

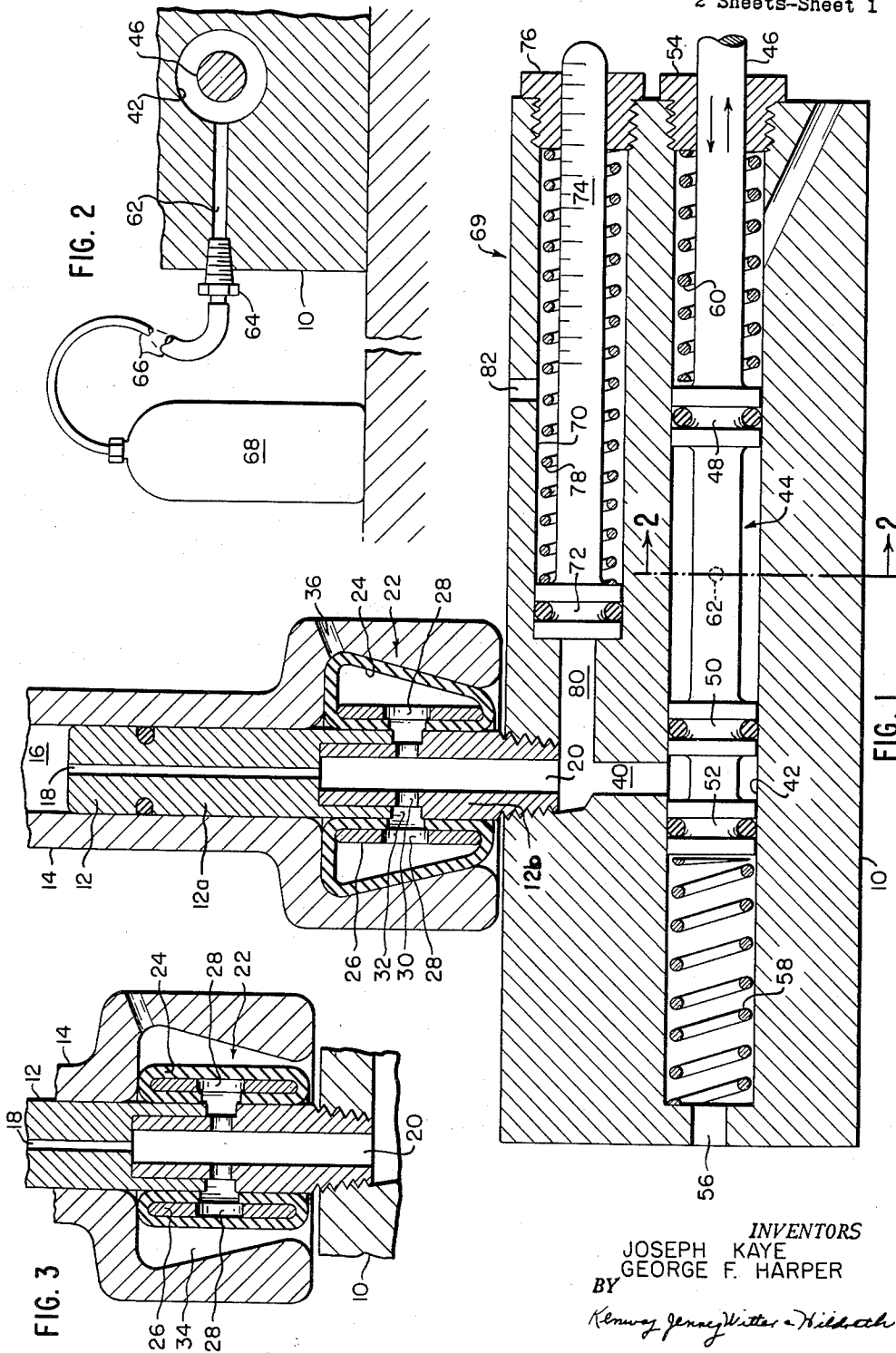
March 20, 1962

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ROCKET LAUNCHER

3,025,633

Filed Feb. 1, 1960

2 Sheets-Sheet 1



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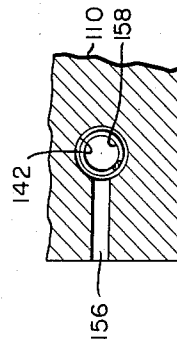
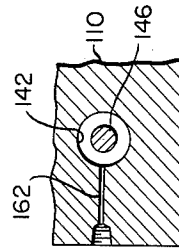
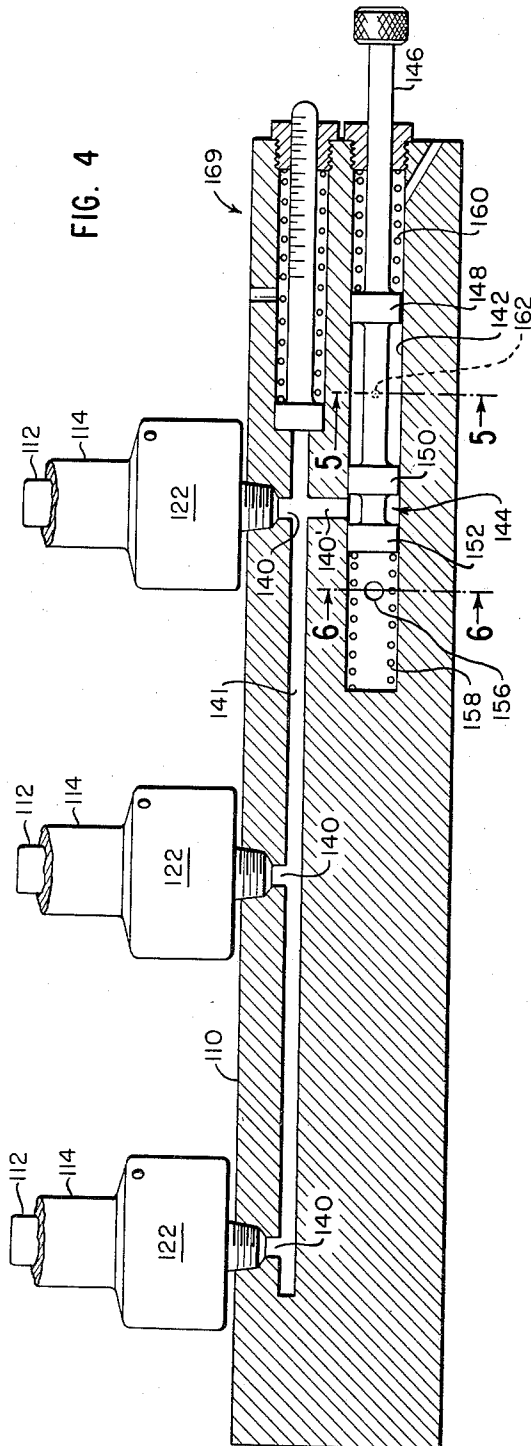
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ROCKET LAUNCHER

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Filed Feb. 1, 1960, Ser. No. 5,799

10 Claims. (Cl. 46-74)

This invention relates to rockets which are propelled by means of a non-combustible pressurized fluid, and, more particularly, the invention relates to means for pressurizing and launching such rockets. Rockets of the type described may be used for various purposes, such as model testing of combustible fuel rockets, testing of equipment under simulated conditions, etc. However, because of the utilization of non-combustible propellant fluid, rockets of this general type are particularly useful as toys; and while this invention is not necessarily limited to use with toy rockets, it is particularly suited for this use.

Toy rockets utilizing non-combustible fluid propellants generally comprise a rocket-shaped body having an internal cavity to which is connected a nozzle or exhaust passage leading to and opening outwardly of the tail section of the rocket. The cavity within the rocket body is normally filled with a pressurized fluid propellant such as compressed air or gas, with the propellant being exhausted through the nozzle opening at the tail of the rocket to provide the thrust for the rocket. Often a launching pad or base is provided, in combination with the rocket, to hold the rocket in launching position while the rocket is filled with pressurized propellant. Also, the launching base normally includes suitable latching means to maintain the rocket and base in assembly until the rocket has been filled with propellant and it is desired to launch the rocket. Inasmuch as it is preferable, in many cases, to provide for remote control launching of such a rocket, the means for releasably latching the rocket to the launching base should preferably be of a type which is suitable for remote actuation. In rockets utilized in scientific testing and the like, the latching means may be of a rather complex type, inasmuch as cost is not of primary importance. However, in the case of a toy rocket, it is desirable to provide a suitable and safe mechanism while at the same time it is desirable to maintain a low cost of manufacture. Further, in the case of a toy rocket and launching pad, the assembly will usually be relatively light; and it is, therefore, desirable that the release of the rocket launching mechanism be accomplished with little force being exerted on the rocket and base assembly so as to preclude any tendency for the assembly to be tipped over or otherwise misaligned so that the rocket, when launched, will not take a dangerous and undesired course.

