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INCLINATION INDICATOR IN WELL HOLES

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www.plumbbob.de

PLUMB BOB AS INCLINATION INDICATOR IN WELL HOLES

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A INTRODUCTION:

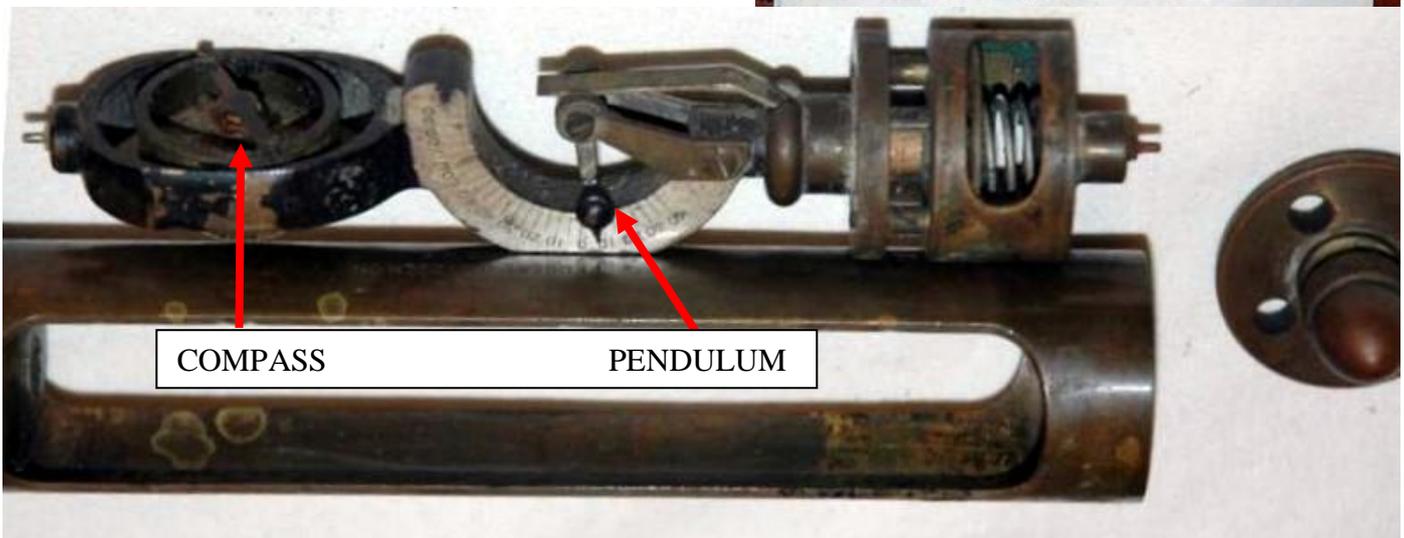
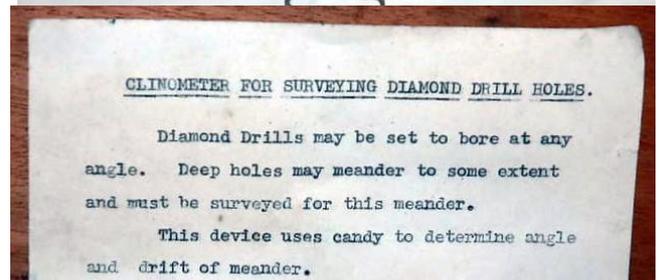
Dear Reader, Fellow Collector,

recently there was offered on ebay a (not complete) DIETZGEN CLINOMETER for a BORE HOLE, marked "No. 12 CHAS GARVEY DIAMOND DRILLING CO GROWN POINT NY PATENT APPLIED FOR" There I had the idea to search for (patented) plumb bobs used for this task.

On the paper in the box of the instrument we read:

!!! Use of CANDY !? ☺
(Sweets or crystallization?)

It looks very similar to the patent US 802071 W. R. BAWDEN 1905 (more see B 1)

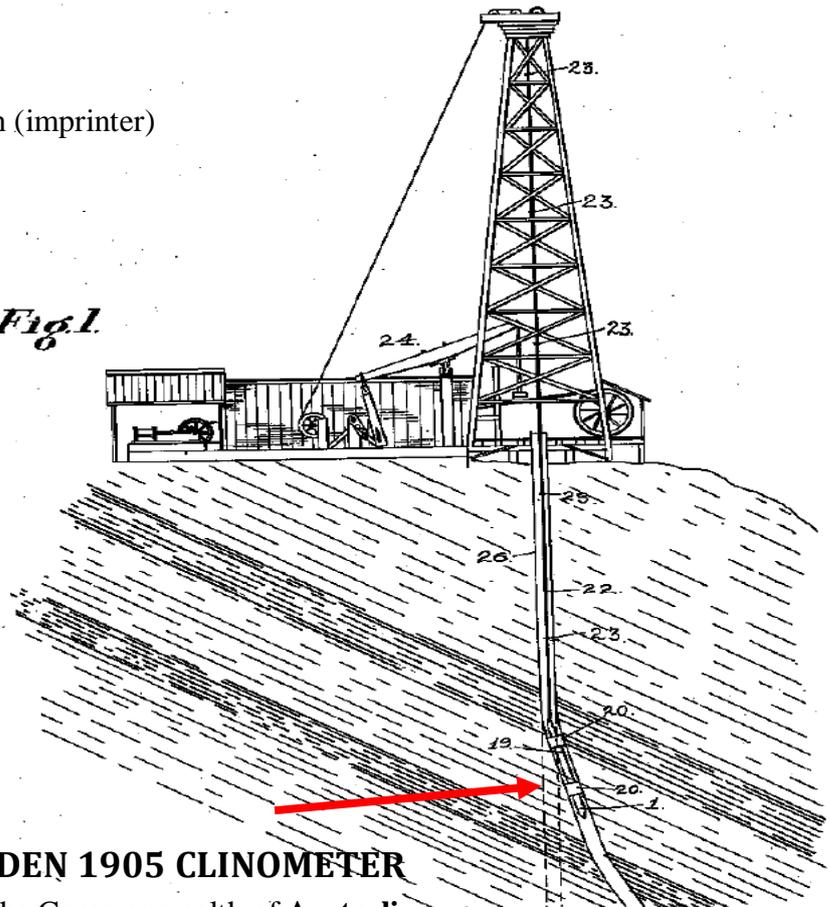


Very interesting for me is, how they get the information from the inclinometer (plumb bob). **959,912.**

There are different ways:

- Warm gelatin gets cold
- Candy
- Ball indicator with markings thereon (imprinter)
- Point with barbs
- A spring presses a recording disc
- Water presses the plumb bob down
- and so on

Fig. 1.



