

Aug. 22, 1933.

J. H. HOWARD ET AL

1,923,488

WELL BIT

Filed Oct. 5, 1931

*Fig. 1.*

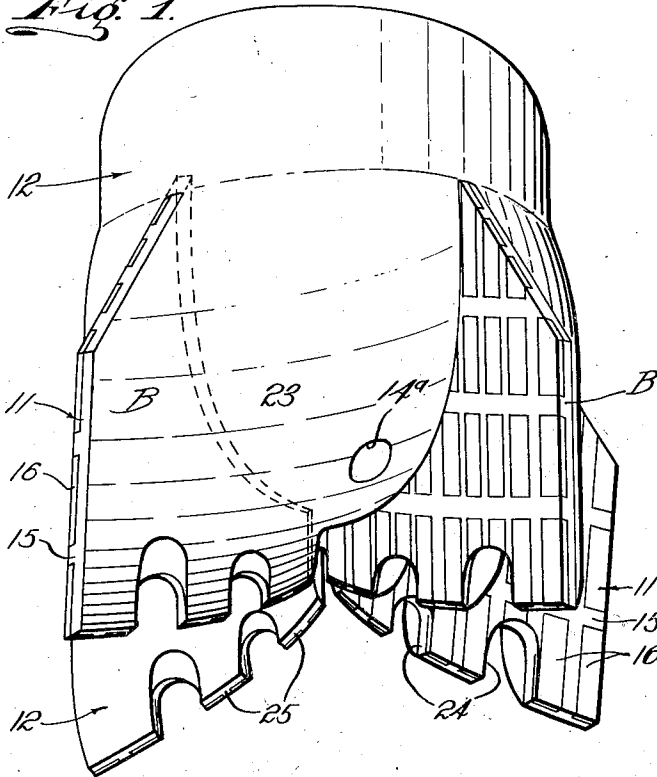


*Fig. 4.*

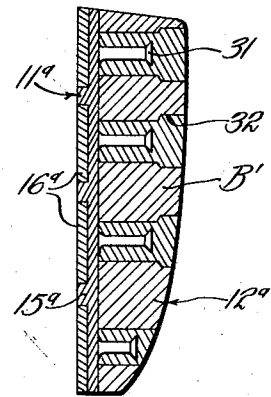


*Fig. 2.*

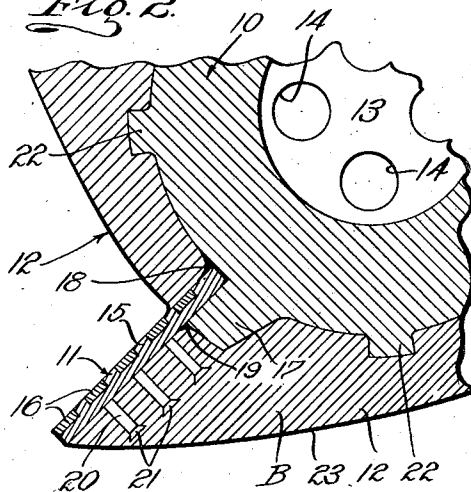


*Fig. 3.*

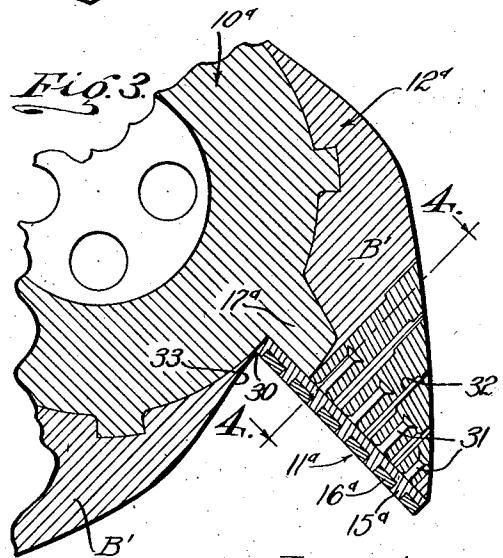
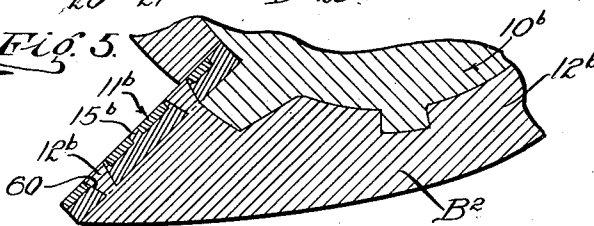


