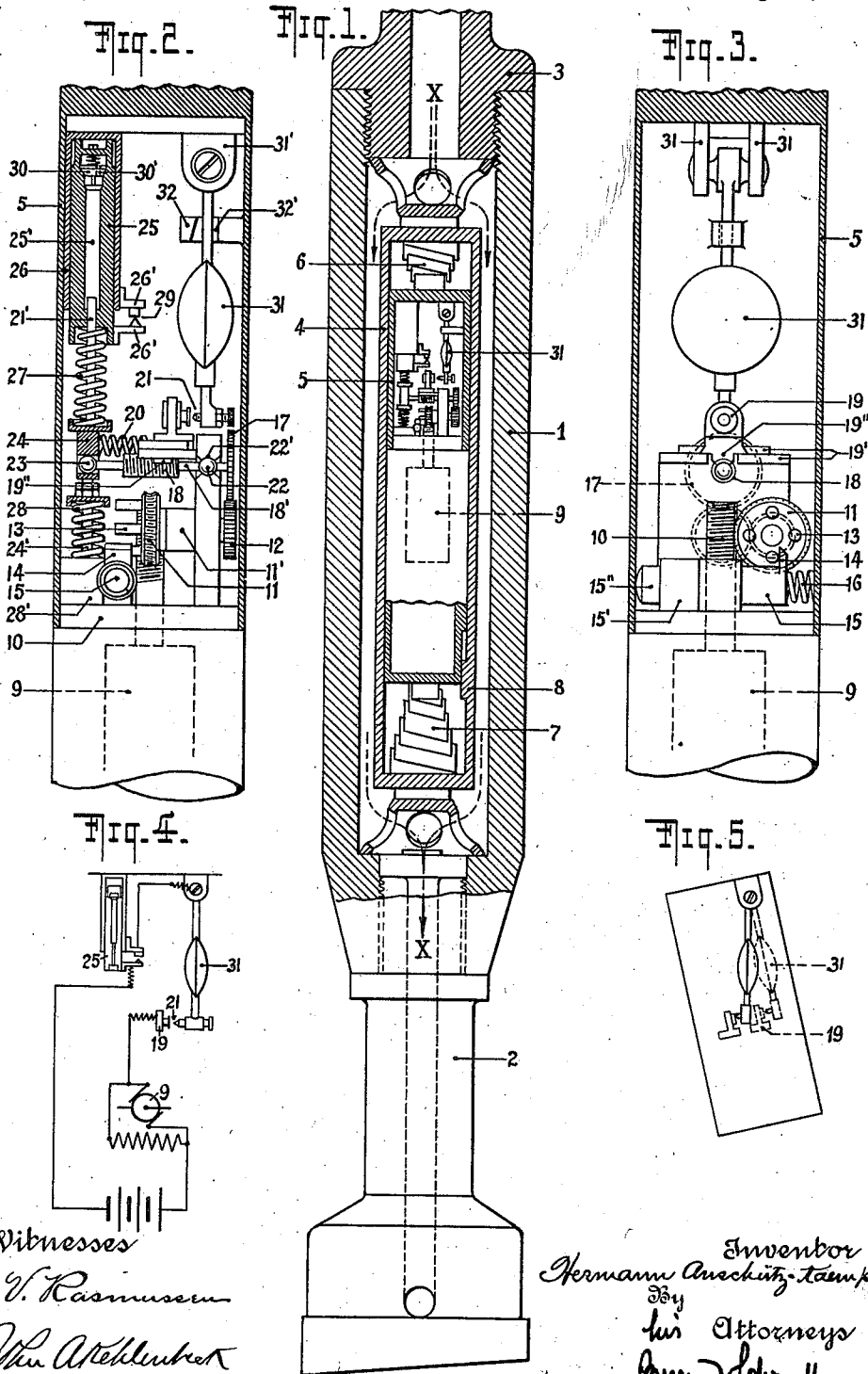


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BORING TOOL.
APPLICATION FILED-NOV. 23, 1917.

1,313,367.

Patented Aug. 19, 1919.



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BORING-TOOL.

1,313,367.

Specification of Letters Patent.

Patented Aug. 19, 1919.

