

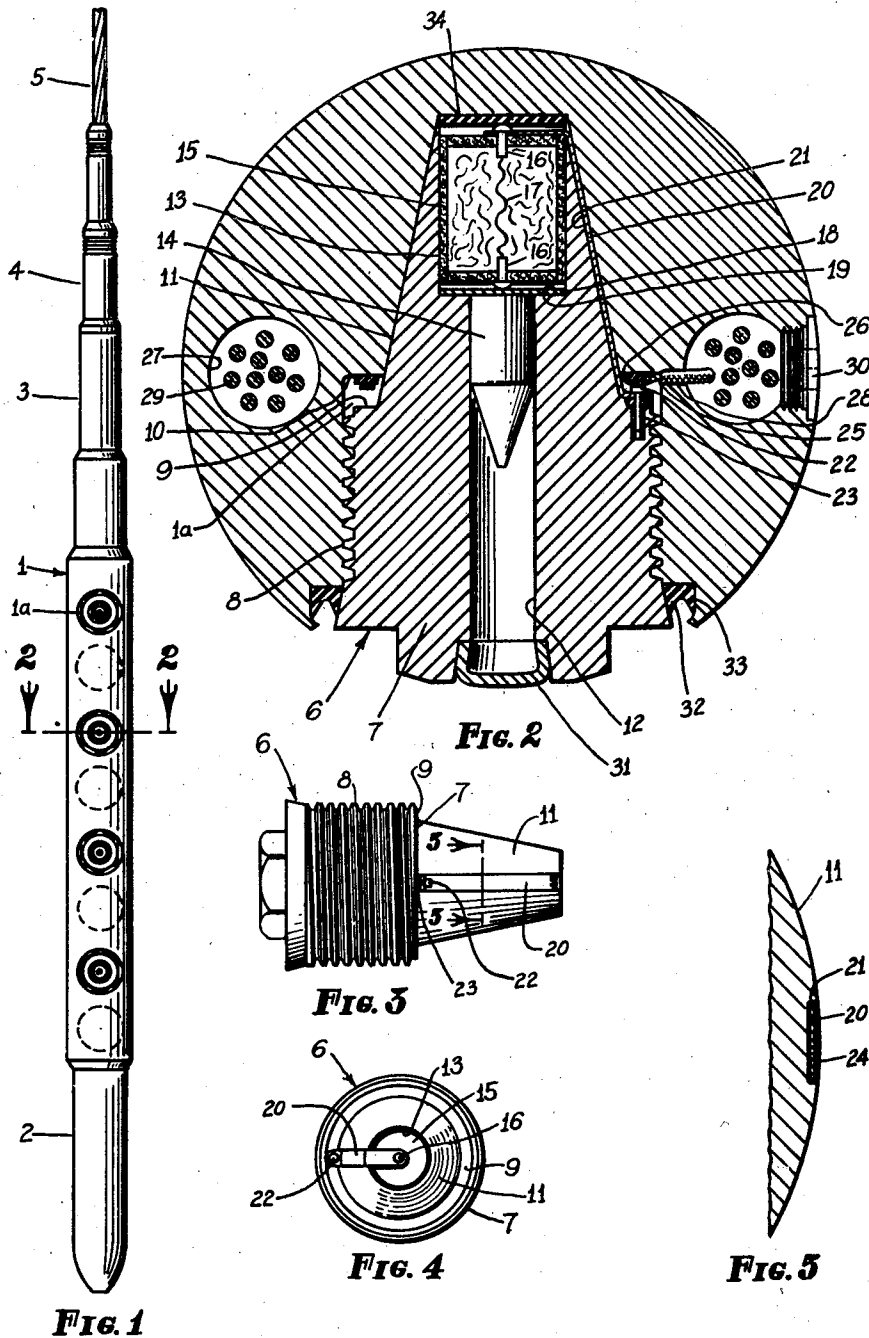
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G. F. TURECHEK

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GUN PERFORATOR

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INVENTOR
 GEORGE F. TURECHEK
 BY *Clayton Spencer*
 ATTORNEY

UNITED STATES PATENT OFFICE

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GUN PERFORATOR

George F. Turechek, Los Angeles, Calif., assign-
or to Lane-Wells Company, Los Angeles, Calif.,
a corporation of Delaware

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My invention relates to gun perforators, that is, to explosively operated devices which fire projectiles through well casing in place, and among the objects of my invention are:

First, to provide a gun perforator comprising a gun body in which is fitted a plurality of gun units, the gun body and gun units being so arranged that the gun body reinforces the gun units against the explosive pressures generated within the gun units when they are fired;

Second, to provide a gun perforator of this class which, by reason of the fact that the gun body reinforces the gun unit, enables the gun unit to be made particularly compact and readily transported;

Third, to provide a gun perforator which is particularly easy to clean and reload, and is so arranged that, if desired, only the additional cartridges and bullets need be carried;

Fourth, to provide a gun perforator of the removable gun unit type which is an improvement on my preceding patent, No. 2,092,294, in that the distance between centers of adjacent gun units may be reduced and a larger number of such gun units carried in a gun body of given length and weight;

Fifth, to provide a gun perforator wherein the pressure exerted on the gun unit, tending to force it from the gun body, is limited to the area of the powder charge, thus minimizing the strain imposed on the threaded connection provided between the gun unit and body; and

Sixth, to provide a gun perforator which incorporates a novel means of electrically connecting the several gun units so that they may be fired in sequence.

