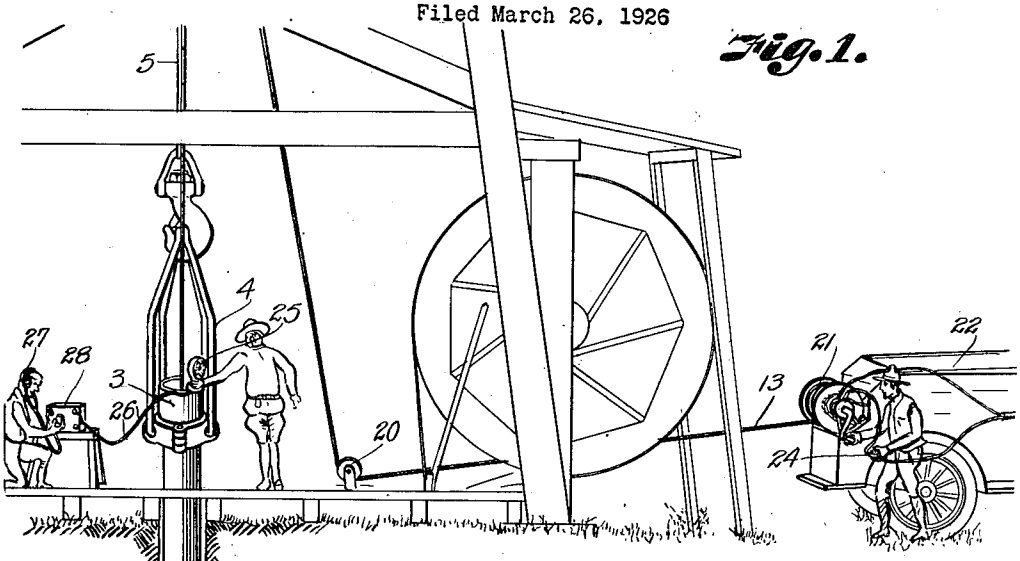
Jan. 3, 1928. 1,654,819

M. M. KINLEY

METHOD OF AND APPARATUS FOR DETECTING BINDING POINTS IN WELL CASINGS

Filed March 26, 1926

Fig. 1.



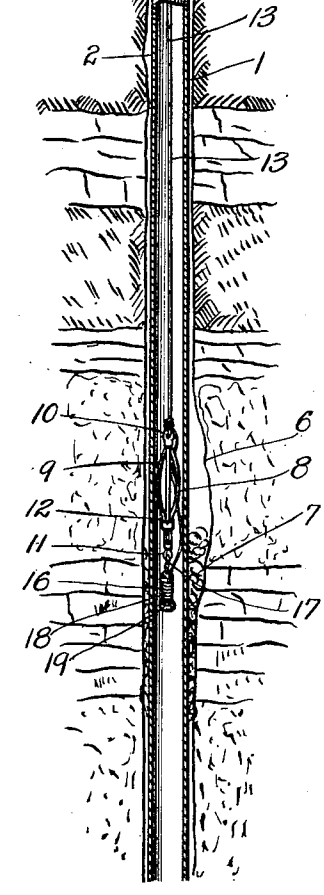


Fig. 2.

