The present invention relates to a core bit (1) for a core drill in which a tube (20) is detachable relative to a coupling (10), and has a structure which allows core remaining in a tube to be removed out of an opening of the tube at a side thereof where no segment is present. The core bit further has a firm structure for fitting the tube (20) onto the coupling (10). The coupling (10) of the core bit (1) to be fitted to the core drill has an insertion part (11b), onto which the tube (20) is to be detachably fitted. On the outer side of the coupling (10), there is mounted a coupling cover (30), which covers the insertion part (11b) of the coupling (10). The provided on respective separate positions are: an anti-rotation structure for preventing the tube (20) fitted onto the insertion part (11b) from rotating relative to the insertion part (11b); and a fixing structure for preventing the tube (20) from dropping off the insertion part (11b).
FIG. 1

(a) View showing an observation from an arrow A

(b) View showing an observation from an arrow A

(c) View showing an observation from an arrow B
(a) Cross sectional view showing a D section

(b) Cross sectional view showing an E section
FIG. 5

(a)

(b) H-O-I face
Fig. 6

(a) 
(b) J-O-K face 

(c)
**FIG. 9**

(a) Detachable state of a tube

(b) M-M face

(c) N-N face

(b) M-M face

(c) N-N face

(d) M-M face

(e) N-N face

Detachable state of a tube

Fixed state of a tube
FIG. 14

PRIOR ART
CORE BIT FOR USE WITH A CORE DRILL

TECHNICAL FIELD

[0001] The present invention relates to a core bit to be used with a core drill, which perforates objects to be machined such as a concrete construction, stone, bedrock, steel construction, and the like.

BACKGROUND OF THE INVENTION

[0002] A core bit is used with a core drill 100, which is for example shown in FIG. 13 (see Japanese Patent Application Laid-Open No. Hei 10-315223). Schematically speaking, the core drill 100 has a mounting base 101, a column 102 erected on the base 101, and a motor-incorporated drill unit 103, which moves up and down along the column 102. A core bit 104 is mounted to a rotating shaft S of the drill unit 103 for use, and is comprised of, as is shown in FIG. 14, a coupling 104a to be connected to the rotating shaft S, an outer ring 104b to be fitted onto a periphery of the coupling 104a, an outer ring support plate 104c for locking the outer ring 104b to the coupling 104a, and a hollow cylindrical tube 104d, which is to be detachably fitted onto a periphery of the outer ring 104b and has a segment fixed at one end of the tube.

When such a core drill is employed for a perforation work, the core bit 104 is first fitted to the core drill 100 (see FIG. 13). Then, the core bit 104 is rotated with the use of a motor, and in this state of things, the drill unit 103 is allowed to move down along the column 102 to press a lower end of the core drill having a segment fixed thereon against a concrete construction W. Then, the concrete construction W is bored with the use of the core bit 104 and a bore is formed in the concrete construction W. However, such a perforation work sometimes leaves, as FIG. 15 shows, “bored pieces” called as core C within the core bit 104 after the perforation work. The core C left in the core bit 104 hinders a subsequent perforation work, so that the core C left in the core bit 104 needs to be removed in advance of the subsequent perforation work.

In order to remove the core in the core bit 104, a spanner should be firstly applied to a spanner-application part 105 formed in the coupling 104a to simultaneously allow a wrench to engage an elongate hole 106 of the tube 104d, and then rotate the tube 104d with respect to the outer ring 104b with the use of the spanner and wrench. Accordingly, a square hole 107 of the tube 104d and a leaf spring 108 of the outer ring 104b will be disengaged, loosening the tube 104d from the outer ring 104b. Subsequently, lowering of the tube 104d to detach itself from the outer ring 104b will allow the core C in the tube 104d to be removed out of an upper opening of the tube 104d. After removal of the core C, the tube 104d will be placed to the original position for a subsequent perforation work.

As a core bit, which has a tube detachable with respect to a coupling, there has been proposed one as shown in FIG. 16 other than the above-discussed one (see Japanese Patent Application Laid-Open No. Hei 4-75812). In this core bit 110, a coupling 111 is immobilized for anti-rotation with a tube 112 fitted to a tube-fit part 111a of the coupling 111, and only the tube 112 is made rotate to predetermined degrees in a direction opposite to a rotative direction of the tube 112 during perforation to allow a retaining member 111b to engage an engaging opening 112a, thereby fitting the tube 111 onto the coupling 111. In a fitted state, the coupling is fixed and only the tube 112 is made rotate to predetermined degrees in a rotative direction of the tube 112 during perforation to provide a state where the tube 112 is detachable from the coupling 111. Therefore, like the aforementioned core bit, core within the tube 112 can be removed out of the upper opening, having no segment 112a, of the tube 112 after the tube 112 has been detached from the coupling 111.