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To all whom it may concern:

Be it known that I, HERMANN ANSCHÜTZ-KAEMPFE, a subject of the Emperor of Germany, and a resident of Neumühlen, near Kiel, Germany, have invented certain new and useful Improvements in Boring-Tools, of which the following is a specification.

This invention relates to a boring tool for sinking deep vertical holes. The tool proper, which constitutes no part of this invention, comprises a suitable bit holder to the bottom of which is fixed a boring chisel or bit having a cutting edge inclined with reference to the axis of the holder. In drilling with a bit of this kind, the bit has a tendency to slip off at each blow, in the direction of the high side or edge of the bit. By uniformly rotating the boring tool, a vertical hole tends to be produced. If, however, any deviation from the vertical takes place, the blows of the bit should be restricted to that portion of the circle of rotation which includes the plane in which deviation has taken place, with the high point or edge of the bit on the side opposite the position it had when the deviation took place. In this way, a new deviation, opposed to the original deviation, will be produced. When verticality has again been restored, uniform rotatory motion of the boring tool may again be resumed.

The object of the present invention is to provide means by which it may be known by the operator at the surface of the ground when the tool has deviated from the vertical so that the boring tool may be suitably manipulated to make the bore truly vertical.

The invention is illustrated in the accompanying drawing, in which—

Figure 1 is a vertical section through the bar holding the chisel or bit,

Figs. 2 and 3 show parts of this section on an enlarged scale, at an angle of 90° to each other,

Fig. 4 shows the circuit of the electric drive used, and

Fig. 5 is a detail view of the same.

The hollow bit holder 1 is provided at the lower end with the hollow beveled or oblique chisel or bit 2, and at the upper end secured by means of the connection 3 to the boring

rods. Apart from the oblique edge of the bit and the bore of the bit holder which receives the measuring device, these parts do not differ substantially from the boring tools generally used with flushing devices. Care is taken to insure that the flushing liquid reaches the bit through the hollow bit holder and the hollow boring rods, as indicated by the dotted lines *x*.

In the hollow space of the bit holder 1 is rigidly mounted a completely closed outer casing tube 4 for the transmitter, the inner casing tube 5 of the transmitter being longitudinally adjustable in the outer casing tube and supported by means of spring buffers 6 and 7, while it is forced to participate in the rotation and inclinations of the bit holder. In order to bring this about, the outer casing tube 4 is provided with a guide projection or lip 8.

In the transmitter is arranged a source of power 9 (accumulator battery with an electric motor, or a clockwork operated by a spring or the like). In the construction described, it has been assumed that this source of power 9 is an electric one. It drives the driving worm 10 which engages with the worm wheel 11, the spindle of which is supported at 11' and carries a toothed wheel 12 keyed to the outer end. The surface of the worm wheel 11 is provided with four pins 13 arranged in a circle, which on rotation in the direction of the arrow shown (Fig. 3), consecutively engage with the finger 14 of a hammer 15. The latter comprises a bolt adjustably mounted at 15' and controlled by the pressure of a spring 16. The pins 13 striking the nose 14, drive the hammer for a short distance in opposition to the action of the spring 16, and then release it, so that its head 15'' is projected against the wall of the inner casing tube 5. As the number of pins is four, four blows of the hammer 15 are produced at each revolution of the wheel 11.

The toothed wheel 12 mounted on the spindle of the worm wheel 11, engages with a toothed wheel 17 mounted on a shaft 18' carrying a screw-threaded barrel or worm 18. The latter can be connected to, or disconnected from, a slide 19 adjustably

mounted on guides 19', carrying a half-nut 19'' coupling with barrel 18 and controlled by a spring 20. When barrel 18 is rotating and in engagement with the half-nut 19'', the slide 19 is shifted in opposition to the pressure of the spring 20, in Fig. 2, to the left. On the slide 19 is mounted an electric contact 21, the object of which will be hereinafter explained.

