April 29, 1952 H. K. ENDICOTT 2,594,627

JET-PROPELLED DEVICE

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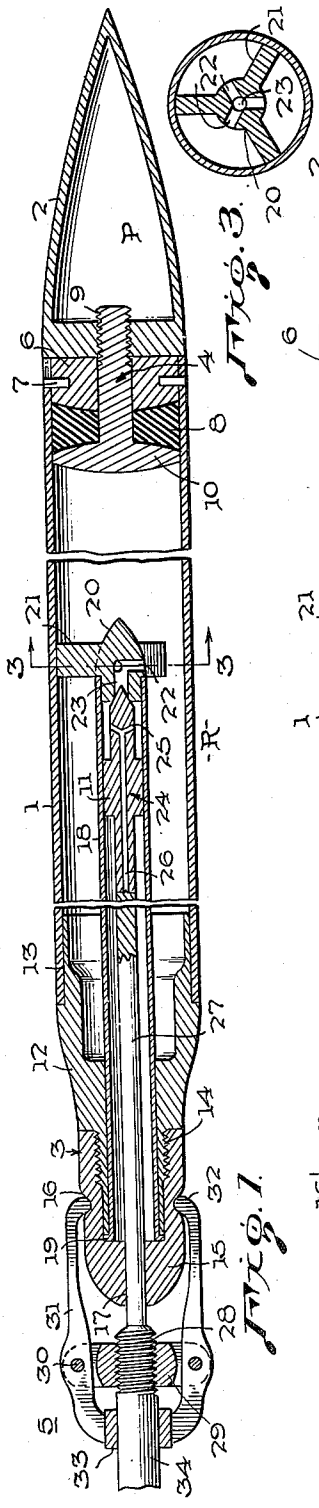

Fig. 1.

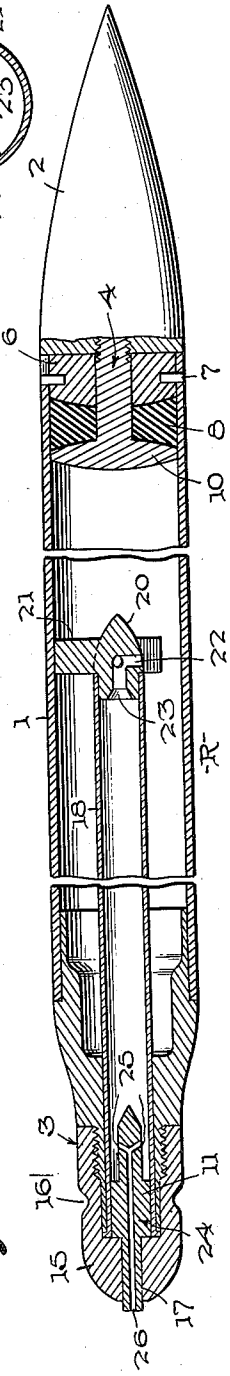

Fig. 2.

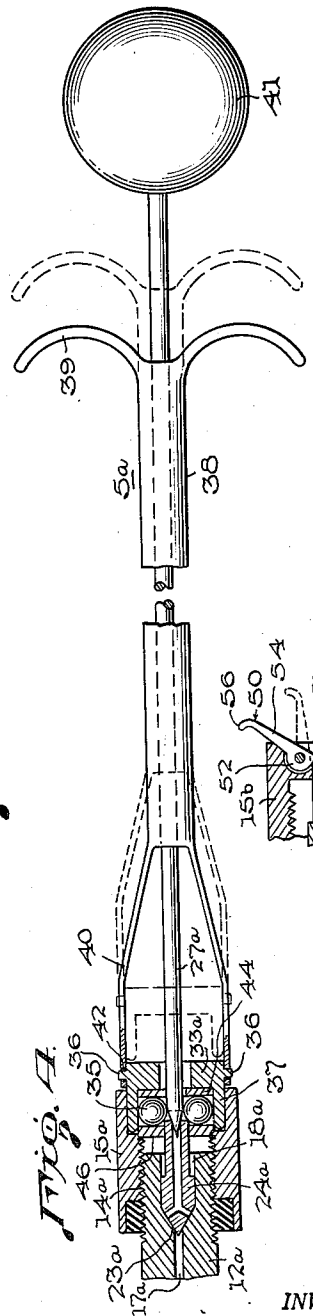

Fig. 4.

