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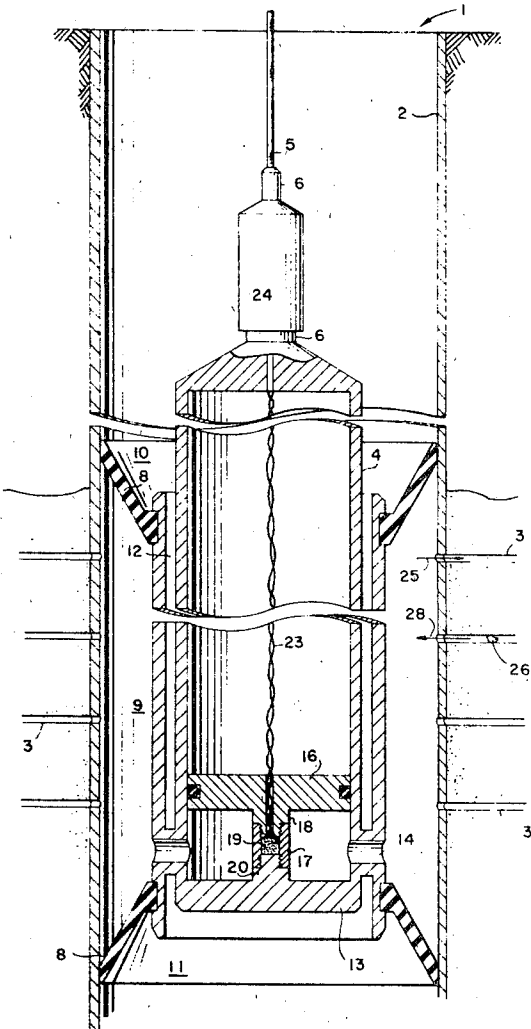
[56]		References Cited	
		UNITED STATES PATENTS	
2,729,292	1/1956	Hinson	166/63
2,361,558	10/1944	Mason	166/299
2,776,715	1/1957	Fuson et al.	166/63
3,029,732	4/1962	Greene	166/63 X
3,372,755	3/1968	Venghiaths	166/63

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[54] **WELL SHOCK DEVICE**
1 Claim, 1 Drawing Fig.

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[50] Field of Search.....	166/63, 299, 311, 65; 175/1

ABSTRACT: A shock device for unplugging perforations in a well and the like which comprises a chamber of low pressure relative to the pressure adjacent the perforations, the chamber being suddenly openable to the pressure adjacent the perforations with a consequent shock effect on the perforations.



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WELL SHOCK DEVICE

BACKGROUND OF THE INVENTION

Perforations are formed in the earth surrounding a well bore to facilitate the production of liquid such as oil therefrom or to facilitate the injection of a liquid such as water into the earth to increase oil production in another well. In either instance liquid is passed through the perforations, either toward the well bore in the case of the producing well or away from the well bore in the case of an injection well. Sometimes the perforations become clogged with solidlike materials thereby lowering the efficiency of the well be it a producer or an injection well. In such a situation it is beneficial to unplug the perforations and restore its original efficiency.

Heretofore clogged perforations have been unplugged by using equipment generally known as perforation washers. This equipment is lowered into the well on tubing. For example, in a producing well heated oil under pressure is passed through tubing down to the perforations and the heated oil, because of the pressure behind it in the tubing, enters the perforations to clean same. The use of perforation washers which require the introduction of tubing into the well for their operation involves a substantial amount of expense and time because of the need for running tubing down the well bore.

According to this invention, a device is provided which can be run down the well bore on a cablelike support such as a wire rope. A shock is then applied by the device to the perforations by suddenly reducing the pressure adjacent the perforations thereby unclogging the perforations.

Passing a tool down a well bore by means of a cablelike support is much faster and substantially less expensive than running tubing down the well bore for the same distance.

According to this invention there is provided a shock device for wells which comprises means for separating a section of the well which contains perforations from its adjacent upper and lower sections thereby defining an isolation zone, a chamber openly connected to the defined isolation zone, blocking means for preventing pressure from the defined isolation zone from entering the chamber, and means for releasing the blocking means to suddenly allow pressure from the defined isolation zone to surge into the chamber thereby creating the desired shock effect.

By applying the device of this invention to a producing well a vacuum-type shock is applied thereby tending to cause greater flow of liquid in the perforations towards the well bore containing the shock device.

In the case of injection wells the shock action is the same, but since the injection liquid is traveling in the perforations away from the well bore containing the shock device, the shock action tends to reverse the liquid flow direction in the perforations back towards the well bore containing the shock device thereby backwashing the perforations.

Accordingly, it is an object of this invention to provide a new and improved device for applying a shock effect to a well bore. It is another object to provide a new and improved device for unplugging clogged perforations in a well bore. It is another object to provide a new and improved device for backwashing injection well perforations. It is another object to provide a new and improved device for unclogging perforations in a well bore without the use of a tubing string.

Other aspects, objects, and advantages of this invention will be apparent to those skilled in the art from the disclosure and the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

The drawing shows a device according to this invention.

More specifically, the drawing shows a well bore 1 lined with casing 2 and having perforations 3 extending radially outward therefrom.

