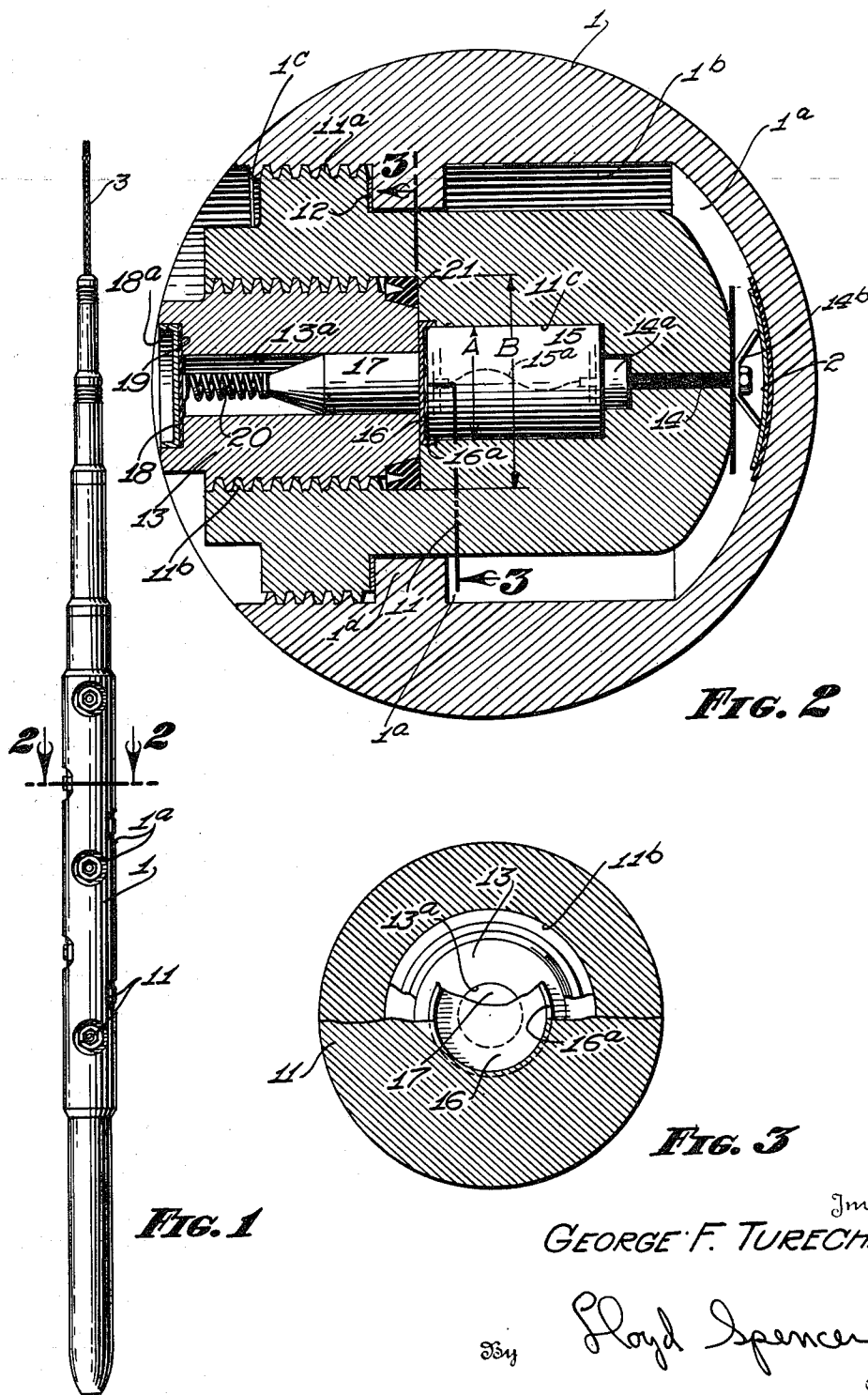


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G. F. TURECHEK
GUN UNIT FOR GUN PERFORATORS

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Inventor
GEORGE F. TURECHEK

By *Lloyd Spencer*

Attorney

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GUN UNIT FOR GUN PERFORATORS

George F. Turechek, Los Angeles, Calif., assignor
to The Technicraft Engineering Corp., Los
Angeles, Calif., a corporation of California

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My invention relates to gun units for gun perforators designed for perforating well casing in situ by gun fire, and is a continuation in part of Patent No. 2,043,340 issued June 9, 1936.

