June 4, 1963 H. K. PRICE 3,092,027

ROCKET-PROPELLED VEHICLE WITH PROPULSION ASSISTANT

Filed Nov. 23, 1959 3 Sheets-Sheet 1

FIG. 1.

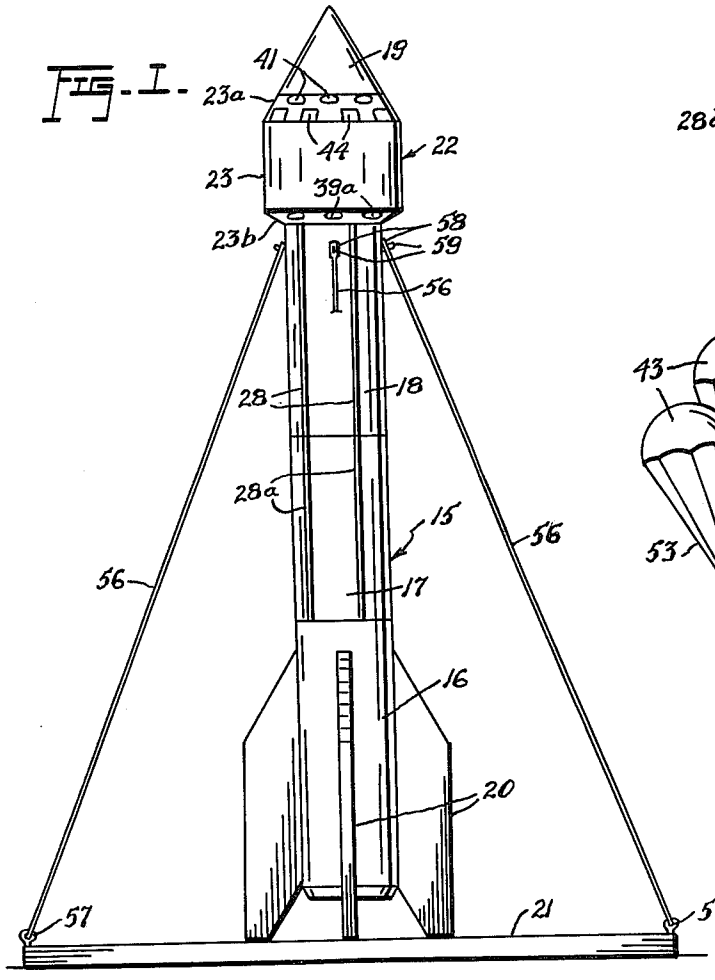
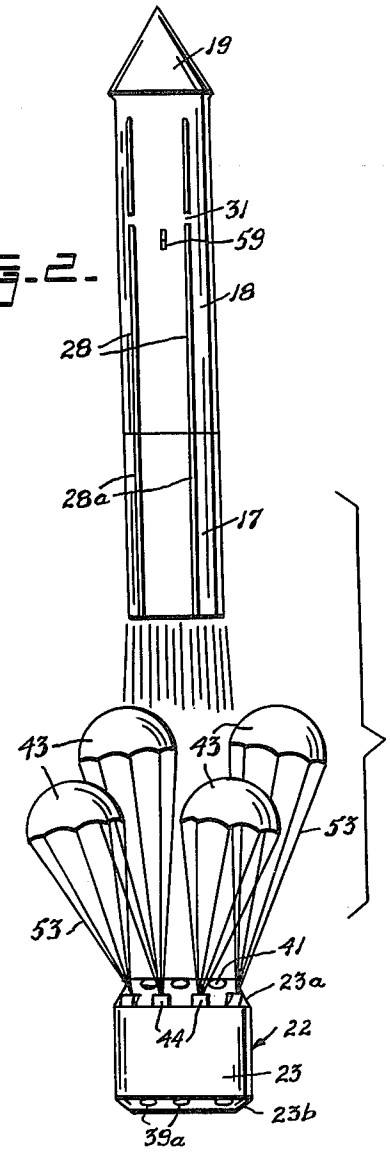


FIG. 2.



