July 9, 1946. T. F. BENNETT 2,403,488

EXPLOSIVE CARTRIDGE ASSEMBLY

Filed May 1, 1945

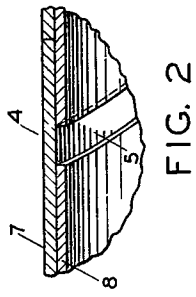

FIG. 2

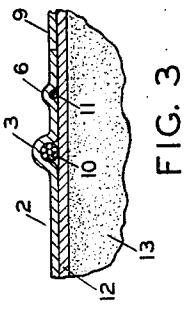

FIG. 3

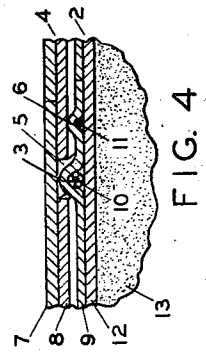

FIG. 4

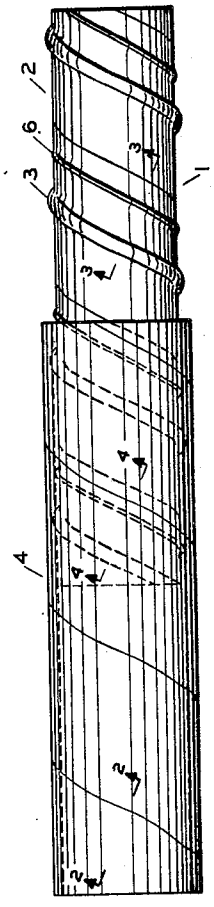

FIG. 1

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EXPLOSIVE CARTRIDGE ASSEMBLY

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Application May 1, 1945, Serial No. 591,304

4 Claims. (Cl. 102—24)

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This invention relates to an explosive cartridge assembly and more particularly to an improvement in a threaded explosive assembly of the type used in geophysical prospecting.

In U. S. Patent 2,317,354 to Bennett, there is disclosed an explosive cartridge assembly comprising a plurality of explosive cartridges connected in end-to-end abutting relationship by a plurality of connecting sleeves which threadedly engage the cartridges. With such an assembly, the cartridges and sleeves are supplied in a standard unit which is readily built up at the site of use by simply screwing the units together to form an explosive column of desired length. However, the desired length is sometimes of considerable magnitude, thereby placing a considerable tensile stress on the entire column, which stress is translated into a torsional force due to the pitch of the threaded sleeves and cartridges. The resultant effect of this torsional force is a tendency for a section of the column to rotate and come apart. That is, the cartridge and sleeve having the least frictional resistance in threaded relationship actually can become unscrewed and the portion of the column therebelow may be dropped during lowering of the column into a vertical borehole.

One of the objects of the present invention is to prevent rotation and consequent disengagement of sections of a threaded explosive column.

Another object is to provide a friction thread which prevents rotation and consequent disengagement of sections of such a column.

Still another object is to provide a friction thread on a threaded explosive cartridge to frictionally engage threaded connecting sleeves for the cartridge and thereby prevent sections of a column of such sleeves and cartridges from becoming unscrewed due to torsional forces created by the weight of the column when vertically suspended.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

Generally described, the present invention comprises a threaded explosive assembly composed of threaded cartridges and threaded sleeves provided with a friction thread on each cartridge in frictional engagement with its respective sleeves, which friction thread permits screwing of the sleeves upon the cartridges to form an explosive assembly, but prevents the unscrewing of sections of the assembly by torsional forces created by the weight of the assembly or column when vertically suspended.

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A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawing which forms a part of the specification, wherein reference numerals refer to like parts wherever they occur.

In the drawing:

Fig. 1 is an elevational view of a threaded cartridge and sleeve with the cartridge provided with an additional friction thread, illustrating the application of the invention;

Fig. 2 is a fragmentary, sectional view taken on line 2—2 of Fig. 1, illustrating the sleeve thread;

Fig. 3 is a fragmentary, sectional view taken on line 3—3 of Fig. 1, illustrating the cartridge thread and the friction thread; and

Fig. 4 is a fragmentary, sectional view taken on line 4—4 of Fig. 1, illustrating in detail the application of the invention with the cartridge and sleeve engaged.

