Feb. 13, 1962 W. F. MOORE 3,021,095

PROPULSION UNIT

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3 Sheets-Sheet 1

FIG. 1

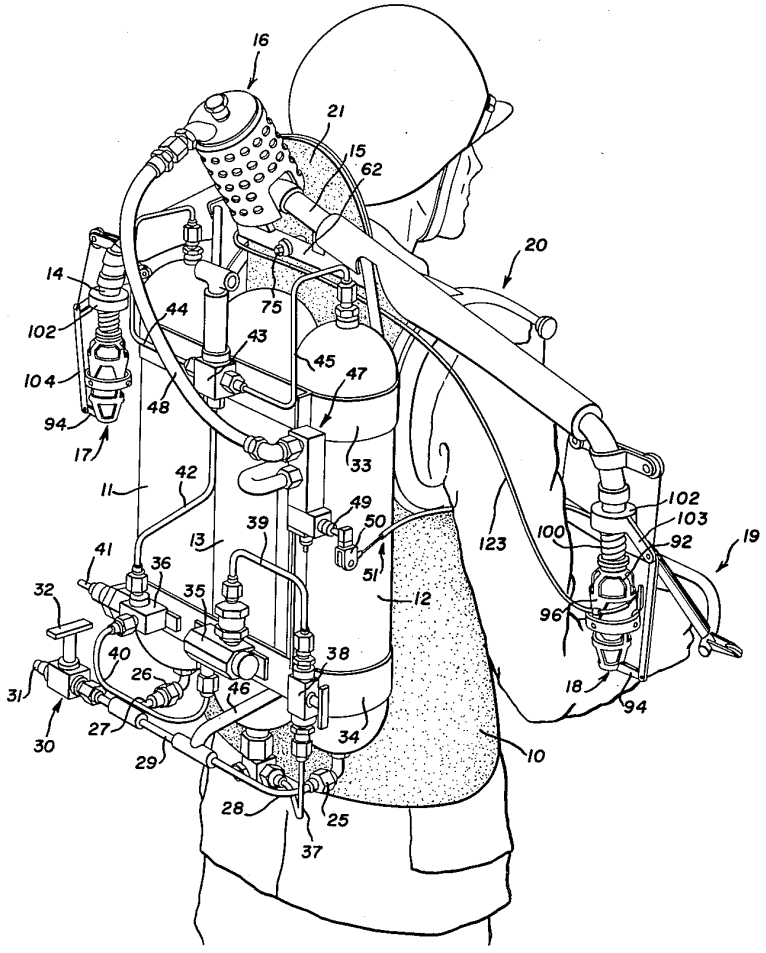

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FIG. 2

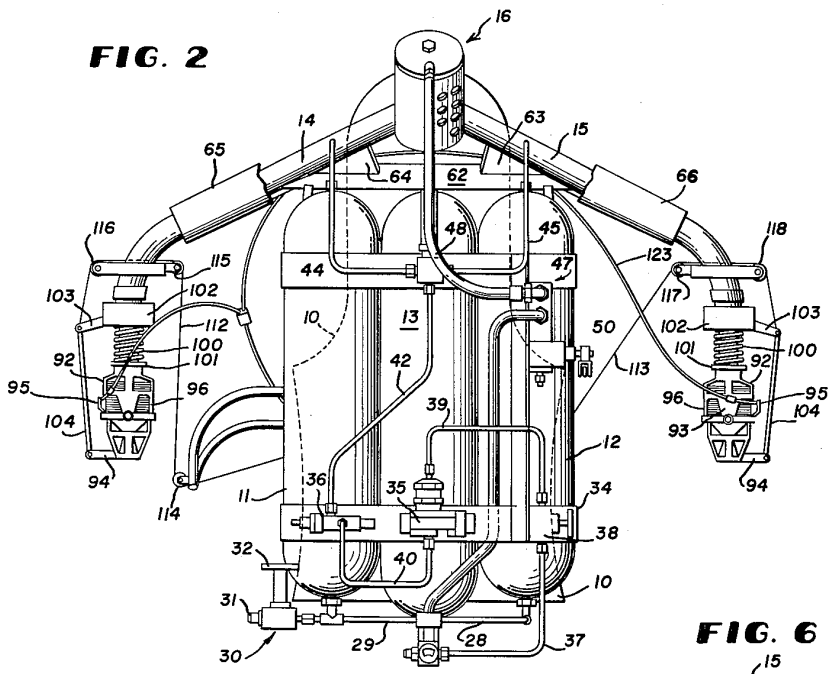


FIG. 5

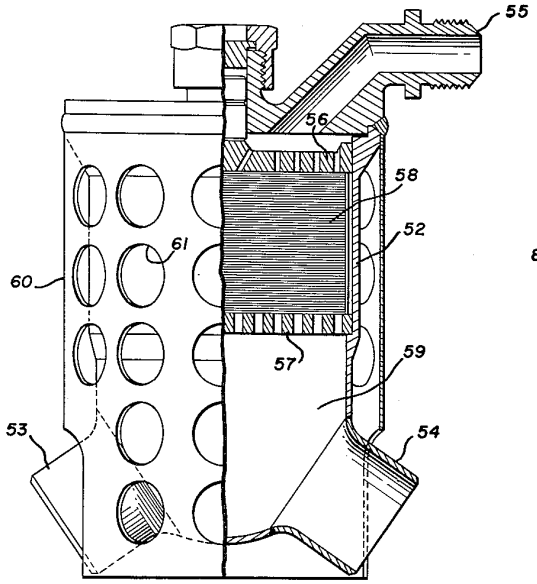
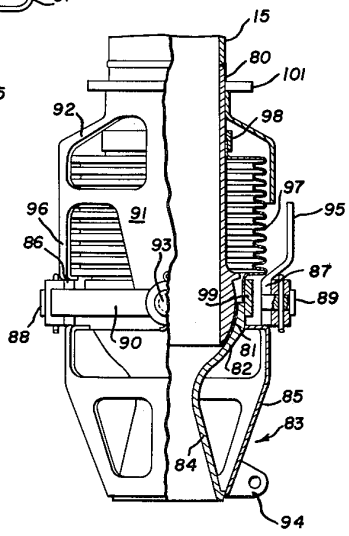


FIG. 6



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larged chamber 59 to allow expansion of the generated hot gas and distribution thereof evenly to the two discharge branches 53 and 54. The housing is surrounded by a heat shield 60 having openings 61 for cooling, the purpose of the shield being to prevent personnel from directly contacting the gas generator housing.

As can be seen best in FIGURE 2, the hot gas tubes 14 and 15 are directly and rigidly connected to the gas generator 16, more specifically to the branches 53 and 54 thereof, and extend generally laterally downwardly therefrom. Extending between the two hot gas tubes 14 and 15 is a brace or reinforcing member 62 gusseted as at 63 and 64 to the gas tubes so that the entire structure is rigidly and integrally formed. The major extent of the gas tubes particularly where they pass in close proximity to the user is provided with heat insulative material 65 and 66.

As can be best seen in FIGURES 1 and 3, the shoulder rings 20 are rigidly connected to the gas tubes by means of fore and aft braces 67 and 68 so that the shoulder rings too are rigidly and fixedly connected to the hot gas tubes. The shoulder rings are open at their fronts to permit the assemblage to be easily applied and removed from the individual and are provided with retaining bars 70 and 71 to hold the rings properly in place on the user's body. Preferably, these bars are pivotally connected at one end or the other to the shoulder rings, with the other ends thereof being provided with a suitable quick-release coupling or fastening such as a removable pin acting as a latch to hold these bars in place when desired.

The cross-brace 62 serves, in addition to interconnecting the gas tubes, as a means for pivotally connecting the secondary component to the harness 10 and for this purpose, there is provided a pivot bolt member 75, see particularly FIGURE 1, which pivotally connects the intermediate portion of the cross-brace 62 to the extension 21 of the harness 10. In this manner, the operator can, by moving and maneuvering his shoulders, effect kinesthetic control of the nozzles 17 and 18.

