Dec. 1, 1942. L. A. DOUGLAS 2,303,727

MEANS FOR TESTING UNDERGROUND STRATA FOR THE FLUID CONTENTS THEREOF

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Fig. 1

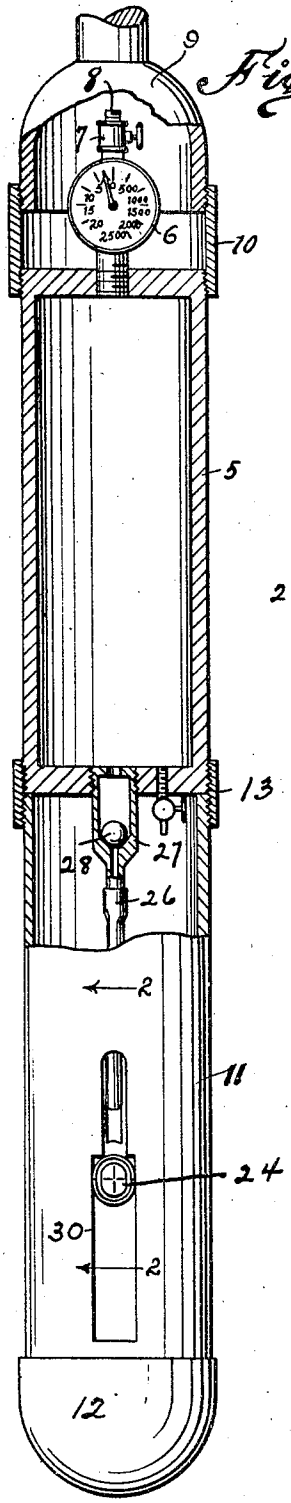
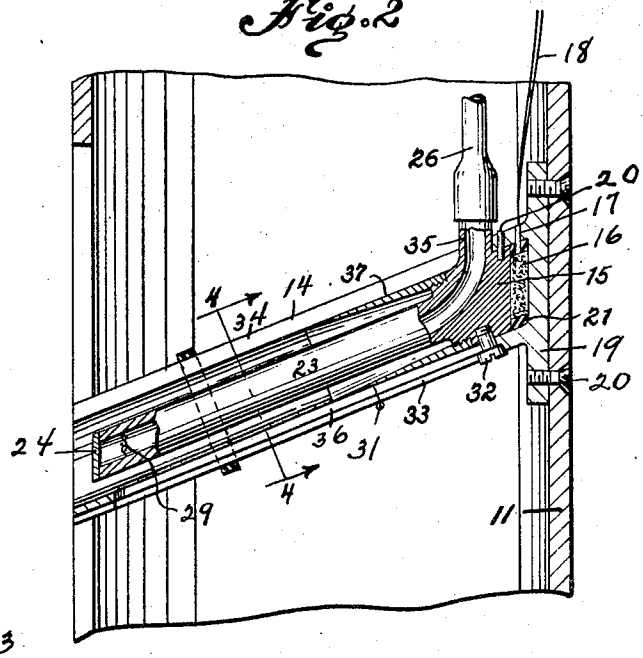


