

March 4, 1941.

F. A. WITT

2,233,930

OIL WELL CLEANER

Filed Aug. 4, 1938

2 Sheets-Sheet 1

FIG. 1.

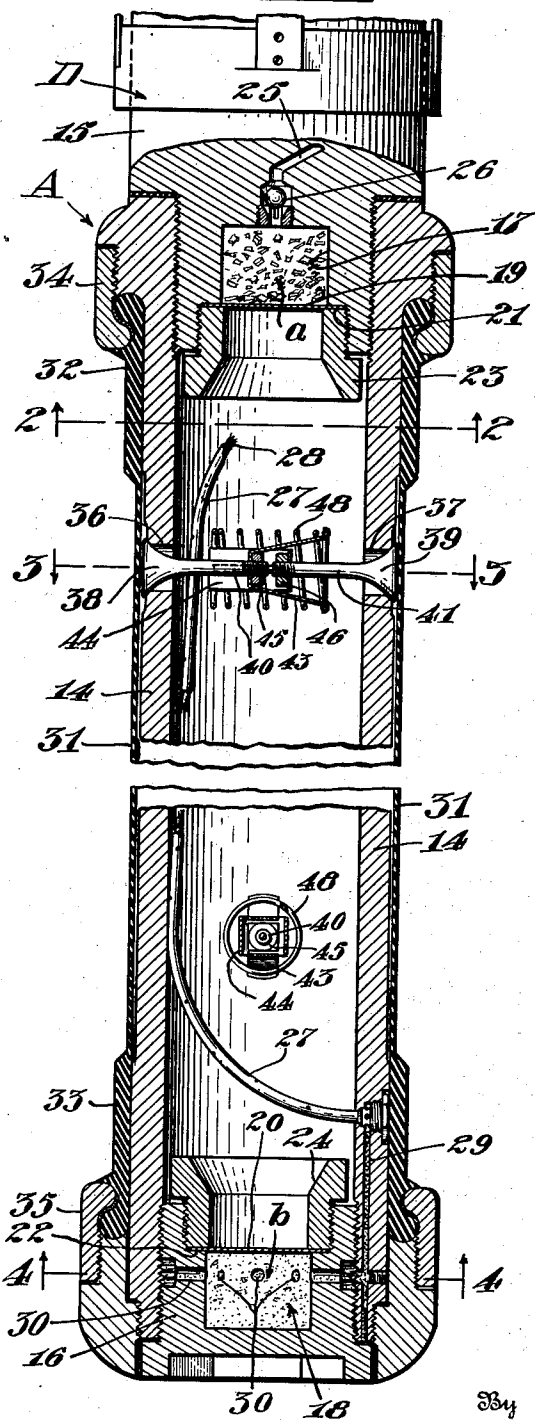


FIG. 2.

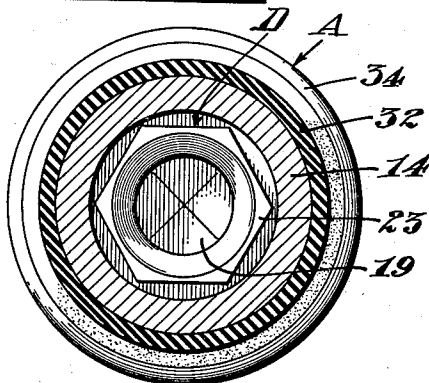


FIG. 3.

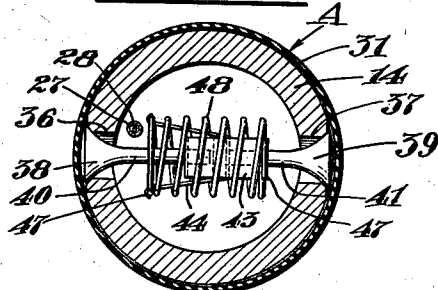
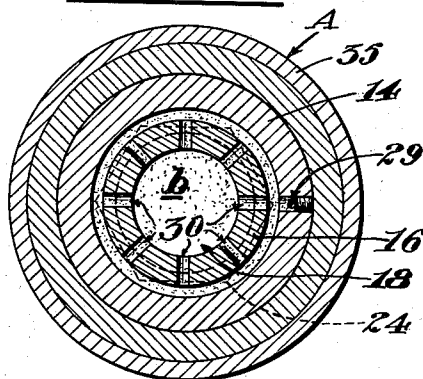


FIG. 4.



