March 6, 1934. M. F. F. BIAZZI 1,950,019

DETONATOR

Filed April 20, 1932

FIG.1. FIG.2. FIG.3.

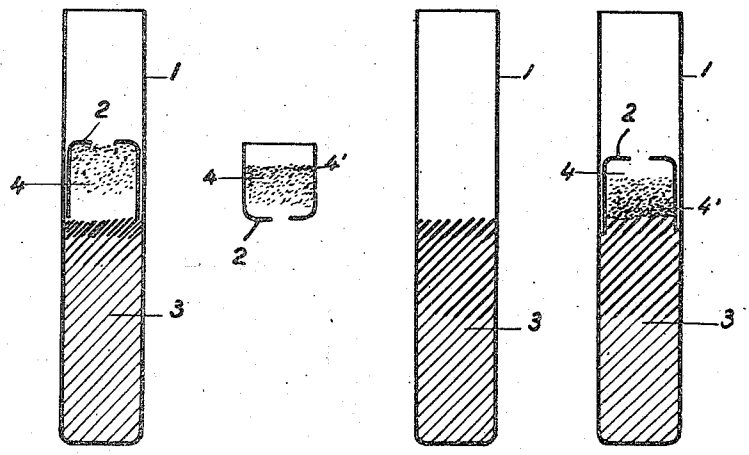

FIG.4. FIG.5. FIG.6.

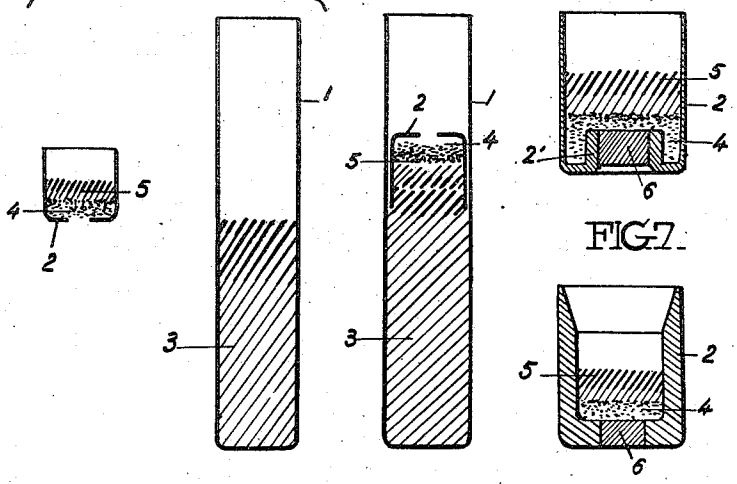

FIG.7.

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DETONATOR

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5 Claims. (Cl. 102—9)

The compound detonators actually used are constituted by a metallic cartridge or chased case into which is compressed in one or several times a so called secondary explosive material (generally a nitro derivated from the aromatic series) and a metallic cap or washer bored with a hole in it and which is introduced into the cartridge after having placed in this latter and over the secondary explosive material a small quantity of a so called primary explosive material (fulminate of mercury, nitride of lead or the like) the object of which is to start the detonation of the secondary explosive which gives to the detonator its real priming power.

The compression of the primary explosive material in the detonator is made after the cap has been set in its place and by means of a compressing punch which acts on the cap and indirectly on the primary explosive material in which the cap is thrust down by this means.

Said loading system does not allow an efficient compression of the primary load; it is in fact close to the compressing punch, i. e. near the bottom of the cap, that the strongest compression of said load is obtained; the maximum density zone of said load is thus limited near the top, the compression thereof decreasing more and more towards the lower end of the primary load.

Now, during the previous compression of the secondary load, the highest compression of this latter was also obtained at the top and was progressively decreasing towards the lower end of the load.

In the accompanying drawing showing a practical embodiment of the invention;

Fig. 1 is a sectional view of the detonator of the invention.

Fig. 2 is a sectional view of the separated members of the detonator.

Fig. 3 is a further sectional view of the detonator.

Figs. 4 and 5 are sectional views, respectively, of the two separated or joined members of the detonator loaded with intermediate sensibility explosive material.

Figs. 6 and 7 show modifications of the cap of the detonator.

The above phenomenon is clearly indicated in Figure 1 of the appended drawing, which illustrates, in diagrammatical cross section, a present compound detonator in which 1 is the casing, 2 the cap, 3 the secondary load, 4 the primary load.

As it may be seen, in this detonator, and owing to the method of loading thereof, the minimum density zone of the primary explosive material 4 is in contact with the maximum density zone of the secondary explosive material 3.

Now it is well known that explosive materials are the more powerful as their density is higher, but that the increase of density, all other things remaining equal, decreases their sensibility for being primed.

Since in the detonators, the explosion travels from the primary to the secondary, it is obvious that the succession of the densities, such as it is in the present detonators, is not a rational one.

At the point where the detonation of the primary explosive material is transmitted to the secondary explosive material 3, two causes for missing fire are added the one to the other.

1. The small density of the primary explosive material;

2. The high density of the secondary one.

It has already been searched after remedies for said drawback by using bottomless cases wherein the loads are introduced and compressed by this side. The result thereof is that the succession of densities is favorable for the priming of the secondary. But said detonator has the disadvantage of being bottomless which allows the moisture to penetrate by this side; further the loading is difficult and necessitates the use of dies.

