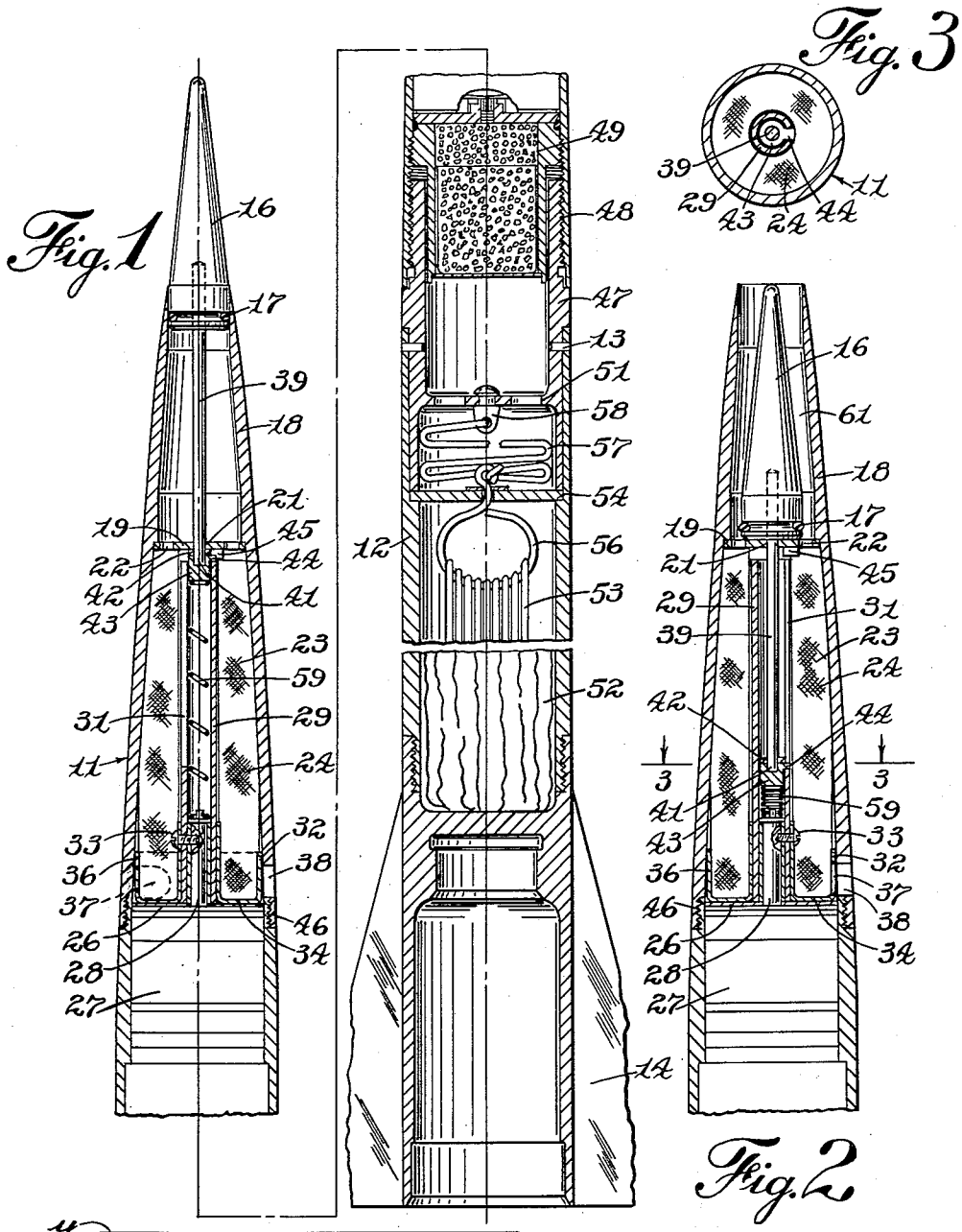
Nov. 20, 1962 Y. SEKELLA 3,064,480

HIGH ALTITUDE SOUNDING PROJECTILE

Filed June 20, 1960



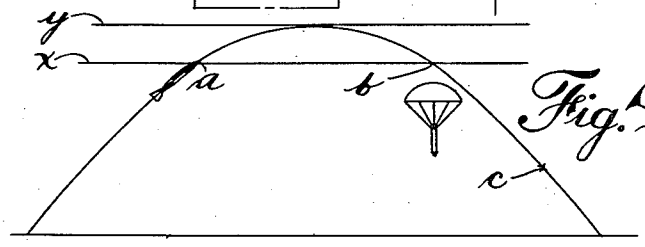


Fig. 4

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HIGH ALTITUDE SOUNDING PROJECTILE

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The present invention relates to a high altitude sounding projectile (HASP) and more particularly relates to a rocket which is arranged to collect a sample of the impurities in the atmosphere at predetermined stratums of the atmosphere and to safely and reliably return the sample to earth for analysis.

