

AN ARTILLERY PROPELLANT CHARGE MODULE

INTRODUCTION



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This invention relates to a propellant charge module.

BACKGROUND OF THE INVENTION



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Evolution of the artillery propellant charge system has led to the 155 mm Modular Propellant Charge System. The system allows a number of sealed uniform cylindrical packages (usually referred to as modules) to provide propellant for the firing of artillery guns such as 155mm artillery systems. Individual modules, enclosing propellant in a rigid combustible cartridge case can be combined to provide a selectable total charge size thereby providing a propellant charge system with incremental charge zones. Most of the Modular Charge systems adopt a so-called Bi-Modular Charge approach, which consists of two types of module configurations one for shorter range (Low Charge Module) and the other for longer range fire missions (Standard Charge Module).

The Low Charge Module for short range use can be fired as a single module for Zone 1 or in pairs as a 2-module charge for Zone 2. The Standard Charge Module for longer range missions is used in combinations of three to six modules to provide for Zones 3, 4, 5 and 6. The modules for Low and Standard Charges usually differ in colour and top or body surface characteristics for visual identification and tactile identification respectively.

It is important particularly during battle to be able to identify the type of charge that is being loaded into the barrel of the gun so that an appropriate total charge is being used which will not cause any misfire or other undesirable output of the propellant.

US 4864932 describes a modular charge for use in a multi modular charge system wherein for example two or more charges may be placed into a barrel of a large caliber gun in series and wherein adjacent charges merely abut each other end on end. It has been recognised in for example US 5282432 that it may be desirable for a space saving connection to be made between adjacent modules and to allow the charges to be pre-assembled. Such a

firm fit method is commonly employed to join the identical modules for use in various combinations (as Zone 2, 3, 4, 5 and 6 charges). In such configurations where more than two modules are combined to provide the total charge, the modules are normally pre-assembled outside the barrel of the gun and in an assembled condition they are loaded into the barrel for use. For production efficiency, the shape characteristics of the cartridge case for shorter and longer range use are normally very similar and in particular the configuration providing the functional features are substantially identical. In particular a distinct characteristic of the firm fit feature is a protruding collar at one end of each module, which friction fits into ring-shaped groove on the next module. Hence each individual module is provided with a protruding collar at one end and a ring-shaped groove one at the other end of the cylindrical shaped cartridge case. With the advantages of a Modular Propellant Charge System wherein charge modules can be easily combined to provide a total propellant charges of different sizes, the ease of adaptability has resulted in strict procedural control being required in order to ensure that an undesirable combination of modules does not result. For safety reason, a Low Charge Module cannot be fired in a combination of three or more modules combined. However as mentioned above, the cartridge cases of each module are currently provided in a form where each module consists of a ring-shaped groove and a protruding collar such that the protruding collar of one module can engage with the ring-shaped groove of the next module to be abutted. The Low Charge Module is currently provided in such a configuration and since the propellant charge for use is assembled outside of the barrel prior to being loaded in the barrel, the possibility exists that a total propellant charge for shorter range use can be assembled with three or more modules in abutment. This may particularly happen in the heat of battle wherein forethought may not be present. Because the current configuration of modules for a Low Charge Module can allow for three or more modules to be engaged together outside of the barrel, such undesirable configuration of charge can only be avoided through procedural control. Such preventive measures are undesirable and in certain circumstances may not be effective.

AIM OF THE PRESENT INVENTION

The aim of this invention is to provide a propellant charge module for use in a Bi-Modular Propellant Charge System which will prevent the inadvertent assembly of more than two modules.

Accordingly in a first aspect the present invention consist in a propellant charge module for selectably defining a total charge on its own or as an assembly in series with one other identical propellant charge module for use to propel projectile in a barrel of an artillery gun, said propellant charge module comprising or including ;

an envelope having a cylindrically shaped wall portion and two end wall portions enclosing a propellant charge

wherein one only of said two end wall portions is a like charge module engagement wall and has surface relief to allow secure engagement thereby with the like charge module engagement wall of an identical shaped propellant charge module which includes surface relief which is mutually cooperable therewith.

