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(54) IMPROVEMENTS IN OR RELATING TO GRENADES FOR PROJECTING FROM HAND FIRE-ARMS

We, DYNAMIT NOBEL AKTIENGESELLSCHAFT, a German company, of 521 Troisdorf, Near Cologne, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to grenades for firing from hand fire-arms, more particularly, but not exclusively to grenades for the projection of tear gas or flare substances.

Grenades are a class of device which may be projected by hand or fired from a hand fire-arm such as a rifle or pistol on the muzzle of which they are fitted. The term "hand fire-arm" is used herein to mean a rifle or pistol from which a grenade can be projected. The grenade contains a so-called secondary charge which comprises a percussion fuse which initiates the firing thereof when the target is hit. The grenades for firing from a hand fire-arm are fitted on to the front end of the barrel of the fire-arm, generally with the assistance of an auxiliary device attached to the muzzle, and can be projected over relatively long or relatively short distances, depending for example on their weight, shape and the propellent charge by which they are fired.

Furthermore, ammunition comprising a solid body which generates irritant gases on smouldering and which can be thrown by hand or projected using a hand fire-arm, is described in German Auslegeschrift No. 1,933,029. The ignition of such ammunition can be initiated either by hand immediately before a throwing operation, by using a friction fuse, or can be initiated only at the target by using a percussion fuse.

Ammunition which is to be thrown by hand has the disadvantage that the maximum throwing range is often too short. Furthermore, the kinetic energy of the thrown ammunition may not be sufficient to cause the ammunition to enter closed rooms through closed windows or doors. These disadvantages do not of course exist with ammunition which is to be fired with firing arrangements such as rifles but in this case the ignition of the ammunition can only be initiated by means of a percussion fuse on striking the target and as a result the generation of the irritant gases only starts at the target. This late generation and emission of the irritant gases does however involve the danger that the ammunition can be picked up by demonstrators or terrorists and can be thrown back again. As a consequence the ammunition may not fulfil its purpose and may even have an effect opposite to the desired effect if it is returned to the region of the firing position. Furthermore, for the satisfactory functioning of the percussion fuse, it is a prerequisite that the ammunition should strike a relatively hard surface within a range of impact angles which depends on the fuse construction.

According to the present invention, there is provided a grenade for firing from a hand fire-arm as hereinbefore defined, comprising a grenade body for housing a secondary charge, a launching tube by means of which the grenade can be pushed on to the muzzle of a said fire-arm and an ignition section for said charge adapted to remain bound to the grenade while the grenade is in flight and including igniter means which is impact operative and which is arranged at the end of the grenade which is, in use, adjacent the muzzle of the fire-arm by which the grenade is to be projected and a pyrotechnic delay section disposed between the igniter means and the secondary charge, the ignition section further comprising a striker member which is constrained to remain spaced apart from the igniter means and which is adapted to be projected towards the igniter means with sufficient energy to actuate it when the grenade is projected by said fire-arm on ignition of a primary charge utilised in the fire-arm.

By constructing the grenade in accordance with this invention, ignition thereof

can thus already be initiated on firing the grenade as a result of the striker member being driven towards the igniter element under the pressure effect of the propellent gases produced by the propellent cartridge (primary charge) inserted into the cartridge chamber of the fire-arm. In this way, the satisfactory ignition of the grenade is reliably guaranteed, completely independently of impact surface and angle. The igniting impulse produced in the ignition section is transmitted to the combustible charge to be actually ignited with a certain time delay owing to the provision of the delay section. The length of this delay can be pre-established as required by suitably selecting the composition of the pyrotechnic mixture, and hence its burning speed, and also the length of the delay section. It is thus possible to ensure that the charge arranged following the delay section is ignited only after the grenade has covered a certain distance from the firing position.

