Oct. 10, 1944. G. F. TURECHEK 2,360,024

GUN PERFORATOR

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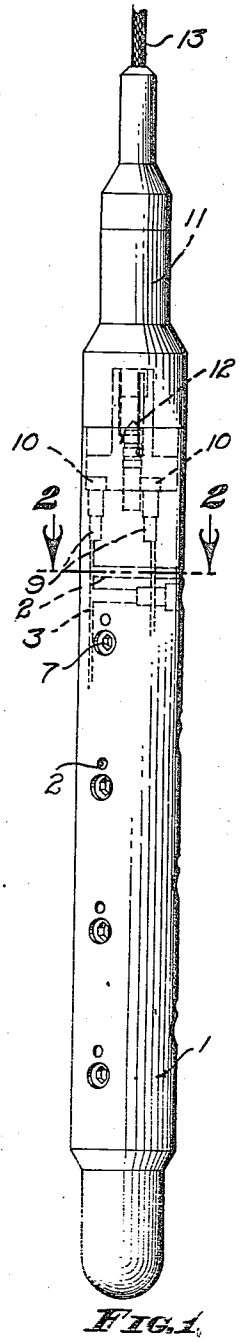


FIG. 1

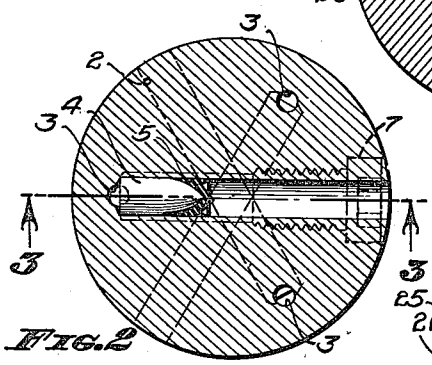


FIG. 2

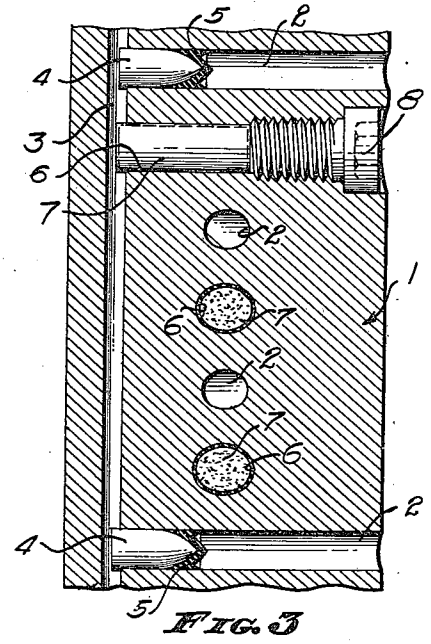


FIG. 3

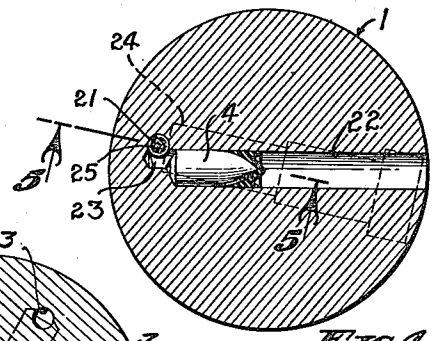


FIG. 4

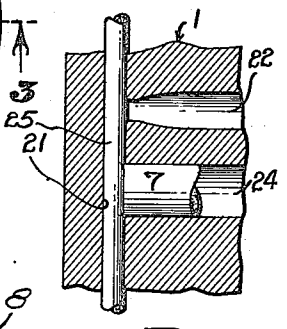


FIG. 5

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GUN PERFORATOR

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13 Claims. (Cl. 164—0.5)

My invention relates to gun perforators, that is, to devices adapted to be lowered within a well casing for the purpose of penetrating the wells thereof and permitting the entrance of fluids. Among the objects of my invention are:

First, to provide a gun perforator wherein a large number of gun units are incorporated in a unitary gun body and wherein only minimum axial spacing between the gun bores of adjacent units is required;

