Sept. 1, 1970 B. CAIN 3,526,376

AIR DROPPABLE APPARATUS

Filed March 12, 1969 2 Sheets-Sheet 1

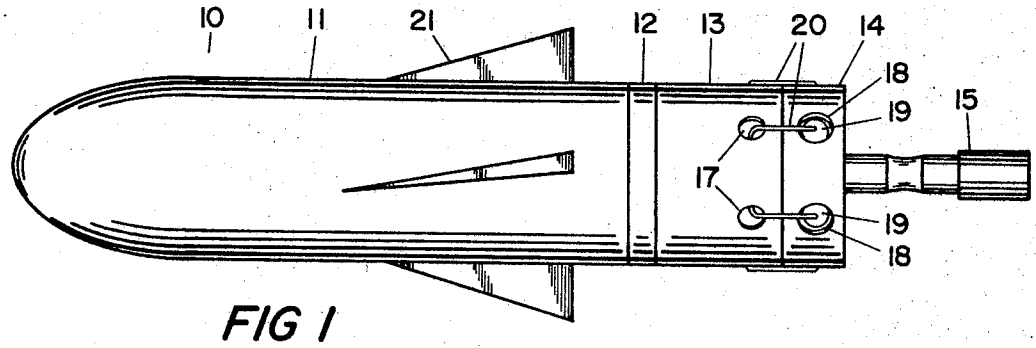


FIG 1

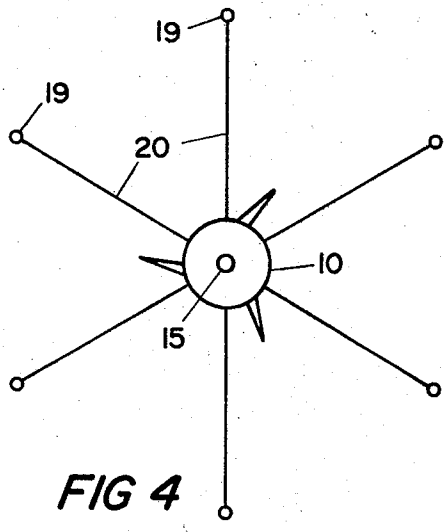


FIG 4

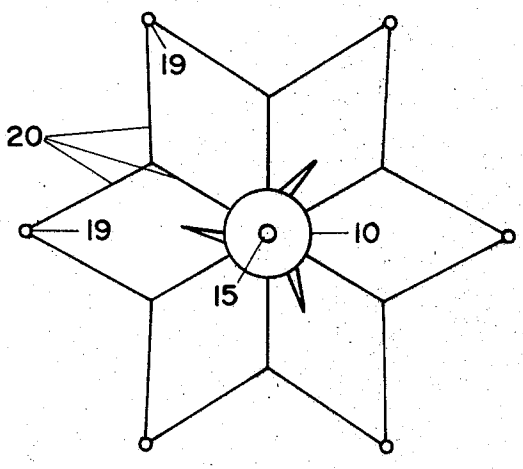


FIG 5

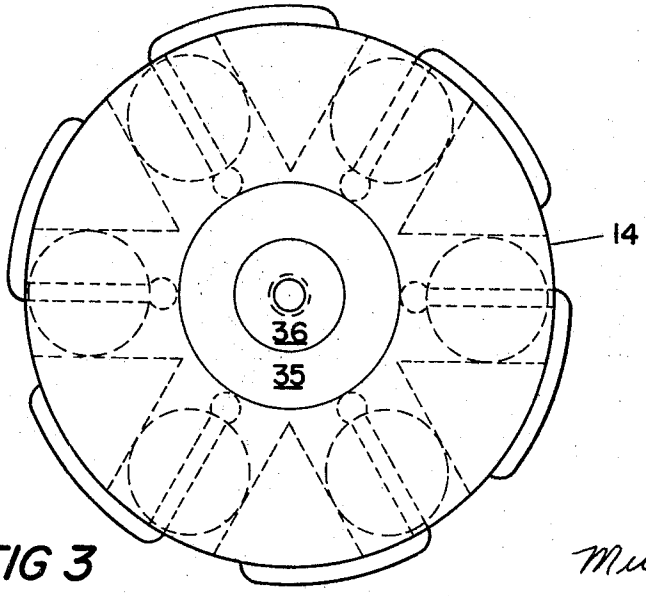


FIG 3

INVENTOR.
Blanchard Cain

BY
Mueller, Aichele, & Rauner
Attys

Sept. 1, 1970 B. CAIN 3,526,376

AIR DROPPABLE APPARATUS

Filed March 12, 1969 2 Sheets-Sheet 2

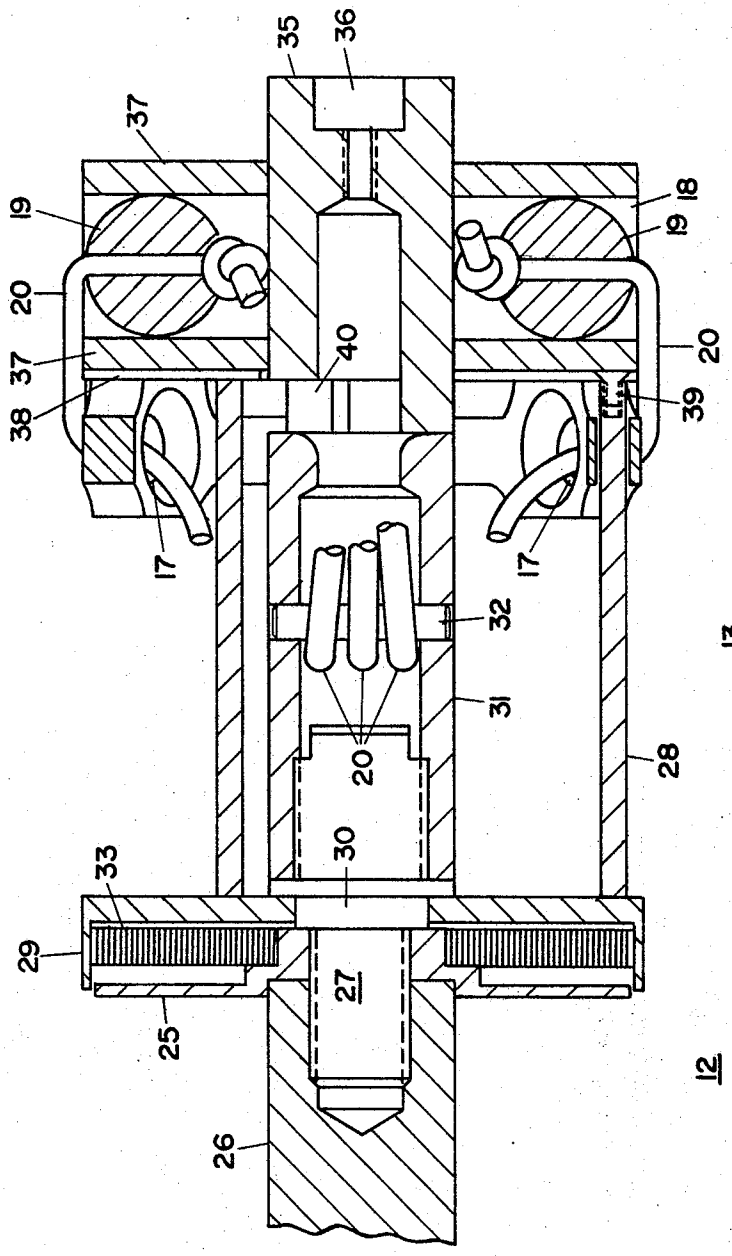


FIG 2

INVENTOR.
Blanchard Cain
BY
Mueller, Aichele, & Rauner
Atty's

United States Patent Office 3,526,376 Patented Sept. 1, 1970

3,526,376

AIR DROPPABLE APPARATUS

Blanchard Cain, Scottsdale, Ariz., assignor to Motorola, Inc., Franklin Park, Ill., a corporation of Illinois

Filed Mar. 12, 1969, Ser. No. 806,581
Int. Cl. B64d 1/02
U.S. Cl. 244—138 8 Claims

ABSTRACT OF THE DISCLOSURE

An air drop radio beacon wherein the housing is provided with auto-rotation means and contains a series of weights attached to elastic lines. During the travel of the radio beacon through the atmosphere, the weights are centrifugally deployed about the beacon and contribute to the stability thereof as well as providing tree top retention by entanglement with the ground cover.

BACKGROUND OF THE INVENTION

The present invention relates to air drop packages of the type containing radio beacons and, more particularly, to air drop packages adapted to be retained by the ground cover at an above ground level position.