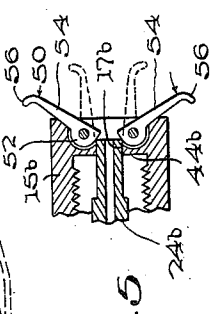

Fig. 5.

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JET-PROPELLED DEVICE

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6 Claims. (Cl. 46—74)

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This invention relates to jet-propelled devices and in particular to rockets. The embodiment which will be disclosed as illustrative of the invention pertains to a toy rocket in combination with a launching device.

It is a general object of this invention to provide a device adapted to be propelled by an expanding gas under pressure and having a quickly releasable valve means that permits of its ready application to a rocket, car, airplane or boat.

It is a further object to provide an elongated chamber for containing high pressure gas such as carbon dioxide. A related object resides in the provision of a detachable end portion permitting ready insertion of a charge material in the form of solid carbon dioxide.

Another object is to provide a rocket type toy of relatively large gas capacity in which the amount of charge may be varied as desired. It will be understood that this offers considerable improvement and advantage over the present sealed flasks which are connected to various toys for propelling purposes.

The provision of an elongated chamber having a readily detachable but effectively sealing nose end portion and simple efficient valve means for an axial bore in a rear end portion satisfies another object of the invention.

It is also a specific object of the invention to provide a launching device adapted to engage an end portion of the rocket, to guide the rocket in its initial movement, and to maintain the valve means in closed position until release is desired.

Other additional features of improvement reside in the provision of means movable transversely of the tail end portion to either hold the valve means in closed position or to permit its release and discharge of pressure gas when desired.

It is a further and general object of this invention to provide a jet-propelled device that is inexpensive to manufacture, simple in construction, and easy to use.

These and other features of improvement will be fully understood from the following detailed description of a preferred embodiment of the invention, and several modifications thereof, taken in connection with the accompanying drawings in which

Fig. 1 is a longitudinal section of the device of this invention embodied as a toy rocket and showing details of the launching and valve means;

Fig. 2 is a similar longitudinal section of the rocket of Fig. 1 with the launching means detached and the valve means in an open or released position for discharge of pressure gas;

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Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 1 and showing a part of the valve means;

Fig. 4 is a side elevational view partly sectioned to show the tail end part of a modified form of rocket, the valve-retaining means and cooperating launching means; and

Fig. 5 is a fragmentary longitudinal section showing the tail end part of a modified form of rocket and valve holding and releasing means.

While for purposes of illustration, the principles of this invention have been embodied in a toy rocket, it will be understood that the invention is applicable to air, land, water and combination devices or vehicles, each of which will be provided with suitable and conventional appurtenances in the form of wings, rudders, keels, wheels, steering means, and the like.

With reference to the drawings, a rocket R is shown as being constructed of steel, aluminum, or any other material of sufficient strength to withstand gas pressures of the order of several hundred pounds per square inch. Rocket R includes an elongated casing member 1 of cylindrical shape and provided with a nosepiece 2 and a rear assembly or tail end portion 3.

Nosepiece 2 is secured to the forward end of the elongated casing 1 by means of a sealing and fastening assembly 4. This assembly comprises plug 6 closely fitting within the casing 1 and secured thereto by bayonet slot and pin connections 7. A headed bolt 10 extends through the plug 6 and through a sealing washer 8 on the inner end of said plug. The washer 8 may be formed of rubber or any similar resilient material capable of forming an effective gas seal when deformed against the walls of the casing 1. The sealing effect of the washer may be varied by suitable adjustment of the bolt 10 which has a threaded connection 9 with the base of the nosepiece 2. This form of seal and the strong but readily detachable bayonet connections 7 permit the easy removal of the nose end of the rocket R for charging the device with propellant gas.