B PATENTS

I found the following PATENTS

B 1 US 802071 W. R. BAWDEN 1905 CLINOMETER

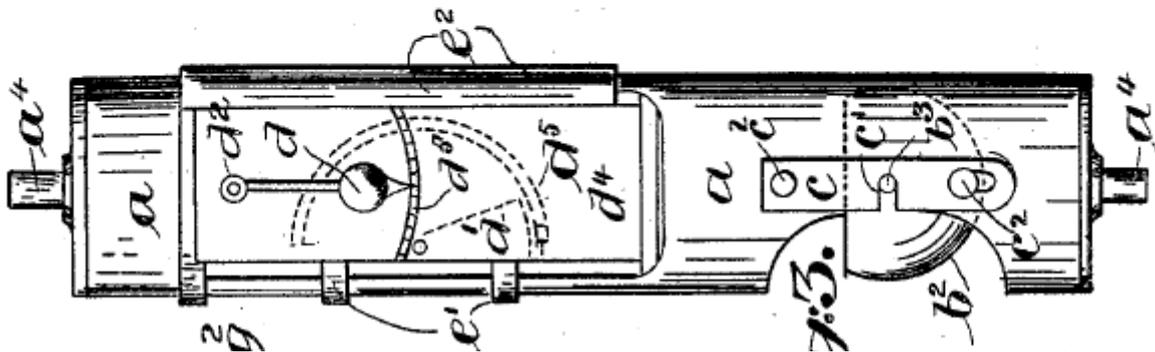
William Reynold Bawden was a citizen of the Commonwealth of **Australia**

No. 802,071.

W. R. BAWDEN.
 CLINOMETER.

PATENTED OCT. 17, 1905.

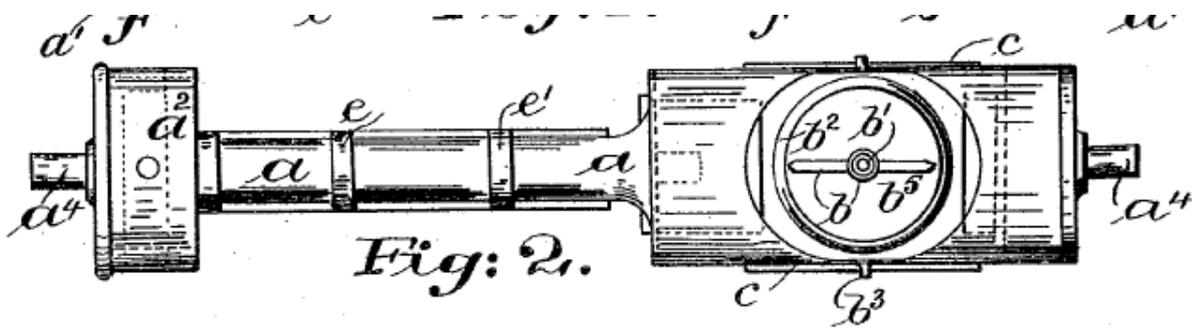
APPLICATION FILED DEC. 15, 1903.



This patent is similar (but not identically) to the pictures shown on page 1. Let's look how it works: (Text from the patent)

"The object of my improved clinometers is to provide an instrument which will easily and accurately record the position and angle of bore-holes whether vertical or horizontal and at any point of locality in their line of travel.

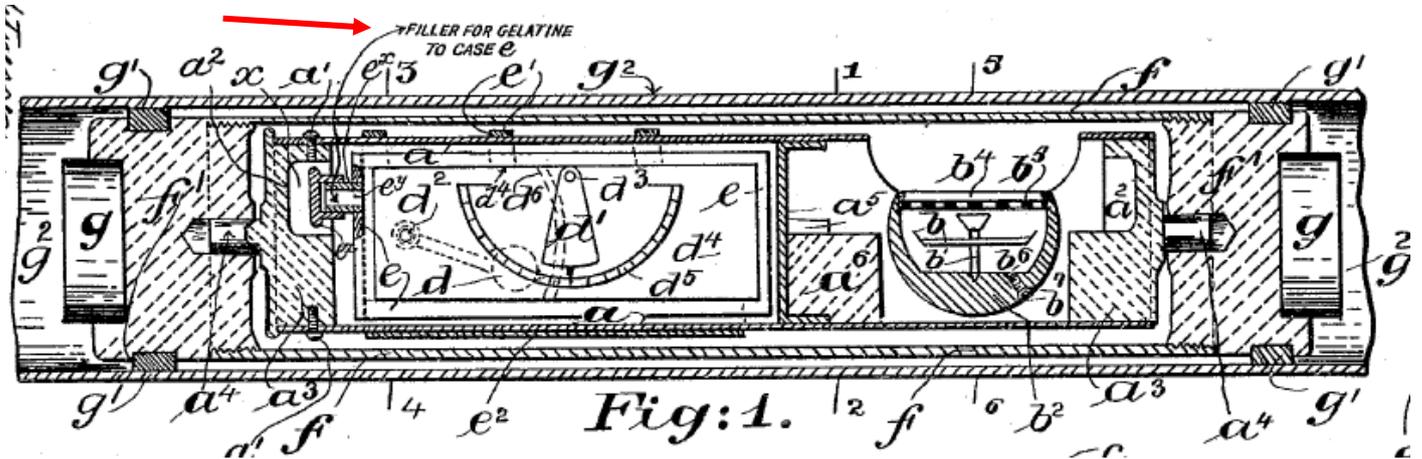
As is well known in mining operations, the diamond drill has a tendency to deviate from its desired or assumed line of travel by reason of pursuing the line of least resistance or other causes and which errors and consequent loss are the greater in hard and refractory country.



This clinometers has been principally designed to record such errors, so that the travel of a diamond drill and consequent position of the bore may from time to time be checked and charted in order to ascertain the position of the lode or other desired object as quickly and as cheaply as possible.

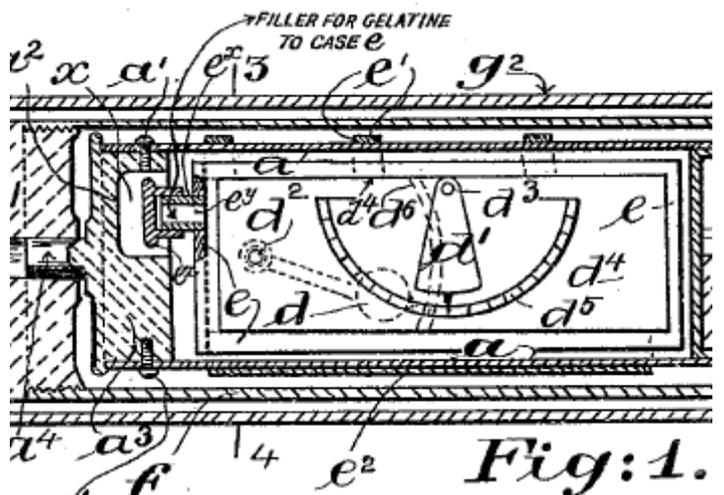
... A further advantage consists that when the clinometers is used for surveying a vertical or inclined bore-hole and upon the gelatin becoming firmly set the instrument may be placed in a horizontal position, thus giving a clear view of the magnetic needle, and, again, if found necessary, the compass-box may be removed from its gimbal and placed on the reading-protractor, with the object of bringing the needle as nearly as possible to the sighting-line.