Preferably said charge module engagement wall is substantially planar surface save for said relief.

Preferably said relief is at least one upstand and at least one recess the positioning thereof when viewed axially along the axis of said cylindrical shaped envelope being symmetrical about a line of symmetry through said axis.

Preferably said relief is at least one upstand and at least one recess the positioning thereof when viewed axially along the axis of said cylindrical shaped envelope being symmetrical about two lines of symmetry perpendicular to each other and provided through said axis.

Preferably said at least one recess is deeper than the height of the upstand.

Preferably the profile of said at least one upstand when viewed in the axial direction is the same as the profile of the at least one recess.

Preferably the profile of said upstand when viewed in the axial direction is smaller than the profile of the recess.

Preferably said envelope is a rigid combustible cartridge case.

In a second aspect the present invention consist in a two module propellant charge comprising two propellant charge modules as herein before described wherein said two propellant charge modules are engaged together at said like charge module engagement wall in a mutually cooperating condition.

In a further aspect the present invention consist in a two module propellant charge comprising

a first propellant charge module comprising

an envelope having a cylindrically shaped wall portion and two end wall portions enclosing a propellant charge

a second propellant charge module of an identical shape to said first propellant charge module wherein one only of said two end wall portions for each propellant charge module has surface relief which provides a secure engagement thereby to the other propellant charge module in a mutually cooperating manner.

In a further aspect the present invention consists in a method of assembling a two module charge for use in propelling an artillery projectile said method comprising

taking a first propellant charge module as herein before described and engaging with the like charge module engagement wall thereof a like charge module engagement wall of a second propellant charge module as herein before described .

In still a further aspect the present invention consists in a method of propelling an artillery projectile for low range use comprising

assembling a charge consisting of two propellant charge modules as herein before described said method including the steps of

loading the assembly into the barrel of said gun

closing the breach

igniting the charge.

Preferably the step of loading the two module charge is preceded by a loading of the projectile into the barrel.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood with the description of the different embodiments with reference to the appended drawings in which ;

Figure 1 is a perspective view of the first example of the Propellant Charge Module of the present invention,

Figure 2 is a plan view of Figure 1;

Figure 3 is a side view of Figure 1;

Figure 4 is a sectional view through Section A-A of Figure 2,

Figure 5 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 1 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

Figure 6 is a perspective view of the second example of the Propellant Charge Module of the present invention,

Figure 7 is a plan view of Figure 6;

Figure 8 is a side view of Figure 6;

Figure 9 is a sectional view through Section A-A of Figure 7,

Figure 10 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 6 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

Figure 11 is a perspective view of the third example of the Propellant Charge Module of the present invention,

Figure 12 is a plan view of Figure 11;

Figure 13 is a side view of Figure 11;

Figure 14 is a sectional view through Section A-A of Figure 12,

Figure 15 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 11 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

Figure 16 is a perspective view of the fourth example of the Propellant Charge Module of the present invention,

Figure 17 is a plan view of Figure 16;

Figure 18 is a side view of Figure 16;

Figure 19 is a sectional view through Section A-A of Figure 17,

Figure 20 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 16 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

Figure 21 is a perspective view of the third example of the Propellant Charge Module of the present invention,

Figure 22 is a plan view of Figure 21;

Figure 23 is a side view of Figure 21;

Figure 24 is a sectional view through Section A-A of Figure 22,

Figure 25 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 21 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

Figure 26 is a perspective view of the fifth example of the Propellant Charge Module of the present invention,

Figure 27 is a plan view of Figure 26;

Figure 28 is a side view of Figure 26;

Figure 29 is a sectional view through Section A-A of Figure 27,

Figure 30 is a perspective view of a Charge wherein 2 modules of the configuration is shown in Figure 26 are engaged to each other and wherein shown in phantom is the hidden detail including the surface relief of the mating surfaces of the two modules;

DESCRIPTION OF THE INVENTION ILLUSTRATED WITH THE DRAWINGS

With reference to Figure 1 there is shown a Propellant Charge Module which consists of an outer envelope (9) which is preferably of a rigid and combustible material. The outer envelope includes a cylindrical shape wall portion (10) as shown in Figure 2 and has two end walls (11), (12) as shown in Figure 3. One of the end walls, end wall (12) is shaped so as to be configurable with a like Propellant Charge Module in a manner such that they become engaged together in a secure but preferably separable manner. This end wall, also herein referred to as the "like charge module engagement wall" is provided with surface relief of a kind to provide a locking engagement with a like charge module engagement wall of an other charge module.