It has been found desirable and necessary for the health, safety and welfare of the nation to obtain at various intervals and at various locations samples of the content of selected stratums of the atmosphere. An analysis of these samples, which content in this atomic age is usually radioactive, is necessary to determine the expected amounts of radioactive fall-out. In the event of a national emergency where atomic weapons were used the need for such vital information would be greatly increased.

It has been possible to obtain, to a degree, a sample for analysis of the concentration of foreign particles and their radioactive intensity but these samples for the most part have been obtained in a most unreliable fashion. These readings in most instances have been made by dispatching balloon lifted or carried recording devices. However, a quicker and more detailed analysis of the particle content than is normally afforded through this balloon method is desirable.

Several factors militate against the use of a balloon transported device for taking samples or making the analysis. The number of instruments needed is great and in most instances they are extremely costly. This is true because a complete analysis requires the completion of a myriad of tests which quite naturally require a number of instruments. When all the necessary instruments are assembled into one recording device, the weight factor becomes important and there is also the added requirement of cradling equipment necessary to protect them. During the time the instruments are aloft their accuracy is not always reliable since they may be subjected to or influenced by harmful ambient conditions. In the interest of reducing the time between taking of the samples and making the tests it has become necessary to equip the device with a radio transmitter and this radio equipment thus adds to the weight factor.

After the prior art devices have obtained samples and returned to earth it is desirable that the instruments be recovered. A balloon is not too controllable and hence it is subject to any prevailing conditions especially winds and consequently the exact location of drop is never positively assured. There have been many instances where the instruments never have been recovered and there have been other instances when souvenir hunters have discovered and destroyed the instruments before the proper authorities could recover them resulting in substantially all the instruments being damaged, destroyed or lost. The above are just a few of the unfavorable factors. Probably the time factor is most important and it can be readily appreciated that such a system is extremely time consuming by its very nature.

In view of the above it is an object of the present invention to provide a novel meteorological projectile for collecting a sample of the contents of the atmosphere.

It is another object to provide a meteorological device which is efficient and reliable in operation as well as simple and compact in construction.

It is another object to provide a device which eliminates the need for sending costly instruments into the atmosphere to make impurity content determinations and analysis.

It is another object to provide a device which will sample a preselected stratum of the atmosphere.

It is still another object to provide a projectile in which the nose member is retracted into the ogive at the desired altitude and shutter means therein are opened thereafter at a first predetermined interval and closed at a second time interval after collecting a sample of the atmospheric content.

It is a further object to provide a projectile having a head member detachable therefrom after a predetermined interval and to have the head member gently descend to earth in or near a predetermined recovery area.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which:

FIGURE 1 is a side elevation, partly broken away and in section, of a preferred embodiment of the invention;

FIGURE 2 is a view similar to FIGURE 1 illustrating a portion of the ogival head section with the nose member thereof in a retracted position and the shutter members positioned to allow the passage of air through the sampling filter;

FIGURE 3 is a section taken substantially on the plane of line 3—3 of FIGURE 2; and

FIGURE 4 is a diagrammatic illustration of the projectile's proposed trajectory and its various points of operation.

In the drawing there is illustrated a dart-shaped projectile having a hollow ogival head section generally indicated as 11, a tubular body section 12 secured at one end of the ogival head by frangible pin members 13 and a tail member 14 secured by any convenient method to the other end of the body member.

The ogival head carries a retractable nose member 16 which ordinarily extends forwardly of the ogival head as is best illustrated in FIGURE 1. An O-ring sealing member 17 prevents the ingress of air during the flight of the projectile prior to the retraction of the nose into the hollow ogive 18. Within the head there is disposed normal to the axis of the ogive a guide member or washer 19 having a centered aperture 21 for guiding and controlling a portion of the retracting means hereinafter described. The guide member 19 is also formed with perforations or marginal notches 22 which provide the forward entrances to the air passage 23 in which a filtering element 24 is disposed. The forwardly disposed wall 26 of the HASP timing and arming unit 27 defines the rear wall of the air passage 23.