The construction of each nozzle is as is shown in FIGURE 6. Each gas tube 14 or 15 is provided with an extension 80 having a ball surface 81 provided at the lower extremity thereof mating with a spherical or rather part spherical seat portion 82 of the nozzle body 83 proper. The inner wall 84 of the nozzle is formed suitably as shown for proper discharge characteristics and the outer wall 85 thereof mounts a pair of apertured ears 86 and 87 receiving the pivot pins 88 and 89 which pass through a gimbal ring 90 so as to permit lateral deflection of the nozzles. The gimbal ring is carried by arm projections 91 at either side of the cover member 92 rigidly affixed to the extensions 80 and the gimbal ring 90 is pivotally connected to these arms by means of pins 93 diametrically opposed with respect to each other and completing the universal connection between the cover 92 and the nozzle bodies through the gimbal ring 90. The nozzle bodies 83 are provided with laterally outwardly extending actuator lugs 94 for effecting lateral control of the nozzles. Each cover 92 is provided with an inner side extension 96 effecting stops to prevent lateral inward deflection of the nozzles towards the user's body. Disposed within each cover 92 is a sealing bellows 97 coupled at its opposite ends by means of rings 98 and 99 to the extension 80 and the nozzle body 83 respectively, thus sealing the connection between the ball 81 and its seat 82.

As can be seen best in FIGURE 2, a control spring 100 surrounds each gas tube above a respective nozzle assembly, being seated on the shoulders 101 of the respective covers 92 and resiliently mounting the bobweights or stability weights 102 which surround the respective hot gas tubes. Each such weight is provided with a rigid radially projecting arm 103 having a rod connection 104 to its respective nozzle lug 94.

The purpose of these weights 102 is to provide stability control for the nozzles operative automatically due to inertia forces and controlling angular acceleration of the system independently of the operator's control although, of course, the control effected by the weights can be overridden by the manual control means.

In addition to the actuator lugs 94, each nozzle is also provided with a further actuator lug 95 rigidly connected, in each case, to its respective nozzle ear 87 (see FIGURE 6) and extending upwardly therefrom in the region of an associated pivot pin 93. Whereas the actuator lugs 94 are provided for the purpose of obtaining lateral outward deflection of the nozzles, the lugs 95 are utilized for obtaining fore and aft deflection of the nozzles.

For the purpose of manual control, the lower branch of each shoulder ring 20 is provided with an extension, such as those indicated by reference characters 105 and 106. One of such extensions is provided with a rigid terminal end portion 107 having a pivoted grip lever 108 associated therewith so that the operator, by squeezing on the portion 108, will actuate the throttle control cable 51. Also, it is preferred that a flight time remaining indicator 109 be mounted on either the extension 105 or the extension 106, in this case, the extension 105, and which is simply a pressure gauge connected to the system calibrated in seconds to indicate the flight time remaining in the system. The other extension 106 carries a pressure gauge 110 reading in pounds per square inch. The other extension 106 also has a terminal end portion 111 universally connected thereto and by means of which the deflection of the nozzles is controlled, either fore and aft, or laterally, or a combination of both.

For deflecting the nozzles laterally, cables 112 and 113 are provided for having one end thereof in each case attached to the bottom of universally pivoted control handle 111. One cable, 112, extends from handle 111 over pulleys 114, 115 and 116 and is connected to arm 103 on the stabilizing weight 102. The other cable 113 extends from the lower end of handle 111 over pulleys 117 and 118 on the right hand side and is connected to the other weight arm 103. Since the nozzles can be deflected only outwardly in the lateral direction, cables 112 and 113 are adequate inasmuch as tension loads only are required.

For obtaining fore and aft nozzle deflection, handle 111 is provided with an arm 120 rigid therewith and which extends upwardly beyond the universal connection between the handle 111 and frame extension 106. To the upper end of this arm a Bowden cable 121 is connected which extends to a junction member 122 from which two separate Bowden cables 123 and 124 emanate. Bowden cable 124 extends to lug 95 at the left hand nozzle whereas cable 123 extends behind the corset as shown in FIGURE 4 for connection to the right hand nozzle lug 95. It will be appreciated that the Bowden cable system is anchored, where necessary, to achieve both push and pull motions of the wire. That is to say, the sheath for the movable wire is appropriately anchored to permit the wire to operate properly.

