April 23, 1946. W. W. FARR 2,398,927

SELF-PROPELLING PROJECTILE

Filed Dec. 27, 1943

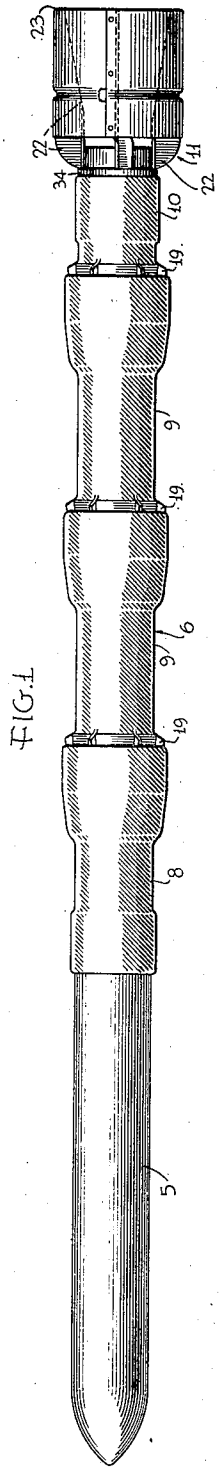


FIG. 1

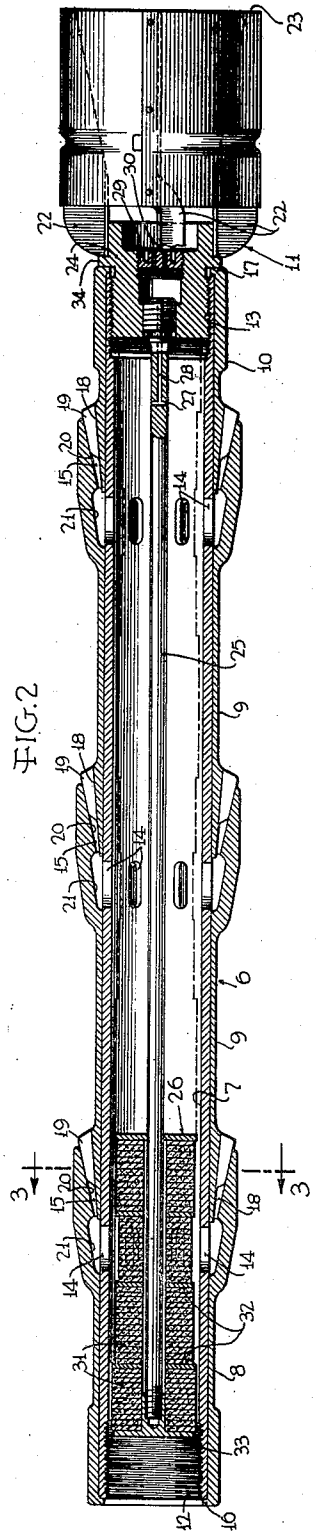


FIG. 2

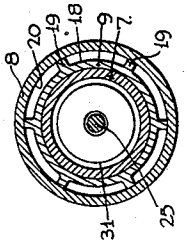


FIG. 3

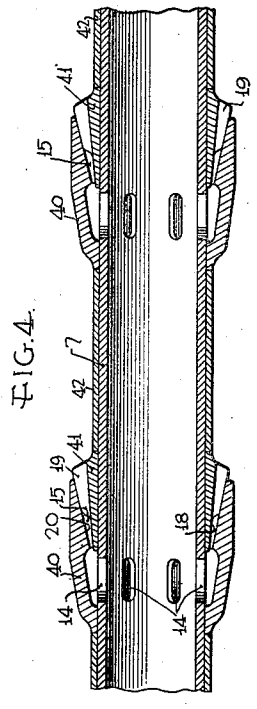


FIG. 4

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SELF-PROPELLING PROJECTILE

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4 Claims. (Cl. 102—49)

This invention relates to rocket-propelled devices, more particularly to the casing for the propelling charge.

The primary object of the present invention is to provide a rocket-propelled device of the multi-jet type in which the jets are formed through a novel arrangement of parts so constructed as to provide for convenient and simple machining and assembly operations.

Another object is to provide a multi-jet rocket-propelled device of new and improved construction wherein the jets are formed by interfitting tubular parts so shaped as to provide for desired concentricity of the jet walls.

A further object is to provide an improved rocket-propelled device with a plurality of axially-spaced jets so constructed as to insure true flight of the device.