The other end wall (11) is of a shape such that it cannot engage with a similar charge module in a locking engagement like manner. As shown the other end of the (11) is preferably of a substantially planar nature. However it may also be of a shape which includes surface relief but where such relief is of a kind to prevent it from being locked with a like charge module. The other end wall (11) may be provided such that the axis of the cylindrical shaped wall portion is substantially normal thereto. However alternatively the other end wall may be angled to the axis. Similarly, the engagement wall (12) is preferably also substantially planar save for the surface relief wherein the planar orientation is such that the axis of the cylindrical shaped wall portion is substantially normal thereto.

Engagement by abutting the like charge module engagement walls of two modules together is preferably achieved by a friction fit sliding engagement of the two charge modules together in a direction parallel to the axis of the cylindrical shaped wall portion. In some of the configurations of the present invention, a rotational replacement can also be required to provide for further secure engagement of the two modules together.

The engagement of two modules together is in a secure but preferably releasable manner. Accordingly, the means of securing the two modules together is by a friction like fit. Such friction is preferably provided by features of the surface release.

With reference to Figure 5, it can be seen how the upstand (1) can engage with the recess of another identical shaped Propellant Charge Module as for example shown in Figure 5. The recess (2) of the charge module is preferably of a depth which is equal or is greater than the height of the upstand. In this manner the upstand can be located substantially with its entirety in the recess. Figures 1-5 show one upstand and one recess provided in the like charge module engagement wall (12), however more than one of such upstand and recess may be provided. With reference to Figure 2, it can be seen in plan view that the positioning of a recess and a substantially complimentary shaped upstand are provided in a symmetrical manner about at least one axis of symmetry through the axis of the cylindrically shaped wall portion. Indeed as shown in Figure 2, the positioning of the complimentary shaped upstand and recess is symmetrical about two axes.

Figures 6-10 illustrate an alternative arrangement of the Propellant Charge Module of the present invention wherein the surface relief provided to the like charge module engagement wall provides a groove (13) and a complimentary shaped upstand (14) to an otherwise substantially planar end wall surface. Again symmetry when viewed in a direction parallel with the axis of the cylinder, is provided about two axes.

With reference Figures 11-15 there is shown an other embodiment of the Propellant Charge Module of the present invention wherein provided from a substantially planar end wall there is a upstand (8) and a rebate (7) at the perimeter. Slanted edges (9) of the upstand/rebate are

provided such that when two charge modules of this kind are engaged together and when the two charge modules are rotated one against the other, two of the four slanted edges (9) will engage with each other and will subsequently decrease the ease of dislodging the assembly. In addition the surfaces (10) of the module will engage with the relief facing surface of the upstand (8) in a friction like manner thereby hold two modules together.

Figures 16-20 illustrate yet an alternative arrangement of a charge module of the present invention wherein a different configuration of the like charge module engagement wall (12) is provided. In this configuration, the surface relief may be provided to define upstands (17) and (15) and a recess (16) which when engaged with a charge module having the same configuration of the end wall, enhance the strength of the engagement between the two charge modules. In this configuration, the recess inevitably results from the provision of the upstands and the recess is provided to receive the upstands of a like shaped charge module. The upstands (17) are provided with undercut edges (18) which upon rotation of one charge module relative to the other, become engaged with a like undercut of the other charge module and in such a manner locate with each other wherein the only way of disengaging the two charge modules from each other firstly requires a rotation in the reverse direction. The upstands (15) provide additional friction fitting between the outer facing surfaces of the upstands (17) of another charge module.