*Fig. 5.*



Inventors  
John H. Howard  
and  
Alfred C. Catland  
By *W. H. McQuell*  
Their Attorney

## UNITED STATES PATENT OFFICE

1,923,488

## WELL BIT

John H. Howard, Huntington Park, and Alfred C. Catland, Alhambra, Calif., assignors to Globe Oil Tools Company, Los Nietos, Calif., a Corporation of California

Application October 5, 1931. Serial No. 566,912

9 Claims. (Cl. 255—61)

This invention relates to a well drilling tool and relates more particularly to a drilling bit. It is a general object of the invention to provide a well drilling tool, such as a bit or the like, that embodies a simple, practical and improved cutting means whereby the tool is self-sharpening through use.

In the drilling of deep wells, certain earth formations are encountered that are effectively drilled by diamonds or bodies of hard cutting material, usually known as diamond substitutes, located on the cutting parts of the drilling tools. Self-sharpening drilling tools have been suggested wherein the parts or bodies of hard cutting material are carried by, or backed up by, materials such as bronze, brass, aluminum, etc., having relatively low resistance to abrasion. Material having a low resistance to abrasion does not have sufficient strength to withstand the usage to which a drilling tool is subjected, or to properly and dependably hold the bodies of hard cutting material.

An object of this invention is to provide a self-sharpening drilling tool in which the diamond substitute or bodies of hard cutting material are mounted in a simple and effective manner and are firmly held against displacement or separation from the tool.

Another object of the invention is to provide a drilling tool of the character mentioned in which the diamond substitutes are mounted or embedded in plates of relatively hard strong material carried on the faces of blades formed of a material having a relatively low resistance to abrasion.

Another object of the invention is to provide a tool of the character mentioned in which the plates of relatively hard material carrying the bodies of hard cutting material are directly joined or connected to the body of the tool as well as being bonded or attached to the blades of relatively soft material.

Another object of the invention is to provide a drilling tool of the character mentioned involving improved means for anchoring or securing the plates of the cutting units to the blades of relatively soft material.

Another object of the invention is to provide a bit or tool of the character mentioned in which the material having relatively low resistance to abrasion and the plates carrying the diamond substitutes are anchored to the body of the tool and to one another in an effective manner so that the finished tool is in the form integral body or unit.

Another object of the invention is to provide a cutting element or unit for embodiment in a well drilling tool that embodies a plate or the like, formed of steel or hard bronze in which a multiplicity of diamond substitutes or bodies of hard cutting material are embedded.

Further objects and features of the invention will be best and fully understood from the following detailed description of typical preferred forms, throughout which description reference will be had to the accompanying drawing, in which:

Fig. 1 is a perspective view of one form of bit provided by the present invention. Fig. 2 is a horizontal fragmentary sectional view of the tool illustrated in Fig. 1 of the drawing, being a view taken through one of the blades and cutting units. Fig. 3 is a horizontal fragmentary sectional view similar to Fig. 2 of another embodiment of the invention. Fig. 4 is a vertical detailed sectional view taken as indicated by line 4—4 on Fig. 3, and Fig. 5 is a horizontal fragmentary detailed sectional view of another form of the invention.

In accordance with the broader aspects of the invention, the cutting means or cutting units provided by the invention are adapted to be employed on tools of various characters, for example, on well bits, well reamers, core drills, milling tools, etc. Throughout the following detailed disclosure, the invention will be described in two simple forms embodied in well drilling bits. It is to be understood that the invention is not to be taken as limited or restricted to the specific forms and applications about to be described, but is to be taken as including any features or modifications that may fall within the scope of the claims.

The embodiment of the invention illustrated in Figs. 1 and 2 of the drawing includes generally, a body 10, a plurality of cutting elements or units 11 connected directly to the body 10, and material 12, having relatively low resistance to abrasion, cast on the body and the rear or back sides of the units 11 forming the blades B of the tool.