In the meantime as described above, in the former core bit 104 (see FIG. 14), a wrench is engaged the elongate hole 106 of the tube 104d to allow the tube 104d to rotate with respect to the outer ring 104b to make the tube 104d detachable (loosened state). However, since the core bit 104 is a member susceptible to strong torque during perforation, if a connection structure is of such a level that manual rotation of the tube 104d can loosen the tube, the torque which the tube undergoes during perforation may possibly loosen the fixed tube 104d. However, it should be noted that firm connection between the outer ring 104b and the tube 104d will disable the tube 104d to be detached from the ring 104b manually.

DISCLOSURE OF THE INVENTION

[0006] The present invention has been made in view of the problems, and is related to a core bit in which a tube is detachable relative to the coupling. It is an object of the present invention to provide a core bit for a core drill, which has a structure allowing core remaining in the tube to be removed easily out of an opening on a segment-free side of the tube after a perforation work has been completed, and has a firm structure for fixing a tube to a coupling.

[0007] The present invention which has been made to solve the problems relates to a core bit for a core drill to be used for drilling or perforating a concrete construction or the like. The core bit comprises a coupling to be mounted on a rotating spindle of the said core drill and a hollow cylindrical tube detachably fitted to the coupling, and is characterized in that the tube has at an opening end thereof perforating blades, the coupling has an insertion part onto which the other opening end is detachably fitted, the coupling is externally fitted with a coupling cover which covers an insertion part of the coupling, the core bit has: an anti-rotation structure for preventing the tube fitted onto the insertion part from rotating relative to the coupling: and a fixing structure for preventing the tube fitted onto the
insertion part from moving in a path of fitting of the tube, and the anti-rotation structure and fixing structure are provided on separate positions from each other.

[0010] If core remains in a tube after a perforation work, in the core bit according to the present invention, the tube fixed through a fixing structure is firstly released, and the other opening end of the tube fitted onto the insertion part of the coupling should be withdrawn from the insertion part. Then, the core is removed out of the other opening end. The other opening end, unlike opposite end of the tube, has no obstacles such as for example a segment, thereby allowing the core in the tube to be removed readily and promptly. Further, a structure permitting insertion and removal of a tube with respect to the insertion part does not require any formation of a female screw which is needed in for example a screw member, so that the core is not caught in a screw thread formed on an inner face of a tube, thereby allowing the core to be removed readily and promptly.

[0011] The core bit according to the present invention is provided with a coupling cover positioned on an exterior of the coupling. Since a core drill is used under severe conditions such as a construction site or building site, it is preferable if it has an excellent durability. In this respect, a coupling cover will prevent an object from hitting directly a coupling or tube, thereby preventing misalignment between a coupling and a tube coaxially fitted relative to each other from generating. A coupling cover will inhibit, to a minimum level, dirt including cement paste caused by perforation from adhering to a coupling, thereby improving the durability of a core bit. Especially, covering an insertion part of a coupling with a coupling cover can cover an engaged part between the insertion part and tube, thereby securely preventing dirt from adhering to the engaged part. As a result, an easy and prompt attachment and detachment of a tube is secured, and easy and prompt work for removing core is also secured.

[0012] In the core bit according to the present invention, the anti-rotation structure and the fixing structure are provided on respective positions independently. Both the core parts exemplified as prior art have a structure of which single engaged part serves for anti-rotation and fixing of a tube, so that there remained a possibility of entailing easily-loosening of a fixed tube and difficulty in detaching a tube from a coupling due to a deformed engaged part between the coupling and tube. In this respect, like in the core bit according to the present invention, provision of the anti-rotation structure and the fixing structure on respective positions does not allow torque during a perforation work not to be transmitted to the fixing structure, thereby securely preventing a tube fixed to a coupling from loosening or the fixing structure from being deformed. Thus, the core bit according to the present invention has been made firm in terms of structure with respect to the fixing structure of the tube to the coupling. As a core bit having an anti-rotation structure and a fixing structure provided on respective positions, there would be a wide variety of ones including for example one in which a coupling cover is used as a part of a fixing structure, as described below.

[0013] Next, a description is made about a core bit having a more preferable structure. A coupling cover will be preferable if it is rotatable around the said rotation spindle and is fitted onto the coupling in a manner immovable in the said path of fitting. The said fixing structure would be preferable if it is comprised of: catching members provided on a coupling cover; and steps disengageably engaged with the catching members and provided on the said tube, and the core bit for a core drill would be preferable if the catching members and the steps engage with each other when the coupling cover is rotated to a predetermined engaged position with the tube being fitted onto the insertion part of the coupling.

[0014] In the core bit like this, rotating the coupling cover to a predetermined engaged position with the tube being fitted onto the insertion part of the coupling will allow the said catching members and the said steps to engage with each other, thereby locking the tube immovable in a path of fitting (especially in a removal direction opposite to an insertion direction of a tube during fitting of a tube). Rotating the coupling cover from the said engaged position to a predetermined disengaged position will release the engagement between the said catching members and the said steps to allow the tube to be moveable in a removal direction of the tube. Therefore, in a work of removing core out of a core bit, only rotating the coupling cover for detaching the tube from the coupling will make the tube releasable readily. After the core has been removed from the tube, and when the tube is fitted upon the tube again to return the tube to its original state, only fitting the tube upon the insertion part before rotating the coupling cover will allow the tube to return to its original fixed state readily.