First, to provide a particularly compact gun unit which is so shaped that it may be mounted in a laterally extending position within a cylindrical gun body and of such size as to fit within comparatively small well casing.

Second, to provide a gun unit which although compact is designed to withstand a comparatively heavy charge of explosive even when fired when the gun unit is submerged to great depths in liquid.

Third, to provide a gun unit which incorporates a novelly arranged sealing means between the explosive chamber and the gun barrel which not only functions to delay or retard expansion of the explosive in order to obtain higher projectile velocity in a short barrel, but also localizes or minimizes the pressure area of the barrel; that is, the area subjected to the pressure exerted by the explosive, thereby minimizing the stresses tending to blow the barrel from the chamber block or otherwise damage the gun unit.

Fourth, to provide a novel means of retaining the bullet in position at the breach end of the barrel.

Fifth, to provide a gun unit having a minimum number of parts which are capable of quick assembly and disassembly, and which incorporate easily positioned sealing adapted to seal the gun unit against extreme external hydrostatic pressures.

With these and other objects in view as may appear hereinafter, reference is made to the accompanying drawing, in which:

Fig. 1 is an elevational view of a gun perforator incorporating my gun units.

Fig. 2 is an enlarged sectional view through 2—2 of Fig. 1 showing the gun body in transverse section and the gun unit in longitudinal section with the bullet, cartridge, and contact means shown in elevation.

Fig. 3 is a transverse sectional view of the gun unit taken substantially through 3—3 of Fig. 2 with the cartridge removed.

The gun perforator with which my gun unit is adapted to be used comprises a gun body 1 in the form of an elongated cylinder with a plurality of laterally directed sockets 1a. Each socket is divided into an inner part 1b and an outer part 1c by an internal flange 1d. The outer part 1c is provided with screwthreads. At the base of each socket there is mounted a contact

plate 2 insulated from the gun body. The contact plates of the several sockets are individually connected with a controller or selector mechanism, not shown, which is carried in the upper end of the gun body. The gun perforator is attached to a cable 3 which both supports the gun perforator and supplies electrical energy thereto.

A plurality of my gun units are incorporated in each gun perforator and their charges are adapted to be fired electrically in sequential order by said controller. A chamber block 11 constitutes the dominating member of each gun unit. Said chamber block is generally cylindrical in form and adapted to fit within the internal flange 1d of a socket 1a. The outer portion of the chamber block is provided with a screw threaded enlargement 11a adapted to engage the screw-threaded outer part 1c of the corresponding socket. The inner shoulder of the enlargement 11a and outer shoulder formed by the flange 1d confront and a sealing washer 12 is positioned therebetween to seal the inner part 1b of the socket.

At its outer or muzzle end the chamber block is provided with an internally threaded barrel socket 11b which is adapted to receive a correspondingly threaded barrel 13. The muzzle end of the barrel protrudes beyond the chamber block. Similarly, the muzzle end of the chamber block protrudes beyond its screwthreaded enlargement 11a. The protruding portions of the barrel 13 and chamber block are suitably shaped to receive wrenches for securing the barrel in the chamber block and the chamber block in the gun body; however, these protruding portions do not project beyond the circle defined by the gun body.

Inwardly from the barrel 13, the chamber block defines an explosive receiving chamber 11c of somewhat smaller cross-section than the barrel. A small opening is provided between the inner end of the chamber 11c and the inner end of the chamber block. This opening receives a small insulated contact pin 14, and the opening is enlarged at the chamber 11c to receive a contact head 14a forming a part of the contact pin. The end of the contact pin 14 protruding from the gun unit into the socket 1a is provided with a suitable contact means 14b engageable with the contact plate 2.

The chamber 11c is adapted to receive a cartridge 15, preferably formed of insulating material and containing an explosive through which extends a fusible wire 15a. Terminals at the ends connect one end of the wire with the con-

tact head 14a and ground the other or forward end thereof.

