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BORE HOLE DIRECTIONAL APPARATUS AND METHOD OF ORIENTATION

Original Filed Aug. 15, 1924 2 Sheets-Sheet 1

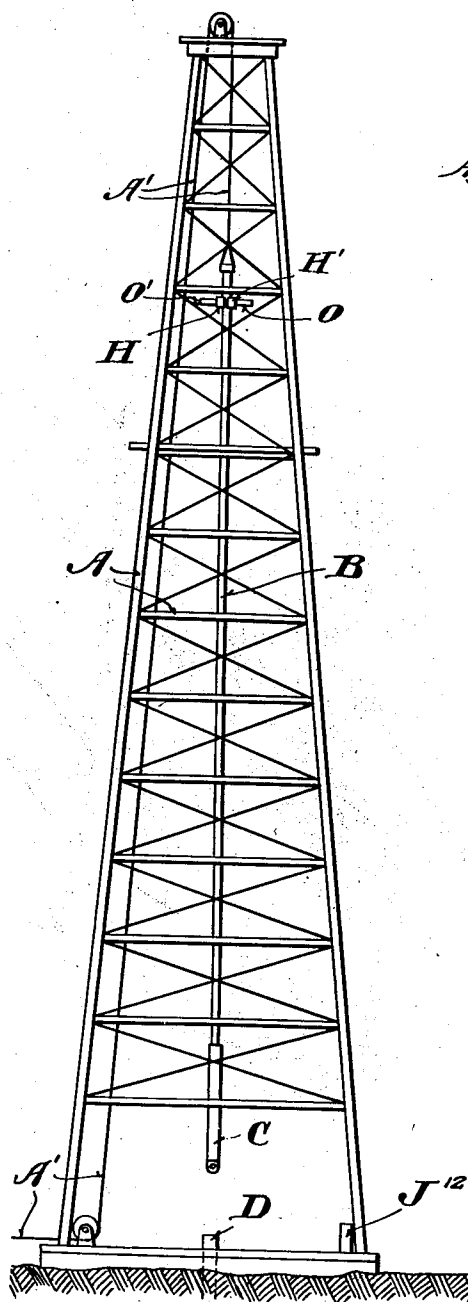
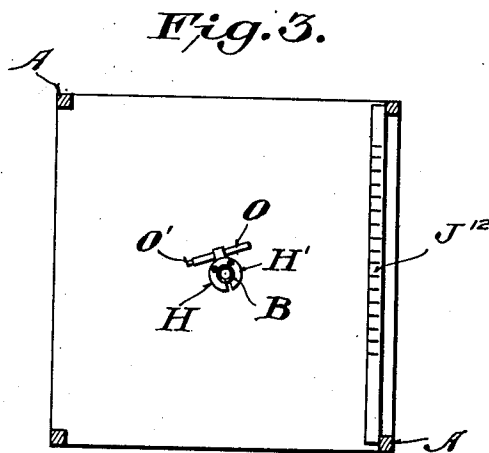
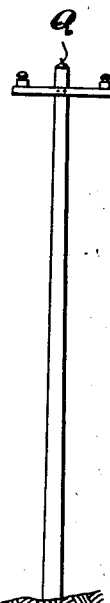


Fig. 1.



