

June 8, 1926.

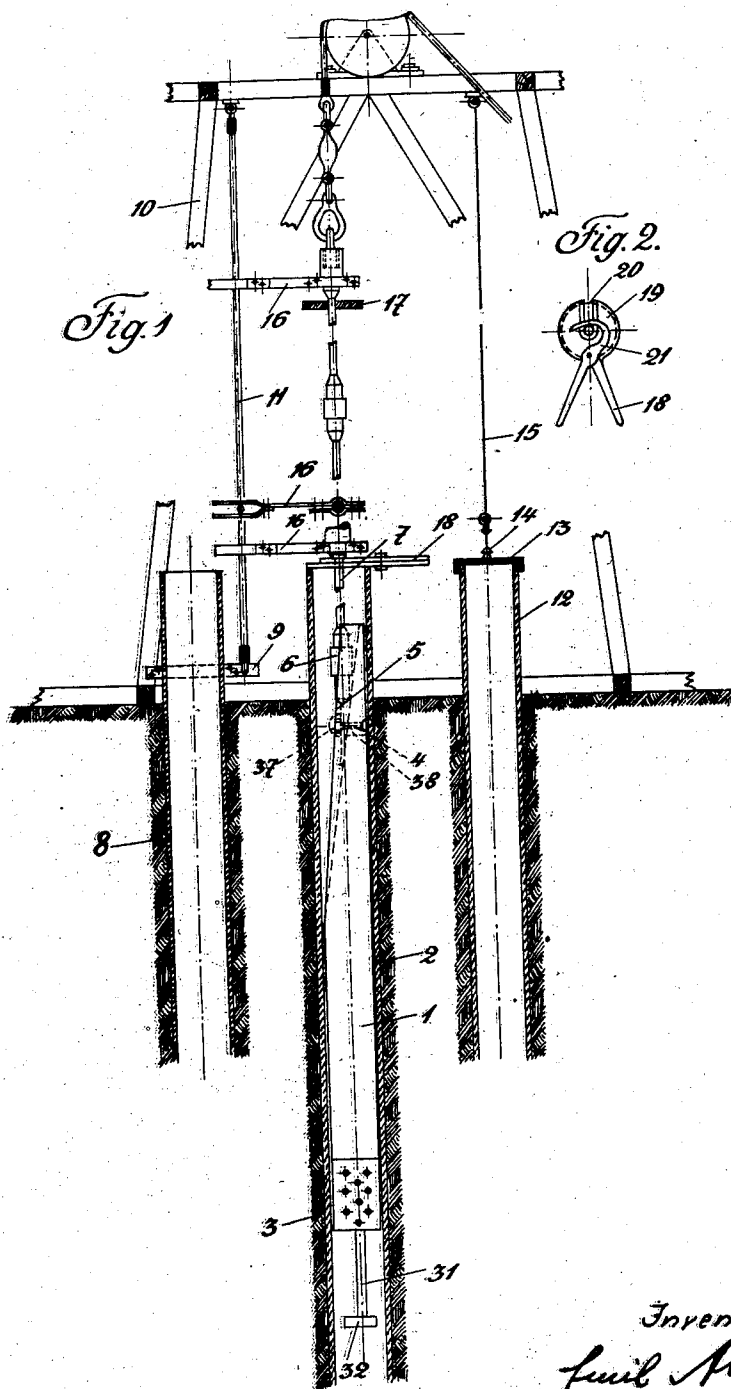
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E. ALBRECHT