The shaft of barrel 18 is mounted so that it can oscillate. It is of spherical shape at 22 and rests in a spherical bearing 22', and at the free end is provided with a ball shaped thickened part 23. The ball 23 is arranged in a recess of an adjustably mounted pressure pin 24 so that, when the said pin moves down, the shaft end with the ball 23 is forced downward, owing to which the half-nut 19'' of the slide 19 is disconnected from barrel 18, and the slide 19 is returned to the original position by the pressure of the spring 20. The toothed wheels 12 and 17 are cut so deep that, even when the shaft 18' oscillates, they remain in engagement. To the pressure pin 24 are secured at both sides rods 24' on which are mounted helical springs 27 and 28. The spring 27 supports a comparatively heavy plunger 25 guided in a cylinder 26. The spring 28 is mounted on a support 28', the plunger 25 is provided with a hollow space 25' into which the upper rod 24' passes when the plunger 25 is moved downward in opposition to the pressure of the spring 27. The hollow space 25' is closed at the upper end by means of a spring controlled check-valve 30. The latter opens when the plunger 25 moves downward, but closes again when the plunger moves upward. An equalization of pressure can then be effected only by means of a fine bore 30' in the valve.

To the plunger 25 and the cylinder 26 are secured two brackets 26' carrying the two parts of an electric contact 29. The contact is closed when the plunger 25 is in its upper position shown in Fig. 2, but is broken as soon as the plunger begins to move downward.

Finally, in the lugs 31' provided on the frame is suspended a heavy pendulum 31, the oscillation of which toward the inner space of the tubular casing 5 (in Fig. 2 on the left), is limited by a stop 32, and to the right by a stop 32'. This pendulum carries the second part of the above mentioned contact 21 of the slide 19. Whether this contact is open or closed, depends, on the one hand, on the position of the pendulum 31, and on the other hand, on that of the slide 19.

The two electric contacts 21 and 29 are arranged in the circuit of the electric source of power 9 which operates the worm 10. As will be seen in Fig. 4, the two contacts in

this circuit are connected in series. The circuit will be therefore broken, and the motor brought to a standstill even if only one of these contacts is switched out. How and under what conditions this takes place, will be now explained together with the whole working.

When a blow is executed with the boring bit, the plunger 25, owing to momentum, will continue its downward movement at the moment when the boring tool strikes and the bit holder stops, the plunger compressing the suitably calculated springs 27 and 28. This will result in the pressure pin 24 being moved downward, and accordingly the shaft 18' of the screw spindle 18 will be turned downward about the spherical portion 22 as the pivot, until the screw spindle is disengaged from the half-nut 19''.

A movement of the slide 19 would therefore no longer take place. But owing to the downward movement of the plunger 25, the contact 29 is also broken, so that the motor 9, and accordingly the screw spindle 18 stop. After the blow the plunger 25 cannot at once move up under the action of the springs 27 and 28, as the valve 30 closed in the meantime, admits air only slowly into the hollow space 25'. The speed with which the plunger can move upward, is calculated so that, before the screw spindle can return to its working position and the contact 29 close, a new blow—assuming regular working—and therefore a new downward movement of the plunger takes place. This condition of things is maintained as long as regular boring goes on. If the blows on the boring rods are interrupted for a longer time than that determined by the springs 27, 28, the mass of the plunger 25, the adjustment of the valve 30 etc.,—for instance for more than 20 seconds,—only then can the plunger 25 return to its initial position, and therefore the screw spindle 18 be thrown in again and the contact 29 closed. The motor 9 would then start working if at this moment the contact 21 were also closed. Whether however it will be or not, depends on the position of the pendulum 31, if the latter, and therefore the bit holder, still remain vertical, or if the bottom end of the bit holder became inclined to the left, and the pendulum accordingly moved to the right or engaged with the stop 32', the contact 21 will not be closed, and the motor and the parts connected to it, will remain at a standstill. If, on the contrary, the bottom end of the bit holder has deviated—in the construction illustrated, to the right—that is to say, assumed the position shown on an exaggerated scale in Fig. 5, the contact 21, and therefore the working circuit will be closed, the motor will start and the worm 10 will begin to work. The latter will drive first the worm wheel 11 provided with

the pins 13, and as already stated, the said pins will move the hammer 15 so that the latter will execute a blow on the wall of the inner casing 5 at each passage of a pin 13 past the projection 14. These blows are transmitted to the surface through the outer casing 4 of the transmitter, through the bit holder and through the boring rods firmly screwed to the latter, and can there be clearly perceived and counted, for instance by means of a listening ear-piece with rubber tube and the like, placed in the boring rods.

