April 30, 1968 R. W. SCHNEPFE, JR 3,380,383

DIRECTIONAL DISPENSING GRENADE

Filed May 26, 1965

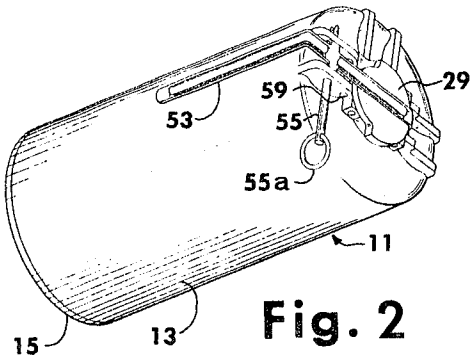

Fig. 2

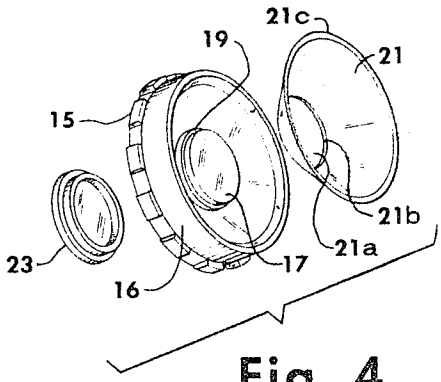

Fig. 4

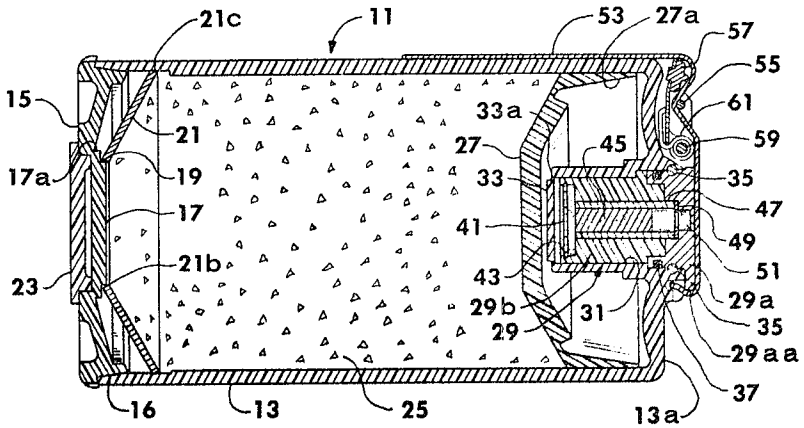

Fig. 1

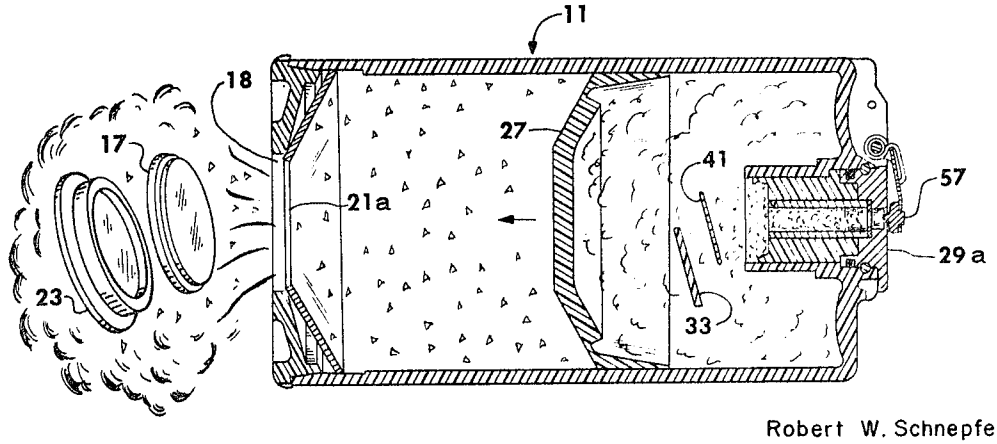

Fig. 3

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United States Patent Office 3,380,383 Patented Apr. 30, 1968

3,380,383

DIRECTIONAL DISPENSING GRENADE

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Filed May 26, 1965, Ser. No. 459,068
14 Claims. (Cl. 102—64)

This invention relates to grenades or other particle or liquid ejecting devices, and particularly to a grenade arrangement and method which enables the facile ejection and dissemination of particles or liquid material from within an initially closed and sealed canister or the like.