Also, inasmuch as toy rockets of the type described are often operated by children of relatively young ages, it is desirable to provide as simple and safe a means for pressurizing the rocket as is possible. It is also desirable in rockets of the type described to be able to selectively vary the pressure of the propellant fluid within the rocket in order to selectively vary the range of the rocket. It is equally desirable to provide means for preventing inadvertent overpressurizing of the rocket, which might cause structural failure of the same.

Accordingly, it is an object of our present invention to provide a launching pad or base for use with a rocket of the type described which will incorporate novel and improved means for latching the rocket to the base during pressurizing of the rocket and for releasing the rocket at the desired time.

It is a further object of our invention to provide a rocket launching base or pad of the type described having means for selectively pressurizing the rocket to any of a plurality of pressures.

It is still a further object of our invention to provide a

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novel and improved rocket launching base of the type described which will provide a simplified pressurizing and launching operation, which will be simple and of a relatively economical structure, and which at the same time will be rugged and safe.

Briefly and in one aspect thereof, a rocket launching base incorporating our present invention comprises a multi-position valve adapted to be connected to a source of pressurized fluid and to the interior of a rocket mounted on the launching base. The base also includes fluid pressure responsive latch means engageable with a rocket on the base and connected to the valve for controlling the flow of fluid propellant to the rocket. The latching means and control valve are so constructed and arranged that the latching means will be actuated in response to the flow of propellant fluid into the rocket so that as the rocket is filled with propellant fluid the latch means will be maintained in firm latching engagement with the rocket to hold the same on the base. The control valve is further constructed and arranged to be selectively operable to release the pressure on the latching means so as to initiate launching of the rocket. From the above it can be seen that the same control means is utilized to control the pressurizing of the rocket, to actuate the latching means to engage the rocket, and to release the latching means to launch the rocket. In this manner, the pressurizing and launching of the rocket is greatly simplified and, as will be hereinafter seen, the control valve is easily adapted to remote operation. A more detailed understanding of this as well as other aspects of our invention may be had by reference to the following detailed description of specific embodiments of the invention when taken in connection with the accompanying drawings, in which:

FIG. 1 is a cross sectional view of a rocket launching base incorporating the present invention with a rocket mounted on the base in latching engagement therewith;

FIG. 2 is a fragmentary cross sectional view substantially along the line 2-2 of FIG. 1;

FIG. 3 is a fragmentary side elevational view, partly in section, of the base of FIG. 1 with the latching means thereof in inoperative position;

FIG. 4 is a cross sectional view of an alternative embodiment of a rocket launching base incorporating the present invention which is adapted for the salvo launching of a plurality of rockets;

FIG. 5 is a fragmentary cross sectional view substantially along the line 5-5 of FIG. 4; and

FIG. 6 is a fragmentary cross sectional view substantially along the line 6-6 of FIG. 4.

With reference to the drawings, and particularly FIGS. 1-3, a rocket launching base incorporating the present invention comprises a base 10 on which is mounted an upright cylindrical member or post 12 for supporting a rocket of the type described in vertical position. An exemplary rocket of a type adapted for use with this invention comprises a body 14 having a cylindrical elongated passage 16 extending longitudinally of the body and opening outwardly of the tail section of the rocket. As shown in FIG. 1, the post 12 is telescopically engageable within the passage 16. The passage 16 serves as a charging passage during pressurizing of the rocket and also serves as the exhaust passage for propellant fluid contained within the body of the rocket in a charging chamber (not shown). The post is provided with a fluid passage 18 extending longitudinally from the upper end of the post so as to be in communication at its upper end with the passage 16 within the rocket body when the rocket is telescopically assembled over the post, as shown in FIG. 1. The passage 18 is provided with a counterbore 20 at its lower end portion.

