July 29, 1969 S. R. CROCKETT 3,457,861

MISSILE BOOSTER PRESSURE CONTROL MECHANISM

Filed Jan. 25, 1968

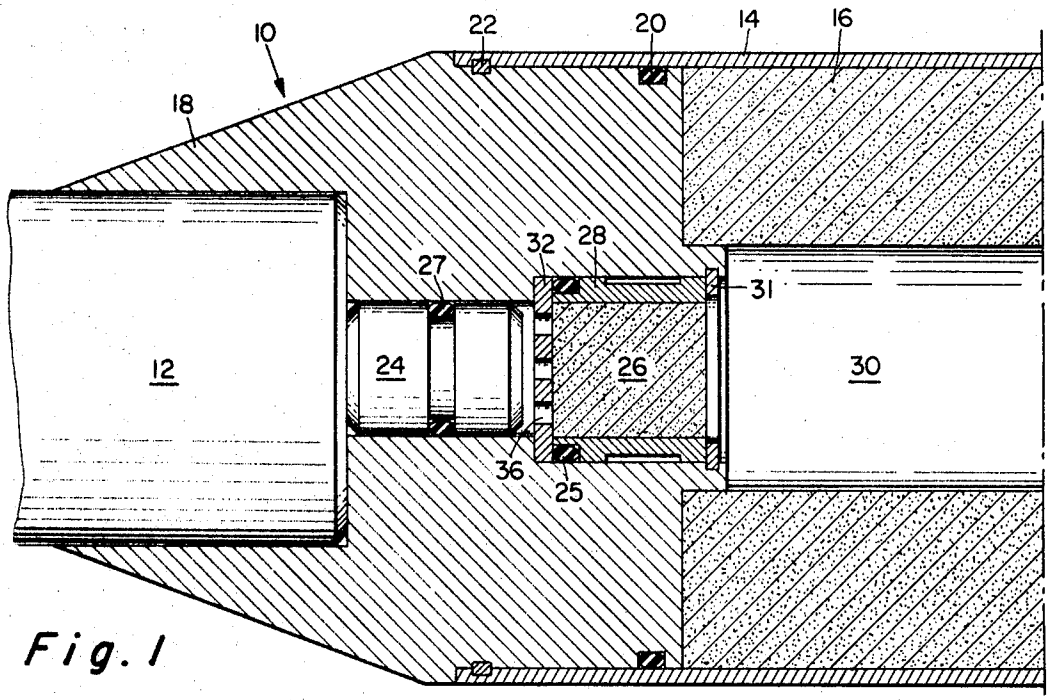


Fig. 1

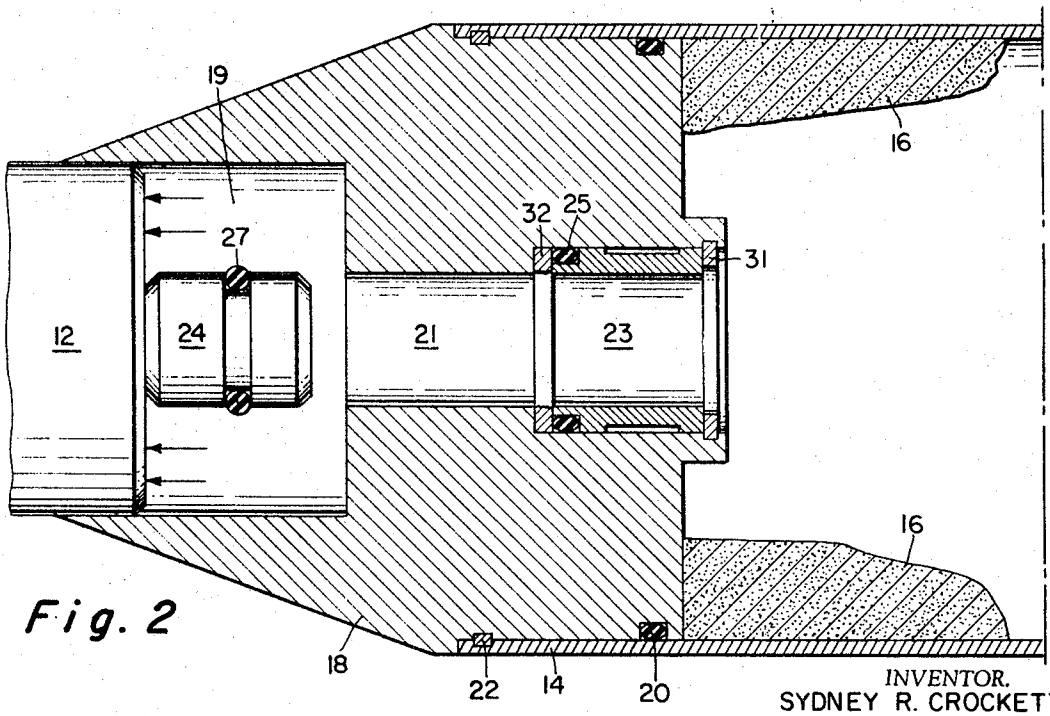


Fig. 2

INVENTOR.
SYDNEY R. CROCKETT

BY Hayward N. Mann

Q. Baxter Jarvis

ATTORNEYS

United States Patent Office 3,457,861
Patented July 29, 1969

3,457,861

MISSILE BOOSTER PRESSURE CONTROL MECHANISM

Sydney R. Crockett, Oxnard, Calif., assignor to the United States of America as represented by the Secretary of the Navy

Filed Jan. 25, 1968, Ser. No. 700,644
Int. Cl. F42b 15/10
U.S. Cl. 102—49.4 4 Claims

ABSTRACT OF THE DISCLOSURE

A plug of consumable propellant serves to delay application of booster pressure to the second stage of a missile until acceleration forces are sufficiently great to prevent stage separation during launch.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to control devices for preventing premature application of booster burn out pressure to a subsequent stage of a missile. It may form a part of any missile stage separation programming system.

Description of the prior art

Heretofore it has been proposed to provide mechanical timing devices, latches or detents to prevent missile stage separation during the initial stages of missile flight and particularly before sufficient G forces accumulate to prevent accidental separation of the stages. Such devices are frequently bulky in size, costly in construction and are not always reliable in operation.

SUMMARY

Briefly the present invention provides a coupling device for interconnecting a missile probe and its booster in which a time delay plug of a propellant is employed to block a passage and prevent booster pressure from reaching the probe base until sufficient acceleration force is achieved. Thus initial separation of the missile probe from the booster during launch is prevented.

Accordingly an object of this invention is to provide a coupling device for a missile stage and its booster motor in which the separation thereof is prevented until satisfactory conditions exist.

