

UNITED STATES PATENT OFFICE

2,548,972

IGNITER CASE FOR ROCKETS

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Application February 8, 1946, Serial No. 646,453

2 Claims. (Cl. 102—49)

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This invention relates to rockets and more particularly to a new and improved igniter for rockets employing a multiple grain charge of smokeless powder as a propellant.

The rockets to which this invention relates consists essentially of a combustion chamber for containing the propellant material, a nozzle of constricted cross-section formed at the rear of the chamber, and a "pay load" carried by the forward end. The propellant consists preferably of a plurality of circular grains of a smokeless powder composed of nitroglycerin and nitrocellulose having a single axial perforation. The grains are supported to lie longitudinally of the combustion chamber by being strung on trap wires secured to a suitable trap plate retained forwardly within the chamber. Upon ignition the gaseous combustion products liberated by the burning propellant pass rearwardly out of the chamber through the nozzle with great velocity and thus propel the assembly toward the object at which it is aimed.

The successful operation of rockets designed to employ a multi-grain charge of a double-base propellant is dependent upon the satisfactory operation of the igniters for its propellant charge. In order for the igniter operation to be satisfactory it must not only function with a short and reproducible time delay over the operating temperature range for the rocket, but must also produce a simultaneous and uniform ignition of the entire exposed surface of all of the propellant grains, without causing high pressure peaks to be built up in the chamber and without causing the surface area of the grains lying close to the igniter to be scarred by a violent and sudden igniter action. In addition, the igniter must be of a rugged construction to resist damage from rough handling; it must be relatively easy to manufacture, and easily assembled in a fixed position within the combustion chamber.

It has been the practice prior to this invention to utilize as an igniter for the propellant assembly a muslin bag containing the igniter composition and a suitable electrically fired squib for setting off this composition. The igniter bag is taped at one side to the propellant assembly. One of the foremost objections to the use of this type of an igniter for the propellant results from the fact that a very fine granulation of the igniter compound cannot be used because the weave of the muslin bag is too loose to prevent this finely granulated powder from leaking out. These bags also have the disadvantage in that they are subject to moisture intrusion and break-

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age in assembly. Furthermore, the delays encountered with this type of igniter have been unduly long and rather arbitrary. It is believed that the ignition is non-uniform with this type of igniter and that this non-uniformity in ignition may account in part for the dispersion of the rocket.

Another type of igniter which has been utilized in rockets consists essentially of a plastic cup which has a radial flange with an edge surface tapered to conform to the configuration of the expanding portion of the nozzle so that the igniter cup may be supported within the nozzle flare. Ignition with this type of igniter has not been entirely satisfactory because the ignition flame must be projected forwardly in a direction opposite to the normal direction of the gas flow, thus the ignition of the portion of the propellant in the forward part of the combustion chamber is delayed and uniform burning of the propellant is not obtained. Various means for igniting the multi-grain propellant charge by utilizing igniter assemblies supported in the forward portion of the combustion chamber have been proposed, but all of these methods have been difficult to reduce to practice because of unsatisfactory support for the igniter assembly.

We have discovered that an igniter assembly may be advantageously supported in the forward portion of the combustion chamber by engagement with the ends of the powder grains. Thus our invention consists of an igniter assembly having radially divergent means for engaging the end surface of the powder grains at the forward end of the motor chamber to advantageously hold the igniter in its preferred position forwardly of the combustion chamber. The igniter of this invention is also characterized by the fact that it is not subject to moisture intrusion or breakage and that it gives a short and reproducible ignition delay without the development of high pressures or scarring of the propellant grains. The igniter further has the advantages of simplicity in construction and ease of assembly.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same, there is illustrated an igniter of this invention applied to the 3¼ inch rocket motor adapted to propel an identification flare, wherein:

Figure 1 is an elevation of a rocket,

Figure 2 is an enlarged fragmentary longitudinal section of a rocket embodying the invention taken on the line 2—2 of Figure 1,

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Figure 3 is a longitudinal section of an igniter showing a modified form of the tube and,

Figure 4 is a transverse section of an igniter tube taken on the line 4-4 of Figure 3.

Referring now to the drawings, the numeral 5 designates a rocket provided with a rocket motor combustion chamber 6 enclosed within the body 7. A trap plate 8 to which beaded trap rods 9 are secured is positioned at the forward end of the said motor chamber 6 supported on an annular shoulder 10 formed in the inner surface of the body 7. The powder grains 11 are strung upon the trap rods 9 and supported in the manner shown in Figure 2.

The body 7 is arranged for screw threaded engagement 12 with an adapter 13 provided with a recess 14 in which a flare chamber 15 is inserted and secured in position by the pins 16. The base of the adapter 13 is provided with an annular groove 17 to receive the beaded heads 18 of the trap rods 9, and the said base also acts to hold the trap plate 8 securely in place against the shoulder 10. A flat head may be substituted for the beaded head 18 of the trap rod 9 without adversely affecting the utility of the said rod, and in such event the annular groove 17 may be omitted. A segmented spacer element 19 is provided within the flare chamber 15 to provide space for an ignition delay element 20 leading to the propulsive charge 21 of the parachute flare enclosed within the forward portion of the flare chamber 15. To provide for ignition of the delay element 20, thermal igniter 23 is threaded into a tapped opening 24 provided in the base of adapter 13, said igniter consisting of a hollow screw filled with black powder and being positioned so that the closed end of the igniter will extend rearward through an opening 25 in the trap plate 8 and into the igniter element while the open end is flush with the bottom of the recess 14 in the adapter 13 and in alignment with the delay element 20.