Simultaneously with the worm wheel 11 will start, under the action of the toothed wheels 12, 17, the screw spindle 18 which will move the slide 19 to the left in opposition to the action of the spring 20. This movement is followed by the pendulum 31 which rests on the slide, until it again hangs vertically and lags behind, whereupon the contact 21 is broken, and the motor, and accordingly the other parts connected to it, as well as the slide, will come to a standstill. Until this takes place, four hammer blows are executed at each revolution of the worm wheel 11. The observed total number of blows indicates therefore to what extent the slide 19 must have moved to the left in order to reestablish the vertical position of the pendulum 31, that is to say it is also a measure of the obliquity of the bit holder with the boring bit.

The observer on the surface has therefore merely to stop the boring blows from time to time and to listen to the signal blows of the hammer 15 against the boring rods, in order to find out whether and to what extent the chisel has deviated from the vertical position.

Three limitations have however to be observed for the purpose:

1. Only the oscillations of the pendulum to the left (in the plane of the drawing) can really be measured.

2. The pendulum always measures only one component of the inclination.

3. The position of this component of the inclination of the bore hole is known with certainty only relatively to the chisel, and not relatively to the geographical position of the bore hole.

Nevertheless the indications obtained are perfectly sufficient for the purpose, as the chisel has merely to be turned to an angle of 90° to one or the other side, in order to measure in this position the other component. Moreover the position of the chisel, in which a component assumes its maximum, coincides with the total inclination. About this point it is then necessary to turn the deep edge of the chisel, instead of rotating it uniformly in a circle, in order to equalize again the deviation produced, as described in the prior specification. As long as no

twisting of the transmitter relatively to the chisel takes place, any twisting of the boring rods may be left out of account. If only the beginning deviation is equalized as quickly and completely as possible, the object of the invention will be fulfilled, so that one may dispense with ascertaining in which geographical direction the bore hole would have deviated from the vertical without the equalization in question.

It will be seen from the foregoing what a considerable simplification is effected by this invention. This simplification can be more-over advantageously utilized also when it is desired to transmit to the surface the position of measuring tools which are arranged not, as in the present apparatus, in the bit holder of a boring instrument, but in an apparatus for plumbing a finished bore hole, such as for instance is described in Letters Patent 1,209,102 dated December 19, 1916. The invention extends therefore also to the application of acoustic signals in such plumbing apparatus and the like devices.

I claim:

1. In a boring tool, a bit holder, a pendulum pivotally supported upon said holder, and a motor driven sounding apparatus also attached to the holder and controlled by the pendulum, the motor being inoperative when the bit holder is vertical.

2. In a boring tool, a bit holder, a pendulum pivotally supported upon said holder and arranged to swing in but a single plane thereof, and a motor driven sounding apparatus also attached to the holder and controlled by the pendulum, the motor being inoperative when the bit holder is vertical.

3. In a boring tool, a bit holder, a pendulum pivotally supported upon said holder and arranged to swing in but a single plane thereof, and an electrically operated hammer also attached to the holder, the hammer circuit having a pair of contact points which are open when the pendulum is vertical but are adapted to be closed by the pendulum when the bit holder is inclined in the plane of the pendulum.

4. In a boring tool, a bit holder, an electrically operated hammer attached to the holder, a mass resiliently attached to the holder and arranged to move quickly with respect thereto when a boring blow is struck with the bit, and means for retarding the return of said mass to its original position, the operating circuit of the hammer having a pair of contact points which said mass closes together when in its position of rest and opens when it moves therefrom.

5. In a boring tool, a bit holder, an electrically operated hammer attached to the holder, a pendulum pivotally supported upon the holder, a mass resiliently attached to the holder and arranged to move quickly

with respect thereto when a boring blow is struck with the bit, and means for retarding the return of said mass to its original position and a pair of electrical contacts in series in the hammer circuit, one pair of said
5 contacts being closed by the mass when in its position of rest but opening when it moves therefrom and the other pair of contacts being opened by the pendulum when it is vertical with respect to the bit holder and
10

closed when the same becomes suitably inclined with respect to the bit holder.

In witness whereof I have hereunto signed my name this 22nd day of March, 1917, in the presence of two subscribing witnesses. 15

DR. HERMANN ANSCHÜTZ-KAEMPFE.

Witnesses:

ERHARD ERNST,

FRANZ BAUMANN.