Aug. 31, 1943. F. I. ALEXANDER 2,328,247

CASING GUN

Filed Dec. 8, 1941 2 Sheets-Sheet 1

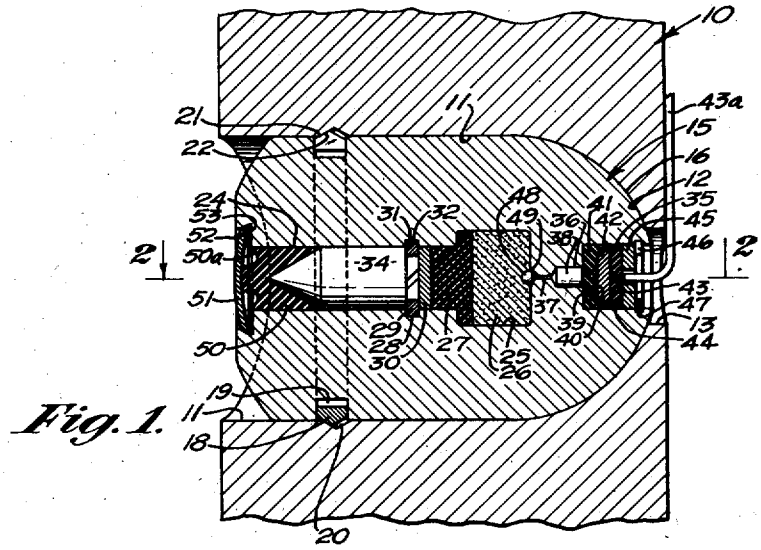

Fig. 1.

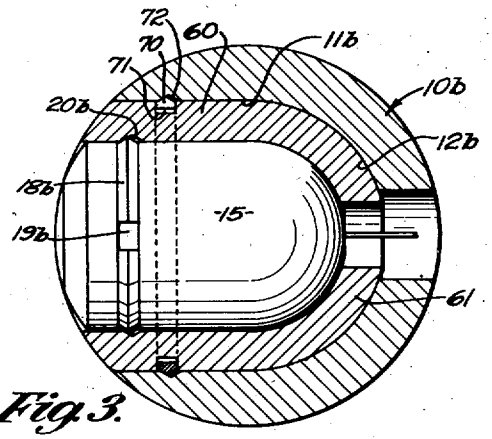

Fig. 3.

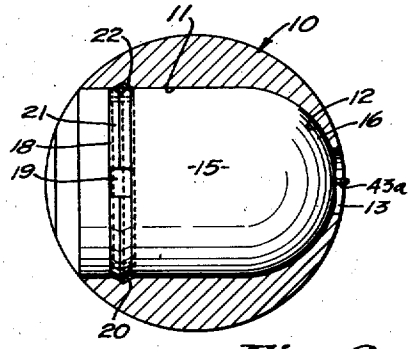

Fig. 2.

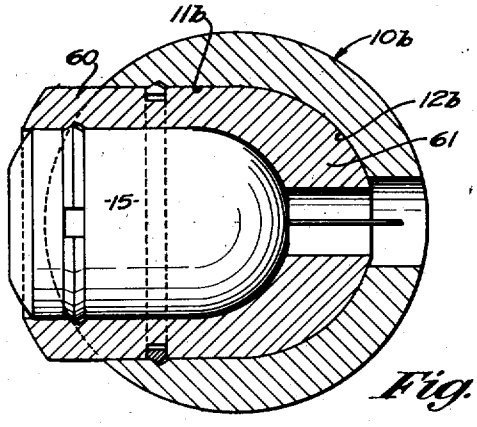

Fig. 4.

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CASING GUN

Filed Dec. 8, 1941 2 Sheets-Sheet 2

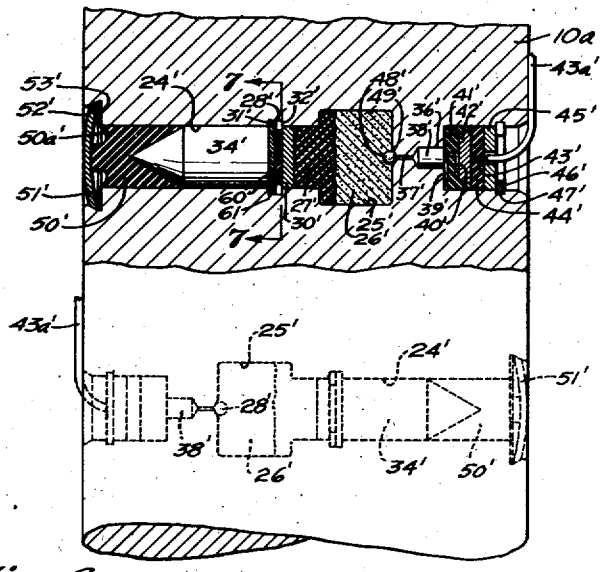

Fig. 6.