The body 10 of the tool is adapted to be mounted on and operated by an operating string of rotary drill pipe, or the like. The body is cylindrical in its general configuration and has a central vertical circulation opening 13 extending into its upper end. In the particular form of invention illustrated in the drawing, the lower end of the body 10 is rounded or semi-spherical and is provided with a plurality of branch cir-

culuation openings 14 communicating with the central opening 13.

The cutting units 11 are the active or cutting elements of the tool for acting on the formation. There may be any desired number of cutting units 11, depending upon the type of bit and upon the character of the formation for which the bit is intended. In the case illustrated in the drawing, there are four like cutting units 11 attached directly to the body 10 and arranged on the forward sides of the blades B, relative to the direction of rotation of the tool. Each cutting element or cutting unit 11 includes a plate 15 and a multiplicity of diamond substitutes or bodies 16 of hard cutting material carried by the plate.

The plates 15 are formed of material having sufficient strength and hardness to withstand the working conditions in the well and to dependably and firmly hold the inserts 16. It has been found practical to form the plates 15 of steel, hard bronze, or the like. It is a feature of the invention that the plates 15 are attached or connected directly to the body 10 of the tool and form the faces or forward sides of the blades B. The plates 15 are shaped to conform to the external configuration of the lower end portion of the body 10 and the configuration of the blades B, and in the form of invention illustrated in the drawing, have flat parallel sides. The cutting units 11 are disposed in vertical planes and in planes radial relative to the vertical longitudinal axis of the body 10. The inner edges of the plates 15 engage or abut the exterior of the body 10 and the plates are attached to the body by points equally spaced apart around the body. In the preferred construction, the plates 15 of the cutting units and the blades B of relatively soft material, extend considerable distance longitudinally of the body 10 and project downwardly and outwardly from the lower end part of the body. The lower ends of the plates 15 are inclined or curved upwardly and inwardly while the upper ends of the plates are inclined downwardly and outwardly.

The means for connecting or attaching the plates 15 of the cutting units to the body 10 includes elongated lugs or ribs 17 projecting from the body. The rear sides or backs of the plates 15 are arranged against the forward sides of the ribs 17 so that the ribs operate to brace and back up the cutting units 11. The ribs 18 are preferably of sufficient length to extend substantially the entire lengths of the plates 15. The plates 15 are welded or brazed to the body 10 depending upon the material of which the plates are formed. The inner edges of the plates 15 may be welded or brazed directly to the body 10 as at 18 while welding or brazing 19 may connect the rear sides of the plates 15 with the outer ends of the ribs 17. In the preferred construction the welding or brazing 18 and 19 extends the entire lengths of the plates 15. It is to be understood that the plates 15 are brazed or welded directly to the body 10 prior to the casting of the material 12 on the body so that the cutting units 11 constitute integral portions of the body 10 before the casting of the material on the body.

The diamond substitutes or bodies 16 of hard cutting material may be formed of tungsten carbide or like cutting and abrasion resisting material. There is a multiplicity of cutting bodies provided in each cutting unit 11 and the bodies 16 may be either fully or partially embedded in the plates 15. In the forms of the invention il-

lustrated in the drawing, the hard cutting bodies 16 are partially embedded in the plates 15 to have their outer sides flush with the faces or forward sides of the plates 15. The diamond substitutes or cutting bodies 16 may be rectangular members and are preferably embedded in the plates 15 in spaced relation. The cutting bodies 16 may be spaced apart in spaced vertical and horizontal rows as illustrated in Fig. 1 of the drawing. It is preferred to have a vertical row of diamond substitutes occur at the outer edge of each plate 15 and a horizontal row of the cutting bodies along the lower margin of each plate. The diamond substitutes or bodies 16 of hard cutting material have greater resistance to abrasion than the plates 15 and blades B so as to be at all times exposed to effectively act on the formation. As set forth above, the plates 15 of the cutting units 11 may be formed of steel, hard bronze or the like. It may be desirable to make the plates 15 of hard bronze in preference to steel as bronze bonds more readily with tungsten carbide, or the like, and has a comparatively low melting point so that the diamond substitutes 16 are not materially affected or injured by high temperatures when cast or embedded in the plates.

