June 2, 1953 C. F. BJORK ET AL 2,640,417

IGNITION SAFETY DEVICE FOR INDUCTION FIRED ROCKETS

Filed Dec. 18, 1946

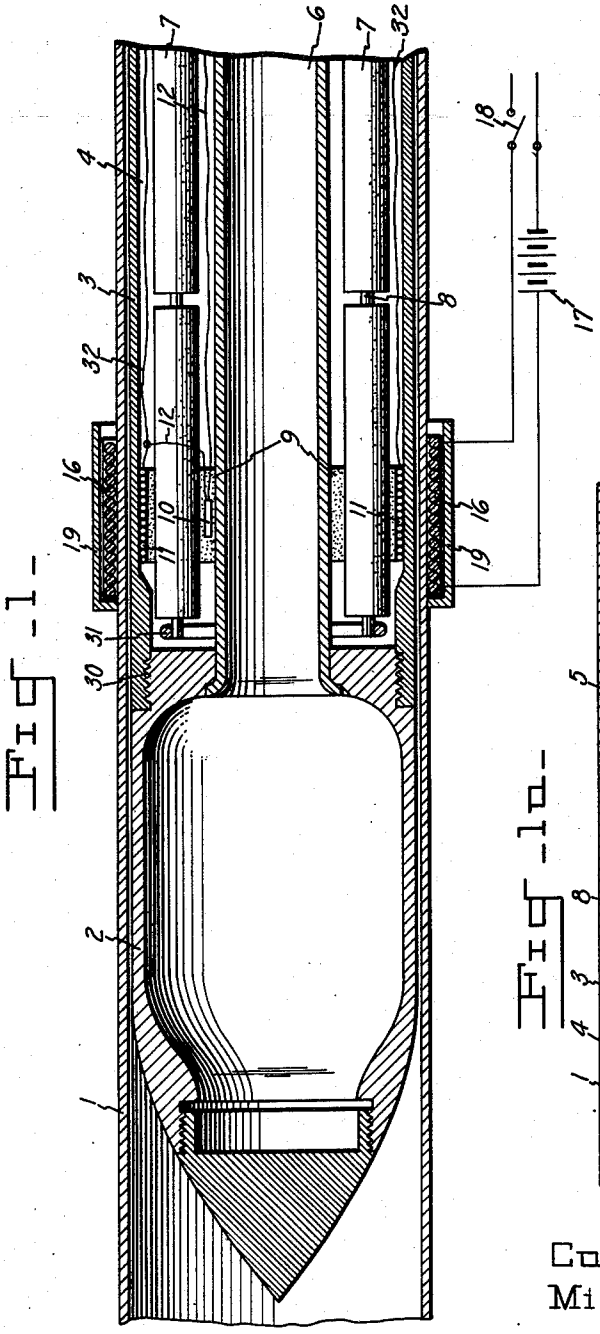


Fig. 1.

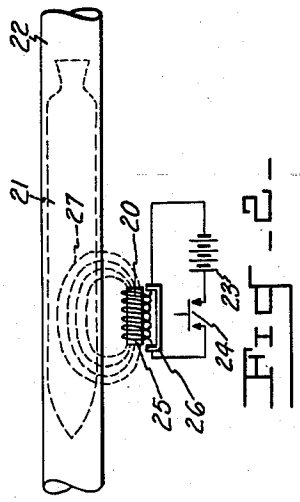


Fig. 2.

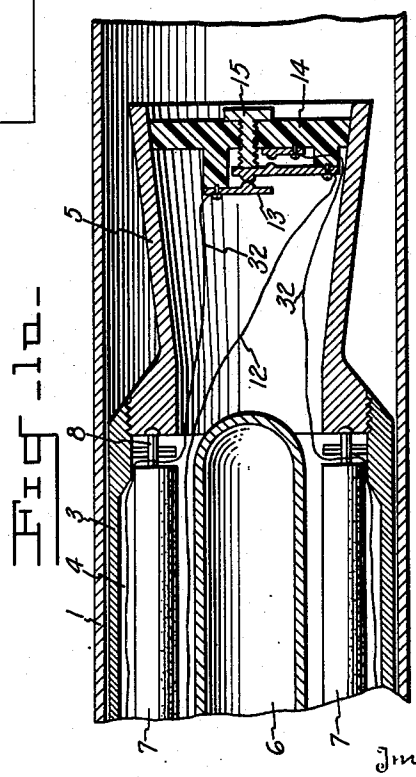


Fig. 1a.

