MEANS AND METHOD OF PERFORATING DEEP WELLS

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9 Claims.

The present invention is a method and means for increasing the efficiency of submersed guns, and relates to well casing perforations and similar operations wherein projectiles are discharged to perforate or penetrate steel, cement or other material submerged in liquid.

The objects of my invention include: The provision of a method and means for decreasing the resistance of liquid, surrounding a gun body, to progress therethrough of projectiles, by gasifying said liquid or otherwise releasing bubbles of air or gas in said liquid so that said liquid will be compressible sufficiently to let it displace as the projectile moves through it.

In the drawing: Figure 1 is a partial sectional partial elevational view of my apparatus disposed within a liquid filled well casing; and Figure 2 is a transverse sectional view thereof through II—II of Figure 1.

Referring to the drawing, the numeral 1 indicates a well casing into which is lowered on a cable 2 a gun body 3.

Body 3 is bored and tapped at 4 to receive removable breech-blocks 5 into which are threaded at 7 removable barrels 8.

In the bores of barrels 8 are projectiles 9 to which are spot-welded discs 11. Said discs serve as a retard for projectiles 9 and as a seal against hydrostatic pressure of liquid 12 in casing 1.

When the discs are compressed by barrels 8, they seal combustion chambers in which are shells 14 closed at both ends by wads 16. Thermo-electric elements 17 extend through the shells 18 and the ends thereof are secured to contacts extended through the wads 16. One of said contacts in each shell presses against a pin 19 the lead of which is in contact with a spring dip 19 insulated at 21 from the gun body 3.

A wire 22 leads from clip 18 upward through a bore 23 in the gun body 3 and through cable 2 to a control switch at the mouth of the well.

When said control switch (not shown) is closed current from any suitable source, at the mouth of the well passes through insulated wire 22 to clip 18, through pin 19, to thermal element and gun body 3, thence through spring centering devices 24 to casing 1.

The current, so introduced, energizes each of elements 17 which are embedded in explosive 26 causing same to explode, shearing disc 11 and driving projectile 9 through the liquid 12, casing 1 and causing it to penetrate the surrounding formation.

The lower end of body 3 is bored and tapped at 28 to receive the threaded end of a pipe 27 closed at the bottom by a cap 28 threaded thereon.

Pipe 27 serves as a container for a gas-releasing agent, indluded at 29, which may be carbon dioxide, CO₂, or any chemical reagent capable of generating and disseminating gas at a pressure sufficient to overbalance hydrostatic pressure of the drilling fluid 12.

I have found that commercial “dry ice” is well adapted to this use.

Just before the gun body 3 is lowered in casing 1, the tubular container 21 is removed from the body 3 and filled with dry ice. It ordinarily requires about ten minutes of time to lower the gun to the level to be perforated.

Temperature change causes the dry ice to volatilize, escaping gas filling a chamber 31 in the gun body. Accumulations of pressure in said chamber unseats check valves 32 which open outwardly in passages 33 which bleed chamber 31 and discharge into flutings 34 which are quadrilaterally disposed on the periphery of gun body 3.

These grooves are positioned directly beneath the projectile bores in gun barrels 8 and serve to direct bubbles 35 of gas in upward travel past said bores.

I claim:

1. The combination with a submersible gun adapted to be fired while submerged; of a chamber connected with said gun containing a quantity of a compressible medium under pressure sufficient to flow from said chamber against the pressure of the liquid in which the gun is submerged; and means for discharging said medium into the region of gun-fire.

2. A submersed firing gun comprising: a gun body, means for discharging projectiles therefrom; and a container adapted to contain a compressible medium under pressure in excess of the liquid therearound; and means for discharging said medium into the region traversed by said projectiles.

3. A method of firing gun type well casing perforators while submerged in a liquid within a well casing, characterized by: creating an upwardly flowing gaseous jacket around the casing perforator and firing projectiles laterally from the perforator through the gaseous jacket and surrounding casing.

4. A method of firing gun type well casing perforators while submerged in a liquid within a well casing, characterized by: increasing the compressibility of the well fluid by introducing a gas therein below the casing perforator.
5. A method of firing gun type well casing perforators while submerged in a liquid within a well casing, characterized by: generating a gas at a point below the casing perforator, and introducing the gas so generated into the well fluid to increase its compressibility.

6. The method of firing well casing perforators of the type having a plurality of laterally directed gun units, characterized by: submerging the gun within a liquid filled well casing; introducing into the liquid below the gun a train of gaseous bubbles in such a manner that they flow past the muzzles of the several gun units to increase the compressibility of the surrounding liquid; then firing said gun units.

7. The method of minimizing excessive pressures within a liquid filled well casing during perforation thereof by gun fire, characterized by: introducing into the liquid below the region of perforation a continuous stream of a compressible medium to absorb the shock resulting from the gun fire.

8. A method of perforating a well casing in situ wherein the casing contains a substantially incompressible medium, characterized by: submerging a gun type perforator therein; discharging a projectile by gun fire through the medium and casing while permeating the medium with a gas to absorb the shock of such discharge.

9. A gun type well casing perforator adapted to be submerged in a well casing containing an incompressible fluid and fired therein; and means for permeating the fluid with a compressible medium to cushion or dampen the pressure surge created in the fluid upon firing the perforator.

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