April 12, 1938. L. DAMBLANC 2,114,214

SELF PROPELLING PROJECTILE

Filed March 5, 1936

Fig. 1

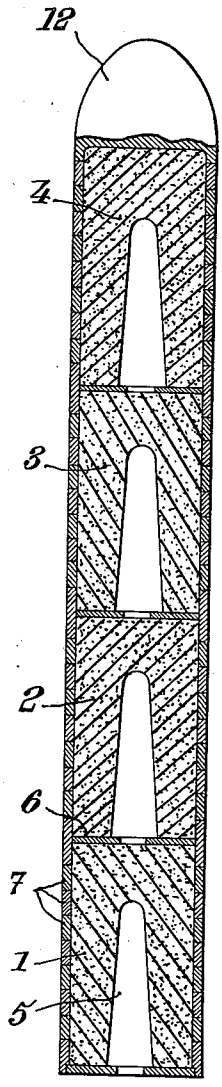


Fig. 2

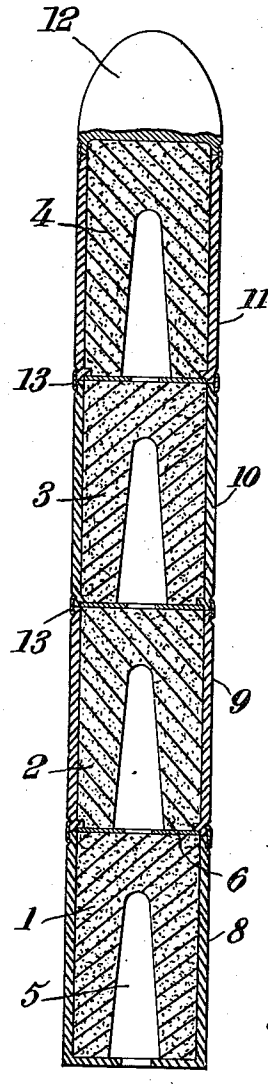
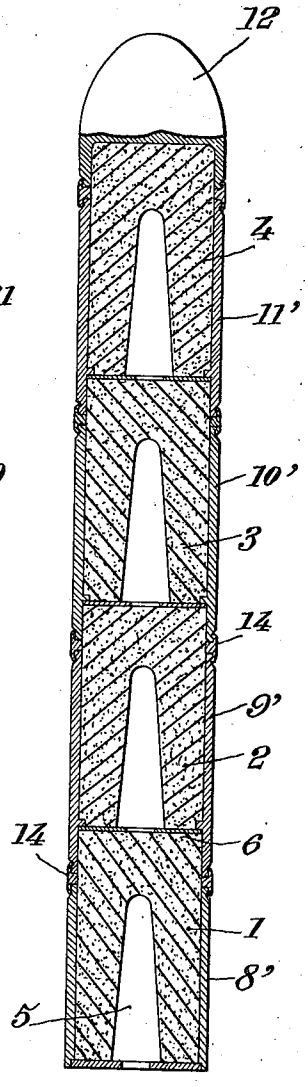


Fig. 3



LOUIS DAMBLANC
INVENTOR

Bailey & Larson
ATTORNEYS

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SELF-PROPELLING PROJECTILE

Louis Damblanc, Paris, France

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In Belgium March 9, 1935

7 Claims. (Cl. 102—26)

The present invention relates to self-propelling projectiles, that is to say projectiles which are provided, in addition to their specific charge, which may be of any nature whatever (for starting a fire, producing a smoke of a special kind, etc.), with a propelling charge the combustion of which imparts to said projectiles, along at least a portion of their path of travel, a certain impulse. The invention is more especially, although not exclusively, concerned, among projectiles of this kind, with rockets.

The object of the present invention is to provide a projectile of the kind above referred to which is better adapted to meet the requirements of practice, and in which, in particular, the combustion of the propelling charge contained in the projectile is utilized with an improved efficiency.

The essential feature of the present invention consists in devising the envelope of a projectile of the type above referred to in such manner that the length of said envelope is gradually reduced as the propelling charge is being gradually burnt.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawing, given merely by way of example, and in which:

Fig. 1 is an elevational view, partly in section, of a rocket made according to an embodiment of the present invention;

Figs. 2 and 3 are views, similar to Fig. 1, relating to other embodiments.