In accordance with the invention, fluid pressure responsive latching means, generally indicated at 22, are pro-

vided adjacent the lower end of the post 12 for latching engagement with the rocket body 14 to hold the same on the base during pressurizing of the rocket. In the specific embodiment of FIGS. 1 and 3, this latching means comprises an annular expansible chamber 24 formed from a distensible resilient cylinder fabricated of rubber or the like, with the ends of the cylinder being folded over the ends of a sleeve or tube 26. The sleeve 26 is telescopically engaged over the post 12 to clamp the turned-over ends of the resilient member 24 in sealed engagement between the sleeve and the post 12. In order to facilitate assembly of the latching means on the post, the post may be provided in two sections—an upper section 12a and a lower section 12b. The lower post section 12b is provided with a reduced diameter portion at its upper end which is telescopically engaged within an annular skirt or flange projecting from the lower end of the upper post portion 12a. In assembling the post and latching means, the sleeve 26 and distensible cylinder may be slipped onto the lower end of the upper post member 12a, with the upper end of the cylinder having just been turned over the upper end of the sleeve 26. The lower end of the cylinder may then be turned over the lower end of the sleeve 26 so as to lie along the inner surface thereof, whereupon the lower end portion 12b of the post may be inserted upwardly through the sleeve and into telescopic engagement with the upper post portion 12a.

The sleeve 26 is provided with a plurality of apertures 28 which register respectively with a plurality of passages in the post 12 extending radially outwardly of and from the counterbore 20. These radially extending passages are, in the specific embodiment, formed by radial passages 30 in the lower post section 12b. The passages 30 communicate at their outer ends with an annular passage 32 formed by a spacing of the lower end of the upper post section 12a from the axially facing annular shoulder on the lower post section 12b formed at the intersection of the reduced upper end portion and remainder of the lower post portion. As will be apparent from the structure thus far described, the introduction of a pressurized fluid within the counterbore 20 will result in the distention or expansion of the outer wall of the chamber 24 in a radially outward direction relative to the post 12.

As will be apparent from FIGS. 1 and 3, the tail section of the rocket body 14 is provided with an enlarged cavity arranged concentrically of the exhaust passage 16 so that the outer walls of the cavity surround the post 12 in radially outwardly spaced relation. The walls 34 of the cavity are, as most clearly shown in FIG. 3, preferably inclined so as to give the cavity a frusto-conical configuration with the wall of the cavity tapering toward the base of the rocket. As will further be apparent from FIG. 3, when the chamber 24 is in its undistended condition, the outer wall of the chamber will lie closely adjacent the outer surface of the sleeve 26. The smaller diameter of the cavity 34 is preferably larger than the outer diameter of the chamber 24 in its undistended condition, whereby the rocket body may be slipped onto the post 12 with the latch means 22 being freely movable into the cavity 34. Upon expansion of the chamber 24, the distended walls thereof will engage the walls of the cavity 34 and particularly the inclined peripheral wall thereof and exert a restraining force on the rocket body which will resist movement of the rocket body upwardly and away from the post 12. In order to facilitate rapid expansion of the chamber 24, the rocket body is preferably provided with a vent passage 36 extending from the upper end of the cavity 34 and opening outwardly of the rocket body into atmosphere communication. From the above it will be apparent that the application of fluid pressure within the counterbore 20 of the post 12 will effect distention of the walls of the chamber 24 to provide latching engagement between the distended walls of the chamber 24 and the rocket body and prevent separation of the rocket and launching base during the time

that pressurized fluid propellant is being passed upwardly through the passage 18 in the post and into the rocket body.

In accordance with the invention, the lower end of the counterbore 20 in the post 12 is connected to a passage 40 in the base 10 leading to an elongated cylindrical valve chamber 42 in which is received a spool valve 44. The valve 44 includes a valve stem or control rod 46 and a plurality of pistons 48, 50 and 52 spaced axially along the stem. One end of the valve chamber 42 opens outwardly of the base 10 and is closed by a threaded plug 54, through which the stem 46 slidably extends outwardly of the base. The other end of the valve chamber 42 terminates short of the opposite side of the base and a smaller diameter passage 56 connects this end of the valve chamber to atmosphere externally of the base. A pair of centering springs 58 and 60 maintain the valve 44 in a normal inoperative position, wherein the pistons 50 and 52 are disposed on opposite sides of the passage 40 and in spaced relation thereto. As will be apparent from FIG. 2, a small diameter lateral passage 62 in the base 10 is connected at one end to the valve chamber 42 at a point between the pistons 48 and 50 and in spaced relation thereto when the valve member 44 is in its normal centered position. The other end of the passage 62 communicates with a fitting 64 which is connected by a flexible tube 66 to a container 68 filled with a pressurized propellant fluid such as Freon, the receptacle 68 being the source of pressurized propellant fluid for the rocket.