Fig. 2



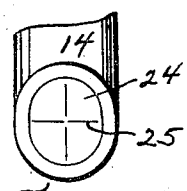


Fig. 3

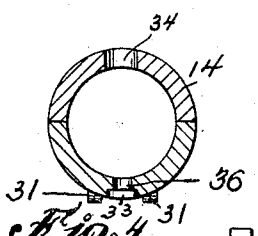


Fig. 4

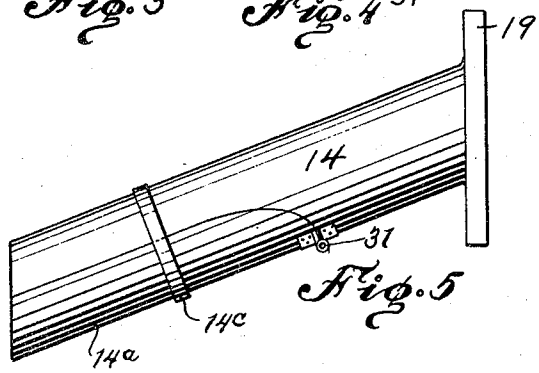


Fig. 5

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Fig. 6

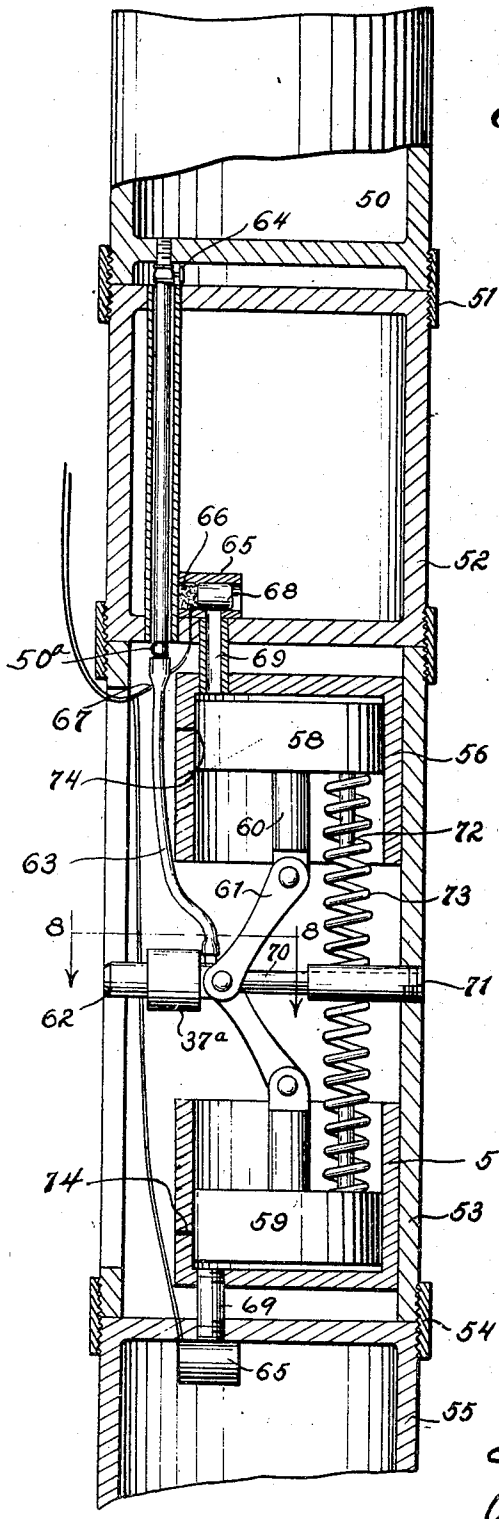


Fig. 7

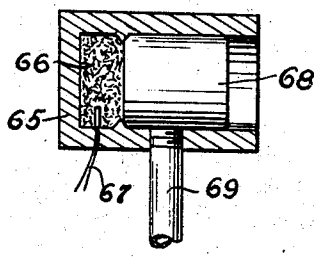
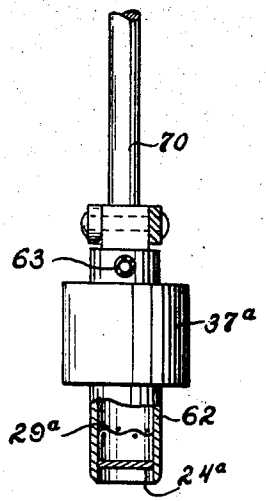


Fig. 8



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2,303,727

UNITED STATES PATENT OFFICE

2,303,727

MEANS FOR TESTING UNDERGROUND STRATA FOR THE FLUID CONTENT THEREOF

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Application June 10, 1941, Serial No. 397,505

11 Claims. (Cl. 255—1.4)

The primary object of the present invention is to provide efficient means for penetrating oil well strata at any desired depth, and to withdraw therefrom the pore content of the strata so that it may be brought to the surface of the ground for examination.

I am aware of the fact that devices have heretofore been proposed, adapted to be projected laterally into the material of subterranean strata and to bodily withdraw a portion of said strata for purposes of examination. The present invention differs radically from these formerly known structures, in that it is not concerned with the withdrawal of a core of solid material containing a very small amount of gases or fluids, but, upon the contrary, aims to withdraw the gaseous and fluid content from a volume of solid material which would be many times that which could be withdrawn in a core tube.

Further objects and advantages will be set forth in the detailed description which follows:

In the accompanying drawings:

Fig. 1 is a vertical sectional view of the device of the invention;

Fig. 2 is an enlarged vertical sectional view through a portion of the structure of Fig. 1, upon line 2—2 of Fig. 1;

Fig. 3 is an end view of the core tube;

Fig. 4 is a transverse section taken upon line 4—4 of Fig. 2; and,

Fig. 5 is a side view of the guide barrel shown in section in Fig. 2.

Fig. 6 is a view partly in side elevation and partly in section of a modified form of the invention;

Fig. 7 is a detailed view of the explosive charge carrying element hereinafter described, and;

Fig. 8 is a plan view of the tool showing one of the actuating links for the same in section, on line 8—8 of Fig. 6.

Like numerals designate corresponding parts throughout the several figures of the drawings.

Broadly stated, the invention comprises the combination of a vacuum receptacle adapted to be lowered into a bore hole or well, having associated therewith means for laterally piercing the subterranean strata so that the liquid and gaseous content of the pierced strata may be drawn under the action of the vacuum into said receptacle.