MEANS FOR SINKING BOREHOLES

Filed August 31, 1921

3 Sheets-Sheet 1



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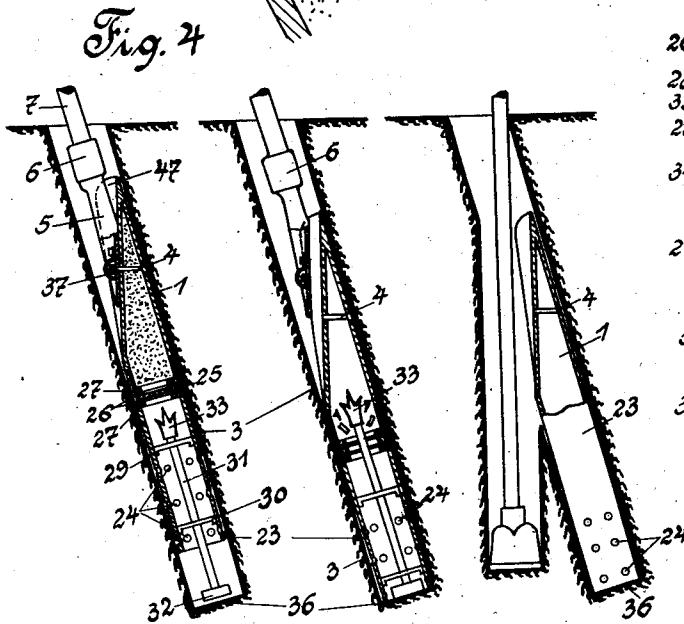
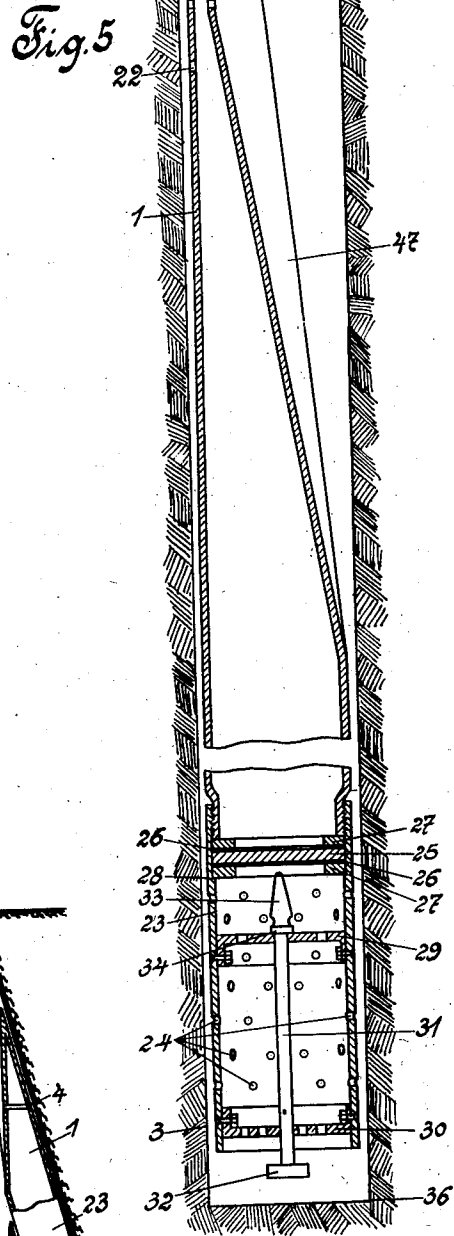
