April 27, 1943. R. B. SMITH 2,317,415

EXPLOSIVE CARTRIDGE ASSEMBLY

Filed April 24, 1940

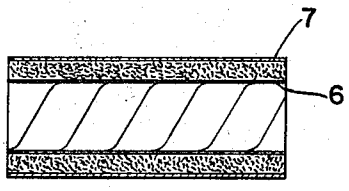


FIG.-6

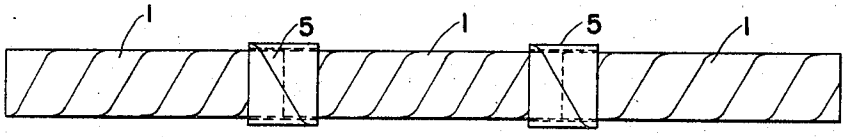


FIG.-5

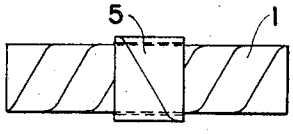


FIG.-4

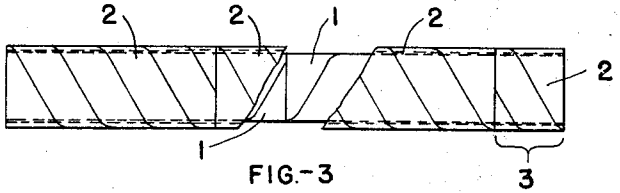


FIG.-3

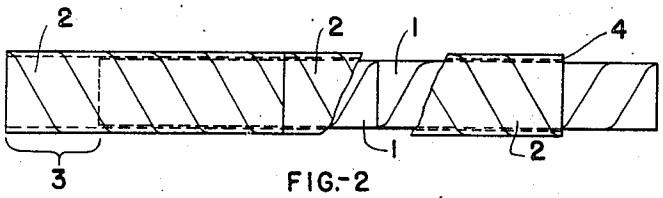


FIG.-2

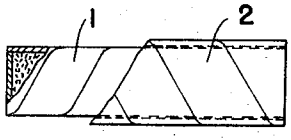


FIG.-1

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UNITED STATES PATENT OFFICE

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EXPLOSIVE CARTRIDGE ASSEMBLY

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Application April 24, 1940, Serial No. 331,291

4 Claims. (Cl. 102—24)

This invention relates to an explosive cartridge assembly and more particularly to an explosive assembly which is especially adapted for use in geophysical prospecting, wherein the charge of explosive is placed in a drilled hole and is exploded, the time required for the sound wave to be reflected to a seismograph recording device being measured in order to determine the contour of underground strata and the like.

In the seismograph blasting art, it has heretofore been customary to place in the drilled hole a plurality of explosive cartridges attached together in various ways as, for example, by attachment to a relatively long stick of wood. This method is tedious and time-consuming.

It has also been proposed to use an ammonium nitrate explosive in a sheet metal cartridge, these cartridges being provided at their ends with threads so that the assembly can be made by interthreading a number of these cartridges. In order to explode the assembly thus produced, there is screw-threadedly attached at a point in the column a priming charge in the form of a special cartridge of trinitrotoluene or amatol (a mixture of trinitrotoluene and ammonium nitrate) which is provided with a blasting cap. This method is disadvantageous because the metal containers are expensive to manufacture and unduly increase the handling cost. Moreover, the use of a relatively heavy metal container unduly lowers the percentage by weight of actual explosive in the unit. In addition, the length of the metal cartridge shell is limited to about 8'' because of manufacturing difficulties, whereas paper cartridges may be made in any length up to the 30'' maximum allowed by I. C. C. shipping regulations.

It is an object of the present invention to provide a rigid unitary assembly of high explosive cartridges for blasting, which overcomes the disadvantages of the prior art set forth above.

It is another object to provide a seismograph blasting assembly which contains more explosive per unit of volume and more explosive per unit of weight than the metal assembly made as described above.

Another object is to provide a single cartridge unit which can be quickly associated with one or more units, identical therewith, to build up a seismograph blasting assembly of the desired length and explosive effect.

