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GUN PERFORATOR

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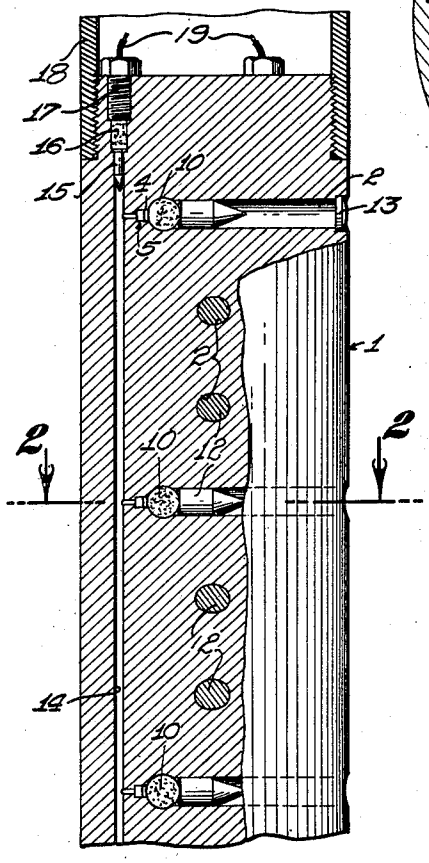


FIG. 1

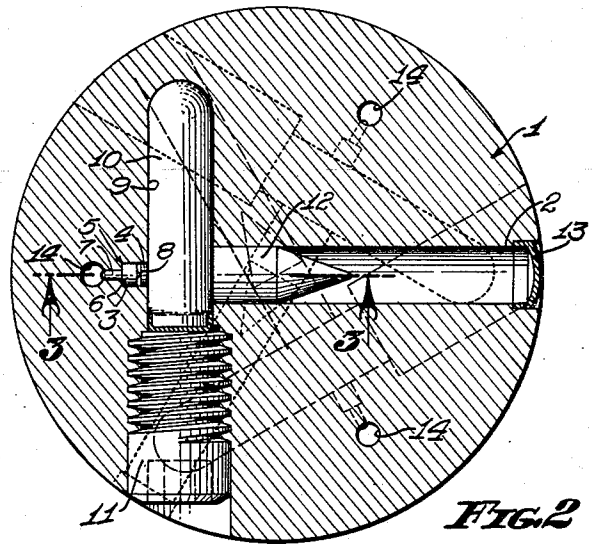


FIG. 2

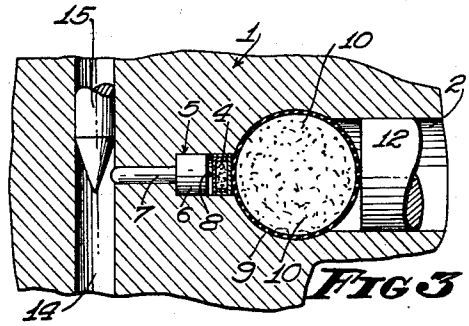


FIG 3

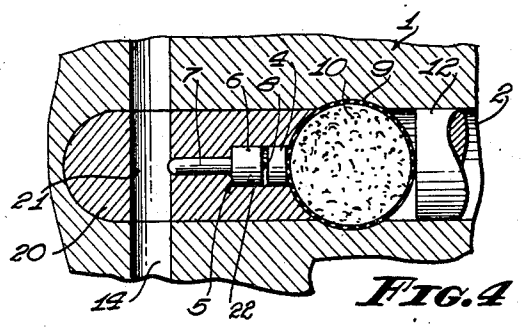


FIG. 4

INVENTOR
GEORGE F. TURECHEK
WELTON G. WELLINGTON
BY Floyd Spencer.
ATTORNEY

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GUN PERFORATOR

George F. Turechek, Los Angeles, and Welton G. Wellington, San Gabriel, Calif., assignors to Lane-Wells Company, Los Angeles, Calif., a corporation of Delaware

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15 Claims. (Cl. 164—0.5)

Our invention relates to gun perforators; that is, the devices adapted to be lowered into a well casing for the purpose of firing bullets therethrough to form channels for the entrance of fluid from the surrounding formation. Among the objects of our invention are:

First, to provide a gun perforator which offers the compactness and simplicity of construction found in gun perforators in which a powder train is utilized to initiate the firing of the several gun units of the gun perforator, but which eliminates the need of an open port between the powder train and the cartridges of the several gun units, thereby eliminating the attendant loss of powder pressure or frequent repair due to the erosion of said port;

Second, to provide a gun perforator in which a combined firing pin and check valve isolates each gun unit from the fire-initiating or triggering bore; and

Third, to provide a gun perforator which utilizes a special triggering bullet to engage the several contact pins, but which may be caused to operate by the concussion of the initiating explosive charge without the use of a bullet or other direct pin-engaging means.