The secondary charge in a grenade according to this invention is preferably of a type which liberates tear gas or flare substances when ignited. To achieve such a result, a conventional smouldering composition for generating tear gas, or a flare composition equipped with an ejector and an igniter charge, is arranged following the pyrotechnic delay section. If necessary, when a flare composition is used, the grenade can be provided with a parachute so as to achieve a slowest possible descent of the burning flare. It is however obvious that the grenade can also be used for projecting other types of charges including those generating irritant gases, smoke as in smoke-generating marking charges or fog.

So as to prevent an unintentional ignition of the grenade taking place perhaps as a result of the grenade's accidentally falling to the ground, the striker member is held in a safe position at a distance from the igniter means. For this purpose, the striker member can be connected to the launching tube at a suitable position by a connecting structure having zones of predetermined weakness, the strength thereof being such that only when a prescribed propellent gas pressure is reached as on firing the grenade is the striker member separated from the launching tube and driven against the igniter means. A particularly inexpensive method of ensuring that the striker member is projected towards the igniter means, more particularly with directional guidance, when such a connecting structure is ruptured is to provide for the striker member to be held by means of at least one spring element in spaced relation from the igniter element. A cylindrical or a conical helical spring, or one or more plate springs, can be used for this purpose.

In order that the ignition section should be compact, easily assembled and capable of satisfactorily withstanding the gas pressure and acceleration forces set up on firing the grenade, the igniter means is preferably inserted with a friction fit in a central through bore of an ignition support body from one end thereof, while the pyrotechnic delay section or length, in a casing therefor, is preferably inserted in the ignition support body from the other end, preferably by means of a threaded connection. The ignition support body is made of metal, advantageously aluminium. In addition the striker member can then be designed to be axially displaceable in a sleeve-like extension of the ignition support body which projects rearwardly beyond the igniter means. The construction of a grenade according to this invention can be usefully simplified if the ignition support body serves to connect the grenade body and the launching tube. The separate parts can be screwed to one another, if necessary with the use of separate supporting discs and/or holding nuts.

So as to ensure that the pyrotechnic mixture of the delay section burns away satisfactorily within the required time interval, even under unfavourable circumstances, it is preferred that an ignition support body as described in the preceding paragraph should comprise at least one gas discharge passage leading from the central bore in the region between the actuation means and the delay section. Two or more such gas discharge passages which are symmetrically distributed are preferably provided. These passages connect the space between the igniter means and the delay section with another space, for example that in the interior of the launching tube, so that the combustion gases of the pyrotechnic mixture are able to flow into this latter space and as a result the mixture is able to burn away under a practically constant pressure. This additional space, can also be an empty space which is provided around the casing of the pyrotechnic delay section.

Although the grenades of this invention will generally be fired in conventional manner using a propellent cartridge as the primary charge, it is possible to design them so that they can be fired using live ammunition. In this case, the striker member can be combined with a target device which is arranged with a tight fit in the launching tube which acts as a casing for the ignition section and is projected forwardly under the action of a striking live bullet which impinges thereon. The target device, which is for example made of high-grade steel, is easily deformed under the impact of the bullet and is driven forward with the striker member against the igniter means in a bush-

ing which is preferably fitted into the launching tube with a strong frictional fit with respect to the inside wall thereof. By suitable choice of material for the target device and of the radial clearance between the latter and the bushing, it is possible to determine as required what proportion of the kinetic energy of the bullet driven through the weapon barrel is converted into heat and as a result is dissipated. In order to ensure that the bullet does not rebound on hitting the target device and thus be directed back into the weapon barrel, the target device is preferably formed with a blind bore starting from the rearward end. The blind bore preferably extends over about three quarters of the length of the target device and its internal diameter is preferably so chosen as to be somewhat smaller than the bullet calibre, so that the bullet, after penetrating into the blind bore, is securely caught in the latter.