... When in use, this box b^2 is filled with gelatin, and upon the cooling of same it will concurrently act and fix the needle b in the position it occupies at such moment of time.



... The method for the use of the instrument is as follows:

The pendulum-case e and compass-box b^2 are both filled with warm gelatin or other similar transparent liquid and which acts as the medium for setting the pendulums d and d^1 and the magnetic needle b . The instrument is then placed within its primary case f , and for the better maintenance of the gelatin in a liquid form, if found likely to congeal owing to its small bulk, **hot water or hot gelatin may be poured into the space inclosed by the primary case f , causing the instruments to be held in a warm bath**, and such water or gelatin would be removed prior to the reading of the results. The outer protector-tube g^2 , containing the instruments, is lowered or placed in that locality of the bore-hole which is to be charted. **The instrument there remains until such time as the recording gelatin has set hard**, and thereby setting the needle b and the pendulums d and d^1 in the positions which they occupy at such moment of congealment. In the use of the instrument due care should be taken so that the gelatin or other medium, owing to variations of temperature in the bore-hole, does not respectively congeal or liquefy prior to or subsequent to the time of the taking of the record. When the instrument is withdrawn from the bore-hole, the readings of the pendulums and compass may be made with greater or more precise accuracy by removing and placing each separately on a reading-protractor made specially for such purpose. "



Dec. 10, 1929.

E. KOPPL

1,738,589

INCLINATION INDICATOR

Filed May 14, 1928

3 Sheets-Sheet 1

This 80 years old patent shows another System:

“Fig. 1 shows a well hole which is inclined to the vertical, a portion thereof being broken away, and an inclinometer for insertion in a small hole at the bottom.

Fig. 2 is a longitudinal section through the inclinometer shown in Fig. 1 on an enlarged scale with the indicator released.

Fig. 4 and 5 are plan views of the ball indicator with markings thereon. ...

... In the body is a chamber 41 for a pendulum or plumb bob.

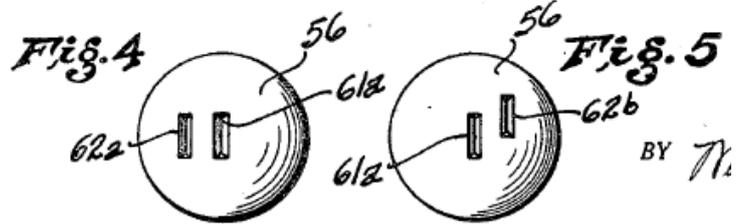
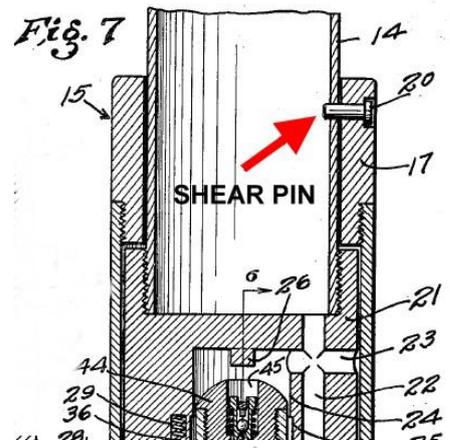
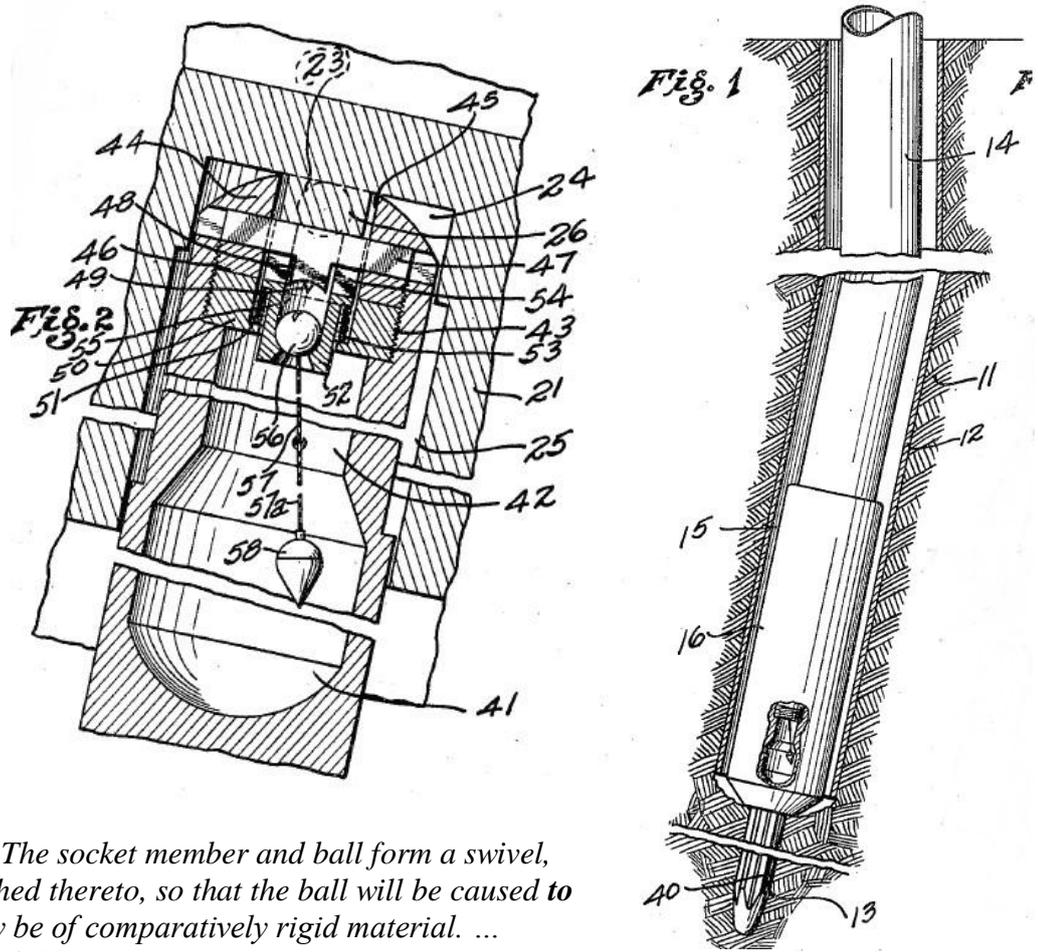
... The lower end of bore 55 is reduced in diameter and sloped to form a seat for a ball 56. This ball is preferably of soft metal adaptable to receive an imprint

from the imprinter projection 49. The socket member and ball form a swivel, there being a rod or line 57 attached thereto, so that the ball will be caused to swing with the line. This line may be of comparatively rigid material. ...