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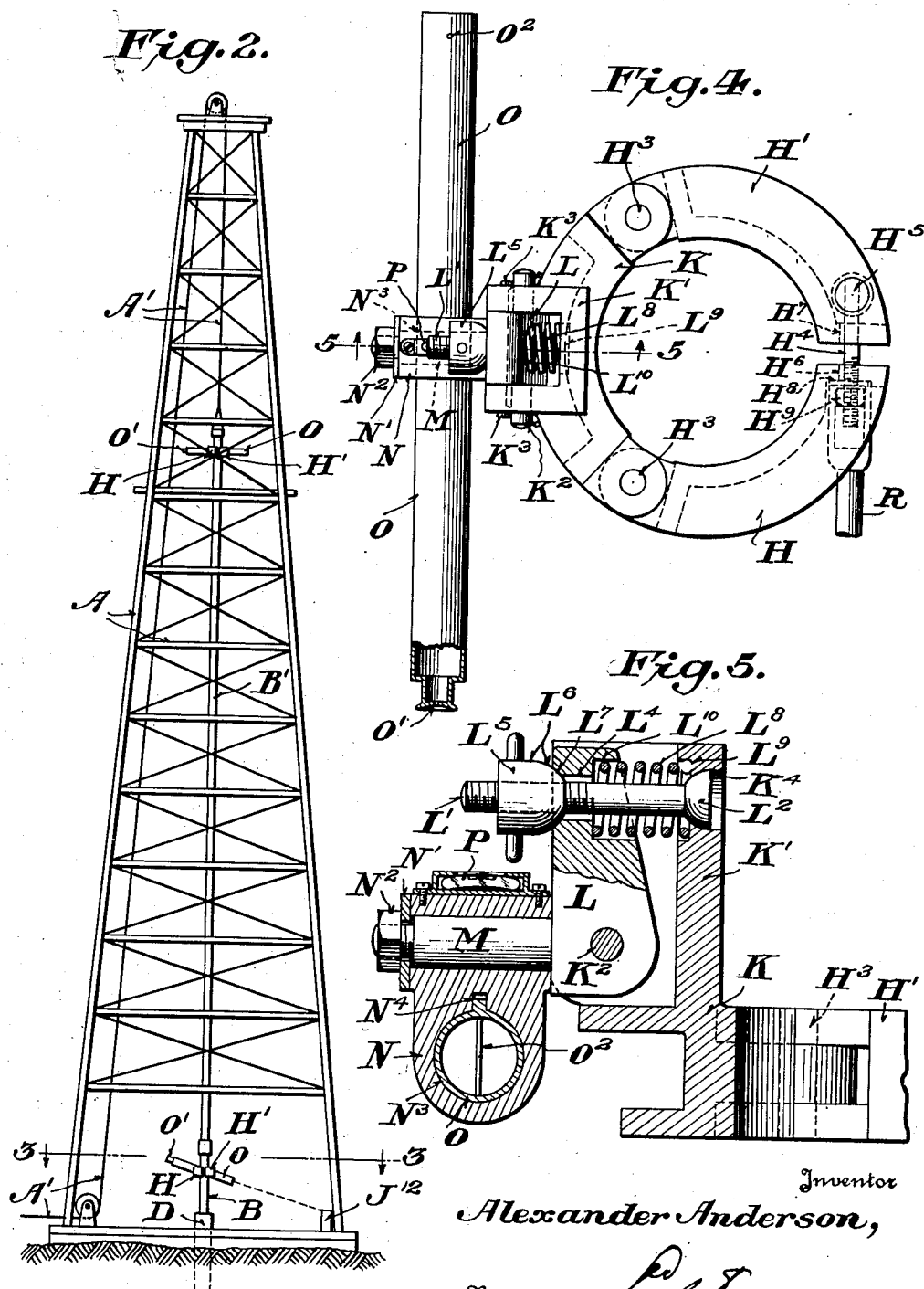
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UNITED STATES PATENT OFFICE

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BORE HOLE DIRECTIONAL APPARATUS AND METHOD OF ORIENTATION

Original application filed August 15, 1924, Serial No. 732,145. Divided and this application filed June 3, 1930. Serial No. 459,075.

This invention relates generally to apparatus and process for surveying bore holes, and this application is a division of application S. N. 732,145, filed August 15, 1924, now Patent No. 1,770,224 granted July 8, 1930.

The survey of any bore hole is completed when the bore hole is divided into a suitable number of successive parts, and the length, inclination, and direction of inclination of each part is determined and known. The present invention may be used in connection with any known type of bore hole surveying apparatus which is adapted to be run into the bore hole, attached to a line of pipe or rods, the use of which requires knowledge of the orientation of the line of pipe as it is passed into the bore hole. The invention may also be used in conjunction with impression blocks, deflecting wedges, and any other tools operating in the bore hole. Thus where a tool has been broken in a bore, an oriented impression may be obtained and the fishing tool may be accurately run in on a known orientation so as to slide exactly over and fit the broken tool.

One object of this invention is to provide new and improved methods and apparatus for accurately and rapidly determining the orientation of, or for accurately and quickly orienting a line of pipe or rods as it is passed into the hole for the above purpose. Another object of the invention is to determine the orientation of the tool or other body already within the bore hole. Another object is properly to place in oriented relation with a tool or other body already in the hole, a second tool, impression block or other part. Other objects will appear from time to time throughout the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Fig. 1 is a diagrammatic side elevation of a derrick with a stand of pipe in position at the time of starting to carry out a survey, a survey apparatus attached to the lower end and with a sighting device attached near the top of the stand and a scale member in position on the derrick floor.

Fig. 2 is a side elevation in part similar to Fig. 1 showing a later stage in the surveying operation, with a second sighting device in position on the pipe.