A still further object is to provide a standard cartridge which is identical with all other cartridges used therewith and which, therefore, does not require that some of the group be of special construction or manufacture, or that special devices be used therewith, in this way simplifying manufacture and use.

Still other objects will more fully appear hereinafter.

In accordance with the present invention, two or more explosive cartridges are disposed coaxially in end-to-end abutting relationship, and a sleeve is provided around the cartridges and extending on each side of the joint formed therebetween, this sleeve providing for the interconnection of the two cartridges. In a preferred form, the sleeve is of the same length as the cartridge and is slidable therealong into holding engagement with the adjacent cartridge. In a modified form of the invention, the sleeve is considerably shorter than the cartridge and is moved along the cartridge into holding relationship with an adjacent cartridge when it is desired to assemble two or more units for blasting. The wrapping of the cartridge is commonly of paper or equivalent non-sparking material and is of substantial rigidity. However, the cartridge may, in some cases, comprise a metal container filled with explosive. Preferably the connecting means is of paper or similar non-sparking material and is likewise of substantial rigidity, so that the blasting assembly is sufficiently resistant to transverse buckling, either at the joints between the cartridges, or along the cartridges themselves. However, the connecting means may be of metal, as for example, in the connection of metal cartridges.

Referring to the accompanying drawing:

Fig. 1 is a side elevation of a cartridge unit with the upper portion of the connecting sleeve cut away. The cartridge is also partially cut away.

Fig. 2 is a side elevation with one sleeve partially cut away showing two cartridges connected together in order to make a blasting assembly.

Fig. 3 is a similar view showing one way in which the assembly of the cartridges may be made at the job.

Figs. 4 and 5 are similar views of a modified form of the invention, Fig. 4 showing the cartridge unit as it would be manufactured and shipped to the job, and Fig. 5 showing the assembly of a plurality of the cartridges of Fig. 4 at the job.

Fig. 6 is a vertical sectional view through an alternative form of connecting sleeve which is particularly adapted for use in the inter-connection of cartridges to form a permissible explo

sive assembly for use, for example, in the coal mines.

Referring to the drawing in detail, and first to the preferred form illustrated in Figs. 1 to 3, the explosive itself preferably of the gelatin type, such as, for example, what is known as "60% strength" is packed in the tubular paper cartridge 1 which may be of the spiral wrapped paper or metal type and is of substantial rigidity by itself. Surrounding the cartridge 1 in close fitting relationship thereto is the slip tube 2. The slip tube 2 engages the cartridge 1 with such clearance that while it normally exerts a holding action upon the cartridge, as a result of its frictional engagement therewith, it is slidable axially upon the exertion of a force thereupon relative to the cartridge 1. The cartridge 1 comprises the usual high explosive in the form of either a solid body or powder molded, packed or wrapped within the tubular wrapper or container. The ends of the cartridge are sealed in any suitable manner as, for example, in the manner indicated diagrammatically in Fig. 1, or by crimping the ends of the paper inwardly over the explosive therein or, where a metal container is used, by the usual metal can closure, or in any other suitable manner.

The explosive units are shipped in the form shown in Fig. 1, these units being capable of convenient packing and shipping since they are all identical. Cartridge 1 carries its own slip tube 2 which aids in the attachment to another cartridge in a manner which will presently appear.

When it is desired to assemble a blasting unit in the field, the operator takes a single cartridge unit and slides the shell 2 relative to the cartridge 1, and then inserts within the open end of the shell 2 the cartridge 1 of another cartridge unit, the cartridges 1 being abutted in end-to-end relationship, and the shells 2 being likewise abutted in end-to-end relationship in the manner shown in Fig. 2. As is apparent from Fig. 2, the joint between the two adjacent cartridges 1 is staggered relative to the joint formed by the abutting of the sleeves 2. In this manner any number of cartridge units may be connected together to provide a single unitary blasting assembly of any desired length and explosive power. The assembly as shown in Fig. 2 is sufficiently rigid to be readily lowered or positioned downwardly into the bore hole through mud or debris. The telescoping of the cartridges within the sleeves prevents the entrance of dirt or foreign matter into the joint or joints between adjacent cartridges and the great rigidity imparted by the combined effect of the rigidity of the wrapping of the cartridge 1 and of the sleeve 2, produces an assembly which is highly resistant to transverse buckling. Thus there is no likelihood of buckling the assembly, either at the joints between the cartridges 1 or elsewhere during the lowering into the bore hole through mud or debris.