Referring now to the drawing in detail, an explosive cartridge 1 is provided with a wrapper 2 which has an external spiral thread 3 throughout its length. The cartridge 1 threadedly engages a sleeve 4 which is substantially the same length as the cartridge. The sleeve 4 is provided with an internal thread 5 as illustrated in Fig. 2. In addition to the spiral thread 3, the wrapper 2 has an external, spiral, friction thread 6 throughout its length. The friction thread 6 is disposed relative to the thread 3 so as to frictionally engage the interior surface of the sleeve 4 as illustrated in Fig. 4.

With particular reference to Figs. 2, 3 and 4, the sleeve 4 comprises an outer wrapping 7 adhesively affixed to an inner wrapping 8 which is spaced to form the thread 5. The cartridge wrapper 2 comprises an outer wrapping 9 which covers the cords 10 and 11, which form the threads 3 and 6, respectively. The wrapping 9 is adhesively affixed to an inner wrapper 12 which is adjacent the explosive 13.

An example of the operation of the invention is given for building up an assembly of cartridges and sleeves. An explosive cartridge such as 1 is screwed into a sleeve such as 4 until approximately half of its length extends from the sleeve. Another sleeve is screwed upon the length of cartridge extending from the first sleeve until the two sleeves are in tight abutting relationship. Another cartridge is then screwed into the extending sleeve until the two cartridges are in tight abutting relationship. This procedure is continued until a rigid, explosive column of the

desired length, and accordingly weight of explosive, is obtained. The entire column is then raised vertically and lowered into a vertical borehole. The weight of the assembly of cartridges and sleeves constituting the column creates a torsional force on the column which tends to unscrew the cartridges and sleeves. That is, the cartridge and sleeve which have the least frictional resistance afforded by their threaded relationship may become unscrewed and that portion of the column therebelow may actually drop into the borehole. However, the friction thread on the cartridge greatly increases the frictional resistance as between the cartridge and sleeve by being in frictional engagement with the interior of the sleeve. This frictional engagement permits the cartridge to be screwed into the sleeve, but has sufficient resistance to prevent any section of the column from unscrewing due to the torsional forces created by weight.

The preferred method of manufacturing the cartridge wrappers and sleeves of the present invention is by spiral winding. This method of manufacture is economical and permits formation of the necessary threads on the sleeves and cartridge wrappers in a facile manner, since these threads are wound on the respective parts at the same pitch used for the spiral winding. However, this method of manufacture requires the use of strip, sheet material, such as paper or other cellulosic material. Materials of this kind have a considerable range of dimensional stability. Moreover, spiral wrapping machines and convolute wrapping machines, particularly where adhesives are employed, are not capable of manufacturing cellulosic tubes within close tolerances. The range of dimensional stability inherent in a cellulosic material plus the best tolerance limits obtainable in machines of the class described does not permit a close fit between the sleeve thread and cartridge thread. When a close fit was attempted, it was found impossible, in a considerable percentage of cases, to manually screw the cartridges and sleeves together. As a result of this, it has been found necessary to provide a loose fit between the sleeve thread and cartridge thread. This loose fit, of course, has a low factor of frictional resistance. The friction thread in accordance with the present invention augments the entire frictional resistance between the cartridge and sleeve to an extent sufficient to resist the torsional forces heretofore described, but yet permits manual assembly of a column of explosive cartridges and sleeves in a facile manner.

Paper is preferred as the material for the cartridge wrapper; however, other cellulosic material or derivatives thereof may be utilized. Paper twine is preferred as the cord material for forming the threads; however, hemp or cotton cord material may be used. For cartridges from about 2 inches to about 4 inches in diameter and from about 16 inches to about 30 inches in length, it has been found that a cord in the order of 0.06 inch diameter covered with an outer wrapping of manila paper in the order of a 64# paper will give a cartridge thread of sufficient strength to withstand the loads practically imposed on columns built up of such cartridges. It has also been found that a cord in the order of 0.017 inch diameter covered with paper of the above weight will give the desired frictional resistance when the clearance between the cartridge wrapper and the interior of the sleeve is in the order of 0.015 inch.