Attached to the plumb line is a bob 58. ...

The rotary drill pipe or drill string 14 is then forced downwardly and cause the lug 26 on body 21 to enter the bore 45 in the cap and project the socket member 52, thereby releasing the ball 56 and permitting it to be moved by the plumb line as shown in Fig. 2. ... As the drill string is raised, the lug 26 is retracted, permitting the socket member to retract and clamp the ball 56. This causes an indentation on the ball, such as 62^a or 62^b Figs. 4 and 5. ... The mark on the ball 56 will indicate the inclination. ...

The plumb bob will have been clamped in vertical alignment. The drill string is the forced downwardly to shear the pin and cause the lug to release the plumb bob ball. This will cause the plumb bob to swing to vertical position. Upon raising the drill string, the ball will again be clamped and marked to indicate the inclination of the well hole with respect to the vertical. ... “



Dec. 13, 1938.

F. L. LE BUS

2,139,899

DEPTH MEASURING DEVICE FOR OIL WELL EQUIPMENT

Filed Dec. 4, 1936

From the patent text:

"This invention relates to improvements in well drilling appliances generally ... and for measuring the depth of the hole, without removal from the drill pipe string. ...

Another object of the invention is the provision of means for opening and closing said valve from a point above the ground surface or at the well rig for the purpose of ascertaining the depth of the hole being drilled and this without the removal of the operative valve. In this mode of operation the pipe string with the valve arrangement can be floated in the manner heretofore explained and a plumb bob and measuring line can be passed through the string of drill pipe through the valve down to the top of the drill bit. After such measurement has been made, the measuring line can be withdrawn though the valve. In the meantime, the valve itself has been held open for the downward and upward passage of the measuring line by a device forming part of the improvement and hereinafter described in detail. The valve then closes and is again ready for further drilling operations. ... In the present invention the valve can be opened by the device referred above in connection with the measuring line and held open until the depth is ascertained, after which the removal of the device releases the valve and causes it to close. ...

Figure 1 is a vertical and longitudinal sectional view of the pipe sections, showing the valve in open position and illustrating one form of means for opening the valve by a depth measuring element. ...

One end of the valve opener is conical shaped having a neck 19 and each end is aperture as at 20 and 21 for the passage of a small cable or plumb bob line 23. One end of this line carries a plumb bob 24. ...

The operation of the valve opener is as follows:

The valve opener shown in Figures 3 and 4 is seated on the plumb bob line 23 and held in position by the plumb bob 24. It is then lowered into the drill pipe string. As the valve opener comes in contact with the valve 6, the downward movement of the valve opener will shove the valve 6 aside in the position shown and the lip 17 will be seated upon the beveled surface 16 of the valve body 10, thus holding the valve open. The plumb bob and plumb bob line then continue the descent to the bottom of the hole or to a point on top of the drill bit and the depth of the hole is determined. When the end of the descent is reached, the plumb bob and line are withdrawn upwardly until the bob 24 is received again in the notch 21 – whereupon the valve opener is withdrawn, allowing the valve again close."

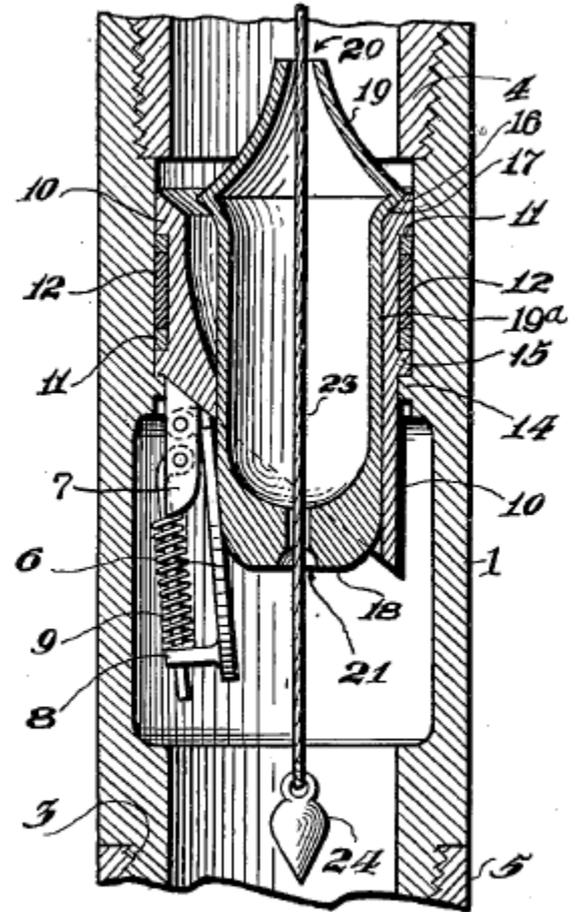
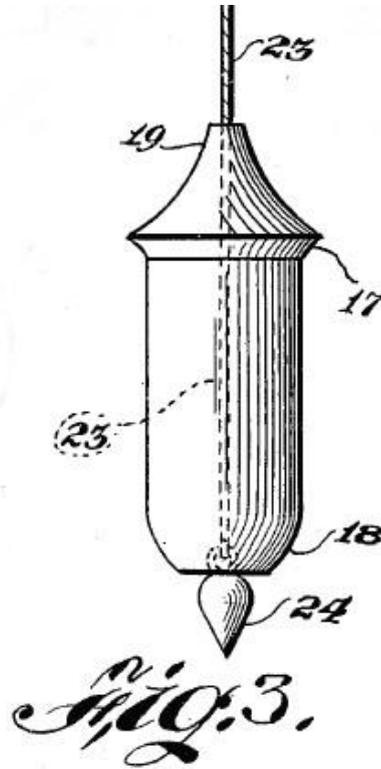


Fig. 1.

Jan. 31, 1933.

W. ELLIOTT

1,895,615

CROOKED HOLE INDICATOR

Filed Oct. 1, 1929

From the patent text:

"This invention relates to indicating apparatus to be used by well drillers. It should be distinguished from apparatus such as has been used for surveying a well after it is drilled to indicate the inclination or "dip" of the well at different points in its depth. ...

Figure 1 is a vertical section through the device and showing a short portion of a drillstring in which the device is placed. This view shows the indicating apparatus in its normal position.