The present invention has for its object a process for loading the detonators which allows to avoid these different drawbracks.

Said process consists in introducing and compressing as before the secondary explosive matter in the case, in one or several operations, but in introducing and compressing the primary explosive matter in the cap, separately, and afterwards in introducing the so loaded cap into the case.

By this means I obtain a detonator which, as it will be ascertained hereafter, constitutes, owing to the distribution of the primary and secondary loads thereof, a new industrial product.

By refering to Figure 2 of the hereby annexed drawing, which illustrates diagrammatically, in cross section, the separated elements of a detonator according to the invention, it may be seen that the secondary load 3 is still compressed in the case 1.

The primary load is compressed inside cap 2 with its maximum density in 4' near the open part of the cap where the compressing punch acts.

When cap 2 is placed in the case 1 (Figure 3) the maximum density zone 4' of the primary load is thus in contact with the secondary load, what secures a rational transmission of the detonation between both loads.

Instead of introducing the whole secondary load into the chased case, a part thereof may be introduced directly into the cap over the primary load which has been previously compressed as seen before. By this means, the succession of the densities is made more rational, as it is obvious, because the primary has its maximum density close to the minimum density of the secondary. To this relay of secondary explosive material, thus introduced and compressed into the cap, might also be substituted an explosive material the sensibility of which should be intermediate between those of the primary and secondary, and the power of which should be very great, such as for instance nitropentacrythrit, trimethylentrinitramine and so on . . .

In Figure 4 of the annexed drawing have been illustrated the two separated members of a so constituted detonator, and in Figure 5 the two members joined together; 5 is then the relay of secondary or of intermediate sensibility explosive material, introduced and compressed into cap 2 before the introduction thereof in the case 1.

Further, it is possible to use a much slighter quantity of primary explosive matter either on account of the fact above referred to or on account of the greater density which may be given thereto. In fact, said load is compressed between two rigid walls relatively very close to each other (the bottom of the cap and the end of the compressing punch); thus no lateral pressure is produced which should have a tendency to inflate and to crush the cap, as such is the case when, as in the present detonators, the primary load is compressed in the case over the secondary load which has a tendency to give way under the compression instead of standing up against it. It is therefore possible to reach a very high density of compression for the primary load, which allows to greatly increase the priming power and to reduce the weight thereof.

It should also be noted that the introduction of the loaded cap 2 into the case 1 is much less dangerous than in the ordinary loading system, wherein the cap must necessarily rub on the walls of the case which are coated with a layer of primary explosive material (fulminate or very sensible nitrides), and is then brutally pushed into it.

Another advantage of the invention is the fact that the very high pressure of the primary explosive material decreases its capillarity and makes it impossible for the moisture to penetrate by the side of the cap. The greater coherency thus obtained prevents any loss of primary explosive material through the hole in the cap either during the different manipulations of the detonator, during the manufacture in the works, or during the transport and use thereof.

Since the primary load is wholly enclosed in the cap and is very highly compressed a perfect coherency of the explosive material is secured without the least loss of particles, it is possible to load fulminate of mercury into a copper cap and to introduce this latter into an aluminium case without risking the case to be attached by the fulminate of mercury. It is even possible to load a heavy metal nitride in an aluminium cap and to introduce this latter into a copper case without risking the very dangerous formation of copper nitride.

Instead of using an ordinary cap, as illustrated in 2 in Figures 1 to 5 of the drawing, one might also use caps provided in their bottom of a hollow space 6 made by punching the bottom 2' of cap 2 (Figure 6) or made inside the thickness of the bottom wall of cap 2 (Figure 7); said hollow space being used for placing a relay load, thus placed between the lighting means of the detonator and the primary explosive material 4, in order to make easier the lighting or to prime the primary explosive material, if necessary.

When the nature of the primary explosive matter shall allow it, this latter shall be itself put and compressed in said hollow space 6 under a very much reduced volume with reference to an ordinary volume.

I claim:

1. A process for loading detonators, which consists in compressing a primary explosive material in a cap, then compressing in said cap an explosive material having high power and a sensibility to impact intermediate between the primary explosive material and the secondary explosive material, separately loading the secondary explosive material in a case and forcing said cap into said case.

2. A detonator comprising a case, a secondary explosive material compressed in said case, a cap within said case, a primary explosive material partly filling said cap, and in said cap and in contact with the zone of maximum density of the primary explosive material an explosive having power and sensibility to impact intermediate between the primary and the secondary material.

3. A detonator comprising a case, a secondary explosive material compressed in said case, a cap within said case, a primary explosive material compressed in said cap and in contact by its zone of maximum density with the secondary explosive material within the case, a hollow provided in said cap, and primary explosive material within said hollow.

4. The process for loading detonators, which consists in compressing a primary explosive material in a cap, separately loading a secondary explosive material in a case, then compressing in one of said caps or cases a secondary explosive material of higher power and sensibility in position to lie between and in contact with the primary and secondary materials in the finished detonators, and forcing said cap into said case.

5. A detonator comprising a case, a secondary explosive material compressed in said case, a cap within said case, a primary explosive material compressed in said cap and in contact by its zone of maximum density with the secondary explosive material within the case, a hollow provided in said cap and a relay load in said hollow and between the firing means of the detonator and the primary explosive material.

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