

The invention relates to a drill tube corresponding to the preamble of claim 1.

Drill tubes, which, once the bore has been produced, become expendable tools and are used at the same time as a type of rock anchor, are known in many forms. They must be suitable not only to produce a bore but also for the problem-free, in particular central, guiding of the drill tube and for introducing a mortar suspension or a comparable medium which can harden. The production of the bore is accompanied by the guiding of a suitable flushing medium adapted to the nature of the surrounding rock or ground, which flushing medium must be carried away during the boring process in the direction towards the mouth of the drill hole. By means of the central guiding of a tube, it should be ensured that the drill tube, when surrounded by the mortar suspension, is covered in the most extensive and uniform manner possible, in order that the drill tube is reliably protected from corrosive influences. A mortar suspension is customarily introduced by way of the drill tube situated in the drill hole, wherein the mortar flows out preferably in the region of the drill bit and flowing in the reverse direction, ie., in the direction towards the mouth of the drill hole, fills the drill hole.

DE-GM 90 04 176 discloses an injection drill anchor which is formed as a smooth rod, at one end of which a drill bit is situated and at the other end of which - while interpositioning a sleeve - a termination portion is disposed which comprises, amongst other things, a drill hole closure

formed as expanded packing. The termination portion ends at the drill hole mouth end in a spring-loaded non-return valve which renders it possible for a medium, which can harden, to flow into the drill anchor, but on the other hand prevents a back flow. The said rod carries a conveyor helix of which the cross-section is larger than the expanded packing in the non-expanded state. This drill anchor, as a disrupting disk inside the sleeve shows, is designed for rotational drilling without the use of a flushing medium, so that the conveyor helix is dimensioned amongst other things with respect to its gradient corresponding to its function as a conveyor means, wherein a further effect of this helix is seen in the improvement of anchoring the drill anchor in the drill hole.

GB-A-790 483 discloses an injection drill anchor which consists of a tubular main body provided with a longitudinal duct, which main body comprises a drill bit at the drill hole base end, and wherein radial bores branch off from the longitudinal duct - equally distributed over the length of the main body. On the outside, the main body carries a helix which can be produced by means of welding on a wire but also by means of a forging process and which changes at the drill hole mouth end into a threaded portion, off-set with respect to the diameter, which, in connection with an anchor plate and a tensioning nut, serves the purpose of axially tensioning the injection drill anchor anchored in by mortar or another medium inside the drill hole. The purpose of the said helix consists of profiling the main body in the surface region in order to prepare an improved anchoring in a mortar

filling the drill hole after placing this anchor.

It is the object of the invention to produce a drill tube of the generic type referred to in the introduction to the effect that, in a convenient manner, in particular in cohesive ground, the drill tube is centrally guided and the drilling process as such can be controlled in a problem-free manner. This object is achieved in a generic type drill tube by means of the features of the characterising part of claim 1.

It follows from this that the invention resides in a main body, which forms the drill tube, provided on the outside with a comparatively steep-spiral helix, wherein the outer radius of the helix can correspond to the radius of the drill hole. This helix fulfils multiple functions. By reason of its steep-spiral nature, it ensures a comparatively short flow path for a flushing medium which is laden with soil particles, as a rule in cohesive ground it ensures a supply of air and at the same times supports this conveyor process. Furthermore, the wall of the drill hole is held stable or smoothed out over the whole length during the drilling process. Since the helix extends over the entire length of the drill tube, the drill tube is furthermore subjected, over its entire length, to a reliable support at the walls of the drill hole and thus to a central guiding. The latter ensures in the case of the use of the drill tube as a type of injection tube or injection drill anchor when mortar or other hardening medium is introduced into the drill hole, a uniform

covering on all sides of the drill tube and thus a reliable protection against corrosion. For reasons of this corrosion protection the radial width of this helix should amount to at least 10 mm, preferably at least 15 mm. It is fundamental that the surfaces of the helix - seen in a cross-sectional view of the main body - are continuously tangentially joined at the profile of the main body so that the surfaces of the main body and the helix, serving to guide the flow, are as free as possible from nonuniformities. This ensures a problem-free carrying away of the flushing medium laden with released soil particles and serves the purpose of a reliable anchoring into the mortar suspension to be guided into the drill hole. The drill tube in accordance with the invention is further characterised in that the radial outer dimensions of the helix can be slightly larger than those of the drill head, in particular the drill bit.

The main body forming the drill tube can be formed as one piece with the helix, corresponding to the features of claim 2 and consist of a cold-formed steel. The main body can therefore be, in the simplest case, a drill tube formed smooth in the surface region and provided with a steep-spiral helix, wherein in addition to the above-mentioned functions the helix also acquires the function of an anchoring means inside the mortar.