In the preferred form, the sleeve 2 is constructed with a weight and rigidity substantially equal to that of the wrapping of the cartridges 1, each of these elements being rigid by itself, but cooperating to form an extremely rigid structure. As an example of a specific construction which has been successful in actual practice, the cartridge of gelatin explosive may have its wrapper formed of four plies of spirally wound paper, and having a weight of 90 pounds per ream, wound left hand, and may be employed with a sleeve made of four plies of paper weighing 90 pounds per ream, wound right hand. These figures are merely typical of one embodiment and are not intended to be limiting. If desired, the cartridge wrapper and the sleeve may be wrapped in the same direction.

Since in ordinary usage, the operator will usually cut off the projecting empty portion 3 of the upper sleeve 2, there is illustrated in Fig. 3 an assembly wherein the operator has transferred this cut off, otherwise discarded portion 3 to the bottom of the assembly over the projecting end of the lowermost cartridge 1. In this way the presence of the ledge or shoulder 4 is eliminated, and the possibility of collapse of the projecting lower cartridge during the loading into the bore hole is reduced. Moreover in this manner, the outer tubular sleeve is extended throughout the full length of the assembly, thereby adding to the rigidity of the assembly and eliminating the possibility of the assembly being telescoped so as to unjoint it as it is inserted into the bore hole.

From the foregoing, it will be seen that the embodiments shown in Figs. 1 to 3 completely overcome the disadvantages of the prior art methods referred to above, making possible the practical attainment of the objects set forth above, and provide an easy method of joining cartridges which will give an explosive column of any desired length, the frictional engagement between the tubular sleeves and the cartridges preventing the assembly from becoming disconnected when it is lowered into the vertical hole. Moreover, the separation of the consecutive cartridges in the line is prevented so that the explosive column explodes as a unit when it is fired, because of the relatively slight separation of the powder or explosive in adjacent cartridges.

The use of the sleeve as described permits employment of the standard priming methods with the ordinary blasting cap as the sleeve does not interfere with the normal insertion of the blasting cap.

In Fig. 4 there is illustrated a modified form, wherein the cartridge 1 is supplied to the job with a short slip sleeve 5 thereover. In order to assemble the cartridge units into a column, an adjacent cartridge 1 is abutted end-to-end to the cartridge in question and the sleeve 5 is slid axially into position over the joint formed between the two cartridges, as indicated in Fig. 5. This form of the invention is not quite as advantageous for use in seismograph work, because the insertion of the column downwardly into the bore hole occasionally causes the sleeve 5 to be pushed upwardly, thereby disconnecting the adjacent cartridges. However, this form of the invention is advantageous if the sleeve 5 very tightly fits the cartridges, and it is especially advantageous where it is not necessary to insert it into a deep bore hole. The sleeves 5 may be so tightly fitting that they are not readily slidable along the cartridges and may consequently be shipped separately from the cartridges instead of slidably disposed centrally thereof as indicated in Fig. 4. For example, they may be shipped folded flat.

In Fig. 6, there is portrayed an alternative form of sleeve. This sleeve is employed with cartridges of permissible explosives, the sleeve being made of a length equal to the length of the cartridge of permissible. The sleeve shown has the inner wall 6 and the outer wall 7, the inner wall 6 frictionally slidably engaging the exterior of the permissible cartridge in the same manner as that described above. The space between the walls 6 and 7 is filled with granular pellets of any suit-

able compressible material as suggested in the copending application of Jacob Barab, Serial No. 225,342, filed August 17, 1938.

Instead of using a double walled sheathing filled with granular material as shown in Fig. 6, there may be employed a rigid or semi-rigid sheathing in which the sheath tube itself acts as the slip tube for interconnecting permissible cartridges in the same manner as that suggested above for making a seismographic blasting assembly.