In the riot control field it is often desirable to employ a grenade which will enable the full and complete ejection of a tear gas substance such as CN powder or liquid from the grenade into the atmosphere within a short interval of time. Such an ejection can be obtained with a grenade employing explosive charge for expelling the tear gas particles or liquid, but when such is attempted with an initially sealed container a difficult problem is encountered in the conflicting requirements of providing a strong enough seal to prevent undesired inadvertent preopening, with a low cost lightweight canister or other container, while providing sufficient initial pressure to cause opening of the seal at the discharge opening to enable ejection of the tear gas granules or liquid. Thus, if one employs a heavy walled canister it is quite possible to have a strong seal over the discharge opening and effect adequate breakage of this strong seal with a sufficiently adequate explosive charge; however, it is desirable on the other hand to employ a lightweight canister in most instances while still having a sufficiently strong seal over the discharge opening, and this presents problems in the accomplishment of rupturing or otherwise opening of the seal with the requisite lesser explosive charge which can be tolerated by the lighter weight canister. It has also been found that in the case of ejecting particle materials from such a grenade through the use of an explosive charge a difficulty is often encountered with compacting of the particles along the side walls of the grenade canister, and consequent prevention of ejection of these particles, particularly when the discharge or ejection opening is substantially smaller than the cross-section of the chamber formed by the canister side walls.

It is accordingly a major object and feature of this invention to provide a grenade which is useful in the dispensing of tear gas material, such as powder or liquid from which tear gas is generated in the atmosphere, and which is particularly adapted to the expulsion of particle type material, particularly tear-gas-forming material, and which enables the employment of a relatively lightweight canister with a relatively small propellant charge, while still enabling the employment of a relatively rugged discharge opening seal arrangement if desired.

Still a further feature of the invention is the provision of an ejection arrangement in which a discharge opening seal is employed, and in which the pressure generated within the device for ejection of material is transmitted in such a manner as to create an increased effective pressure at and effective force transmitted to the discharge opening seal to facilitate rupture of the seal and ease of discharge of the material.

A further feature of the invention is the provision of a particle ejection device having pressure-transducing means therein which serves the dual functions of transmitting the force resulting from particles ejection pressure thereon to the zone of a seal at the discharge opening for increasing the effective rupture force applied to the seal, and which facilitates the lateral movement toward the discharge opening of the material to be ejected, by transforming longitudinal ejection forces into radially inwardly directed forces which converge along a line in alignment with the discharge zone.

Still other objects, features and attendant advantages will become apparent to those skilled in the art from a reading of the following detailed description of one physical embodiment constructed in accordance with the invention, taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a longitudinal section view of a grenade constructed according to the invention, the grenade being shown in its condition prior to firing;

FIGURE 2 is an external perspective view of the grenade of FIGURE 1;

FIGURE 3 is a longitudinal section view similar to that of FIGURE 1, illustrating the grenade action during firing;

FIGURE 4 is an exploded view in perspective of the transducer and seal parts of this embodiment.

Referring now in detail to the figures of the drawing, the illustrated grenade **11** takes the form of a container or canister **13**, which is preferably formed of plastic material such as nylon, Delrin acetal resin, or other suitable relatively lightweight material of good strength. In this illustrated embodiment one end **13***a* of the canister **13** is closed as initially moulded, and over the mouth of the other end of the cylindrical canister **13** is secured a cover **15** which may be of similar material and which is suitably secured to the main body **13** of the canister as by a pressure weld or adhesive along an annular joint line as indicated at **16**.