[0015] As described above, the core bit according to the present invention has a fixing structure, which employs a coupling cover. During perforation, torque from a core drill to a core bit is normally transmitted from the coupling to the tube via an area where they are directly engaged with each other. The core bit as exemplified in prior art has also a fixing structure for a tube at the directly engaged area. Therefore, in the conventional core bits, torque is applied directly to a fixing structure for the coupling and tube to deform the fixing structure, thereby often making attachment and detachment of a tube difficult. In contrast, a fixing structure employing a coupling cover like in the core bit according to the present invention does not allow torque to be transmitted to the fixing structure, thereby preventing the fixing structure from being deformed and making the structure firm. Prevention of deformation will also ensure a simplicity and promptness of detachment of a tube, and will enable core to be removed readily and promptly.

[0016] As a coupling, it is preferable if it is provided with a pressure means, which is in engagement against either the coupling cover or tube and imparts pressure pressing the said catching members and steps, both being in engagement with each other via the coupling cover and/or tube, against each other. The catching members of the aforementioned coupling cover are to be engaged in the steps of the tube, and the engagement locks the tube immovable in a detaching direction thereof. In such a structure, pressing the coupling cover or tube with the use of the pressure means to impart pressure to the catching members and steps (a fixing structure) for pressing against each other will firmly press the catching members and steps against each other, thereby improving a certainty of fixation. As pressure means referred to here, plungers for pushing the coupling cover in a fitting
direction of the tube during fitting of the tube, and ones for pushing the tube in a detaching direction of the tube can be exemplified.

[0017] As the said pressure means, it is preferable if it is provided with convex members, which engage against the coupling cover while being urged in the same direction as that of fitting of the tube, and as a coupling cover, it is preferable if it has concave portions in which the convex members disengageably engage. The core bit for a core drill is preferable if the said convex members disengageably engage in the said concave portions when the coupling cover is rotated to the said predetermined engaged position with the tube fitted onto the insertion part of the coupling. Since the coupling cover which has been rotated to a predetermined rotated position will be certainly positioned to the position by engagement between the convex members and concave portion, inadvertent rotation of the cover caused by any application of external force will be prevented. When movement of the coupling cover is prevented, the engaged state between the catching members and steps will be positively maintained, thereby preventing the tube from dropping off in a more positive manner.

[0018] As an anti-rotation structure, it is preferable if it comprises: pins for an anti-rotation formed either on the coupling or tube and extending in the said path of fitting of the tube; and holes into which the pins formed on the others. In a work for removing core out of the tube, such a structure will allow the tube to be detached from the insertion part easily only by pulling out the tube, when the tube is to be detached from the coupling. In returning the tube to the original position, the tube can be returned to the original anti-rotative state only by fitting the tube onto the insertion part in a manner that the pins engage into the holes.

[0019] As a coupling, it is preferable if the insertion thereof has a seal packing, which fills a gap between the coupling and the tube fitted onto the coupling. In a perforation work with the use of a core drill, water is generally supplied to a tip of the core drill in operation of perforation for the purpose of lubrication, heat dissipation, and anti-scattering of dust. Thus, in the core bit according to the present invention, there is a possibility that grinding containing cement paste enters between the insertion part of the coupling and the other opening end of the tube to be fitted onto the insertion part. If cement paste should enter the area, it is sometimes difficult to attach or detach the tube with respect to the coupling in a work of removing core out of the tube. In this respect, such a seal packing will inhibit cement paste from entering. Especially, a seal packing provided on the above-mentioned position will more positively inhibit cement paste from entering a gap between the coupling and of the tube to be fitted onto the insertion part, thereby preventing the tube from getting difficult to be attached or detached with respect to the tube, to a minimum level. As a result, a condition that the core can be removed readily and promptly is positively secured.

[0020] As will be understood from the above description, the core bit according to the present invention allows core remaining in a tube after a perforation work to be removed readily through an opening at a side where no segment is present. Furthermore, the core bit according to the present invention has a firm structure for fitting a tube onto a coupling, so that it is hardly deformable and is easy to deal with.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1(a) is a front view showing an embodiment of a core bit according to the present invention, (b) is a top plan view thereof, and (c) is a bottom view showing a lower end face of a tube observed from a direction indicated by an arrow B;

[0022] FIG. 2 is an exploded front view showing the core bit of FIG. 1;

[0023] FIG. 3 shows a front view and right and left side views, illustrating a coupling of FIG. 2;