When at least one gas discharge passage is provided for the delay section, the possibility of penetration of moisture therethrough into the pyrotechnic mixture, for example, during the storage and the transport of the grenade, can be prevented by providing the launching tube which acts as a casing for the ignition section at its rearward end with a cover which is connected to it by a force-fit and/or by friction. The cover is removed before the grenade is fired. The cover can also serve at the same time to support a propellent cartridge, which is to be used to fire the grenade. Such a propellent cartridge can however also be pushed into the launching tube together with a sighting device for the grenade. Such a sighting device can be pushed on the muzzle of the fire-arm prior to firing and can take into account any variation of the flight path of the grenade which deviated from that of conventional projectiles fired from the weapon. In this way, the marksman can have at his immediate disposal all the parts which are necessary for the satisfactory firing of the grenade when it is to be fired from a rifle.

For a better understanding of the invention and to show how the same can be carried into effect, reference will now be made by way of example only to the accompanying drawings in which:—

Figure 1 shows a complete grenade according to this invention partly in longitudinal section;

Figure 2 is a part section of the grenade shown in Figure 1 to a larger scale;

Figure 3 is a modification of the grenade of Figures 1 and 2;

Figure 4 is another modification of the grenade of Figures 1 and 2;

Figure 5 shows a complete grenade, partly in section and comprising a cover fitted into the launching tube thereof, and

Figure 6 is a modification of the grenade of Figure 5.

In the various figures of the drawings, like reference numerals are used to denote like parts.

Referring to Figure 1, the grenade comprises a launching tube 2 with a tail unit 3 fitted into the rearward end of the body 1 of the grenade. The grenade body 1 is preferably made of synthetic plastics material, more particularly a thermoplastic synthetic plastics material, and houses for example a smouldering composition, flare composition or any other type of combustible charge of a type employed in grenades to be fired from hand fire-arms. The grenade body 1 is tightly closed at the forward end by means of a hood 4 which is fitted thereon and is preferably welded to it around the circumference of the grenade. Arranged in the region of the connection between the grenade body 1 and launching tube 2 is an igniter support body 5 which is made of metal, for example, aluminium. The tail unit 3 which is preferably made of synthetic plastics material, is pushed from the rear on to the launching tube 2, which is made of metal, preferably aluminium, and is held by means of a spring ring.

The construction of the grenade in the region of the connection between the grenade body 1 and the launching tube 2 can be seen from Figure 2 to include an igniter element 6 and a pyrotechnic delay section 7 arranged in a case (element 6 and the case are shown in elevation). The igniter element 6 is friction fitted into the rear end of a through bore 8 in the igniter support body 5, while the rear end of the pyrotechnic delay section 7 is screwed into the bore 8. A striker member 10, made for example of aluminium, is inserted in a widened extension 9 of the bore 8 in the igniter support body 5 so as to be axially displaceable, being held by means of a spring ring or circlip 11. It is held apart from the element 6 by means of a helical spring 12. The bore 8 is connected through two gas discharge passages 13 to the interior of the launching tube 2. The igniter support body 5 is formed on its end facing the grenade body 1 with an annular collar 14, on which bear a support disc 15 and the base 16 of the grenade body 1 which are reliably held in this position by means of the launching tube 2 which is screwed on to the igniter support body 5 by means of a screw connection 17. Fitted into the forward end of the delay section 7 are black powder elements 18, which serve in conventional manner for propagating the firing impulse to the ignitable charge in the grenade body 1, which is not shown in full. The formation and arrangement of the different charges, of which only the rear-

most charge represented at 19 is shown can be entirely conventional.