Anchoring means are provided on the units 11 to insure an effective bond or connection between the material 12 of the blades B and the plates 15. A plurality of spaced anchors 20 project from the rear side of each plate 15 to project into or be embedded in the blades B. The anchors 20 may be attached to the plates 15 in any suitable manner, for example, they may be welded or brazed to the plates. Heads or enlargements 21 are provided on the outer ends of the anchors 20 to effectively lock together or connect the cutting units 11 and the blades B.

The material 12 is cast on the body 10 and the backs or rear sides of the plates 15. The material 12 may be bronze, brass, aluminum, or other material that has a comparatively low resistance to abrasion. In accordance with the invention the material 12 is cast directly on the body 10 and rear sides of the plates 15. The plates 15 and the body 10 may be plated or otherwise treated to insure a more perfect bond with the covering 12 of relatively soft material. In practice, the relatively soft material 12 effectively bonds with the body and the plates 15 and thus forms an integral or unbroken connection between the plates and body. The sheath or covering of relatively soft material 12 may completely encase the periphery and the lower end of the body 10 as illustrated throughout the drawing. Anchor means is provided to aid in connecting or locking the cast material 12 to the body 10. Circumferentially spaced lugs or ribs 22 project from the body 10 to be embedded in the material 12. Openings 14a are provided in the material 12 in register with the branch circulation openings 14 to discharge the fluid downwardly from the body at points spaced between adjacent blades B.

The blades B form integral projections on the main body of the material 12. In the preferred construction the blades B extend the entire lengths of the plates 15 and are of suitable thickness. In the particular case illustrated in the drawing the blades B are bevelled or cut away rearwardly and inwardly from the outer and lower edges of the plates 15. The outer sides 23 of the blades B are gradually curved or bevelled inwardly from the outer edges of the

plates 15 to evenly join or form continuations of the exterior of the body of material 12. A plurality of spaced notches 24 are provided in the lower end of each plate 15 and its backing plate B. In the particular instance illustrated in the drawing there are two radial spaced notches 24 in each assembly of a unit 11 and blade B. The spaced notches 24 provide three spaced downwardly projecting cutting projections or teeth 25 on the lower end of each assembly of a cutting unit 11 and blade B.

It is believed that the utility and practicability of the embodiment of the invention illustrated in Figs. 1 and 2 of the drawing will be readily apparent from the foregoing detailed description. In operation, the inserts or diamond substitutes 16 resist abrasion and effectively destroy or act upon the formation. The steel or hard bronze plates 15 have sufficient inherent strength and hardness to properly and tightly hold the cutting bodies 16 against displacement. The blades 15 being formed of a relatively soft material, wear away during operation so that the cutting units 11 are at all times exposed to be active and to have proper working clearance. In this manner the tool is self-sharpening through wear or use. The plates 15 in being formed of a material having strength and hardness intermediate that of the diamond substitutes 16 and the blades B operate to dependably carry the diamond substitutes B and to prevent premature wearing away of the forward faces of the blades B. The ribs 17 and welding or brazing 18 transmit the horizontal working or cutting thrusts directly from the cutting units 11 to the body 10. The inner edges of the plates 15 in abutting the rounded lower end of the body 10 transmit the upward thrusts directly to the body. The blades B properly back up the cutting units 11 and give the bit the desired size and weight. The body 10 may be recovered after the cutting units 11 and the blades B are worn away. The material 12 may be melted from the body and the remaining portions of the blades 15 may be broken or cut from the body so that new cutting units 11 and a new covering of relatively soft material 12 may be applied to the body.

In the form of the invention illustrated in Figs. 3 and 4 of the drawing, the cutting units 11a are applied to the tool after the relatively soft material 12a has been cast on the body 10a. The body 10a, the cutting units 11a and the material 12a may be of substantially the same construction, shape, and character as the corresponding parts of the tool illustrated in Figs. 1 and 2 of the drawing. As set forth above, the relatively soft material 12a is cast on the body 10a prior to the mounting of the cutting units 11a on the tool. The forward faces of the blades B' are flush with the forward sides of the ribs 17a as illustrated in Fig. 3 of the drawing. The plates 15a carrying the bodies 16a of hard cutting material are arranged against the forward faces of the blades B' and the ribs 17a. The inner edges of the plates 15a may be welded or brazed directly to the body 10a as at 30. Anchoring projections 31 are provided on the rear sides of the plates 15a. Spaced openings 32 are provided in the blades B' to receive the anchors 31. The body of material 12a may be cut away as at 33 to permit the ready insertion of the anchors 31 in the openings 32. The openings 32 pass the anchors 31 with considerable clearance. After the cutting units 11a have been arranged in position against the forward faces of the blades B', molten