Inventors

Carold F. Bjork

Michael F. Bondy

By J. H. Church & H. C. Thibodeau

Attorneys

Patented June 2, 1953 2,640,417

UNITED STATES PATENT OFFICE

2,640,417

IGNITION SAFETY DEVICE FOR INDUCTION FIRED ROCKETS

Carold F. Bjork, Luke, Md., and Michael F. Bondy, Watertown, Mass., assignors to the United States of America as represented by the Secretary of War

Application December 18, 1946, Serial No. 717,038

1 Claim. (Cl. 102—49)

1

This invention relates to an improved method and apparatus for igniting ordnance devices, and more particularly for igniting sealed rocket projectiles by electro-magnetic induction.

Ignition of rocket projectiles by percussion has been supplanted in the art by electrical methods. However, the use of electricity in firing rockets has also presented several drawbacks. Due to the necessity for leading ignition wires from the interior of a rocket motor to a connector on the launching apparatus, it becomes difficult to effectively seal the rocket motor against the entry of air or moisture both of which are harmful to the propellent charge. Moreover, time-consuming delays are often encountered in making the proper electrical connections and in addition positive operation is rendered uncertain due to the occasional accidental grounding of the lead wires.

But in the electro-magnetic induction system of the present invention, the necessity for ignition lead wires is eliminated. Positive ignition of a rocket motor is brought about by a secondary coil positioned within a sealed propellent chamber, the voltage necessary for such secondary coil being induced by a primary coil mounted on the launching apparatus.

Accordingly, it is an object of this invention to provide improved ignition apparatus for the firing of sealed ordnance devices by electro-magnetic induction.

It is the further object of this invention to provide an electrical ignition system for rocket type projectiles without the use of lead wires or electrical connections between the rocket and launching apparatus.

It is a still further object of this invention to provide a safe electrical ignition system for firing rocket projectiles. That is to say, a system whereby the rocket projectile must first be placed into proper firing position within or on a launching apparatus before ignition can be brought about.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a fragmentary longitudinal sectional view of a rocket and rocket launching apparatus embodying this invention.

Fig. 1*a* is a similar view of the nozzle end of the ordnance shown in Fig. 1.

Fig. 2 is a diagrammatic view of a modified form of electro-magnetic apparatus for igniting sealed ordnance.

2

In Fig. 1 is shown a rocket launching tube 1 in which is contained a rocket motor comprising a head 2 adapted to hold a "pay load," a casing 3 outlining a cylindrical combustion chamber 4 and secured to head 2 as by threads 30, and a nozzle 5 shown in Fig. 1*a* preferably of Venturi construction extending rearwardly from combustion chamber 4. A central burster tube 6 communicates with head 2 and extends axially through chamber 4 to the vicinity of nozzle 5. The propellent charge 7 surrounds burster tube 6 and preferably comprises cylindrical grains of double-base powder supported on trap wires 8, the forward ends of which are secured to a ring member 31.

A belt type igniter 9 of ethyl cellulose material or the like filled with black powder encircles the propellent charge 7 preferably near the front end of combustion chamber 4. Embedded within such flat belt igniter 9 is an igniting squib 10 of conventional design. A coil 11 constituting the secondary of the induction firing system is wound around igniter 9 and is connected to squib 10 by lead wires 12. Other lead wires 32 extend from igniter 9 and terminate in a single pole, double throw switch 13 contained within a plug 14 which hermetically seals nozzle 5. Switch 13 is operated by a thumbscrew 15 as will be later explained.

The primary coil 16 is wound on the outside of launching tube 1 at a position concentric with secondary coil 11 when the rocket or projectile is located within tube 1 at the firing position. A source of electricity 17, such as a battery or generator, and a firing key switch 18 are provided for electrical actuation of primary coil 16. A protective shield 19 designed to ward off the influence of any stray magnetic fields surrounds primary coil 16.