The HASP timing unit 27 forms no part of the present invention and further description thereof is deemed unnecessary.

A rotating shaft member 28 extends forwardly into the air passage 23 from the timing unit 27. A tubular member 29 encompasses the shaft surface and extends substantially the entire length of the air passage 23. The tube 29 is provided with an axial slot 31 extending from the edge adjacent the guide member 19 to a point adjacent the forward end of the shaft 28. Shutter means 32 encompass the tube 29 and the shaft 28 with both the tube and shutter means being secured to the shaft by any suitable means which herein comprises a screw member 33.

The shutter means 32 comprises a substantially cup-shaped member having a flat bottom wall 34 adjacent the rear extremity 26 of the air passage 23 and has an integral substantial cylindrical side wall 36 which is contiguous with the ogive wall. The cylindrical side wall 36 is provided with a plurality of apertures 37 which are

adapted to register with circumferentially spaced radial openings 38 provided in the ogive 18.

The nose member 16 is provided with a guide stem or shaft member 39 extending rearwardly from the nose in coaxial alignment with the ogive 18 and supported in the aperture 21 of the guide member 19. The distal extremity 41 of the stem 39 is rotatably journalled in a plug member 43. A disc member 42 is fixedly secured to the stem adjacent its distal extremity and positioned to abut the under or rear side of guide member 19 to limit the forward or extended position of the nose member. The plug member 43 has a substantially cylindrical body and a radially depending tongue 44 extending from its upper edge portion. The tongue 44 in FIGURE 1 is disposed or positioned to abut the top edge portion of the tube 29, but upon rotation of the tube by the timing means 27 it will be caused to engage the slot 31. Once the tongue and slot are in registry the frontal pressure on the nose member will be of sufficient force and effect to cause the plug member to be depressed into the tube cavity against the biasing force exerted by the spring 59.

To assure that the plug member will be held stationary relative to the revolving tube when the tongue engages the tube's upper edge there is provided a plurality of tabs or lugs 45 (only one is illustrated for clarity) struck from portions of guide member 19. The lugs are so disposed and of sufficient axial length to engage the tongue 44 at various positions relative to the tube slot 31. Varying the circumferential separation between the tongue and slot determines the time interval between firing and nose retraction.

For convenience in manufacture the ogive can be made as a single unit or it can be made as separate sections which are threadedly connectable as is indicated at 46. The posterior surface of the ogival head 11 comprises a sleeve 47 threadedly connected to the head 18 as is best illustrated at 48. An explosive charge and fuze means generally indicated at 49 is disposed within the sleeve 47 and is operably connected to the HASP timing and arming means by means not deemed necessary to this disclosure.

The frangible pins 13 extend radially inward from the tubular body section 12 and engage a reduced diameter portion of the sleeve 47. The sleeve 47 is also provided with an apertured integral wall 51. A parachute 52 is supported within the tubular body 12 and its shroud lines 53 connected to a disc member 54 secured within and normal to the axis of the body 12. The parachute shroud lines 53 are connected to a ring like member 56 which passes through the disc 54 and is secured by cord like means 57 to a swivel anchor member 58 centered in the apertured end wall 51 of sleeve 47.