Fig. 3 is a sectional view, taken on the line 3—3 of Fig. 2, and showing a plan view of the derrick floor and the scale member located thereon.

Fig. 4 is a plan view of a clamping member and a sighting device supported thereby.

Fig. 5 is a partial vertical cross section taken on line 5—5 of Fig. 4.

Like parts are indicated by like characters throughout.

A is a derrick supporting the line A' by means of which the pipe B may be lowered into the bore. B is a stand of pipe about to be lowered into the bore. C is a surveying tool fixed on the lower end of the stand of pipe. This device is not described in detail here because its details form no part of the present invention. D indicates the lining of the bore hole. O is a sighting device fastened on the pipe by means of a clamping member which will be described later.

Q is a clearly defined object visible from the position of the sighting device in the upper part of the derrick. Q¹ and Q² are stakes located in the vertical plane of direction between the sighting device O and the object Q.

J¹² is a scale member, positioned on the floor of the derrick A and having measuring marks located in known relation to the chosen plane of direction.

As shown particularly in Figs. 4 and 5, the clamping device comprises three segments K, H and H¹. The segments H and H¹ are hinged to the ends of the segment K at H³. At their free ends they are detachably secured together by a bolt H⁴. This bolt H⁴ is mounted in a pin H⁵ which is pivoted in the segment H¹. The ends of the segments H, H¹ are slotted at H⁶H⁷ respectively to receive the bolt H⁴. A circular recess H⁸ is provided in the segment H, and in this recess a nut H⁹ which is located on the end of the bolt H⁴, is received and retained even when it is not fully tightened. The inner surfaces of the segments are surfaces of a

cylinder made to fit around the pipe. Recesses are provided, opposite the hinge H³.

The segment K has a bracket K¹ formed on its upper side. A cylindrical pin K² passes through holes in the bracket and is retained by cotter pins K³K³. The lower end of a member L is pivoted on the pin K². L¹ is a bolt which has a hemispherical head L² which lies within a socket K⁴ of the bracket K¹. This bolt passes through an enlarged hole L⁴ in the member L. L⁵ is a nut on the bolt L¹ and is provided with a hemispherical face L⁶ which rests in a socket L⁷ adjacent the end of the perforation L⁴ in the member L. L⁸ is a coiled helical spring positioned between the member L and the bracket K¹ about the bolt L¹. It is normally kept under compression between the bracket K¹ and the member L and its ends are received in recesses in the two members.

M is an axis member projecting from the lower portion of the member L at right angles to the axis of the pin K². The socket member N is held on this axis by a washer N¹, and the nut N². Within the socket member N is formed a cylindrical socket N³ which carries a sighting tube O. This socket N³ is at right angles to the axis member M. N⁴ is a key way along the top of the socket N³.

P is a spirit level attached to the top of the socket member N in a position parallel to the axis member M. The sighting tube O has a small sight-hole centrally located at its axis O¹ and a hair O² passes through the axis near the end of the tube. When the axis member M is horizontal the hair O² lies in a vertical plane. A longitudinal rib on the exterior upper surface of the sighting tube O closely fits the key way N⁴ of the socket N³ to prevent rotation of the tube in the socket. In place of the sighting tube O a telescope might be used.

Although I have shown an operative device, still it will be obvious that many changes might be made in size, shape and arrangement of parts without departing materially from the spirit of my invention; and I wish, therefore, that my showing be taken as in a sense diagrammatic.

Where, in the claims and specification I have used the word "pipe" I mean pipe, rod, or other elongated member. My invention is not of course limited to the use of pipe. For many purposes rods, poles, or other elongated objects might be used, the rods or poles would normally be in quantities joined together end to end like sections of pipe. Therefore, when the word "pipe" is used it is to be understood as referring to any elongated object which could be used in the manner herewith described.

The use and operation of my invention are as follows:

A clearly defined point or object visible

from the upper part of the derrick is selected, for example the telegraph pole Q. A first stand of pipe B is suspended over the mouth of the bore hole, and then a surveying device, or other tool C is rigidly attached to the lower end of the pipe B. The device C and the pipe B are placed in a known position in azimuth, and a clamp, such as that shown in Fig. 4, is placed about the pipe near the top of the stand. The sight tube is pushed into the socket O of the clamp.

Using the barrel of the sight tube as a lever, the clamp is moved around the pipe until the line of sight falls approximately on the distant object Q. The sight tube is then adjusted by means of the nut L⁵ until the bubble in the spirit level upon it is exactly at a horizontal position, and the hair O² is in a vertical plane. The line of sight may then be exactly trained on the distant object and the nut H⁹ on the clamp is tightened preferably by a wrench R, thus locking the clamp in position upon the pipe with the sight tube aligned in the chosen plane of direction.