The features of claims 3 and 4 are concerned with different embodiments of the helix. This can also be formed as a separate component part which in a suitable manner is

connected to the main body, for example, by welding. The helix can thereby be formed as a hollow body, but also with a solid cross-section and in the former case is open at the front face end. This means that the inner space of the helix is also available for conveyor processes and moreover is filled during the introduction of the mortar.

The features of claim 5 are in particular concerned with the form of the helix. This is accordingly formed as a profile tapering, in respect of its cross section, in a radially outwards direction, therefore in the simplest case it is formed as a triangular profile of which both helix surfaces - seen in a cross-section of the main body - are joined tangentially thereto.

The features of claims 6 and 7 are concerned with a further advantageous embodiment of the main body. This is accordingly formed as a tubular body provided on the inside and outside with a thread-type deformation, wherein this thread is preferably also a thread which can be used to provide a screw connection.

As a result of this, during the anchoring of the main body, an effect naturally also arises which improves the form closure with the mortar. Since the thread extends over the entire length of the main body, this latter can - without incidentally impairing the effects of the thread-type profile - also be cut down in any way whatsoever according to requirements.

The features of claim 8 are concerned with a particular embodiment of a coupling piece which serves to screw two drill tubes or main bodies. It is fundamental that in the screwed state the two drill tubes comprise on the outside, in particular also in the connecting region, continuously similar radial dimensions, so that in the connecting region no structures applied to the outside are provided, such as in the case of a sleeve used to screw in drill tube ends. A precondition for this effect is that the said second tube cylinder in its radial dimensions corresponds to the main body. The latter tube cylinder can, if need be, also be secured in its central position by spot welding.

By means of the features of claim 9 it is achieved that in the screwed state of two main bodies by using a coupling piece in accordance with the invention, the flow leaving the helix, open at the front face end, of one of the drill tubes can enter as directly as possible into the similarly open helix of the attached main body. This is achieved in accordance with the invention in that the screwing of the coupling piece to the main bodies, for example, by the screwing length, is arranged to the effect that both the helixes in the final screwed state, in which the main bodies lie with the front face end at the said second tube cylinder, lie precisely opposite to each other.

The features of claim 10 are concerned with a variation of the coupling piece in so far as the said second tube cylinder

is for its part likewise provided with a helix which structurally corresponds to the helixes of the main body and in the assembled state is continuously attached to the latter. This means that the helix, in accordance with the invention, is equipped with a continuously extending helix, from the mouth of the drill hole to the base of the drill hole - extending away over the connecting region of each of two main bodies.

The drill tube in accordance with the invention can be provided, corresponding to the features of claims 11 and 12, with a releasable drill head which can be screwed to the drill tube. It is fundamental that the drill head is provided with a special support cylinder which extends over the length of the said coupling body and defines an annular space which is connected to the central longitudinal bore of the drill head by radially extending bores. This means that during drilling the flushing medium on the one side leaves the flushing bore of the drill bit but at the same time leaves by means of the said radial bores of the coupling body and the annular space, flows backwards and at the end of the coupling body develops a suction effect which in a supporting manner affects the carrying away of the materials released as a result of the progress of the drill. At the same time a stabilising and forming effect is exerted on the surrounding drill hole walls by means of the support cylinder. The support cylinder comprises an outer diameter which at most corresponds to the outer diameter of the drill bit, preferably, however, is formed slightly smaller.

The support cylinder is preferably non-releasably connected to the drill bit and can therefore be welded thereto and is preferably formed with smooth walls corresponding to the features of claim 13. In addition to this its position is stabilised by means of cross pieces which are fixedly connected to the coupling body.

The coupling body is formed, corresponding to the features of claim 14, to the effect that the threaded portion protruding therefrom is intended to be screwed into the main body of a drill tube.

The features of claim 15 are advantageous in so far as they have a use within the scope of the coupling body merely as such function elements which are also already used within the scope of the coupling part and of the main body. In essence it concerns two tube cylinders of differing lengths which can be screwed into each other, of which the inner, longer one forms the threaded portion which is intended to be screwed into the facing end of a drill tube. Both tube cylinders, screwed into each other, are welded at one end to the drill bit.

The radial dimensions of the helix preferably correspond to those of the support cylinder.

The invention will be explained in more detail hereinunder with reference to the embodiment illustrated in the drawings;

in which

Fig 1 illustrates the drill bit of an injection drill anchor in accordance with the invention;

Fig 2 illustrates a part of the drill rod or anchor rod of the injection drill anchor;

Fig 3 illustrates a view of the anchor rod corresponding to the plane III-III of Fig 2;

Fig 4 illustrates a view of a coupling piece which can be used to lengthen the anchor rod in accordance with Fig 2.