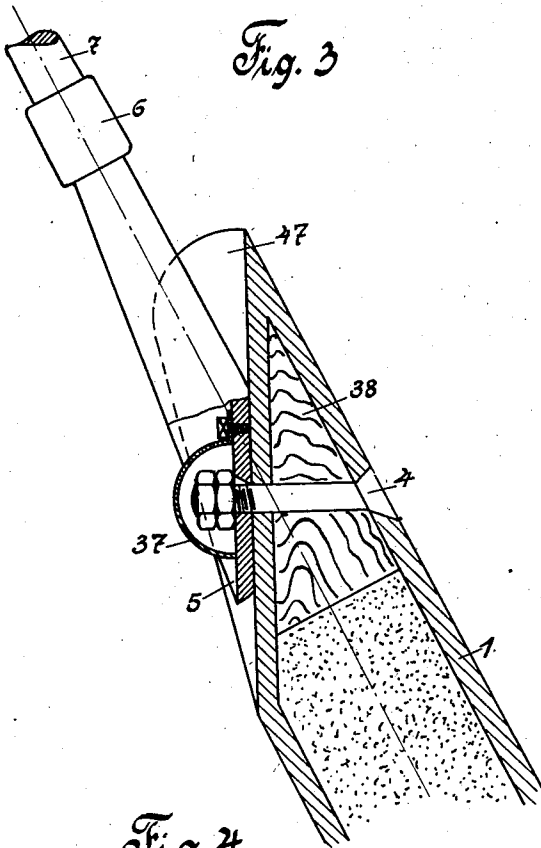
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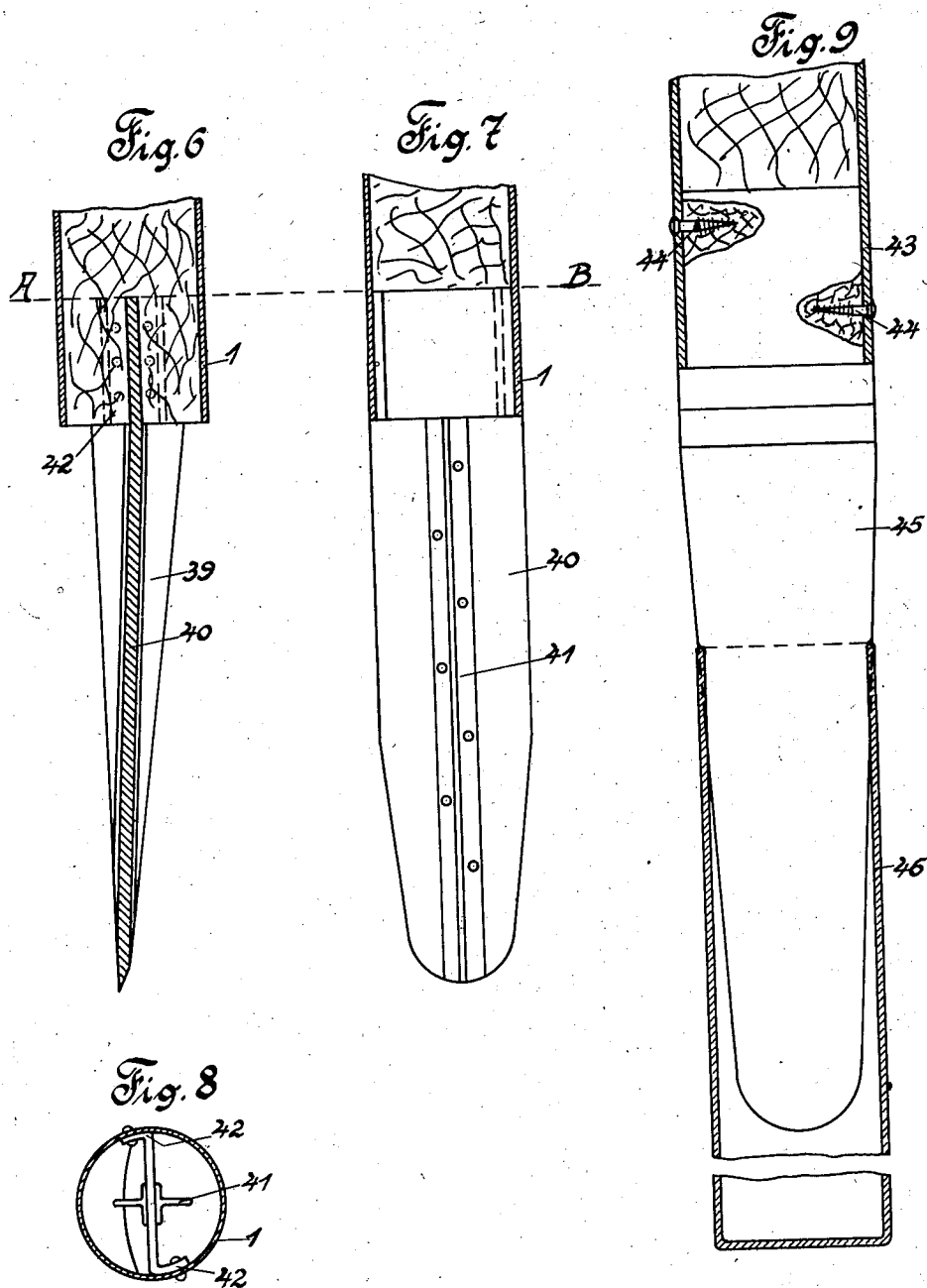
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# UNITED STATES PATENT OFFICE.