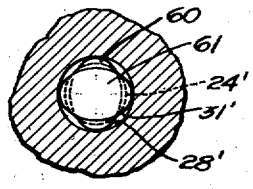

Fig. 7.

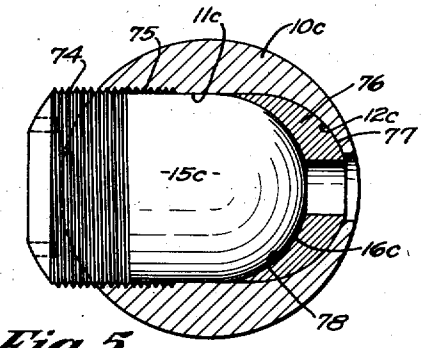

Fig. 5.

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Patented Aug. 31, 1943 2,328,247

UNITED STATES PATENT OFFICE

2,328,247

CASING GUN

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Application December 8, 1941, Serial No. 422,177

13 Claims. (Cl. 164—0.5)

This invention relates generally to guns adapted to operate in well casing, general objects of the invention being the provision of a casing gun of increased durability, increased firing power, decreased cost of manufacture, and universal adaptability to various sizes of casing. Such guns are used in well casing for various purposes and my improvements are generally applicable to such uses. A typical use is for casing perforation, and I explain my invention with particular regard to that use but without implying limitation thereto.

Casing perforating guns used in the past have commonly included a long cylindrical body, of a cross-sectional size such as nearly to fill the casing to be penetrated, provided with a plurality of vertically spaced lateral sockets for the reception of individual gun units, each comprising a chamber block partially defining a powder chamber, and an insert member, in the form of a barrel or plug, screwthreaded into the chamber block so as to complete the definition of the powder chamber. A shooting bore, of a cross-sectional size smaller than the powder chamber, extends from the powder chamber through the forward or muzzle end of the chamber block, being sometimes formed directly in an insert barrel, and sometimes directly in the metal of the chamber block itself. In the latter case, the screwthreaded insert member is generally to the rear of the powder chamber, and serves as a breech block. It has been well recognized by those skilled in this art that with this general type of gun unit construction, the force of the explosion in the powder chamber acts longitudinally against the barrel or plug which is screwthreadedly joined to the chamber block, in such a way as to strain or deform the screw threads so that subsequent disassembly is made very difficult, while often the threads are entirely ruptured and the screw threaded member blown from the chamber block. The heat treating of the chamber block and barrel (either original, or for reconditioning purposes), often carbonizes the threads slightly, and the subsequent conventional sand blasting treatment often leaves the threads with a slight nonuniformity, which causes a poor fit, and allows an undue strain to be placed on a few of the threads at the time of the explosion, with the result that these may yield first, and then all of them strip out. These results have been of the commonest occurrence in the past, and it has been recognized that such threaded joints, subjected to explosive pressure, constitute a source of recurring trouble. And even though the threads may originally be highly uniform, so as to form a tight joint, the conditions of service are such that they soon become loose, and when loose, are liable to rupture. Recourse has been had in the past to various sealing expedients for reducing the force delivered by the explosion against the screwthreaded joint, not, however, with complete success.

One feature of the present invention is accordingly the provision of a chamber block in which the powder chamber and shooting bore are both formed in a single one-piece body, all screw threaded insert parts receiving strain at the time of the explosion being avoided.

