Sept. 21, 1948. J. Q. DU PONT ET AL 2,449,645

BLASTING PLUG

Filed Feb. 13, 1947

Fig. 1.

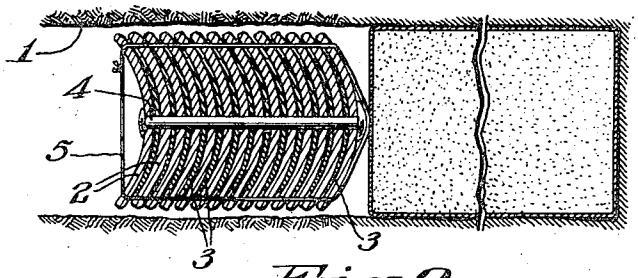


Fig. 2.

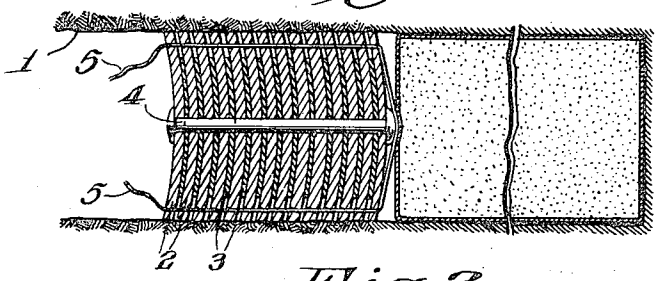


Fig. 3.

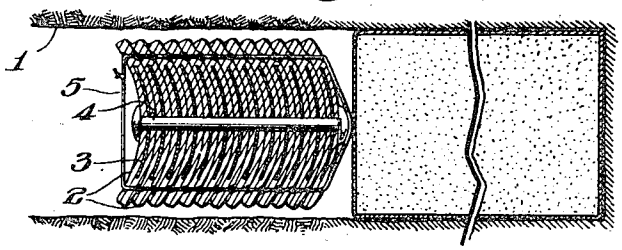
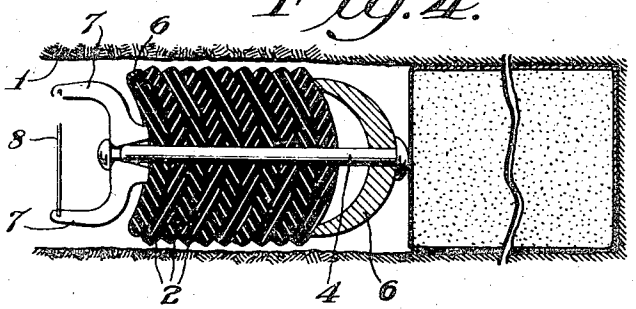


Fig. 4.



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BLASTING PLUG

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4 Claims. (Cl. 102—30)

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This invention relates to an improved plug assembly adapted for the retention of pressure and more particularly to a blasting plug of novel design.

It is customary, in the use of explosives for blasting down rock and the like, to provide stemming or tamping material above the charge of explosive, both for protective purposes and more particularly to give added confinement and thereby to increase the efficiency of the blast. While loose inert stemming materials have commonly been used and compressed in the borehole by means of a tamping stick, it is frequently desirable in the case of relatively small diameter holes to employ blasting plugs. These have several advantages over tamped stemming material in that the plugs are more rigidly fixed so that they afford greater confinement, are not subject to removal by suction from neighboring blasts, and moreover, are safer and more satisfactory in many cases because the plugs need not be pressed down against the explosive charge and they allow the ready passage of blasting cap wires.

While blasting plugs have been used rather widely in blasting operations, the plugs of the prior art have not been satisfactory in every respect.

An object of the present invention is a pressure-retaining plug assembly of novel and improved design. A further object is a blasting plug offering increased resistance to pressure from within the blast hole and adapted to remain securely in position for the desired time. Additional objects will be disclosed as the invention is described more at length hereinafter.

The foregoing objects are accomplished by the utilization of a plug assembly which will be illustrated more specifically in the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of the plug assembly as inserted in the borehole capable of movement to final position;

Figure 2 is a similar sectional view of the plug tightly wedged against the walls of the borehole and in position to withstand pressure;

Figure 3 is a view of the plug of the same parts as shown in Figure 1 and likewise capable of movement in the borehole, the component parts of the plug being in alternative relative position to one another;

Figure 4 is a view of a blasting plug in free position, with a different type of release means.

With particular reference to Figure 1, a blasting plug assembly is shown after insertion in borehole 1, of 1½ inches diameter for example,

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and so disposed that it can be moved readily to any desired position. The assembly is comprised of a plurality of disk-shaped bodies 2 of flexible material of greater diameter, when in normal position, than the borehole. Inserted between each pair of such disks of flexible material are disk-like members 3 of lesser diameter than the disks of flexible material, these smaller diameter disks being of resilient rugged material. A pin or fastener 4, passes through substantially the center of the assembled disks longitudinally and holds them compactly together. While the flexible disks 2 are of greater diameter than the borehole, they are maintained in deformed position as represented in Figure 1, by means of a rupturable means 5 for holding both the flexible and the resilient disks in said deformed position under conditions such that the diameter of the flexible disks is less than that of the borehole.

