the same time sufficient rigidity to allow insertion from the nozzle.

Still further objects of the invention are to provide means for securing the igniter tube within the combustion chamber; means for sealing the container for the igniter compound against possible moisture intrusion; and to provide means for retaining the lead wires of the igniter within the chamber after the igniter casing has been filled and prepared for use.

Original experiments in designing an igniter casing for this invention comprised the use of a strip of plastic material wound spirally. It was found that such a container was not sufficiently flexible and was not easily insertable from the nozzle end. It was found that a container of elliptical cross-section did have the necessary flexibility in one direction, and at the same time maintained sufficient rigidity in another direction so that the igniter could be easily inserted.

It was necessary to design means to secure the igniter within the chamber after it had been inserted through the nozzle, and we conceived the idea of utilizing a plastic disc and securing the igniter container to a projection therefrom. The electric wires from the squib were brought out through holes formed in this projection and were sealed thereto by filling the inside of the projection with any suitable sealing compound, such for example as that known as "Glyptal." The recess for the screw which secures the disc to the rod was also sealed with compound to completely seal the igniter from any possible moisture intrusion. Extension leads for the squib were provided, and the plastic disc was provided with a recess in its surface wherein these extension leads were conveniently coiled, and they are retained in place in their coiled position by a cardboard disc which fits into another recess in the plastic disc and which is removed when the rocket is inserted in the projectile tube, allowing the leads to be uncoiled, the retaining clip to be removed, and each lead connected individually to a suitable clamp on the projector. Thus the igniter compound may be easily inserted through the nozzle so as to lie adjacent the powder grains

at the forward end of the combustion chamber.

Other objects and advantages of the invention will become apparent during the course of the following specification, and the accompanying drawings, forming part of the specification, wherein like numbers are used to designate like parts.

In the drawings:

Figure 1 is a fragmentary view in longitudinal section taken on line 1—1 of Figure 2 of a rocket motor employing an igniter assembly of this invention,

Figure 2 is a cross sectional view taken on line 2—2 of Figure 1, and,

Figure 3 is a cross sectional view taken on line 3—3 of Figure 1.

Referring in detail to the drawings, the numeral 5 designates a rocket motor combustion chamber which has a forwardly flared end leading to a constricted throat 6 from which the flared sides of the nozzle 7 extend to provide for the discharge of the expanded gases of combustion therethrough. The propellant consisting of a plurality of cylindrical powder grains 8, each of which has a single axial perforation 9 formed therein. These grains are supported to lie lengthwise of the motor chamber 5 by being strung on a plurality of trap rods 10 and are restrained within the chamber by a trap ring 11 which is welded to each of the trap rods 10. The burster tube 12 is shown extending longitudinally of the combustion chamber.

The rocket motor chamber 5, as shown in Figure 1, is provided with a movable insert which is designed to provide an automatic self-adjustment of the pressure within the combustion chamber, the said insert being more fully described by one of the co-inventors of this invention in application Serial No. 583,140 filed March 16, 1945. The insert assembly consists of a 3-vane spider 13 which is inserted into the rocket motor chamber 5 from the end thereof opposite the nozzle 7. The spider 13 retains the rod 14 centrally within the nozzle venturi. The rod 14 is provided with a forward portion of reduced cross-section and a rear portion of enlarged diameter. The insert 15 which is supported on the rod is a streamlined configuration and moves rearwardly at pressures exceeding a predetermined maximum, to move down the rod 14 to the diameter of its forward position.

The rod 14 is conveniently used for retaining the insulated disc 16 within the end portion of the nozzle 7. The disc 16 has a projection 17 formed on its surface which is elliptical in a cross-section and has an opening 18 drilled therethrough through which extend the lead wires 19 and 20 of an electrical squib 21.

An elliptical shaped container 22 formed of an extruded plastic material has its open end 23 fitted over the projection 17. A partition member 24 is disposed within the container 22 for retaining black powder 25 or other suitable igniter composition in the forward end thereof.

The outer surface of the insulated disc 16 is provided with a circular recess 26 into which the lead wires 19 and 20 of the electric squib 21 are coiled. The two ends of these leads are brought together and clipped so that they may at all times provide an effective short circuit of the electric squib 21. A cardboard disc 27 is retained in the insulated disc 16 by being inserted into a cut-out portion 28 thereof and serves to retain the coiled wires 19 and 20 within the circular recess 26. The cardboard disc 27 is provided with a tab 29 which permits its easy removal to gain access to the said coiled extension leads.

In use, the propellant and rocket motor chamber are assembled for shipment as a unit without the igniter in place, and thus the hazards of transporting the rocket with an assembled igniter may be avoided. The igniter assembly is transported separately, and is inserted into the motor chamber just before the rocket is loaded into the projector tube. The cardboard disc 27 is then removed and the extension leads are unclasped and connected to suitable clasps provided on the projector for completing an electrical circuit leading to the electrically fired squib 21.

As shown in Figure 1, the recess 30 formed in the projection 17 is filled with sealing compound 31 to seal the lead wires 19 and 20, and the recess 32 for the screw 33 which secures the disc 16 to the rod 14 is also filled with sealing compound 34.

It is to be understood that the form of the invention herewith shown is to be taken as a preferred example of the same, and that various modifications may be made in the combination and arrangement of parts disclosed in the drawings accompanying the invention without departing from the spirit thereof as defined in the claims annexed hereto.

Having thus described our invention, we claim:

1. In combination a rocket motor supported by a "pay-load" compartment at its forward end, said motor comprising a cylindrical combustion chamber, a plurality of trap rods extending longitudinally of said chamber, a cylindrical grain of propellant material having a cylindrical and concentric perforation strung on each of said rods, a tube communicating with said "pay-load" compartment having a closed end extending longitudinally and concentrically of said chamber, a constricted orifice formed in the chamber at the end opposite said "pay-load" compartment for the high velocity discharge of the production of combustion liberated by said propellant, a flared exit passage extending from said constricted orifice for expanding said combustion products to increase the exit velocity thereof, an igniter for said propellant comprising an elongated plastic envelope of generally elliptical cross-section containing an igniter composition, and having flexibility for insertion in said chamber through said constricted orifice to lie between said propellant grains and said tube, and a closure disc for said flared exit passage supporting said envelope.

2. In combination a rocket motor supporting a "pay-load" compartment at its forward end, said motor comprising a cylindrical combustion chamber, a multigrain propellant supported within said chamber so that the grains lie generally longitudinally thereof, a constricted exit orifice at the end of said chamber opposite said "pay-load" for the discharge of combustion products liberated by said propellant, a rearwardly flared exit passage extending from said constricted orifice for expanding said combustion products to increase the exit velocity thereof, an igniter for said propellant including an envelope containing an igniter composition and an electrical ignition means therefore, a closure disc inserted within said flared exit passage, ignition leads extending from said means through said disc, said disc having a recess formed therein, and removable means retaining said leads coiled within said recess, said envelope comprising an elongated plastic tube of generally elliptical cross-section

permitting flexibility in the direction of its minor axis whereby said igniter may be inserted into said chamber through said constricted orifice.

3. In combination a rocket motor chamber adapted to contain a propellent material combustible to generate a fluid under pressure, a constricted Venturi-like orifice for the high velocity discharge of said fluid and an envelope for containing an igniter composition for said propellant, said envelope having a generally elliptical cross-section permitting flexibility in the direction of its minor axis only whereby said envelope may be inserted into said chamber through said orifice.

ROBERT A. APPLETON.
CLARENCE N. HICKMAN.
CAROLD F. BJORK.

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