With the foregoing and other objects in view which will be apparent, from the following detailed description, to those skilled in the art to which the invention appertains, the present invention consists in certain features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawing, and then claimed.

In the drawing,

Figure 1 is a longitudinal view of a rocket-propelled device incorporating the features of the present invention;

Figure 2 is an enlarged longitudinal section through the trailing rocket portion of the device of Figure 1;

Figure 3 is a transverse section taken substantially on line 3—3 of Figure 2; and

Figure 4 is a fragmentary section of a modified construction.

Referring to the accompanying drawing, the present invention is applicable to various types of rocket-propelled devices, such as for example, an explosive projectile, chemical projectiles or flare projectiles, and to this end the projectile or other decise is merely indicated in outline by the numeral 5 in Figure 1. The present invention is directed to the rocket portion 6 which is attached to the trailing end of the projectile or other device 5.

The rocket portion 6 of the present invention is comprised mainly of an inner tubular member 7 open at its ends, a plurality of outer tubular elements comprising a leading end element 8, intermediate elements 9 and a trailing end element 10, and a stabilizing member 11.

The opposite ends of the tubular member 7 are internally threaded at 12 and 13 for threaded attachment at the forward end to the main projectile or other device 5 and for threaded reception at the rearward end of the stabilizing member 11. Depending upon the number of jets or Venturi passages desired, the tubular member is provided at axially spaced zones with a series of openings 14 extending through the wall thereof. As shown here, there are three such groups of axially spaced openings 14 for association with three Venturi passages to be later described.

Each jet or Venturi passage 15 is formed by the ends of adjacent tubular elements—the forward passage 15 between the adjacent ends of the forward element 8 and the forward intermediate element 9, the intermediate passage 15 between the adjacent ends of the intermediate elements 9, and the rearward passage 15 between the adjacent ends of the rearward intermediate element 9 and the rearward element 10.

Each of these tubular elements is of such diameter as to have a slidable yet tight fit with the tubular member 7, the end elements 8 and 10 having inturned flanges 16 and 17, respectively, which in the assembly engage with the ends of the tubular member 7, as shown in Figure 2.

The forward end of each of the tubular elements 9 and 10 terminates adjacent a group of openings 14 and while being tapered toward such end to provide one wall 18 of the Venturi passage 15 is formed with radially outwardly extending, circumferentially spaced vanes 19 which extend longitudinally for an appreciable distance.

The inner wall of the rearward end of each of the elements 8 and 9 flares outwardly in tapering fashion at a slightly greater angle than the wall 18 of the adjacent element to form the outer wall 20 of the Venturi passage 15, the circumferential faces of the vanes 19 of the adjacent element having the same taper as the wall 20 so that rearward and forward ends of adjacent elements substantially nest within the other through engagement between the circumferential faces of the vanes 19 and the Venturi walls 20.

The portion of each wall 20 which overlies or surrounds the openings 14 is circumferentially recessed or enlarged at 21 to provide a circumferential distributing passage.

The stabilizing element 11 comprises an assemblage of stabilizing fins 22 mounted within a surrounding metal band 23 and having their

forward ends secured to a plug 24 having threaded engagement with the threads 13 at the rearward end of the tubular member 7. The plug 24 is annular in cross section and threadably receives at its forward end a rod member 25 upon which the propelling charge 26 is mounted.

The rod 25 near its attachment to the plug 24 is provided with a cross passage 27 and an axial passage 28 opening into the bore of the plug for ignition of the propelling charge from a flash charge (not shown) contained in the plug bore. The outer end of the plug bore is closed by a threaded member 29 having a series of openings 30 therethrough for the reception of ignition wires (not shown) used in igniting the flash charge.

Various forms of the propelling charge may be utilized and as here partially shown in solid and dotted outline, the charge may comprise a series of blocks 31 separated by spacers 32 mounted on the rod 25 throughout its length, the forward end of the rod 25 having a headed portion 33 for retaining the blocks 31 on the rod 25.

In the assembly of the structure described, first the intermediate elements 9 and then the end elements 8 and 10 are forced on the tubular member 7 and then the stabilizer assembly 11 is threaded into the rearward end of the member 7, the flanged portion 34 thereof forcing the flanged end of the rearward element firmly against the end of the member 7.

Prior to assembly of the stabilizing element 11 to the member 7, the rod 25 having the propelling charge of blocks 31 thereon may be secured to the plug 24, or this may be accomplished after the stabilizer element 11 is assembled.