[0024] FIG. 4(a) is a cross sectional view showing a D section of FIG. 3 depicting a plunger of a coupling, and (b) is a cross sectional view showing an E section of FIG. 3 illustrating a coil spring;

[0025] FIG. 5 shows front and side views, illustrating a tube of FIG. 2;

[0026] FIG. 6 shows a front view and right and left side views, illustrating the coupling cover of FIG. 2;

[0027] FIG. 7 is a cross sectional view showing a state where a coupling has been fitted with a coupling cover;

[0028] FIG. 8 is a perspective view showing an opening of the coupling cover and an adapter of the tube;

[0029] FIG. 9(a) is a cross sectional view showing a state where the coupling of FIG. 7 has been fitted with a tube, (b) is a cross sectional view showing an M-M cross section of a state where the tube has been made irremovable, (c) is a cross sectional view showing an N-N cross section of a state where the tube has been made irremovable, (d) is a cross sectional view showing an M-M cross section of a state where the tube has been made removable, and (e) is a cross sectional view showing an N-N cross section of a state where the tube has been made removable;

[0030] FIG. 10 is a cross sectional view showing another embodiment of a core bit according to the present invention;

[0031] FIG. 11 is an exploded front view showing the core bit of FIG. 10;

[0032] FIG. 12 is an exploded frontal cross section view showing the core bit of FIG. 10;

[0033] FIG. 13 is a perspective view showing a core drill, which has been fitted with a core bit;

[0034] FIG. 14 is an exploded front view showing a conventional core bit;

[0035] FIG. 15 is a frontal cross section view showing a core bit having core left therein; and

[0036] FIG. 16 is an exploded perspective view showing another conventional core bit.

BEST MODE FOR CARRYING OUT THE INVENTION

[0037] Preferred embodiments of a core bit according to the present invention are described hereafter with reference to the drawings.

[0038] As shown in FIGS. 1 and 2, a core bit 1 comprises a coupling 10 being screwed into a rotating shaft S of a motor of a core drill (not shown), a tube 20 which is
removably mounted to the coupling 10, a coupling cover 30 for covering the coupling 10, and a C-shaped fastener 40 for fastening the coupling cover 30 to the coupling 10.

[0039] As shown in FIG. 2, the coupling 10 schematically comprises a substantially cylindrical coupling body 11, and a screw part 12 projecting beyond an end face 11a of the coupling body 11. As shown in FIG. 3(a), the screw part 12 is provided with a periphery thereof with a male screw being screwed into a screw hole Sh of the rotating shaft S and is provided with at a center thereof with a hole 12a for water supply. Further, the screw part 12 has at a base thereof: a knock pin 12b mounted for limiting a rotational range of the coupling cover 30; and an annular groove 12c formed for allowing the fastener 40 to put thereon. A fitted state of the coupling cover 30, which is rotatably fitted onto the coupling 10 will be described later.

[0040] As shown in FIG. 3, the coupling body 11 is formed with an insertion part 11b onto which the tube 20 is detachably fitted. The insertion part 11b is cylindrical, and has at a periphery thereof annular seal packings 13a, 13b mounted. The packings 13a, 13b contact with a later-described adapter 21 of the tube 20 fitted onto the insertion part 11b to seal a gap between the insertion part 11b and the tube 20. On the screw part 12 side of the insertion part 11b, there is provided a flange part 11c, and on an end face on the insertion part 11b side of the flange part 11c, there are provided pins (as a part of an anti-rotation structure) 11d extending in a path of fitting of the tube. The pins 11d act to stop the tube 20 fitted onto the insertion part 11b from rotating relative to the coupling 10, and are provided four in number. Holes 11e are an air vent hole employed when the pins 11d are hit in.

[0041] As shown in the figure, the coupling body 11 is hollow, and a hollow part 11f of the coupling body 11 is in communication with a hole 12a of the screw part 12. Therefore, if a core drill to which a core bit 1 is fitted has a water supply line within the rotating shaft S, the hollow part 11f of the coupling body 11 can be used to supply water to a tip of the tube 20.

[0042] On the end face 11a of the coupling body 11, there are provided two plungers (pressure means) 14. As shown in FIG. 4(a), the end face 11a has a hole 11g formed, and the plunger 14 comprises a coil spring 14a installed in the hole 11g, and a ball (convex member) 14b being urged toward outside of the hole 11g via the coil spring 14a. The ball 14b is retractable into the hole 11g. Further, on the end face 11a of the coupling body 11, there are provided two coil springs (pressure means) 15 for a pressing purpose. As shown in FIG. 4(b), the coil spring 15 is installed in another hole 11g, which has been formed on the end face 11a. The coil spring 15 has a free-length longer than a depth size of the hole 11g, but has a whole length retractable via compression within the hole 11g. Each of these plungers 14 and coil spring 15 contacts a later-described contact plate 30b (see FIG. 6) of the coupling cover 30, and urges the contact plate 30b toward an fitting direction of the tube. The plunger 14 and coil spring 15 are prevented from dropping off the coupling 10 thanks to the contact plate 30b, which contacts them.