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MEANS FOR SINKING BOREHOLES.

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(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

In putting down bore-holes in solid ground it often happens that the holes deviate considerably from the vertical direction and it is then necessary to insert devices by which the drill is deflected so as to cause the continuation of the hole to extend in a more vertical direction or in some other desired direction. A known method consists in letting a drill-deflecting member down into the hole. The deflecting member consists of a cylindrical body with an oblique surface at its one end, so that this end is shaped somewhat like a wedge. The drill-deflecting member is either dropped down into the hole, without being turned in any particular direction, on its longitudinal axis, but with the thin edge of its wedge-shaped portion directed upwards, or it is screwed to a bore-rod or pipe and let down at the end of the same, whereupon the screw connection is dissolved and the rod removed whilst leaving the deflecting member in the hole. The drill that is then lowered is deflected by the top oblique surface of the deflecting member. The present invention relates in general to a method of this kind.

The fundamental idea of the invention is to fix the hole-correcting or drill deflecting means in the position where the correcting operation is to be carried out in such a manner as to be absolutely immovable. The correcting-means is embedded or fixed in the hole in different ways according to the nature of the stratum to be drilled. If the stratum is solid the method adopted in accordance with the invention is to lodge the wedge-shaped member in a fluid fixing material that sets and hardens more or less gradually, such as cement, this material being preferably carried down into the hole by the wedge-shaped member itself, and being allowed to run out into the hole at a certain moment, preferably at the moment when the wedge carrying the fixing material reaches the bottom of the hole. A preferred procedure consists in causing the fixing material to be let out at the proper moment by an automatic appliance.

The wedge-shaped member employed in practising the said method may consist for example of a hollow body composed of two parts, one of which is formed in the known manner so as to be partly cylindrical and partly wedge-shaped and arranged to contain the fixing material. The other part,

however, is made entirely cylindrical and provided with walls adapted to permit of the exit of the fixing material into the bore-hole. During the downward passage of the wedge-shaped member both of the said parts are partitioned off from each other. But the partition separating the spaces of the two parts from each other is made of a material comparatively easy to smash which is shattered so as to establish communication between the two said spaces at the moment in which the fixation of the drill-deflecting member is to take place. The fixing material then flows into the lower pervious cylindrical part of the deflecting member and through its penetrable walls into the space between the member and the sides of the bore-hole, rising in this space in a manner corresponding to that observed in communicating tubes. For the shattering of the said frangible partition a bolt adapted to move in the direction of its length may be arranged in the lower cylindrical part of the wedge-shaped member in such manner as to be shifted when the member strikes the bottom of the bore-hole and to deal a sharp blow against the partition so as to smash it and bring about the above described result.