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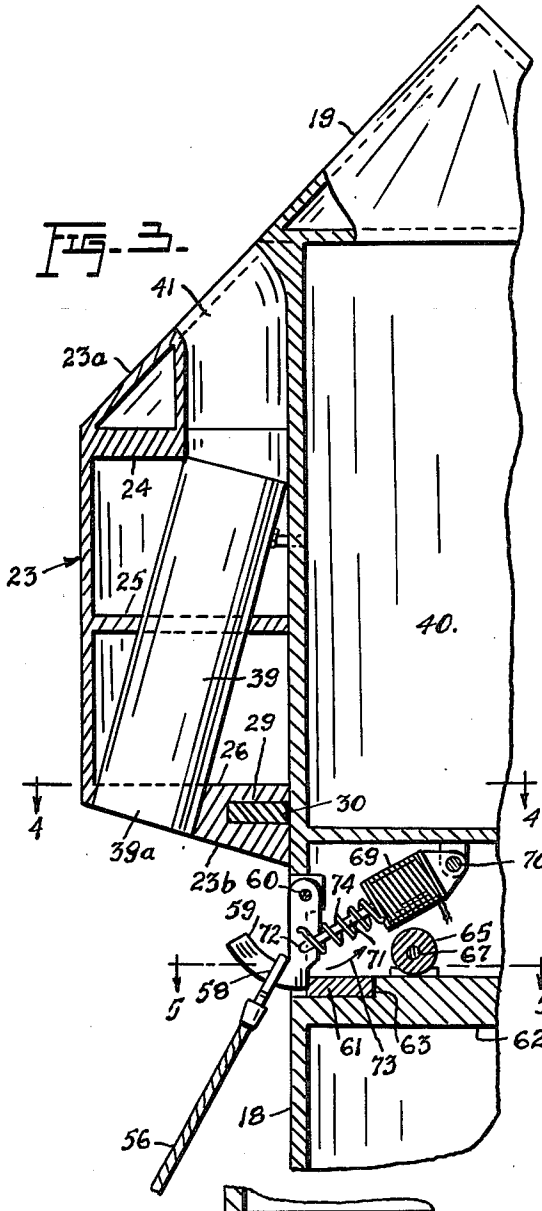


Fig. 3.

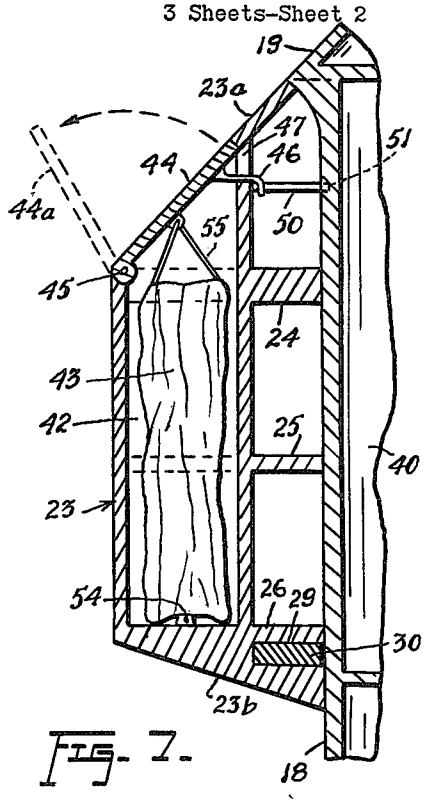


Fig. 7.

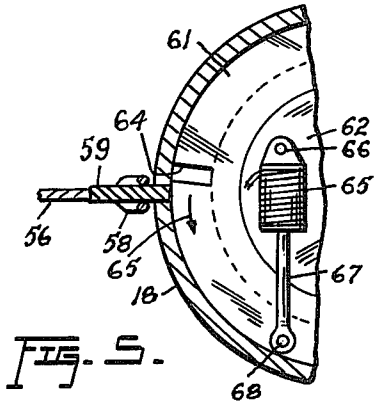


Fig. 5.

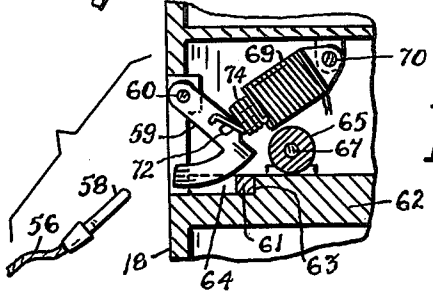


Fig. 6.