The igniter element consists of a cylindrical tube 25, of a suitable plastic material, having a closed end 26 and a closure partition member 27 within the tube 25 enclosing the black powder igniter charge 28 and an electric squib 29. The closed end 26 is provided with drilled openings 30 for the ignition wires 31 leading to the squib 29. The upper end of the tube 25 is provided with a radially projecting flange 32 for engaging the end surfaces of the powder grains 11 to hold the igniter in place forwardly within the motor chamber 6.

The thermal igniter 23 extends within the igniter element tube 25. In order to permit the gases liberated by the propellant powder grains 11 to flow over the said thermal igniter 23 even in the event that the closure partition member 27 should fail to be ejected upon ignition of the squib 29 a plurality of circular openings 33 are provided in the tube 25 so that upon ignition of the propellant powder grains 11 the hot gaseous combustion products may readily gain access to the thermal igniter 23 by passing through the said opening.

The igniter tube 25 may be formed, as shown in Figure 3, with an open bottom, and a closure partition 34, similar to the partition 27 within the tube, may be used to close the bottom opening. In all other respects, the invention will function as heretofore described.

As heretofore pointed out, one of the foremost objections to the presently used muslin bag as a container of the igniter charge and electric squib results from the fact that a very fine granu-

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lation of the igniter compound cannot be used because the weave of the muslin bag is too loose to prevent this finely granulated powder from leaking out. A very important advantage of this invention is that it permits the use of two different granulations of black powder within the igniter tube 25. In the igniter element illustrated in Figures 2 and 3, the powder 35 lying adjacent to the squib 29 is an A-5 granulation which is the finest granulation obtainable; the powder 36 adjacent to this finely granulated A-5 powder 35 is the regular Navy blend of black powder and is of a much coarser granulation. By utilizing the two different granulations the ignition delays are materially reduced, and in the assembly illustrated no difficulty is encountered in retaining the A-5 granulations within the igniter enclosure.

The rocket is fired by means of a battery, or an electric blasting machine or exploder, to which the wires 31 are connected. Immediately after the contact is made with the battery, or immediately after operation of the exploder the electric current causes the igniter charge within the igniter tube 25 to ignite. This in turn ignites the propelling charge 11 which propels the rocket out of the launcher, and at the same time ignites the thermal igniter 23 which in turn furnishes ignition means for igniting the delay element 20 leading to the propulsion charge 21 of the parachute flare 22.

It is to be understood that the form of our invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of the parts may be resorted to, without departing from the spirit of our invention, or the scope of the subjoined claims.

Having thus described our invention we claim:

1. In a rocket employing a multiple grain charge of smokeless powder as a propellant a cylindrical combustion chamber having a nozzle of constricted cross-section at its rear end, its forward end being of a slightly larger inside diameter to provide an annular shoulder within the said chamber, a plurality of trap rods spaced substantially circumferentially relative to each other and substantially equidistant relative to the combustion chamber walls, a trap plate at the forward end of the combustion chamber positioned on the annular shoulder within the said combustion chamber and provided with a plurality of recesses to support the said rods, and a plurality of cylindrical grains of a propellant material, each having a cylindrical and concentric perforation, strung on each of the said trap rods, an igniter tube centrally located with respect to said trap rods at the forward end of said chamber and adapted to be closed at both ends and provided with radially extending annular means at its forward end for engaging the end surfaces of the propellant grains at the forward end of the combustion chamber, a suitable igniter charge within the igniter tube, and electrically controlled means of igniting said igniter charge.

2. In a rocket employing a multiple grain charge of smokeless powder as a propellant a cylindrical combustion chamber of varying interior diameter, the back end of the chamber being formed in the shape of a Venturi nozzle through which the burning gases flow when the propellant is ignited and having a shoulder formed in its forward end where it is arranged to receive an adaptor within its largest diameter, a propellant

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charge of double base powder which has been extruded in stick form and has a single perforation running axially through the stick, a plurality of wires upon which the sticks are strung, the said wires suspending the sticks longitudinal of the said combustion chamber, a trap plate resting on the shoulder formed within the combustion chamber holding the powder sticks in place and locating the powder within the combustion chamber, the improvement comprising a plastic tubular igniter arranged to be tightly closed at each end, an igniter charge consisting of a graduated powder charge and an electric squib contained within the igniter, and a radial flange element engaging the forward end of the igniter tube providing means for engaging the end surfaces of the powder sticks at the forward end of the said

combustion chamber and suspending the igniter tube within the circle of suspended powder sticks.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,360,602	Van Deuren	Nov. 30, 1920
2,402,809	Farr	June 25, 1946
2,412,173	Pope	Dec. 3, 1946

FOREIGN PATENTS

Number	Country	Date
237,880	Great Britain	Feb. 18, 1926