That is to say, by virtue of the pivotal connection between the upper portion of the device (manifold nozzles, etc.) and the harness extension 21 and due to the flexibility of the extension 21, the operator may, by manipulating his shoulders and/or manipulating the hand grips 107 and 111 to deflect the upper portion of the assembly relative to his body, effect disposition of the nozzles so as to propel himself fore and aft as well as laterally. During such manipulation, the operator will instinctively maintain himself in a generally upright or balanced position, i.e. by swinging his legs, "hunching" his body, etc. This balanced position of the operator is made possible by his instinctive shifting of his center of gravity, as by the gymnastics as aforesaid. A detailed treatise of the forces involved is beyond the scope of this disclosure since

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PROPULSION UNIT

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5 Claims. (Cl. 244—4)

This invention relates generally to means for propelling an individual, and pertains more particularly to such a means which can be quickly and easily applied and which will afford a propelling force to lift the individual from the ground and to propel him to a remote spot.

For a number of years, there has been a need for increasing the mobility of military personnel, for example, infantrymen, by way of providing some means to directly lift and transport an individual soldier. It is of primary concern in connection with the present invention to provide such means in the form of a safe, reliable and easily controllable rocket propulsion system having sufficient total impulse to lift and propel an individual for distances up to approximately two or three miles.

It is a further object of this invention to provide a device in accordance with the above which is capable of being utilized by the average soldier with an absolute minimum of training.

Another object of this invention resides in the provision of a light weight rocket propulsion system capable of quick installation and removal from the individual and which can be safely and easily carried by one man. To this end, the present invention envisages a simple light weight harness in the form of a corset upon which is mounted the heavier components of the system so that such heavier components are more easily carried by the individual inasmuch as the weight thereof is attached directly to and carried by the torso and wherein there is provided a control, gas generator, hot gas tube and nozzle assembly pivotally connected to the upper extremity of the corset harness and having separate means in the form of quickly detachable rings obtaining support from the user's shoulders and permitting of kinesthetic control when desired.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims, and the several views illustrated in the accompanying drawings.

FIGURE 1 is a perspective view showing the device as applied to an individual.

FIGURE 2 is a rear elevational view of the assemblage.

FIG. 3 is a right side elevational view of the assemblage as shown in FIGURE 2.

FIGURE 4 is a left side elevational view of the assemblage shown in FIGURE 2.

FIGURE 5 is an elevational view partly in section showing details of the gas generator.

FIGURE 6 is an elevational view partly in section showing one of the nozzle members.

Referring at this time more particularly to FIGURE 1, the propulsion unit will be seen to be constructed of two main component parts. The first of these utilizes a corset-like harness 10 by means of which the device is directly attached to the user's body. Directly carried by this harness on the back panel thereof are a pair of propellant supply tanks 11 and 12 and, intermediate these tanks, a pressurizing gas tank 13 and sufficient couplings and fittings interconnecting these several tanks as well as control means therefor later to be described.

The second of the assemblies includes a pair of hot gas tubes 14 and 15 emanating from the gas generator indicated generally by reference character 16, the nozzles

indicated generally by the reference characters 17 and 18 at the ends of the respective hot gas tubes, control handle members such as the throttle control assembly indicated generally by the reference character 19 and shoulder engaging rings such as the ring indicated generally by the reference character 20. This entire second component or subassemblage is a rigid, integral unit separate from the first-mentioned component but being pivotally attached thereto, in a manner hereinafter more specifically set forth, permitting a certain amount of freedom of movement of the second component relative to the first so that the operator may, if desired, utilize kinesthetic control.

The harness 10 has an enlarged black panel including the extension 21 which projects upwardly behind the user's neck so as not only to protect the user from the heat of the mechanism but also to provide means for pivotally mounting the second component to the harness. As previously described, there is a propellant supply means which, in the specific form of the invention shown, comprises the two tanks 11 and 12 and there is also a pressurizing gas supply in the form of the tank 13 which is utilized in the specific example shown to pressurize the tanks 11 and 12 and provide the means for discharging the contents of the latter to the gas generator 16.