In the preferred form, the tail end assembly 3 includes a tapered end member 12 connected in sealed relation to the casing 1 by welding or other suitable means. The other end is externally threaded at 14 for interengagement with an end plug or cap 15. The end cap 15 is formed with a circular recess 16 around its outer periphery and has a small longitudinal bore 17 extending therethrough and along the longitudinal axis

of the rocket. Centrally supported in the casing 1 is a tube 18 forming an enlarged continuation of the bore 17 and having a flared end 19 which is clamped between the adjacent part of cap 15 and end member 12. The forward end of the tube 18 extends well forward into the casing 1 and is closed by a solid end piece 20 having a supporting spider with legs 21 integrally joined to the casing 1.

Between the legs 21 there are a plurality of lateral ports 22 connected with a central bore 23 having a conical opening into the tube 18. The tube 18 and the ported end piece 20 provide partitioning means separating the gas storing space of the casing 1 from the axial bore 17 in the tail portion 15. This partition means also includes the valve seat formation which the conical inner end opening of the bore 23 provides.

Fluid communication between the gas space of the casing 1 and the interior of the tube 18 is controlled by a valve plunger 24 slidably mounted within said tube for movement between the closed and discharge positions illustrated by Figs. 1 and 2 respectively. The valve plunger has a nose portion 25 with a tapered end formed for complemental seating on the conical opening of the bore 23. Rearwardly of the nose portion, the valve plunger 24 is formed with an intermediate piston section 11 which snugly fits and provides adequate sliding bearing for guiding the movement of the valve plunger within the tube 18. The forward end of the valve plunger is formed also with a plurality of lateral ports 22 positioned a short distance rearwardly of the part which seats on and closes the bore 23. These peripheral ports or openings 25 communicate with a central bore 26 extending therefrom to the rearward end of the valve plunger. Besides guiding the valve plunger, the cylindrical tubular formation 11 acts also to seal against rearward gas discharge other than through the ports 22 and bore 26. The rearwardly projecting stem of the valve plunger 24 is of reduced diameter and only slightly smaller than the axial bore 17 with which it has a sliding fit. When the piston part 11 of the valve plunger 18 is stopped by abutment with the adjacent surface of the end cap 15, the tubular reduced stem will project a short distance beyond the tail end of the rocket so as to discharge the gas freely to the atmosphere. In this manner, the valve plunger 24 moves between the valve closing position of Fig. 1 and the gas discharging and propelling position of Fig. 2, but is prevented from separation from the rocket R.

Fig. 1 illustrates also a launching mechanism 5 which is assembled with the rocket R and detachably connected therewith. The launching mechanism 5 retains the valve plunger 24 in its seated or closed position by means of a rod portion 27 adapted to extend through bore 17 with a close sliding fit and engage the rear end of the valve plunger. The inner end of the rod portion 27 is shaped to interfit with and close the rear end of bore 26 so that even if leakage occurs through the valve seat bore 23 the escape of gas will be prevented. The rod portion 27 has a threaded section 28 engaging a nut 29 spaced a short distance from the outer end of the rear end cap 15. Pivotally mounted at 30 on outer extensions of the nut 29 are a number of lever arms 31 having forward finger portions 32 which engage the recess 16 of the tail end plug or cap 15. The rear ends of said levers 31 rest on a locking sleeve 33 that is slidably mounted

on the rearward end 34 of the rod 27. The outermost end 34 of the rod portion 27 may be fixedly secured to any suitable base for launching of the rocket R.