Second, to provide a gun perforator wherein the gun bores occupy a maximum proportion of the gun's diameter, the gun perforator cartridges for each gun unit being positioned in a plane offset from its gun bore so that virtually no portion of the gun perforator's diameter in the plane of the gun bore need be occupied by a cartridge, but instead the bullet may rest against the face or inner end of its gun bore;

Third, to provide a gun perforator wherein the bullets rest against the inner end of their gun bores and are subjected to the hydrostatic pressure incidental to submergence of the gun at great depth;

Fourth, to provide a gun perforator which is particularly simple in construction and adapted to be fired by flame propagation or by fuse without the need of electrical wiring through the gun body; and

Fifth, to provide a gun perforator wherein the gun units are arranged in sets, the member of each set adapted to fire simultaneously and the several sets being staggered with respect to each other so that the axial displacement of gun units belonging to the same set may be ample to prevent undue stress on the surrounding casing without necessitating an excessive length of gun body.

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 side elevational view of a gun perforator incorporating my invention;

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

Figure 3 is an enlarged fragmentary longitudinal sectional view through 3—3 of Figure 2;

Figure 4 is a transverse sectional view similar to Figure 2, showing a modified construction; and

Figure 5 is a fragmentary longitudinal sectional view through 5—5 of Figure 4.

A gun body 1 in the form of a solid cylinder is provided with a plurality of laterally directed gun bores 2. These are arranged in several sets. In the illustration three sets of bores are shown, pointing in three lateral directions and arcuately spaced 120°. The gun bores of the several sets are staggered so that every third gun bore belongs to the same set. Each set of gun bores is intersected at its inner or base end by a longitudinally extending flame passage 3. The passages 3 are smaller in diameter than the gun bores and each gun bore receives a bullet 4 which is adapted to rest against the rear end of the gun bore without completely closing the flame passage. Each bullet 4 is covered by a seal cap 5 of rubber or similar material, the bore outwardly therefrom being exposed to the well fluid in which the gun may be submerged.

Below or above each gun bore and parallel therewith is a cartridge bore 6, the inner end of which intersects the flame passage 3 and the outer end of which is enlarged and screw-threaded. The inner portion of the cartridge bore 6 receives a cartridge 7 and the outer screw-threaded portion receives a plug 8.

The upper end of the gun body 1 is provided with axially extending counterbores which communicate with the flame passages 3. The counterbores receive ignition cartridges 9 and are sealed by ignition cartridge plugs 10. The upper end of the gun body is adapted to be screw-threaded to a cable head 11 and the connection between the gun body and cable head incorporates a suitable electrical contact means 12 which communicates through the cartridge plugs 10 to the ignition cartridges 9 so that the ignition cartridges may be set off by an electric spark. The cable head and gun body are suspended from a conductor cable 13. The gun perforator is operated by setting off the ignition cartridges, either simultaneously or one at a time. The flame from the ignition cartridges travels down the flame passages 3, igniting the cartridges 7. The flame passes through the passage 3 with extreme rapidity so that the cartridges are ignited virtually simultaneously, and the pressure within the flame passage develops substantially uniformly throughout its length and drives the bullets simultaneously from the gun bores. Therefore, very little erosion of the flame passage 3 occurs, except between the cartridge bore 6 and its corresponding or adjacent gun bore 2. However, very substantial erosion may take place in this relatively short portion of the flame passage 3 before the performance of the gun perforator is affected.

The construction shown in Figures 4 and 5 differs from the previously described structure in

that the flame passage 21 therein is offset arcuately from the gun bore 22, there being a short socket 23 of reduced diameter continuing rearwardly from the gun bore into intersection with the flame passage. The cartridge bores 24 are likewise arcuately offset from the gun bores, but preferably only in an amount sufficient to align with the offset flame passage 21. The sockets 23, being of small diameter, form, with the main gun bores 22, abutments for limiting rearward movement of the bullet 4, as shown in Figure 4. In this construction the flame passage 21 is adapted to receive an ignition cord or fuse 25, preferably a fuse in which the ignition impulse moves with extreme rapidity, fuses of this type being known commercially as "Permacord." In the construction shown in Figures 4 and 5 the fuse cords 25 are ignited by the ignition cartridges 9, as in the first described structure. The ignition impulse actually travels faster in "Permacord" than in the open passageway 3, so that ignition of the several cartridges approaches the simultaneous.

