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ROCKET PROPELLED BODIES
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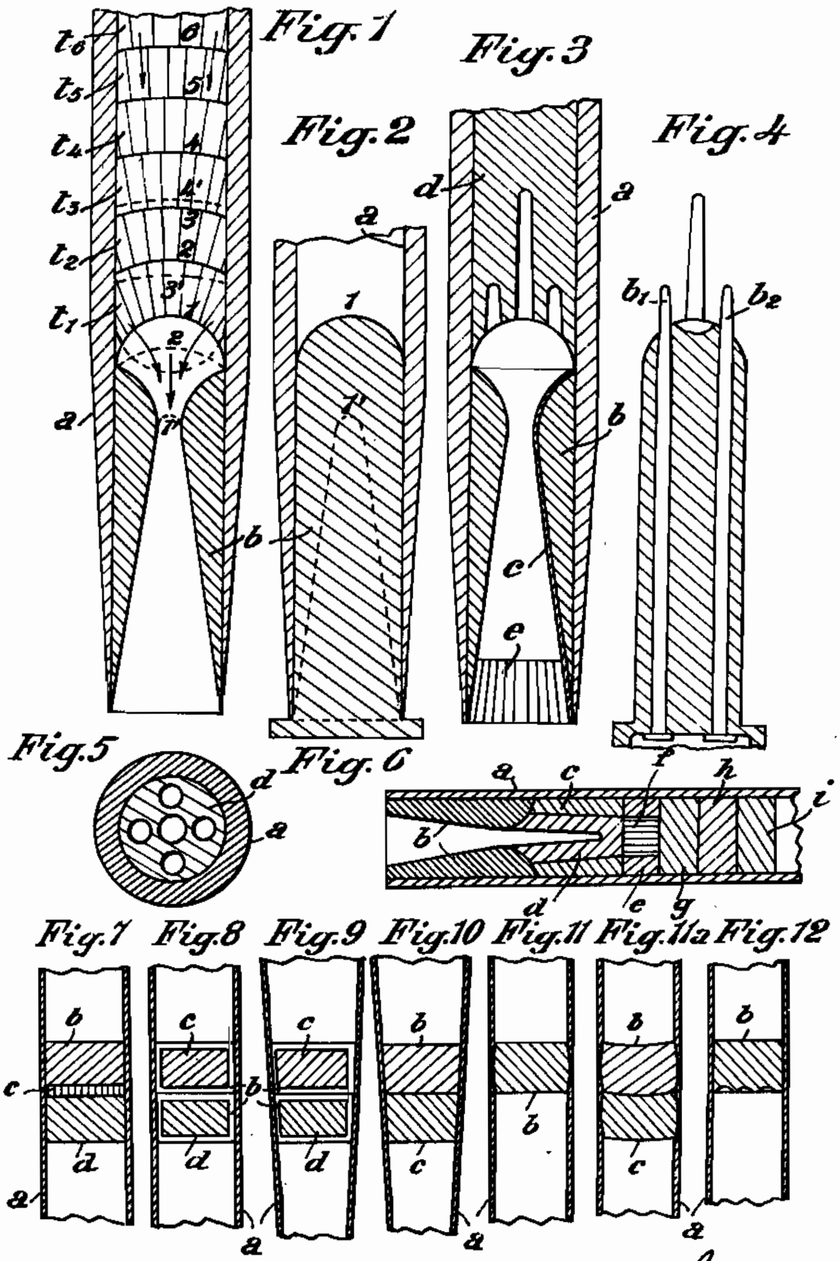

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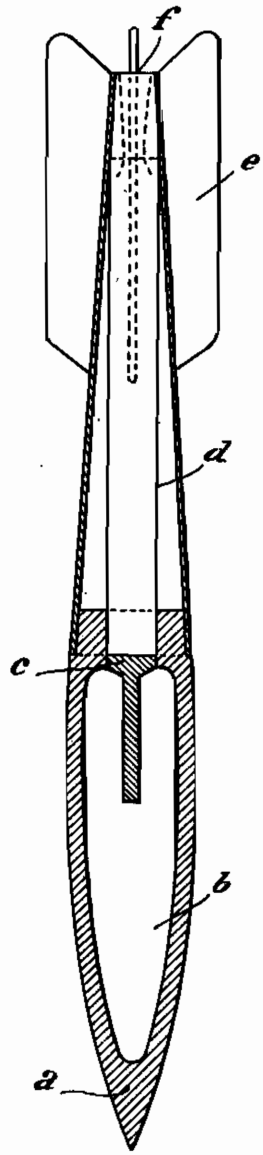
Fig. 13