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ROCKET-PROPELLED VEHICLE WITH PROPULSION ASSISTANT

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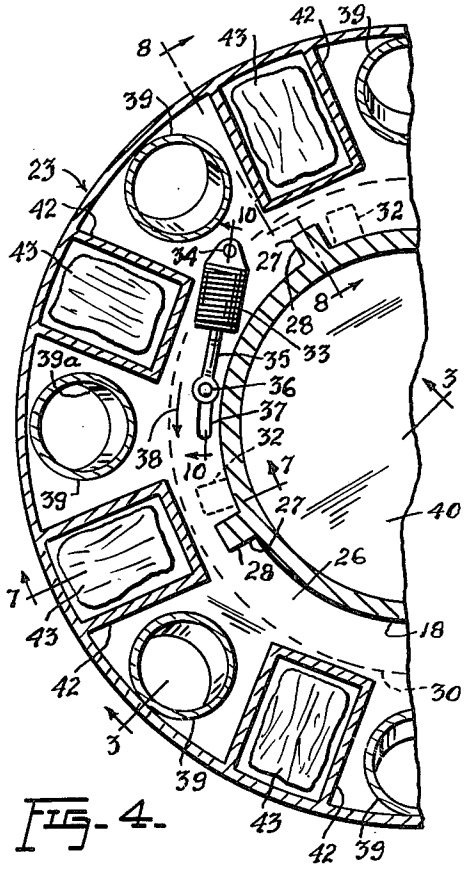


FIG. 4.

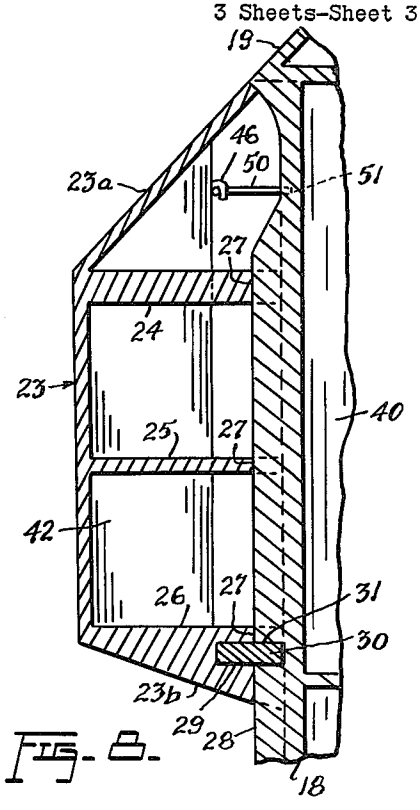


FIG. 8.

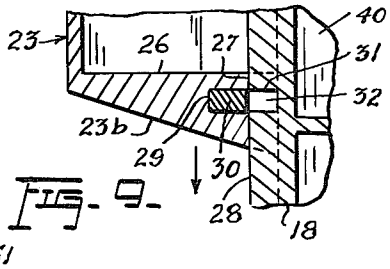


FIG. 9.

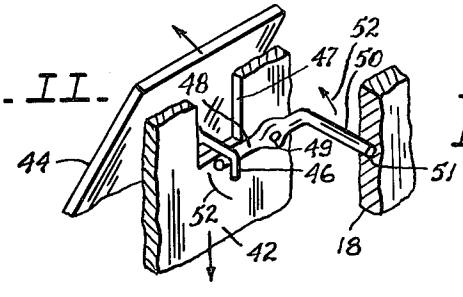


FIG. 11.

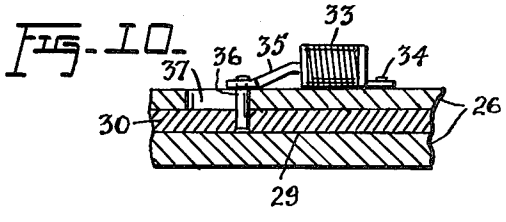


FIG. 10.