As shown in Fig. 1*a*, switch 13 serves as a safety device to prevent premature operation of the firing circuit. When thumbscrew 15 is tight against the outside wall of plug 14, switch 13 is held closed. Thus the circuit to secondary coil 11 is open and squib 10 is short-circuited thereby preventing accidental energizing of the firing circuit. When thumbscrew 15 is loosened or removed, the spring tension of switch 13 opens the squib contacts and closes the coil contacts. Voltage sufficient to fire squib 10 can then be induced by the electricity flowing through primary coil 16. The steel casing 3 of the rocket motor also prevents premature inductive firing of

the rocket by shielding the secondary coil 11 from extraneous sources liable to yield a magnetic flux, such as high tension power lines, for example.

Referring to the modification illustrated diagrammatically in Fig. 2, it will be noted that the primary coil 20 need not surround and be concentric with rocket 21 and launching tube 22. Instead, the primary coil 20 can be placed away from tube 22 in any convenient mounting arrangement. As in the Fig. 1 construction, a battery or generator 23 and a firing switch 24 are connected to the primary coil 20. However, in this modification, the primary coil 20 is provided with an internal core 25 and a shield 26 on the side away from launching tube 22. The magnetic field of coil 20 will pass into the rocket motor 21 as shown by dotted lines 27 and thence induce voltage in the secondary coil (not shown) within the rocket motor 21.

The modification above described is particularly useful for firing rocket projectiles mounted in multiple launching apparatus such as can be utilized on airplanes and the like. In such apparatus, a plurality of launching tubes containing rockets may be carried on an endless belt arrangement for individual or automatic firing by electro-magnetic induction as each launcher is moved into a firing position adjacent the primary coil 20.

It appears unnecessary to describe the mode of operation of this invention in more detail since the principles are well known in the art. The passage of an alternating or a suitable direct current through primary coil 16 induces a voltage impulse in the secondary coil 11 sealed within the rocket to set off a squib 10. Ignition of squib 10 is transferred by the belt igniter 9 to the propellent powder grains 7. Gases are thereby generated which by their passage through the Venturi orifice of the nozzle produce a forward impelling movement of the rocket.

It is desired to emphasize that the apparatus and method described above eliminate the use of lead wires extending out of the rocket projectile and hence permit effective sealing against moisture and air deleterious to the propellent charge. Uncertain connections and the delays inherent in such connections are also non-existent in the induction method of firing ordnance.

We claim:

In an induction-fired rocket, a tubular casing having a rearwardly-directed Venturi nozzle, a propellent charge in said casing, an induction coil in said casing, an electrically-initiable fuze in said casing in firing relation with said charge, a dielectric plug removably fitting said nozzle and closing the same, a switch mounted on said plug and comprising first and second opposed contacts and an arm movable selectively to alternatively engage either of said contacts, a first circuit including said fuze, first contact and switch arm, in series, a second circuit including said induction coil, fuze, second contact and switch arm in series, and means carried by said plug and normally holding said arm and first contact in engagement to close said first circuit, said means being manually operable from the exterior of said rocket to effect engagement between said arm and second contact whereby said first circuit is opened and said second circuit is closed to connect said fuze and coil in series, said plug and switch being blown out in response to initiation of said charge.

CAROLD F. BJORK.
MICHAEL F. BONDY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
319,629	Russell	June 9, 1885
785,644	Unge	Mar. 21, 1905
1,263,763	Hasting	Apr. 23, 1918
1,739,921	Schuler et al.	Dec. 17, 1929
2,124,579	Knerr et al.	July 26, 1938
2,391,864	Chandler	Jan. 1, 1946
2,421,522	Pope	June 3, 1947
2,429,021	Gould et al.	Oct. 14, 1947
2,459,854	Swift	Jan. 25, 1949

FOREIGN PATENTS

Number	Country	Date
3,761	Great Britain	Mar. 4, 1899
668,368	Germany	Dec. 1, 1938
402,630	Italy	Mar. 13, 1943
578,153	Great Britain	June 18, 1946
590,489	Great Britain	July 18, 1947

OTHER REFERENCES

"American Rifleman," Magazine, issue of March, 1945; page 23.