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ROCKET PROPELLED BODIES

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Rockets with liquid fuels and rockets with solid fuels are already known as driving or propelling means, among the latter so-called core rockets and fire rockets, which are rockets with solidly pressed driving means the combustion surface of which is at the maximum equal to intersecting surface vertical to the longitudinal axis of rocket, the said surface being circular, which means that there is the drawback that every time only too small surfaces of fuel or driving means, respectively, are ignited,—which is particularly insufficient at the start of such rockets,—for generating the accelerating forces necessary, in that moment. Furthermore the direction of the inflamed gases is parallel to the longitudinal axis of the rocket so that these rapidly moved gases beat the surfaces of the outlet opening (cross section of nozzle) and cannot be so soon deflected as this would be necessary for being capable of using the most energetic propelling means, and must produce explosion of rockets. Furthermore, the surface of inflammation which during the whole combustion remains of equal extension offers no possibility to keep the combustion during the flight of the rocket always such as to be capable of obtaining, for every moment of the flight, the most favorable value of velocity of flight.

Purpose of present invention is to avoid the above said drawbacks always occurring at the state of the art of today as regards production of incendiary rockets, and at the same time obtain further considerable advantages.

The present invention consists in giving the driving means or propellant for each inflammation the only mathematically possible optimum combustion surface and to keep this optimum combustion surface during the whole action of combustion so that the direction of the inflamed gases in dependance from these combustion surfaces always possess the exact direction in the cross section of the neck of the nozzle, which means the exact intersection point of the longitudinal axis of the rocket with the cross section of neck of nozzle to the common mark or butt.

The present invention further consists in obtaining,—by such formation of every combustion surface,—which in the surface part *f* in Figure 1 has double the extension as the surface of same size of known rockets,—always the best flight rate for every moment of the flight, owing to the fact that the change of extension of every inflammation area, with regard to the decrease of weight of rockets during the flight, makes a priori the propellants of the single layers selectable as regards their efficiency.

The efficiency of these single layers of the propelling material, according to the invention, is so determined with regard to the combustion area in each case that for the formation of pressure in the combustion chamber the progressive extension of combustion chamber is calculatorily considered.

Therefore all solid propellents, even explosives, may be used as fuel, and the latter will be preferably controlled as to their rate of evaporation by special mechanical means (such as gelatinisation, etc.). These retardation means, in the shape of slabs of a lower combustion rate, are lodged between the several layers of propelling material, as is shown at *c* in Figure 7. It is also provided by the present invention to introduce into the envelope or shell of the rocket quantities of propelling material in solid form, wrapped in retardation materials, such portions without empty spaces being afterwards, in the envelope of the rocket, airtightly pressed against the inner wall of the envelope of the rocket, Figure 8. Furthermore the envelope of the rocket may be given conical shape, entirely or only at its inner wall, so that the several introduced portions are given a particularly solid seat in the shell. According to the present invention these parts, if necessary, may also be introduced into the rocket shell in the retarding wrapper and only compressed in the shell so as to improve the tight closure of these parts against the inner wall of the envelope or shell, particularly in case of the said wrapper being up to a certain degree elastically yielding, Figure 9. According to the present invention such portions of the propelling material may also be introduced in solid shape, without retarding wrapper, directly into the cylindrical or conical shell, because these portions have no hollows, Figure 10, and firmly compressed against the inner wall of the envelope or shell, in which case inflections are given to the latter, Figure 11, which warrant sure tightness along the inner wall of the envelope, which is a condition sine qua non for avoiding posterior ignition along the inner wall of envelope or shell. If there is no such tight closure, the rocket must explode. If, in fine, the several propelling portions are not introduced in hard condition into the envelope, by compression in the latter, the portion of propelling material is shaped as in Figure 11*a*. If necessary, according to invention, a portion of propelling material is to be provided with inflections at its initial inflammation area, whereby increase of combustion pressure and consequently intensification of combustion is obtained, because certain propelling materials are the more rapidly and therefor the more efficiently gasified the greater the pressure in the combustion chamber, Figure 12, happens to be.

Object of invention is furthermore to propel the rocket propelled bodies during their flight partly by black gun powder or smokeless powder, and partly by stronger propellants which, if necessary, are influenced by above described retarding means. This may be obtained, according to invention, either in the above described rockets, or in rockets according to Figure 6.