Seventh, to provide a gun perforator having removable gun units adapted to fit into a gun body and so arranged that the gun body serves to support the gun unit against expansion when an explosive charge within the gun unit is detonated, the inner end of the gun unit fitting the walls of the gun body in such a manner that the force of such explosion is transmitted directly thereto.

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

Figure 1 is an elevational view of my gun perforator shown in position in a well-bore;

Figure 2 is an enlarged transverse sectional view thereof, through 2—2 of Figure 1;

Figure 3 is an elevational view of one of the gun units removed from the gun;

Figure 4 is an end elevational view thereof; and

Figure 5 is an enlarged fragmentary sectional view through 5—5 of Figure 3.

My invention is preferably incorporated in a gun perforator which comprises generally a body 1, at the lower end of which is suspended a cushion chamber 2 and at the upper end of which is provided a controller case 3 which, in turn, is suspended from a cable head 4 provided at the lower end of a conductor core cable 5. The gun body is provided with a plurality of laterally directed sockets, designated 1a, opening in opposite directions in alternation, each socket receiving a gun unit 6.

Each gun unit comprises a barrel 7, the outer portion of which is externally threaded, as indicated by 8, to coact with corresponding threads provided at the outer portion of the socket 1a. At the inner end of the threaded portion 8 the gun barrel is reduced in diameter, forming a shoulder 9 which confronts a shoulder 10 of said socket 1a. Inwardly of the shoulder 9 the gun barrel is frusto-conical, as indicated by 11, and the corresponding portion of the socket 1a is likewise frusto-conical in conformity, so that the inner portion 11 of the barrel is completely supported or reinforced by the gun body.

The gun barrel 7 is provided with a bore 12 and a counterbore 13 which receive, respectively, a bullet 14 and a cartridge 15. The cartridge may be of the construction more particularly disclosed in Patent No. 2,092,317 in that it comprises a case of insulating material having contacts 16 at its ends connected by a fusible wire 17.

The bullet 14 is provided at its inner end with a shear disc 18, the periphery of which bears against the shoulder 19 formed between the bore 12 and counterbore 13. The shear disc 18 is preferably spot-welded to the bullet and serves to restrain the bullet not only before ignition of the powder charge, but also for an instant after said ignition, so that the pressure in the counterbore 13 builds up sufficiently to impart a high velocity to the bullet.

One of the contacts 16 of the cartridge 15 is grounded to the shear disc 18 while the other contact located at the inner end of the gun unit is attached to a contact strip 20 which extends across the end of the cartridge and down a rudimentary groove 21 provided in the conical portion 11 of the gun barrel. The extremity of the contact strip 20 terminates in a pin 22 adapted to fit into a small hole provided in the shoulder 9, an insulated grommet 23 being provided around the pin 22 to insulate the same from the gun barrel. Except for its ends, in order to make con-

tact with the pin 16 and pin 22, the contact strip 20 is provided with a coating of insulating material 24. Such insulation may be a dipped or applied coating, or may be an oxide coating such as may be formed on aluminum. The contact strip 5 may be extremely thin and the groove in which it fits accommodates the strip very snugly.

The shoulder 10 formed between the threaded outer portion and the tapered inner portion of the gun unit socket receives an insulation ring 25, preferably of slightly yieldable material, upon which is suitably secured a contactor ring 26.

The gun body 1 is provided with a pair of longitudinally extending conductor passages 27, each 15 of which communicates with alternate gun units through lateral passages 28 intersecting the sockets adjacent the shoulders 10. A plurality of conductors 29 are threaded through the passages 27, each one corresponding to a gun unit and 20 having a lead extending laterally through the corresponding lateral passage 28 and electrically connected to the conductor ring 26. Opposite such lateral passages 28 the passages 27 may be provided with openings adapted to be sealed by 25 removable plugs 30 to facilitate wiring of the gun body.

The several conductors 29 extend to the top of the gun body and are suitably connected with a controller which, for the purposes of this application, is conventional and more fully set forth 30 in Patents Nos. 2,062,974 and 2,048,451.

The gun unit is sealed against water intrusion by means of a sealing disc 31 provided at the outer end of the gun barrel 12 and by a sealing ring 35 32 set into a retainer portion 33 formed at the outer end of the gun unit socket.