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ROCKET-PROPELLED VEHICLE WITH PROPULSION ASSISTANT

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Filed Nov. 23, 1959, Ser. No. 854,884
6 Claims. (Cl. 102—49)

This invention relates to new and useful improvements in rocket-propelled vehicles, and the principal object of the invention is to materially assist the propulsion of such vehicles at the time of and subsequent to take-off, so that by virtue of such assistance a greater and a more sustained thrust is developed to propel the vehicles into orbit or to some other target.

An important feature of the invention resides in the provision of means for anchoring the vehicle to its launching pad prior to take-off so that the propulsion engines, when started, may develop almost their full thrust, whereupon the anchoring means may be released so that the vehicle ascends with almost full power and at a relatively fast speed compared to the usual, slow acceleration which is characteristic to the take-off of conventional rocket vehicles which leave their launching pad while their engines gradually develop thrust.

Another important feature of the invention resides in the provision of a propulsion assistant which is mounted on the body member of the final stage of a multi-stage rocket vehicle and is adapted to furnish the thrust required not only for take-off and propulsion immediately after take-off, but which also operates concurrently with the firing of the first stage and continues in its operation until the first stage is burned out, whereupon both the first stage and the propulsion assistant are dropped while the remaining stages of the rocket vehicle are successively fired.

Another important feature of the invention resides in the provision of parachute means in the casing of the propulsion assistant, which means are automatically releasable upon separation of the propulsion assistant from the final stage of the rocket vehicle, whereby to facilitate slow descent of the propulsion assistant to the ground reclaiming thereof for purposes of analysis and repeated use.

With the foregoing more important objects and features in view and such other objects and features as may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawings, wherein like characters of reference are used to designate like parts, and wherein:

FIGURE 1 is a side elevational view of a multi-stage rocket propelled vehicle embodying the invention, the vehicle being shown anchored on its launching pad;

FIGURE 2 is a group side elevational view showing the propulsion assistant separated from the vehicle and carried by parachutes during its descent;

FIGURE 3 is a fragmentary vertical sectional view on an enlarged scale, showing the propulsion assistant on the vehicle and the releasable means for anchoring the vehicle to its launching pad, this view being taken substantially in the plane of the line 3—3 in FIGURE 4;

FIGURE 4 is a fragmentary horizontal sectional view, taken substantialy in the plane of the line 4—4 in FIGURE 3;

FIGURE 5 is a fragmentary horizontal sectional view, taken substantially in the plane of the line 5—5 in FIGURE 3;

FIGURE 6 is a fragmentary sectional view, similar to that shown in FIGURE 3 but showing the anchoring means released;

FIGURE 7 is a fragmentary sectional view, taken substantially in the plane of the line 7—7 in FIGURE 4;

FIGURE 8 is a fragmentary sectional view, taken substantially in the plane of the line 8—8 in FIGURE 4;

FIGURE 9 is a fragmentary sectional view, similar to that shown in FIGURE 8 but showing the means for retaining the propulsion assistant on the vehicle in its released position;

FIGURE 10 is a fragmentary sectional detail, taken substantially in the plane of the line 10—10 in FIGURE 4; and

FIGURE 11 is a fragmentary perspective view showing the releasable locking means for the door of one of the parachute compartments.

Referring now to the accompanying drawings in detail, particularly to FIGURES 1 and 2 thereof, the general reference numeral 15 designates a substantially conventional multi-stage rocket-propelled vehicle, including a first or initial stage 16, an intermediate stage 17, of which more than one may be provided, and a final stage 18 equipped with a nose cone 19. Each stage of the vehicle is equipped with its own rocket engines (not shown) which are fired in succession as the preceding stages are dropped off, as is the usual practice in the art, until only the final stage 18 with its nose cone 19 remains for delivering the nose cone to its destination. The initial stage 16 of the vehicle is provided with the usual stabilizing fins 20 resting on a suitable launching pad 21, all the components thus far described being conventional and well known.

The invention resides in the provision of a propulsion assistant designated generally by the reference numeral 22 which comprises an annular casing 23 positioned in encircling relation on the cylindrical body member of the final stage 18 adjacent the nose cone 19. The base of the nose cone projects radially outwardly beyond the outer surface of the final stage 18 so as to be flush with the outer surface of the casing 23, more particularly, flush with the outer surface of a frusto-conical upper end portion 23*a* of the casing, which also has a frusto-conical lower end portion 23*b*.