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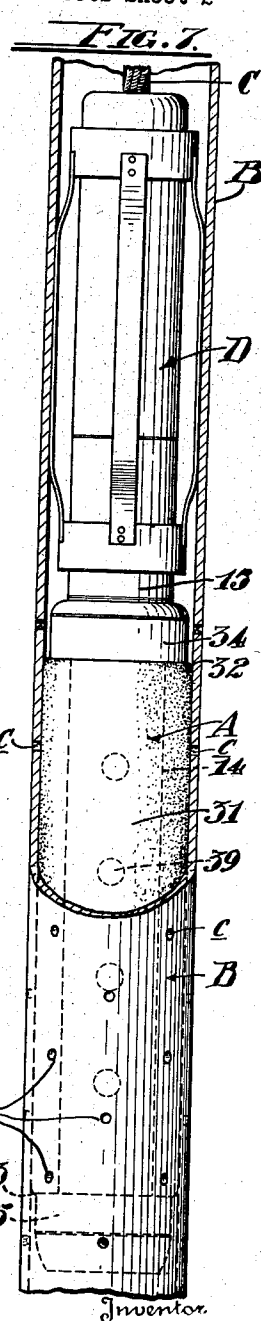
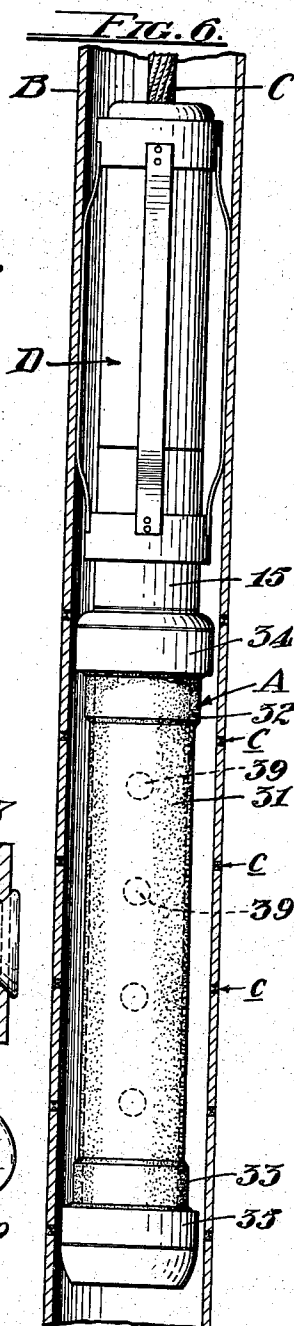
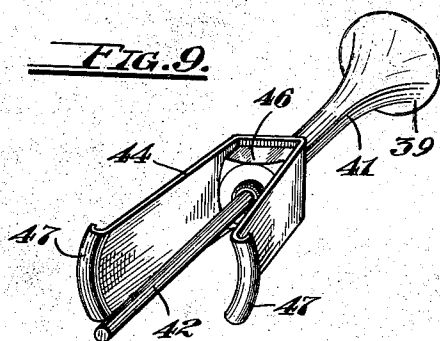
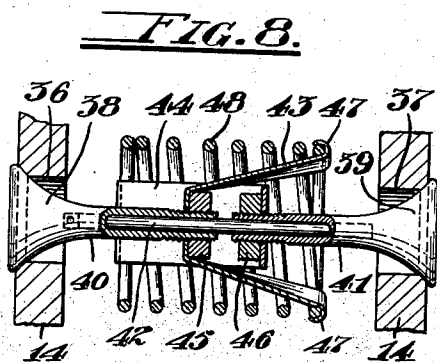
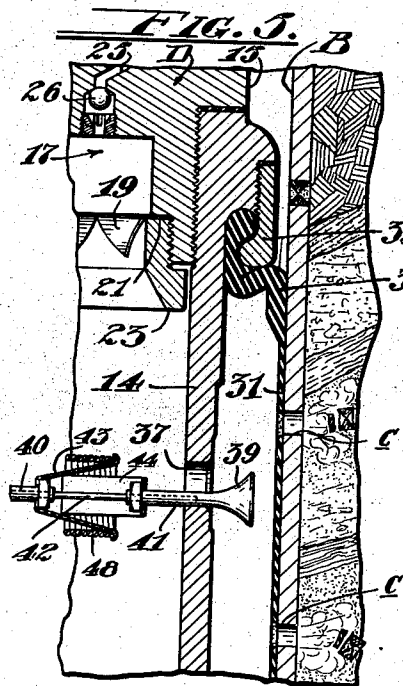
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OIL WELL CLEANER