The examples that will be hereinafter described concern the case of rockets in which the propelling charge is divided into a plurality of stages of combustion.

Concerning, the general arrangement, with the exception of the envelope containing the propelling charges, it is devised in any usual manner known in the art.

Concerning the stages, or chambers, of combustion, (which are supposed to be four in number in the following description), they are advantageously superposed in the direction of the longitudinal axis of the rocket, which is for instance given the general shape of a cylinder.

I further provide, in the direction of the axis of each chamber 1, 2, 3, or 4, a nozzle 5, consisting of a cavity or recess, preferably of the shape of a frustum of a cone, the dimensions of which will be more particularly referred to in what follows, said nozzle being intended to facilitate the propagation of combustion in the charge.

Advantageously, the respective chambers 1, 2, 3 and 4 are separated from one another by means of annular elements 6, made for instance of cardboard, which prevent premature ignition of the successive charges of said chambers.

As for the charges, they may consist of any suitable matters, for instance powder.

Concerning now the envelope to be provided, in such a rocket for forming the various chambers of combustion, instead of making it of a metal (or any other matter) capable of withstanding without deterioration the temperatures resulting from the combustion of the powder, according to the present invention it is made in a different manner, as will be hereinafter explained. As a matter of fact, the use of a metal capable of withstanding the temperatures of combustion of the charge would have the following drawbacks:

(*a*) Formation of eddies in the free part of the envelope or cartridge as the charges of the first chambers disappear by combustion;

(*b*) Heating of said free part, due to the fact that it is no longer heat insulated by the presence of powder thereon;

(*c*) Reduction of the useful outlet pressure; and

(*d*) Dead weight constituted by the parts of the envelope that are no longer useful.

According to the present invention, said envelope or cartridge is devised in such manner that its length is gradually reduced as the propelling charge that it contains is being burnt.

This result can be obtained in various ways.

For instance, according to an embodiment of the invention, illustrated by Fig. 1, the cartridge or envelope is constituted by the mere juxtaposition of annular elements 7, of copper for instance, said elements being kept in position owing to the cohesion of the charge of powder they surround. With this arrangement, as it will be readily understood, the combustion of the charge of powder produces the successive elimination of annular elements 7.

However, I consider that it is more advantageous to constitute the cartridge or envelope of the assembly of elements, the number of which is, for instance, equal to the number of chambers or stages of combustion, established, or connected together, in such manner that each of the elementary propelling charges produces, at the end of its combustion, the elimination, through partial or total melting, or through combustion, of the element of the cartridge or envelope that contained said elementary charge.

In order to carry out a rocket according to this

embodiment of the invention, it is necessary to make use of a metal, or other material, which melts at a temperature lower than the temperature of combustion of powder (about 300° C.), while being sufficiently strong for constituting the cartridge or envelope of the rocket.

There exist, at the present time, many alloys which comply with these conditions, for instance the following:

Rose's metal (1 part of tin, 1 of lead, 2 of bismuth), the melting point of which is 110°;

Wood's metal (4 parts of tin, 8 of lead, 15 of bismuth and 4 of cadmium), the melting point of which is 70° C.; and

Lipowitz' metal (4 parts of tin, 2 of lead, 16 of bismuth and 3 of cadmium), the melting point of which is 60° C.

According to the present invention, I may, for instance, provide annular parts separating the envelope into a plurality of elements, said annular separating parts being made of one of these metals.

According to the embodiment illustrated by Fig. 2, the elements 8, 9, 10 and 11 of the envelope are made of Wood's metal.

These elements are connected with one another and with the nose 12 of the rocket through any suitable means, for instance bronze rings 13. I may also make these rings of a heat insulating material in such manner that heat cannot be transmitted too rapidly to the elements located close to the nose.

Nozzles 5 must then be made of a size such that, account being taken of the rate of combustion of powder, the portions of the charge of each combustion chamber that are farthest from the nose of the rocket are those which first finish burning, thus avoiding any risk of letting go a portion of an element containing still a certain amount of powder. Experiments proved, from this point of view, that it suffices, when nozzle 5 is axial and of the shape of a frustum of a cone, to give it an apical angle of about 10°.

