

SPECIFICATION

Methods of producing firing tubes for hand grenade fuses

5 This invention relates to methods of producing firing tubes for hand grenade fuses.

It is known for a firing tube for a hand grenade fuse to contain a delay-action
10 change. The delay-action charge in the firing tube causes a delay in detonation, in order to avoid endangering the thrower of the grenade, after the grenade has been thrown, when a safety lever has been released and a
15 firing primer is impacted. After the delay-action charge has burnt away, a flash issues from an open end of the firing tube and initiates a detonator charge (for example, as disclosed in US Patent No. 2 562 928). Now
20 it may happen, particularly when such fuses are mass-produced, that the primer is not filled with the delay-action charge, or is not sufficiently filled. In the former case, the flash of fire which is emitted by the primer directly
25 strikes the detonator charge so that the hand grenade detonates immediately upon being thrown. In the latter case, although the flash hits the delay-action charge, the delay is too short and the hand grenade detonates while
30 still in flight.

In order to avoid immediate detonation of a hand grenade, that is to say, when there is no delay-action charge, Austrian Patent Specification No. 335 314 provides a safety disc
35 which closes off the firing tube relative to the detonator charge, the disc being of such a size that it melts through only when a lowermost part of the delay-action charge is ignited, but does not melt through when there is no
40 delay-action charge, and the flash from the firing primer hits the safety disc. Therefore, firing of the detonator charge when the delay-action charge is present depends on the properties of the material of the safety disc. In
45 addition, there is still the problem of the firing tube being incompletely filled, when the delay-action charge is too small and therefore the delay time is too short.

According to the present invention there is
50 provided a method of producing a firing tube, open at both ends, for a hand grenade fuse, to enable an associated detonator charge to be ignited only when a delay-action charge is contained in the firing tube, wherein the de-
55 lay-action charge is inserted into a firing tube which is closed at one end, and the filling height of the delay-action charge is subsequently measured, whereupon said one end of the firing tube is perforated only if the filling
60 height of the delay-action charge is sufficient.

A preferred method embodying the invention and described hereinbelow provides for the production of defect-free firing tubes, with which ignition of the detonator charge cannot
65 be initiated directly by a firing flash from a

primer but only by the delay-action charge, this being dependent not only on filling of the tube with the delay-action charge but also on the correct filling height of the delay-action
70 charge. The preferred method embodying the invention does not have to provide for the incorporation of a safety member in order to render any omission of the delay-action charge ineffective, as is the case for the
75 arrangement disclosed in the above-mentioned Austrian Patent Specification No. 335 314. Instead, the next manufacturing step directly following the filling operation, namely perforating said one end of the firing tube, is made
80 dependent on the presence of the delay-action charge. An additional and particularly advantageous and important effect which is achieved in this way is that the operation of perforating said one end of the firing tube is
85 not effected if the delay-action charge has not reached the required filling height. As the delay-action charge is generally in the form of a plurality of layers, the omission of a layer and also insufficient compacting of the layers
90 is detected. The firing tubes which have been improperly filled can now be removed directly from the production cycle. However, they may instead remain in the production cycle, particularly if the firing tube used is one in which
95 said one end does not melt under the flash of fire or jet of gas from the delay-action charge. Therefore, even when a firing tube which has been only partially filled is made up into a hand grenade fuse and the fuse is fitted into a
100 hand grenade, the hand grenade will not explode while being thrown.

The preferred method provides that, after the delay-action charge has been introduced into the firing tube, a test piston is inserted
105 into the firing tube to a desired filling height and a perforating punch is applied to said other end of the firing tube, whereupon the distance between the test piston and the perforating punch is reduced so that, depending
110 upon the actual filling height, the firing tube is either pushed on to the perforating punch, thereby perforating said one end of the firing tube, or is pushed further on to the test piston.

The above-mentioned preferred method embodying the invention will now be described in greater detail with reference to the accompanying drawings, to illustrate a preferred way of carrying the invention into effect, without
120 the invention however being limited thereto. In the drawings:

Figure 1 shows a view in longitudinal section through a hand grenade fuse;

Figure 2 shows the operation of punching a
125 firing tube which has been filled to the desired height, in accordance with a method embodying the present invention;

Figure 3 shows the corresponding operation when the filling height is insufficient; and

130 *Figures 4 and 5* show further embodiments

of a firing tube which is closed at one end, for use in the method embodying the invention.