In the operation of the rocket device R of Figs. 1 and 2, the pressure gas space within the casing 1 is first filled by disconnecting the slot and pin connections 7 and removing the nosepiece 2 and sealing assembly 4. This space is then loaded with a desired amount of solid carbon dioxide or any other material that will evaporate to build up a pressure of the order of 700 to 800 pounds per square inch. The forward tapered end piece 20 with its lateral ports 22 and spider supporting legs 21 permit the solid material to be inserted within the casing 1 without entering the launching tube 18 or being materially obstructed. Either before or immediately after loading, and replacing the nosepiece 2, the rod portion 27 is inserted in the bore 17 and moved inwardly against the valve plunger 24 until the tapered nose of the latter is firmly seated in the conical opening of the bore 23. The finger portions 32 are then engaged in the exterior recess 16 and the sleeve or ring 33 is slid under the rear ends of the levers 31, thereby forcing the fingers 32 into gripping engagement. The adjusting nut 29 is then rotated slightly in a direction to further seat the rod portion 27 and valve plunger 24, thus producing a very tight and effective high pressure gas seal.

After sufficient time has elapsed for the solid carbon dioxide or other evaporating material to become gaseous and build up a high internal pressure, the rocket R is ready for launching. This is accomplished simply and safely by sliding the sleeve or locking ring 33 out from under the engaged parts of the lever arms 31. A wire or cord may be attached to the ring 33 to facilitate the release. The removal of the ring 33 allows the arms to pivot at points 30 and the finger portions 32 to separate from the recess formation 16. The contained high pressure gas then quickly expands and reacts against the valve plunger 24 and rod portion 27 causing the rocket R to be propelled slowly at first while the rod portion 27 is sliding out of the tube 18 and rear end bore 17. When the rocket R is entirely free of the rod portion 27, the expanding gas may then escape freely through the rear end of the valve plunger bore 26 so that the device will be propelled with maximum force.

Although this invention has been described principally as a toy rocket or other jet-propelled device, it is obviously adaptable to other purposes. As a rocket it can be used for scientific investigation, in which event the nosepiece 2 having a space P can be equipped with a camera, signal flares and a variety of recording devices. For such uses the nose space P may be provided with a parachute releasable under the action of gravity or a timing mechanism to lower the rocket safely to earth.

Figs. 4 and 5 show two modifications of the valve means and launching mechanism for the rocket R illustrated in Figs. 1 and 2. As these modifications relate only to the tail end portion of the rocket it will be necessary only to describe the parts which have been changed or rearranged.

Fig. 4 illustrates modifications which are particularly suitable for use with a wheeled toy or boat, although they may be used also with an airborne toy. In this embodiment, the tapered end member 12*a* is formed to include the axial bore 17*a* and has a tapered or conical opening 23*a* pro-

viding a valve seat formation at the rearward end of that bore, and terminating in an enlarged bore 18a. The plunger valve 24a is quite similar in structure to that of the principal embodiment and is retained as part of the propelled device by means including an end cap 15a having a threaded connection 14a with the tailpiece member 12a.

The end cap 15a is closed by an apertured rear end plate 44 and is provided with a spaced inner apertured plate 46, the apertures of which plates form a final continuation of the bore means 17a, 18a and 15a. The arrangement of the plates 44 and 46 is such as to provide a housing or raceway for valve-retaining balls 35 having a diameter approximately equal to the spacing between the plates. The housing thus provided for the balls 35 permits their movement from inner positions as shown obstructing the axial discharge bore to outer positions which free that bore and permit unseating of the valve plunger 24a.