In operation the meteorological projectile is fired into a predetermined stratum of the atmosphere indicated in FIGURE 4 by the horizontal lines *x* and *y*. Prior to firing the missile the timing means are set by disposing the tongue 44 of the plug member 43 in an abutting engagement with the end surface of the tube 29. Upon release of the timing mechanism and at the time of firing the timing mechanism 27 will start to rotate the shaft 28 and thus rotate the tube 29 fixed thereto as well as the shutter means 32. The necessary degree of rotation will be determined in advance in order to cause the plug member tongue 44 to engage the slot 31 of the tube 29 as the projectile's trajectory passes point *a* in the diagrammatic illustration of FIGURE 4. Up to that point the tubular member 29 had been rotating but the plug member 43 has been held stationary due to the engagement of its tongue 44 with a lug 45 of the guide member 19. When the tongue 44 engages the slot 31 which registers at a predetermined point in the projectile's trajectory, the frontal pressures which are exerted on the nose member 16 will cause the nose member to be urged rearwardly into the hollow ogive 18 thus causing the shaft to traverse the cavity of the tube 29 against the exerted pressures of a compression spring 59. When the nose is completely retracted within the ogive 18 as illustrated in FIGURE 2, the plug member will continue to rotate with the tube 29 and timing mechanisms allowing the predetermined sequences of timing intervals or operations to continue unimpeded. When the nose 16 is in the fully retracted position, it will define within the ogive member 18 the throat-like passage 61 communicating with the peripheral notches 22 leading to the air passage 23. Concomitantly with the retraction of the nose the shutter means 32 will have rotated to cause its apertures 37 to register with the ogive apertures 38 and thereby provide a through passage for the flow of atmospheric air through the filter means 24. The projectile will remain in the condition illustrated in FIGURE 2 during the portion of its trajectory in the stratum, but upon reaching a point *b* illustrated in FIGURE 4 the timing means 27 will have caused the shutter 32 to have rotated sufficiently to cause the closing of ogive opening 38. The timing means will continue to operate beyond point *b* in the trajectory and at some point in the trajectory between points *b* and *c* the timing means will activate the arming means and ignite the fuze and explosive charge 49. The force of the charge will be directed through the apertured wall 51 of the sleeve 47 and will exert a pressure on the disc 54 sufficient to cause the frangible pins 13 to be fractured and thereby release the ogival head 11 from the body and tail assemblies, 12 and 14 respectively. Since the parachute 52 is secured to the sleeve 47 it will upon separation of the head and body be withdrawn from the body and thereafter will open to gently carry the ogival head to earth in or near a recovery area previously determined. It can be readily appreciated by those skilled in this art that the point of ignition of the explosive charge 49 should be determined by exterior conditions such as wind conditions, etc. It would be desirable in most instances to have the head blown clear of the head and body sections at a point as close as possible to the recovery point thereby reducing or eliminating drifting of ogival head and sample and making its recovery much easier and more certain.

After the projectile begins its earthward descent gravity will increasingly exert a force on the nose and will cause the nose to slide forward in the ogive 18 to close off the throat or passage 61 thereby preventing the ingress of foreign matter in the stratums through which the sample containing the ogival head will pass. Forward movement of the nose assembly will be limited by the engagement of the disc 42 with the guide member 19. Of course, the position of the shutter 32 closing off passage 38 will also prevent the flow of air through the passage 23 and prevent the accumulation of foreign matter from the other stratums through which the separated head must descend.

The foregoing are considered illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction generally described and accordingly all suitable modifications and equivalents may be resorted to falling within the scope of the invention as claimed.

I claim:

1. A projectile having a tail section, a body section secured to the tail section, a hollow ogival head section detachably secured to the body section, said ogival head section comprising, in combination, means within said head section defining a sampling air passage, a filter element disposed in said air passage, a nose member normally extending from one end of said ogival head section retractable into said head to expose one end of said air passage to the atmosphere, means for controlling the

passage of air through said air passage and filter element, and means for retracting said nose member.

2. A projectile as set forth in claim 1 including further, explosive means within said head section for releasing said ogival head from said body section and means secured to the other end of said ogival head section for returning and controlling the descent of said head to earth after its release.

3. A projectile as set forth in claim 1 wherein said controlling means comprises, in combination, timing means operatively supported in said ogival head and having a rotatable shaft member, vent means in said ogival head section defining openings between said air passage and the exterior of said ogival head section, and cup-shaped shutter means fixedly secured to said timing means shaft member having circumferentially spaced radial openings in the side wall contiguous to said vent means to alternately block and register with said vent means.

4. A projectile as set forth in claim 1 wherein said retracting means comprises, in combination, timing means operatively supported in said ogival head section and having a rotatable shaft member, slotted tubular means fixedly secured at one end to said timing means shaft member and extending substantially through said sampling air passage, a stem member connected to said nose member supported by a portion of said passage defining means and having one extremity thereof when in the nose extended position adjacent the other end of said tubular means, means including a depending tongue member rotatably and slidably supported in said tube and engageable with said stem member for controlling the retraction of said nose member, said tongue member being sequentially engageable with said other end and the slots of said tubular means whereby said nose member when actuated by frontal pressure and when said tongue member registers with said tubular slot is permitted to assume a retracted position in said head.

5. An atmospheric sampling projectile comprising a hollow body section, a tail section closing one end of said body section, a hollow conical ogive section, frangible means for securing said ogive section to the other end of said body section, explosive means for fracturing said frangible means and disassociating said ogive section from said body section, means disposed in said hollow body section and connected to said ogive section for returning the disassociated ogive section to earth; said ogive section further including an air passage formed therein, filter means in said air passage, means disposed in said ogive section defining vents to said air passage, a nose member defining the tip portion of said ogive section retractable at a first predetermined instant into said ogive section to define in the retracted position throat means communicating with said air passage, shutter means carried by said ogive section alternately opening and closing said vent means at other predetermined intervals.