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

Figure 1 is a fragmentary partial elevational, partial sectional view of a gun perforator embodying our invention;

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

Figure 3 is a further enlarged fragmentary sectional view through 3—3 of Figure 2, showing particularly the firing pin and percussion cap; and

Figure 4 is a similar view showing a modified form of construction.

A gun body 1 is provided which is in the form of an elongated solid cylinder and is provided with a plurality of laterally directed gun bores 2. These are preferably arranged in three vertical sets, defining planes 120° offset from each other. The inner end of each gun bore is provided with a rudimentary socket 3 which accommodates a percussion cap 4 and a firing pin 5. The firing pin is provided with a head 6 and a stem 7, the latter of small diameter and adapted to fit in a small hole or port continuing from the socket 3. The head of the firing pin is provided with a small point 8 which, when driven against the percussion cap 4, causes its ignition.

Immediately forward of the percussion cap each gun bore is intersected by a cross bore 9 which receives an explosive cartridge 10 and is closed at its outer end by a suitable screw-threaded plug 11. Each gun bore receives a bullet 12 and its outer end may be closed by a sealing cap 13.

The gun body is provided with three longitudinal trigger bores 14 which intersect the small opening or ports continuing from the corresponding set of sockets 3, that is, one trigger bore 14 is provided for each set of gun bores. The upper end of each trigger bore 14 is adapted to receive a fire-initiating or trigger bullet 15, a cartridge 16 and a sealing plug 17. These are preferably arranged at the upper end of the trigger bores and are covered by a suitable case 18. The cartridges 16 may be fired electrically, in which case conductors 19 are provided, or any suitable mechanical means may be used.

Operation of the gun perforator is as follows: The cartridges 16 are ignited simultaneously or in sequence to cause the trigger bullets 15 to pass downwardly through the trigger bores 14. The inner or stem ends of the firing pins protrude slightly into the corresponding trigger bores 14, with the result that the trigger bullets 12 strike the inner ends of the firing pins in sequence, causing them to be driven forwardly to set off the corresponding percussion caps 4, as indicated in Figure 3.

It is not necessary in all cases to rely upon the bullets 16 inasmuch as a very substantial pressure or percussion wave may be created in the trigger bores by the discharge of a so-called blank cartridge. Such percussion wave has the effect, like the bullet, of forcing the firing pin forwardly to set off the percussion cap.

Each firing pin serves not only to set off the corresponding percussion cap but also acts as a check valve to prevent the high pressure gases generated within the cartridge chamber from passing into the trigger bores. This eliminates erosion of the ports joining the cartridges and trigger bores and prevents reduction in the effective powder pressure, as none of it is dissipated into the trigger bore.

Because of the fact that the firing pins must be maintained as small as possible, any wear of the ports or holes in which they fit is undesirable. Consequently, the gun bores may be drilled inwardly to intersect the trigger bores and renewable plugs 20 inserted in the inner ends thereof. The plugs 20 are provided with transverse bores 21 registering with the trigger bores 14 and are provided with a socket 22 to receive

the firing pin head and percussion cap as well as a hole to receive the stem 7 of the firing pin.

Various changes and alternate arrangements may be made within the scope of the appended claims, in which it is our intention to claim all novelty inherent in the invention as broadly as the prior art permits.

We claim:

1. A gun perforator comprising: a plurality of gun units, each having a gun bore, a cartridge chamber and a firing pin socket; a bullet, cartridge, percussion cap and firing pin for each gun unit; a gun body incorporating said gun units and having a bore intersecting said firing pin sockets; and explosively operated means adapted to travel along said gun body bore for actuating said firing pins in sequence.

2. A construction, as set forth in claim 1, wherein said firing pins constitute sealing means against discharge from said firing chambers into said gun body bore.