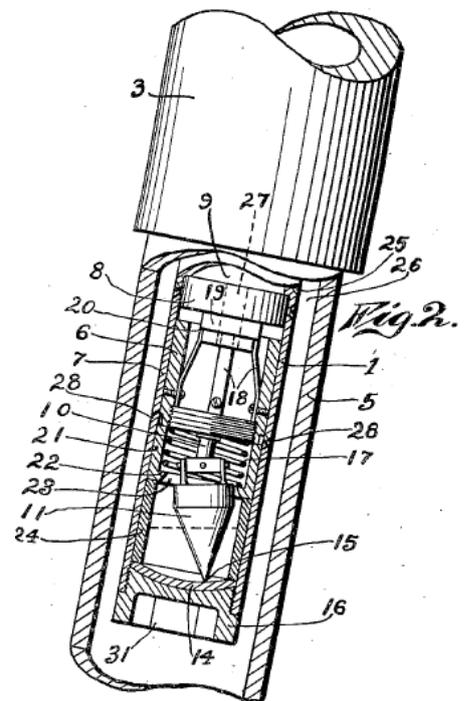
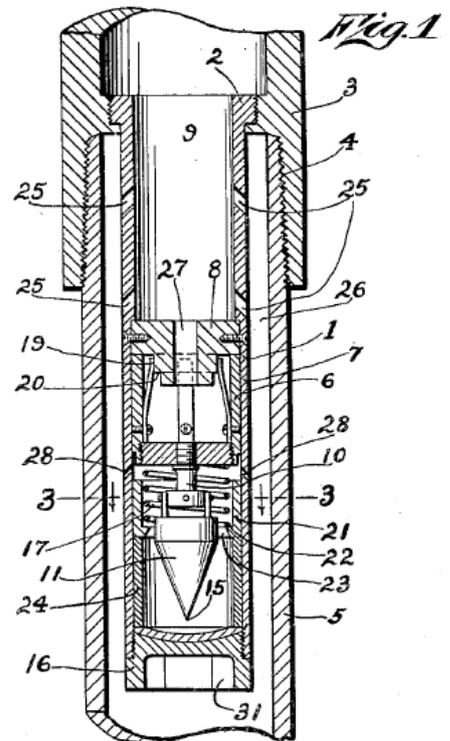
Figure 2 shows the apparatus in an inclined position such as it would have in a crooked portion of a hole being drilled, and illustrates the apparatus in its "set" or actuated position. ...

Any device of this nature can be employed, but for simplicity I prefer to employ a plumb-bob, which is mounted in such a way that it constantly maintains itself with its axis in a substantially vertical position. This directional device is mounted in the casing of the device in such a way that it can cooperate with an indicating member. Normally the directional device or plumb-bob is out of contact with the indicating member, but adjacent to it. In the normal position of the device, when the hole is straight, the plumb-bob is in a position such that its axis coincides with the axis of the tool string and with the central axis of the indicating member. If the hole being drilled starts to deviate the axis of the tool string and the casing of the instrument will become inclined, but the plumb-bob will maintain itself with its axis vertical. When the parts are in this relation, I develop a relative movement between the indicating member and the plumb-bob which brings them together, thereby forming an indication, or mark, by the plumb-bob on the indicating member.

This mark will be off the center of the indicating member, and the number of degrees that it is off from the center will indicate the inclination of the crooked portion of the hole. If the device is constructed so as to operate as indicated above, the indicating member is formed of some yielded material which can be punched or marked by the point of the plumb-bob when it strikes it. For this purpose I might employ a plate of soft material such as lead or any other suitable material.

If desired, the instrument may include means for holding the plumb-bob in its position of contact with the indicating member, in which case, if desired, the indicating member need not be constructed of a yielded material, but could be formed of any material which would operate to engage the point of the plumb-bob and hold it in a relatively fixed position. For this purpose I might employ a punctural diaphragm of any suitable material, or a diaphragm of wire gauze of fine mesh.

The contact between the plumb-bob and the indicating member or element can be accomplished in any desired way, for example, by a down-jar of the instrument such as would cause the point of the plumb-bob to strike the indicating element."



Oct. 20, 1936.

D. B. MONROE

2,057,787

OIL WELL SURVEYING INSTRUMENT

Filed April 2, 1935

2

From the patent text:

"This invention relates to a surveying instrument for oil wells, and has for its principal object the provision of a highly efficient device which can be lowered into a well casing or drill stem to produce an accurate record of the vertical inclination of said well. ...

Fig. 2 is an enlarged vertical section through the operating portion of the device illustrating the latter in the "released" position. ...

Fig. 4 is an enlarged detail plan view of the indicating target....

Fig. 7 is an enlarged vertical detail section through the plumb bob employed in the invention.

Fig. 8 is a detail horizontal enlarged section through the plumb bob bearing. ...

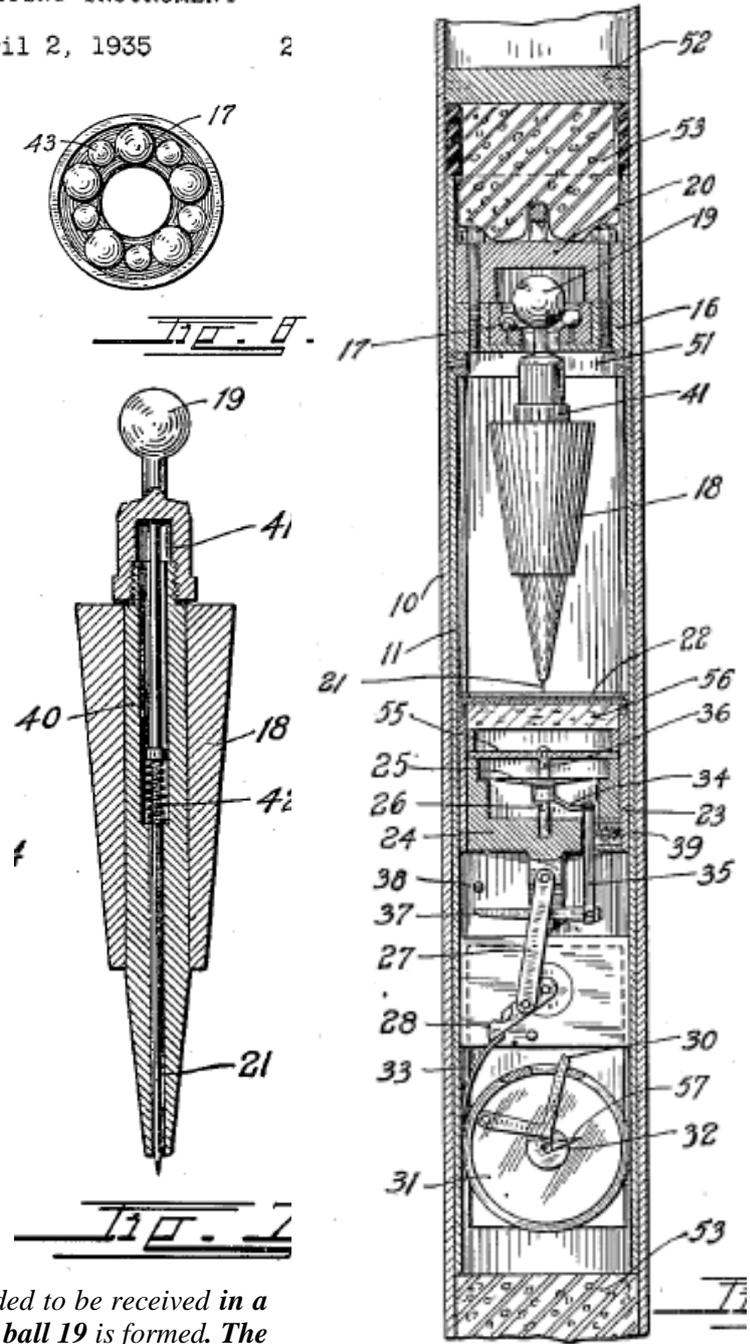
A bearing block 16 is supported in the upper portion of the inner housing 11 upon a suitable shoulder ring 51 and supports ball bearings 17 which in turn support a weighted plumb bob 18. The plumb bob 18 depends from a bearing ball 19 which rests on the ball bearings 17. The bearings 17 and the ball 19 are covered and protected by a suitable bearing cap 20.