A drill head in its entirety is designated by 1 in Fig 1. This is provided with an axially short, plate-like drill bit 2, which shows at least one bore 4, the axis of which cuts the longitudinal axis 3 of the drill head or which is at least disposed off-centre. The bore 4 fulfils the function of a flushing bore. The drill bit 2 is incidentally provided in a manner known per se with cutting edges 5, extending on the outside or drill hole base end, or with similar means.

A tube cylinder is designated by 6 and in its radial dimensions as in its wall thickness corresponds to the drill rods to be described hereinunder and in which is installed a further tube cylinder 7. Both tube cylinders 6, 7 consist of cold-rolled steel and are provided with an inner and outer thread and moreover in such a way that the smaller diameter

tube cylinder 7 is screwed into the tube cylinder 6. The tube cylinder 7 incidentally protrudes by an amount 8 out of the tube cylinder 6 and serves, in a manner yet to be described, to couple a drill rod.

The system of tube cylinders 6, 7, which are screwed into each other, is welded to the drill bit 2 in an arrangement coaxial to the longitudinal axis 3.

A hollow space designated by 9, is rotationally symmetrical to the longitudinal axis 3, connects directly to the longitudinal bore 10 of the tube cylinder 7 and widens conically in the direction towards the drill bit 2.

The hollow space 9 is incidentally characterised by a series of radially extending bores 11 which penetrate the walls of the tube cylinders 6, 7 which are screwed into each other, the significance of which bores will be explained in more detail hereinunder.

The drill bit 2 protrudes radially beyond the system of the tube cylinders 6, 7, and 12 designates a smooth-walled metal cylinder which is likewise welded to the drill bit 2 and the radial dimension 13 of which cylinder corresponds substantially to that of the drill bit 2. The cylinder 12 incidentally extends in an axial direction over a length corresponding to the outer tube cylinder 6 and is connected thereto by means of cross pieces 14 which are provided at the end region of the tube cylinder 6 remote from the drill bit

2. Therefore, between the outer side of the tube cylinder 6 and the inner side of the cylinder 12, an annular space 15 remains and bores 11, mentioned earlier, issue into this annular space 15. The cylinder 12 forms a support cylinder which will be explained in more detail hereinunder.

A flushing medium flowing in the direction of the arrow 16 or even a mortar suspension flows on the one side by way of the bore 4 in the direction of the arrow 17 but, at the same time, by way of the bores 11 and the annular space 15 in the direction of the arrow 18.

The drill rod 19 shown in Figs 2 and 3, is formed as a tubular main body provided with continuous inner and outer thread, which main body again consists of cold-rolled steel. It corresponds, in its radial dimensions as in its wall thickness, to the dimensions of the tube cylinder 6. The inner thread (not shown in Figs 2 and 3) of the drill rod 19 is intended to be screwed onto the portion of the tube cylinder 7 protruding out of the tube cylinder 6, so that, in the assembled state of the drill rod, the front face end of the tube cylinder 6 lies directly at the facing end of the drill rod 19.

A helix is designated by 20 and is formed by a hollow profile which is almost triangular in its cross-section.

The profile is characterised by two, substantially identical limbs 21 which extend symmetrically with respect to the axial

plane 22 and substantially tangentially to the cross-sectional profile of the drill rod and are welded to the drill rod.

The helix comprises a comparatively large gradient of 1 m to 3 m, and is formed smooth on the outside. The helix 20 extends uniformly over the entire length of the drill rod and the front face ends of the helix 20 are formed open and are available for a through-flow process. The helix 20 can consist practically of a bevelled metal sheet formed from the same material as the drill rod 19.

It is fundamental that the radius 23 of the helix 20 corresponds approximately to the radius of the drill bit 2 and thus to the radius of a drill hole. If necessary the diameter of the helix can also be larger than that of the drill head and in fact measure up to a value of at most 1.05 times the diameter of the drill bit. The outer radius of the drill rod 19 can, for example, amount to 15 mm to 20 mm.

The purpose of the helix 20 will be explained in more detail hereinunder.

A coupling piece in its entirety is designated by 24 in Fig 4 and is formed symmetrically with respect to a radial plane 25. The coupling piece consists substantially of a first tube cylinder 26 which, with respect to its radial dimensions including its inner and outer threads, corresponds to the tube cylinder 7 of the drill head 1, and of a second tube cylinder 27 which, with respect to its inner and outer thread

and the wall thickness, corresponds to the tube cylinder 6. The tube cylinder 27 is screwed onto the tube cylinder 26 and is fixed in a central position for example by means of spot welding. The ends of the inner tube cylinder 26 therefore protrude symmetrically on both sides out of the tube cylinder 27.

