

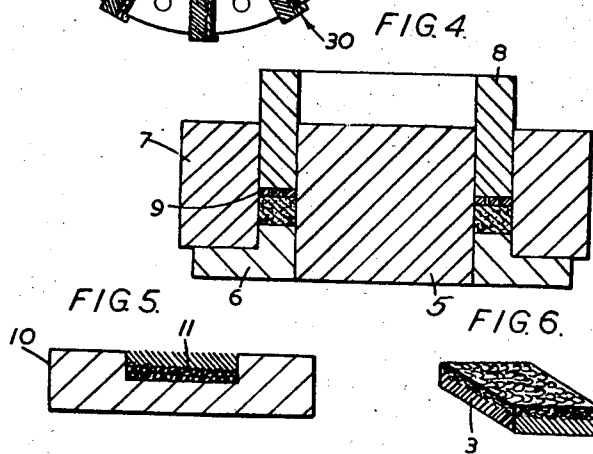
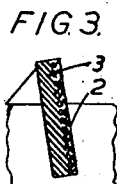
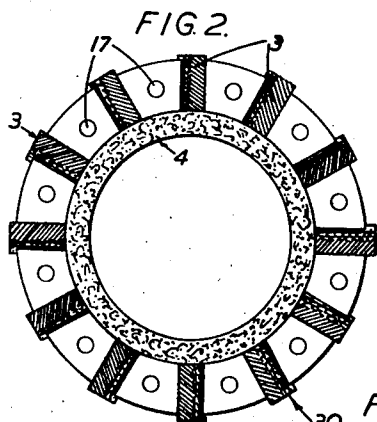
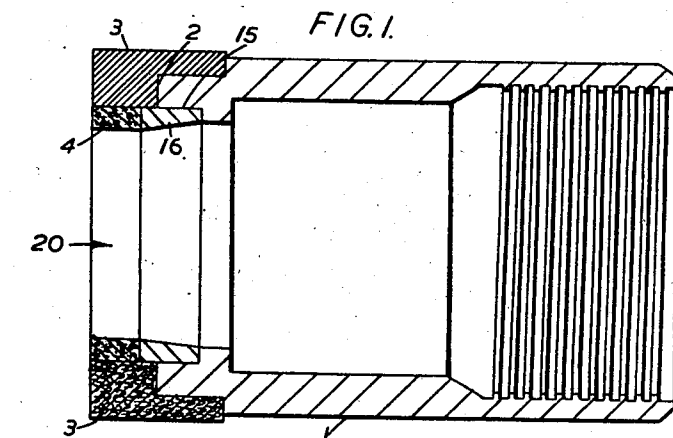
June 20, 1950

L. NUSSBAUM
ROTARY DRILLING TOOL

2,511,991

Filed Feb. 25, 1948

3 Sheets-Sheet 1



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FIG. 7.

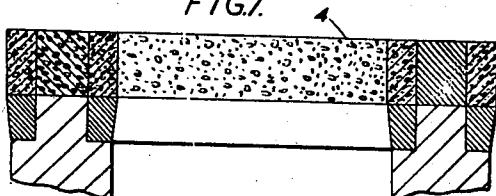


FIG. 8.

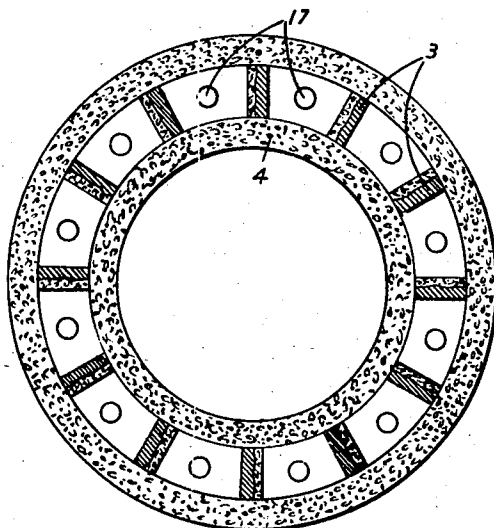
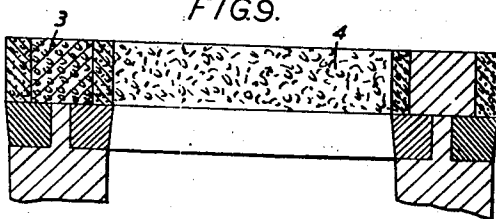


FIG. 9.



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FIG. 10.