Further in accordance with the invention, and referring again to FIG. 1, the base 10 is provided with pressure indicating and limiting means comprising an internal elongated cylindrical chamber 70 which in the preferred embodiment extends parallel to the valve chamber 42 and opens outwardly of the base 10 on the same side of the base as the valve chamber 42. A piston 72 is slidably received within the chamber 70 and is provided with a rod 74 extending coaxially therefrom and outwardly of the base 10. A threaded plug 76 closes the outer end of the chamber 70 and slidably receives the rod 74. A spring 78 biases the piston 72 to the left as viewed in FIG. 1. The inner end of the chamber 70 is connected by a passage 80 to the supply passage 40. Accordingly, when pressurized propellant fluid is introduced into the passage 40 it will act upon the piston 72 to move the same to the right as viewed in FIG. 1 against the force of the spring 78. The amount that the rod 74 projects beyond the base 10 will, of course, be indicative of the pressure acting upon the piston 72 and, as thus, will be indicative of the pressure of the propellant fluid within the charging chamber of the rocket.

A vent passage 82 connects the chamber 70 to atmosphere externally of the base 10. The inner end of the passage 80 communicates with the chamber 70 intermediate the ends of the chamber and is spaced from the inner end of the plug 76 a distance greater than the length of the piston 72. Accordingly, the inner face of the piston 72 will clear the inner end of the vent passage 82 at a predetermined fluid pressure in the passage 40, whereupon the vent passage 82 will effectively prevent any further build-up of pressure in the rocket. In this manner, there may be assurance that excessive internal pressure will not be developed in the rocket.

In the operation of a launching base constructed in accordance with this invention the container of pressurized propellant fluid is connected to the passage 62 so as to connect the source of fluid pressure to the valve chamber 42 intermediate the pistons 48 and 50 of the valve 44. It is preferred that the passage 62 be of relatively small size in order to provide a metering or a throttling of the fluid propellant as it enters the valve chamber. This flow restriction of the propellant fluid insures that rocket charge will occur over a span of several seconds rather than in a fraction of a second as would occur if no flow restriction is provided. In this

manner, the pressure within the rocket may be more accurately controlled.

In order to charge the rocket with propellant, the control rod 46 of the valve 44 is moved to the left as viewed in FIG. 1 to connect the passage 40 with the source of pressurized propellant. As will be apparent from the above, a connection of the passage 40 to the source of pressurized propellant will also actuate the latching means 22 into latching engagement with the rocket body to hold the rocket on the base during the charging operation. The rod 46 may be held in its leftward position until the piston 72 clears the vent opening 82, thus indicating the reaching of maximum pressure, and then the rod 46 may be released, whereupon the valve 44 will be centered by the centering spring. The passage 40 will then be connected to the valve chamber 42 intermediate the pistons 50 and 52 so that the pressurized propellant will be sealed within the rocket; and, correspondingly, the latching means 22 will be maintained in latching engagement with the rocket body. If desired, the control rod 46 may be released from its leftward position prior to reaching maximum pressure. As will be apparent from the above, the determination of the reaching of a desired intermediate pressure within the rocket may be made by reference to the amount of extension of the rod 74 outwardly of the base. In this connection, indicia may be provided on the rod to indicate pressure and/or range.

With the latching means actuated and the rocket charged with propellant fluid, the pressure of the fluid in the charging passage 16 of the rocket will act on the top of the post 12 to tend to lift the rocket from the base. However, the same pressure will of course be present in the expansible chamber 24. As will be apparent from FIG. 1, the projected area of the inclined wall of the cavity 34 in the base of the rocket is substantially larger than the area of the top of the post 12. Accordingly, the latching force afforded will be greater than the lifting force and the rocket will remain locked to the base until the latching means are released.