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.

I claim:

1. A gun perforator comprising: a gun body defining at least one longitudinally extending ignition passage, a plurality of transversely extending gun bores communicating with said passage, and a plurality of transversely directed cartridge bores also communicating with said passage; bullets for said gun bores; and cartridges and seal plugs for said cartridge bores.

2. A gun perforator comprising: a gun body defining at least one longitudinally extending ignition passage, a plurality of transversely extending gun bores communicating with said passage, and a plurality of transversely directed cartridge bores also communicating with said passage; bullets for said gun bores; cartridges and seal plugs for said cartridge bores; said gun and cartridge bores being larger in diameter than said ignition passage and terminating short of complete transection thereof to form stops limiting movement of said bullets and cartridges, whereby the ignition passage is relatively free.

3. A construction, as set forth in claim 1, wherein said cartridge bores are arcuately displaced from said gun bores.

4. A gun perforator construction comprising: a gun body defining a plurality of longitudinally extending ignition passages near the periphery of the gun body, said gun body also defining sets of laterally directed gun bores and cartridge bores extending diametrically from each of said ignition passages and communicating with each other through their common ignition passage, the gun and cartridge bores of each set being interposed between those of the other sets; bullets for said gun bores, and cartridges and seal plugs for said cartridge bores.

5. A gun perforator construction comprising: a gun body in the form of a solid cylinder and defining a plurality of longitudinally extending ignition passages near its periphery; said gun body also defining sets of laterally directed gun bores and cartridge bores in axially offset planes extending diametrically from each of said ignition passages and communicating with each other through their common ignition passage, each gun bore and corresponding cartridge bore being grouped in close proximity to each other to form a gun unit, the gun units of each set being arranged between those of the other sets, the length of ignition passage between the bores of each gun unit being materially less than the ignition passage length between gun units; bullets for said gun bores; and cartridges and seal plugs for said cartridge bores.

6. A gun perforator construction, as set forth in claim 4, wherein the cartridge bores are arcuately offset with respect to each other and said ignition passages are eccentrically located with at least one of the bores of each gun unit.

7. A gun perforator construction, as set forth in claim 5, wherein the cartridge bores are arcuately offset with respect to each other and said ignition passages are eccentrically located with at least one of the bores of each gun unit.

8. A gun perforator comprising: a gun body in the form of a solid cylinder, said gun body defining a laterally extending gun bore and a laterally offset cartridge bore intersecting the surface of said gun body adjacent the muzzle end of said gun bore and being internally threaded in part, said gun body also defining a longitudinal ignition passage intersecting the inner ends of and connecting said bores, said gun bore and cartridge bore forming a gun unit; other gun units in said gun body communicating with said ignition passage and spaced a substantially greater distance from each other than the spacing between the gun bore and cartridge bore of each unit.

9. A gun perforator construction, as set forth in claim 8, wherein said gun body is provided with several sets of gun units, the gun units of each set occupying a substantially common plane and communicating with a common ignition bore, and those of each set displaced circumferentially from the others and interposed therebetween.

10. A gun perforator comprising: a gun body structure defining at least one longitudinally extending ignition passage, at least one gun bore and at least one cartridge bore, the longer axes of both of said bores disposed transversely to said ignition passage, their inner ends intersecting said ignition passage and their outer ends forming openings in the side walls of said gun body structure; a bullet for said gun bore; and a cartridge and sealing plug for said cartridge bore.

11. A construction as set forth in claim 10 wherein said cartridge bore is arcuately displaced from said gun bore.

12. A gun perforator comprising: a gun body structure defining at least one longitudinal ignition passage located parallel to and adjacent the side wall of said body structure, at least one gun bore and at least one cartridge bore, both of said bores extending substantially crosswise of said body structure and intersecting said ignition passage, both of said bores occupying more than half the width of said gun body structure; a bullet for said gun bore; and a cartridge and sealing plug for said cartridge bore.

13. A construction as set forth in claim 12 wherein said cartridge bore is arcuately displaced from said gun bore.

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