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(54) Projectile.

(57) This invention relates to a smoke generating bomb or shell used for example to break up riots or to provide a screen for troops. The body (13) and tail member (14) of the bomb are constructed out of cross-link plastic material. Incorporated between the smoke composition (30) and the inner wall of the bomb body is an insulating sleeve (35). The cross-linking of the plastic can be achieved by either gamma irridation or by the use of cross-linking additive agents. The use of plastic body and sleeve is likely to reduce the cost of manufacture considerably.

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PROJECTILE

Thie invention relates to a projectile and in particular to a smoke generating projectile or a smoke shell to generate smoke, for example, to break up a riot or to provide a screen for troops.

At present various kinds of smoke generating projectiles are in use which can be thrown or shot from a gun.

These projectiles have a tail member which guides the bomb to follow a certain trajectory.

There are various constraints which have to be observed when designing the smoke generating projectile, for example, when the projectile is to be shot from a gun, the diameter has to be limited to a size of the gun barrel. The projectile has to remain intact on firing from the gun. It must also remain intact after impact with the ground, in order to give controlled rate of smoke emission. The projectile body must not distort when heat is transmitted by the burning smoke composition, which can be of the order of 1000°C. The projectile when shot from the gun, should also be capable of having a large variation of range, for example, between 50-750m. It is also important that the projectile body should be able to carry sufficient smoke composition to produce a screen which can last for a long period.

The smoke composition should be such that a screen of dense smoke is produced.

Presently, smoke generating projectiles are constructed out of aluminium alloy bodies for carrying smoke composition, and meets all the necessary requirements. However the current cost of producing such projectiles is high because a large proportion of time is contributed to labour-intensive machining of the aluminium alloy case. Each tail member of the projectile is also manufactured separately requiring further labour intensive machining.

In the past, studies into cheaper methods of production have suggested that an injection-moulded plastic projectile body would significantly reduce the cost of production. Early tests carried out on plastic bodies have proved unsatisfactory. Each plastic body was deformed badly, the plastics melting due to the intense heat generated by the burning smoke composition.

Furthermore a rupture of the projectile body increased a burn rate of the smoke composition and thereby reduced a smoke emission period considerably.

The present invention allows the aforementioned disadvantages to be avoided to a very substantial extent, which still allow a projectile to be produced relatively cheaply.

According to the present invention a smoke generating projectile for smoke dispertion into the atmosphere comprises a hollow member containing a charge, a tail member co-axial with the hollow member, a propellant cartridge holder including a delay block and a fuse co-axial with the tail member, the delay block being adjacent the charge, and an insulating sleeve between the charge and the hollow member, the hollow member being constructed of crosslinked plastic material.

The coaxial tail member of the projectile may be of cylindrical shape and formed integrally with the hollow member of plastics material, or formed separately and attached thereto. Holes are provided around the periphery of the tail member to act as air intake holes. These provide stability for the projectile in flight. Additionally the holes may be angled downwards and inwards to improve the flow of air in the holes. Further, the holes may be angled sidewards as well as downwards to deflect the airflow at the intakes inducing a spin reaction on the projectile thus further improving its flight stability.

It will be noted that this design of tail member can usefully be applied to projectiles other than smoke projectiles and according to another aspect of the invention a tail member for a projectile comprises a hollow cylinder having a plurality of air intake holes spaced over its surface.

By way of example, one embodiment of the invention will be described with reference to the accompanying diagrammetric drawings of which,

Figure 1 is a perspective view of a smoke projectile in accordance with the invention.

Figure 2 is a vertical sectional view on line II-II in Figure 1.

Figure 3 is a side view of one embodiment of the tail member.

Figure 4 is a side view of another embodiment of the tail member.

Figure 5 is a side section view of the angled holes on the tail member.

Figure 6 is a side section view of frusto-conical holes on the tail member.

With reference to Figures 1 and 2, a smoke projectile 10 consists of a hollow cylindrical member 12 having an integrated tail member 14 at one end of the hollow cylindrical member 12. The hollow cylindrical member 12 also contains a charge 30 in a charge chamber 31, an insulating sleeve 35, a delay fuse 32 and an explosive cartridge 40. A groove 23 formed on a perimeter of the hollow cylindrical member 12 accommodates an obturating ring 24 and a plurality of holes 26 are formed on the cylindrical member 12 for smoke emission.

An insulating sleeve 35 is slidably positioned into the hollow cylindrical member 12 from the end, remote from the tail member 14 end, until it comes

to rest against a step bore 36. The length of the sleeve is such that it forms a barrier between the charge 30 and the cylindrical wall 11.