In order to assemble a lengthening drill rod of the type shown in Fig 2 the coupling piece 24 is first screwed into the end of one of the drill rods, wherein the lengthening drill rod is subsequently screwed onto the remaining tube cylinder portion 26. In the assembled state, ie after screwing the drill head 1 to a drill rod, a coupling piece and a lengthening drill rod, the drill rod therefore comprises over its entire length radially constant dimensions and, in particular in the connecting region of two drill rods, no outwardly protruding sleeve-type structures are provided. The drill rods are provided with a continuous thread uniformly over their entire length, and again over the entire length a through-going bore is available which is narrowed merely in the connecting region by the tube cylinder 26, which bore serves to guide a flushing medium or a mortar suspension.

A coupling piece of the type shown in Fig 4 can serve not only to connect a lengthening drill rod but also to connect an adapter part for introducing a flushing medium or a mortar suspension and a drill drive.

In order to position an injection drill anchor equipped as described above, which is preferably designed for cohesive ground, this is first used in a manner known per se as a drill rod, wherein air flows as a flushing medium by way of the central longitudinal bore 10. During the advance of the drill, the flushing medium exits axially, on the one side by way of the bore 4, thereby receiving the soil particles released by the drill bit 2 in order to flow back subsequently about the drill bit 2 and on the outer side of the cylinder 12.

However, a part of the flushing air flows out by way of the bores 11 into the annular space 15 and after leaving this annular space develops a suction effect at the position 26 which supports the further conveyance in the direction towards the mouth of the drill hole. At the same time a stabilising effect is exerted on the drill hole wall by the cylinder 12 which on the outside substantially corresponds to the dimensions of the drill hole wall.

The helix 20 extends almost directly to the end, facing the helix, of the cylinder 12 and during the progress of the drill develops a conveying effect on the materials, between the inner side of the drill hole wall and the outer side of the drill rod 19, flowing towards the mouth of the drill hole. At the same time the drill hole walls are smoothed and evened off by the helixes and a further effect of the helixes consists of a precise central guiding of the drill rods inside the drill hole.

The cross-section of the helixes 20 also plays a part in the conveyance of released ground material. In the region of a coupling piece 24 it is assured, by means of a corresponding longitudinal dimension of the portion of the tube cylinder 26 protruding out of the tube cylinder 27, that the cross-sectionally open front face ends of the helix 20 of two drill rods, which are positioned against each other, lie precisely opposite. If need be, the tube cylinder 27 can also be equipped with a corresponding helix element so that, by reason of the longitudinal dimension of the said portions, a continuous extension of the helix 20 occurs over the entire length, made up of a plurality of drill rods, of the injection drill anchor.

Once the bore has been produced, the longitudinal bore 10 is used in a manner known per se to introduce a mortar suspension which continuously fills the drill hole - commencing in the region of the base of the drill hole and continuing in the direction towards the mouth of the drill hole. By reason of the central guiding by the helix, the drill rods, in the filled state, are therefore provided on the outside with a uniform covering of mortar over the entire length of the drill hole, which covering by reason of the hollow helix cross-section also protrudes inside the same. This means that, over the entire length of the injection drill anchor, a uniform and reliably effective protection against corrosion exists. It has been pointed out that the radius 23 of the helix 20 is correspondingly dimensioned to

the effect that, when the injection drill rod is centrally guided, a minimum covering with mortar or a comparable medium, eg artificial resin, is applied on all sides in a layer thickness of at least 10 mm or 15 mm.

The use of an anchor rod in accordance with the invention was explained above within the scope of an injection drill anchor consisting of a drill head 1 and diverse drill rods which are interconnected by means of coupling pieces. However, application possibilities are not limited to this. For example, the possibility also exists of inserting injection valves which can be screwed in, between two respective drill rods. The characteristics thereof are tube cylinders of the type shown in Fig 4 with the reference number 27 which, at a distance from each other, are screwed on a tube cylinder 26 of a smaller diameter and between which extends a valve part consisting of an elastic enveloping body, wherein in a similar manner as in the coupling part 24, end portions of the inner tube cylinder 26 protrude over the outer tube cylinder 27 and are intended and formed for screwing into respectively facing drill rod ends. By the use of such an injection valve between two drill rod ends the radial dimensions thereof are therefore not generally altered overall.