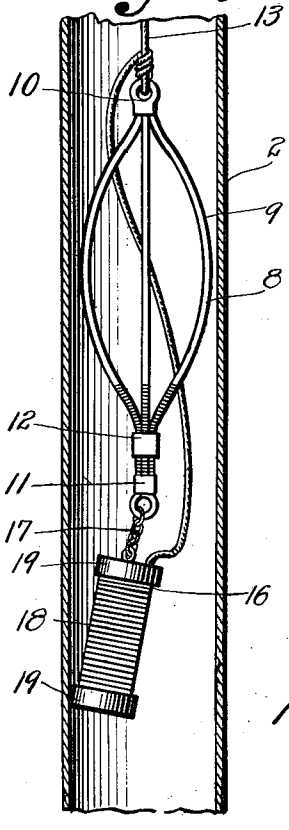
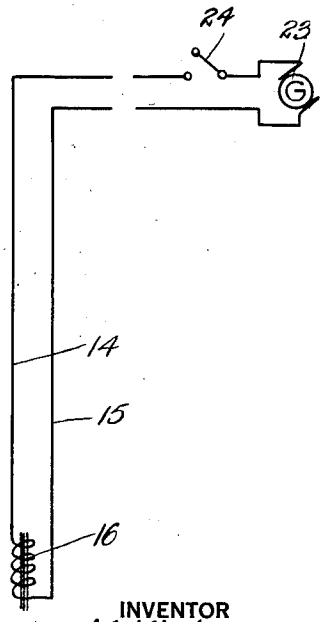


Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR DETECTING BINDING POINTS IN WELL CASINGS.

Application filed March 26, 1926. Serial No. 97,814.

My invention relates to a method of and apparatus for detecting a binding point in well casing, and more particularly adapted for employment when, in the pulling of casing from abandoned oil wells, movement of the casing is obstructed by a cave, wedging of a loosened rock between the wall of the well and the casing or other causes.

In ordinary practice, when a well is abandoned, the casing is pulled from the well and salvaged. It often occurs that when an attempt is made to pull the casing it is discovered that the casing is bound at some point within its length by a cave or wedge, or for some cause impossible to discover, so that the casing cannot be withdrawn. In other cases binding occurs after the casing has been partially removed, initial movement of the casing in such instances no doubt loosening the wall of the well to start caving or dislocating a rock so that it settles in a wedge-like relation to the casing and prevents further withdrawal. According to methods commonly employed under such circumstances the binding point is located approximately by placing a definite pulling stress on the casing and noting the stretch of the casing; the stretch per foot under a definite stress being known and the length of the loose portion calculated from the extent of stretch. A charge of explosive is then let into the casing and fired as close to the binding point as possible to sever the pipe at or above the binding point so that the upper or loose portion may be pulled. Because of the impossibility of exact calculation of the binding point, it often happens that the charge is exploded below the binding point and the operation is ineffectual, and explosion of further charges becomes necessary before the severance can be effected at the proper point. In other cases the charge is exploded at a point sufficiently above the binding point to leave a considerable length of free casing in the well, thereby effecting a loss which could have been salvaged if the casing had been severed closer to the binding point.

It is the object of my invention to more accurately locate the binding point and thereby obviate the necessity for repeated explosions or the loss of casing by its severance at any material distance from the binding point.

In accomplishing this object I have provided apparatus comprising a tapper which may be let into the casing after the latter is stretched and made to contact with the casing to produce vibrations in the tensioned metal, and an indicator sensitive to vibrations in the casing and preferably comprising a transmitter, an amplifier and a receiver, whereby the binding point may be indicated by the quality of the vibrations transmitted through the casing and amplifier circuit from the point of contact by the tapper. With such apparatus, employed in accordance with my method, the location of the binding point may be determined by tone of the vibrations; those emanating from free points in the casing being clear and those from the binding point muffled by the blanketing contact of the caved wall or wedging rock.

More specifically the invention comprises certain details of structure illustrated in the accompanying drawings, wherein

Fig. 1 is a perspective view of a portion of a well casing and derrick, illustrating use of my apparatus in connection therewith, a part of the casing being broken away to illustrate the apparatus.

Fig. 2 is an enlarged longitudinal section of a portion of a well casing, illustrating the sounding portion of my apparatus in connection therewith.

Fig. 3 is a circuit diagram.

Referring more in detail to the drawings, 1 designates an oil well and 2 a casing, the upper section of the casing having a collar 3 located above ground. 4 designates an ordinary type of elevator whereby the casing is suspended from a pull rope 5 in the ordinary manner.