In the figure, the disk-shaped members are shown for purposes of clarity as separated from one another. Actually in practical use, these disks will be in close contact with one another. Whereas, also, four flexible disks and three resilient disks are shown in the figure, any desired number of each of such members may be employed, and ordinarily a considerably larger number of disks or sheets will be used. Various materials are applicable for the flexible disks such as asbestos, paper or paper board, rubber, leather, neoprene, and other synthetic rubber-like materials, in fact any material that has the properties of flexibility and sufficient rigidity. Preferably, I use a non-combustible or difficultly combustible material. For the resilient members, we may employ sheets of steel or other metal, either in solid form or perforated, for example, wire screening. While it will be logical to have such members of substantially circular cross-section, it will be apparent that they may be elliptical or star-shaped or of any form that will lend itself to the intended use, whether of metal or of other material that possesses satisfactory resilience and resistance to breaking. The rupturable member, holding the assembled members in deformed position will desirably be any elongated cord-like or rod-like material that possesses sufficient tensile strength to hold the members in shape and that is readily rupturable, for example, rope, wire, chain and the like.

Figure 2 shows the plug assembly of Figure 1, after the rupturable member 5 has been severed, allowing the various disks to resume their natural undeformed position, as far as the diameter of the borehole will allow this. The flexible disks

2 have thus become wedged tightly against the walls of the bore hole, under the effect of the elastic members 3. The place of rupture of the member 5 is apparent from the drawing, and severance of this member may be brought about in any desired manner, as by cutting, etc.

Figure 3 depicts the plug assembly in the same deformed and freely movable position as in Figure 1. In Figure 3, however, the resilient members 3, instead of being interleaved with the flexible members 2, are contained within the disks of flexible material as integral parts thereof.

Figure 4 shows a pressure resistant plug assembly of somewhat different design, in position to be inserted in free position in a hole or passageway 4 of any kind. A plurality of flexible disks 2 of normal diameter greater than the hole are maintained in deformed position, as shown by means of elastic deforming members 6, which in turn are held tightly against the flexible disk assembly by means of the element 7. The taut member 8 compresses the deforming members against the flexible disks and, when this member 8 is released, a tight seal is made against the walls of the hole. Various methods for effecting such release may be employed, e. g., by use of a readily severable retainer 8, use of a fusible link, release as a result of impact, etc.

The description of the invention in connection with the embodiments shown in the various figures discloses the function and working of the plug assemblies. In all cases, the plug is inserted in the bore hole or other passageway in freely movable form as a result of deformation of flexible members that become wedged against the sides of the hole when released in a manner to allow expansion. As stated previously, the flexible members may comprise disks of any material possessing at the same time flexibility and sufficient elasticity to cause them to tend to revert to normal form and diameter when released, and such materials are applicable as asbestos, paper or paper board, various plastics, leather, rubber, neoprene and other rubber-like materials, etc. The presence of the strongly resilient members of small diameter, interspersed with or embodied in the flexible members brings about this opening up of the flexible members at the time of release. Such resilient members may comprise bodies of thin metals or other materials of sufficient elasticity and rigidity.

The invention has been described with particular reference to blasting plugs where it is desired to provide protection of the explosive charge and sufficient confinement to allow the building up of pressure. In such use, the plug materials will desirably be non-flammable in nature, in order that increased oxygen deficiency will not favor the production of toxic gases at the time of the explosion. The plug may be applied to other uses than in blasting, however, as in the case of pressure vessels for chemical operations, where a predetermined degree of confinement may be provided. The plug may be used also in the sealing of oil wells, as a bridge plug for example, and many other applications will be apparent.

Various methods of inserting the plug into position may be employed, as by the use of push rods and tools of different description, but these are not a part of the present invention.

While the invention has been described at length in the foregoing, it will be understood that many modifications in details of construction, arrangement and component parts may be introduced without departure from the scope of the invention.

We intend to be limited only by the following claims.

We claim:

1. A blasting plug comprising a plurality of disk-shaped bodies of flexible material having a resilient lamella paired with each of said bodies of flexible material and securely attached thereto, said resilient lamellae being of diameters less than the bodies of flexible material; and releasable means holding both disks of flexible material and the resilient lamellae in deformed position of reduced diameter, said plug being adapted in deformed position to allow ready insertion in a blast hole of predetermined diameter and on subsequent release of said rupturable means to become tightly wedged against the walls of said hole.

2. The blasting plug of claim 1, in which the resilient lamellae are interspersed between the disks of flexible material.

3. The blasting plug of claim 1, in which the resilient lamellae are contained within the disks of flexible material as integral parts thereof.

4. A blasting plug comprising a plurality of disk-shaped bodies of flexible material; a plurality of resilient metal disks interspersed amongst said disks of flexible material, all of said disks being firmly held adjacent to one another and said resilient metal disks being of diameters less than the disks of flexible material; and rupturable means holding in deformed position of less than normal diameter both the disks of flexible material and the resilient disks, said plug being adapted in deformed position to allow ready insertion in a blast hole of predetermined diameter and on subsequent release of said rupturable means to become tightly wedged against the walls of said hole.

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