From the foregoing, it is seen that the present invention provides a convenient method of assembling identical cartridge units into a rigid column of any desired length. It will further be seen that the invention makes possible the use of cartridges containing high explosive in assembling a column for use especially in seismic prospecting. The invention provides a high explosive package which can be quickly and conveniently assembled into a column of any desired length. In addition to the foregoing advantages, the present invention completely prevents mud, dirt, or debris from getting between the separate cartridges as they are lowered as a unit into the bore hole. Numerous other advantages from the standpoint of manufacture, shipping, and actual use in the field will be obvious to those skilled in the art.

While particular reference has been made to high explosives used in seismographic work, the invention is applicable to explosives used in other fields, such as black powder, permissibles, etc. While the use of spirally wound paper wrapper and sleeve is described, there may be employed instead what is known as a "convolute" tube wherein the paper is wound non-spirally inwardly from one side. In addition the container or the sleeve or both may be of any suitable material other than paper or metal such as, vulcanized fiber, Bakelite, synthetic resins, etc. In order to additionally prevent separation of the cartridges in the assembly as a result of untelescoping between the cartridges and the sleeves associated telescopically therewith, after the assembly has been completed, it may be pegged, for example, by the insertion of pointed wooden pegs transversely through each sleeve into the cartridge associated therewith, each peg preferably being inserted until its outer end is flush with the outer periphery of the sleeve. Instead of employing a sleeve for each joint, a single outside tube of the desired length may be employed, the cartridges being inserted into the single tube in the obvious manner.

In the field of sheathed permissibles, it may be desirable to provide a sheath cap of compressible material over the ends of the explosive column in order that the desired action may be obtained.

Instead of using a gelatin type explosive in the cartridges an insensitive explosive, such as ammonium nitrate, black powder, etc., may be employed.

It will be understood that the details and examples hereinbefore set forth are illustrative only, and that the invention as broadly described and claimed is in no way limited thereby.

What I claim and desire to protect by Letters Patent is:

1. An explosive device comprising a plurality of tubular explosive cartridges disposed co-axially and with their adjacent ends in abutting relationship and forming a joint therebetween, and a plurality of longitudinally disposed tubular sleeves around said cartridges, said sleeves being disposed with their ends in abutting relationship and forming a joint therebetween, said joints formed between said sleeves being staggered relative to said joints between said cartridges.

2. An explosive device comprising a plurality of tubular explosive cartridges of substantially equal length disposed coaxially and with their adjacent ends in abutting relationship and forming a joint therebtween, a connecting tubular sleeve disposed around said cartridges and extending across each of the joints between said cartridges, said sleeve being of a length substantially equal to that of each of said cartridges, said sleeve terminating on each side of the joint intermediate the length of the adjacent cartridges, a tubular sleeve surrounding one end cartridge and extending from the termination of the connecting sleeve associated therewith to the free end of said end cartridge, and a tubular sleeve surrounding the other end cartridge and extending from the termination of the connecting sleeve associated therewith to the free end of said other end cartridge, the combined lengths of said two left-named sleeves substantially equalling the length of each of said cartridges.

3. An explosive device comprising a plurality of tubular explosive cartridges of approximately equal length disposed in substantially continuous co-axially end-to-end relationship and being in propagating contact with one another, a connecting tubular sleeve of a length approximately equal to that of each of said cartridges, around each pair of adjacent cartridges and extending across the joint therebetween, said sleeves forming a substantially continuous tubular reinforcing and joining member for said cartridges and producing a rigid explosive device.

4. An explosive device comprising a plurality of tubular explosive cartridges of approximately equal length disposed in substantially continuous co-axially end-to-end relationship and being in propagating contact with one another, a connecting tubular sleeve of a length approximately equal to that of each of said cartridges, slidably engaging each pair of adjacent cartridges and extending across the joint therebetween, said sleeves frictionally engaging said cartridges and forming a substantially continuous, tubular, reinforcing and joining member for said cartridges, and producing a rigid explosive device.

ROSCOE B. SMITH.