The cover **15** of the canister is provided with a shear disc **17** which is formed integrally therewith, there being an annular relatively weaker shear zone **17***a* formed by a thinner wall zone surrounding the shear disc and connecting with the remaining portion of the cover **15**. If desired, a flanged cap **23** may be provided over the shear disc to give added protection against undesired rupture from external forces, in which case the cap may be seated in a recess in the cover **15** as shown in FIGURE 1, as by a slight pressure fit or by holding in place with a pressure-sensitive tape or the like (not shown). However, the use of the cap **23** is optional in many instances, as the shear disc shear zone may be made sufficiently strong with this invention to prevent most accidental or other unwanted rupture of the shear disc without the necessity for the additional cap **23**. The cap **23** is of particular use in such instances as where the cover **15** may be subjected to external high pressures, such as explosive propellant pressures, prior to the firing of the grenade itself.

Rupture of the shear disc **17** along the shear zone **17***a* is accomplished by exerting a concentrated force on the shear disc along the annular shear zone through the medium of a funnel-shaped pressure transducer **21** having a central discharge opening **21***a* at its smaller tapered end **21***b*. This small open end **21***b* of the funnel transducer **21** is seated on an annular step seat **19** formed on the inner surface of the shear disc **17** adjacent the annular shear zone, and the larger outer end **21***c* of the transducer **21** is guided by the cylindrical side wall surface of the canister **13**. To enable ease of movement of the funnel transducer **21** in its rupture action on the shear zone **17***a* the transducer **21** is initially spaced from the remaining portion of the cover **15**, as shown in FIGURE 1, and upon rupture and expulsion of the shear disc this funnel transducer **21** is moved into abutment with the main body of cover **15** by the forces exerted thereon through the material being discharged, as shown in FIGURE 3.

The tear gas powder or liquid or other material **25** which is to be ejected is initially disposed between the funnel-shaped pressure transducer **21** and an obturator piston **27** which is initially disposed adjacent the opposite

end of canister 13. The obturator piston 27 may be provided with a suitable trailing annular pressure-responsive obturating edge 27*a* to aid in sealing of the tear gas particle chamber from the propellent gases which are employed to impart longitudinal movement to the obturator piston 27 and thereby effect rupture of the shear zone 17*a* and the ejection of the tear gas powder or other material 25 through the discharge opening 18 formed upon rupture and ejection of the shear disc 17.

In order to provide the desired explosive propellent gas pressures for imparting motion to the obturator piston 27 and tear gas powder 25, there is provided a propellent chamber assembly 29 which is disposed in a cup-shaped recess 31 formed in the closed end 13*a* of the canister 13. The propellent chamber assembly 29 is of self-contained modular construction enabling insertion into the recess 31 either before or preferably after the filling of the canister 13 with tear gas powder or other desired material 25, particularly inasmuch as the recess 31 is also completely sealed from the internal chamber holding the tear gas powder 25. This enables mutual ease and independence of the loading of the tear gas powder and the positioning of the propellent chamber assembly 29.

The propellent chamber assembly 29 may be suitably formed with outer and inner main body portions 29*a*, 29*b*, which are slidably or press fit together. Suitable sealing against pressure loss may be provided by an annular O-ring seal 37 disposed in an annular groove in the outer body portion 29*a*, and the entire assembly 29 may be suitably retained in position within the cup-shaped recess 31 as through the medium of a pair of retainer pins 35 which engage complementary transverse locking grooves formed in the adjacent interfacing wall portions of the canister end 13*a* and the propellent assembly body portion 29*a*.

The propellent chamber assembly 29 includes a propellent charge 39 which is covered by a blowout cover 41 disposed in an annular groove 43 at the inner end of the main body portion of the assembly 29. Formed at the bottom of the recess 31 of the canister 13 is a shear disc 33 which has an annular thinner wall shear zone 33*a*, as shown in FIGURE 1. In the seated position of the propellent chamber assembly 29 the blowout cover 41 is disposed in facing relation to the shear disc 33, and is adapted to effect blowout of the shear disc 33 upon energization of the explosive propellent charge 39 as shown in FIGURE 3.