Referring now to FIGURES 3, 4, 7 and 8, it will be noted that the casing 23 also includes a set of ring members 24, 25, 26, the underside of the ring member 26 constituting the aforementioned casing portion 23*b*. The ring members 24, 25, 26 slidably engage the outer surface of the final stage 18 and are provided with a set of slots 27 which slidably receive longitudinally extending guide bars 28 provided in circumferentially spaced relation on the outer surface of the stage 18, as is best shown in FIGURES 1, 2, 8 and 9. Similar guide bars 28*a* are also provided on the intermediate stage 17, in longitudinal alignment with the bars 28. The ring member 26 is provided with a groove 29 accommodating a rotatable locking ring 30, the latter being disposed in a horizontal plane where the guide bars 28 are interrupted as indicated at 31 in FIGURES 8 and 9, so that the locking ring 30 fits in the space created by the interruption of the guide bars as shown in FIGURE 8, and thereby serves to retain the entire casing 23 in position on the stage 18 immediately adjacent the nose cone 19. However, the locking ring 30 is provided with a set of slots 32 and when it is rotated so that the slots 32 are in alignment with the slots 27 in the ring member 26, as shown in FIGURE 9, the entire casing 23 is free to slide downwardly along the stages 18 and 17 so that it may be dropped from the vehicle after the initial stage 16 has been dropped, as will be hereinafter explained. The required amount of rotation of the locking ring 30 which is necessary to align the slots 32, 27 is effected by one or more solenoids 33 pivotally mounted by a pin 34 on the ring member 26 and having a reciprocable

armature 35 connected to a pin 36 which, as is best shown in FIGURE 10, extends through an arcuate slot 37 in the member 26 and is rigidly secured to the locking ring 30. When the casing 23 is locked in position on the stage 18 as shown in FIGURE 4 and the solenoid 33 is energized through suitable remote control, movement of the armature 35 and pin 36 in the slot 37 in the direction of the arrow 38 will partially rotate the ring 30 in the groove 29 so as to align the slots 27, 32 and permit the entire casing to slide off the stages 18, 17 along the guide bars 28, 28*a*.

The casing 23 accommodates a set of thrust-producing engines 39 which may be of either the rocket type or the jet type, and if jet type engines are utilized, they may derive their source of fuel from a suitable fuel tank 40 provided in the body of the stage 18. The engines 39 are circumferentially spaced in the casing 23 and have their axes convergent in the direction of the nose cone 19, so that their exhaust or thrust producing ends 39*a* from which products of combustion are delivered are oriented laterally away from the body of the vehicle. The upper ends of the engines 39 communicate with air pick-up scoops 41 provided in the upper portion 23*a* of the casing 23, as shown.

Disposed in the casing 23 between the engines 39 are a plurality of vertically elongated compartments 42 each containing a parachute 43, the compartments 42 having spring-pressed doors 44 at their upper ends, which doors are biased to their open position on suitable hinge pins 45, as indicated at 44*a* in FIGURE 7. However, means are provided for releasably locking the doors 44 in their closed position, these means comprising a hook-shaped keeper 46 which is secured to each of the doors 44 and projects inwardly through a recess 47 in the inner wall of the compartment 42 and is engaged by a latch 48 pivoted at 49 to the compartment wall, (see FIGURE 11), the latch 49 having an angulated extension 50 which has its free extremity normally disposed in a socket 51 in the outer wall of the stage 18. However, when the casing 23 is released from the vehicle and slides off downwardly along the stage 18, the engagement of the extensions 50 in the sockets 51 causes the latches 48 to turn as indicated at 52, thus disengaging the latches from the keepers 46 and permitting the spring-biased doors 44 to open automatically.

The usual harness 53 of each parachute 43 is firmly anchored to the bottom of its compartment 42 as indicated at 54 and the parachutes are also connected by rupturable cords 55 to the doors 44 so that the parachutes are drawn outwardly from their compartments to a sufficient extent when the doors are opened to cause the parachutes to open as shown in FIGURE 2. It may be noted in this connection that the releasing and opening of the parachutes takes place with a sufficiently delayed action after separation of the casing 23 from the body of the vehicle that the parachutes are not damaged by the discharge of products of combustion from the rocket motors of the remaining stages after the casing 23 is released.