metal, or the like, may be poured into the openings 32 to connect the anchors 31 to the blades. It will be apparent how the material upon cooling, effectively locks together the cutting units 11a and the blades B'. The use and operation of the embodiment illustrated in Figs. 3 and 4 of the drawing is substantially identical with the form illustrated in Figs. 1 and 2.

In Fig. 5 of the drawing, we have illustrated another manner of anchoring or connecting the cutting units to the blades. The cutting units 11b, the material 12b and the blades B<sup>2</sup> may be identical with the corresponding elements of the form illustrated in Figs. 1 and 2 of the drawing. A plurality of spaced transverse openings 60 are provided in the plates 15b. The openings 60 are tapered or flared outwardly toward the forward faces of the plates 15b. When the material 12b is cast on the body and plates it flows into and fills the openings 60 and upon cooling effectively connects the plates 15b and blades B<sup>2</sup>.

Having described only typical preferred forms of the invention, we do not wish to limit ourselves to the specific details set forth, but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described our invention, we claim:

1. A well drilling tool including, a body, a member of relatively hard material attached directly to the body, bodies of hard cutting material embedded in the member, and a layer of material having relatively low resistance to abrasion encasing the body and intimately adhering to the body and the rear side of said member.

2. A well drilling tool including, a shank, a plate of relatively hard material joined directly to the shank, bodies of hard cutting material embedded in the plate, and a surrounding layer of material having relatively low resistance to abrasion cast on the shank and having a projecting blade portion cast on the rear side of the said plate.

3. A well drilling tool including a body, plates of relatively hard material joined directly to the body at spaced points, bodies of hard cutting material embedded in the plates, and a layer of relatively soft material intimately adhering to the body and having projecting blade portions intimately adhering to the rear sides of the plates.

4. A well drilling tool including a body, plates of relatively hard material integrally joined to the body at spaced points by fusion, bodies of hard cutting material embedded in the plates, a surrounding layer of relatively soft material cast on the body and having projecting blade portions cast on the rear sides of the plates, and anchoring means between the plates and blade portions.

5. A well drilling tool including a body, plates of relatively hard material integrally joined to the body at spaced points, bodies of hard cutting material embedded in the plates, a layer of relatively soft material cast on the body and having projecting blade portions cast on the rear sides of the plates, and anchoring means between the plates and blade portions, said means including anchor projections on the rear sides of the plates embedded in the said blade portions.

6. A well drilling tool including a body, a plate of relatively hard material integrally joined to the body, bodies of hard cutting material embedded in the plate, a surrounding layer of relatively soft material cast on the body and having projecting blade portions cast on the rear sides

of the plate, and anchoring means between the body and said soft material, said means including projections on the body and embedded in the said material.

- 5 7. A well drilling tool including a body, an integral projecting rib on the body, a plate of relatively hard material arranged against the forward side of the rib and integrally joined to the body, hard cutting material embedded in the plate, and a layer of relatively soft material cast on the body and having a blade projection backing up the plate.

- 10 8. A well drilling tool including a body, a layer of relatively soft material cast on the body and having a blade projection, a plate of hard material joined with the body, a plurality of spaced cutting embedded in the plate, and means for

attaching the plate to the blade projection including an anchor projection on the plate adapted to be passed into an opening in the blade projection, and material poured into the said opening.

9. A well drilling tool including a body, a surrounding layer of relatively soft material cast on the body and having a blade projection, a cutting unit, and means for attaching the cutting unit to the blade projection including an anchor projection on the unit adapted to be passed into an opening in the blade projection, a head on the anchor projection, and material poured into the said opening.

JOHN H. HOWARD.  
ALFRED C. CATLAND.

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150