The well is here illustrated as caved at 6 so that the casing is bound or "stuck" at the point 7. The apparatus for locating the binding point 7 in accordance with my method, comprises a cage 8 of the type ordinarily employed for letting in shots and comprising a spread, wire body 9, the upper and lower ends of the wires being connected by eyelets 10 and 11, the lower ends being screw threaded and provided with a nut 12 whereby the cage may be contracted or expanded to adapt it for use in casings of different diameter. The cage 10 is suspended from a cable 13 containing the lead wires 14 and 15 of a magnet 16 which is suspended from the lower cage eyelet 11 by a chain or like flexible connection 17. The magnet may be of any suitable construction but preferably

comprises a core for the coil 18 and having end collars 19 of substantially greater diameter than the coil so that when the magnet is swung laterally in the casing the lower metallic collar 19 will strike the wall of the casing. The cable 13 is tied to the upper cage eyelet 10 and loosely extended therebelow to connection with the magnet. The cable is run up through the casing over the pulleys 20 on the derrick to a reel 21 on a vehicle 22 and from the reel to a generator, not shown in detail but preferably located on the vehicle and indicated at 23 in the circuit diagram; a switch 24 being located in the circuit, preferably adjacent the reel 21, so that an operator may manipulate the reel with one hand and operate the switch with the other.

25 designates a sound transmitting device which may consist of a microphone, and 26 a connection between the transmitting device and a receiver indicated by the ear phones 27, an amplifier, indicated at 28, being located within the connection 26 to increase the volume of sound emanating from vibrations in the casing set up by impact of the magnet against the casing wall.

In pulling a casing from an abandoned well, if the wall of the well remains intact the casing may be pulled joint by joint and all of the casing removed and salvaged. If, however, the well has caved so as to bind the casing at some point in its length or the casing becomes "stuck" from any cause, it is necessary to sever the casing above the binding point to free it so that the loose portion may be pulled.

In locating the binding point, according to my method, I stretch the casing by means of the ordinary pulley cable to place it in tension, and let the cage, with the electromagnet suspended from it, into the casing, preferably by means of the lead wires whereby current is conducted from the generator to the magnet, the cage being employed in order to center the magnet in the casing and prevent its contact with the casing except under the following conditions. The magnet is let into the casing intermittently and during the periods of interrupted travel of the magnet the switch in the lead line is closed to flow current into the magnet. When the magnet is energized it is attracted to the metallic casing, swinging on its loose suspension so that it acts as a tapper to set up vibrations in the casing. At such periods of interrupted travel of the magnet a transmitter, such as the microphone illustrated and above referred to, is placed in contact with the casing to receive and transmit the vibrations to a receiver, such as the ear phones of an ordinary radio set; an amplifier being preferably interposed between the microphone and the receiver to increase the volume of sound transmitted through the microphone. As the casing is held stretched during the detecting operation, the vibrations set up by the magnet produce a clear tone in the receiver when emanating from such portions of the casing as are free in the well. When, however, the tapping occurs at a point in the casing where the cave is located or where a rock is wedged tightly against the casing, the vibrations are deadened by transmission into the surrounding material and the sound waves have a tone clearly distinguishable from those emanating from the free part of the casing. When the deadened tones are received the operator removes the magnet, measures the letting-in line to determine the depth from which the muffled tones emanated and then shoots the casing at that depth, severing it at or above the binding point so that the free, upper portion of the casing may be removed and salvaged.

It is apparent that, according to my method, and with the apparatus described, the binding point may be definitely located and the expense and delay of ineffectual shooting due to inaccurate measurement is obviated.

While I have referred to use of the invention for detecting a binding point in well casing resulting from a cave or the like, it is apparent that the invention may be employed to advantage in determining the depth to which a well has been cemented or the location of any point in a well where the casing is contacted by an object or material capable of receiving vibrations from the casing or of interfering with free transmission of the vibrations through the casing to the receiving instrumentality at the top of the well.