The powder chamber and shooting bore are, as stated, formed in a single one-piece chamber block or body, the chamber preferably being of greater cross-sectional area than the shooting bore, so as to provide for packing either a small or relatively large powder charge therein. To the rear of the powder chamber, provision is made for reception of an electrically fired fuse, and the communication between the fuse and the powder chamber is confined to a small diameter flame duct, which is automatically closed pressure-tight when the powder begins to burn by a valve element acted upon by the pressure of the expanding gases. With the construction as thus described, the powder chamber is completely defined by one block of metal, and is permanently closed except for the small flame duct and for the shooting bore. There are no screwthreads to be subjected to jar at the time of the explosion. In order to permit use of such a permanently closed chamber block, and still employ expansion retarding provisions, I provide in combination with my chamber block construction an expansion retarding means in the form of a washer or key receivable in a groove in the shooting bore, a disk freely received in the bore and engaging the side of said key facing the powder chamber, and a packing or wadding placed between the disk and the powder in the powder chamber. The key, thus anchored to the bore, serves as an abutment against which the base of the projectile is positioned, and the disk, packed by the described packing, holds back the expansive gases to the necessary extent, and then the key and disk give way, being blown from the gun with the projectile. The packing also functions to seal against loss of explosive pressure past the projectile during its propulsion through the shooting bore. Particularly in gun units which have been fired a number of times, there is, in the absence of counter-provisions, considerable "blow-by" past the

projectile, with attendant loss of projectile velocity. The packing element seals against such blow-by, thereby keeping up the pressure built up behind the projectile, and hence increasing the initial velocity and penetrating power of the projectile.

A further feature provided by the present invention is a casing perforating gun construction in which one size of gun unit and one size of gun body may serve for casing of various different diameters. In order to assure firing in a direction substantially normal to the casing wall, which is essential to assure penetration, it is the practice to employ a relatively close fitting gun body. For example, for four inch casing, a three and one-half inch gun body would be used. For six inch casing, a five inch gun body would be proper, and so on. This relatively close fit positions the muzzle of the shooting bore closely adjacent the casing wall to be penetrated, and also assures firing along a line at substantially right angles to the casing wall, both of which conditions contribute toward the securing of penetration. But not only are larger gun bodies thus required for the larger casing sizes, but the individual gun units have in the past necessarily been graded in size in accordance with the size of the casing to be penetrated. For example, for four inch casing, a three and one-half inch gun body might be used, and the individual barrel-like gun units for such a gun body would be only about three inches in diameter. But while a gun unit of such diameter, as heretofore constructed, has been strong enough to withstand the explosive force of a powder charge heavy enough to cause penetration of relatively small casing, it has not been strong enough for the much heavier powder charge required to assure penetration of the much heavier walls of the larger sized casings. Accordingly, it has been conventional, as stated, to provide not only a series of main gun bodies of different diameters for the different casing sizes, but to equip them with gun units which are also of different sizes for the different casing sizes.

The gun unit provided by the present invention, being housed in a single mass of metal, has such wall strength that even when embodied in the smallest conventional size, it will easily withstand the explosive force resulting from a heavy powder charge such as required for penetrating large, heavy casing. Moreover, the projectile velocity attained when my small gun unit is loaded with a heavy powder charge is such that, if the unit be properly positioned in the casing, the very largest and heaviest of casings can be penetrated. I therefore have need of but one size of gun unit, the smallest.

The present invention provides adapter means whereby the same gun body (one of small cross-section) may be used in casings of various diameters, the small-size individual gun units being caused to project somewhat from the sides of the gun body proper for the larger casing sizes, so as to gain not only a centering effect within the casing, but an assured position with the muzzle closely adjacent the casing wall. Thus I achieve the important economic advantage that one main gun body and one set of gun units will serve for a number of casing sizes, making for substantial savings in materials. There are, however, several other advantages; the small diameter main gun body is not subject to sticking in the casing behind incoming sand, and the lessened weight of the small sized equipment saves the lowering line, as well as being easier to handle generally. At this point I wish it to be understood that while the type of gun unit shown in Fig. 1 has such a high ratio of wall strength and firing power to diameter as to make possible its use even in small size for perforating the larger and heavier sizes of casing, and has thus made possible my improved adapter arrangements whereby one size of main gun body and one size of individual gun unit may be adapted for all casing sizes, nevertheless I regard those adapter arrangements as disclosing invention whether or not taken in combination with the particular gun unit of the present invention. Such of my claims dealing with the adapter arrangements as do not specify the particularities of my improved gun unit are therefore not to be taken as inferentially limited thereto.

Other objects, features and accomplishments of the invention not mentioned in the foregoing will appear and be described in the course of the following detailed description of certain present illustrative embodiments thereof, reference for this purpose being had to the accompanying drawings, in which:

Fig. 1 shows a portion of an elongate gun body and contained gun unit in longitudinal vertical section;

Fig. 2 is a reduced horizontal cross section on line 2—2 of Fig. 1, the chamber block appearing in elevation;

Figs. 3 and 4 are sections similar to Fig. 2, but showing the use of an adapter member for converting one gun body and one size of chamber block for use with different sized casings. Figs. 3 and 4 are drawn to the same scale, and they may be considered as being drawn to the same scale as Fig. 2;

Fig. 5 is a view in aspect similar to that of Fig. 4, but showing a modification, on the scale as that of Figs. 2, 3 and 4;

Fig. 6 shows a portion of an elongate gun body, with parts broken away along a central vertical plane, in which the gun body and gun units are formed as one integral member; and

Fig. 7 is a detail section taken on line 7—7 of Fig. 6.