Referring now to the drawings, 5 designates a preferably cylindrical body, from which the air is exhausted by any suitable means before the device is lowered into the well to be tested. A suitable recording pressure gauge 6 of a conventional type may be mounted upon the receptacle 5, said receptacle constituting the vacuum chamber hereinafter referred to.

A shut-off valve 7 is located in an air hose connection 8 and by attaching a suction pump to said connection, the air may be exhausted from the receptacle 5 at the surface of the ground. The vacuum chamber and the parts connected thereto may be lowered into the well to be tested by a cable, a drill stem or a drill pipe, a drill pipe being indicated at 9, and being connected to the receptacle 5 by a coupling 10.

A pipe section 11 having its lower end closed by a bull plug 12, is connected to the receptacle 5 by coupling 13. The chamber formed within the pipe section 11 is laterally spanned by a guide barrel 14. A plunger 15 is slidably disposed in this guide barrel and is adapted to be forcibly impelled outwardly therefrom by an explosive charge 16. The explosive charge may be fired in any suitable way, as, for example, by an electrical cap 17 supplied with current from the surface through a conductor 18.

The guide barrel 14 is carried by a head block 19, said block being secured by bolts 19a to the pipe section or cylinder 11. In loading the structure the plunger 15 is forced under considerable pressure toward the explosive charge and is then held in place by any suitable number of shear pins 20, said pins being adapted to shear off as the plunger starts to move toward the left in Fig. 2. When, in the act of loading this device, the plunger is moved forcibly toward the explosive charge, it compresses a gasket or gaskets 21 of rubber, or like suitable material to thereby insure the exclusion of water from the explosive charge.

A collecting tube 23 is carried by the plunger and is adapted to be projected forcibly and laterally from cylinder 11 by the outward travel of the plunger. The guide barrel 14 and tube 23 are preferably downwardly inclined at about an angle of twenty-five degrees (25°). The forward end of the tube 23 is initially closed with a thin brass plate 24, said plate being weakened by scored lines 25, so that it will be ruptured upon contact with any material more solid and resistant than mud, such, for example as oil-bearing sand or shale.

The rear end of the tube 23 is in communication through tube 26 with a fitting 27 in which an upwardly opening check valve 28 is located. When the plate or disc 24 is ruptured upon reaching sufficiently solid material, the oil and gaseous pore content of the strata pierced will begin to flow into the vacuum chamber 5 and

this action will continue over such period of time as the device may be left in place or until the vacuum is satisfied. This flow may be accentuated by any external pressure existent in the strata.

It is not the object of the present invention to withdraw sand or other solid material and I may, if desired, provide a coarse screen 29 in the tube to prevent the entry of sand or like material to said tube.

The lower outer end of guide barrel 14 projects into a vertical slot 30 formed in the side wall of pipe section 11. By referring to Fig. 5, it will be seen that the guide barrel is made in two parts. In other words, its lower forward portion 14a is separate from and hingedly connected to the main portion of the barrel by hinges 31.

A guide screw 32 is screwed into the plunger 15 and its head travels in a shallow guide groove 33 formed in the lower portion of the guide barrel. The guide barrel is provided with an upper longitudinal slot 34 in which the nipple extension 35 of plunger 15 may travel, this nipple extension constituting the point of attachment for tube 26. The guide barrel is also provided with a lower slot 36 in which the shank of the screw 32 travels.

An apron 37 is engaged with and moves with the plunger 15. The function of this apron is to impact mud as the core tube is shot out into the strata, the greater density of the mud thus brought about tending to prevent flow of the mud into the core tube.

The arrangement shown and described is such that if, because of the nature of the strata, the core tube penetrates the same to such an extent that it can not be withdrawn and retrieved, it may be abandoned without necessitating the loss of the whole tool. To this end, the connection of the lower end of the tube 26, with nipple 35 is such that the connection may be broken at that point by a strong pull. It will be understood that because of the existence of the slots 34 and 36, the core tube may be shot entirely out of the guide barrel and into the strata to be tested. The screw 32 will shear off when this takes place.

Where the nature of the subsoil is such that the core tube is stopped before the plunger completely leaves the guide barrel, the plunger may be retrieved by drawing upwardly upon the whole tool. In this case the hinged section 14a swings downwardly upon its hinge and permits the movement of the outer end of the core tube back into the pipe 11 by a downward swinging movement through the opening 30. A rubber band or cord 14c may be employed to hold the section 14a closed during the outward movement of the core tube. The screw 32 will shear this cord or band off to free the section 14a.

In the form of the invention illustrated in Figs. 6 to 8, pre-created air pressure, i. e., air pressure stored in the tool before it is lowered into the well, is utilized to forcibly project a collecting tool into the strata. Here a vacuum chamber 50 is secured by a coupling 51 to an air pressure receptacle 52. This receptacle is, in turn, connected to a pipe section 53, and 53 is connected by a coupling 54 with a second air pressure receptacle 55.