Means are provided for anchoring the entire vehicle 15 to the launching pad 21 prior to take-off, these means comprising a set of cables 56 which are anchored at one end to the launching pad as indicated at 57, while their other ends are equipped with eyes 58 which are releasably engaged with retractable keeper hooks 59, pivotally mounted as at 60 in the stage 18 below the fuel tank 40. The hooks 59 are normally held in their projected position by their abutment with a locking ring 61 which is rotatably mounted on a transverse plate 62 in the stage 18, the plate 62 being provided with an annular groove 63 to receive the ring 61, as shown. However, the ring 61 is provided with slots 64 which, when the ring is rotated in the direction of the arrow 65 (see FIGURE 5), may be brought in alignment with the hooks 59 so as to permit the hooks to be retracted from the position shown in FIGURE 3 to that shown in FIGURE 6, thus releasing the eyes 58 of the cables 56 from the hooks 59 and permitting the entire vehicle to take-off. Rotation of the ring 61 necessary to bring the slots 64 in alignment with the hooks 59 is effected by one or more solenoids 65, pivoted to the plate 62 as at 66 and having a reciprocable armature 67 connected to a pin 68 on the ring 61, so that when the solenoid or solenoids 65 are energized, the ring 61 is rotated to its unlocked position as indicated by the arrow 65.

Retraction of the keeper hooks 59 is effected by a solenoid 69 associated with each of the hooks and pivoted to the bottom of the fuel tank 40 as at 70, the solenoid 69 having a reciprocable armature 71 operatively connected to the hook 59 at 72 so that when the solenoid is energized, the armature thereof causes the hook to be retracted as indicated at 73. In addition, a tension spring 74 is positioned on the armature 71 and anchored at one end thereof to the solenoid while its other end is anchored to the hook 59, whereby to assist the solenoid in retracting the hook, once the ring 61 has been rotated to its unlocked position.

The various solenoids 33, 65 and 69 are, of course, supplied with suitable source of current through a suitable remote control and it is to be understood that while solenoids have been shown and described herein, other actuators such as air or hydraulic cylinders, motors, or the like, may be employed.

When the apparatus is placed in use, the vehicle 15 is erected on the launching pad 21 as shown in FIGURE 1, being anchored to the pad by the cables 56. At launching, the engines 39 of the propulsion assistant 22 are first energized and permitted to operate while they develop some 85% of their maximum thrust while the vehicle is still anchored to its pad. Thereupon, the solenoids 67 and 69 are energized by remote control from the ground so as to rotate the ring 61 to its unlocked position and to retract the hooks 59, thus permitting the anchor cables 56 to be released and enabling the vehicle to take-off under almost maximum power of the engines 39 of the propulsion assistant 22. The vehicle will then climb at a fast rate, gaining speed as the maximum power of the engines 39 is developed to overcome inertia. When an altitude of 50,000 to 100,000 feet is reached, the engines of the first or initial rocket stage 16 are fired by remote control from the ground, but the engines 39 of the propulsion assistant still continue to operate, so that during this period the vehicle is propelled by both the first rocket stage and the propulsion assistant. The operation of these two is timed so that their fuel supply is exhausted simultaneously, whereby the engines 39 of the propulsion assistant 22 cease to operate by the time the first rocket stage 16 is burned out. At that time the first stage 16 is dropped in the usual manner and the solenoids 33 are suitably energized so as to rotate the ring 30 to its unlocked position, thus permitting the entire propulsion assistant 22 to slide downwardly off the stages 18, 17 along the guide bars 28, 28*a* and separate itself from the then remaining portions 17, 18, 19 of the vehicle. Upon separation of the assistant 22 from the vehicle, opening of the doors 44 will permit the parachutes 43 to open, thus gradually lowering the assistant 22 to the ground for purposes of analysis and repeated use. In the meantime, firing of the intermediate rocket stage 17 will propel the vehicle on its way and, upon burning out and dropping thereof, the final stage 18 will continue to do so, until the nose cone 19 is delivered into its orbit or to its target.