Paper is likewise preferred as the material for the outer wrapping of the sleeve; however, other cellulosic material or derivatives thereof may be utilized. Chipboard or equivalent material is preferred as the material for the inner wrapping of the sleeve which when wound in spaced relationship forms the sleeve thread. Chipboard of about 30 point or approximately 0.03 inch thick has been found suitable in conjunction with the cartridge thread heretofore described to withstand the loads imposed on columns under practical conditions.

The principle of the present invention is applicable to the interconnection of threaded explosive cartridges for any use and, while the above description refers particularly to geophysical prospecting, the invention may be utilized in any type of blasting work where a long column of explosive is needed. Accordingly, gelatin explosives, ammonium nitrate explosives, black powder, or any other type of blasting explosive may constitute the cartridge charge and use of any of these explosives in conjunction with the present invention is contemplated, regardless of their particular field of use.

The particular utility of the present invention has been found to reside in conjunction with the cartridge and sleeve assembly disclosed in U. S. Patent 2,317,354 to Bennett, in which the sleeves and cartridges are disclosed as being substantially the same length. With this arrangement, it has been found possible to obtain sufficient frictional resistance by utilizing the friction thread in accordance with the present invention, even when assembling cartridges in the order of 3 inches in diameter and greater.

To build up a rigid column of explosive the sleeves should be in end-to-end abutting relationship as well as the explosive cartridges. When the sleeves and cartridges are of the same length in such a column, the sleeves are contiguous to the cartridges throughout the length of the column with the exception of each end of the column which has extending therefrom a half of sleeve and a half of cartridge, respectively. In view of this, it is contemplated within the purview of the invention that the sleeves may be half the length of the cartridge or any other multiple length of the cartridge, the only requirement being that they be adapted to be screwed in end-to-end abutting relationship over the cartridge and provide a sufficient extension from each end of the cartridge to permit positive engagement of additional cartridges.

It is further contemplated within the purview of this invention that more than one friction thread may be utilized on each cartridge to give the desired frictional resistance between the cartridge and its sleeves. It will be evident that limitations are imposed on the size of friction thread which may be utilized by the clearance between the cartridge and interior surface of the sleeve. If the friction thread is too large, the cartridge cannot be conveniently screwed into the sleeve. It is preferable to use an increased number of small friction threads rather than a single large friction thread to obtain an increased amount of resistance.

It will be seen that the present invention provides for the attainment of the objects heretofore set forth in a simple, convenient, and economical manner, and that the invention makes possible the ready provision of a rigid column of interconnected explosive cartridges which can be subjected to a variety of uses and remain intact.

The invention further positively prevents dirt, mud, or debris from getting between the separate cartridges as they are placed into a borehole and likewise prevents a separation of cartridges in a column with attendant loss of propagation. Other advantages and applications of the invention than those heretofore set forth will be apparent to those skilled in the art.

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

1. A threaded explosive assembly comprising a plurality of threaded explosive cartridges held in end-to-end abutting relationship by a plurality of threaded sleeves in end-to-end abutting relationship, and at least one friction thread disposed on each cartridge and extending throughout the length of the cartridge in frictional engagement with the interior surface of each sleeve in threaded engagement with said cartridge.

2. A threaded explosive assembly comprising a plurality of threaded explosive cartridges held in end-to-end abutting relationship by a plurality of threaded sleeves in end-to-end abutting relationship, the said cartridges and sleeves being of substantially the same length, and at least one friction thread disposed on each cartridge and extending throughout the length of the cartridge in frictional engagement with the interior surface of each sleeve in threaded engagement with said cartridge.

3. A threaded explosive assembly comprising a plurality of threaded explosive cartridges held in end-to-end abutting relationship by a plurality of threaded sleeves in end-to-end abutting relationship, and a friction thread disposed on each cartridge and extending throughout the length of the cartridge in frictional engagement with the interior surface of each sleeve in threaded engagement with said cartridge.

4. A threaded explosive assembly comprising a plurality of threaded explosive cartridges held in end-to-end abutting relationship by a plurality of threaded sleeves in end-to-end abutting relationship, the said cartridges and sleeves being of substantially the same length, and a friction thread disposed on each cartridge and extending throughout the length of the cartridge in frictional engagement with the interior surface of each sleeve in threaded engagement with said cartridge.

THOMAS F. BENNETT.