The tanks 11 and 12 are provided with outlet couplings 25 and 26 having connection with branches 27 and 28 of the main line 29 for the propellant. Also coupled with the main line is a filling valve assembly, indicated generally by reference character 30 having a nipple 31 for connection to a propellant supply whereby the tanks 11 and 12 may be charged, during which time, of course, the valve 30 is disposed in the open position through the medium of a handle 32.

The several tanks are rigidly mounted relative to each other by means of strap members 33 and 34 having suitable connection directly to the harness 10 and which straps also serve to mount certain component parts of the mechanism. For example, the lower strap 34 mounts a pressure regulating valve 35 and a vent valve 36. The pressurizing gas tank 13 is connected through line 37, shut-off valve 38, and line 39 to one side of the regulator 35, the other side of the regulator being connected through line 40 to the vent valve 36. The vent valve is so constructed as to harmlessly vent the pressurizing gas through the outlet 41 in case of failure of this part of the system. Leading from the vent valve 36 is a line 42 extending to the manifold block 43 having pressurizing gas branches 44 and 45 leading therefrom to the respective tops of the tanks 11 and 12, as shown.

In the specific form of the invention shown, the propelling medium is hydrogen peroxide and the pressurizing gas is nitrogen. The aforementioned main line 29 for the propellant, that is, for the hydrogen peroxide, has a discharge branch 46 leading from the main line to the throttle valve assembly indicated generally by the reference character 47 and on the downstream side of this throttle valve the flexible connection 48 extends to the previously mentioned gas generator 16. The throttle valve 47 is provided with an externally projecting actuating rod 49 having a clevis crank 50 fixed thereto having connection with a control cable 51 by means of which the flow of propellant to the gas generator 16 is controlled.

The gas generator is shown in FIGURE 5 and will be seen to include a casing or housing 52 having at its lower end a pair of generally oppositely directed discharge portions 53 and 54 and having an inlet 55 at its upper end. Within the housing 52 are a pair of vertically spaced plates 56 and 57, perforate as shown, and sandwiching therebetween a catalyst bed 58, it being preferred that there is provided below the plate 57 a somewhat en-

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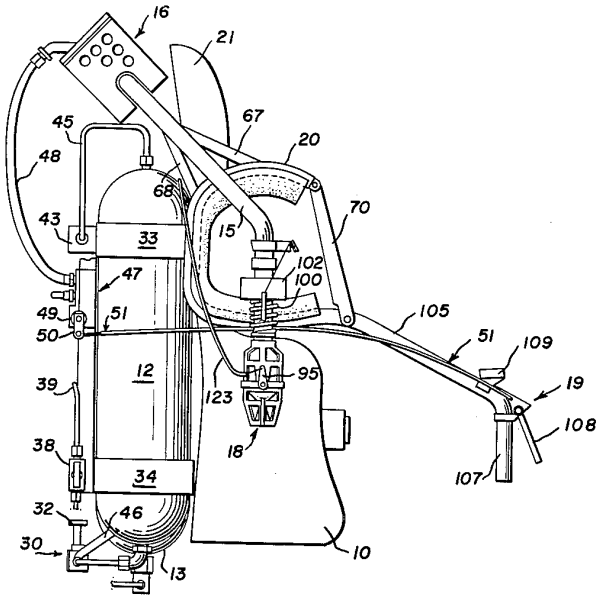