[0043] As shown in FIGS. 1 and 2, the tube 20 comprises a hollow adapter 21 being fitted onto the insertion part 11b of the coupling body 11, and a hollow tube body 22 detachably fitted to the adapter 21 and provided at an opening end (one opening end, and a lower end in FIG. 1) of a distal end side of the tube body with a segment (perforating blades) 22a.

[0044] As shown in FIG. 5(a), the adapter 21 has four holes (a part of an anti-rotation structure) 21b on an opening end (the other opening end) opposite to the tube body 22 side. The adapter 21 is designed to fit onto the insertion part 11b of the coupling 10 from an opening end 21 side, and once the adapter 21 is fitted onto the insertion part 11b, the hole 21b of the adapter 21 and the pin (an anti-rotation structure) 1d of the coupling 10 engage each other to provide a state where the tube 20 is not rotatable relative to the coupling 10. The adapter 21 has at the periphery thereof a step (a part of a fixing structure) 21c. The step 21c is a portion, which is allowed to engage a later-described projection (a catching member as a part of a fixing structure) 32 (see FIG. 6) of the coupling cover 30. Further, there is formed on the step 21c a concave portion 21d (see FIG. 8) to which the later-described projection 32 fits. It should be noted that the concave portion 21d configuration has a circularly arcuate bottom as shown in FIG. 8 in the present embodiment, however it is not limited to such a configuration, and various ones including V-shape and long groove can be assumed. The periphery of the adapter 21 has been worked to have two sides. Specifically, as shown in FIG. 5(a), there are formed on the periphery of the adapter 21 two flat faces 21e, which are parallel to each other. There is formed on an inner circumference of an opening on the tube body 22 side of the adapter 21 a female screw to which the tube body 22 is detachably screwed.

[0045] The tube body 22 has a male screw, which screws into the female screw on the adapter 21 side and can be detachably screwed into the adapter 21. The tube body 22 is hollow, and has an inner surface providing a smooth cylindrical surface free from a step or screw head. The hollow part of the adapter 21 communicating with the counterpart of the tube body 22 is larger than the hollow part of the tube body 22 in diameter. Therefore, the core C (see FIG. 15) left within the tube body 22 can be removed out of an opening end 21a side of the adapter 21.

[0046] As shown in FIG. 6, the coupling cover 30 has a hollow cylindrical configuration. The inner diameter of a hollow part 30a has a moderate size slidably fitted onto the flange part 11c of the coupling 10. The coupling cover 30 has at one end thereof a contact plate 30b integrally formed through welding, and the contact plate 30b has at the center thereof a through hole 30c formed. Thus, fitting the coupling cover 30 onto the coupling 10 in a manner that the screw part 12 is inserted to the through hole 30c allows the coupling cover 30 to cover the coupling 10, as FIG. 7 shows. As shown in a figure, the contact plate 30b, while being fitted on a coupling 10, contacts the insertion part 11b of the coupling body 11, and the contact plate 30b, is formed with four holes (depressed portion) 30d in which plunger balls 14b of a coupling 10 engage.

[0047] The through hole 30c is provided with a larger-diameter part 31 where the diameter of an opening is made partially larger. The larger-diameter part 31 is an insulating surrounded by two steps 31a extending radially of the through hole 30c and a circularly arcuate part 31b of a larger diameter located between the two steps 31a. The length of the larger-diameter part 31 equals to a length formed when...
two line segments extending from a center of the through hole 30c toward the steps 31a located at respective ends of the larger-diameter part define an angle θ of 90°. The larger-diameter part 31 is for limiting a rotatable range of the coupling cover 30. In fitting the coupling cover 30 onto the coupling 10, the contact plate 30b is made contact with the end face 11a of the coupling 10, while the knock pin 12b is kept positioned to the larger-diameter part 31 (see FIG. 7). The rotatable range of the thus fitted coupling cover 30 is limited within the angle of 90° where the steps 31a and the knock pin 12b do not contact each other.

[0048] There is formed on an outer face of the through hole 30c a spot-faced portion 30e on which the fastener 40 (see FIG. 1) of the coupling cover 30 is disposed. The fastener 40 is to be fixed to the groove 12c of the screw part 12 in a manner that the fastener 40 catches the groove 12c with the coupling cover 30 fitted onto the coupling 10, as shown in FIG. 7. The fastener 40 fixed in this manner allows the coupling cover 30 to catch the groove 12c and spot-faced portion 30e, thereby fitting the coupling cover 30 onto the coupling 10.