Air droppable apparatus is presently being utilized to establish radio communication links for a radio beacon in rescue operation or to mark a particular area wherein activity has been observed. Since in many parts of the world the ground cover or foliage is exceedingly dense and high, it has been found that conventional air drop packages which are designed to penetrate the ground and remain in an upright position suffer from the fact that the ground cover greatly attenuates the transmitted and/or received radio signals. Further, the fact that the air drop package penetrates through the ground cover to the ground renders it likely that the physical presence of the package is readily detected. In addition, successful use of air drop packages has heretofore required that the package and associated penetration device, i.e., spike or spear, be designed in accordance with the altitude and speed of the plane carrying it. The package normally contains relatively fragile electronic apparatus and, consequently, shock absorbing means or parachutes are normally provided to control the impact shock generated when the package encounters the ground.

Thus, a need has arisen for an air drop package which is retained by the ground cover in an off-the-ground position. The present invention is directed to an air drop package which contains means for engaging the ground cover and thereby preventing the package from reaching ground level. Further, it is an object of this invention to provide the aforesaid engagement of the ground cover at a relatively low cost and weight while still providing a high degree of reliability. Still other objects are the provision of an air drop package which is suitable for transmitting radio signals in densely foliated areas and which is relatively undetectable by visual observation.

SUMMARY OF THE INVENTION

The apparatus incorporating the present invention includes a housing for containing the radio beacon or similar electronic apparatus and auto-rotation means mounted thereon for imparting rotation to the housing as it travels through the atmosphere. The auto-rotation means, typically vanes angularly disposed on the outer surface of the housing, cause the housing to rotate about its central axis. In addition, a plurality of weights are contained within receiving passages provided in the housing. Each weight is attached to one end of at least one elastic flexible elongated retaining member. The opposing end of each retaining member is attached internally of the housing, preferably by biasing means which tend to retain the members within the housing when the air drop package is stationary or non-rotating.

The passageways containing the weights are provided at equally spaced locations about the outer surface of the housing. The rotation of the air drop package as it travels downwardly through the atmosphere results in the centrifugal force of the weights overcoming the biasing force tending to retain the elastic members in the housing. Consequently, the weights move radially out through the passageways from the housing. The centrifugal force of the weights rapidly exceeds the biasing force as the housing increases in rotation. After a short period of travel through the atmosphere, the weights are essentially symmetrically disposed about the housing at the end of the corresponding elastic retaining member. The retaining members are fully extended at this point in time. Since the passageways are equally spaced on the surface of the housing and the elastic members are made of equal length, the rotating weights are found to improve the stability and trajectory of the package as it travels through the atmosphere due in part to the gyroscopic effect provided by the moving weights.

When the air drop package falls to the level of the ground cover, the weights are rotating about the housing with the elastic members fully extended therefrom. The extended elastic members contact the ground cover and firmly engage their extremities since the rotating weights rotate about the ground cover rather than the central axis of the housing. As a result, the downward travel of the package is arrested prior to its making contact with the ground. The elastic characteristic of the members provides the shock-absorbing function and thus reduces the likelihood of damage to the electrical apparatus contained within the housing. Further, the air drop package is retained in the preferred above ground position and the possibility of visual detection is reduced. In addition, the air drop package is located proximate to the edge of the ground cover so that the attenuating effects of the foliage on the transmitted signal are substantially reduced. Further features and advantages of the invention will become more readily apparent from the following detailed description of a specific embodiment when viewed in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of an air drop package incorporating one embodiment of the present invention.

FIG. 2 is a partial side view in section of the weight retention assembly of one embodiment of the invention.

FIG. 3 is an end view of the embodiment of FIG. 2 showing the weights in the retracted position.

FIG. 4 is an end view of the embodiment of FIG. 2 showing the weights in the deployed position.

FIG. 5 is an end view of another embodiment of the invention showing the weights in a deployed position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, an air drop radio beacon **10** is shown including a cylindrical housing **11** for containing the radio transmitting apparatus and any other additional cargo therein. Housing **11** is provided with a coupling section **12** located at its upper end. The coupling section is connected to weight deployment section **13** which in turn is connected to weight retention section **14**. An antenna **15** is provided at the end of the radio beacon. As shown, the air drop radio beacon **10** is provided with a number of angularly disposed vanes **21** which impart rotation to the beacon when it travels through the atmosphere. While vanes **21** are shown in the present

embodiment, it will be apparent that many other types of auto-rotation means may be employed if desired.

The weight retention section **14** contains a number of apertures equally spaced about its surface. These apertures or passageways, totalling six in the embodiment shown, contain weights **19**. Each weight is provided with an elastic line **20** which extends outwardly of the passageway in retention section **14** and down to a corresponding aperture **17** in deployment section **13**. The lines extend inwardly and the ends thereof are secured within section **13**. When the radio beacon **10** is dropped and travels through the atmosphere, it rotates about a central axis due to vanes **21**, and this rotation results in the weights **19** moving outwardly from the retention passageways in section **14**. The weights rotate about in a plane normal to the central axis of the beacon. The centrifugal force exerted by the weights on the elastic members results in the elastic members being placed in tension.