The plumb bob 18 contains a needle 21 having an accurately ground point which projects from the bottom of the plumb bob. This point swings immediately above an indicating target card 22 which is removably carried on the upper extremity of a combined compass sleeve and target support 23.

It is desired to call particular attention to the construction of the plumb bob 18, and its supporting bearing. The bob consists of a central tube 40 about which is secured the weighted plumb bob proper 18. The latter is conical in shape with its smaller extremity downward. The lower extremity of the tube 40 projects from the bob and is also tapered to a relatively pointed extremity. The upper extremity of the tube 40 projects above the bob and is threaded to be received in a threaded socket 41, upon an extension of which, the bearing ball 19 is formed. The needle 21 extends entirely through the length of the tube 40, and contacts at its upper extremity with the bottom of the inverted socket 41. A spring 42 constantly forces the needle upwardly. When the device is not in use, the tube 40 can be threaded downwardly in the socket 41 so as to bring its lower extremity over the needle point to protect the latter. When being set for use, the tube 40 is threaded into the socket 41 to allow the needle point to project the desired distance.

It has been found that a more accurate swing of the plumb bob results if the ball bearings 17 are separated by means of smaller balls 43, as shown in Fig. 8. Only the large balls contact with the bearing ball 19.

The indicating target consists of a cardboard disc marked in degrees of compass direction around its periphery and marked in degrees of inclination by a series of concentric numbered circles as shown in Fig. 4. The cards are held upon a diaphragm surface 46 and are clamped in place thereon by means of a clamping ring 47. The upper surface of the clamping ring 47 is marked with degree marks as indicated by the lines and dots in Fig. 4."



Nov. 13, 1934.

W. A. HUNSUCKER

1,980,529

ORIENTING DEVICE FOR CORE DRILLS

Filed March 3, 1928

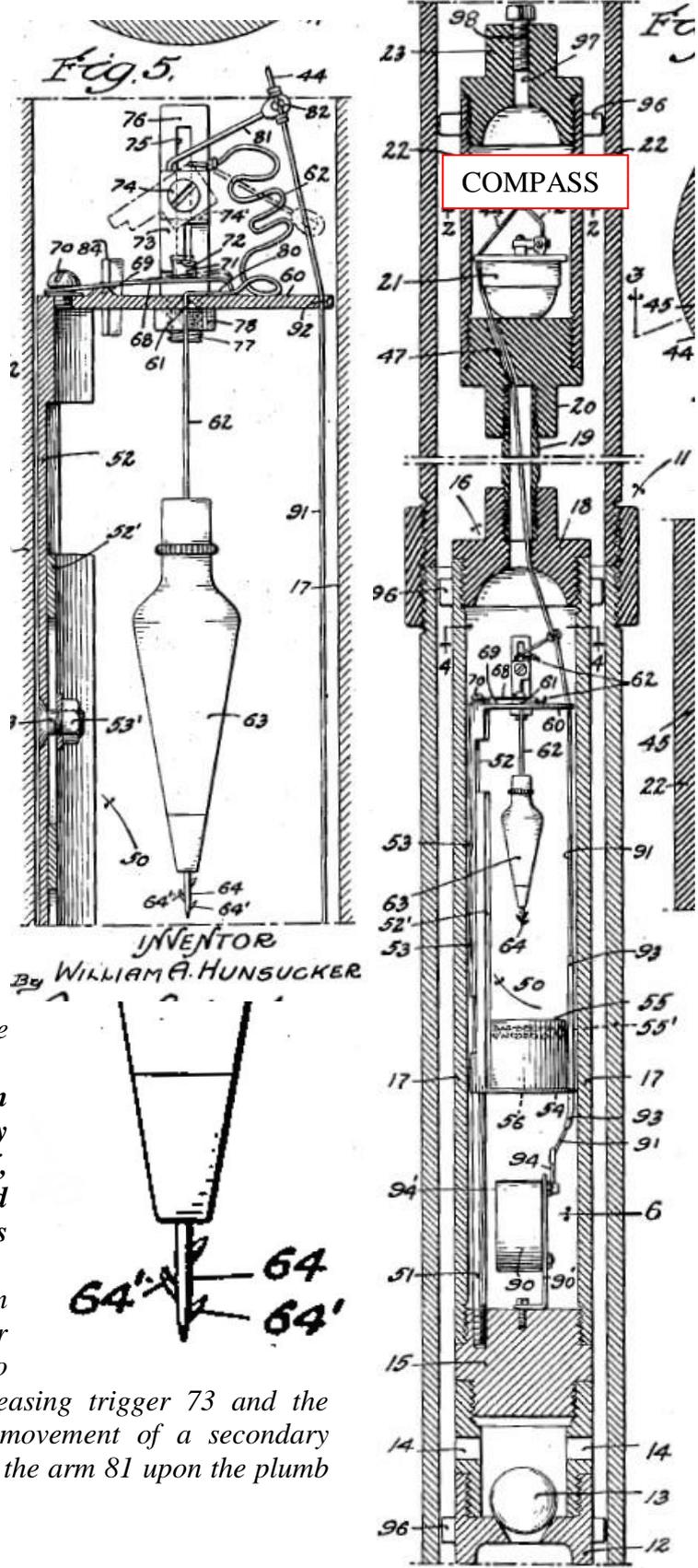
From the patent text:

“... Aside from the question of coring and the determination of geological structure, it is frequently advantageous to know whether or not the drill hole is being maintained in a substantially vertical line, or if the drill hole is “wandering” and, if so, to what extent and in what direction. Thus, it could be readily determined by accurately mapping a drill hole whether or not the well was maintaining its course within the property on which it was “spudded in”. ...

