A guide and protector arrangement for a drill bit that has openings therein for receiving removable jets which includes jacket means for covering the bit cutting surfaces with access openings in the jacket means for insertion and removal of the bit jets. Fluid passage means are provided in the jacket means for communicating with the well bore at one end and the access openings at the other end, and a closure means is provided for the access opening after the jets have been positioned in the bit.
BIT GUIDE AND PROTECTOR INCORPORATING AN ARRANGEMENT FOR INITIALLY INSERTING OR REPLACING OF BIT JETS

CROSS REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

The present invention relates to a guide and protector for a drilling bit, and more particularly, to a drilling bit incorporating removable jets therein, wherein the guide and protector is constructed and arranged for access to the removable drill bit jets for the installation, removal, and replacement thereof.

SUMMARY OF THE INVENTION

Arrangements for guiding and protecting tubular members incorporating drilling means therein are described in our above referred to copending applications. In those situations where the drilling means incorporates a removable jet means, it may be desirable prior to lowering the drilling means into a well bore to change or replace one or more of the jet means employed in the bit.

An object of the present invention is to provide a bit guide and protector constructed in a manner so that access may be had to the removable jets within the bit for replacement thereof.

An object of the present invention is to provide a molded guide and protector jacket means for covering drill bit cutting surfaces wherein the jacket means includes passage means therein with one end connected for communicating fluid between the drill string on which the bit is to be connected and the well bore through the other end of the passage means, the jacket means being constructed and arranged to provide an access opening for removal and replacement of the jets in the drill bit as desired.

Another object of the present invention is to provide a molded guide and protector jacket means for covering drill bit cutting surfaces wherein the jacket means includes passage means therein with one end connected for communicating fluid between the removable jets in the bit and the well bore through the other end of the passage means, and removable insert means associated with the jacket means adjacent the removable jets to provide an access opening for removal and replacement of the jets as desired, and fluid pressure responsive means within the jacket means communicating with the passage means intermediate the ends thereof which pressure responsive means is responsive to hydraulic pressure within the well string to aid in removal of the guide and protector arrangement from the bit for exposure of the bit cutting surfaces when desired.

A further object of the present invention is to provide a molded guide and protector jacket means for covering drill bit cutting surfaces wherein the jacket means is molded with an access opening for access for inserting or replacing removable jet nozzles in the drill bit.

Yet another object is to provide a method of field inserting or replacing jet nozzles in a drill bit, which bit is provided with a molded guide and protector jacket means for covering the bit cutting surfaces and shirt tails of the bit. The jacket means is provided with a passage means for communicating between the drill string on which the bit is to be positioned and the well bore, and an arrangement for access to insert or replace the jet nozzles and wherein the method includes the steps of positioning the jet nozzle in the bit, forming passage means, and forming a closure for the access arrangement that includes passage means for communicating with the passage means in the jacket that communicates with the well bore.

A further object of the present invention is to provide an access opening to the jets of a drill bit in a molded jacket means for covering the cutting surfaces of a drill bit, the jacket means including fluid passage means communicating with the well bore at one end and with the access opening at the other end.

Another object of the present invention is to provide an access opening to the jets of a drill bit in a molded jacket means for covering the cutting surfaces of a drill bit, the jacket means including fluid passage means communicating with the well bore at one end and with the access opening at the other end and an insert means for closing off the access opening.

Yet another object of the present invention is to provide an access opening to the jets of a drill bit in a molded jacket means for covering the cutting surfaces of a drill bit, the jacket means including fluid passage means communicating with the well bore at one end and with the access opening at the other end and an insert means for closing off the access opening, wherein the insert means is formed in situ in the access opening.

Other objects and advantages of the present invention will become more readily apparent from a consideration of the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view illustrating a bit with removable jets therein and a form of the present invention;

FIG. 2 is an enlarged detailed view illustrating the arrangement of the removable insert means in the jacket means of the form of the invention shown in FIG. 1 with one form of removable jet in position in the drill bit;

FIG. 3 is a view similar to FIG. 2 but illustrating another form of removable jet means and another form of insert means;
FIG. 4 is a perspective view illustrating the form of insert means shown in FIG. 1 which may be employed with the present invention;

FIG. 5 shows a form of the present invention with the access opening formed therein;

FIG. 6 is an enlarged view of the form of invention in FIG. 5 and showing the insert being formed in situ in the access opening; and

FIG. 7 illustrates another step in forming the insert means in situ in the access opening.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Attention is first directed to FIG. 1 of the drawings wherein a drill bit 10 is illustrated and is shown as including a threaded shank 11 for connection with a drill string (not shown) and a body 12 which incorporates cutting surfaces of any desirable form on the rotatable core members illustrated at 13. The present invention is referred to generally by the numeral 15 and includes a jacket means 16 which may be formed in any suitable manner as described in our copending application Ser. No. 107,786 previously referred to. The jacket means 16 may be molded in situ on the bit 10 from suitable means such as an epoxy resin and an aggregate such as by way of an example, silica sand, or may be formed of a cementitious material. It may also be preformed integrally or in sections and then positioned on the bit.