Referring next to Figure 3 there is shown part of another grenade whose igniter support body 5, again made of metal, is formed with an external diameter which is the same as that of the grenade body 1. The launching tube 2 is screwed into the rear of the support body 5 by means of a screw connection 20, while the grenade body 1 is pushed on from the front and is fixed with a holding nut 21. The connection hereby achieved between grenade body 1 and launching tube 2 has a greater strength than the connection shown in Figure 2, while having the same external diameter, and is capable of being made from the same materials. Such a form of connection is particularly suitable for use with grenades which are heavier or are to be projected to a greater distance, since these require a higher firing pressure. An additional advantage of the igniter support body 5 being constructed as shown in Figures 3 is the radial arrangement of the gas discharge passages 13, since these can be more easily produced than the gas discharge passages 13 which are shown in Figure 2 and which extend obliquely towards the rear. These radial gas discharge passages 13 are connected by way of annular turned recess 22 and bores 23 provided in the holding nut 21 with an additional space 24, into which the gases being formed as the pyrotechnic delay section 7 burns away are able to escape. The additional space 24 is an annular space formed in a part 25 which is advantageously injection-moulded from synthetic plastics material. Following this part 25 are arranged additional charges, cover discs, etc., of which only a part 26 is indicated, of any suitable flare, irritant gas, marking or other composition. The striker member 10 made of metal bears at the forward end of the launching tube 2 against a shoulder 27. The striker member is supported on the ignition support body 5 by the spring element 12 here constructed as a plate spring.

The grenade part of which is shown in Figure 4 differs from that which is shown in Figure 3 in respect of the construction of the striker member 10, which is made in one piece with a target device 28 made of high-strength steel. The target device 28 is inserted with a tight fit into a bushing 29, which is likewise made of high-strength steel and is clamped in the launching tube 2 between the ignition support 5 and a shoulder 27 so that the striker member 10 is held together with the target device 28 in a safe position spaced from the element 6. A blind bore 30 which starts from the rearward end of the target device 28 is shown in broken lines.

The grenade which is shown in Figure 5 is so designed that the launching tube 2 is provided at its rearward end with a cover 31 inserted with a friction fit thereinto. The cover comprises a gripping strap 32 for facilitating its removal before firing the grenade. A propellent cartridge 33 is so fitted into the cover 31 that the required tight seal of the launching tube 2 is guaranteed. The tail unit 3 pushed on to the launching tube 2 is held by means of a safety ring 34. The grenade shown in Figure 6 differs from that shown in Figure 5 in that the propellent cartridge 33 is fitted into an additional sight 35 which is pushed into the launching tube 2. The cover 31 is provided at the rearward end of the sight 35, being inserted with a frictional fit into the launching tube 2.

Before firing, the marksman removes the cover 31, withdraws the additional sight 35 if present with the propellent cartridge 33 and then fits cartridge supporting parts 31 and 33, or any other suitable cartridge and other necessary parts into or on to the weapon which is to fire the grenade.

The grenade is fitted on the muzzle of the fire-arm, the launching tube 2 fitting over the muzzle. The fire-arm will then be fired and the propellent gases produced by the propellent charge cartridge will cause the grenade to leave its mounting on the muzzle of the fire-arm and travel towards its target. In the case of a grenade constructed as shown in Figures 1 and 2, the pressure of the gases will be sufficient to break the connection of the striker member 10 to the sleeve like extension 9 of the bore 8 in the ignition support body and drive the striker member forward against the spring 12 towards the element 6. In the case of the grenade constructed as shown in Figure 3, the gas pressure will force the striker member 10 forward from its abutment with the shoulder 27 under the constraining effect of the plate spring 12. The grenade constructed as shown in Figure 4 will be fired by a 'live' cartridge whose bullet will enter the blind passage 30 and drive forward the target device 28 carrying the striker member 10 so that the latter strikes the element 6.

In each case the impact of the striker member 12 on the element 6 will be with sufficient force to actuate the ignition means therein which in turn ignites the delay section 7 which eventually ignites the ignition means 18 for the grenade charge.

The construction of the grenade according to the invention makes it possible, in advantageous manner, for this grenade, when projecting irritant gas substances, to be easily fired over distances of 75 to 100 metres and to reliably enter closed rooms through windows or doors. The grenade body will be of suitable strength and will

penetrate a window pane or door, if fired at such and either remains stuck in the latter or drops into the room, so that the irritant gas is able to escape into the room through discharge openings arranged at the forward end of the grenade body to temporarily incapacitate persons who are in said room. The discharge openings can be formed in the hood or nose of the grenade body as regions of smaller wall thickness, which split open in a defined manner when a certain gas pressure is reached inside the grenade body.