In the illustrated embodiment the propellent charge is fired through the medium of an intermediate pyrotechnic time delay fuze 45 which is in the form of a rod of suitable fuze material such as a powder mixture of ground glass or silica, and zirconium barium chromate, of standard time delay fuze construction, carried within a metallic tube shield 47 and communicating with the propellent charge 39 at its inner end. Over the outer end of the tube of the tube shield 47 may be disposed an apertured metallic shield such as a cover washer 49, on which rests a percussion primer 51 of conventional construction and which is adapted to be fired through the medium of a striker 57.

The striker 57 may be of suitable conventional construction and is illustrated as being carried by a pivot pin 59 which also carries an actuating torsion spring 61 which serves to effect the desired actuating movement of the striker 57 into contact with the primer 51. Prior to firing, the striker 57 is held in the ready position as shown in FIGURE 1 through the medium of an L-shaped handle 53 of conventional construction and which is hooked under a lip 29*aa* of the propellent chamber assembly outer body portion 29*a*, as seen in FIGURES 1 and 2. The handle may be suitably retained in this initial position through the medium of a releasable retainer pin 55 and pull ring 55*a* carried in a suitable transverse bore formed in the end wall 13*a* of the container 13.

In operation, the grenade 11 may be either hand-held,

thrown or shot toward the desired action zone. The handle 53 is conditioned for release by removing the pull ring 55*a* and the retainer pin 55, and after release of the handle 53 the striker 57 is moved into percussion contact with the primer 51 by action of the spring 61. The primer initiates the burning of the time delay fuze 45 which subsequently initiates the burning of the propellent charge 39 which effects blowout of the blowout cover 41 and shear disc 33 and longitudinal movement of the obturator piston 27 toward the discharge end of the canister 13. Movement of the obturator piston 27 by the pressure of the propellent gases imparts compression pressures to the tear gas powder or other material 25, which pressures are transmitted to both the shear disc 17 directly and the funnel pressure transducer 21. By virtue of the tapered inner surface of funnel transducer 21 the wall pressure exerted thereupon is converted into a longitudinal component and a transverse radially-acting component, the longitudinal component being opposed along the relatively much smaller annular end wall section forming the shear disc zone 17*a*, and thereby increasing the pressure and effective force at this shear zone may fold over what would without transducer 21 be exerted as a result of only the pressure applied by the particles 25 along the face of the shear disc 17, so as to facilitate rapid and facile rupture of shear zone 17*a* and blowout of the shear disc 17. The radial component forces resulting from the pressure exerted against the transducer funnel 21 effect a radially inward camming motion of the particles which greatly facilitates the movement of the particles from the peripheral portion of the canister chamber toward and through the discharge opening 18, thereby obviating any tendency of the particle material to become compacted and remain in columnar form along the peripheral portion of the container. It will also be apparent that by formation of the transducer 21 in the funnel shape as shown in this embodiment the strength of the transducer is substantially increased over what would otherwise be its strength in a flat or plain apertured disc shape. It is to be understood, however, that in some instances, particularly where liquid is to be dispensed, it may be found suitable to employ a transducer 21 which is other than funnel-shaped, although the much to be preferred embodiment in particle type material discharge is a funnel shape as shown, with its resultant multiple functions and advantages.

While the invention has been illustrated and described with respect to a single physical embodiment it will be readily apparent that various modifications and embodiments may be made without departing from the scope and spirit of the invention. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrative embodiment, but only by the scope of the appended claims.

That which is claimed is:

1. A grenade comprising

a container having material-moving means for ejecting particle or fluid material from said container, and

a chamber for containing particle or fluid material to be ejected,

said container including a chamber cover spaced from said material-moving means and having a rupturable portion for rupture and ejection of material through the rupture opening,

and a movable frusto-conical pressure transducer member disposed adjacent one end of said chamber and having a central opening therein, the smaller end of said transducer being disposed for concentration of pressure on said rupturable portion of said cover in response to pressure on said transducer member through pressurized contact thereof by said material.