If, on the other hand, the deflecting member is to be fixed in a soft deposit which will not bind with cement, as for instance clay, the invention contemplates a deflecting member of a special form. In this specially shaped deflecting member an elongation extending from the member in the shape of a blade is provided that is caused to sink, or is generally driven, into the bed or bottom of the bore-hole and which prevents the deflecting member from being turned out of its proper position. Thus this blade anchors the wedge-shaped deflecting member to the bottom of the bore-hole. The blade may consist of a member in the shape of a flat sword with a cross-shaped cross-section attached to the lower end of the cylindrical portion of the drill-deflecting wedge.

Another case to be considered is that of holes that have been lined with piping and which, on account of excessive deviation from the proper direction at a certain point of their depth, have been abandoned. The invention contemplates corrective means for enabling such holes to be utilized so as to effect a corresponding saving. In such

cases the means mentioned at the beginning of this specification is developed in a special manner, the freezing tube being severed at the point at which the direction of the hole is to be changed and a plug forming an extension of the deflecting member being driven into the end of the portion of the pipe that has been left in the bore-hole, the deflecting member being thus firmly fixed to prevent any movement in any direction so that the boring operations may then be recommenced.

To enable the deflecting means to be employed in the intended manner provision has to be made for lowering this means down the hole with the greatest possible speed. If such provision is omitted a premature hardening of the fluid fixing material or a closing up of the unlined bore-hole might occur. But in addition to enabling the deflecting means to be lowered with the greatest possible speed the degree of accuracy obtained in deflecting the drill should be as high as possible in order to make the drill operate in the direction actually required.

A means for accomplishing this result forms another feature of this invention and this comprises devices for letting the deflecting means down the bore-hole in several stages, an additional section (or sections) of bore-rods being inserted in the line of bore-rods at each stage. During this operation the proper adjustment as to direction is obtained with the aid of the two adjacent bore-holes or at least one of them. To enable the work of letting down the deflecting means to be carried out in stages this means is held up at the end of each stage by a support at the head of the pipe in the bore-hole. An advantageous form of this support is that of a pair of tongs.

The deflecting means is turned into the proper direction and held in its correct position with the aid of a rope that is stretched from one of the adjacent holes to the top of the head-frame over the hole. This rope serves as a directing member against which guide arms slide that are fixed to the bore-rods by which the deflecting means is suspended. The sections of bore-rod inserted at the various stages are held in the first place by the said tong-like support and besides, to prevent swinging of the bore-rod line further up, by a clamping device that is clamped to a bore-rod and fixed to the head-frame. The bore-rods are furthermore brought into a perfectly vertical line with the central axis of their bore-hole by causing the plumb bob of a plummet line to settle over the center of the adjacent bore-hole.

The invention contemplates a connection between bore-rod and the deflecting member by means of a special coupling appliance inserted between the rod and the said means,

the coupling appliance being attached to the deflecting member by a link adapted to automatically disconnect the deflecting member when it lands upon the bottom of the hole.

The new means for correcting the individual holes preparatory to sinking a shaft will be better understood by reference to the accompanying drawing in which

Fig. 1 illustrates an elevation of an entire contrivance for letting the correcting means or drill deflecting means down into the bore-holes,

Fig. 2 is a plan view of a tong-shaped bore-rod supporting device,

Fig. 3 is a sectional view of the connection between the bore-hole and the drill-deflecting member on an enlarged scale,

Fig. 4 illustrates the manner in which the new drill-deflecting member is dropped down into the hole, how it is severed from the rod by the shearing of the connecting bolt, and how the subsequently lowered drill is deflected.

Fig. 5 is a vertical sectional elevation of a bore-hole with a correcting or drill-deflecting means therein,

Fig. 6 represents a vertical sectional elevation of the lower part of a modified drill deflecting means,

Fig. 7 shews the same means as viewed from the left of Fig. 6,

Fig. 8 is a top view of Fig. 6, and

Fig. 9 represents a vertical sectional elevation of another modified deflecting means.

Similar signs of reference denote similar parts in the various figures.