[0049] On an inner circumference of an opening of the coupling cover 30, there are two projections (catching members) 32 welded. The projections 32 are shaped like a disc in the present embodiment, however they are not limited to such a shape and may be shaped like a bar. The distance L1 between the projections 32 is smaller than an outer diameter L2 of (see FIG. 5) the adapter 21 of the tube 20 which fitted onto the insertion part 11b, however larger than a distance L3 between the two flat faces 21e. Therefore, aligning the position of the flat faces 21e of the adapter 21 to that of the projections 32 allows the adapter 21 to fit onto the insertion part 11b, even if the coupling cover 30 has been fitted. When the coupling cover 30 is rotated with the adapter 21 being fitted onto the insertion part 11b, a projection 32 and a step 21c (a fixing structure) engage each other, making the fitted tube 20 undetachable from the coupling 10. Thus, the core bit 1 of the present embodiment undetachably locks the tube 20 to the coupling 10 with the use of the fixing structure composed of the projection 32 and the step 21c of the tube 20, and the fixing structure is provided on a position independent from the anti-rotation structure composed of pins 11d of the coupling 10. Thus, such a structure where the fixing structure should be provided on a position independent from the anti-rotation structure and with the use of the coupling cover 30 realizes a structure where any torque generated during perforation is not loaded to the fixing structure and is firm.

[0050] Next, description is made about a perforation work using the core bit 1.

[0051] In performing a perforation work, the screw part 12 of the core bit 1 as shown in FIG. 1 is firstly screwed into a screw hole Sh of a rotating spindle S for fixing the core bit 1 to a core drill (see FIG. 13). Then, as described was made with respect to background art, the core drill 1 should be placed in a predetermined position, and the core drill 1 is pressed against a concrete construction for performing a perforation work with the core bit 1 kept rotating.

[0052] After a perforation work, if core C (see FIG. 15) remains inside the core bit 1, the core C is removed out of the core bit in a manner as follows.

[0053] First, the coupling cover 30 of the core bit 1 (see FIG. 9(a)) is made rotate to place the tube 20 in a condition for being releasable from the coupling 10. Before the cover 30 rotates, the adapter 21 is in a condition where the step 21c and the projection 32 of the coupling cover 30 are engaged with each other as shown in FIG. 9(c), which prohibits the adapter 21 from detaching from the coupling 10. In the state, the coupling cover 30 is made rotate by 90° in a direction shown with an arrow S1, to move the position of the projection 32 of the coupling cover 30 to a position of the flat faces 21e of the tube 20 (see FIG. 9(e)). Then, the step 21c of the adapter and the projection 32 are disengaged from each other to allow the tube 20 to be withdrawn from the insertion part 11b.

[0054] Subsequently, the tube 20 is withdrawn from the insertion part 11b to allow the core C to be removed out of an opening on the adapter 21 side of the tube 20. An inner face 21f of the hollow adapter 21 and a hollow part 22b of the tube body 22 are smooth cylindrical face free from steps or screw thread, and the hollow part of the adapter 21 is larger than the counterpart of the tube body 22 in terms of diameter, and further since an opening end of the adapter 21 side has no obstacles, such as for example a segment 22a, for removing the core C, the core C can be relatively easily and promptly removed out of the tube body 22. Thus described, in the core bit 1 according to the present embodiment, rotating the coupling cover 30 allows the tube 20 to be detached from the coupling 10 easily and promptly, and then the core C in the tube can be easily and promptly removed.

[0055] Upon completion of removing the core C, the adapter 21 of the tube 20 is to be fitted onto the insertion part 11b, while the flat faces 21e of the adapter 21 of the tube 20 are positioned with the projections 32 of the coupling cover 30 (see FIG. 9(e)). As previously described, positioning the projections 32 with the flat faces 21e will allow the tube 20 to be fitted onto the insertion part 11b of the coupling 10 with the coupling 10 fitted with the coupling cover 30. Then, the holes 21b of the adapter 21 of the tube 20 are to be engaged with the pins 11d of the coupling 10 (see FIG. 9(a)). By this operation, the tube 20 is non-rotatably fitted onto the insertion part 11b. Positioning between the holes 21b and the pins 11d can be readily performed through rotating the tube 20. Further, the opening end 21a of the adapter 21 of the tube 20 is to be firmly pressed against the flange part 11e of the coupling 10.

[0056] Then, the coupling cover 30 is made rotated by 90° in a direction indicated with an arrow S2 with the opening end 21a pressed against the flange part 11e. As a result, as shown in FIG. 9(c), the projections 32 of the coupling cover 30 will be engaged with the steps 21c and fitted into the concave portion 21d, thereby making the tube 20 undetachable from or locked to the coupling 10. This completes an operation of removing the core C. Thus, in the core bit 1 according to the present embodiment, the core C remaining in the core bit can be removed readily and promptly only through attachment and detachment of the tube 20, which allows a next perforation work to be initiated promptly.