Such rockets in the part forming the continuation of the nozzle may, for instance, contain black; powder. The layers of propelling material *e f* forming continuation of part *c d* in Figure 6 may be constructed as described with reference to Figure 1 or, according to eventual requirements, as shown in Figures 7–12 inclusively.

If a rocket such as shown in Fig. 6 is needed, according to invention a structure such as shown in Figure 3 is possible for the first inflammation area, i. e. that nearest to the nozzle. It is known from Gerasimoff's Patent to provide plural hollows in portions of propelling material closed all around. This may, anologously, also be applied to the portion of propellant nearest the nozzle. However, according to invention, in Figure 3 such portion of propelling material is shown with plural hollows in the very rocket, so that in the first place, instead of a discharge nozzle, a pressure base such as shown in Figure 4 is used, which is removed after compression of rocket is completed, and in its placed a nozzle of any shape or structure is afterwards fixed in the rocket shell. As is known, the nozzles of rockets are always made very short, because in the act of compression they unduly increase the stroke of the press, and furthermore, if very long, they form a considerable part of total weight of rocket. According to invention such nozzles afterwards introduced into the shell are made of materials which do not stand the compression pressure to which a nozzle permanently connected to the rocket shell is subjected, such for instance as wood, which material is then protected against combustion by paint, or by a covering, for instance copper plating, as shown in Figure 3 at *b* and *c*.

Suppose that according to invention a brusque start is to be effected by expelling under the pressure of the developed gases a conveniently shaped closure *e*, Figure 3, disposed at a suitable point in the nozzle.

Fig. 1 is a longitudinal section of a rocket according to invention. *a* is the shell, *b* the nozzle, t_1—t_6 portions of propelling material. 1—6 are layers of the latter, disposed concentrically to the centre of line 1, whilst 1′—4′ are layers of propelling material disposed concentrically to the centre of line 1′.

Fig. 2 is a longitudinal section of an envelope or shell and a base for compression of rocket as shown in Figure 1, where *a* is the shell and *b* the pressure base.

Fig. 3 is a longitudinal section of a rocket according to invention, with a plurality of hollow spaces or cavities in a cross section of the rocket. *a* is the envelope or shell, *b* the nozzle, *c* the covering of wall of nozzle, and *e* the closure of the nozzle.

Fig. 4 shows the contents of a cross section of the pressure base for the compression of a rocket according to Figure 3. *a* is the pressure base with a spindle or punch for the main cavity. $b_1 b_2$ are pins inserted into the pressure base *a*. The said pins will be preferably removed after the compression of the rocket, first each singly, and then the pressure base may be removed in known manner from the shell by rotation.

Fig. 5 is a cross section of Fig. 3. *a* is the envelope or shell, *d* the propelling material, same as in Fig. 3.

Fig. 6 represents a longitudinal section of a rocket containing in one part for instance black powder, and in the other a stronger propellant. *a* is the shell and *b* the nozzle, whilst *d* are portions of propelling material, such as black powder, *e, f, g, h,* and *c* are portions of a propelling stuff, for instance of a more powerful composition.

Figure 7 is a longitudinal section of a portion of propelling material of the rocket according to invention. *a* is the shell, *b* and *d* are portions of propelling material, and *c* retardation means.

Figure 8 is a longitudinal section of the part of propelling material of a rocket according to invention. *a* is the shell, *b* the retardation means, and *c d* the portions of propelling material.

Fig. 9 is a similar longitudinal section, but with a conical shell *a*, retardation means *b* and portions of propelling material *c* and *d*.

Figure 10 is a similar longitudinal section where *a* is the shell, and *b c* are the portions of propelling material.

Fig. 11 is a similar longitudinal section in which *a* is the shell and *b* a portion of propelling material pressed into the shell so as to produce inflections in its inner wall.

Fig. 11 *a* is an equivalent longitudinal section where *a* is the shell, and *b c* are portions of propelling material which in the act of compression produce inflections in the inner wall of the shell on the one hand, and in the other parts on the other hand.

Fig. 12 is a similar longitudinal section where *a* is the shell and *b* the portion of propelling material.

With the above described rockets also graduated rockets may be formed which, as is known, are so that one stage after the other consumes its propelling charge, whereby additional velocity is obtained in known manner, and very long ways may be made.

Owing to this circumstance it is possible to utilize rockets for a new method for rocket propelled bodies.

The new method consists in that with numerous rockets, and precisely as their useful load, a substance designed for pulverisation or gasification is brought to a determined spot in such way that the latter, with the scarce accuracy of aim inherent to rockets, is filled in all its parts with a great number of such rockets, whereupon the ignition of the space so prepared is produced by one rocket. Again for the ignition no great accuracy of aim is needed, because the arrival of the ignition rocket at any point of the prepared space starts inflammation of the whole space.