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2 Sheets-Sheet 2



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2,233,930

OIL WELL CLEANER

Fred A. Witt, Los Angeles, Calif., assignor of sixty-six and two-thirds per cent to William A. Witt, and thirty-three and one-third per cent to Edward A. Witt, both of Los Angeles, Calif.

Application August 4, 1938, Serial No. 223,036

13 Claims. (Cl. 166—20)

This invention relates to a method and apparatus for cleaning well casings and more particularly pertains to a device for cleaning the perforated tube section or screen in a well casing by effecting the removal of accumulated deposits of asphaltum, sand and the like, so as to effect increased well production.

Another object is to provide a device of the above character in which expanding gases are utilized as a medium for effecting the cleaning action on the screen apertures, and in which means are provided whereby the expanding gases will be applied to direct a blast thereof outwardly through the screen apertures in a fashion to effect dislodgment of clogging materials and at the same time cause displacement of sub-strata material adjacent the well screen so as to facilitate flow of oil into the well.

Another object is to provide an effective means whereby the expanded gases may be formed at the point of application thereof by an explosive substance such as gun powder and the like.

Another object is to provide a construction in the cleaning device whereby in its operation an initially formed volume of gas will be utilized to displace liquids contained in the well screen and immediately thereafter a second volume of gas be generated and utilized in blasting the apertures of the well screen.

Another object is to provide a well cleaning device of the above character in which a record will be made denoting the extent to which the apertures of a well screen has been opened by the expansive gases, so as to enable determining the effectiveness of a cleaning operation.

A further object is to provide a method of cleaning perforated well casings which may be easily and quickly carried into effect by forming expanding gases in the well casing and causing such gases to exert pressure outwardly through apertures in the casing in a fashion to effect dislodgment of deposits clogging such apertures.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into effect as illustrated by way of example, in the accompanying drawings, in which:

Fig. 1 is a view in vertical section partly in elevation of the well cleaning device with portions broken away, showing the parts as disposed in the position preparatory to operation thereof;

Fig. 2 is a detail in horizontal section taken on the line 2—2 of Fig. 1 as seen in the direction indicated by the arrows;

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 1 as seen in the direction indicated by the arrows;

Fig. 4 is a detail in horizontal section as seen on the line 4—4 of Fig. 1 as seen in the direction indicated by the arrows;

Fig. 5 is a detail in section of a fragmentary portion of the upper part of the cleaner depicting the mode of operation thereof;

Fig. 6 is a view in section and elevation illustrating the cleaner as positioned in a well preliminary to its operation;

Fig. 7 is a view in section and elevation depicting the cleaner as disposed in a well screen with the parts as disposed in effecting displacement of the liquid in the well screen preliminary to blasting the apertures of the latter;

Fig. 8 is an enlarged detail in section and elevation of the valve structure shown in Fig. 3;

Fig. 9 is a view in perspective of one of the valve elements shown in Fig. 8.

Referring to the drawings more specifically, A indicates generally the well cleaner which is adapted to be lowered into a well casing B as particularly shown in Fig. 6 as by means of a cable C, and D designates a mechanical detonator with which the cleaner A is associated; the detonator D constituting the subject matter of a companion application filed coincident herewith which bears filing date of August 4, 1938, and Serial Number 223,037.

The cleaner A is here shown as embodying a rigid cylindrical metallic tube 14 fitted at its ends with plugs 15 and 16 in which are formed explosion chambers 17 and 18 normally closed to the interior of the tube 14 by thin metallic diaphragms 19 and 20. The diaphragms are held in place against shoulders 21 and 22 formed on the inner end portions of the plugs 15 and 16 by means of threaded rings 23 and 24 screwed into engagement with the plugs 15 and 16 for detachable connection therewith. The plug 15 at the upper end of the tube 14 constitutes the lower end portion of the detonator D, and is formed with a flame passage 25 leading from a suitable firing mechanism in the detonator D to the explosive chamber 17 through a normally open check valve 26.