2. A grenade according to claim 1 wherein said pressure transducer member is a centrally apertured funnel, said cover including a cover disc adapted to be dislodged from a covering position in response to pressurized move-

ment of said material toward said funnel and said cover disc, the small apertured end of said transducer funnel corresponding in approximate size to said cover disc and being disposed in lateral registry therewith for transmitting a concentrated pressure on said cover disc.

3. A grenade according to claim 2 wherein said cover disc is a shear disc having a surrounding annular weakened shear section connecting between said shear disc and the contiguous container wall, said container being cylindrical in shape and said shear disc and annular weakened shear section being disposed at one end of said cylindrical container and being of smaller diameter than the continer body diameter.

4. A grenade according to claim 1 further comprising a charge of particle material disposed within said chamber for ejection.

5. A grenade according to claim 4 wherein said material-moving means includes a movable piston spaced from and movable toward said rupturable cover portion to effect movement of said material and transducer member, rupture of said cover and ejection of said material.

6. A grenade according to claim 5 wherein said material-moving means further includes gas pressure generating means adjacent, and separated from said charge of particle material by, said piston, said piston being an obturator piston having a pressure-responsive radially-sealing expandable trailing edge.

7. A grenade according to claim 6 wherein said gas-generating means is an explosive charge.

8. A grenade according to claim 7 wherein said explosive charge has an exteriorly exposed percussion primer for exterior actuation, said explosive charge and primer being disposed at the opposite end of said container from said rupturable chamber cover.

9. An explosive charge actuated grenade dispenser for tear gas or comminuted or liquid material comprising

a cylindrical container having a cylindrical chamber formed therein for carrying a charge of material to be ejected,

a piston disposed for movement within and along said chamber for causing ejection of material from said chamber,

an explosive charge disposed adjacent said piston and on the opposite side thereof from said charge chamber,

said container having an opposite end wall with a shear disc disposed thereon,

said shear disc being of smaller diameter than said piston and cylindrical chamber,

and a movable pressure transducer disposed at one end of said chamber adjacent said shear disc and adapted to transmit increased pressure to said shear disc upon movement of said charge material thereto-ward,

said transducer having a tapered wall surface and a central thru-opening formed therein in longitudinal registry with said shear disc.

10. A grenade according to claim 9 wherein said shear disc has a surface protruding inwardly from the adjacent surface of said end wall, said pressure transducer being spaced in loaded position away from the adjacent end wall surface to enable ease of transmission of motion by said transducer to said shear disc.

11. A grenade according to claim 10 wherein said shear disc has an annular step formed thereon forming a seat for said pressure transducer.

12. A grenade according to claim 11 wherein said pressure transducer is a funnel having a central opening in registry with and smaller than said shear disc.

13. An explosive charge actuated grenade dispenser for tear gas or other comminuted or liquid material comprising

a cylindrical container having a cylindrical chamber formed therein for carrying a charge of material to be ejected,

a piston disposed for movement within and along said chamber for causing ejection of material from said chamber,

an explosive charge disposed adjacent said piston and on the opposite side thereof from said charge chamber,

said container having an opposite end wall with a shear disc disposed thereon,

said shear disc being of smaller diameter than said piston and cylindrical chamber,

and a movable pressure step-up transducer disposed within said container and adapted to transmit increased pressure to said shear disc upon movement of said charge material theretoward,

said transducer having an opening formed therein in longitudinal registry with said shear disc.

14. A grenade according to claim 13 wherein said shear disc has a surface protruding inwardly from the adjacent surface of said end wall, said pressure transducer being spaced in loaded position away from the adjacent end wall surface to enable ease of transmission of motion by said transducer to said shear disc.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,380,383 April 30, 1968

Robert W. Schnepfe, Jr.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 22, "may" should read -- many --. Column 5, line 13, "continer" should read -- container --. Column 6, line 51, "2,925,042" should read -- 2,925,942 --.

Signed and sealed this 9th day of September 1969.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents