SPECIFICATION
Hand grenade

The invention relates to a hand grenade having a fragmentation body filled with explosive and a detonator head from which a detonator tube with a detonator projects into the lower half of the interior of the fragmentation body.

The fragmentation body of a hand grenade is usually a cast iron member or a member of plastics material with metal fragments embedded therein. Detonation of the explosive causes the fragmentation body to break up and the fragments thereof to be scattered. The breaking-up of the fragmentation body and the energy which is imparted to the fragments is not usually distributed uniformly over the fragmentation body. It would be theoretically be possible to achieve approximately uniform scatter of the fragments if the fragmentation body were spherical and if detonation of the explosive charge began at the centre of the sphere, that is to say, the centre of the sphere was the detonation firing point. In this case, a spherical wave front of the detonation wave originating from the detonation firing point would reach all points on the spherical inside surface of the fragmentation body simultaneously and would there apply its energy uniformly to the spherical inner surface of the fragmentation body, resulting in the fragments being scattered uniformly in all directions. In practice however, hand grenades are not a spherical configuration in most cases, but are approximately egg-shaped as this shape is more easily handled than the spherical shape, when the hand grenade is of large volume. In particular in such approximately egg-shaped hand grenades, the detonation firing point is not at the centre of the explosive-filled interior of the fragmentation body, but in most cases is in the lower half of the interior of the hand grenade, *i.e.* at a position remote from the detonator head, for it is in the lower half of the interior of the hand grenade that the detonator is located, in the detonator tube which is connected to the detonator head.

Initiation of explosion of the explosive charge is effected at the detonator. In such a hand grenade, the spherical wave front of the detonation wave whose centre (detonation firing point) is in the lower half of the interior of the hand grenade reaches the lower regions of the fragmentation body first so that the lower region of the fragmentation body is preferentially broken up, with a lower energy level imparted to fragments of the upper region of the fragmentation body, in particular the 'neck region' or 'shoulder region' around the detonator head.

According to the invention there is provided a hand grenade having a fragmentation body filled with explosive, a detonator head and a detonator tube, in which the interior of the hand grenade is sub-divided into two chambers of which a lower chamber has a height of at least half the total height of the interior of the hand grenade and has a curved side wall which projects inwardly at its upper end to form an annular rib, which annular rib forms a construction to effect the sub-division of the interior into said two chambers comprising the lower chamber and an upper one of the chambers, the detonation tube extending from the detonation head through the upper chamber into the lower chamber.

The fragmentation body of a hand grenade according to the invention can break up more uniformly than the bodies of previously proposed hand grenades so that fragments thereof are scattered generally uniformly over the entire surface of the fragmentation body, resulting in an improvement in the fragment penetration capacity of the hand grenade.

Detonation of the explosive charge which is in the interior of the hand grenade between the detonator tube and the fragmentation body originates from the detonator at the lower end of the detonator tube, when the hande grenade is detonated, and causes a detonation wave to be propagated in the lower chamber of the hand grenade. This detonation wave is propagated at least approximately normal to the inside wall of the fragmentation body in the region of the lower chamber, and results in intensive scatter of fragments of the fragmentation body which formed the wall of the lower chamber. For the above-described propagation of the detonation wave in the lower chamber of the interior of the hand grenade, it is desirable for the diameter of the lower chamber to be of approximately the same dimension as the height of the lower chamber.

Due to the interior of the hand grenade being sub-divided into two chambers by the annular rib which separates the two chambers, in conjunction with the surface of the detonation tube, the detonation wave is influenced in such a way that a wave front is also formed in the upper chamber above the annular rib, which wave front is propagated as perpendicularly as possible relative to the inside wall of the fragmentation body. The detonation wave originates from the detonation firing point in the region of the detonating cap, is reflected at the annular rib, which acts, so-to-speak, as a wave forming means, between the upper and lower chambers of the interior of the hand grenade, and is projected by the detonator tube against the inside wall of the upper chamber of the hand grenade body, whereby the region of the fragmentation body ('neck or shoulder region') which is disposed around the detonator body is also broken up and the fragments of this part of the body are also scattered intensively.

This effect is particularly influenced by the height of the lower chamber in relation to the overall height of the interior of the fragmentation body or in relation to the height of the upper chamber. Particularly favourable results are attained if the lower chamber extends approximately over two thirds of the overall height of the interior of the hand grenade, or the upper chamber extends over approximately one third of the overall height of the interior of the hand

grenade.

A further influence on the propagation of the detonation wave in the upper chamber of the hand grenade, is also exerted by the shape of the annular rib which separates the lower chamber from the upper chamber in the interior of the hand grenade. It is advantageous for the rib to be of an approximately triangular cross-section. The triangular cross-sectional configuration of the annular rib is preferably symmetrical with respect to the plane of separation the upper and lower chambers, and is therefore in the form of an equilateral triangle. The faces of the rib, which are directed one towards the upper chamber and the other towards the lower chamber, are advantageously of concave curvature.

Furthermore, for achieving the desired propagation of the detonation wave in the upper chamber of the fragmentation body, it is advantageous for the constriction formed by the annular rib to be of a diameter which is greater than half the inside diameter of the upper or lower chamber respectively, which not only provides the propagation of the detonation wave from the lower into the upper chamber is not prevented but also avoids (in conjunction with the feature of the triangular cross-sectional shape of the annular rib) an excessive concentration of mass in the region of the annular rib, and thus non-uniform fragmentation scatter.

The shape of the detonator tube can also influence uniform scatter. It is advantageous for the portion of the detonator tube located in the upper chamber to be of a tapered configuration with the oustide diameter of the detonator tube increasing conically in an upward direction.

The feature of the side walls of the lower chamber being curved in the same direction is intended to prevent the detonation wave being dispersed at the side wall of the lower chamber. However, the side wall may show minor deviations from the construction with curvature in the same direction, such as for example moulding projections for producing the fragmentation body injection moulding.

Uniform fragment scatter can occur in a particularly clear manner in a hand grenade in which the fragmentation body comprises a multiplicity of individual metal fragments which are embedded in a carrier layer which is preferably of a plastics material.

The invention is diagrammatically illustrated by way of example in the accompanying drawing, which shows a hand grenade according to the invention with the detonator head and the detonator tube in side view, but with the hand grenade body in vertical longitudinal section.

Referring to the drawing, a hand grenade has a detonator head 1 to which a safety lever 2 is fixed and secured by a pin 3. The safety lever 2 holds a striker (not shown in the drawing) in a stressed position. A detonator tube 4 is connected to the detonator head 1 by a screw connection, and includes (as viewed in a downward direction) a primer capsule, a delay composition and a heat-ignited detonator.

The hand grenade body shown in cross-section in the drawing comprises an outer casing 5 of an impact-resistant plastics material, for example polyethylene, and a fragmentation body 6 of plastics material, for example polystyrene with metal fragments embedded therein. The interior of the fragmentation body 6 is filled with explosive, such as TNT, PETN or a like explosive.

The interior of the hand grenade is sub-divided into two chambers 7 and 8 by an annular rib 9. The lower chamber 7 has a substantially smooth symmetrical side wall. This also applies, in the embodiment illustrated, in regard to the upper chamber 8. The side walls of the two chambers 7 and 8 curve inwardly to form the annular rib 9.

In the embodiment illustrated, the height of the lower chamber 7 comprises approximately two thirds of the total height of the interior of the hand grenade with the height of the upper chamber forming the remaining third of the height of the interior of the hand grenade.

In the embodiment illustrated, the annular rib 9 which separates the lower chamber 7 from the upper chamber 8 is of an approximately triangular cross-sectional shape, with a face 10 directed towards the lower chamber 7 and a face 11 directed towards the upper chamber 8 each having a slight concave curvature.

The lower portion of the detonator tube 4, which contains the detonating cap, projects into the lower chamber 7, so that the detonation firing point is approximately at the centre of the lower chamber 7. The portion of the detonation tube 4 which extends through the upper chamber 8 is of a conical outside configuration, and has a cone portion 12 of wood or plastics material, for example polyethylene, which increases in diameter in an upward direction engaged over the otherwise cylindrical detonator tube 4.

It has been found that with a hand grenade as in the illustrated embodiment, on the basis of the technical effect described in the preamble to this description, it was possible for the fragmentation penetration capacity of the hand grenade to be increased by more than 10%, in comparison with a hand grenade of conventional structure with the same explosive charge and the same number of metal fragments embedded in the fragmentation body.

CLAIMS

1. A hand grenade having a fragmentation body filled with explosive, a detonator head and a detonator tube, in which the interior of the hand grenade is sub-divided into two chambers of which a lower chamber has a height of at least half the total height of the interior of the hand grenade and has a curved side wall which projects inwardly at its upper end to form an annular rib, which annular rib forms a constriction to effect the sub-division of the inerior into said two chambers comprising the lower chamber and an upper one of the chambers, the detonation tube extending from the detonator head through the upper

grenade.

A further influence on the propagation of the detonation wave in the upper chamber of the hand grenade, is also exerted by the shape of the annular rib which separates the lower chamber from the upper chamber in the interior of the hand grenade. It is advantageous for the rib to be of an approximately triangular cross-section. The triangular cross-sectional configuration of the annular rib is preferably symmetrical with respect to the plane of separation the upper and lower chambers, and is therefore in the form of an equilateral triangle. The faces of the rib, which are directed one towards the upper chamber and the other towards the lower chamber, are advantageously of concave curvature.

Furthermore, for achieving the desired propagation of the detonation wave in the upper chamber of the fragmentation body, it is advantageous for the constriction formed by the annular rib to be of a diameter which is greater than half the inside diameter of the upper or lower chamber respectively, which not only provides the propagation of the detonation wave from the lower into the upper chamber is not prevented but also avoids (in conjunction with the feature of the triangular cross-sectional shape of the annular rib) an excessive concentration of mass in the region of the annular rib, and thus non-uniform fragmentation scatter.

The shape of the detonator tube can also influence uniform scatter. It is advantageous for the portion of the detonator tube located in the upper chamber to be of a tapered configuration with the oustide diameter of the detonator tube increasing conically in an upward direction.

The feature of the side walls of the lower chamber being curved in the same direction is intended to prevent the detonation wave being dispersed at the side wall of the lower chamber. However, the side wall may show minor deviations from the construction with curvature in the same direction, such as for example moulding projections for producing the fragmentation body injection moulding.

Uniform fragment scatter can occur in a particularly clear manner in a hand grenade in which the fragmentation body comprises a multiplicity of individual metal fragments which are embedded in a carrier layer which is preferably of a plastics material.

The invention is diagrammatically illustrated by way of example in the accompanying drawing, which shows a hand grenade according to the invention with the detonator head and the detonator tube in side view, but with the hand grenade body in vertical longitudinal section.

Referring to the drawing, a hand grenade has a detonator head 1 to which a safety lever 2 is fixed and secured by a pin 3. The safety lever 2 holds a striker (not shown in the drawing) in a stressed position. A detonator tube 4 is connected to the detonator head 1 by a screw connection, and includes (as viewed in a downward direction) a primer capsule, a delay composition and a heat-ignited detonator.

The hand grenade body shown in cross-section in the drawing comprises an outer casing 5 of an impact-resistant plastics material, for example polyethylene, and a fragmentation body 6 of plastics material, for example polystyrene with metal fragments embedded therein. The interior of the fragmentation body 6 is filled with explosive, such as TNT, PETN or a like explosive.

The interior of the hand grenade is sub-divided into two chambers 7 and 8 by an annular rib 9. The lower chamber 7 has a substantially smooth symmetrical side wall. This also applies, in the embodiment illustrated, in regard to the upper chamber 8. The side walls of the two chambers 7 and 8 curve inwardly to form the annular rib 9.

In the embodiment illustrated, the height of the lower chamber 7 comprises approximately two thirds of the total height of the interior of the hand grenade with the height of the upper chamber forming the remaining third of the height of the interior of the hand grenade.

In the embodiment illustrated, the annular rib 9 which separates the lower chamber 7 from the upper chamber 8 is of an approximately triangular cross-sectional shape, with a face 10 directed towards the lower chamber 7 and a face 11 directed towards the upper chamber 8 each having a slight concave curvature.

The lower portion of the detonator tube 4, which contains the detonating cap, projects into the lower chamber 7, so that the detonation firing point is approximately at the centre of the lower chamber 7. The portion of the detonation tube 4 which extends through the upper chamber 8 is of a conical outside configuration, and has a cone portion 12 of wood or plastics material, for example polyethylene, which increases in diameter in an upward direction engaged over the otherwise cylindrical detonator tube 4.

It has been found that with a hand grenade as in the illustrated embodiment, on the basis of the technical effect described in the preamble to this description, it was possible for the fragmentation penetration capacity of the hand grenade to be increased by more than 10%, in comparison with a hand grenade of conventional structure with the same explosive charge and the same number of metal fragments embedded in the fragmentation body.

CLAIMS

1. A hand grenade having a fragmentation body filled with explosive, a detonator head and a detonator tube, in which the interior of the hand grenade is sub-divided into two chambers of which a lower chamber has a height of at least half the total height of the interior of the hand grenade and has a curved side wall which projects inwardly at its upper end to form an annular rib, which annular rib forms a constriction to effect the sub-division of the inerior into said two chambers comprising the lower chamber and an upper one of the chambers, the detonation tube extending from the detonator head through the upper

chamber into the lower chamber.

2. A hand grenade according to claim 1, in which the lower chamber has a height equal to approximately two thirds of the height of the interior of the hand grenade.

3. A hand grenade according to claim 1, in which the diameter of the lower chamber is substantially equal to the height of the lower chamber.

4. A hand grenade according to any one of claims 1 to 3, in which the annular rib which forms the constriction between the lower chamber and the upper chamber has a triangular cross-section.

5. A hand grenade according to claim 4, in which the faces of the annular rib which are directed one towards the lower chamber and the other towards the upper chamber have a slight concave curvature.

6. A hand grenade according to any one of claims 1 to 5, in which the constriction formed by the annular rib is of a diameter which is greater than half the maximum inside diameter of the upper chamber or the lower chamber.

7. A hand grenade according to any one of claims 1 to 6, in which the portion of the detonator tube located in the upper chamber is of a tapered configuration with the oustide diameter of the detonator tube increasing conically in an upward direction.

8. A hand grenade according to claim 7, in which the tapered portion of the detonator tube is formed by a conical plastics member which is engaged over the otherwise cylindrical detonator tube.

9. A hand grenade according to any one of claims 1 to 8, in which both in the region of the lower chamber and in the region of the upper chamber the fragmentation body comprises a plurality of individual metal fragments embedded in a carrier layer.

10. A hand grenade according to claim 9, in which the carrier layer is formed of a plastics material.

11. A hand grenade substantially as hereinbefore described and illustrated with reference to the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.