It may be noted that while the device 22 has been identified herein as a propulsion assistant for a multistage, conventional rocket vehicle, in effect the engines 39 of that assistant may be regarded as another, primary stage of the rocket propulsion which becomes effective at take-off and continues in its operation so as to overlap the firing of the first rocket stage itself, whereby for a period coextensive with firing of the first rocket stage

the latter and the propulsion assistant coact together in propelling the vehicle. Thus, apart from its consideration as a propulsion assistant, the device 22 may be regarded as the first stage of the rocket vehicle as a whole, with its function overlapping the second stage, whereupon the first and second stages are dropped, leaving propulsion of the vehicle to be effected by successive stages (regardless of their number) up to the final stage.

While in the foregoing there has been described and shown the preferred embodiment of the invention, various modifications may become apparent to those skilled in the art to which the invention relates. Accordingly, it is not desired to limit the invention to this disclosure, and various modifications may be resorted to, such as may lie within the spirit and scope of the appended claims.

What is claimed as new is:

1. The combination of a rocket-type vehicle having a cylindrical fuselage with front and rear ends and abutment means intermediate said ends, an annular casing slidably positioned externally on said fuselage rearwardly of and in engagement with said abutment means, a laterally outwardly projecting guide bar extending longitudinally on the outer surface of said fuselage rearwardly from a point within said annular casing toward the rear end of the fuselage, a portion of said guide bar spaced rearwardly from its front end and disposed within said casing being interrupted to form a recess in the guide bar, and quick disconnect means for locking said casing against sliding rearwardly along the fuselage, said disconnect means comprising a ring mounted in said casing for rotation in a plane transverse to the axis of said fuselage, said ring passing through said recess in the guide bar and having an inner edge provided with a slot which is offset circumferentially of the ring from the guide bar when the casing is locked on the fuselage but which is registrable with the guide bar upon rotation of the ring in the casing to permit rearward sliding of the casing along the fuselage, and means for rotating said ring.

2. The combination as defined in claim 1 wherein said last mentioned means comprise an electro-magnet mounted in said casing and having a reciprocable armature operatively connected to said ring.

3. The combination as defined in claim 1 together with parachute means contained in and releasable from said casing, and means responsive to rearward sliding of the casing on said fuselage for automatically releasing said parachute means.

4. The combination as defined in claim 1 wherein said casing is provided with a compartment, a parachute disposed in said compartment and including cable means connected to the casing, and openable closure for said compartment, and means responsive to rearward sliding of the casing on said fuselage for automatically opening said closure whereby to facilitate releasing of said parachute from the compartment.

5. The combination as defined in claim 4 wherein said last mentioned means include resilient means biasing said closure to its open position, and a latch for holding said closure closed, said latch being operatively connected to said casing and to said fuselage.

6. The combination of a rocket-type vehicle having a cylindrical fuselage, an annular casing slidably positioned externally on said fuselage, quick disconnect means for locking said casing against sliding along the fuselage, means for disconnecting said disconnect means to permit sliding of the casing on the fuselage, said casing being provided with a compartment having a door opening, a parachute disposed in said compartment and including cable means connected to the casing, a hinged door normally closing said opening, and means responsive to sliding of the casing on the fuselage for automatically opening said door whereby to facilitate releasing of said parachute from said compartment, said last mentioned means including resilient means biasing said door to its open position, and a latch for holding said door closed, said latch being pivotally mounted in said casing and having an end portion seated in a socket formed in said fuselage, whereby the latch may be pivotally swung to a door releasing position by sliding of the casing on the fuselage.

References Cited in the file of this patent

UNITED STATES PATENTS

37,940	Plant	Mar. 17, 1863
2,426,537	Van Dorn	Aug. 26, 1947
2,508,237	Eserkaln et al.	May 16, 1950
2,717,309	Campbell	Sept. 6, 1955
2,748,703	Goss et al.	June 5, 1956
2,787,218	Anthony	Apr. 2, 1957
2,801,571	Lusser	Aug. 6, 1957
2,831,400	Hosli	Apr. 22, 1958
2,928,346	Grimes	Mar. 15, 1960
2,932,252	Korn	Apr. 12, 1960
2,958,282	Czajkowski	Nov. 1, 1960

FOREIGN PATENTS

914,341	France	June 17, 1946