Between the chamber 11c and the breach end of the barrel 13 is positioned an expansion retarding and pressure localizing disk 16. The disk 16 is flat except for a peripheral cylindrical skirt or wall 16a which projects toward the chamber 11c and fits in a slight enlargement provided at the forward end thereof. The functions of this disk will be brought out in more detail hereinafter.

The barrel 13 is provided with a bore 13a there-through in axial alignment with the chamber and somewhat smaller in diameter. A bullet 17 is fitted in the bore and occupies a large part of its length.

The outer or muzzle end of the barrel is provided with a shallow recess forming a shoulder around the outer end of the bore and which receives a cup-shaped sealing disk 18 having an outwardly facing peripheral wall 18a. The disk is backed by a sealing washer 19. The disk 18 is pressed into place and its wall 18a and the washer 19 are forced by external hydrostatic pressure to seal the bore of the barrel.

The barrel 13 is necessarily very short and it is highly desirable that the bullet always be as near the breach end of the barrel as possible. This is insured by a small spring 20 inserted between the sealing disk 18 and the pointed end of the bullet.

The screwthreaded connection between the barrel 13 and chamber block is sealed at the inner end of their threads by an annular sealing ring 21 preferably formed of rubber and having a channel in its forward side defining skirt portions which are forced by external pressure tightly against the adjacent surfaces.

Reference is again directed to the expansion retarding and pressure localizing disk 16. As the name implies, the disk 16 with its wall or skirt 16a performs two important functions; namely, retarding the expansion of the explosive to build up pressure before acting upon the bullet, and localizing the area of the barrel subjected to the force of the explosion.

It is manifestly impossible in a gun unit of this character to provide anything but the shortest of barrels, while it is necessary that a comparatively heavy bullet have sufficient velocity in its extremely short travel to penetrate not only one, but two or three strings of casing. The disk 16, while formed of comparatively soft material, sufficiently delays the expansion of the explosive to increase greatly the pressure of the explosive with the result that muzzle velocities comparable with rifle bullets are obtained.

The generation of such high pressures naturally cause some expansion between the barrel and chamber block so that without the skirt or wall at the periphery of the disk 16, the pressure generated would be applied over the entire breach end surface of the barrel. The force of such high pressure over this large an area places extreme stresses on the threaded connection between the barrel and the chamber block as well as that portion of the chamber block between its enlargement 11a and breach end of the barrel. In other words, assuming that the area indicated by A of the chamber 11c is one square inch, and that the area indicated by B of the barrel is two square inches, and that the pressure generated within the chamber is 150,000 pounds per square inch, it follows that the force on the barrel with the disk 16 and its skirt 16a is only 150,000

pounds; whereas, without the skirt 16a, the force tending to blow out the barrel or break the chamber block at the breach end of the barrel would be 300,000 pounds.

Though I have shown and described a particular embodiment of my invention, I do not wish to be limited thereto but desire to include in the scope of my invention such embodiments as are embraced in the appended claims.

I claim:

1. A gun unit for gun type well casing perforators comprising; a chamber block having an explosive receiving chamber and a barrel receiving portion of larger diameter than the chamber; a barrel removably securable in said chamber block; and a skirted disk of smaller diameter than said barrel receiving portion interposed between said barrel and chamber with its skirt directed toward the chamber.

2. A gun unit for gun type well casing perforators comprising; a chamber block; a barrel adapted to be screwthreadedly secured thereto and defining therewith an explosive receiving chamber of larger diameter and a projectile receiving bore of smaller diameter; a sealing ring interposed between the barrel and chamber block at the inner or breach end of the barrel; a sealing disk closing the bore of said barrel; said ring and disk sealing the chamber against external liquids; a projectile in said bore; and a yieldable means interposed between said disk and projectile for holding said projectile at the breach end of the barrel.