When the structure described and so assembled is attached through the medium of the threads 12 at the forward end of member 7 to the projectile or other device 5, the flange 16 of the forward element 8 is securely clamped against the forward end of member 7, the lengths of the elements 8, 9 and 10 being such that during this operation these elements are forced into tight-fitting end engagement.

Inasmuch as the means for initially igniting the propelling charge forms no part of the present invention, the same is not shown.

If desired, the vanes 19 instead of being truly axial may be angularly arranged so that the gases resulting from the burning propelling charge which discharge through the openings 14 and thence through the Venturi passages 15 under pressure may tend to cause rotation of the structure at the initiation of the flight of the same.

Also, if desired, the vanes 19 may be formed on the walls 20 instead of the walls 18.

The modified construction of Figure 4 is similar to the construction described except that the forward and rearward end portions of the tubular elements previously described are formed as separate elements. As will be seen from Figure 4, two separate ring or sleeve elements 40 and 41 are employed to form each Venturi passage 15, the sleeve element 40 forming the outer wall 19 of the passage and the sleeve element 41 forming the inner wall 18 of the passage. The sleeve element 41 of one passage is separated from the sleeve element 40 of the next adjacent passage by a tubular spacer 42. One advantage of this modified construction resides in the fact that tubular stock may be used for the spacers 42.

The structures described, as is obvious from the foregoing description, are capable of easy assembly. Also, by reason of the concentricity of the parts, such parts, except for the formation of the vanes 19, may be machined by turning operations with the result that the same can be properly balanced whereby to insure true and accurate flight.

It will be apparent that various changes may be made in the detailed arrangements and construction of the parts described without departing from the spirit and substance of the present invention, the scope of which is defined by the appended claims.

What is claimed is:

1. In a rocket-propelled device having a propelling charge, a tubular casing surrounding the propelling charge, said charge when fired being adapted to build up propelling pressures within said casing, and annular sleeve elements each having a portion closely fitting the external surface of said casing, said portions being spaced apart axially of said casing, one of said elements overlapping both the space between said portions and the other element in circumferentially spaced relation and defining with said other element an exhaust jet communicating with the space defined by said closely fitting portions and the overlapping part of said one element, said casing having at least one aperture through the wall thereof opening into said space, said elements having interengaging parts for preventing relative axial movement of said elements toward each other.

2. In a rocket-propelled device having a propelling charge, a tubular casing surrounding the propelling charge, said charge when fired being adapted to build up propelling pressures within said casing, and annular sleeve elements each having a portion closely fitting the external surface of said casing, said portions being spaced apart axially of said casing, one of said elements overlapping both the space between said portions and the other element in circumferentially spaced relation and defining with said other element an exhaust jet communicating with the space defined by said closely fitting portions and the overlapping part of said one element, said casing having at least one aperture through the wall thereof opening into said space, the jet defining surface of one of said elements having a plurality of integral radial vanes engaging the jet defining surface of the other of said elements.

3. In a rocket-propelled device having a propelling charge, a tubular casing surrounding said charge, said charge being adapted when fired to develop propelling pressures within said casing, and means providing a plurality of axially spaced jets for the passage under pressure of gases developed within the casing by the propelling charge, said means comprising axially spaced groups of apertures in the wall of said casing and a plurality of sleeve elements closely fitting around said casing, the end portions of adjacent elements overlapping each other in circumferentially spaced relation, the inner overlapped end portion of each element terminating at least in part at one side of a group of apertures and the outer overlapped end portion of each element circumferentially spanning a group of apertures to provide a surrounding chamber communicating with the interior of the casing through the group of apertures and with the space defined by said circumferentially overlapped end portions.

4. In a rocket-propelled device having a propelling charge, a tubular casing surrounding said charge, said charge being adapted when fired to develop propelling pressures within said casing,

and means providing a plurality of axially spaced jets for the passage under pressure of gases developed within the casing by the propelling charge, said means comprising axially spaced groups of apertures in the wall of said casing and a plurality of sleeve elements closely fitting around said casing, the end portions of adjacent elements overlapping each other in circumferentially spaced relation, the inner overlapped end portion of each element terminating at least in part at one side of a group of apertures and the outer overlapped end portion of each element circumferentially spanning a group of apertures to provide a surrounding chamber communicating with the interior of the casing through the group of apertures and with the space defined by said circumferentially overlapped end portions, the overlapping end portions having a plurality of circumferentially spaced vanes extending between the opposed walls thereof, said vanes being an integral part of one of said opposed walls and engaging the other of said walls.

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