The general construction of my invention comprises a compass, which is provided with a device for clamping the needle, and a plumb bob which is adapted to be suspended above a soft material by means which may be adjusted for automatic release of the plumb bob simultaneously with the clamping of the mentioned compass. The release of the plumb bob permits the same to fall in a vertical line and to be imbedded in the mentioned soft material. It will be apparent that by knowing the center of the soft materials and its distance from the point of suspension of the plumb bob, the inclination of the core barrel at the time the plumb bob was released may be readily calculated by measuring the distance from the center of the soft material to the point at which the falling plumb bob strikes the same, and that the accuracy of this measurement may be regulated by varying the vertical distance between the point of suspension and the center point of the mentioned soft material. ...

The plumb bob 63 is preferably provided with an extending penetrating point 64, which may optionally be provided with a plurality of barbs, indicated at 64', which are adapted to engage the gauze 55' and hold the plumb bob against movement after the point has been imbedded in the soft material. ...

An interval timing device or suitable clock mechanism indicated at 90 is mounted upon the lower base member 15 by means of the standards 90' and is adapted to impart a segmental rotation to the plumb bob releasing trigger 73 and the compass clamping trigger 39 through the lateral movement of a secondary flexible member 91 which is received by the eye 82 in the arm 81 upon the plumb bob releasing trigger.”



Patented Apr. 3, 1928.

1,665,058

UNITED STATES PATENT OFFICE.

G. DALLAS HANNA, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO ASSOCIATED OIL COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

MEANS FOR OBTAINING DATA IN EARTH BORES.

From the patent text:

“Fig. 2 represents an enlarged vertical sectional view of the recording mechanism of the invention.

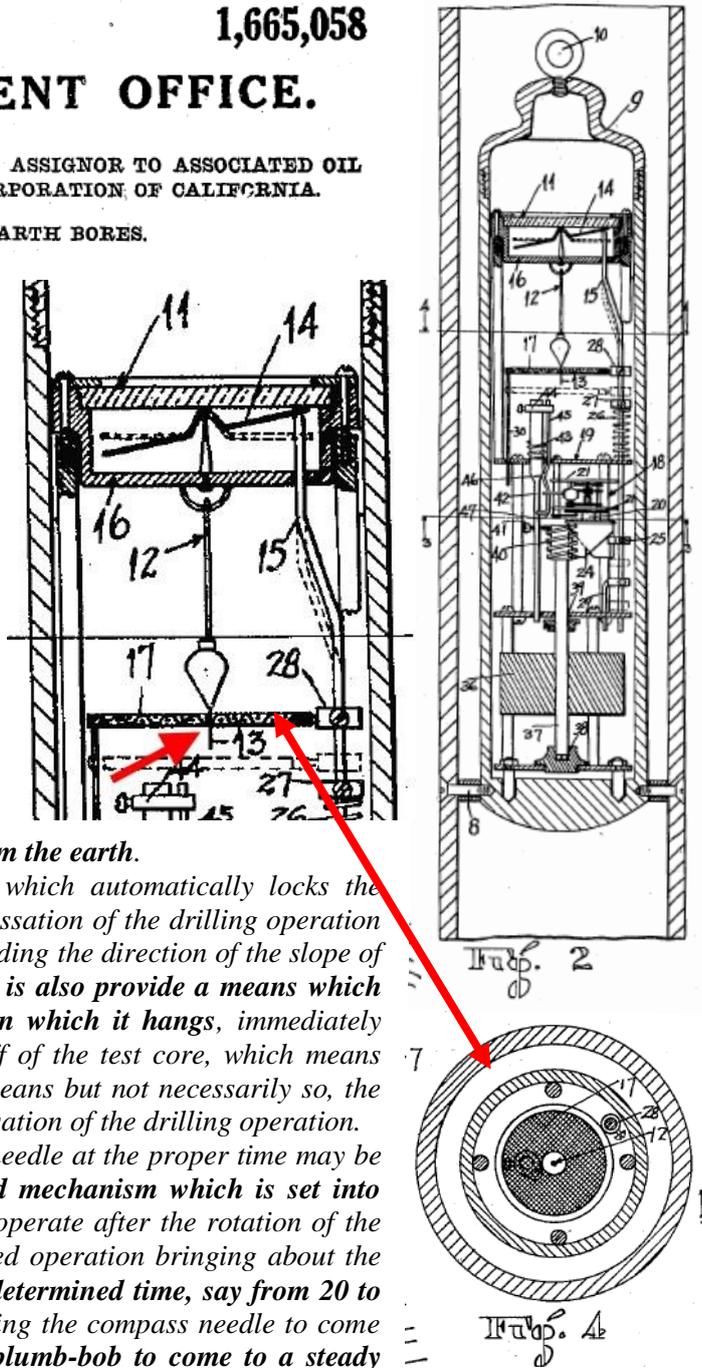
... This embodiment of the invention is carried out by combining with suitable test drilling apparatus of the present day type, a compass, either magnetic or gyroscopic, a plumb-bob and setting mechanism for the compass and plumb-bob. The purpose of the compass is to indicate the direction of the slope of the strata beneath the earth’s surface in order that a definite compass point, such as the north point, may be established in the bore and on the sample or core. The plumb-bob is arranged so that it will indicate the inclination of the bore relative to the vertical. The compass and plumb-bob will also provide for determining the direction of the inclination of the bore and the angle of inclination of the test core removed from the earth.

Operatively associated with the compass is a means which automatically locks the compass needle at a predetermined time following the cessation of the drilling operation and before the breaking off of the test core, thereby recording the direction of the slope of the strata so that accurate data may be obtained. There is also provide a means which will automatically fix the plumb-bob in the position in which it hangs, immediately following the drilling operation and before breaking off of the test core, which means may operate co-incidentally with the compass locking means but not necessarily so, the main requirement being that it operate following the cessation of the drilling operation.

Various means for locking the plumb-bob and compass needle at the proper time may be employed but I prefer to use an automatically operated mechanism which is set into operation by the rotation of the drill and continues to operate after the rotation of the drill ceases, due to the momentum thereof, this continued operation bringing about the locking of the compass needle and plumb-bob at a predetermined time, say from 20 to 30 seconds after the drill rotation ceases, thereby allowing the compass needle to come to position of rest or quiet. This likewise permits the plumb-bob to come to a steady hanging position before it is locked in the indicating position and in this way accuracy is assured. ...

