April 23, 1963 J. J. GALLAGHER ETAL 3,086,467

GAS OPERATED EXTENDIBLE PROBE FOR BALLISTIC MODEL

Filed May 15, 1959

FIG.1.

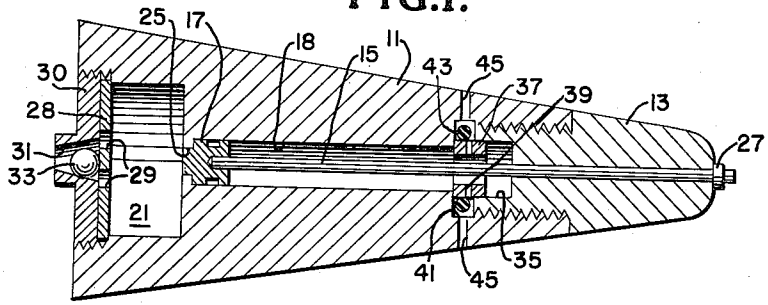


FIG.2.

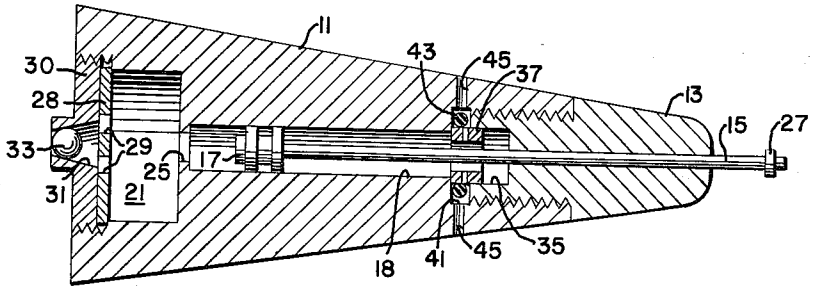


FIG.3.

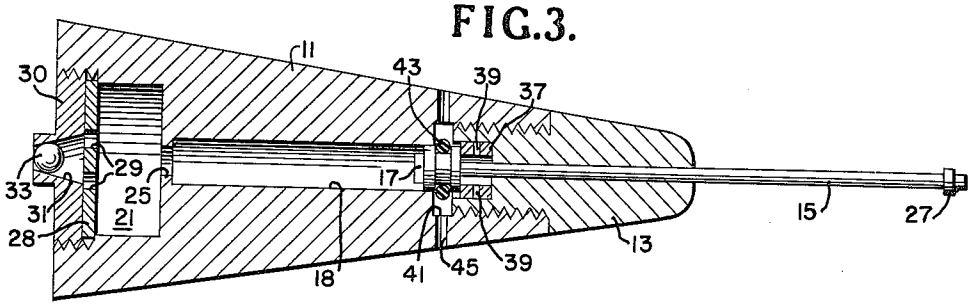
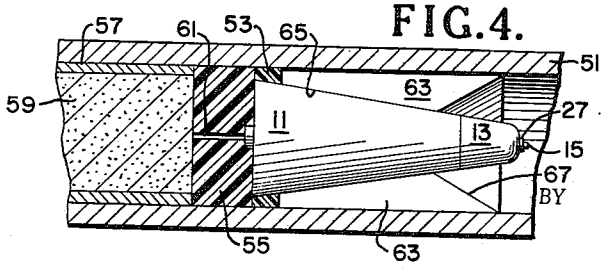


FIG.4.



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GAS OPERATED EXTENDIBLE PROBE FOR BALLISTIC MODEL

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(Granted under Title 35, U.S. Code (1952), sec. 266)

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.

This invention relates generally to a ballistic model having a chamber for trapping and utilizing explosion gases and more specifically to a projectile having a thin probe in a retracted position therein which is forced outwardly and forwardly when the force of acceleration has ceased during flight of the projectile.

In the testing of ballistic models it was found desirable to utilize the energy of the explosion or propulsion gases to perform useful functions when the model is in flight. The explosion gases may be used, for example, to move a thin probe from a recessed position within the model to an extended position after the model has been fired from a gas or powder gun. The gases may also be used to shift the center of gravity of a ballistic model after it has been launched.

Another example of such use of trapped gases may be to move control surfaces of a ballistic model to a desired position after the model has been launched. Gases may be trapped in a chamber of a ballistic model by providing an aperture at the rear of the model containing a check valve. Upon explosion, gases are forced through the aperture into a gas chamber, but prevented from escaping by virtue of the check valve.

It is an object of this invention to provide a ballistic model with a gas chamber having a check valve for capturing the explosion or propulsion gases used in launching the model.

It is another object of this invention to provide a high velocity ballistic model of a projectile having a gas chamber therein for moving a probe into a forwardly extended position from a position within the model while the model is in flight.

It is another object of this invention to provide means for capturing propulsion gases within a ballistic model for shifting the center of gravity of the model after it is launched.

It is a further object of this invention to provide a ballistic model with a chamber for trapping explosion gases for performing useful functions after the model has been launched.

It is a still further object of this invention to utilize explosion or propulsion gases to operate control surfaces of a ballistic model while the model is in flight.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIG. 1 illustrates a cross-sectional view of a ballistic model with the probe thereof in the retracted position;

FIG. 2 illustrates a cross-sectional view of the ballistic model with the probe moved partially forward;

FIG. 3 illustrates a cross-sectional view of the probe locked in the extended position; and

FIG. 4 illustrates the mounting assembly of the model in a gun.