3. A gun perforator comprising: a plurality of gun units, each having a gun bore, a cartridge chamber and a firing pin socket; a bullet, cartridge, percussion cap and firing pin for each gun unit; a gun body incorporating said gun units and having a bore intersecting said firing pin sockets; a triggering bullet for said gun body bore engageable with said firing pins in sequence; and means for firing said triggering bullet.

4. In a gun perforator having a plurality of gun units and a triggering bore traversing said gun units: a firing pin extending from each gun unit into said triggering bore; and explosive means associated with said triggering bore for actuating said firing pins in sequence.

5. In a gun perforator having a plurality of gun units and a triggering bore traversing said gun units: a firing pin extending from each gun unit into said triggering bore; a triggering bullet adapted to pass along said triggering bore and engage said firing pins in sequence; and an explosive cartridge for said triggering bullet.

6. In a gun perforator having a triggering bore, and a plurality of gun units communicating with said triggering bore through passages of reduced cross section: a firing pin for each passage; a percussion cap associated with each firing pin; and explosively actuated means adapted to travel along said triggering bore to actuate said firing pins in sequence.

7. In a gun perforator having a triggering bore, and a plurality of gun units communicating with said triggering bore through passages of reduced cross section; a firing pin for each passage; a percussion cap associated with each firing pin; a triggering bullet adapted to pass along said triggering bore and engage said firing pins in sequence; and an explosive cartridge for said triggering bullet.

8. In a gun perforator having a triggering bore, and a plurality of gun units communicating with said triggering bore through passages of reduced cross section: a firing pin for each passage, said firing pins adapted to seat in said passages to seal against discharge from said gun units into said triggering bore; percussion caps for the gun units associated with said firing pins; and explosively actuated means associated with said triggering bore to actuate said firing pins.

9. In a gun perforator having a triggering bore, and a plurality of gun units communicating with said triggering bore through passages of reduced cross section: a firing pin for each passage, said firing pins adapted to seat in said passages to seal against discharge from said gun units into said triggering bore; percussion caps for the gun units associated with said firing pins; a triggering bullet adapted to pass along said triggering bore and engage said firing pin in sequence; and an explosive cartridge for said triggering bullet.

10. A gun perforator comprising: a gun body defining a plurality of gun units, each comprising a laterally directed gun bore and laterally directed cartridge bore crossing the gun bore in a common plane therewith; bullets for said gun bores; cartridges and sealing plugs for said cartridge bores; said gun body also defining a longitudinal passage in communication with the gun units; and explosive means operable through said passage for discharging said gun units.

11. A gun perforator comprising: a cylindrical block having pairs of intersecting laterally directed bores, each pair constituting the gun bore and cartridge bore of a gun unit, said gun units arranged in sets with the muzzle ends of their respective gun units facing in different directions; said block also having longitudinally directed triggering bores for the sets of gun units communicating with the several gun units; and explosively operated means associated with each triggering bore for discharging the corresponding gun units.

12. A gun perforator construction, as set forth in claim 10, wherein the inner end of each gun bore is intersected by the triggering bore, and which includes further: a plug fitting the inner end of the gun bore and having a hole registering with said triggering bore; and triggering means mounted in said plug cooperating with said explosively operated means for discharging the corresponding gun unit.

13. A gun perforator, as set forth in claim 11, wherein the longitudinal passage is smaller in diameter than the bores of the gun units and traverses one bore of each of the gun units, and which includes further: a removable plug fitting said traversed bore and having an opening in registry with said triggering bore.

14. A gun perforator, as set forth in claim 11, wherein the longitudinal passage is smaller in diameter than the bores of the gun units and traverses one bore of each of the gun units, and which includes further: a removable plug fitting said traversed bore and having an opening in alignment with said triggering bore and a port communicating therefrom to said bore; and a means in said port cooperating with said explosive means for discharging said gun units.

15. A gun perforator comprising: a gun body incorporating a plurality of gun bores and a plurality of cartridge bores in communication with said gun bores, the cartridge bores being accessible from the exterior of the gun body and independently of said gun bores; said gun body also defining a triggering passage in communication with said bores; and explosive means operable through said passage to discharge cartridges contained in said cartridge bores.

GEORGE F. TURECHEK.
WELTON G. WELLINGTON.