[0057] Further, rotating the coupling cover 30 by 90° in a direction indicated with the arrow S2 with the opening end 21a pressed against the flange part 11e allows the projections 32 and the steps 21c to engage with each other, and simultaneously to move the position of the holes 30d of the contact plate 30b of the coupling cover 30 to the position of the plunger balls 14b, thereby engaging the balls 14b in the
holes 30d (see FIG. 4(a)). As a result, the coupling cover 30 will enter a non-rotatable or locked state with respect to the coupling body 11, thereby insuring the tube 20 undetachable from the coupling 10 in a more reliable manner. In the plunger 14, the balls 14b will engage in the holes 30d and simultaneously generate a sound or vibration of “click”, so that the coupling cover 30 will be promptly recognized, through detection of the sound or vibration, to have rotated to a position where the projections 32 and the steps 21c engage with each other, and thus workability is excellent.

[0058] Further, the core bit 1 according to the present embodiment is provided with, in addition to the plungers 14, coil springs 15 which impart a biasing force to the coupling cover 30, thereby preventing in a more reliable manner the coupling cover 30 from rotating. Yet further, a biasing force is imparted to the coupling cover 30 in a fitting-on direction with the use of the plungers 14 and coil springs 15, the biasing force being transmitted to the engaged part between the projections 32 and the concave portion 21d of the steps 21c, thereby firmly fitting the projections 32 into the concave portion 21d of the steps 21c. As a result, the tube 20 is more securely locked to the coupling 10. The biasing force acts to press the opening end 2L of the tube 20 against the flange part 11c of the coupling 10. As a result, the tube 20 is fitted onto the insertion part 11b, with its center aligned, and this state is maintained.

[0059] Next, a core bit of another embodiment is described.

[0060] Another core bit 2 as shown in FIGS. 10 and 11 are, similarly to the previously-described core bit 1 (see FIG. 1), comprised of a coupling 10 to be screwed into a rotating spindle S of a core drill, a tube 20 to be detachably fitted to a coupling 10, and a coupling cover 30 for covering the coupling 10, and the core bit 2 and the core bit 1 have a common basic structure in that they have these elements. Therefore, a description is made hereunder with respect to the coupling 10 and coupling cover 30, which both have a different structure from the counterparts of the aforementioned core bit 1. It should be noted any elements common to those of the core bit 1 are allotted with an identical symbol, and a description thereon is omitted.

[0061] As shown in FIG. 12, the coupling 10 comprises a coupling body 11, and a screw part 12 projecting from an end face 11c of the coupling body 11. The coupling body 11 has a flange part 11c adjacent to an insertion part 11b, as the aforementioned core bit 1 does. There is formed on a periphery of the flange part 11c of the core bit 2 a male screw 11k on which a later-mentioned female screw 30k formed on the coupling cover 30. In the flange part 11c, a coil spring-incorporated plunger (pressure means) 16 is located. However, the orientation of the plunger 16 located is different from that of coil springs (pressure means) 15 of the core bit 1. Specifically, the plunger 16 of the core bit 2 is located in a manner that a tip thereof contacts an opening end 21a of an adapter 21 to push the adapter 21 in a detaching direction of the tube. The core bit 2 does not require any pin 12b or groove 12c, unlike the aforementioned core bit 1 in the screw part 12 of the coupling 10.

[0062] The coupling cover 30, unlike the counterpart of the aforementioned core bit 1, is fitted to the coupling 10 in a manner that the coupling cover 30 covers the coupling cover 11. Therefore, any contact plate 30b (see FIG. 6) the coupling cover 30 of the core bit 1 has is not provided. As shown in FIG. 12(c), the coupling cover 30 has an outer circumference of an opening end thereof the female screw 30k to be screwed on the male screw 30k. On an other opening end, there are integrally formed annular projections 32 to be engaged in the steps 21c of the tube 20.

[0063] In order to fit the coupling cover 30 to the coupling 10, the coupling cover 30 is to be first fitted onto the tube body 22 from an opening end side having the female screw 30k (see FIG. 11) Then, the female screw 30k of the coupling cover 30 is made threadedly engaged upon the male screw 11k of the coupling 10. As a result, the coupling cover 11 is covered with the coupling cover 30. When the coupling cover 30 has been threadedly engaged upon the coupling 10, the projections 32 will be engaged with the steps 21c, thereby making the tube 20 undetachable from the coupling 10.

[0064] Consequently to a perforation work with the use of the core bit 2, the core C remaining in the core bit 1 will be removed in a manner as described below.

[0065] First, the coupling cover 30 threadedly engaged upon the coupling 10 is made rotate to allow the coupling cover 30 to be detached from the coupling 10. As a result, since the tube 20 is releasable from the insertion part 11b, the tube 20 is to be detached from the insertion part 11b. As in the case of the aforementioned core bit 1, the core C can be removed readily and promptly out of the opening on the adapter 21 side of the detached tube 20.