To prevent grounding of contact 16 at the back-end of the cartridge 15 an insulation plate 34 is provided at the inner end of the gun unit socket.

The gun units 6 may be made up with the cartridges and bullets in place and used interchangeably in a gun body. In such a case the gun units are preloaded and carried in trays along with the gun body on the service truck. On the other 40 hand, the bullet 14 and cartridge 15 may be readily and quickly inserted into the gun unit, and the contact strip 20 may be placed in position easily; consequently these elements only may be supplied with the gun perforator body and its gun 45 barrels 7. It should be borne in mind, of course, that as soon as the bullet has fired, the gun-bore and counterbore fill up with well fluid and must be thoroughly cleaned after each trip.

When the cartridge is discharged the pressure 50 built up is transmitted by the walls of the conical portion 11 to the body 1, the walls of such conical portion withstanding very little of the force so generated. Also, it should be noted that the pressure area, tending to force the gun unit from its 55 socket, is limited to the diameter of the counterbore 13 and is not exerted over the entire thread diameter of the gun unit. Consequently, extremely high pressures may be built up inside the counterbore without danger of blowing the 60 gun unit from the body. Furthermore, by reason of the fact that electrical connection is at the side of the gun unit, rather than at the back, as, for example, in Patents Nos. 2,062,974 and 2,062,975, the maximum length of barrel is obtained for a given body diameter. This is of material importance inasmuch as the velocity and, 65 therefore, the energy stored up in the bullet 15 is increased in proportion to the length of the barrel.

75 Various changes and alternate arrangements

may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention as broadly as the prior art permits.

I claim:

1. In a gun perforator adapted to be suspended 5 in a well casing and discharge bullets laterally therethrough: a gun body having a laterally directed socket threaded at its outer portion and tapering at its inner portion; and a gun unit 10 adapted to screwthread into said socket and having a conical end adapted to conform to and be supported by the tapering walls of said socket, said gun unit having a bore therethrough and a 15 cartridge chamber within its conical end adapted to receive, respectively, a bullet and explosive cartridge.

2. In a gun perforator adapted to be suspended in a well casing and discharge bullets laterally therethrough: an explosive-resisting gun body 20 having a laterally directed socket including a tapered inner end; and a gun unit including a tapered inner end portion conforming to and supported by the tapered inner end of said socket, a cartridge chamber within said conforming portion of said gun unit and a projectile bore continuing from said chamber and means for holding 25 said gun unit in said socket.

3. In a gun perforator adapted to be lowered into a well casing and discharge bullets laterally therethrough: a gun body having a laterally directed socket provided with a tapered inner end; electrical contact means mounted in said pocket outwardly of said inner end; a gun unit adapted 30 to fit said socket, including a tapered portion conforming to the inner end of said socket, a cartridge chamber within said tapered portion, and a bullet bore extending outwardly from said chamber; and electrical conductor means carried 35 by said gun unit for connecting said contact means with a cartridge contained within said chamber.

4. In a gun perforator adapted to be lowered into a well casing and discharge bullets laterally therethrough: a gun body having a laterally directed socket provided with a tapered inner end; electrical contact means mounted in said socket 40 outwardly of said inner end and a gun unit having a cartridge chamber and a tapered portion; said tapered portion provided with a rudimentary recess extending from its inner end to a point in proximity to said contact means; and a conductor 45 substantially complementary to said recess extending from said contact means to a cartridge contained in said chamber.

5. In a gun perforator adapted to be lowered into a well casing and discharge bullets laterally therethrough: a gun body having a plurality of laterally directed sockets, each having a tapered inner end and having longitudinal passages offset from, but communicating with, the sockets; conductors threaded through said passages and contact elements electrically associated with said 50 conductors and mounted in said sockets outwardly from said tapered inner ends; a gun unit for each socket, including a tapered portion snugly fitting said tapered inner end, a bore in its outer portion adapted to receive a bullet and a counterbore in its tapered portion adapted to receive an electrically-ignited power cartridge; and a conductor 55 extending from said cartridge alongside of said tapered portion to said contact element.

6. In a gun perforator: a body member having a laterally directed socket; a gun unit including 60 a barrel having a bullet-receiving bore at its outer 75

portion and a cartridge-receiving chamber at its inner portion, the walls of said barrel around said bore and the forward end of said cartridge chamber being sufficiently thick to withstand
5 without appreciable flexure the destructive force of the explosive discharged therein, said walls of the gun barrel being reduced in thickness toward the inner end of said chamber and adapted to be

supported by the walls defining the inner end of said socket, the inner end of said chamber being closed by the inner end of said socket and the inner end of said barrel adapted to expand against the walls of said socket to seal against
6 the escape of explosive charge.

GEORGE F. TURECHEK.