Leading downwardly in the tube 14 from a point adjacent the inner end of the plug 15 is a perforated tube 27 containing a fuse 28 which latter is presented at its upper end to the opening in the ring 23.

The lower end of the tube 27 and the fuse

therein connects with a fuse passage 29 communicating with the explosion chamber 18 through apertures 30 in the side wall of the latter. The end plug 16 at the lower end of the tube 14 has threaded engagement therewith for detachment therefrom.

In carrying out the invention a sleeve 31 formed of elastic tubing is positioned around the tube 14 which sleeve has thickened portions 32 and 33 engaged by demountable clamping rings 34 and 35 respectively carried by the end portions of the tube 14.

The tube 14 is formed at intervals throughout the length thereof with pairs of diametrically opposed ports 36 and 37 which ports are fitted with normally closed outwardly opening valves 38 and 39 respectively. The valves are formed with inwardly extending tubular stems 40 and 41 and rigidly mounted in the stem 41 is a rod 42 which projects into telescopic engagement with the stem 40, the rod 42 constituting a guide on which the valves 38 and 39 are movable toward and away from each other. Carried on the stems 40 and 41 are oppositely extending overlapping yokes 43 and 44 which are held in place respectively on the stems 40 and 41 by nuts 45 and 46 screwed on the stems 40 and 41 to bear against connecting portions of the yokes. The outer end of each of the side members of the yokes 43 and 44 is formed with an out-turned arcuate flange 47 and bearing between the flanges 47 of the yokes 43 and 44 is a coil spring 48 which is tensioned to press the yokes outwardly in opposite directions relative to each other thereby operating to pull the valves 38 and 39 inwardly toward each other and to yieldably maintain the valves in their seated position on the outer margins of the ports 36 and 37.

In the operation of the invention the explosion chambers 17 and 18 are filled with explosive powder *a* and *b*; the rings 23 and 24 and diaphragms 19 and 20 being removed for this purpose while the end plugs 15 and 16 are detached from the tube 14 and after which the rings and diaphragms are replaced in the end plugs and the latter affixed to the ends of the tube.

The assemblage consisting of the cleaner and the detonator D is lowered into the well casing B to a position where the tube 14 with its elastic encompassing sleeve 31 will be disposed opposite a group of the apertures *c* in the screen portion of the casing B whereupon the mechanical detonator D is operated in a manner not necessary to be here set forth to effect propagation of flame in the flame passage 25 in the plug 15 so as to ignite and explode the explosive charge *a* in explosion chamber 17 which acts to create a body of expanding gases in the chamber 17 which closes the valve 26 and splits the diaphragm 19 as shown in Fig. 5. The expanding gases are thus suddenly released to the interior of the tube 14 and are confined momentarily therein until the pressure thereof is sufficient to overcome the springs 48 of the several valve assemblies and act to force the valves 38 and 39 outwardly so that the expanding gases enter the elastic sleeve 31 through the ports 36 and 37 thereby inflating the sleeve 31 and causing it to displace well liquid encompassing the sleeve until the sleeve is forced to a seated position on the inner periphery of the well casing B as particularly shown in Fig. 7.

In the meantime the fuse 28 will have been ignited by flames propagated from the exploded discharge *a* and emitted through the ruptured diaphragm 19, and which acts to effect slightly

delayed ignition of the explosive charge *b* in explosion chamber 18 and which occurs approximately at the time the sleeve 31 has reached its outermost position.

The exploding of the charge *b* bursts the diaphragm 20 so that the resultant gases under rapid expansion flow into the tube 14 and effect violent displacement of the gas content thereof in such fashion as to force the sleeve 31 tightly against the inner periphery of the casing B and then cause the portions of the sleeve 31 overlying the apertures *c* to enter such apertures and act to force obstruction therein to the exterior thereof. In some instances the sleeve may burst where overlying the apertures, in which event gases under high pressure will be directed into the apertures *c* from the inner ends thereof such as to blast out and effect dislodgment of plugs of sand, asphaltum and the like previously accumulated therein; the gases passing through the apertures 20 acting to effect disturbance of the oil bearing sand and such strata surrounding the well as to stimulate flow of oil into the well.