Another object of this invention is to provide a separation means between a missile stage and its booster motor wherein the application of booster pressure to the missile stage is delayed until substantial launch velocity is achieved.

Another object is to provide a chemical means of preventing separating a missile stage from its booster motor until a desired time after launch.

A further object is to provide a relatively small, simple and reliable device for controlling missile stage separation.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a longitudinal sectional view of the separation device with the booster motor and missile stage closely connected one to the other.

FIGURE 2 is a change position view showing the missile stage during the act of separation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring particularly to FIGURE 1, there is shown generally a booster motor section **10** with a missile stage, rocket probe or other payload **12** positioned partially therein. The booster motor section **10** includes an outer casing **14** within which a conventional hollow core propellant grain **16** is positioned, and a conically shaped booster nose fitting **18** with the base thereof lying flush with the end of said propellant grain **16**. The booster nose fitting **18** extends slightly within the aforesaid casing **14** and is sealed by gasket **20** and maintained in fixed position by the retaining ring **22** of square cross section as shown.

Booster nose fitting **18** is provided with communicating axially aligned openings **19**, **21** and **23**. Opening **19** receives the aft portion of a probe or missile stage **12** in a free sliding relationship and central opening or passage **21** receives an axially aligned piston **24** of diameter less than the end of the probe **12**. The piston **24** is sealed against presure loss by an O-ring gasket **27**. Directly behind the cylinder in a blocking position within opening **23** and extending slightly within the hollow bore **30** of booster motor **10** is a plug or charge **26** or propellant material, preferably of the same type as propellant grain **16** in order to assure temperature and burn rate compatability.

