Feb. 27, 1940. R. ZWERINA 2,191,841

ROCKET

Filed March 17, 1938

FIG. 1.

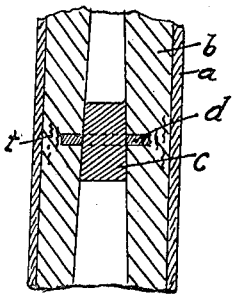


FIG. 2.

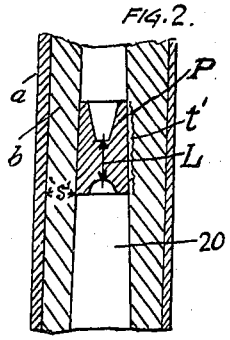


FIG. 3.

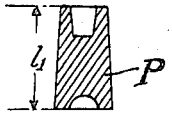
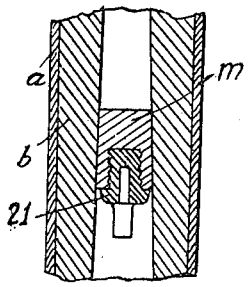


FIG. 4.



R. Zwerina
INVENTOR

By: Glascock Downing & Seebold
Attys.

Patented Feb. 27, 1940 2,191,841

UNITED STATES PATENT OFFICE

2,191,841

ROCKET

Rudolf Zwerina, Vienna, Austria

Application March 17, 1938, Serial No. 196,522
In Austria March 27, 1937

3 Claims. (Cl. 102—23)

The present invention relates to rockets and particularly pertains to means for controlling the combustion of the propelling material.

Rockets provided with a plurality of chambers having a single propelling charge are already known. Various other partial embodiments of the idea have been disclosed wherein a series of hollow propelling bodies are used having a C formed section, in the longitudinal direction of the rocket, in order to save the expense of inserting full-plugs.

Every full end of the C, contacts with an open end of the following hollow C plug. If a plurality of hollow bodies are placed together in a container, along the surfaces of contact between the charge and its container, there are defects in tightness and inequalities in fit. Other sources of defects may be found in all such parts in which the single C-shaped bodies come into contact one with another. This is why such types of rockets have never come into practical use.

Another detail in construction has been to subdivide the compact-charge by means of layers placed transversely to the longitudinal centre-line of the rocket, at the same height of the plug, and formed of a more or less combustible material. When the separating layer burns, it provides propulsion only from this small surface of the cross section of the plug. Therefore, such rockets rise with a non-uniform speed and lose considerably in height of flight. When such rockets are fired at an angle they do not follow the usual parabolic trajectory, but a broken one, in the direction of gravity, as a result of the slight propelling forces described above.

The various objects and features of the invention will be readily apparent to those skilled in the art upon a consideration of the appended drawings and the following description wherein several exemplary embodiments of the invention are disclosed.

In the drawings:

Fig. 1 is a partial longitudinal sectional view of a rocket illustrating means for controlling the combustion of the propelling charge.

Fig. 2 is a similar sectional view illustrating a modified plug.

Fig. 3 is a sectional view of a modification of plug shown in Fig. 2.

Fig. 4 is a partial longitudinal sectional view of a rocket showing another type of plug.

In carrying out the invention the disadvantages of the prior devices are completely avoided when the rocket is made as shown in Figure 1, in which a disc *d*, consisting of more or less combustible material, is placed round the plug *c*, thus obtaining a slowing-down in the combustion of the charge *b* placed around the plug. This disc provides means showing a constant bearing of the propelling charge, in the zone between the inside wall of the sleeve *a* and the outside rim of the disc, as shown at *t* in Fig. 1.

An irrational construction of rockets with a powder charge, may have the consequence that the part *t'* of the propelling charge (Fig. 2) burns quicker than the plug *c*. During combustion of this part of the rocket the flame enters suddenly in a chamber closed on all sides and, according to the depth of the plug the same can be gasified more rapidly by the firing pressure, whereupon the second chamber burns regularly, or the plug, being yet too thick, cannot be expelled by the firing pressure, so that gasification takes place in a closed space, exploding the rocket.

The present invention avoids such disadvantages by the use of a hollow plug as shown in Fig. 3 formed of a proper material, so that its shortest length L in the axial longitudinal direction of the rocket should be approximately equal to the depth S of the propelling charge as shown in Fig. 2. The result is that, the plug burns at the same time in which the charge in the first chamber is being burned. The recesses at the ends of the plug *p* allows the length l_1 to be made considerably greater than depth s_1. Thus the propelling charge burns while the charge in the first chamber is burned. When the plug *p* is burned the firing of the following chambers takes place and the combustion gases pass freely through the opening 20 and outside the rocket. In the plug *p* there is at first a narrow exit-channel which causes an initial increase in the velocity of the outgoing gases, even with a rather small initial combustion surface, so that the efficiency of the rocket is still improved. Said hollow plugs may be inserted as such, or can be hollowed out after having been placed in position, for instance by punching or drilling them, or else they are formed as compound plugs *m* as shown in Fig. 4. This latter plug can be readily modified to a hollow one, by extracting the filling element 21.

The plugs and the discs dividing two chambers, can, according to the invention, take any known shape and can be made out of combustible, non-combustible or partially non-combustible materials. According to the invention and according to the shape of the dividing element, between this part of the propelling charge and the following one, another combustible or incombustible body

can be inserted or added; said body being used for instance either to adjust the combustion or to secure tightness.

The hollow plugs offer a completely new possibility of use for rockets with solid propelling charges, as the same rocket, after having been prepared, may be used, either as a short combustion rocket and with a short trajectory or as a long combustion rocket and with a long trajectory. This is obtained by firing in the first case the first plug to be burned as a combined plug, burning slowly and for a long time, and if the second plug is hollow the speed of the rocket will be accelerated by the firing of the second chamber. If before letting off the rocket, the part 21 of the plug is extracted, there remains the hollow plug which burns rapidly and the initial speed will also be high.

This rocket can be used for signalling and for reaching with a single type any required distance.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In a rocket, a sleeve, a tubular shaped firing charge arranged within said sleeve so as to provide a central tubular opening within the sleeve, a plug formed of combustible material arranged within said opening, and said plug having means associated therewith for preventing the firing charge laterally of the plug from burning through prior to the burning of the longitudinal dimension of the plug.

2. In a rocket, a sleeve, a tubular shaped firing charge arranged within the sleeve so as to provide an opening extending longitudinally of the rocket, a plug formed of combustible material arranged within said opening, and said plug having a recess in one end thereof so as to permit an opening to be burned through the longitudinal dimension of the plug before the firing charge adjacent the plug will be consumed.

3. In a rocket, a sleeve, a tubular shaped firing charge arranged within the sleeve so as to provide an opening extending in the direction of the longitudinal axis of the rocket, a plug formed of combustible material arranged within said opening, said plug having a recess in one end thereof, and a removable combustion element arranged within said recess.

RUDOLF ZWERINA.