1 denotes the hole correcting or drill deflecting means which is more fully described below and which is to be let down into the bore-hole 3 containing a pipe 2. Attached to the wedge-shaped correcting member or deflecting device 1 by means of a bolt 4 (Fig. 3) is a connecting member or shoe 5, to which in turn the bore-rod 7 may be connected by the usual joining sleeve 6. Fixed to the lining pipe 8 of an adjacent bore-hole is a clamp 9 and tautly and vertically stretched between this clamp and the top beam of the head-frame 10 is a rope 11. The lining pipe 12 of the other adjacent bore-hole is closed by a cap 13 having a central pointed cone 14 above which the plummet line 15 perpendicularly extends so as to form the standard of verticality for the operation of letting down the bore-rod or rods.

The rope 11 serves as a guide for arms 16 three of which are shown one above the other, the middle one being turned through an angle of 90° so as to exhibit its plan view. The arms 16 are fixed to connecting sleeves 6 between the bore-rod sections for the purpose of guiding the bore-rod with the aid of the rope 11.

A means is also provided for holding the

bore-rod in position relative to the head-frame above the bore-hole this means consisting of an unfoldable clasp 17 fixed to the head-frame. The top end of the pipe 2 serves as a resting surface for a tong-shaped device 18, a plan view of which is shewn in Fig. 2. The one jaw 19 of the tongs is formed in the shape of a plate adapted to rest upon the top end of the pipe 2 and having a slot 20 for the reception of the bore-rod. The other jaw 21 of the tongs is bent so as to embrace the bore-rod 7 when the tongs are closed and to guide the bore-rod so that, on being let down, its thicker portion bears upon the tongs. To center the tongs with respect to the pipe 2 lateral abutments (not shewn) may be provided at the bottom surface of the plate-shaped jaw 19.

The hole correcting or drill deflecting device 1 (Fig. 5) has in general the shape of a wedge with its thin edge pointing upwards so as to present a slanting surface which deflects the drill that is subsequently lowered into the bore-hole towards the desired direction. The upper hollow wedge-shaped part is completely closed except at the opening 22 through which a suitable fluid fixing material may be inserted and screwed at its lower end to its other cylindrical part 23 whose walls are adapted to let the contents of the device escape through perforations 24. The internal spaces of both parts are separated from each other by a glass plate 25 which is clamped in between two packing rings 26 and two special abutment rings 27 the lower one of which is held up by a circular ledge 28 within the cylindrical part 23. Pressure is applied to the upper abutment ring 27 by the lower end of the upper part 1 of the deflecting member, this lower end having a male thread that is screwed into a female thread in the lower part 23.

Two plates 29 and 30 are horizontally disposed within the perforated lower part 23 and a bolt 31, whose lower end 32 projects beyond the bottom end of the cylinder part 23 and which tapers to a point 33 at the top, is arranged to be shifted in the direction of its length in holes in the said plates 29 and 30. As long as the bolt 31 is in its ordinary position its collar 34 rests upon the upper plate 29.

The method of using the above described equipment is as follows: First the pipes of the holes adjacent to the bore-hole to be corrected are furnished with the plummet line 15 and the guide rope 11 respectively. Then the interconnecting shoe 5 being protected by a shield 47 at the top of the wedge-shaped member is screwed by a sleeve 6 to a section of bore-rod 7 and by a bolt 4 to the wedge-shaped part 1 of the deflecting device. The deflecting device with the attached section

of bore-rod is thereupon lowered into the bore-hole with the aid of a windlass 35, the lowering operation being continued until the upper collar of the first bore-rod section is held up by the tong-shaped support 18. The tongs 18 are then closed so as to hold the deflecting device with the section of bore-rod attached to it suspended and in a central position in the pipe. A second section of bore-rod is then inserted and now the entire bore-rod is raised somewhat and subsequently turned so as to bring the inclined deflecting surface of the deflecting device into the correct direction; and to prevent it from turning out of this direction when it is subsequently lowered, guide arms 16 are fixed to the bore-rod sleeves, these guide arms having fork-shaped parts whose prongs are adapted to slide against the guide rope 11 so as to prevent rotation of the line of bore-rods and the deflecting device suspended thereby.