WHAT WE CLAIM IS:—

1. A grenade for firing from a hand fire-arm as hereinbefore defined, comprising a grenade body for housing a secondary charge, a launching tube by means of which the grenade can be pushed on to the muzzle of a said fire-arm and an ignition section for said charge adapted to remain bound to the grenade while the grenade is in flight and including igniter means which is impact operative and which is arranged at the end of the grenade which is, in use, adjacent the muzzle of the fire-arm by which the grenade is to be projected and a pyrotechnic delay section disposed between the igniter means and the secondary charge, the ignition section further comprising a striker member which is constrained to remain spaced apart from the igniter means and which is adapted to be projected towards the igniter means with sufficient energy to actuate it when the grenade is projected by said fire-arm on ignition of a primary charge utilised in the fire-arm.

2. A grenade as claimed in Claim 1, which contains in the grenade body a secondary charge which comprises a smoulderable substance which emits an irritant gas on smouldering.

3. A grenade as claimed in Claim 1, in which the secondary charge comprises a signal charge.

4. A grenade as claimed in Claim 3, which additionally comprises a parachute in the grenade body.

5. A grenade as claimed in any one of the preceding claims, in which the ignition section is housed in said launching tube.

6. A grenade as claimed in any one of the preceding claims, in which the igniter means and the pyrotechnic delay section are sequentially housed in a through bore in an ignition support body.

7. A grenade as claimed in Claim 6, in which the igniter means is friction fitted into one end of said bore and an encased pyrotechnic delay charge enters into screw-threaded engagement with the other end of said bore.

8. A grenade as claimed in Claim 6 or 7 when appendant to Claim 5, in which the ignition support body connects together the grenade body and said launching tube.

9. A grenade as claimed in any one of Claims 6 to 8, in which at least one gas discharge passage communicates said bore with the exterior of the ignition support body.

10. A grenade as claimed in Claim 9, which comprises at least two said gas discharge passages symmetrically arranged around the ignition support body.

11. A grenade as claimed in any one of the preceding claims, in which the striker member is constrained to remain spaced apart from the igniter means by spring means.

12. A grenade as claimed in any one of Claims 5 to 10, in which the striker member is capable of being projected towards the igniter means by the pressure of gases produced on firing the firearm.

13. A grenade as claimed in any one of Claims 5 to 12, in which the striker member is connected to said launching tube by connecting means having a zone or zones of predetermined weakness.

14. A grenade as claimed in any one of Claims 5 to 10, in which the striker member is mounted on a target device arranged with a tight fit in the launching tube and serving for impacting thereon in use of a bullet released from ammunition used in firing the fire-arm.

15. A grenade as claimed in Claim 14, in which the target device is arranged with a tight fit in a bushing fitted into said launching tube.

16. A grenade as claimed in Claim 15 when appendant to Claim 6, in which the bushing is clamped between the ignition support body and an annular shoulder formed in said launching tube.

17. A grenade as claimed in Claim 16, in which both the target device and the bushing are made of metal.

18. A grenade as claimed in any one of Claims 14 to 17, in which the target device comprises a blind bore open at its rear end.

19. A grenade as claimed in any one of the preceding claims, which comprises a cover fitted over the rear end of the launching tube in a force and/or friction fit.

20. A grenade as claimed in Claim 19, in which a propellent cartridge for firing said fire-arm is fitted into the cover.

21. A grenade as claimed in Claim 5 or any one of Claims 6 to 19 when appendant to Claim 5 in which a propellent cartridge for firing said fire-arm is fitted into said launching tube together with a sight for use in firing the fire-arm.

penetrate a window pane or door, if fired at such and either remains stuck in the latter or drops into the room, so that the irritant gas is able to escape into the room through discharge openings arranged at the forward end of the grenade body to temporarily incapacitate persons who are in said room. The discharge openings can be formed in the hood or nose of the grenade body as regions of smaller wall thickness, which split open in a defined manner when a certain gas pressure is reached inside the grenade body.