When it is desired to launch the rocket, the rod 46 is merely moved to the right as viewed in FIG. 1 to connect the passage 40 to the inner end portion of the valve chamber 42, which is vented to atmosphere through the passage 56. Accordingly, propellant fluid will be discharged through the passage 18 in the post 12 from within the rocket body. Due to the flow restriction offered by the passage 18, as compared to the counterbore 20, the pressure in the counterbore 20 will be lower than that in passage 16 of the rocket body above the post 12. Accordingly, the pressurized fluid in the chamber 24 will be released with an attendant deflating thereof and unlatching of the rocket body. At the same time, the pressure of the propellant fluid in the passage 16 and acting upon the upper end of the post 12 will cause the rocket to rise off the post and go into flight. It will be apparent to those skilled in the art that other flow restricting means could be utilized to obtain the drop in pressure desired between the upper and lower end of the passage 18. It will thus be seen that there has been provided novel and improved means for charging a rocket of the type described while at the same time effecting latching of the rocket to the launching base during the charging operation. A launching base constructed in accordance with our invention has the advantage that the same control member is utilized to effect charging of the rocket, latching of the rocket to the base during the charging, and for releasing the rocket when launching is desired. Further, the pressure limiting and indicating means provided by the piston 72 and rod 74 provide simple and relatively reliable means for selectively setting the desired range of the rocket while at the same time assuring that excessive pressures will not be built up within the rocket. While the movement of the control rod 46 may be effected in any manner desired, it will be apparent that the actuation

of the rod from a remote position may be easily accomplished in a variety of ways.

While the invention as thus far described has been concerned with the launching of a single rocket, a launching base constructed in accordance with the present invention is particularly adaptable to the salvo launching of a plurality of rockets. This is illustrated in FIGS. 4 to 6, wherein the launching base 110 is provided with a plurality of posts 112 and latch means 122, which correspond to the post 12 and latch means 22 previously described. The internal supply passages within the post 112 are connected by passages 140 with a manifold passage 141, which is in turn connected by a passage 140' to a valve chamber 142 housing a valve member 144. The construction and arrangement of the valve 144 corresponds to that of the valve 44 previously described. Also connected to the manifold passage 141 is pressure limiting and indicating means 169, corresponding in construction to the pressure limiting and indicating means 69 previously described. As shown in FIG. 5, an internal passage 162 in the base 110 is connected at one end to the valve chamber 142 intermediate the pistons 148 and 150 and is adapted to be connected at its outer end to a source of pressurized propellant fluid. As can be seen from FIG. 6, an internal passage 152 in the base 110 is connected at one end to the valve chamber 142 intermediate the inner end of the valve chamber and the piston 152. The outer end of the passage 156 opens outwardly of the base 110. As should be apparent, the operation of the embodiment of FIGS. 4 to 6 is the same as the operation of the previously described embodiment of FIG. 1 to 3 in that movement of the control rod 146 inwardly of the base will effect charging and latching of rockets on the posts 112 while outward movement of the rod 146 will effect simultaneous unlatching actuation of the latch means 122 so as to effect simultaneous launching of the rockets mounted on the post 112.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having thus described our invention, we claim:

1. In combination with a rocket having a charging chamber for containing a pressurized fluid propellant, a launching base supporting the rocket in launching position, fluid pressure responsive latching means on the base engageable with the rocket to hold the rocket on the base, the base being provided with a propellant fluid charging passage in communication with the charging chamber in the rocket, and valve means connected to said latching means and to said charging passage and adapted to be connected to a source of pressurized fluid propellant, said valve means being operable selectively to connect said latching means and said fluid passage simultaneously to a source of pressurized fluid propellant and to vent said latching means.

2. In combination with a rocket having a charging chamber for containing a pressurized fluid propellant, a launching base supporting the rocket in launching position, fluid pressure means on the base member including an expansible chamber engageable in latching engagement with the rocket supported on the base in launching position, fluid passage means on the base for connection to the rocket supported on the base for charging of the rocket, and a valve adapted to be connected to a source of pressurized fluid propellant and connected to said expansible chamber and to said fluid passage means for

controlling the flow of pressurized fluid propellant to said chamber and fluid passage means, said valve being selectively operable to connect said chamber and fluid passage means to a source of pressurized fluid propellant and to vent said expansible chamber to launch the rocket.

3. In combination with a rocket having a charging chamber for containing a pressurized fluid propellant, a launching base supporting the rocket in launching position, fluid pressure responsive latching means on the base including an annular expansible chamber, the rocket being telescopically disposed over the chamber and having means cooperable with the chamber when the chamber is expanded to provide latching of the rocket to the base, the base being further provided with a fluid passage communicating with the charging chamber in the rocket, and a multi-position valve on the base adapted to be connected to a source of pressurized fluid propellant and connected to said fluid passage, said valve being selectively operable to connect said chamber and fluid passage simultaneously to a source of pressurized fluid or to vent said expansible chamber to launch the rocket.