As will later be described in additional detail, the coupling section **12** contains a biasing means which tends to oppose the effect of the centrifugal force of the rotating weights. In addition, weight deployment section **13** is connected between coupling section **12** and weight retention section **14** in a manner which permits the relative rotation thereof. As a result, the centrifugal force of the weights tends to cause deployment section **13** to rotate about the central axis of the housing **11**. This rotation of deployment section **13** results in additional lengths of the elastic lines **20** being fed from section **13** and the weights moving outwardly of the central axis of the housing **11**. After a short interval, the centrifugal force of the weights is sufficient to overcome the biasing force provided by coupling section **12** and to draw the elastic lines out to their full length. As the air drop beacon continues to travel through the atmosphere, the rotation of the beacon ensures that the weights continue to travel in a path about the central axis of the housing. When the beacon enters the ground cover area, the weights cause the elastic line **20** to become entangled with the extremities of the ground cover and therefore prevent the beacon from reaching ground level. The elastic character of the lines **20** provides the shock absorbing feature necessary to protect the electronic apparatus contained in housing **11**.

The construction of the weight retention assembly affixed to housing **11** is shown in further detail in the side view of FIG. 2. As shown, coupling section **12** includes cover plate **25** and extension member **26** attached thereto by threaded bolt **27**. The extension member **26** extends into housing **11** of the assembled radio beacon and is attached thereto by suitable fastening means. The weight deployment section **13** includes outer sleeve **28** which contains the equally-spaced apertures **17** at the upper end thereof. In addition, section **13** includes base plate **29**, bearing means **30**, and central core section **31**. The centrally located core section **31** contains a pin member **32** extending laterally therethrough. The inner ends of the elastic lines **20** are connected about the pin **32**. Core section **31** is coupled to the top plate of bearing **30** by the upper portion of threaded fastener **27**. As shown, the core section **31** is fastened to cover plate **25** of coupling section **12**. Thus, core section **31**, cover plate **25**, and extension means **26** rotate as an integral part as the air drop radio beacon travels through the atmosphere. The bearing **30** between core section **31** and base plate **29** permits the outer sleeve **28** of deployment section **13** to rotate relative to the core section **31**. Spring **33** contained in the space between flange **29** and cover plate **25** prevents the rotation of the outer sleeve **28** except when the centrifugal force of weights **19** exceeds the biasing force provided by the spring.

Apertures **17** are provided about the periphery of sleeve **28** in the upper section thereof. As mentioned previously, the apertures are equally spaced about the circumference of the sleeve. Threaded through each sleeve is an elastic line **20** which is wrapped about core element **31** and then brought inwardly thereof and fastened about pin **32**.

The weight retention section **14** is shown fastened to core section **31** by means of central element **35**. Central element **35** contains a recess **36** in the outwardly extending portion thereof for the attachment of a radio antenna. The central element **35** is fastened about its inner end to core element **31** and contains apertures **40** therein to permit the elastic lines **20** to extend from inside the core section **31** out to the chamber formed between sleeve **28** and the core section.

The ball retention housing **37** of section **14** is attached to central element **35** or may be formed as an integral part thereof. Bushing **38** is fastened by screws **39** to sleeve member **28** and is interposed between sections **13** and **14**. Since the weight retention housing **14** is coupled directly to the housing **11** of the air drop beacon via the central core section and the threaded fastener, the entire weight retention section rotates with the housing. However, bushing **38** permits sleeve **28** to rotate relative to the retention section **14** and thereby enables the lines to be drawn outwardly from within section **13**. The retention passageways **18** are contained in section **14** and initially hold the weights **19**.

When the entire assembly is attached to a housing of an air drop radio beacon preparatory to the drop, the weights are contained in section **14** although connected via lines **20** to section **13**. The lines are coiled about central element **31** and the ends thereof are fed through apertures **40** in central element **35** to pin **32**. At this time, the biasing force provided by spring **33** retains the lines in a coiled position. As the beacon travels through the atmosphere, the auto-rotation means on the housing **11** provide the rotation which causes the weights to leave the retention passageways. This is due to the centrifugal force urging the weights out of the passages. When the weights are disposed outwardly of the retention assembly, the centrifugal force increases as the beacon travels through the atmosphere and overcomes the biasing force provided by springs **33**, whereupon the sleeve **28** rotates and in effect lines **20** become uncoiled from core element **31**. As a result, the balls move outwardly until the lines are fully extended. The weights continue to rotate with the air drop beacon until they encounter an obstacle such as the extremities of the ground cover. At this point, the lines become entangled with the ground cover and the beacon is retained in a position above ground level. The gyroscopic effect of the weights rotating outwardly of the air drop radio beacon has been found to impart stability to the beacon and reduces the possibility of end-over-end travel or tumbling as the beacon drops.