A centrally apertured retaining member 33a is frictionally engaged with the rearward end of the cap 15a for preventing outward movement of the balls 35 (which are of hardened metal) and release of the valve plunger 24a from the seated position of Fig. 4. The retaining member 33a is shown in both full and dotted line positions and is formed with forwardly projecting prongs or lugs 37 which pass complementally through the apertures or slots in the end plate 44 and cap 15a to a position between the balls 35 and the side wall of said cap, thus blocking outward movement of the balls 35 in their housing space. The outer portion of the retaining member 33a is provided with radially projecting lugs 36 to facilitate its detachment from cap 15a. A special hand type launching mechanism and extracting tool 5a may be used to move member 33a to its dotted line position releasing balls 35 and valve plunger 24a. The hand tool 5a has a tubular casing 38 provided with curved grips 39 on one end and spring fingers 40 on the other. The fingers 40 have suitable apertures or recesses 42 arranged to fit over the lugs 36. Extending through the casing 38 is a rod 27a pointed at one end to fit into the end of the stem of valve 24a. The other end of the rod 27a is provided with a knob 41, adapted to fit into the palm of the hand.

In operation, the stem 27a is pushed into the outer end of the interrupted bore 18a until it seats in the rear end of the valve plunger 24a. At the same time the spring fingers 40 are snapped over and into engagement with the lugs 36. Then, by placing the knob 41 in the palm of the hand and hooking the fingers around the grips 39, the latter may be moved to the dotted line position of Fig. 4. The retaining member 33a will thereby be withdrawn to its dotted line position. The rocket device is held in the other hand or otherwise clamped during this operation. Finally, rod 27a is removed and the balls 35 are free to move outwardly into the space previously occupied by the prongs 37 of retaining member 33a. The valve plunger 24a is immediately unseated by gas pressure and moves into the outer end of bore 18a.

Fig. 5 shows a modification of the means for releasably securing the valve means of Fig. 4. It is to be understood that the construction and arrangement are the same as Fig. 4 except for the substitution of pivoted levers 50 for the retaining balls 35, and the changes in structure of the threadedly connected end cap 15b required by elimination of the pronged retaining member 33a. Each lever 50 is pivotally connected intermediate its ends to the rearmost portion of cap 15b at opposite sides of the bore 17b. The inner end 52 of each lever 50 is formed as an arcuate plate segment having a corner projecting over the bore 17b when the arm portion 54 of the other end engages the cap 15b in the angular relation shown. The end of valve plunger 24b is freed by rotation of the levers 50, against the pressure exerted by the plunger, to the dotted line positions of Fig. 5. The outer ends of the levers 50 may be formed with rounded angularly directed ends 56 so that the launching mechanism 5a can be used. The tip of rod 27a will engage in the end of valve plunger 24b and the lever ends 56 will hook into the apertures 42 of spring fingers 40. Both hands can be used to hold the rod 27a and plunger 24b in engagement after the end of valve plunger 24b has been freed.

While this invention has been described in detail with respect to specific embodiments, those skilled in the art will recognize that many changes can be made in the construction and arrangement of parts without departing from the principles of the invention and the scope of the appended claims.

Having thus described my invention, what I claim as novel and desire to secure by Letters Patent of the United States is:

1. A rocket-type device comprising an elongated cylindrical member formed with a hollow space adapted to contain a high pressure gas charge, said elongated member including a detachable nosepiece closing one end of the hollow space, and a tailpiece having axial bore means; a valve plunger reciprocable in said cylindrical member and having a reduced forward end part, a rearwardly opening tubular stem portion fitting and slidable in said axial bore means, and a lateral port in open communication with said tubular stem portion and the outside of said reduced end part; a valve seat formation within and integral with said elongated member providing a forward abutment for said reduced forward end part and including a portion blocking gas flow from the charge gas space to said lateral port when the reduced forward end part is seated in the abutment; and releasing means including a member relatively movable into and out of the axial bore means of the tailpiece to engage the outer end of the tubular stem portion of the valve plunger to hold the reduced forward end part seated in the abutment of said valve seat formation.