[0066] After removal of the core C, the adapter 21 is to be fitted onto the insertion part 11b, while the hole 21a of the adapter 21 is positioned with the pins 11d of the coupling 10. Then, the female screw 30k of the coupling cover 30 is to be made threadedly engaged upon the male screw 11k of the coupling 10. As a result, the coupling cover 30 is fitted, covering the coupling body 11. The projections 32 of the coupling cover 30 will be engaged with the steps 21c, thereby making the tube 20 undetachable from the insertion part 11b and the coupling cover 30 immobilized not to be moveable in a path of fitting. With this operation, a set of work for removing the core C is completed. Thus, the core bit 2 allows itself to its original state readily and promptly, as the aforementioned core bit 1 does.

[0067] Specifically, in the core bit 2 according to the present embodiment, the core C in the core bit can be removed readily and promptly only through fitting and detaching the coupling cover 30, thereby allowing the next perforation work to be initiated promptly. Like in the core bit 1, the fixing structure consisting of the projections 32 and steps 21c is provided on a position independent from the anti-rotation structure consisting of the holes 21b and pins 11d, which contributes to a firm structure where the fixing structure is immune to torque during a perforation work.

[0068] Threadedly engaging the female screw 30k of the coupling cover 30 firmly upon the male screw 11k of the coupling 10 will securely press the opening end 21a of the adapter 21 of the tube 20 against the flange part 11c of the coupling 10, allowing the plunger 16 of the coupling 10 to push the opening end 21a of the adapter 21 in a detaching direction of the tube. Then, a pressing pressure in a detaching direction from the plunger 16 is transmitted to the female screw 30k via the engaged part between the steps 21c and the
projections 32, making a screwed engagement between the male screw 11k and the female screw 30k more firm. Namely, the plunger 16 of the coupling 10 acts as a locking of the coupling cover 30.

INDUSTRIAL APPLICABILITY

[0069] The core bit according to the present invention is suitable as a core bit for a core drill, which is employed in perforating an object to be machined such as a concrete construction, stone, bedrock, and an iron and steel construction.

1. A core bit for a core drill which is used for boring or perforation of an object such as a concrete construction, said core bit comprising: a coupling being mounted on a rotating spindle of said core drill; and a hollow cylindrical tube being detachably fitted to said coupling,

wherein said tube has at an opening end thereof perforating blades,

said coupling has an insertion part onto which an other opening end of the tube is detachably fitted;

said coupling is fitted on an exterior thereof with a coupling cover, said coupling cover covering said insertion part of the coupling,

said core bit has: an anti-rotation structure for preventing the tube fitted onto the insertion part from rotating relative to the coupling; and a fixing structure for preventing the tube fitted onto the insertion part from moving in a path of fitting of the tube, and said anti-rotation structure and fixing structure are provided on separate positions from each other.

2. The core bit for a core drill according to claim 1, wherein the coupling cover is rotatable around said rotation spindle and is fitted onto the coupling in a manner immovable in said path of fitting,

said fixing structure comprising: catching members provided on the coupling cover; and steps disengageably engaged with the catching members and provided on said tube,

said catching members and steps are engaged with each other when the coupling cover is rotated to a predetermined engaging position with the tube fitted onto the insertion part of the coupling.

3. The core bit for a core drill according to claim 2, wherein the coupling is in engagement with the coupling cover or tube, and is provided with a pressure means which imparts a pressure pressing said catching members and steps, being in engagement with each other, against each other via the coupling cover and/or tube.

4. The core bit for a core drill according to claim 3, wherein said pressure means has convex members which is brought into engagement with the coupling cover while being biased in a direction same as that of insertion of the tube,

said coupling cover has concave portions into which said convex members of the pressure means are disengageably engaged, and

said convex members engage into said concave portions when the coupling cover is rotated to said predetermined engaging position with the tube fitted onto the insertion part of the coupling.

5. The core bit for a core drill according to claim 1, wherein the anti-rotation structure comprises anti-rotation pins formed either on the coupling or the tube and extending in said path of fitting, and holes formed on the other into which the pins are inserted.

6. The core bit for a core drill according to claim 1, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

7. The core bit for a core drill according to claim 2 wherein the anti-rotation structure comprises anti-rotation pins formed either on the coupling or the tube and extending in said path of fitting, and holes formed on the other into which the pins are inserted.

8. The core bit for a core drill according to claim 3 wherein the anti-rotation structure comprises anti-rotation pins formed either on the coupling or the tube and extending in said path of fitting, and holes formed on the other into which the pins are inserted.

9. The core bit for a core drill according to claim 4 wherein the anti-rotation structure comprises anti-rotation pins formed either on the coupling or the tube and extending in said path of fitting, and holes formed on the other into which the pins are inserted.

10. The core bit for a core drill according to claim 2, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

11. The core bit for a core drill according to claim 3, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

12. The core bit for a core drill according to claim 4, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

13. The core bit for a core drill according to claim 5, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

14. The core bit for a core drill according to claim 7, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

15. The core bit for a core drill according to claim 8, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.

16. The core bit for a core drill according to claim 9, wherein the coupling has in the insertion part thereof seal packings for sealing a gap between the coupling and tube fitted onto the coupling.