The upper compartment of the deflecting device 1 is then filled with a fluid fixing material, such as a mixture of cement and sand, which is poured through the opening 22, and now the deflecting device with the attached sections of bore-rod is lowered sufficiently to cause the tong-shaped support 18 to hold the bore-rod line suspended by the top collar of the upper section of bore-rod. To enable this second lowering stage to be carried out the lower guide arm 16 must first be loosened, the deflecting member being then kept in the proper direction by the upper guide arm 16. The bore-rod line is now held up with the aid of the tongs by the bore-rod collar beneath the latter guide arm and another double section of bore-rod is interposed and its upper end fixed in its position relative to the head-frame by means of the holding device or clasp 17 so as to prevent it from swerving out of the perpendicular. Another arm 16 is thereupon fixed to the upper end of the newly inserted bore-rod section and its correct radial position is obtained by turning it so that it and the other arm 16 that has already been lowered near to the top of the bore-hole both swing with their guiding prongs practically clear of the guide rope 11.

Additional sections of bore-rod are now inserted piece by piece in the bore-line in the manner already described until the deflecting device is a short distance from the bottom of the bore-hole, as indicated at the left of Fig. 4.

On striking against the bottom 36 of the bore-hole the bolt 31 is shifted lengthwise and shatters the glass sheet 25, thus opening a passage for the fluid fixing material into the cylindrical part 23 from which this material issues by way of the perforations 24 into the space between the cylindrical

part and the walls 3 of the bore-hole. In order that the fluid fixing material may be positively caused to flow out, the hollow deflecting device with the attached bore-rod is lifted again and permitted to drop suddenly from a certain height. This results in the connecting bolt 4 being cut through by a shearing effect (see middle of Fig. 4) so that the bore-rod is separated from the wedge and cylinder shaped deflecting device. The severed piece of the connecting bolt, and the nuts belonging thereto are caught up by a cap 37 (Fig. 3) attached to the shoe and thus carried up when the bore-rod is raised, as shown in the middle hole represented in Fig. 4.

To prevent the deflection of the subsequently lowered drill from being deleteriously affected by yielding of the upper part of the wedge-shaped deflecting device a lining 38 is provided as shown for example in Fig. 3, this lining, which may be of wood, extending from the top end of the wedge-shaped part to a position beneath the bolt 4 and acting to stiffen the said part.

For cases where the deposits are of a kind that will not bind with cement the invention contemplates a deflecting device as shown in Figs. 6 to 8.

Attached to the lower or cylindrical end of the deflecting device 1 is a blade 39 that consists of a flat piece 40 which tapers towards the bottom and has iron bars of T-shaped cross-section riveted to it. At its upper end the edges of the flat blade are bent so as to form wings 42 by which the blade is fixed to the pipe 1. The projecting ribs of the T-irons are pointed like the blade at the bottom in order that the blade may sink readily into the sole of the bore-hole.

The deflecting device 1 is firmly fixed at the point in the bore-hole where the direction of the latter is to be corrected by making it heavy with cement or some other kind of ballast and thus causing its blade to plunge into the ground.

To increase the fixing effect of the blade its longitudinal axis is inclined with respect to the longitudinal axis of the cylindrical part of the deflecting member so as to cause the cylinder to be firmly pressed against one side of the wall of the bore-hole when the blade plunges into the ground.

Fig. 9 illustrates a means for fixing the deflecting member in cases where it is to be applied in bore-holes that have already been lined with piping.