What I claim and desire to secure by Letters Patent is:

1. The method of detecting a binding point in well casing, consisting of setting up vibrations in the material of which the casing is composed and transferring the vibrations to an indicator capable of distinguishing vibrations of different quality.

2. The method of detecting a binding point in well casing, consisting of placing the casing in tension, setting up vibrations in the casing, transferring the vibrations to an indicator capable of distinguishing vibrations of different quality and amplifying the vibrations prior to their reception at the indicator.

3. The method of detecting a binding point in well casing, consisting of setting up vibrations in the material of which the casing is composed, transferring the vibrations from the casing to a transmitter, amplifying the vibrations and delivering the vibrations from a receiver as sound waves.

4. The method of detecting a binding point in well casing, consisting of intermittently setting up vibrations at successive

points in the casing, and transferring said vibrations to a tonal instrument capable of distinguishing vibrations of different quality.

5. The method of detecting a binding point in well casing, consisting of lowering a tapper into the casing, effecting contact of the tapper with the casing to set up vibrations in the casing, and transferring said vibrations to an instrument capable of distinguishing between vibrations of different quality.

6. The method of detecting a binding point in well casing, consisting of intermittently lowering a tapper into the casing, effecting contact of the tapper with the casing during periods of interrupted travel of the tapper, to set up vibrations in the casing, and transferring said vibrations to an instrument capable of distinguishing between vibrations of different quality.

7. The method of detecting a binding point in well casing, consisting of lowering a magnet into the casing, intermittently energizing the magnet to induce its attraction to tapping contact with the casing, receiving the vibrations from the casing and delivering the vibrations through an indicator capable of distinguishing vibrations of different quality.

8. Apparatus for detecting a binding point in well casing, comprising a tapper, means for guiding the tapper into the casing, means for effecting contact of the tapper with the casing to induce vibrations in the casing, an indicator, and means for transmitting vibrations from the casing to the indicator.

9. Apparatus for detecting a binding point in well casing, comprising a tapper, means for guiding the tapper into the casing, means for effecting contact of the tapper with the casing to induce vibrations in the casing, an indicator, means for transmitting vibrations from the casing to the indicator and an amplifier in the transmitting means.

10. Apparatus for detecting a binding point in well casing, comprising a tapper, means for letting the tapper into the casing, means for inducing contact of the tapper with the casing, and an indicator sensitive to vibrations in the casing.

11. Apparatus for detecting a binding point in well casing, comprising a tapper, means for letting the tapper into the casing, means for effecting oscillation of the tapper to contact with the casing, a receiver, and a transmitter connected with the casing and with the receiver.

12. Apparatus for detecting a binding point in well casing, comprising a tapper, means for letting the tapper into the casing, means for effecting oscillation of the tapper to contact with the casing, a receiver, a transmitter connected with the casing and with the receiver, and an amplifier between the transmitter and receiver.

13. Apparatus for detecting a binding point in well casing, comprising a magnet, means for letting the magnet into the casing, means for intermittently energizing the magnet to induce its attraction to tapping contact with the casing, and an indicator connected with the casing capable of distinguishing between vibrations of different quality.

14. Apparatus for detecting a binding point in well casing, comprising a letting-in cage, a magnet loosely suspended from said cage, switch controlled means for energizing the magnet to induce intermittent attraction of the magnet to tapping contact with the casing, and an indicator connected with the casing capable of distinguishing vibrations of different quality.

15. Apparatus for detecting a binding point in well casing, comprising a letting-in cage, a magnet loosely suspended from the cage, a reel, a generator, a conductor line connecting the magnet and generator, suspending the cage and run over said reel to effect intermittent lowering of the magnet, a switch in the conductor line for controlling energization of the magnet to effect attraction of the magnet to tapping contact with the casing and an indicator sensitive to vibrations in the casing.

In testimony whereof I affix my signature.

MYRON M. KINLEY.