FIG. 3

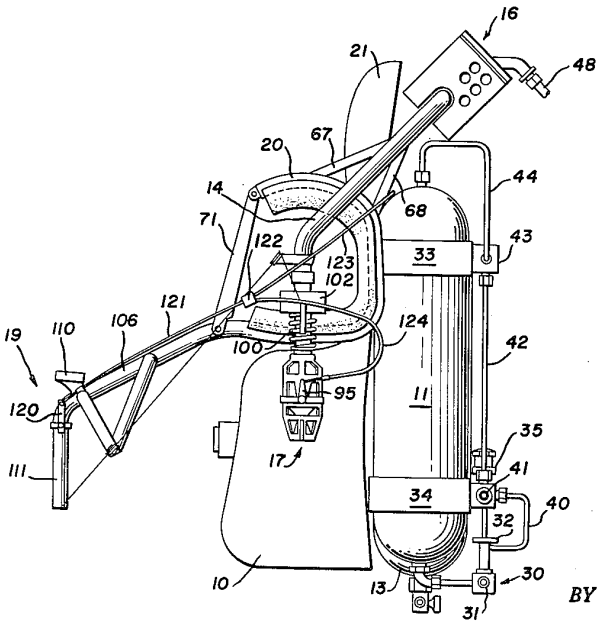

FIG. 4

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it deals with a highly sophisticated force system and it would serve no useful purpose insofar as the present disclosure is concerned. Suffice it to say it is largely instinctive for the operator to maintain his upright position while effecting the aforesaid flight control. The same relationship prevails when the nozzles are deflected to effect control.

What is claimed is:

1. A propulsion unit for an individual such as a foot soldier comprising a first assembly adapted to be attached to the individual's torso for carrying the weightier components of the unit and a second assembly adapted to be carried by the user's shoulders and including propulsion nozzle means, said first assembly including a harness of corset-like form and having a back panel, and propellant supply and discharge means attached to said back panel, said second assembly including a gas generator having a pair of hot gas tubes emanating therefrom and extending generally in laterally opposite directions from such gas generator and each having a downturned end portion mounting a nozzle, a shoulder engaging ring fixed to each gas tube and projecting forwardly therefrom for engagement with the user's shoulders and thereabout, and manual control means carried by said rings for controlling the deflection of said nozzles relative to the hot gas tubes and for controlling the supply of propellant to said gas generator, said propellant supply and discharge means being connected to said gas generator.

2. A propulsion unit for an individual such as a foot soldier comprising a device adapted to be removably attached to a user's body, said device including a torso engaging portion fixedly mounting the weightier components of the unit and thus permitting of the same to be carried directly by the user's body and especially by the hips thereof, said device also including an upper portion including propulsion nozzles provided with means for attachment to a user's shoulders and constituting the lighter of the components of the device, the latter portion of the device being articulately mounted to the torso engaging portion permitting of kinesthetic control of said nozzles.

3. A propulsion unit for an individual such as a foot soldier comprising a first assembly adapted to be attached to the individual's torso for carrying the weightier components of the unit and a second assembly adapted to be carried by the user's shoulders and including propulsion nozzle means, said first assembly including a harness of corset-like form and having a back panel, and propellant supply and discharge means attached to said back panel,

said second assembly including a gas generator having a pair of hot gas tubes extending therefrom in generally laterally opposite directions with each such tube being provided with a down-turned end portion mounting a nozzle pivotally thereon, a shoulder engaging ring fixed to each gas tube and projecting forwardly therefrom for engagement about the user's shoulders, each such ring having a forward extension with one of such extensions being provided with means for controlling the supply of propellant to said gas generator, and the other of such extensions being provided with a pivoted hand grip portion connected to said nozzles for effecting deflections thereof, said propellant supply and discharge means being connected to said gas generator.

4. The unit as defined in claim 3, wherein said second assembly is pivotally connected to said first assembly to permit of kinesthetic control of said nozzles.

5. In a control system of the type having a gas generator, a common manifold connected to a gas generator, and a pair of spaced dirigible nozzles mounted on said manifold an automatic stability device for damping out undesirable directional deviations of the system, said device comprising a bobweight slidably mounted on said manifold in association with each of said nozzles, a spring surrounding said manifold and seated at its lower end thereon and supporting a respective bobweight at its upper end, an arm on each of said nozzles extending laterally outwardly thereof in a direction opposite the other nozzle in each case, an arm on each bobweight substantially aligned above the arm on the associated nozzle, and a control link extending between each such pair of aligned arms whereby movement of each bobweight in response to directional deviations of the system will deflect the associated nozzle angularly outwardly to effect a restorative counteracting force to stabilize the system.

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