A portion of the elongate gun body, preferably cylindric in external form, is designated at 10 in Figs. 1 to 4. This gun body is formed in its side with a plurality (but one being illustrated in Fig. 1) of vertically spaced horizontal bores or sockets 11, each terminating in a concave seat 12, met by a reduced counterbore 13 extending inwardly from the opposite side of the gun body.

The insertible gun unit comprises a body providing a chamber block or barrel, designated generally by numeral 15, preferably cylindric in external form, and of such diameter as to slide freely within bore 11, the block being formed with a convex inner end 16 adapted to engage concave seat 12. Any suitable means may be provided for retaining the gun unit in the bore 11, such as the usual screwthreads commonly employed for the purpose, it being understood that whatever retaining means is employed will not be subjected to substantial shock from the explosion, since the block 15 is sufficiently massive to absorb the recoil. However, for reasons of economy of manufacture and of convenience, I prefer to avoid the use of screwthreads, and have here shown a simple illustrative retaining means comprising a split expansive ring 18 carried by an annular groove 19 formed around the chamber block and expansible into an annular groove 20 formed in bore 11. Ring 18 is so de-

signed as to assure seating of the inner end of the chamber block against the seat 12 formed for it in the gun body, and for this purpose is here illustrated as having an angular camming surface 21 which engages a complementary angular camming surface 22 defining a portion of groove 20, the arrangement being such that the normal tendency of the ring 18 to expand tends to hold the chamber block rearwardly in the bore 11 so as to maintain its proper seat therein. At the same time, the split expansive ring enables the chamber block to be easily and quickly withdrawn from and reinserted into the gun body.

Chamber block 15 is provided with an axial shooting bore 24, terminating in a powder chamber 25, which is preferably enlarged or undercut, as illustrated. The enlargement of the powder chamber is merely to give capacity for different powder loads; the construction as illustrated will accommodate from 60 to 160 grains of powder, such as may be proper from the smallest to the largest sizes of casing. As will be evident from the drawings, the shooting bore and powder chamber 25 are both formed directly within and defined completely by the stock constituting the chamber block 15. The powder charge 26 is packed in the chamber 25 as illustrated, and placed against charge 26, is a wadding or packing element 27, formed of any somewhat "spongy" or "springy" packing material suitable for the purpose, such as sponge rubber or felt.

Shooting bore 24 is formed near its breech end with an annular groove 28 which receives a key, here shown in the form of a split expansive ring 29, which lies partially within the bore 24, as shown. A metal disk 30, of a diameter such as to be received freely but with comparatively close fit within bore 24, is placed between packing 27 and ring 29, so as to seat outwardly against and be backed up by the inner side of the ring 29. The packing 27 fills up whatever portion of the powder chamber is not filled with powder, and, pressing against the disk 30, holds it seated against ring 29. This packing always fills up any otherwise void space in the powder chamber, so that when a relatively small powder charge is used, there will not be a large unoccupied space in the chamber to permit undue expansion of the gases and consequent lowering of the potential explosive pressure. It will be seen that the groove or recess 28 sunk in the shooting bore forms a shoulder 31 presented toward the breech end of the bore, and against which the key 29 and disk 30 are supported against expansive forces generated in the powder chamber. The usual projectile 34 is positioned in bore 24 immediately forwardly of ring 29, with its base seated againt ring 29. Any external hydrostatic pressure transmitted through the later described hydrostatic seals at the muzzle end of the bore 24 and transferred to the projectile is resisted by the ring 29 seated against the forwardly facing annular shoulder 32 formed by the groove 28.