Referring now to FIG. 1 of the drawing, the ballistic model or projectile is comprised of a body portion **11** and a nose portion **13**. The nose portion is threaded into the body portion. A rod-like probe **15** is shown coaxially contained within the model. Probe **15** is fixedly connected to piston **17** which is sildeably engaged in cylinder **18** of the body portion **11** of the model. Piston **17** is provided with an annular groove to accept an expansible annular ring such as an expansible annular ring known in the art as an O-ring. The body portion **11** of the model has a gas chamber **21** connected by a communicating passage **25** to the cylinder **18**. Probe **15** is shown with a collar **27** fixedly connected to the front portion of the probe and adapted to be positioned adjacent to the front of the nose portion when the probe is in the recessed position. The back wall of chamber **21** is formed by a circular plate **28** having axial holes **29** near the center of the plate to provide for passage of explosion gases into chamber **21**. Plate **28** is held in position by a threaded member **30** having a hub portion with a tapered axial hole **31**. A ball **33** fits within the tapered hole to form a ball check arrangement therewith. The nose portion **13** of the model contains an axial bore of a diameter such that probe **15** will fit slideably therein. The nose portion also has an axial recess **35** which provides for a retaining collar **37** to be slideable therein. The diameter of this recess is larger than that of cylinder **18** such that the retaining collar **37** will not enter the cylinder. Retaining collar **37** is provided with radial holes **39** and an enlarged central bore therein within which the probe **15** is disposed. The body portion **11** of the model has a radially disposed annular recess **41** which provides space for contractible ring **43**. Annular recess **41** is also provided with ports **45**. Ports **45** and the holes **39** in retaining collar **37** provide a path for air to escape as piston **17** moves forward.

In operation, when the powder or propelling charge is exploded, the initial setback force holds the probe retracted with piston **17** pressing against the rear end of cylinder **18**. Ball **33** is forced by gas pressure toward the large opening of tapered hole **31** with explosion gases permitted to pass by it and enter chamber **21**. As the pressure of the gases build up in chamber **21**, ball **33** is forced backward to the small opening of tapered hole **31** locking these gases in chamber **21** to maintain a pressure therein.

Referring to FIG. 2 of the drawings, the result of the gas pressure in chamber **21** has now forced the piston **17** partly forward. Ball **33** is shown forced against the small opening of taperetd hole **31**. As piston **17** moves forward, the air in cylinder **18** in front of piston **17** is forced out of the cylinder, through the holes **39** in the retaining ring **37** and through ports **45**. Piston **17** will continue to move forward until it is stopped by retaining collar **37**. When piston **17** comes in contact with retaining collar **37** it will force it into the axial recess and against the nose portion **13** of the model. As the retaining collar is being moved forward, the contratible ring **43** slides from the retaining collar to the annular groove in piston **17**, FIG. 3. When the ring **43** snaps into the annular groove of piston **17**, probe **15** is locked in the extended position. Piston **17** and probe **15**, are thus prevented by the ring **43** from moving backward from the extended position thereof.

Referring now to FIG. 3 of the drawing, probe **15** and piston **17** are shown in the extreme forward position with ring **43** fitted in the groove of piston **17**, locking the piston in this position.

Referring now to FIG. 4 of the drawing, the ballistic model is illustrated mounted within a gun. The model is shown located within a gun barrel **51**. The model is supported within the gun barrel by sabot **53** and spacer

55. Shell 57 containing an explosive 59 is shown behind spacer 55. Spacer 55 contains a coaxial bore 61 which provides for passage of explosion gases into the chamber of the model. Sabot 53 has a plurality of radially disposed slots 63 which serve to weaken the sabot such that it will break apart and leave the model after the model leaves the gun barrel. Sabot 53 is also provided with coaxial tapered bores 65 and 67. Tapered bore 65 has the same taper as the side surface of the model and serves to support the model centrally within gun barrel 51. Tapered hole 67 serves to collect oncoming air which acts to break sabot 53 apart soon after the ballistic model leaves the gun barrel.

The extensible probe is illustrated as an example of one use to which the trapped gases may be put. This invention, however, is not limited to this particular use. As an example of another use, the piston 17 may be in the form of a large mass which would be shifted from the rearward portion of the projectile to the forward portion of the projectile to shift the center of gravity of the projectile after firing. An example of another use might be to have piston 17 adapted to force air or gases out through particular ports to move control surfaces to a particular desired position after the projectile is fired.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A ballistic model comprising a projectile body having an axis, an extensible probe moveable from a recessed position within said body to an extended position, said probe being mounted coaxially within said projectile body and slideable therein, gas chamber means within said projectile body, a port in said chamber in communication with the rear of said projectile body whereby projectile propelling gases may enter said chamber under pressure, check valve means for locking gases under pressure within said chamber, piston means connected to said probe, said piston means being in fluid communication with said chamber and operative to drive said probe to the extended position when the propelling gas pressure exists in said chamber, and means for locking said probe in said extended position.

2. A ballistic model comprising a model projectile adapted to be propelled by gas pressure, a gas chamber within the rear portion of said projectile, a coaxial cylinder in the midportion of said projectile and communicative with said gas chamber, a piston within said cylinder and slideable therein, a probe slideably mounted within a forward portion of said projectile and coaxial therewith, said probe being moveable from a recessed position to an extended position, said piston being fixedly attached to the rear end of said probe, said probe being in recessed position before said projectile is fired, a port in the rear wall of said projectile communicative with said gas chamber and operative to allow propelling gases to enter said gas chamber when said projectile is fired, a ball check in said port to prevent propelling gases from escaping said chamber, said propelling gases in said chamber being operative to drive said piston forward whereby said probe is moved to said extended position after said projectile is fired, means in said projectile for locking said probe in said extended position.

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