... In addition to the compass I mount within the capsule a plumb-bob 12, which in the present instance depends from the compass. The plumb-bob is of the ordinary type except that it is provided with a long, sharp point 13. The compass and plumb-bob are preferably mounted in the upper part of the capsule so that the mechanism which is associated therewith may be effectively disposed below them. The compass needle 14 is adapted to be held against movement or locked by means of a locking rod 15 which extends through the compass casing 16 and is adapted to be moved into and out of engagement with the compass needle. The plumb-bob is adapted to be locked or held by means of a reticulated disk 17 preferably made of fine mesh wire screen and which is adapted to be moved into and out of engagement with the pointed end 13 of the bob. ...

... The said rod is moved downward against the action of the spring by the double cam 24 engaging the projection 25. The plumb-bob locking member 17 is vertically adjustably mounted upon the rod 15 by means of a collar and set screw arrangement shown at 28. ... “



B 8 US 1905299 McLAUGHLIN 1933 RECORDING INCLINATION

April 25, 1933.

W. I. McLAUGHLIN ET AL

1,905,299

INSTRUMENT FOR RECORDING INCLINATION

Filed Nov. 3, 1930

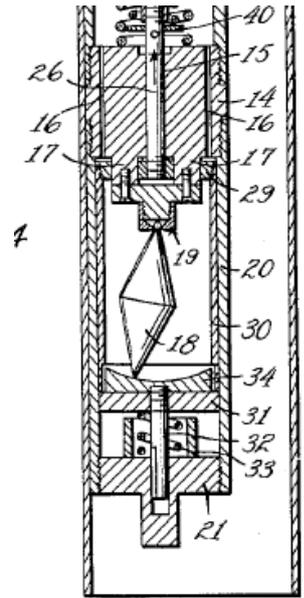
3 Sheets-Sheet 1

From the patent text:

"This invention relates to an instrument for recording the inclination of the drill pipe in the drilling of oil wells ...

... Suitable mounted upon plunger 31 is a recording disc 34 of suitable material such as wood, a soft white metal or brass, on which are scribed circles so that the degree from the vertical may be read. ...

... The pumps are then stopped to allow piston 22 to return to its initial position, to again permit spring 33 to force plunger 31 and disc 34 into recording engagement with plumb-bob 18. ... As soon as the pumps are started plunger 22 is again forced downward and through the mechanism already described forces the recording disc away from bob 18."



B 9 US 1905546 WEBSTER 1930 RECORDING INCLINATION

April 25, 1933.

H. B. WEBSTER

1,905,546

INSTRUMENT FOR RECORDING INCLINATION

Filed Nov. 3, 1930

From the patent text:

To withdraw the drill pipe requires considerable time and labor and is, therefore, expensive and consequently the drill pipe is run as long as possible before being withdrawn and it is, therefore, a further object of this invention to provide an instrument which may be actuated any number of times to check the inclination of the drill pipe during a single run of the drill pipe. ...

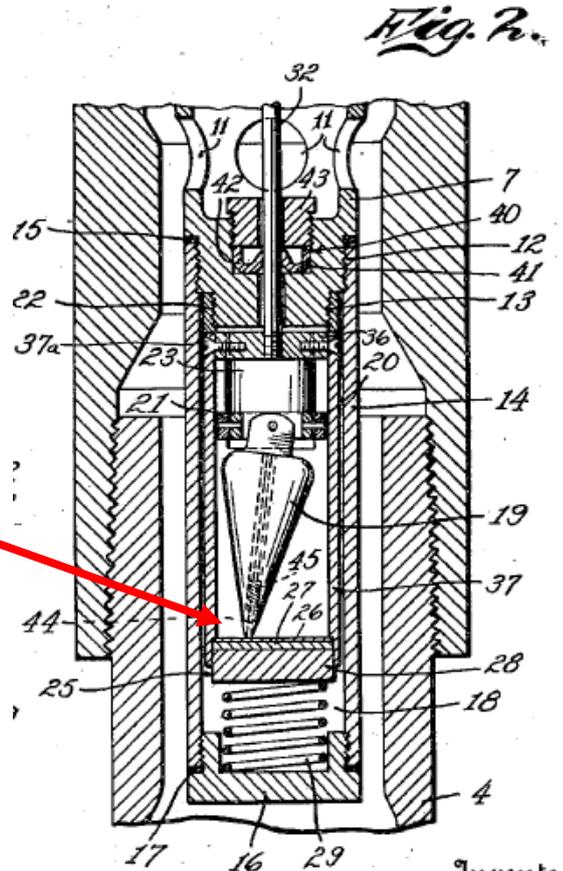
It is a further object of this invention to provide an instrument having a sealed plumb-bob chamber. ...

Figure 2 is a partial view of Figure 1 but illustrating the plumb-bob in engagement with the recording disc. ...

The lower end of shell is screw threaded to receive a removable plug 16 which is made pressure tight by means of gasket 17 and thus there is formed a fluid tight chamber 18 in which a plumb-bob 19 is pivotally mounted upon gimbal rings 20 and 21. ... The use of gimbal rings for pivotally mounting a plumb-bob so that the plumb-bob may swing freely about the pivot is well known that further explanation of this feature I deemed unnecessary.

A target or recording disassembly 25 may be made of any suitable material such as wood or soft metal or as illustrated, of a paper target 26 mounted upon a cork disc 27 which in turn may be mounted upon a target plug 28. The paper target 26 may be inscribed with concentric circles one degree apart.

The target or recording disc assembly 25 is resiliently held in engagement with the needle of bob 19 by means of spring 29."



C CONCLUSION

In the drawings and patent texts above we see, that the plumb bob was used very often in instruments used for earth bores. For the engineers it was of interest to know what inclination and direction the hole has. The systems to find this information are very different.

I am surprised that very common plumb bobs were used in these instruments.
The period where I searched for patents was between 1900 and 1940

Of interest for me are the different systems to “write”/record the results, given by the plumb bob (and compass needle). I am not sure that these systems gave very correct information.

Unfortunately I don't know how this measurement is made in our days.
Who knows more about it?

Now we have ONE TRADE MORE that uses a plumb bob: the *WELL DRILLING ENGINEER*

The original text of the mentioned patents above you can see in the Google patent search:
http://www.google.com/advanced_patent_search

Remark:

This is an article of the monthly published WOLF'S PLUMB BOB NEWS that is sent on demand as PDF-file attachment by email.
You can see all former publications on the website www.plumbbob.de
Remarks and contact by email: plumbbobwolf@t-online.de

The WOLF'S PLUMB BOB NEWS will be **continued in 2010**. (if you want to get it).

I wish you and your family

**A MERRY
CHRISTMAS and
A HAPPY NEW YEAR
2010**



**Do we meet us on the
3rd PLUMB BOB COLLECTORS MEETING
end of September 2010 in Cologne /Germany?**

**Stay-plumb
Wolf**