C L A I M S

1. Drill tube consisting of at least one tubular main body through which a through-going longitudinal duct extends, having a drill bit (2), wherein on the outside of the main body a helix (20) is disposed which extends over the entire length of the main body, characterised in that

- the gradient of the helix (20) amounts to 1m to 3m when the main body has an outer radius of 15mm to 20mm,
- the outer diameter of the helix (20) corresponds at most to 1.05 times the outer diameter of the drill bit (2),
- the helix (20) - starting from the outside of the main body
- comprises a radial width of at least 10 mm and
- the helix (20) - seen in a cross-sectional view of the main body - is tangentially attached to the profile of the main body.

2. Drill tube according to claim 1, characterised in that the main body together with the helix (20) is formed from one piece and consists of a cold formed steel.

3. Drill tube according to claim 1 or 2, characterised in that the helix (20) - seen in a cross-sectional view of the main body - forms a hollow profile of which the front faces are open.

4. Drill tube according to claim 1 or 2, characterised in that the helix (20) - seen in a cross-sectional view of the main body - forms a solid profile.



5. Drill tube according to one of the preceding claims 1 to 4, characterised in that the cross-sectional view of the helix (20) tapers in a radially outward direction.

6. Drill tube according to one of the preceding claims 1 to 5, characterised in that the main body is provided on the outside with a continuous profile which is preferably formed as a screw thread.

7. Drill tube according to claim 6, characterised in that the main body is provided at the same time over its entire length with a continuous inner screw thread.

8. Drill tube according to claim 7, characterised in that a coupling piece (24), serving to connect two main bodies, consists of a first tube cylinder (26) intended to be screwed in two main bodies which are to be connected, onto which first tube cylinder a second tube cylinder (27) is disposed, preferably in a central position, in such a way that the first tube cylinder (26) protrudes on both sides out of the second tube cylinder (27), and that the second tube cylinder (27) is provided, in the same way as the main body, at least with an outer screw thread.

9. Drill tube according to claim 8, characterised in that the portions of the first tube cylinder (26) protruding out of the second tube cylinder (27) are dimensioned in such a way that when two main bodies are in the joined state the



facing ends of the respective helix extend in alignment to each other.

10. Drill tube according to claim 8 or 9, characterised in that the second tube cylinder (27) is provided with a helix (20), which is structurally adapted to the helix (20) of the main body and that in the joined state the helixes attached to each other of one main body, of the said tube cylinder (27) and of the connecting main body comprise a substantially continuous extension.

11. Drill tube according to one of the preceding claims 1 to 10, characterised by a drill head (1) which is releasably connected to the main body.

12. Drill tube according to claim 11, characterised in that
- the drill head (1) comprises an axially short, plate-like drill bit (2) provided with at least one through-going flushing bore connected to the longitudinal duct of the drill tube,

- a coupling body, concentric to the longitudinal axis (3), is disposed at the drill bit (2), which coupling body comprises, at its end remote from the drill bit (2), a screw threaded portion serving to form a screw connection with the main body,

- the coupling body is provided with a through-going bore forming the continuation of the longitudinal duct of the main body,

- the drill bit (2) comprises a larger diameter than the



coupling body,

- a support cylinder is attached at the drill bit (2) - surrounding the coupling body leaving an annular space (15) - which support cylinder is open at the front face at the side remote from the drill bit (2),
- the bore of the coupling body is connected by means of radial through-going bores (11) to the annular space (15) and
- the support cylinder comprises an outer diameter which at the most corresponds to that of the drill bit (2).

13. Drill tube according to claim 12, characterised in that the support cylinder is formed with smooth walls, consists of metal and is preferably in addition connected to the coupling body by means of cross pieces (14) bridging the annular space (15).

14. Drill tube according to claim 12 or 13, characterised in that the portion of screw thread of the coupling body is intended and arranged to be screwed into the main body.

15. Drill tube according to claim 14, characterised in that

- the coupling body consists of two tube cylinders (6, 7) screwed into each other of which the inner (7) protrudes out of the outer (6) and forms the screw threaded portion intended to be screwed into the main body,
- the inner tube cylinder (7) corresponds in its radial dimensions to the first tube cylinder (26) of the coupling piece (24) and the outer tube cylinder (6) corresponds in its radial dimensions to the second tube cylinder (27) of the



coupling piece (24),

- the outer tube cylinder (6) and the second tube cylinder (27) correspond in their radial dimensions to the main body and
- the axial extension of the support cylinder corresponds substantially to that of the outer tube cylinder (27).

16. Drill tube according to one of the preceding claims 12 to 15, characterised in that the radially extending bores (11) issuing into the annular space (15) are provided in a region of the coupling body next to the drill bit (2).