The device itself is composed of a chamber 4 the interior of which is at a pressure lower than the pressure normally obtaining in the casing adjacent perforation 3. The pressure in

chamber 4 can be atmospheric or higher or lower as desired. Generally, the lower the pressure in chamber 4 with relation to perforations 3 the greater the shock effect and the greater the likelihood of unclogging the perforations.

Chamber 4 is a hollow cylindrical like shape of any desired cross-sectional size and any desired length. The cross-sectional size will generally be that which will fit within the casing with some clearance on either side. The length can be any desired length, for example from 10 to 200 or more feet depending upon the magnitude of the shock effect desired.

Although the device is shown inside a casing, the device could also be employed inside tubing if desired.

Chamber 4 is supported by wire cable 5 which can be electrically conductive if desired. Upper member 6 of chamber 4 can carry equipment designed to facilitate the location of the perforations. A conventional casing collar locator and/or equipment desired for initiating operation of the device, e.g., conventional electrical means for receiving an electrical signal by the way of cable 5 and in turn generating an electrical pulse capable of detonating an explosive as will be described hereinafter in greater detail, can be carried on member 6.

Chamber 4 carries around its outer periphery and in spaced apart relation means 8 for separating the section of the well bore which contains perforations 3 from adjacent upper and lower sections of the well bore. The separating means 8 shown in the figure are conventional packer cups which are spaced apart along the length of chamber 4 to define zone 9. Zone 9 encompasses perforations 3 and therefore isolates perforations 3 from upper zone 10 and lower zone 11. Thus, zone 9 is a defined isolation zone.

Chamber 4 also carries conduit means 12 which openly connects upper and lower zones 10 and 11 to allow the free passage of fluid therebetween without entering zone 9.

Near the lower end 13 of the chamber, there is provided a plurality of apertures 14 around the periphery of the chamber. These apertures are means for openly connecting isolation zone 9 with the interior of chamber 4.

A blocking means 16 is provided in the interior of chamber 4 intermediate apertures 14 and the bulk of the interior of chamber 4. The blocking means shown in the figure is a T-shaped piston. A lower end portion of the vertical leg 18 of T-shaped piston 16 threadably engages sleeve 17 which contains explosive charge 19. The lower end of sleeve 17 is threadably fixed to protrusion 20 which is fixedly carried by end 13.

Any conventional means for releasing piston 16 to allow pressure from isolation zone 9 to surge through apertures 14 into chamber 4 and cause the desired shock effect can be substituted for sleeve 17. Sleeve 17 and explosive 19 can be any conventional explosive releasing device which is electrically connected by way of electrical conductor 23 to a firing device 24, e.g., a step up transformer, carried on member 6. Firing device 24 can be electrically connected to cable 5 so that an electrical signal can be passed down cable 5 to firing head 24 which in turn will generate the electrical pulse necessary to detonate explosive 19 or a cap therein and will pass that pulse along conductor 23 to explosive 19.

Other blocking means known in the art can be employed in the device of this invention.

In operation, for example in an injection well, water is normally pumped downwardly in casing 2 and radially outwardly from the well bore into perforation 3 in the direction shown by arrow 25. One or more of perforations 3 can become blocked by solid material 26 thereby reducing the efficiency of the injection well by reducing the amount of water injected into the earth. The device of this invention is lowered into the casing so that packer cups 8 straddle perforations 3, fluid pressure in zones 10 and 11 forcing packer cups 8 outwardly into contact with the casing 2 thereby isolating zone 9 from zones 10 and 11. The pressure inside chamber 4 is substantially atmospheric while the chamber in zone 9 is at least 100 p.s.i.g. greater than atmospheric because of the pressurization of the water in the casing to cause same to enter perforations 3. Bypass 12 allows the lowering of the device in a casing full of liquid.

After the device is set to form isolation zone 9 as shown in the drawing, explosive 19 is detonated by sending an electrical signal down cable 5 as described hereinabove.

When explosive 19 is detonated piston 16 is freed and is very rapidly pushed upwardly to the upper end of chamber 4 5 by the higher pressure fluid, e.g., water, in zone 9 and perforations 3 acting through apertures 14 against piston 16. The sudden upward movement of piston 16 causes a vacuum effect by the great inrush of water through apertures 14 which in turn causes a reversal of the direction of flow of water in perforations 3 as shown by arrow 28. This reversal in direction of water flow in perforations 3 backwashes the perforations and forces obstacles 26 out of the perforations into zone 9 thereby clearing the perforations. The device is then removed from the casing and the injection procedure carried on at normal efficiency. 15

Reasonable variations and modifications are possible within the scope of this disclosure without departing from the spirit and scope of this invention.

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The embodiments of the invention in which I claim an exclusive property or privilege are defined as follows:

1. In a shock device for wells,

means for separating a section of the well from adjacent sections to define an isolation zone, a chamber,

said well section isolating means being spaced apart packing means carried by said chamber,

means for openly connecting said defined isolation zone and said chamber,

said means for connecting said defined isolation zone and said chamber being a plurality of apertures around the periphery of said chamber between said spaced apart packing means,

blocking means for preventing pressure from said defined isolation zone from entering said chamber, and

means for releasing said blocking means to allow pressure from said defined isolation zone to enter said chamber.