43 represents the end of the cylindrical portion of the wedge-and-cylinder deflecting member that is assumed to be filled as usual with some suitable ballast as cement. Attached to this cylindrical portion, as by screws 44, is a wooden plug 45 that tapers towards the bottom. By causing the deflecting member to drop with considerable

force onto the piece of pipe 46 that has been left in the hole (the upper part having been cut off and drawn up) the plug 45 is driven into the pipe 46 and thus effects a firm connection between the said member and the pipe, this connection subsequently becoming still firmer by the swelling of the wooden plug.

I claim:

1. The combination with a bore-rod of a hole-correcting device comprising a hollow member with a slanting surface adapted to deflect a drill, a hollow body attached to the said member, a partition separating the hollow spaces in the said member and in the said body from each other, fixing material in the hollow member for immovably fixing the hole-correcting-device in a bore-hole at a point where the direction of the hole is to be corrected, the walls of the cylindrical body being pervious to the said fixing material, and means for opening a passage for the fixing material through the said partition and the said pervious walls into the bore-hole.

2. The combination with a bore-rod of a hole-correcting-device comprising a hollow member with a slanting surface adapted to deflect a drill, a hollow body attached to the said member, a destructible partition separating the hollow spaces in the said member and in the said body from each other, fixing material in the hollow member for immovably fixing the hole-correcting-device in a bore-hole at a point where the direction of the hole is to be corrected, the walls of the cylindrical body being pervious to the said fixing material, and means adapted to destroy the said destructible partition when the correcting-device reaches the said point of correction whereby a passage for the fixing material through the said partition and the said pervious walls into the bore-hole is opened.

3. The combination with a bore-rod of a hole-correcting-device comprising a hollow member with a slanting surface adapted to deflect a drill, a hollow body attached to the said member, a destructible partition of glass separating the hollow spaces in the said member and in the said body from each other, fixing material in the hollow member for immovably fixing the hole-correcting-device in a bore-hole at a point where the direction of the hole is to be corrected, the walls of the cylindrical body being pervious to the said fixing material, and a bolt arranged beneath the said glass partition so as to be displaced lengthwise and break the destructible partition when the correcting-device lands on the bottom of the bore-hole, whereby the bolt opens a passage for the fixing material through the said partition and the said pervious walls into the bore-hole.

4. The combination with a bore-rod of a hole-correcting-device comprising a member

with a slanting surface adapted to deflect a drill, and separate fixing means associated with the said member and adapted to immovably fix the said member in a bore-hole at a point where the direction of the hole is to be corrected; and a connecting device inserted between the hole-correcting-device and said bore-rod and comprising a coupling member attached to the bore-rod and an automatically detachable fastening contrivance connecting the coupling member to the hole-correcting-device.

5. The combination with a bore-rod of a hole-correcting-device comprising a member with a slanting surface adapted to deflect a drill, and separate fixing means associated with the said member and adapted to immovably fix the said member in a bore-hole at a point where the direction of the hole is to be corrected; and a connecting device inserted between the hole-correcting device and said bore-rod and comprising a coupling member attached to the bore-rod and a bolt connecting the coupling member to the hole-correcting-device, said bolt being adapted to be severed by the impact of the bore-rod when the hole-correcting-device, whilst being lowered by a hoist, suddenly lands upon a bed in the bore-hole.

6. The combination with a bore-rod of a hole-correcting-device comprising a hollow member with a slanting surface adapted to deflect a drill, a hollow body attached to the said member, a partition separating the hollow spaces in the said member and in the said body from each other, fixing material in the hollow member for immovably fixing the hole-correcting-device in a bore-hole at a point where the direction of the hole is to be corrected, the walls of the cylindrical body being pervious to the said fixing material, and means for opening a passage for the fixing material through the said partition and the said pervious walls into the bore-hole, and a connecting device inserted between the hole-correcting-device and said bore-rod and comprising a coupling member attached to the bore-rod and an automatically detachable fastening contrivance connecting the coupling member to the hole-correcting device.

In testimony whereof I affix my signature.

EMIL ALBRECHT.