By rotating the sight tube O on the axis member M, the several targets or pickets Q¹Q² are now spaced apart on the ground on a line with the distant object and in a vertical plane with the hair O²; the line of targets is sufficiently extended to permit at least one to be visible from the derrick floor. The remaining targets are useful because they allow of a choice of points to sight on when parts of the derrick interfere with direct vision of the original distant object.

The scale member J¹² is supported upon the derrick floor, and on the side of the derrick which faces in the direction of the sighted object Q shown in Fig. 1. The scale is preferably so positioned that a substantially midpoint, to be used as the zero point, will lie in the chosen plane of direction or azimuth. In the operations so far described, the clamp carrying the sighting device had been placed upon the upper end of the first stand of pipe, and the clamp rotated about the pipe until the line of sight of the sighting device fell exactly on the distant target Q. The clamp was then secured to the pipe in that selected position. The pipe section with the clamp attached is now lowered until the clamp approaches the derrick floor, or about the level of the scale board J¹². At this level a sighting device is again inserted in the clamp, and sighting upon the scale board, a reading is taken, which may be either to the right or left of the zero mark on the scale. Such reading, with reference to the zero mark, will be an accurate measure of the amount and direction of rotation of the pipe incidental to its lowering; and the same cycle of operations, comprising aligning a sighting device in the chosen direction, clamping it to the pipe, lowering the pipe and attached device, adding another section

to the pipe and measuring the rotation by means of the scale on the derrick floor is repeated with each stand of pipe until the pipe and attached surveying instrument or other tool has been lowered to the desired depth.

5 The algebraic sum of the rotation so measured, (these readings being positive on one side of the zero mark and negative on the other side) that respectively occurred during the lowering of the pipe after the addition
10 thereto of each stand gives the total rotation of the lower end of the pipe. Similarly, the algebraic summation of the appropriate rotations measured will give the total rotation
15 at any depth with respect to which that information is desired as a constant record of the rotational position of the pipe and attached apparatus is made by the operations above described.

20 I claim:

1. In the method of orienting a device at any point in a bore hole within and longitudinally of which the device is moved in stages affixed to a line of pipe, the steps comprising choosing a vertical plane of direction which intersects a fixed scale member, fixing on the pipe a member aligned in the chosen plane of direction and after movement of the device along the bore, measuring
25 on said fixed scale to determine the change in the rotational relation of the member with reference to the chosen plane of direction.

2. In a method for measuring the rotation of a pipe that is moved along and within
35 a bore by determining linear measurements on a fixed scale which subtend the angles through which the pipe has turned, the steps comprising fixing on the pipe a member aligned in a chosen plane of direction, and after movement of the pipe longitudinally
40 of the bore in a desired direction through a predetermined distance, determining the amount and direction of change in alignment of the member by linear measurements
45 on said fixed scale.

3. In apparatus for moving an elongated member in and along a bore hole and measuring the amount and direction of rotation of the member incident to such movement,
50 comprising a derrick structure for supporting the member and means for moving the member along the bore hole while so supported, a stationary scale fixed to the derrick structure, an aligning device adapted to be
55 clamped to the said elongated member in a definite rotational position with relation to a chosen plane of direction and to cooperate with the said scale to determine the
60 amount and direction of rotation of the member incident to its movement along the bore.

4. In apparatus for determining the rotational position of a line of pipe that is
65 moved longitudinally of and within a bore

comprising a pipe-engaging clamp supported on the pipe and adjustable to any desired rotational position thereon, a sighting device mounted on said clamp and pivotally supported thereby for sighting in a substantially vertical plane, whereby a distant target in a chosen plane of direction may be viewed from different sighting stations after the pipe with the clamp secured there-
70 to is moved along the bore.

5. In a device for determining the orientation of an elongated member moved longitudinally in a bore hole, the combination of means for supporting the member for longitudinal movement within the bore, and a fixed member with respect to which said elongated member is movable, said fixed member being adapted to measuring rotation of said elongated member incident to its longitudinal movement.
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6. In a device for determining exteriorly of the bore the orientation of an elongated member moved by stages longitudinally in a bore hole, a clamping member adapted to be secured upon said elongated member against relative rotation with respect thereto, a sighting device, and means for supporting said sighting device upon said clamping member for motion of its axis in a plane parallel to the axis of said elongated member, for sighting upon a fixed object distant from said elongated member.
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