On completion of the operation just described the device may be removed from the well casing 25 whereupon the elastic sleeve 31 will be found to be perforated wherever it has been punctured by the gases passing through the apertures *c* and will be scarred where forced into the apertures but not punctured thus producing a chart that 30 will accurately indicate the extent of the number of the apertures *c* that have been blasted open in the operation.

While I have shown and described a specific embodiment of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

I claim:

1. In a device for cleaning perforated well casings, an expansible sleeve, a support therefor, means for lowering said support and sleeve into a well casing, means for dilating said sleeve against said well casing, and means for blasting portions of said sleeve outwardly through perforations in said casing.
2. In a device for cleaning perforated well casings, an expansible sleeve, means for supporting said sleeve in a well casing, means for expanding said sleeve against the well casing, and explosive means for forcing portions of said sleeve into perforations in said casing.
3. In a device for cleaning perforated well casings, an expansible sleeve, a support therefor, an explosive means carried by said support for forming gases interiorly of said sleeve of sufficient volume to force portions of said sleeve into perforations in a well casing.
4. In a device for cleaning perforated well casings, a metallic tube formed with a series of ports, an elastic sleeve encompassing and carried by said tube, explosive means associated with said tube for forming expansive gases to expand said sleeve and for causing rupture of said sleeve opposite perforations in a well casing.
5. In a device for cleaning perforated well casings, an elastic sleeve, a rigid tube encompassed by said sleeve, means detachably connecting said sleeve to said tube, means associated with said tube for expanding said sleeve against the interior of the well casing, and means within the tube and sleeve for blasting obstructions from

the perforations of the casing to clear the perforations of such obstructions.

6. In a device for cleaning perforated well casings, an expansible sleeve, a rigid tube encompassed by said sleeve, means connecting the ends of said sleeve to said tube, means within and associated with said tube and sleeve for blasting obstructions from the openings in a well casing to clear the perforations of such obstructions.

7. In a device for cleaning perforated well casings, an expansible sleeve, a rigid tube encompassed by said sleeve, means connecting the ends of said sleeve to said tube, means within and associated with said tube and sleeve for blasting obstructions from the openings in a well casing to clear the perforations of such obstructions, said means including an explosion chamber, an explosive in said chamber, and means for detonating said explosive.

8. In a device for cleaning perforated well casings, an expansible sleeve, a rigid tube encompassed by said sleeve, means connecting the ends of said sleeve to said tube, ports in said tube leading to the interior of said sleeve, outwardly opening valves forming closures for said ports, an explosion chamber associated with said tube adapted to be opened to the interior thereof, and means for firing an explosive material carried in said explosion chamber to form expansive gases to effect distension of said sleeve.

9. In a device for cleaning perforated well casings, an expansible sleeve, a rigid tube encompassed by said sleeve, means connecting the ends of said sleeve to said tube, ports in said tube leading to the interior of said sleeve, outwardly opening valves forming closures for said ports, an explosion chamber associated with said tube adapted to be opened to the interior thereof, means for firing an explosive material carried in said explosion chamber to form expansive gases to effect distension of said sleeve, a second explosion chamber associated with said tube adapt-

ed to be opened to the interior thereof, and means for firing an explosive in said second explosion chamber in successive relation to the firing of the explosive in the first named explosion chamber.

10. The method of cleaning perforated well casings, consisting in lining the interior of a perforated portion of the casing with an elastic material, and blasting the elastic material into the apertures of the casing.

11. The method of cleaning perforated well casings, consisting in lining the interior of a perforated portion of the casing with an elastic material, and blasting the elastic material into the apertures of the casing by generating expansive gases in confined relation to said elastic material.

12. The method of cleaning perforated well casings, consisting in lining the interior of a perforated portion of the casing with an elastic material, and blasting the elastic material into the apertures of the casing by exploding an explosive charge and directing the resultant expanding gas into confined relation to said elastic material to force the latter outwardly.

13. In a device for cleaning perforated well casings, an expansible sleeve, a rigid tube encompassed by said sleeve, means connecting the ends of said sleeve to said tube, ports in said tube leading to the interior of said sleeve, an explosion chamber associated with said tube adapted to be opened to the interior thereof, means for firing an explosive material carried in said explosion chamber to form expansive gases to effect distension of said sleeve, a second explosion chamber associated with said tube adapted to be opened to the interior thereof, and means for firing an explosive in said second explosion chamber in successive relation to the firing of the explosive in the first named explosion chamber.

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