A hand grenade fuse (Fig. 1) has a firing tube 1 with a delay-action charge 3 which is filled therewith and which is introduced for example in three layers 3', 3'' and 3'''. The firing tube 1 is open at both ends, with a percussion primer 6 fitted on to the upper end. The second end of the firing tube 1 has an opening 4 in the bottom portion 2. Fitted on to the second end is a carrier tube 7 for a detonator charge 5. After the percussion primer 6 is fired by a spring-loaded striker member, the flash of fire ignites the delay-action charge 3 which has been introduced up to a filling height *a* which ensures a sufficient delay. After the delay-action charge 3 has burnt away, the detonator charge 5 is fired by the flash of fire issuing through the opening 4. If there is no delay-action charge 3, the flash from the primer 6 strikes directly on the detonator charge 5 so that the hand grenade detonates immediately; if the delay-action charge does not reach the proper filling height *a*, then the delay is excessively short and the hand grenade detonates while still travelling through the air. The aim is to be able to eliminate both these situations as far as possible.

The method embodying the invention provides for perforating the bottom portion 2, that is to say, forming the opening 4, only when the amount of delay-action charge 3 introduced is the correct amount, that is to say, if all the layers 3', 3'' and 3''' in the illustrated embodiment are contained in the firing tube 1 (Fig. 2). As shown in Figs. 1 to 3, the firing tube 1 which is closed at one end may have for example an integral bottom portion 2; however, the bottom portion 2 may be fitted subsequently. Figs. 4 and 5 show firing tubes of this kind, by way of example. In Fig. 4, the bottom portion 2 thereof is formed by a disc 14 which is held in place by a flanged-over securing ring 13. Fig. 5 shows a firing tube 1 with an opening 4 at the detonator charge end, the opening 4 being closed before the delay-action charge 3 is introduced by a cup-shaped insert 15 which bears against the wall portion 16 of the firing tube 1, which is disposed around the opening 4 and which increases in thickness in an inward direction.

After the actual or presumed filling operation, the firing tube 1 is fitted on to a test piston 8 which is disposed on a support member 10. The piston 8 penetrates into the firing tube 1 to the desired filling height *a*. A perforating punch 9 which projects from the downwardly movable upper member 11 is applied to the bottom portion 2 of the firing tube and finally moved further downwardly so that the distance between the test piston 8 and the perforating punch 9 is reduced. If the delay-action charge 3 has been introduced to

the correct filling height *a* (see Fig. 2), it acts as an extension of the test piston 8, that is to say, the perforating punch 9 pushes through the bottom portion 2 or the disc 14 or the

insert 15, thereby forming the opening 4.

If however, as illustrated in Fig. 3, the amount of delay-action charge 3 which has been introduced is too small, and is therefore only at a filling height *b*, the reduction in the distance between the test piston 8 and the perforating punch 9 does not result in the opening being formed in the bottom portion 2 as the firing tube 1 is pushed further on to the piston 8, as there is a cavity 12 between the piston and the delay-action charge.

It is now possible for defective firing tubes of this kind to be removed from the production (operating) cycle; however, in order not to interrupt the production cycle, such firing tubes may be made up into hand grenade fuses and fitted into hand grenades, if the unperforated bottom portion 2 does not melt through under the effect of the delay-action charge, as in that case premature detonation cannot occur. Preferably, the firing tube 1 with an integral bottom portion 2 comprises nickel-plated brass. The disc 14 and the cup-shaped insert 15 may also comprise a copper-free aluminium-silicon-magnesium alloy. Various modifications may be made within the scope of the invention. Thus, for example, the operation of testing the filling height *a* may also be effected in a different manner, and, when the filling height is the insufficient height *b*, the firing tube is not even passed to the perforating operation. In addition, it is possible for the perforating operation not to be performed by a perforating punch. It could, for example, be effected by the bottom portion being severed by means of a radial cut, and the like.

CLAIMS

1. A method of producing a firing tube, open at both ends, for a hand grenade fuse, to enable an associated detonator charge to be ignited only when a delay-action charge is contained in the firing tube, wherein the delay-action charge is inserted into a firing tube which is closed at one end, and the filling height of the delay-action charge is subsequently measured, whereupon said one end of the firing tube is perforated only if the filling height of the delay-action charge is sufficient.
2. A method according to claim 1, wherein, after the delay-action charge has been introduced into the firing tube, a test piston is inserted into the firing tube to a desired filling height and a perforating punch is applied to said one end of the firing tube, whereupon the distance between the test piston and the perforating punch is reduced so that, depending upon the actual filling height, the firing tube is either pushed on to the perforating punch, thereby perforating said one end of



of a firing tube which is closed at one end, for use in the method embodying the invention.