The charge 30 is in a form of a cylindrical pellet and is made of a smoke generating composition which preferably has a relatively low burning temperature, easy to ignite and produces a dense smoke screen. The charge 30 is of such a dimension so as to fit tightly inside the insulating sleeve 35. The hollow cylindrical member 12 is sealed at one end, by an end cap 16 which retains the charge 30 and the sleeve 35 and prevents ingress of moisture. The end cap 16 is retained in position to the cylindrical wall 11 by fastening means 18. Each fastening means 18 is arranged so that it does not project beyond the cylindrical wall 11.

A propellant cartridge holder 40 is in a form of a hollow cylinder and is co-axially arranged with the tail member 14. The propellant cartridge holder 40 has a circular extension 43 on the perimeter which coincides with a step bore 38. The propellant cartridge holder 40 is slidable in the bore 42 and is secured to the hollow cylindrical member 12 by fastening means 44. A delay fuse 32 is of conventional pyrotechnic compositon, and is mounted in an axial channel in a cylindrical delay block 34. The cylindrical delay block 34 is adjacent the smoke generating charge 30 and is secured within the propellant cartridge holder 40. The delay block 34, may be made of light metal, preferably aluminium. The delay block 34 also protect the delay fuse 32 to some extent from atmosphere moisture. Formed on a periphery of the propellant cartridge holder 40 is a plurality of holes 46. The reason for these holes will become apparent later. The cartridge holder 40 contains a propellant charge 48 suitably pierced so as to ignite the delay fuse 32. A conventional percussion primer cap 50 is mounted at rear end of the propellant cartridge holder 40. A cambric disc 52 and a priming square plate 54 are situated between the charge 30 and the delay fuse 32.

Smoke emission holes 26 in the hollow cylindrical member 12 are positioned adjacent the cambric disc 52 so that smoke starts to emit as soon as the charge 30 is ignited. The holes 26 can be plugged during storage with mastik to avoid ingress of moisture affecting the charge 30. The plugs, during use, are forced out from holes 26 by build up of pressure in the charge chamber 32 by burning smoke composition.

The tail member 14 has a plurality of air intake holes 20 spaced over its surface. These take in the airflow over the surface of the projectile and control and stabilise the tails's relative position during flight. As can be seen from Fig 3 the holes 20 may be positioned around a single circumference of the cylinder or, as in Fig 4, around more than one circumference. As shown in fig 3 the holes 20 may be angled downwards and inwards to improve the air intake. The holes 20 may be any shape including round, oval, slit shaped rectangular triagular. As shown in Fig 6 the holes may be frustro-conical with the narrow and outwards. Furthermore the holes 20 may be angled sideways to cause the airflow to deflect intake holes and causes a "spinning reaction on the projectile thus further improving its flight stability. The holes may be angled downwards and sideways as shown in Fig 2.

The tail member 14 may be integral with the hollow member 12, or it may be constructed separately attached by any fastening means such as a screw-thread or slip fit and retaining screw.

In use, the propellant charge 48 by which ejection of the smoke generating projectile 10 from the gun is effected, also ignites the pyrotechnic delay fuse 32. The projectile is guided along a trajectory by the tail member 14. After a short period, the cambric disc 52 and priming square 54 are ignited, which ignites the charge 30. The smoke emitted by the charge 30 travel through the hollow cylindrical delay block 34 and is discharged through the holes 46 mentioned above, and the rear end of the propellant cartridge holder 40. Smoke emission also occurs through holes 26 when the mastik plugs are forced out by the build up of pressure in the charge chamber 31.

In the particular embodiment tested and described, a cross-linked low density Polyethylene material for the hollow cylindrical member 12 and the integral tail member 14 was used. The cross linking of the LPD material to improve the materials' thermal properites, was achieved by exposing it to gamma irradiation for a sufficient period.

Although low density polyethylene was used in the embodiment described, other plastic materials which can have their thermal properties improved by cross-linking can be used. The plastic material chosen should also have good mechanical properties, by dimensionally stable, easy to mould, and have resistance against chemical or solvent attack. Cross-linking of the plastic mateials can also be achieved by other processes, for example, the use of cross-linking additive agents.