2. The combination of claim 1 in which the releasing means comprises a plurality of balls mounted in the rear end of the tailpiece for movement transversely of the axial bore means to engage the outer end of the tubular stem portion of the valve plunger; and a retaining member removably extended between the balls and the adjacent wall of the tailpiece to block movement of the balls away from the tubular stem portion.

3. The combination of claim 1 in which the releasing means comprises a plurality of levers pivoted intermediate their ends to the tailpiece, each of said levers having a circular segment arranged to project across the axial bore means and engage the outer end of the tubular stem portion, and an arm portion arranged to abut the end of the tailpiece when the tubular portion is thus engaged.

4. A rocket-type toy comprising an elongated tubular casing with a nose portion on one end and a tail portion with a central longitudinal bore on the other end; a tube within the casing form-

ing an enlarged continuation of the bore of the tail portion, said tube including an end portion closing the forward end thereof and formed with a lateral port and a communicating blind bore portion opening into the tube; a valve plunger reciprocable in the tube and having a reduced forward part shaped to engage and close said bore portion, said plunger being rearwardly formed with a longitudinally bored end portion fitting and slidable in the longitudinal bore of the tail portion, a lateral port communicating with the front end of the plunger bore, and an intermediate tubular piston formation engageable with the tail portion; and a rod removably extended into the bore of the tail portion and the tube continuation and having its inner end shaped to seat on and close the rear end of the valve plunger bore when the forward end portion of the tube is closed by the forward part of the valve plunger.

5. A rocket-type toy comprising an elongated tubular casing having a nosepiece on one end and a tailpiece with a central longitudinal bore on the other end; a launching tube extending within the casing as an enlarged continuation of the tailpiece bore, said launching tube including an end portion closing the forward end thereof and formed with a lateral port and a communicating bore portion connecting the interior space of the casing with the inside of the launching tube; a valve plunger reciprocable in the launching tube and having a reduced forward part shaped to engage and close said bore portion, said plunger being formed rearwardly with a stem portion fitting and slidable in the longitudinal bore of the tailpiece, a blind bore open at the rear end of the stem portion and extending to the forward portion of the plunger, a lateral port communicating with the front end of the blind bore, and an intermediate piston formation rearward of the lateral port of the blind bore and engageable with the tailpiece when the valve plunger moves rearwardly in said tube; a rod removably extended into the bore of the tailpiece and into the launching tube, said rod having its inner end shaped to seat on and close the rear end of the valve plunger stem when the forward end portion of the tube is closed by the forward part of the valve plunger; and quick-release means detachably engaging the outside of the tailpiece for securing the rod seated on the valve plunger within the tube.

6. A rocket-type toy comprising an elongated tubular casing having a nosepiece on one end and a tailpiece formed with a circumferential recess and a central longitudinal bore on the other end; a launching tube extending within the casing as an enlarged continuation of the tailpiece bore, said launching tube including an end portion closing the forward end thereof and formed with a lateral port and a communicating bore portion connecting the interior space of the casing with the inside of the launching tube; a valve plunger reciprocable in the launching tube and having its forward part reduced and shaped to engage and close said bore portion, said plunger being formed also with a stem portion fitting and slidable in the longitudinal bore of the tailpiece, a blind bore open at the rear end of the stem portion and extending to the forward portion of the plunger, a lateral port communicating with the front end of the blind bore, and an intermediate piston formation rearward of the lateral port of the blind bore and engageable with the tailpiece when the valve plunger moves rearwardly in said tube; a rod removably extended into the bore of the tailpiece and into the launching tube, said rod having its inner end shaped to seat on and close the rear end of the valve plunger stem when the forward end portion of the tube is closed by the forward part of the valve plunger; a plurality of locking levers pivotally connected intermediate their ends to opposite sides of the outwardly projecting portion of the rod, said levers each being formed on its forward end with a finger portion engaging the recess of the tailpiece; and sleeve means slidable on the outwardly projecting portion of the rod and engageable with the rear ends of said levers to hold the finger portions thereof removably in said recess.

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