The plug **26** is retained in opening **23** by a lock ring **31** located at the after end and at the forward end contacts a perforated disc **32**. The rear portion of plug **26** is open to the hollow bore **30** of booster motor **10** and heat from a burning booster motor **10** will obviously ignite the said plug **26** which will block passage opening **23** until consumed. Thus, plug **26** keeps booster pressures from being applied to the aft end of piston **24** during the launch and until sufficient missile acceleration force has been obtained.

The aforementioned support disc **32** is positioned between the aft end of cylinder **24** and the forward end of the plug material **26**. In addition to providing support for the plug **26** while under high pressure, it also controls the exposure of piston **24** to the booster motor pressure. This is true since, until consumed, the disc **32** and the gasket **25** prevent portions of propellant plug **26** from being blown against piston **24**. The support disc **32** will remain intact until plug **26** has burned to the surface of said disc **32**; after which it will be subjected to such heat and pressures from the booster motor section **10** that, due to its relatively low melting point, it will be consumed and leave passage **23** open permitting piston **24** to receive gas pressure from the booster motor section **10**. Support disc **32** preferably comprises a material which melts at about 215° F. and supports the plug **26** until about 25 G's boost acceleration is attained. The small apertures **36** in the support disc **32** create higher thermal conductivity and facilitate consumption thereof.

Upon launch of the assembled missile and booster, there is little acceleration force exerted by the booster upon the missile and hence a small pressure on piston **24** would expel the missile. However the acceleration force increases rapidly and after 2 or 3 seconds is such that full boost pressure against the relatively small diameter after end area of the piston **24** would be insufficient to expel the missile. At booster burnout, however, there is a diminution in booster pressure and there is even greater decrease in the acceleration force. The end of the payload **12** which is at or near apogee starts to separate and with-

draw from the booster motor section **10**. When the after edge of piston **24** clears the forward edge of opening **21**, the full force of the tail off booster pressure is applied to the much larger rear end of the payload **12** and expels the said payload from the booster motor section **10** at high velocity.

It is now clear that propellant plug **26** and support disc **32** merely delay the application of launch boost pressure so that it cannot reach the cylinder **24** until accelerator force has been achieved.

What is claimed is:

1. A missile booster interconnection coupling which separates in response to decrease in missile acceleration forces aided by booster propulsion pressure comprising:

an elongate booster body having a propellant gas generating area and provided at its forward end with a missile base receiving cavity into which a missile base is normally urged by acceleration forces;

said booster forward end having a passage communicating said cavity with the propellant gas generating area;

means limiting the missile base area to which booster gas generating force is applied,

means for initially inhibiting access of boost pressures to said reduced area until acceleration forces are sufficient to normally prevent separation of said stages and;

wherein a greater portion of said missile base area is subjected to the booster gas generating force in response to a decrease in acceleration forces.

2. The device of claim **1** wherein the reduced area includes a piston slidable in said passage.

3. The device of claim **1** wherein the inhibiting means includes a combustible plug normally isolating the piston end area from the boost pressure.

4. A separable coupling for interconnecting two objects one of which contains a pressure producing propellant comprising:

first means responsive to said pressure generated by propellant combustion for inducing a separation operation of said coupling, and

second means adapted to inhibit the separation operation of said first means until the propellant has been substantially consumed,

said second means including a piston of reduced area exposed to pressures generated by combustion of said propellant and a combustible plug after destruction of which combustion pressure may be applied to the particular piston surface, and

wherein initial piston movement as a result of decreased forces tending to keep the parts coupled serves to expose a larger area of said first means to the combustion pressures.

References Cited

UNITED STATES PATENTS

2,779,283	1/1957	Baughman	102—49.4
2,945,442	7/1960	Adelman et al.	102—49.5
3,026,772	3/1962	Moreland	102—49.5 X
3,038,407	6/1962	Robertson et al.	102—49.5 X
3,118,638	1/1964	Rohr.	
3,160,098	12/1964	Schulze et al.	102—49.5
3,211,095	10/1965	Foster	102—25

VERLIN R. PENDEGRASS, Primary Examiner