3. A gun unit for gun type well casing perforators comprising; a chamber block; a removable barrel adapted to fit said chamber block and define therewith an explosive receiving chamber, said barrel being larger in diametrical than said chamber; a sealing means interposed between the barrel and chamber responsive to pressures from within the chamber for minimizing the area of said barrel subjected thereto; and a sealing means between the barrel and chamber block, and another sealing means at the muzzle of said barrel adapted to seal the chamber from liquids externally of the gun unit.

4. A gun unit for gun type well casing perforators comprising; a chamber block; a removable barrel adapted to fit said chamber block and define therewith an explosive receiving chamber, said barrel being larger in diametrical section than said chamber; a sealing means between the barrel and chamber block, and another sealing means at the muzzle of said barrel adapted to seal the chamber from liquids externally of the gun unit; said barrel having a projectile receiving bore; and yieldable means interposed between the muzzle sealing means and a projectile within the bore for retaining the projectile at the breach end of the barrel adjacent the explosive receiving chamber.

5. The combination with a gun unit for well casing perforators wherein an explosive charge is retained in a chamber block by a plug of larger diameter than the charge; of a disk interposed between the plug and chamber and having a peripheral skirt directed into the chamber, the disk being responsive to pressures generated within the chamber to maintain the area of the plug subjected to such pressure substantially equal to the section of the chamber.

6. A gun unit for a gun perforator: a chamber block having an explosive receiving chamber and a barrel receiving recess extending therefrom, said recess being substantially larger in

diameter than said chamber and forming there-
with a shoulder; a gun barrel adapted to be re-
movably mounted in said recess for access to said
chamber and abut said shoulder; and a sealing
means interposed between said chamber and gun
barrel to restrain radial flow of gases between said
shoulder and gun barrel upon ignition of an ex-
plosive in said chamber.

7. A gun unit for a gun perforator: a chamber
block having an explosive receiving chamber and
a barrel receiving recess extending therefrom,
said recess being substantially larger in diameter
than said chamber and forming therewith a
shoulder; a gun barrel adapted to be removably
mounted in said recess for access to said cham-
ber and abut said shoulder, said gun barrel hav-
ing a bore smaller than said chamber to define
a confronting face exposed thereto; and a sealing
member covering said face and having a skirted
periphery directed into said chamber for mini-
mizing radial flow of gases between the gun
barrel and chamber block shoulder during igni-
tion of an explosive charge in said chamber.

8. A gun unit for a gun perforator: a chamber
block having an explosive receiving chamber and
a barrel receiving recess extending therefrom,
said recess being substantially larger in diameter
than said chamber and forming therewith a
shoulder; a gun barrel adapted to be removably
mounted in said recess for access to said cham-
ber and abut said shoulder; a sealing means in-
terposed between said chamber and gun barrel
to restrain radial flow of gases between said
shoulder and gun barrel upon ignition of an
explosive in said chamber; a first deleterious fluid
seal between said barrel and its recess; and a

second deleterious fluid seal at the outer end of
said gun barrel.

9. A gun unit for a gun perforator: a chamber
block having an explosive receiving chamber
and a barrel receiving recess extending therefrom,
said recess being substantially larger in diameter
than said chamber and forming therewith a
shoulder; a gun barrel adapted to be removably
mounted in said recess for access to said cham-
ber and abut said shoulder, said gun barrel hav-
ing a bore smaller than said chamber to define
a confronting face exposed thereto; a sealing
member covering said face and having a skirted
periphery directed into said chamber for mini-
mizing radial flow of gases between the gun
barrel and chamber block shoulder during igni-
tion of an explosive charge in said chamber; a
first deleterious fluid seal between said barrel
and its recess; and a second deleterious fluid seal
at the outer end of said gun barrel.

10. A gun unit for a gun perforator: a chamber
block having an explosive receiving chamber and
a barrel receiving recess extending therefrom,
said recess being substantially larger in diameter
than said chamber and forming therewith a
shoulder; a gun barrel adapted to be removably
mounted in said recess for access to said chamber
and abut said shoulder; a first skirted disk at the
inner end of said barrel, the skirt directed into
said explosive chamber to minimize radial flow
of explosive gases between the barrel and shoul-
der; and a second skirted disk at the outer end
of said barrel to seal against entrance of dele-
terious fluid into the bore of said barrel.

GEORGE F. TURECHEK.