An axial bore or socket 35 is sunk in the rearward or inner end of block 15, in alinement with shooting bore 24 and powder chamber 25, and extending inwardly from the bore 35 is a reduced axial bore or socket 36 adapted to receive a later described fuse, while from the inner end of reduced bore 36 extends a small bore or duct 37 opening centrally inside powder chamber 25. An electrically fired fuse 38, preferably of the "match-head" type, such as manufactured by the Atlas Powder Co., is positioned within bore 36, and is adapted, when fired, to project a flame from its forward end through duct 37 to ignite the powder charge 26 packed within chamber 25. Such fuses are well known and will require no detailed description herein, beyond to note that they are fired by passing an electrical current therethrough, for instance, by way of a pair of leads 39 and 40. In the preferred arrangement here illustrated, the one lead 39 is engaged and pressed into electrical contact with the metal of the chamber block at the inner end of bore 35 by the bottom of a cup 41, preferably of rubber, seated at the inner end of bore 35. A metal disk 42 is pressed inside cup 41, so as to engage the other electrical lead 40 which is extended through the bottom of the cup 41, as indicated. Connected to the center of disk 42 is an insulated (preferably enameled) electrical lead 43 which extends outwardly through the rearward end of the block and through the opening 13 in body 10, to be connected to one terminal of a suitable source of electrical current, in any conventional manner. The insulated lead 43 is here shown as provided with a protective sleeve 43a. The other side of such source of electrical current being understood to be grounded, electrical current may thus flow via conductor 43 to disk 42, and thence via lead 40 to fuse 38, the other lead 39 of which is grounded to the chamber block, and therefore to the gun body. It will be understood that such flow of electrical current to fuse 38 will ignite it and cause a flame to be projected to burn the powder in chamber 25, as before described.

Contact disk 42 is shown in Fig. 1 to be backed up by an insulation washer or disk 44 closely surrounding conductor 43, and disk 44 is held in position by means of a washer 45, backed up by a split expansive ring 46 snapped into an annular groove 47 formed towards the outer end of bore 35. External hydrostatic pressure acting inwardly on the disk 35 compresses the rubber cup 41, and effects a good hydrostatic seal at that point.

A small metal ball 48, formed typically of copper, is placed in powder chamber 25 against a concave seat 49 formed at the point of opening of duct 37, the ball being loosely held in position by the powder packed around it. When the fuse 38 is fired, the flame projected therefrom extends past this ball in a cone-like form to effectively ignite the powder, and then, as the powder burns and explosive pressure is developed, the ball acts as a valve, being forced onto seat 49 and thus sealing off the duct 37, so that none of the explosive pressure is dissipated therethrough.

A suitable hydrostatic seal of any type is provided at the forward end of shooting bore 24. I typically show for this purpose both a rubber stopper element 50 inserted into the bore after the projectile, and also a pressure sealing disk 51 mounted in a shallow, undercut annular recess 52 formed in the forward end of the chamber block around the muzzle end of the shooting bore. A gasket 53 is shown as placed on the annular outwardly facing shoulder formed at the juncture of bore 24 with recess 52, and it will be understood that the sealing disk 51, which is preferably somewhat dished, with its concave side exposed to the hydrostatic pressure, will be forced tightly against this gasket 53 and so effect a pressure-tight seal. The rubber stopper member 50 is here shown as formed at its for-

ward end with a thin lip 50*a*, so that the hydrostatic pressure of any external liquid reaching the forward or outer end of this stopper will press said lip into tight sealing engagement with the bore 24. I have here shown two separate hydrostatic sealing means for the muzzle end of the shooting bore, though it will of course be understood that this is for illustrative purposes only, and that either one or the other might be dispensed with, or any other suitable hydrostatic seal substituted. In the event that only the stopper 50 should be employed, the hydrostatic pressure would be sealed off thereby, but pressure would be transmitted to the projectile; the ring 29, anchored within the bore 24, then serves as an abutment for the base of the projectile.

The powder charge 26 being ignited by the fuse 38, and the sealing ball 48 having been tightly seated by the pressure of the gases immediately generated, the explosive pressure then builds up to a very high value, the pressure being held back by the disk 30 forced tightly against the expansive ring 29, while the packing or wadding 27 forced tightly against and around the edges of the disk 30 effects and maintains a pressure-tight seal against escape of gases. As the powder continues to burn the developed explosive pressure finally becomes sufficiently high to cause the hold back ring 29 to give way, whereupon the projectile 34 is ejected, the ring 29 and disk 30 being blown out behind them. The packing or wadding material 30 follows up the projectile as it is propelled through the bore 24, packing around the ring 29 and disk 30 and around the rearward end of the projectile, and effectively sealing against blow-by of explosive gases. By virtue of the provision of the expansion retarding ring 29 and disk 30, the explosive pressure is thus built up to a very high value before it is permitted to act upon the projectile; and by virtue of the provision of the packing 30 which follows up the projectile and is forced against and around it by the expanding gases, an effective seal is established between the projectile and the walls of the bore throughout the length of the bore, assuring maximum pressure on the projectile until it leaves the gun.