Figures 21 to 25 illustrate a further alternative arrangement of a charge module of the present invention wherein friction fit providing surfaces are provided by the upstands from the recesses (19). Friction surfaces (20) are substantially planar and the plan extends substantially parallel with the axis of the cylindrical shaped wall of the charge module. A sliding engagement of one module with another along the surfaces thereby engages two modules together as for example shown in Figure 25. The positioning of the friction surfaces is such that when like friction surfaces of another charge module are provided thereagainst, a frictional force to resist movement the axial direction ensures that the two modules remain attached.

Figures 26-30 illustrate yet an alternative arrangement and illustrate an arrangement wherein symmetry of the surface relief is provided along only one axis of symmetry, being coaxial with the section line A-A. In this configuration as shown in Figure 26 the recess (21) is of a larger plan shaped than the upstand (22). The upstand (22) to be inserted into the recess of a shape as shown in Figure 26 but of another charge module can locate into the recess but still provide some room within the recess as a gap.

With only one end of each Propellant Charge Module being adapted for engagement with another identical shaped propellant charge module, it becomes impossible to assemble more than two propellant charge modules of the present invention together.

The invention described herein is susceptible to variations, modifications and/or additions other than those specifically described and it is to be understood that the invention includes all such variations, modifications and/or additions which fall within the spirit and scope of the above description.

CLAIMS

1. A propellant charge module for selectably defining a total charge on its own or as an assembly in series with one other identical propellant charge module for use to propel ammunition in a barrel of an artillery gun, said propellant charge module comprising or including ;

an envelope having a cylindrically shaped wall portion and two end wall portions enclosing a propellant charge

wherein one only of said two end wall portions is a like charge module engagement wall and has surface relief to allow secure engagement thereby with the like charge module engagement wall of an identical shaped propellant charge module which includes surface relief which is mutually cooperable therewith.

2. A propellant charge module as claimed in claim 1 wherein said charge module engagement wall is substantially planar surface save for said relief.

3. A propellant charge module as claimed in claim 2 wherein said relief is at least one upstand and at least one recess the positioning thereof when viewed axially along the axis of said cylindrical shaped envelope being symmetrical about a line of symmetry through said axis.

4. A propellant charge module as claimed in claim 2 wherein said relief is at least one upstand and at least one recess the positioning thereof when viewed axially along the axis of said cylindrical shaped envelope being symmetrical about two lines of symmetry perpendicular to each other and provided through said axis.

5. A propellant charge module as claimed in claims 3 or 4 wherein said at least one recess is deeper than the height of the upstand.
6. A propellant charge module as claimed in any one of claims 3 to 5 wherein the profile of said at least one upstand when viewed in the axial direction is the same as the profile of the at least one recess.
7. A propellant charge module as claimed in any one of claims 3 to 5 wherein the profile of said upstand when viewed in the axial direction is smaller than the profile of the recess.
8. A propellant charge module as claimed in any one of claims 1 to 7 wherein said envelope is a rigid combustible cartridge case.
9. A two module propellant charge comprising two propellant charge modules as claimed in any one of claims 1 to 8 wherein said two propellant charge modules are engaged together at said like charge module engagement wall in a mutually cooperating condition.
10. A two module propellant charge comprising
a first propellant charge module comprising
an envelope having a cylindrically shaped wall portion and two end wall
portions enclosing a propellant charge
a second propellant charge module of an identical shape to said first propellant charge module
wherein one only of said two end wall portions for each propellant charge module has surface
relief which provides a secure engagement thereby to the other propellant charge module in a
mutually cooperating manner.
11. A method of assembling a two module charge for use in propelling an artillery
projectile said method comprising

taking a first propellant charge module as claimed in any one of claims 1 to 8 and engaging with the a like charge module engagement wall thereof a like charge module engagement wall of a second propellant charge module as claimed in any one of claims 1 to 8.

12. A method of propelling an artillery projectile for lower range use comprising
assembling a charge consisting of two propellant charge modules as claimed in any one or more of claims 1 to 8
loading the assembly into the barrel of said gun
closing the breach
igniting the charge.

13. A method of propelling an artillery projectile as claimed in claim 12 wherein the step of loading the two module charge is preceded by a loading of the projectile into the barrel.