A hand grenade fuse (Fig. 1) has a firing tube 1 with a delay-action charge 3 which is filled therewith and which is introduced for example in three layers 3', 3'' and 3'''. The firing tube 1 is open at both ends, with a percussion primer 6 fitted on to the upper end. The second end of the firing tube 1 has an opening 4 in the bottom portion 2. Fitted on to the second end is a carrier tube 7 for a detonator charge 5. After the percussion primer 6 is fired by a spring-loaded striker member, the flash of fire ignites the delay-action charge 3 which has been introduced up to a filling height *a* which ensures a sufficient delay. After the delay-action charge 3 has burnt away, the detonator charge 5 is fired by the flash of fire issuing through the opening 4. If there is no delay-action charge 3, the flash from the primer 6 strikes directly on the detonator charge 5 so that the hand grenade detonates immediately; if the delay-action charge does not reach the proper filling height *a*, then the delay is excessively short and the hand grenade detonates while still travelling through the air. The aim is to be able to eliminate both these situations as far as possible.

The method embodying the invention provides for perforating the bottom portion 2, that is to say, forming the opening 4, only when the amount of delay-action charge 3 introduced is the correct amount, that is to say, if all the layers 3', 3'' and 3''' in the illustrated embodiment are contained in the firing tube 1 (Fig. 2). As shown in Figs. 1 to 3, the firing tube 1 which is closed at one end may have for example an integral bottom portion 2; however, the bottom portion 2 may be fitted subsequently. Figs. 4 and 5 show firing tubes of this kind, by way of example. In Fig. 4, the bottom portion 2 thereof is formed by a disc 14 which is held in place by a flanged-over securing ring 13. Fig. 5 shows a firing tube 1 with an opening 4 at the detonator charge end, the opening 4 being closed before the delay-action charge 3 is introduced by a cup-shaped insert 15 which bears against the wall portion 16 of the firing tube 1, which is disposed around the opening 4 and which increases in thickness in an inward direction.

After the actual or presumed filling operation, the firing tube 1 is fitted on to a test piston 8 which is disposed on a support member 10. The piston 8 penetrates into the firing tube 1 to the desired filling height *a*. A perforating punch 9 which projects from the downwardly movable upper member 11 is applied to the bottom portion 2 of the firing tube and finally moved further downwardly so that the distance between the test piston 8 and the perforating punch 9 is reduced. If the delay-action charge 3 has been introduced to

the correct filling height *a* (see Fig. 2), it acts as an extension of the test piston 8, that is to say, the perforating punch 9 pushes through the bottom portion 2 or the disc 14 or the insert 15, thereby forming the opening 4.

If however, as illustrated in Fig. 3, the amount of delay-action charge 3 which has been introduced is too small, and is therefore only at a filling height *b*, the reduction in the distance between the test piston 8 and the perforating punch 9 does not result in the opening being formed in the bottom portion 2 as the firing tube 1 is pushed further on to the piston 8, as there is a cavity 12 between the piston and the delay-action charge.

It is now possible for defective firing tubes of this kind to be removed from the production (operating) cycle; however, in order not to interrupt the production cycle, such firing tubes may be made up into hand grenade fuses and fitted into hand grenades, if the unperforated bottom portion 2 does not melt through under the effect of the delay-action charge, as in that case premature detonation cannot occur. Preferably, the firing tube 1 with an integral bottom portion 2 comprises nickel-plated brass. The disc 14 and the cup-shaped insert 15 may also comprise a copper-free aluminium-silicon-magnesium alloy.

Various modifications may be made within the scope of the invention. Thus, for example, the operation of testing the filling height *a* may also be effected in a different manner, and, when the filling height is the insufficient height *b*, the firing tube is not even passed to the perforating operation. In addition, it is possible for the perforating operation not to be performed by a perforating punch. It could, for example, be effected by the bottom portion being severed by means of a radial cut, and the like.

CLAIMS

1. A method of producing a firing tube, open at both ends, for a hand grenade fuse, to enable an associated detonator charge to be ignited only when a delay-action charge is contained in the firing tube, wherein the delay-action charge is inserted into a firing tube which is closed at one end, and the filling height of the delay-action charge is subsequently measured, whereupon said one end of the firing tube is perforated only if the filling height of the delay-action charge is sufficient.
2. A method according to claim 1, wherein, after the delay-action charge has been introduced into the firing tube, a test piston is inserted into the firing tube to a desired filling height and a perforating punch is applied to said one end of the firing tube, whereupon the distance between the test piston and the perforating punch is reduced so that, depending upon the actual filling height, the firing tube is either pushed on to the perforating punch, thereby perforating said one end of



the firing tube, or it is pushed further on to the test piston.

3. A method of producing a firing tube, open at both ends, for a hand grenade fuse,
- 5 to enable an associated detonator charge to be ignited only when a delay-action charge is contained in the firing tube, the method being substantially as herein described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.