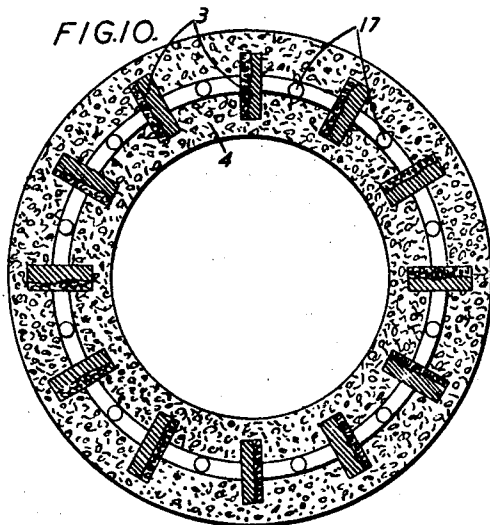


FIG. 11.

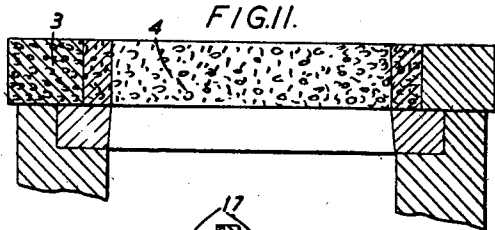
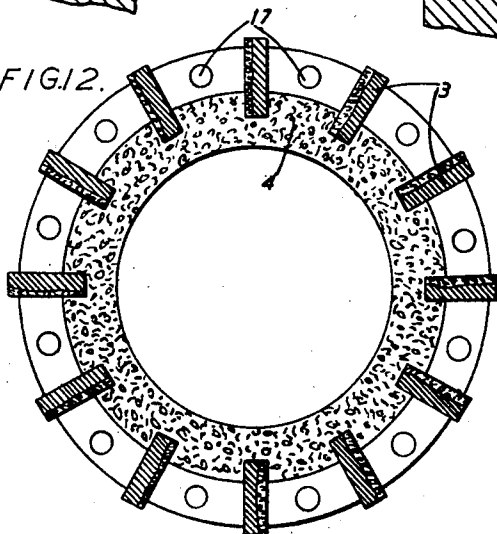


FIG. 12.



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ROTARY DRILLING TOOL

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Application February 25, 1948, Serial No. 10,802
In Great Britain February 13, 1948

6 Claims. (Cl. 255—61)

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This invention relates to the production of an improved cutting tool for drilling holes in the ground including igneous rocks like granite, and the like hard substances, and is especially concerned with drilling tools used in connection with the recovery of cores from brittle, laminated, or unconsolidated formations, including sedimentary formations such as salt, coal, and the like, or laminated formations such as slate, or mica beds, gypsum, and the like.

The chief difficulty in recovering cores from formations of this kind lies in the friability of these substances and the fact that any but the smoothest drilling progress will tend to shatter the brittle core. It is important, however, to obtain complete cores in some instances, such as, for example, in surveys where the depth and extent of a seam consisting of such matter is established by sampling by means of a core obtained from a hole passing through the formation and penetrating into the strata beneath, together with estimations regarding the quality and mineability of the deposit. In all cases where cores are obtained for geological analysis it is desirable to break the core after removal from the hole in order to discover traces of fluid or gas-bearing deposits. If the core breaks up while still in the hole the fragments are mud-washed by the lubricating mud and these faint indications of gases or fluids are lost.

Normal drilling equipment used in core drilling comprises a core barrel on to which is screwed a coring crown. Three types of crowns are used.

(1) Diamond crowns, the chief failures of which occur when broken or laminated strata are encountered, resulting in the loss of diamonds.

(2) Roller bits, which however break up cores of soft, brittle materials.

(3) Drag type crowns, which are designed for the softer formations only.

According to the present invention, the tool comprises a hollow crown provided with a cutting annulus (preferably made of a diamond-containing composition) surrounded by spaced cutting teeth mounted in slots in the lower end of the crown. The inside diameter of the hollow body may be formed with an annular recess at its lower end.

The diamond containing composition may be carried by a backing in the form of a steel ring which may be of a diameter slightly greater than that of the recess, for example, of the order of .005" greater. The crown is heated to enable the recess to receive the ring which becomes tightly shrunk in on cooling the crown. The ring may

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be provided on its upper face with the diamond composition in accordance with the invention described in the specification of British Patent Application No. 32,425/47 and the cutting teeth may be made in accordance with the invention described in the specification of British Patent Application No. 33,106/47.

The invention will now be described by way of example with reference to the accompanying diagrammatic drawings wherein:

Figure 1 is a central sectional view of a tool made in accordance with the invention;

Figure 2 is an end view thereof looking in the direction of the arrow 20 on Figure 1;

Figure 3 is a detail elevational view looking in the direction of the arrow 30 on Figure 2;

Figure 4 is a sectional view of a mould for making the diamond composition annulus;

Figure 5 is a sectional view of a mould for making a cutting tooth; and

Figure 6 is a perspective view of a cutting tooth. Figs. 7 to 12 show modifications.