The substances designed for being pulverized or gasified may become ignitable:

(1) By their mixing with the air,

(2) By being ignitable in themselves, which means without mixing with the surrounding medium, as soon as gasification will be completed.

A method such as above described may, at the one hand, be used in festivals, such as fireworks, for the sudden inflammation of a space, but on the other hand it may also be used for destroying living creatures present in this space. It will be thus possible for instance to surely destroy locust swarms such as infesting in enorm masses certain countries at certain times, which could not be killed by fire, because such locust masses are not sufficiently combustible, whilst with the present method the single animals will be killed by abstraction or combustion of air for respiration.

It is certainly imaginable that such effects may be obtained with special projectiles, but on the one hand the quantity of substance to be rapidly conveyed into a space are too small, whilst accuracy of aim is excessive, which means that working with projectiles is too costly. Also, owing to the necessity of using special apparatuses for firing the projectiles, working with great masses of projectiles is impossible, and would not be convenient, whilst the above described method, if necessary, may be used with large masses and sufficient efficiency under every point of view, and without material cost, because only very simple rocket frames will be sufficient, and the rockets in themselves are very cheap. Furthermore, working with rockets is almost noiseless, and combustion may be so effected by appropriate structure of rockets that very feeble traces of working will be visible.

As rocket propelled bodies also: rocket bombs for aeroplanes may be considered.

The known aeroplane bombs of various structure and size are launching bombs, which means that they fall down from the air craft by gravity to the ground and are prevalently influenced during their fall by inertia and the surrounding atmospheric conditions.

These circumstances result in all kinds of aircraft bombs, such as bursting bombs, gas bombs and incendiary bombs in a scarce force of impact and scarce accuracy of aim as compared with artillery projectiles.

With gas and incendiary bombs the accuracy of aim and force of impact are not so decisively important as with the most important group of aircraft bombs, namely bursting bombs, especially armour protected bombs, which so not exist hitherto.

With bursting bombs there must be made distinction between:

(*a*) Velocity of fall of bombs, and in connection therewith

(*b*) Action of pure force of impact,

(*c*) Splintering effect of the bombs detonating on or immediately above the ground

(*d*) Effect of pressure of detonation gases which are in well known connection with force of impact and depth of penetration into the ground, respectively.

The velocity of fall, and therefor time of fall of the bombs are prevalently influenced by the cross section load and shape of bomb, and furthermore by the absolute height of fall. As an average, the commonly used modern more or less torpedo-like bombs reach a velocity of fall of at maximum under 250 m/sec. and this velocity remains constant even with the greatest height of fall. Therefor, when this velocity has been reached, the bomb continues to fall at the same rate, because the resistance of air formed in the fall balances the acceleration moment and prevents further increase of velocity. In consequence of such long permanence in differently moved zones of air the aircraft bombs not only show different curves and times of fall with different sizes of bombs, having their cause mainly in the different cross section loads in the different sizes of bombs, but a number of air craft bombs of same size falling at the same time and under the same conditions show very considerable differences in the elements of fall, and precisely in consequence of the very considerable and unfortunately mostly irregular pendulations occurring especially at the beginning.

As regards pure force of impact, the aircraft bomb, owing to its generally very much lower final velocity, is inferior to the artillery grenade. As a further difference of the aircraft bombs from artillery grenades the minor cross section load of the aircraft bombs is to be mentioned, because the latter in spite of their considerable total length have a comparatively greater diameter than the artillery projectiles, the reason of which is the feeble envelope structure and small proportion of metal in comparison with the quantity of explosive material, the greatest possible quantity of explosive matter being the first requirement of all known air bombs.

From the above disclosures it is also obvious that artillery projectiles in themselves, and also all the special propelling means connected therewith, necessarily have wholly different effects from air-bombs, especially as regards the gravity position, decisive for fall and accuracy of aim, and the wide differences as to gravity position between aircraft bombs and artillery projectiles.

In order to reduce the above said drawbacks of all known aircraft bombs the dimensions of bomb have been increased, and by indirect hitting (near the mark) the desired effect was obtained (sinking of ship by breaking the side wall beneath the side armour).

Thus an increase of size of bomb being selected in order to increase accuracy of aim as above said, it was necessary to adopt this increase of size of the bomb also in order to increase force of impact, because the other means to be contemplated, namely increase of velocity of final fall, was not yet realizable with any known aircraft bomb.