WHAT WE CLAIM IS:—

1. A grenade for firing from a hand fire-arm as hereinbefore defined, comprising a grenade body for housing a secondary charge, a launching tube by means of which the grenade can be pushed on to the muzzle of a said fire-arm and an ignition section for said charge adapted to remain bound to the grenade while the grenade is in flight and including igniter means which is impact operative and which is arranged at the end of the grenade which is, in use, adjacent the muzzle of the fire-arm by which the grenade is to be projected and a pyrotechnic delay section disposed between the igniter means and the secondary charge, the ignition section further comprising a striker member which is constrained to remain spaced apart from the igniter means and which is adapted to be projected towards the igniter means with sufficient energy to actuate it when the grenade is projected by said fire-arm on ignition of a primary charge utilised in the fire-arm.

2. A grenade as claimed in Claim 1, which contains in the grenade body a secondary charge which comprises a smouldering substance which emits an irritant gas on smouldering.

3. A grenade as claimed in Claim 1, in which the secondary charge comprises a signal charge.

4. A grenade as claimed in Claim 3, which additionally comprises a parachute in the grenade body.

5. A grenade as claimed in any one of the preceding claims, in which the ignition section is housed in said launching tube.

6. A grenade as claimed in any one of the preceding claims, in which the igniter means and the pyrotechnic delay section are sequentially housed in a through bore in an ignition support body.

7. A grenade as claimed in Claim 6, in which the igniter means is friction fitted into one end of said bore and an encased pyrotechnic delay charge enters into screw-threaded engagement with the other end of said bore.

8. A grenade as claimed in Claim 6 or 7 when appendant to Claim 5, in which the ignition support body connects together the grenade body and said launching tube.

9. A grenade as claimed in any one of Claims 6 to 8, in which at least one gas discharge passage communicates said bore with the exterior of the ignition support body.

10. A grenade as claimed in Claim 9, which comprises at least two said gas discharge passages symmetrically arranged around the ignition support body.

11. A grenade as claimed in any one of the preceding claims, in which the striker member is constrained to remain spaced apart from the igniter means by spring means.

12. A grenade as claimed in any one of Claims 5 to 10, in which the striker member is capable of being projected towards the igniter means by the pressure of gases produced on firing the firearm.

13. A grenade as claimed in any one of Claims 5 to 12, in which the striker member is connected to said launching tube by connecting means having a zone or zones of predetermined weakness.

14. A grenade as claimed in any one of Claims 5 to 10, in which the striker member is mounted on a target device arranged with a tight fit in the launching tube and serving for impacting thereon in use of a bullet released from ammunition used in firing the fire-arm.

15. A grenade as claimed in Claim 14, in which the target device is arranged with a tight fit in a bushing fitted into said launching tube.

16. A grenade as claimed in Claim 15 when appendant to Claim 6, in which the bushing is clamped between the ignition support body and an annular shoulder formed in said launching tube.

17. A grenade as claimed in Claim 16, in which both the target device and the bushing are made of metal.

18. A grenade as claimed in any one of Claims 14 to 17, in which the target device comprises a blind bore open at its rear end.

19. A grenade as claimed in any one of the preceding claims, which comprises a cover fitted over the rear end of the launching tube in a force and/or friction fit.

20. A grenade as claimed in Claim 19, in which a propellent cartridge for firing said fire-arm is fitted into the cover.

21. A grenade as claimed in Claim 5 or any one of Claims 6 to 19 when appendant to Claim 5 in which a propellent cartridge for firing said fire-arm is fitted into said launching tube together with a sight for use in firing the fire-arm.

22. A grenade for firing from a hand firearm, substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2, Figure 3 or Figure 4 of the accompanying drawings, optionally modified by either of Figures 5 and 6 of the accompanying drawings.

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