6 A device as set forth in claim 5 including further means for retracting said nose member at said first predetermined interval, means for opening said shutter means at a second predetermined interval and for closing said shutter means at a third predetermined interval, arming means for triggering said explosive means at a forth predetermined interval whereby transporting means are released from said body for returning said ogive section gently to earth.

7. A meteorological projectile for sampling a predetermined stratum of the atmosphere having a hollow body and a tail section detachably secured to a hollow ogival head section, said head section comprising, in combination, means for providing a sampling air passage, filter means disposed in the air passage, a nose member normally extending from said ogival head retractable into one end of the head section to define an opening communicating with the air passage, shutter means arrayed within the head for alternately opening and closing the air passage, explosive means in the other end of the head section for detaching said body and tail sections from the head section, timing means including arming means operatively connected to the nose member for retracting the nose member after a first time interval and operatively connected to the shutter means for opening and closing the air passage at predetermined intervals, said arming means being coupled to the explosive means for triggering the explosive means after said intervals, and means disposed in the body section and coupled to the head section for returning the head section to earth after its detachment from the body and tail sections.

8. A device as set forth in claim 7 wherein frangible means are utilized for detachably securing the head section to the body and tail section.

9. A device as set forth in claim 7 wherein guide means positioned normal to the axis of the head section define one extremity of the air passage, said guide means having a plurality of marginal notches formed therein providing openings to one end of the air passage, and wherein the timing means define the other extremity of the air passage, said head section having a plurality of circumferentially spaced radial openings adjacent the other extremity of said air passage and providing openings therefor.

10. The device set forth in claim 9 wherein said shutter means comprise a substantially cup-shaped member rotatably coupled to said timing means and having a flat bottom wall positioned normal to the axis of the head section adjacent the other extremity of said air passage and a cylindrical side wall apertured and extending into the air passage contiguous to said radial openings whereby a sampling air passage is provided for a predetermined interval when the nose member is retracted and the shutter apertures and head section openings are aligned.

11. The device set forth in claim 10 in which the timing means comprise, in combination, timing and arming mechanisms housed in the head section posteriorly of said air passage having a shaft member of said mechanisms extending into said air passage, a slotted tubular member fixedly secured to the shaft and extending substantially the entire length of the air passage, plug means positioned within said tubular means including a depending tongue member engageable with portions of said slotted tubular member for controlling the retraction of said nose member, and yieldable means disposed within the tubular member to assert a biasing force against portions of the plug means.

12. The device set forth in claim 11 in which the retractable nose member comprises shaft means supported in said guide means, a conical tip fixedly secured to one extremity of the shaft, a disc member fixedly secured adjacent the other end of the shaft member and positioned so as to engage portions of said guide means, and means on the guide means engageable with said tongue means for maintaining said plug member stationary relative to the tubular member during said first time interval.

13. A meteorological projectile having a hollow ogival head, a hollow body section, frangible means attaching the front of the body section to the head, a tail section closing the rear of the body section, said ogival head comprising a nose member axially movable into and substantially out of one end of said hollow head, timing and arming means housed within said hollow head, a slotted tube member coaxially disposed within the hollow head rotatably connected to the timing means, centrally apertured guide means disposed within the housing substantially normal to the axis of said head and having peripheral notch means formed therein, a shaft member connected to the nose tip and slidably supported in said guide means, a tongued member cooperating with the shaft member intermediate one face of said guide means and end portions of said tube member and engageable with the tube member slot upon rotation of said tube, a compression spring nested within said tube member to yieldably abut said tongued member to bias the nose

tip to one of its positions, said hollow head having circumferentially disposed apertures intermediate its extremities and rearwardly of said guide means, shutter means coaxially disposed within said head and rotatably coupled to said timing means to open and mask said head apertures, filter means concentrically disposed about said tube between said guide means and said timing means to define a filtering passage between said guide means peripheral notch means and said hollow head apertures, parachute means including shroud means contained in the hollow body section, sleeve means secured in the other

end of said hollow head, explosive means in said sleeve triggered by said arming means for fracturing said frangible means and blowing off the body and tail sections to permit ejection of said parachute means, said shroud means being secured to said sleeve to allow the ogival head to be gently returned to earth.

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