Referring to Figures 1 to 3 a hollow steel crown or body 1 is formed with an annulus recess 15 into which is shrunk the steel backing ring 16 of the diamond-containing composition cutting ring 4. The end of the body between the ring 4 and the outer periphery is slotted at intervals to receive the cutting teeth 3. Twelve teeth are shown but more or less teeth may be provided—preferably however not less than six or eight. Between the teeth are holes 17 for mud lubrication. The teeth are level with the cutting face of the annulus 4 in the example shown and the teeth project beyond the periphery of the body to protect the body.

For making the annulus 4, a mould of cast iron may be used as shown in Figure 4. The mould consists of a core 5, form ring 6, and outer ring 7. The mould has placed into its lowermost portion a mixture of diamond fragments, together with abrasive carbide and/or oxide particles. A bronze powder is then placed on top of this mixture and partly admixed with it. A ring 8, which may be made of steel or a comparatively hard or high-melting metal or alloy, and which may be provided on its receiving end with a plurality of keyways and recesses 9, is inserted into the top part of the mould in such a way that it will act as a plunger or piston as an integral part of the mould. The whole is then heated to a temperature of the order of 900° C. to 1000° C. until the bronze powder fuses. While this is still liquid the whole is subjected to moderately low pressure of the order of one-half to two tons

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per square inch. Under these conditions the bronze powder, acting as a brazing alloy, will weld itself to the recessed ring at the same time dispersing itself throughout the abrasive mixture thus acting as a bond. The impregnated ring 4 is then removed from the mould, cooled, and machined to the diameter suitable to the dimensions of the core and an outside diameter suitable to provide the necessary interference fit with the body of the tool.

The inserts may be made by means of a graphite mould 10 which has placed in it a quantity of tungsten or other hard carbide 11, which has been crushed and graded to the appropriate size. Monel or other metal or alloy which has a similar degree of toughness in a cast state is then melted and cast into the mould in such a way that it penetrates through the crevices between the carbide particles. After cooling, the cutter 3 is removed from the mould, machined to size, by grinding, and is inserted into prepared slots in the tool which is to receive it. The cutters are then secured to the body by means of metallic fusion. The crown is then placed in a furnace and heated sufficiently for the expanded bore to receive the ring 16 which is then inserted and the whole is allowed to cool.

The cutting teeth are preferably rectangular and preferably extend from the periphery of the cutting annulus outwardly for a distance at least equal to the radial thickness of the cutting annulus and may be at least one and a half or twice such thickness.

Although a diamond-containing composition is preferred for the cutting annulus it is possible to use a cutting annulus of other form but having a large number of cutting projections per square centimetre of the cutting surface.

Provision may be made of at least one cutting annulus having a radius greater than or less than the maximum radius of the inserted cutting teeth but not wholly smaller than the smallest radius of the cutting teeth, the inner annulus being omitted if desired.

Modifications of this kind are illustrated in Figures 7 to 12.

I claim:

1. A rotary core drill comprising a cutting annulus made of a diamond-containing composition, a backing for said annulus, a hollow crown within which said backing is secured, and spaced cutting teeth at the lower end of said crown and surrounding said annulus.

2. A rotary core drill comprising a cutting annulus made of a diamond-containing composition, a backing for said annulus, a hollow crown within which said backing is secured with the annulus projecting below the lower end of the crown, and a series of cutting teeth spaced from each other

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mounted in the lower end of said crown and extending from the outer periphery of the annulus, said teeth having cutting edges substantially level with the lower cutting surface of the annulus.

3. A rotary core drill comprising a cutting annulus consisting of diamond particles, abrasive particles and a bronze bonding agent, a steel backing ring on which said annulus is mounted, a hollow steel crown having an annular recess at the inner periphery of its lower end within which said backing ring is shrunk with the annulus projecting below the lower end of the said crown, and rectangular cutting teeth of metal-bonded hard carbide mounted within slots in the lower end of said crown, said cutting teeth extending below the said lower end of the crown and outwardly from the outer periphery of said annulus.

4. A rotary core drill as claimed in claim 3, wherein the cutting teeth extend outwardly from the outer periphery of the annulus for a distance greater than the radial thickness of said annulus.

5. A rotary core drill as claimed in claim 1, wherein the inner ends of the cutting teeth lie on a circle having a radius not greater than the radius of the outer surface of the annulus but greater than the radius of the inner surface of the annulus.

6. A rotary core drill as claimed in claim 1 comprising a second cutting annulus surrounding the cutting teeth, the outer ends of said cutting teeth lying on a circle having a radius not less than the radius of the inner surface of said second annulus but less than the radius of the outer surface of said second annulus.

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