The pipe section 53 carries a pair of cylinders 56 and 57 in which pistons 58 and 59 are mounted. The piston rods 60 are connected by toggle links 61 with a tool 62 similar to the tool 23 in that it comprises the body 62, sealing disc or plate 24a, screen 29a and apron 37a. This tool is connected by a flexible tube 63 with the vacuum chamber 50 and has an upwardly opening check valve 63a in its length.

A small box-like receptacle 65 in each of the air pressure receptacles receives an explosive charge 66 which, when electrically fired from the surface of the ground through current supplied by wires 67, discharges a lead plug 68 from over the mouth of the corresponding pipes 69 to permit the air pressure to pass into the cylinders 56 and 57 and to there act upon the pistons to thrust the tool outwardly through the open side of pipe section 53.

The rear end of the tool is provided with a guide rod 70 which slidably engages a guide 71. The pistons carry pins 72 which are embraced by a spring 73. When the pistons have travelled toward each other far enough to uncover the ports 74, the air pressure is relieved and the spring 73 may act to retract the tool.

These ports are designedly made very minute so that the escape of the air will be so slow that the tool will remain in its projected position the necessary length of time.

This structure is a practical one for withdrawing the oil and gas content of the strata instead of withdrawing the solid material as has heretofore been done. As far as I am aware, I am the first to do this.

Many ways will readily suggest themselves to those skilled in the art for accomplishing the same result. Therefore, I wish it to be understood that the invention includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

1. A testing tube for oil wells comprising a vacuum chamber having a vacuum performed therein, a barrel adapted to receive an explosive charge, an element adapted to be impelled along said barrel by the action of said explosive charge, means for firing the explosive charge from the surface of the ground, a tubular core tool carried by said element adapted to penetrate the strata to be tested under the action of the explosive charge, means for maintaining connection between the vacuum chamber and the core tool throughout the travel of the core tube, so that the liquid and gaseous pore content of the strata may flow through said tool to the vacuum chamber and means rupturable by the entry of the core tool into the strata to be tested which holds the vacuum until the seal is ruptured, an apron having an outwardly flaring inner wall, said apron extending around the core tool and serving to impact mud around the rear portion of the core tool and means rupturable by the entry of the core tool into the strata to be tested, which holds the vacuum until the seal is ruptured.

2. A tool of the character described, comprising a vacuum chamber, a pipe section depending therebelow, a guide barrel extending across the pipe section, a tubular core tool mounted to move endwise in said guide barrel, means for impelling said core tool forcibly along the guide barrel, and a flexible tube connecting the core tool and the vacuum chamber.

3. A structure as recited in claim 2 wherein said guide barrel is provided with a hinged, downwardly swinging lower outer end portion.

4. A structure as recited in claim 2 wherein the guide barrel is provided with a longitudinally extending slot through which said flexible tube moves.

5. A tool of the character described, comprising a vacuum chamber, a recording gauge there-

in, a pipe section screwed to the lower portion of the vacuum chamber and having a vertical slot formed in its side wall, a bull plug at the lower end of the pipe section, a guide barrel spanning the pipe section and inclined downwardly from the rear to the front wall thereof, a plunger in the guide barrel, a tubular core tool carried by the plunger, said guide barrel having a slot therealong and said plunger having a nipple which travels in said slot, a flexible tube connecting said nipple and vacuum chamber, a check valve between the nipple and vacuum chamber which opens toward the vacuum chamber, and means for creating pressure in the rear of the plunger as and for the purposes set forth.

6. A structure as recited in claim 5 wherein the pressure creating means comprises a body of explosive material and means for firing the same.

7. A structure as recited in claim 5 in combination with a disc having weakened portions, said disc initially closing the outer end of the core tool.

8. A structure as recited in claim 5 in combination with a disc having weakened portions, said disc initially closing the outer end of the core tool, and a screen spanning the core tool inwardly of said disc.

9. A tool comprising a receptacle containing air under pressure, a chamber of preformed vacuum, a strata penetrating tool, a flexible connection between the strata penetrating tool and the vacuum chamber, air operated means for projecting the tool and means for releasing the air from the air pressure receptacle to operate the actuating means of said tool.

10. A tool comprising a receptacle containing air under pressure, a collection chamber, a strata penetrating tool, a tubular connection between the strata penetrating tool and the collection chamber which provides a fluid conduit between them throughout the movement of the strata penetrating tool, air operated means for projecting the tool and means for releasing the air from the air pressure receptacle to operate the actuating means of said tool.

11. A structure as recited in claim 10, wherein the air operated means comprises a pair of opposed cylinders and pistons and toggle links between the pistons and the tool.

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