The insulating sleeve 35 was made from 4mm thickness paper marketed under the trade name 'Koawool'. The 'Koawool' paper composition is Aluminium Oxide (Al_2O_3) 50-53%, Silicon dioxide (SiO_2) 47-50% leachable chlorides 50ppm and 6% acrylic polmer binder and has a density of 340 Kgm^3 & tensile strength of 750 MPa. In the tests, the 'Kaowool' insulating sleeve 34 allowed smoke to be emitted from the holes 26. Other materials for the insulating sleeve 35 are possible which can withstand high temperatures and have a low ther-

mal conductivity.

In an alternative embodiment, it is possible that the smoke composition pellet can be wrapped in an insulating sleeve material of the kind described. A separate insulating sleeve is not then required.

The integral hollow cylindrical member 12 and tail member 14 may suitably be manufactured by an injection moulding process. It is also, of course, possible for the hollow cylindrical member 12 and the tail member 14 to be manufactured separately.

In a further embodiment, the tail member 14 is replaced by a tubular member having a plurality of fins equi-spaced around a periphery of the tubular member. However, the tubular member and the diameter projected by fins should not be greater than the maximum diameter of the hollow cylindrical member 12. The tubular member can either be attached or integral with the hollow cylindical member 12. It is possible that the propellant cartridge holder 40 can be tubular member.

The smoke generating projectile is not restricted to a particular shape. The hollow member 12, for example, may be tapered. The member 12, for example, may have a converging taper towards the tail member, and the tail member 14 can have a diverging taper away from the hollow member 12. It will, of course, be realised that the insulating sleeve and the charge in the hollow member will also be tapered accordingly.

The end cap 16 may, for example, be shaped to have a converging taper away from the member 12. The smoke generating projectile with the taper end cap is suitable for use on soft ground where after the projectile impacts onto the ground, the tapered end cap penetrae the ground and allow the bomb to remain vertical for even smoke emission, particularly, from the smoke emission holes 26. A hollw end cap may be used, made of plastics material and filled, for example, with lead material to adjust the centre of gravity of the projectile.

It should be realised that the holes 26, through which smoke emission can also occur, are not essential, and that all smoke emission can occur through the holes 46 and the rear end of the propellant cartridge holder 40. It is also, of course, possible that a plurarity of equi-spaced tubes concentrically positioned about the axis of the smoke bomb and extending between the charge chamber 31 and passing between the tail member 14 and propellant cartridge holder 40 may be provided for smoke emission. The tubes may be provided with plugs to prevent ingress of moisture into the charge chamber 31. In use, the build up of pressure in the charge chamber 31 will force out the plugs.

Claims

1. A projectile -for smoke dispertion into the atmosphere comprising a hollow member containing a charge, a tail member co-axial with the hollow member, a propellant cartridge holder including a delay block and a fuse co-axial with the tail member, the delay block being adjacent the charge, and an insulating sleeve between the charge and the hollow member, the hollow member being constructed of cross-linked plastic material.

2. A projectile according to Claim 1 in which the hollow and tail members are integrated.

3. A projectile according to Claims 1 or 2 in which the tail member is constructed of crosslinked plastic material.

4. A projectile according to Claims 1, 2 or 3 in which the crosslinking of the plastic material is effected by gamma irradiation.

5. A projectile according to Claim 4 in which the cross-linking of the plastic material is effected by additive agents.

6. A projectile according to any one of the preceding claims in which the plastic material is a low density polyethylene.

7. A projectile according to Claim1 in which the insulating sleeve forms a barrier between the charge and the hollow member.

8. A projectile according to Claim 7 in which the insulating sleeve is made of material which has a low thermal conductivity and can withstand high temperature.

9. A projectile according to Claim 8 in which the material consists of Al_2O_3 50-53%,SiO_2 47-50%, leachable chlorides 50ppm and 6% acrylic-polymer binder.

10. A projectile according to any one of Claims 1-9 in which the hollow member, the charge and the insulating sleeve have a converging taper toward the tail member.

11. A tail member for a projectile comprising a hollow cylinder having a plurality of air intake holes spaced over its surface.

12. A tail member as claimed in Claim 11 in which the holes are spaced about a single circumference of the cylinder.

13. A tail member as claimed in Claim 11 or 12 in which the holes are angled downwards and inwards.

14. A tail member as claimed in Claim 13 in which the holes are angled sideways to the axis of the cylinder.

15. A tail member as claimed in Claim 14 in whcih the holes are oral shaped.

16. A tail member as claimed in Claim 14 in which the holes are frustro-conical with the narrow end outwards.

17. A tail member as claimed in Claim 14 in which the hollow cylinder has a diverging taper awar from the hollow member.

18. A tail member as claimed in any of Claims 11-17 in which the hollow member and tail member are integrated.

19. A projectile according to anyone of Claims 1-6 in which the tail member is in a form of a tubular member and has a plurality of fins equi-spaced around a periphery of the tubular member.