4. In combination with a rocket having a charging chamber for containing a pressurized fluid propellant, a launching base supporting the rocket in launching position, fluid pressure responsive latching means on the base engageable with the rocket to hold the rocket on the base, the base being provided with a fluid passage for communication at one end with the charging chamber of the rocket and including flow restriction means adjacent said one end, and a multi-position valve connected to the other end of said passage and to atmosphere and adapted to be connected to a source of pressurized fluid propellant, the latching means being connected to said fluid passage intermediate the flow restriction means and said valve, the valve being selectively operable to connect and disconnect said other end of the fluid passage to and from a source of pressurized fluid and to connect said other end of the fluid passage to atmosphere.

5. In combination with a rocket having a charging chamber for containing a pressurized fluid propellant, a launching base supporting the rocket in launching position, fluid pressure responsive latching means on the base engageable with the rocket to hold the rocket on the base, the base being provided with a fluid passage connected to said latching means and with a second reduced diameter fluid passage connected at one end to the first fluid passage and at its other end communicating with the charging chamber of the rocket, and a multi-position valve adapted to be connected to a source of pressurized fluid and connected to one end of said first passage, the valve having a first position for connecting said first passage to a source of pressurized fluid, a second position for connecting said first passage to atmosphere, and a normal self-centered third position for closing said one end of said first passage.

6. In combination, a rocket launching base including a base member, an upright member on the base member, a rocket having a fluid propellant charging passage telescopically receiving said upright member, fluid pressure responsive latching means on the base and arranged about said upright member and engageable with the rocket to hold the same on the base, the upright member being provided with a fluid passage opening outwardly of the upper end of the upright member and including flow restriction means, the latching means being connected in fluid flow communication with said fluid passage in the upright member at a point below said flow restricting means, and

a multi-position valve on the base member connected to the lower end of said passage in the upright member and to atmosphere and adapted to be connected to a source of pressurized fluid, the valve having a first position for connecting said fluid passage in the upright member to a source of pressurized fluid, a second position for connecting said fluid passage to atmosphere, and a third position for closing the lower end of said fluid passage.

7. The combination of a launching base and rocket as described in claim 6 in which said latching means comprises an annular expansible chamber telescopically arranged about said upright member; the rocket being provided with a cavity in the lower end thereof and having a diameter larger than that of the annular chamber in an unexpanded condition, the outer walls of said chamber being latchingly engageable with the wall of said cavity in response to expansion of said chamber.

8. The combination of a launching base and rocket as described in claim 7 in which said annular expansible chamber comprises a distensible resilient member arranged about the lower end portion of said upright member and forming the outer walls of said chamber, the inner walls of said cavity in the rocket tapering toward the lower end of the rocket.

9. The combination of a launching base and rocket as described in claim 6 in which said valve comprises an elongated cylindrical valve chamber in the base member, the base member having a fluid passage connecting the valve chamber to said fluid passage in the upright member, a reciprocable valve member in said chamber including a valve stem projecting outwardly of the base member, a pair of pistons on said valve stem spaced apart longitudinally of the stem and on opposite sides of the connection of said fluid passage in the base member to said valve chamber, the base member having a second fluid passage connected at one end to said valve chamber in spaced relation to said pair of pistons in the direction of one end of said valve chamber and opening at its other end outwardly of the base member, the base member being provided with a small diameter fluid flow metering third passage connected at one end to said valve chamber in spaced relation to said pair of pistons in the direction of the other end of said valve chamber and adapted to be connected at its other end to a source of pressurized propellant fluid, a third piston in said stem and disposed between said other end of said valve chamber and the point of connection of said third fluid passage and said valve chamber, and centering means resiliently urging said valve stem in opposite directions longitudinally thereof.

10. The combination of a launching base and rocket as described in claim 6 in which the base member is provided with pressure limiting and indicating means comprising an elongated chamber connected at one end to said fluid passage in the upright member, a piston in said chamber, means biasing the piston toward said one end of the chamber, the base member having a vent passage connected at one end to said chamber and at its other end opening outwardly of the base member, and an indicia bearing rod extending from said piston and outwardly of the base member.

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