The chamber block now described affords two main advantages, first, substantially increased durability, and second, greater shooting power. The increased durability is obtained by the one-piece construction, with avoidance of screw-threaded joints subject to strain or rupture at the time of the explosive discharge, and with greater wall thicknesses, meaning lessened tendency to splitting. The increased shooting power is obtained in part by the improved expansion retarding means, including the packing or wadding member, which not only seals in the explosive pressure during the build up period, prior to failure of the expansion retarding means, but seals against blow-by of gases around the projectile while it is being propelled through the shooting bore, and in part by the valve ball 48 which seals against dissipation of explosive pressure rearwardly through the flame duct 37. Taken all in all, there results a simple, inexpensive unit, of greatly increased strength and durability, and one characterized by a shooting power comparable with or even exceeding that of the heaviest prior units, even when embodied in small size.

Fig. 6 shows a modification in which the above described powder chamber, shooting bore, sealing provisions, etc., are formed or located directly in the main elongate gun body, here designated at 10*a*, rather than in an insert chamber block. The powder chamber, shooting bore, seals, etc., being in general the same as in Fig. 1, corresponding parts in the two figures are for convenience designated by like numerals, but with primes annexed in the case of Fig. 6. Fig. 6, however, discloses a modified form of expansion retarding means, including a pair of oval shaped plates or keys 60 and 61, substituted for the split expansive ring 29 of Fig. 1. The two oval shaped keys 60 and 61 of flexible material are inserted one after the other into the groove 28' by way of the shooting bore, and are positioned at right angles to one another, as shown. These oval keys serve the same purpose as the split expansive washer 29 of Fig. 1, but are somewhat easier to insert.

Fig. 6 also shows the preferred pointing of successive shooting bores in opposite directions, and illustrates further the relatively close vertical spacing between shooting bores permitted by the type of construction illustrated in Fig. 6. Thus, as will be observed, the avoidance of screwthreaded insert barrels or breech plugs, and the forming of the shooting bores and powder chambers directly in the elongate gun body, affords a very substantial thickness of uninterrupted metal between successive chamber and shooting bore units, even when spaced on relatively close centers. As an example, I may state that the successive shooting bores of the form of the invention shown in Fig. 6 may easily be placed on two inch centers, which is about half the spacing of successive gun units in conventional prior practice. Thus the number of shots in a given length of casing may be doubled.

As hereinbefore stated, it is familiar prior practice to provide one elongate gun body, such as the gun body 10 of Figs. 1 and 2, for each size of casing to be perforated, it always being desirable to choose for each casing perforating job a gun body of a size as large as can be readily run into the casing in hand. This practice not only positions the muzzles of the gun units closely adjacent the casing wall, but assures an approximately centered position for the gun body in the casing, and therefore firing along direction lines substantially normal to the wall of the casing, so that the possibility of ricocheting is avoided. And, as also hereinbefore mentioned, it is conventional prior practice to increase the size of the individual gun units for the larger casings, since the smaller units as heretofore constructed have been incapable of withstanding an explosion sufficiently heavy to drive a projectile through the heavy wall of the larger casings. According to the gun construction illustrated in Figs. 3 and 4, one elongate gun body 10*b* is made to serve for all casing sizes except the smallest, the same size of individual gun unit (a small size) being used under all conditions. In Figs. 3 and 4, the gun body 10*b* is shown to be formed with lateral bores or sockets 11*b*, formed with concave seating surfaces 12*b* at their inner ends, of the same form as in Fig. 1, and receivable in said lateral sockets or bores 11*b* are interchangeable adapter cups 60. These cups 60 are formed with rounded inner ends or bottoms 61, adapted externally to engage and seat on the concave seats 12*b*, but of different thickness for different casing sizes, as will be referred to again herein-