Owing to scarce accuracy of aim and force of impact the use of armour protected bombs, though urgently needed in themselves, was not contemplated.

With the increase of weight of the individual bomb and dimensions of same it was impossible to carry a large supply of same if it was desired not to excessively limit the range of flight of bomb carrying aeroplanes, and also the chance of hitting with one or a few bombs was reduced.

With aircraft bombs with prevalent splintering effect, such as necessary for bombarding living marks, in order to increase chance of hitting, launching in masses was resorted to, as force of impact was not prevalently required.

The present invention consists in inserting, into aircraft bombs, a rocket, having at the same time care to construct the aircraft bomb, as regards shape and gravity position, in appropriate form so as to obviate the above said inconveniences, especially want of accuracy of aim and scarce force of impact, and creating definite flight curves for rocket driven aircraft bombs and thereby obtaining new effects of use and action of such rocket driven aircraft bombs, and also consists in obtaining by appropriate connection of an air bomb of dimensions corresponding to the rocket propulsion with a smaller size of rocket with equal efficiancy as to force of impact, and at last in the possibility of obtaining equal curves of flight for all sizes of bomb, and with certain types of bomb obtaining and controlling detonation of contents by combustion of rocket.

By insertion of a rocket into an aircraft bomb in order to obtain full gravitation, the propelling force of the rocket is fully added, the velocity of flight is multiplied, and therefore according to the known laws of final and impact velocity, also the force of impact is multiplied, and at the same time the accuracy of aim materially improved by shortening the time of flight and therefore shortening the permanence in differently moved air zones, and multiplication of accuracy of aim in comparison with all other aircraft bombs obtained according to present invention by the fact that with any desired size and any desired variety of selection of propelling power of rocket, by appropriate co-operation of propelling force of rocket with gravitation and inertia, pre-establishable curves of flight for rocket propelled aircraft bombs are obtained from start to butt. By the insertion of the rocket the same force of impact is obtained with reduced sizes of bomb owing to the multiplied part of impact velocity of such rocket propelled bombs in the total of impact force.

The cross section loads varying for different sizes of aircraft bombs, by appropriate selection of magnitude, case for case, of propelling power of rocket for the various sizes of bomb, are harmonized with each other or respectively made of same size and given equal curves of flight for different sizes of bomb, and therefore the same aiming device may be used for different sizes of bomb.

It is also comprised in the present invention that the acting part of propellent charge is in every case such with regard to the developed propelling force that the cross section load of the rocket propelled aircraft bomb as a value resulting especially from propulsion of rocket, gravity and air resistance reaches its maximum at the end of the flightway. This is obtained by appropriate shaping of body with regard to the velocity of flight occurring, and furthermore by appropriate curves of flight and appropriately selected extension of instantaneous inflammation area of the charge of propelling material.

Furthermore in the rocket propelled air-bomb, especially when armour protected, ignition of explosive charge of bomb is directly effected by the propelling charge of the rocket, which may be done mechanically chemically or electrically.

A modification of idea of invention consists in effecting ignition so that these rocket propelled bombs when detached from the aircraft rather near the ground (for instance 100 m beneath the aircraft) and then already hit the mark, have no energetic action. This means that in such case the explosive charge of the rocket propelled bomb is not ignited, which is obtained for instance with rocket bombs turning on their longitudinal axe, by the fact that the igniting mechanism constructed for instance as a centrifugal controller, has not yet sufficiently oscillated, or that for instance a hammer-like body in such cases falls on the device connecting the propelling charge with the explosive charge thereby separating same in this or another way, or respectively their influence is arrested so that for instance the rocket ceases burning, or only burns out without having acted on the explosive charge of the bomb.

This kind of ignition makes than possible at the head of the bomb the ignition hitherto used with bombs, and this is particularly important for armour protected rocket bombs, because these are designed for penetrating through, or deeply into the butt before exploding through the action of the igniter. In this way it is possible to give the head of the bomb a hardened point particularly adapted for penetrating into fixed butts, and furthermore with correspondingly higher rates of flight, the rocket propelled body by giving it a suitable shape may be made more solid, but not heavier than the same body without rocket propulsion.

In the drawing, Fig. 13, longitudinal section of such rocket propelled bomb is shown. *a* is the head of the bomb and respectively the body proper, *b* the explosive charge of the bomb, *c* the igniter,—to be acted upon by the rocket,—for the charge of the bomb, *d* the rocket, *e* the steering part of the rocket propelled bomb, and *f* a rocket igniter to be placed in the discharge opening of the rocket.

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