20. A projectile according to Claim 12 in which the tubular member is the propellant cartridge holder.

21. A projectile according to Claim 1 in which the hollow member containing the charge and the insulating sleeve is sealed at one end by an end cap.

22. A projectile according to Claim 14 in which the end cap has a converging taper away from the hollow member.

23. A projectile according to anyone of the preceding claims in which a plurality of holes are formed on the hollow member for smoke emission.

24. A projectile substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

25. A tail member substantially as herein described with reference to the accompanying drawings.

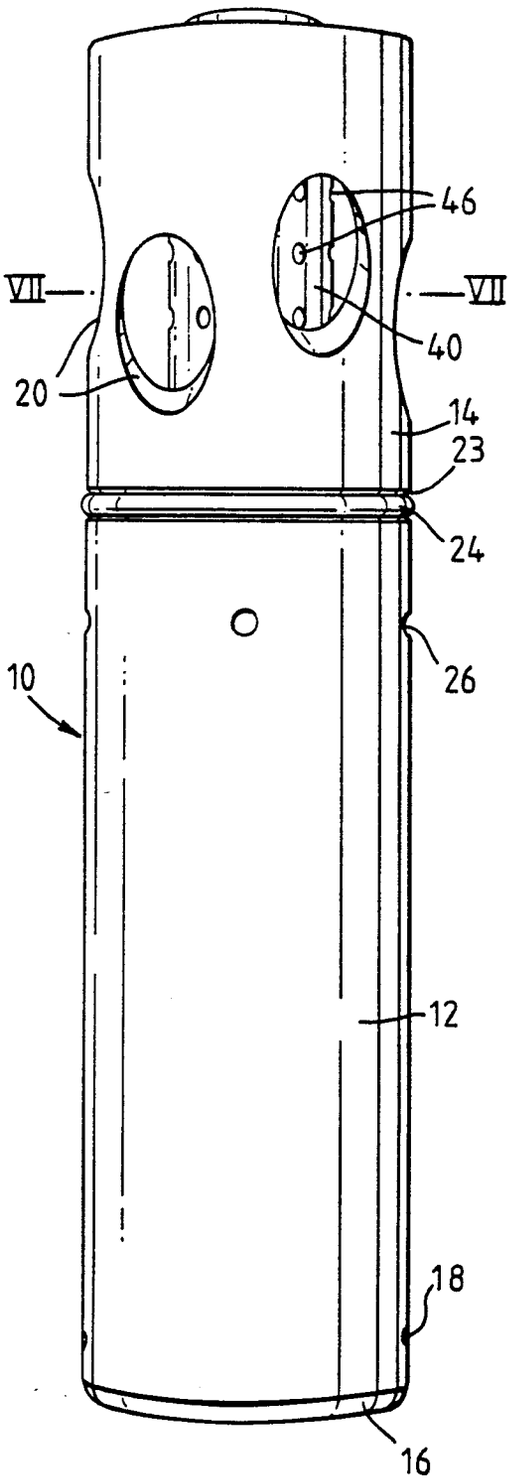
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Fig.1.