after. The chamber blocks 15 are received inside the adapter cups 60, and their forward ends may be substantially flush with the circular outline of the gun body 10b, or may project therefrom, depending upon the thickness of the bottom 61 of the adapter cup 60 selected. Assuming that the gun body 10b is of proper diameter for a given size of casing, an adapter cup 60 such as shown in Fig. 3 is used for casing of that given size, and adapter cups having thickened bottoms, as in Fig. 4, are used for larger size casings. With the chamber block 15 projecting from the gun body, as in Fig. 4, the same effects, both as to central positioning of the gun in the casing, and as to close positioning of the muzzles to the casing wall, are had as though the gun body 10b were correspondingly increased in diameter, as will be readily understood. Any suitable means may be provided for removably retaining the interchangeable adapter cups in the sockets 11b of the gun body 10b, and the chamber blocks 15 in the adapter cups, though I have here illustrated the simple use of retainer rings 18b seated in grooves 19b in the chamber block and expansible into grooves 20b in the adapter cups for retaining the chamber blocks in the adapter cups, and similar retainer rings 70 seated in grooves 71 in the adapter cups and expansible into grooves 72 in the sockets 11b of the body 10b for retaining the adapter cups in said sockets.

Considering the gun body 10 of Fig. 2 to be of the proper diameter for casing of the smallest diameter (and considering the chamber block of Figs. 3 and 4 to be the same size as the chamber block in Fig. 2), the gun body 10b with the adapter shown in Fig. 3 may be considered as being of the proper diameter for the next larger casing diameter. Then longer adapters such as in Fig. 4 may be exchanged with the adapter of Fig. 3 for use with casings of still larger diameters. According to this arrangement, the gun body 10b would serve casings of all diameters except the smallest which would be served by gun body 10, and the chamber blocks would be interchangeable. In order to enable the same gun body 10b to take different adapters 60 to extend the assembled structure to the larger diameters, as in Fig. 4, an adapter is used in Fig. 3 to fill the space between block 15 and body socket 11b, although neither the adapter nor the block project beyond the exterior of the body in that arrangement.

In the arrangement typified in Fig. 4, either the adapter 60, or the block 15 may project beyond the periphery of the body 10b, or both may preferably so project as shown in the figure. The projection of the adapter, which is larger than the block 15, gives the assembly a better bearing on the casing interior, than would be given by the block if it only projected. And the projection of the block puts the muzzle of the firing barrel close to the casing wall. However, the projection of either the adapter or the block will adapt the assembly to different sizes of casing, using the same body 10b.

Fig. 5 shows a modification, in which the chamber block 15c has external screwthreads 74, adapted for engagement with internal screwthreads 75 formed in socket 11c. An interchangeable filler element 76 fills in between the concave seat 12c at the inner end of the socket 11c and the convex end 16c of the chamber block, having a convex face 77 for engagement with the seat 12c, and a concave face 78 engageable with the end of the chamber block. When this filler element is not used, the end 16c of the chamber block engages seat 12c, and the chamber block does not project from the gun body 10c. But with the filler element 76 in position, the chamber block projects from the gun body to an extent depending upon the thickness of the particular filler element selected, thus converting the gun body 10c for use with a casing of larger size. As will be evident, the filler element 76 of Fig. 5 corresponds to the bottoms of the adapter cups of Figs. 3 and 4, both forms of the invention involving interchangeable walls of different thickness insertible between the chamber block and the chamber block seat in the main gun body for causing the chamber block to project to different distances from the side of said gun body.

It will be understood the drawings and description are to be considered as illustrative of and not restrictive on the invention in its broader aspects, since various changes in design, structure and arrangement may be made without departing from the spirit and scope of the invention or of the appended claims.

Although I prefer to utilize a one-piece chamber block, for reasons stated, my adapter means may be used with chamber blocks of other construction; and certain of the following claims are not intended to be limited to a one-piece block.

I claim:

1. In a casing gun, a body containing an outwardly opening powder chamber, a relatively small flame duct opening inside said powder chamber, a fuse receiving socket alined and communicating with said flame duct, and a recess sunk in an outside surface of said body and extending inwardly to said socket, said recess being adapted to receive a hydrostatic seal.

2. In a casing gun, a body containing a powder chamber and a shooting bore extending therefrom, expansion retarding means comprising a disk received and anchored within said shooting bore, said anchored disk being adapted to fail upon development of a given explosive pressure within the powder chamber, a relatively small flame duct alined with said chamber and shooting bore and opening inside said chamber, a fuse receiving socket alined and communicating with said flame duct, and a recess sunk in an outside surface of said body and extending inwardly to said socket, said recess being adapted to receive a hydrostatic seal.

3. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, a chamber block receivable within said socket, said chamber block comprising a one-piece barrel-like member enclosing a powder chamber and opening through its forward end, said chamber block having an external rearwardly facing seating surface, and an interchangeable filler element positioned in said socket and having a rearwardly facing seat engageable with said outwardly facing seat in said socket and having an outwardly facing seat engaged by said rearwardly facing seating surface on said chamber block, said chamber block projecting from the socket to an extent depending upon the dimension of the filler element measured between its two said seats in a direction axially of the socket

4. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, a forwardly opening chamber block receivable within said socket

and containing a powder chamber, and having an external rearwardly facing seating surface, and an interchangeable filler element positioned in said socket and having a rearwardly facing seat engageable with said outwardly facing seat in said socket and having an outwardly facing seat engaged by said rearwardly facing seating surface on said chamber block, said chamber block projecting from the socket to an extent depending upon the dimension of the filler element measured between its two said seats in a direction axially of the socket.

5. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, an interchangeable adapter cup receivable within said socket and having a rearwardly presented seat engageable with said first mentioned seat, said cup having an internal outwardly facing seat, and a chamber block receivable within said adapter cup and formed with a rearwardly presented seat engageable with said outwardly facing seat on said cup, said chamber block comprising a forwardly opening one-piece barrel-like member enclosing a powder chamber.

6. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, an interchangeable adapter cup receivable within said socket and having a rearwardly presented seat engageable with said first mentioned seat, said cup having an internal outwardly facing seat, and a forwardly opening chamber block receivable within said adapter cup and formed with a rearwardly presented seat engageable with said outwardly facing seat on said cup, said chamber block containing a powder chamber.

7. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, an interchangeable adapter cup slidably receivable within said socket and having a rearwardly presented seat engageable with said first mentioned seat, said adapter cup having an internal outwardly facing seat, a chamber block slidably receivable within said adapter cup and formed with a rearwardly presented seat engageable with said outwardly facing seat in said cup, said chamber block comprising an outwardly opening barrel-like member enclosing a powder chamber, resilient means interposed between the gun body and the adapter cup for maintaining pressural engagement of the rearwardly presented seat of said cup with the seat in said gun body, and resilient means interposed between the adapter cup and the chamber block for maintaining pressural engagement of the rearwardly presented seat of said chamber block with the outwardly facing seat in said adapter cup.

8. In a casing gun, the combination of an elongate gun body, a chamber block comprising an outwardly opening barrel-like member disposed laterally of said gun body, and an interchangeable tubular adapter member arranged co-axially with said chamber block, said chamber block and adapter member being carried by the gun body, and said interchangeable adapter member having an end projecting outwardly from said gun body to an extent commensurate with the internal dimension of the casing for engagement with the casing whereby the shooting bore of said chamber block will be confined to a position substantially normal to the wall of said casing.

9. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, an interchangeable adapter cup receivable within said socket and having a rearwardly presented seat engageable with said first mentioned seat, said cup projecting outwardly from said socket, and having an internal outwardly facing seat, and an outwardly opening chamber block receivable within said adapter cup and formed with a rearwardly presented seat engageable with said outwardly facing seat on said cup, said chamber block containing a powder chamber.

10. In a casing gun, the combination of an elongate gun body having a lateral socket formed with an outwardly facing seat, an interchangeable adapter cup receivable within said socket and having a rearwardly presented seat engageable with said first mentioned seat, said cup having an outer end surface extending not beyond the outer surface of said gun body and having an internal outwardly facing seat, and an outwardly opening chamber block receivable within said adapter cup and formed with a rearwardly presented seat engageable with said outwardly facing seat on said cup.

11. In a casing gun, the combination of an elongate gun body having a lateral socket, an outwardly opening chamber block longitudinally receivable in said socket, and seating means for said chamber block in said socket, said seating means being interchangeable and projecting from the socket to present an end surface to bear against the inner surface of the casing.

12. In a casing gun, the combination of a body having therein a socket with an inner end forming an outwardly facing seat, a one piece chamber block comprising an outwardly opening barrel-like member having a closed inner end and enclosing a powder chamber, said chamber block being receivable in the socket with its inner end spaced from the socket end seat, and a changeable adapter element solidly filling the space between the chamber end and the socket end seat.

13. In a casing gun, a body having a block receiving socket extending into it from one side leaving a body wall between the inner end of the socket and the opposite side of the body, an outwardly opening chamber block receivable in the socket and containing a powder chamber, a relatively small flame duct leading from the powder chamber toward the inner end of the block, a fuse receiving socket alined and communicating with the flame duct, a recess sunk in the end surface of the block and communicating with the fuse socket, said recess adapted to receive a hydrostatic seal, and the body wall at the inner end of the block receiving socket having an opening alined with said recess.

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