The weight retention section **14** is shown in the end view of FIG. 3 with the weights in their corresponding passageways. After the initial rotation which results in the weights leaving the passageways, the pattern assumed by the weights as the air drop beacon travels through the atmosphere is determined by the configuration of the elastic lines. One such configuration is shown in FIG. 4, wherein the weights are deployed by elastic lines extending radially outwardly of the beacon **10**. A second embodiment utilizes interconnected elastic lines to further increase the probability of entanglement with the ground cover. It shall be noted that in this embodiment, each elastic line emanating from the housing **10** is coupled to two weights. Thus, a loop is formed which promotes the snaring of the ground cover.

While the above description has referred to specific embodiments of the invention, it will be apparent that many modifications and variations may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In air droppable apparatus of the type containing auto-rotation means mounted on the housing thereof to

impart rotation about a central axis during descent, the improvement which comprises:

(a) a plurality of weights disposed symmetrically about said central axis;

(b) a like plurality of retaining means, each of which is coupled to at least one of said weights;

(c) a like plurality of weight-retaining passageways formed in said housing; each of said passageways retaining at least one of said weights prior to the rotation of said apparatus; and

(d) biasing means provided in said housing for urging said retaining means into said housing, the effect of said biasing means being overridden by the force of said weights when the apparatus is rotating, said weights extending outwardly during the descent of said apparatus to engage ground cover.

2. The improvement of claim 1 wherein said retaining means are flexible elastic lines.

3. The improvement of claim 2 wherein said housing contains a plurality of apertures symmetrically disposed about the central axis thereof, and said lines are connected through said apertures to said biasing means.

4. Air drop apparatus comprising:

(a) a cylindrical housing having a central axis;

(b) auto-rotation means mounted on said housing for imparting rotation thereto about said central axis;

(c) a plurality of weight retention passageways formed in said housing, said passageways being located symmetrically about said housing;

(d) a plurality of weights disposed symmetrically about said central axis; and

(e) a plurality of flexible elongated retaining members, each of said members being attached at one end to at least one weight, the other ends of said members being attached to said housing, the rotation of said housing about said central axis resulting in the symmetrical deployment of weights about said housing whereby said retaining members are in position to engage ground cover extremities during an air drop.

5. Air drop apparatus in accordance with claim 4 wherein said retaining members are attached internally of said housing and further comprising biasing means contained within said housing for urging said retaining members into said housing, the effect of said biasing means being overcome during the air drop whereby said weights are symmetrically deployed about said housing.

6. Air drop apparatus in accordance with claim 5 wherein said housing includes:

(a) a coupling section containing said biasing means, said coupling section being attached to the cargo carrying portion of said housing;

(b) a weight deployment section coupled to said coupling section and containing a plurality of apertures therein symmetrically spaced about the central axis, said retaining members entering the deployment section through said apertures and being operatively coupled to the biasing means in said coupling section; and

(c) a weight retention section coupled to said weight deployment section and containing the retention passageways for the weights therein.

7. Air drop apparatus in accordance with claim 6 wherein said weight deployment section is rotatably coupled between the coupling section and the weight retention section to permit relative rotation thereof when the weights are being symmetrically deployed during the air drop.

8. Air drop apparatus in accordance with claim 7 wherein said weight deployment section comprises:

(a) a core element connected between the weight retention section and the coupling section, the retaining members being attached to the core section; and

(b) an outer sleeve mounted between the coupling section and the weight retention assembly, said sleeve containing said apertures through which the retaining members pass, said core element and said sleeve being coupled to the coupling section and the biasing means thereon to permit relative rotation between said sleeve and core element whereby said weights are deployed when the retaining members are extended.

References Cited

UNITED STATES PATENTS

3,150,850	9/1964	Barish	244—138
3,188,020	6/1965	Nielsen et al.	244—138
3,288,402	11/1966	Icenbice et al.	244—138
3,333,643	8/1967	Girard	244—138

MILTON BUCHLER, Primary Examiner

J. E. PITTENGER, Assistant Examiner