It is further necessary to provide, between the end of the apex of each nozzle 5 and the corresponding ring 6, a thickness of powder sufficient in order that the next element should not start burning before the first element, containing said nozzle 5, is wholly emptied of powder.

It will be readily understood that, with such an arrangement, once combustion of the powder shall have been started, this combustion taking place along concentric zones, the disengagement of heat produced by the combustion of the charge of chamber 1 for instance shall not act on element 8 as long as there remains upon the wall of said element a slight layer of powder which constitutes a heat insulation, whereas, immediately after the combustion of this layer, said heat causes the element in question to melt.

I may also, according to another embodiment of the invention, provide elements of the cartridge or envelope made of any metal, said elements consisting, as shown by Fig. 3, of four sleeves 8', 9', 10', 11' of copper, or preferably of magnesium or of a light alloy of this metal, said sleeves being connected with one another and with the nose of the rocket by annular elements made, at least partly, of Wood's metal.

These elements made of Wood's metal may be made in various manners. However, according to my invention, they should preferably consist, as shown by Fig. 3, of rings 14 clamped to each of the two adjacent elements to be assembled together.

Nozzle 5 must then be given a size such that the particles of powder in contact with ring 14 are the last to burn. Otherwise an element of the envelope might risk being abandoned before the whole of the powder it contains is burnt.

In a general manner, I might make use, for constituting the envelope or cartridge, of any combination of fusible and non-fusible elements assembled in such manner that the combustion of the propelling charge and eventually the heat given off by the exhaust gases ensure a continuous or discontinuous elimination of these elements.

Finally, the projectile above described may further include any suitable stabilizing device, such for instance as ribs or fins which are carried either by the elements intended to be eliminated, or by the portion of said projectile that is intended to remain as long as said projectile is moving along its path of travel.

The projectile above described avoids all the drawbacks above mentioned and it further presents many advantages, the chief of which are the following:

It may include a number of combustion chambers as high as it is desired;

Furthermore, its construction is both simple and cheap.

A rocket according to the present invention may be combined with various devices, such, for instance, as the following:

(*a*) Objects to be transported, for example the end of a cable, or a message, introduced, for this purpose, in a recess provided in the head of the rocket;

(*b*) Luminous signals;

(*c*) Atmospheric or stratospheric sounding devices; and so on.

Of course, although the rocket shown by the drawing is of cylindrical shape, this is by no means a necessity, as the whole may of course be made of any desired shape.

Furthermore, the projectile might include not one but several tubes as above described, suitably distributed with respect to said projectile.

In a general way, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What I claim is:

1. A rocket having a charge of powder divided into a plurality of parts, each of such parts having a recess therein, a casing surrounding said parts and formed of a plurality of metallic elements associated with the respective charge parts some of which are fusible at the combustion temperature of the powder forming the charge, said recesses being so located in each part of the charge that between each recess and the associated fusible metallic element there is a layer of powder of sufficient thickness to prevent the melting of each fusible element until the part of the charge which corresponds thereto has been substantially completely burned.

2. A rocket having a charge of powder divided into a plurality of parts, each of such parts having a recess therein, a casing surrounding said parts and formed of a plurality of metallic elements each enclosing one of the charge parts and which are fusible at the combustion temperature

of the powder forming the charge, and infusible rings joining said elements, said recesses being so located in each part of the charge that between the recess and the wall of the fusible metallic element there is a layer of powder of sufficient thickness to prevent the melting of each fusible metallic element until the part of the charge which it contains has been substantially completely burned.

3. A rocket having a charge of powder divided into a plurality of parts, each of such parts having a recess therein, a casing surrounding said parts and formed of a plurality of infusible sections, and rings fusible at the combustion temperature of the powder connecting said sections, said recesses being so located in each part of the charge that between the recess and the fusible ring there is a layer of powder of sufficient thickness to prevent the melting of each fusible ring until the part of the charge which is contained in the corresponding infusible section has been substantially completely burned.

4. A device as claimed in claim 3, in which said rings are formed of Wood's metal.

5. A device as claimed in claim 3, in which said infusible sections are formed of a light metal alloy.

6. A device as claimed in claim 3, in which said infusible sections are formed of magnesium.

7. In a device as claimed in claim 3, said recesses being so located that substantially all the powder in each section burns before the burning of the powder in contact with the fusible rings.

LOUIS DAMBLANC.