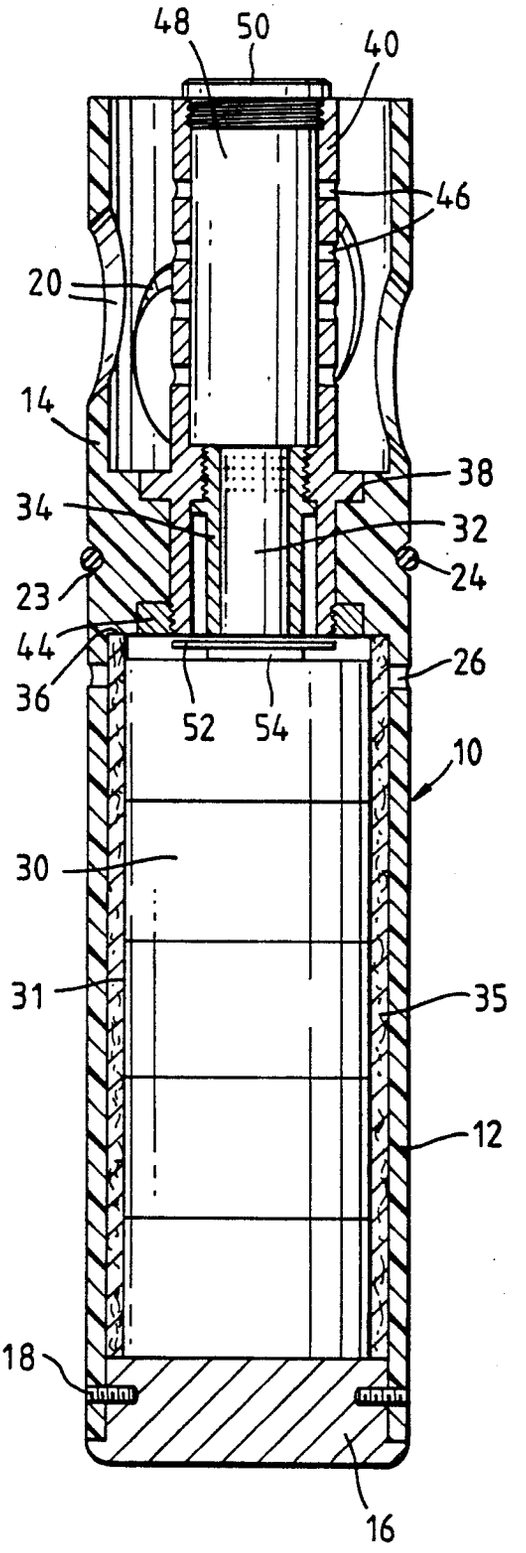
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Fig.2.

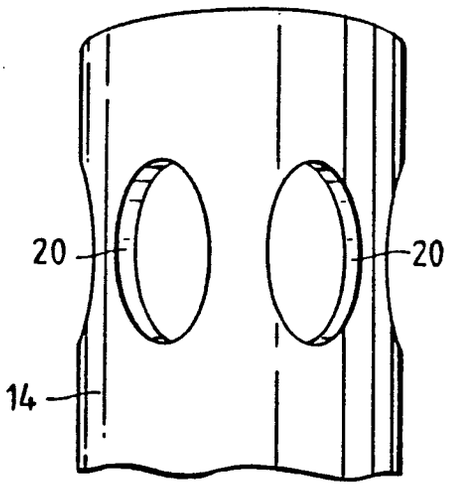

Fig.3.

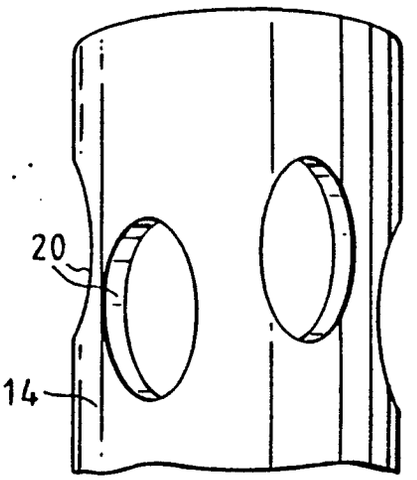

Fig.4.

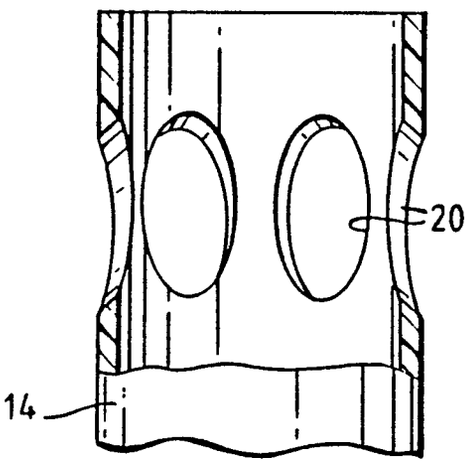

Fig.5.

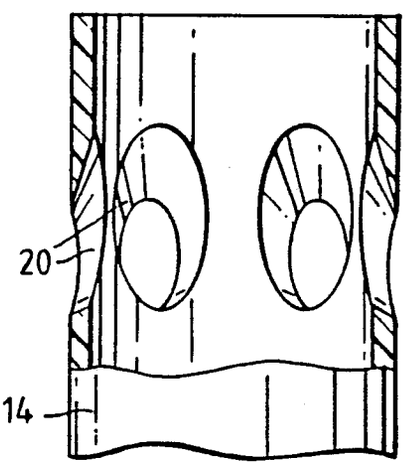

Fig.6.