It will be noted that the body of the bit 10 incorporates fluid passage means 13a for discharge of liquid from the drill string connected with the drill bit into the well bore to accomplish certain desired results. Some drilling means employ jet nozzles 14 which are received in openings at the discharge end of the passage means 13a for jetting the liquid from the drill bit into the well bore to aid in drilling operations. It is sometimes desirable to replace the removable jets 14 with other jets having a different size orifice, or with jet means of a different configuration.

To accomplish this, when the jacket means 16 is formed in situ on the bit 10, suitable plug means as represented at 18 may be positioned at the terminal end of the passage means 13a in the bit body 12. The lug means 18 may incorporate suitable passage means 18a. When the jacket means 16 is molded in situ on the bit as described in our copending application Ser. No. 107,786, previously referred to, passage means referred to generally at 20 will be formed in the jacket means, one end of which communicates with the recess 17 which is formed by plug 18, and the other end of which communicates with the well bore (not shown). Pressure responsive means generally by the numeral 21 is formed intermediate the ends of passage means 20, for a purpose to be described. The portion of passage means 20 between pressure responsive means 21 and the end of the jacket means is referred to by the numeral 23.

The pressure responsive means 21 may be of any suitable form so as to aid in removal of jacket means 16 when hydraulic pressure is applied thereto in an amount sufficient to remove the portion of the jacket means 16 forwardly of the cutting surfaces on the cones 13. The pressure responsive means 21 may be formed by a plurality of cavities as described in our said copending application Ser. No. 107,786 to thereby provide a surface 21a which is responsive to the fluid pressure, or it may incorporate suitable sintered or cellular material within the jacket means 16 as it is formed which accommodated fluid flow therefrom but which restricts fluid flow so that when the fluid pressure is increased, the action of such fluid pressure will aid in removal of the jacket means 16 as previously mentioned.

It will also be noted that the jacket means 16 is of a suitable configuration such as is illustrated by way of example only at 24 which aids in guiding the bit into the well bore in a manner to inhibit damage thereto and to inhibit sticking either in a keyseat or projections or other ledges that may be present in the well bore or in the casing in the well bore. The configuration as illustrated is generally convex.

The invention 15 may be premolded separately from the bit 10 in integral form, or it may be premolded in segments that are then joined by an adhesive. The invention 15 may in such event be formed so that certain portion thereof will clamp or grab the bit 10, or it may be formed to engage in the ends of passages 13a adjacent jets 14.

Where the invention 15 is preformed, the plugs 18 will be inserted in the position they would occupy if they were formed on the bit 10.

After the jacket means 16 has been formed with the plug 18 in position, such plug 18 may remain in position until it is desired to remove the jet 14, or until the drill bit is to be lowered into the well bore. The plug 18 as shown in FIGS. 104 may be formed of any suitable material such as by way of example only, elastomer, and when the jacket means 16 is molded on the bit 10, the elastomer may be provided with a mold release material which inhibits sticking of the plug 18 to the material from which the jacket means 16 is formed. It can be appreciated that the exact configuration of the plug 18 may vary as desired, and in FIG. 2, one arrangement is shown where the plug is employed with a jet means 14 that does not extend beyond the end of the passage 13a formed in the body 12 of the bit 10.

The jet means 14 is normally retained in the drill bit 10 by a suitable means such as a snap ring, threads, or the like, and as previously noted, it may be desirable to replace one or more of the jets 14 prior to the time that the bit 10 is lowered into the well bore. To accomplish this, the plug 18 is removed from its position as illustrated whereby access may be gained to the jet means 14 for removal thereof. After the jet means has been repositioned within the bit 12, a member having the same configuration as the plug 18, but preferably formed of a similar composition as the jacket means 16, may be inserted into the opening where the plug 18 had been positioned. It may be retained in position by a suitable adhesive for adhering the surfaces of the plug 18 to the exposed surfaces of the jacket means 16 within the recess.

In some situations, the jet means 14 is of an elongated form as illustrated in 14a of FIG. 3 which includes a projection 14b extending beyond the terminal end of the passages 13a in the body 12 of the bit 10. In such situations, the plug 18 may be formed by packing a suitable material such as epoxy and catalyst in and around the back of 14b and then permitting it to harden. In such case, the passage between the end of 14b and passage means 20 may be manually formed as
the mass 18c hardens. Then, a partial preformed plug or insert 18b may be inserted in the front of recess 17. It may be retained in position by any suitable adhesive. In some situations, the plug 18 may be formed in two separate portions and then inserted after the jet 14 has been inserted. The numeral 30 represents the edge of such preformed portions, or, where the mass 18c is packed in situ as above described, 30 represents the mating edge of such mass and the front preformed portion 18b. Where the plug 18 is of the preformed split type and it is desired to remove the plug 18, the plug portion 18b is first removed, and thereafter the rear plug portion may be removed. If a jet having an extension 14b is to be inserted within the bit body 12, the rear plug portion may be inserted and then the jet inserted. Thereafter, plug portion 18b is inserted in the recess and may be secured with plug portion 18a and jacket means 16 in such opening by any suitable glue or the like for adhering the insert 18 in position in the recess within jacket means 16. After the inserts of either the FIG. 1 form or the form shown in FIG. 3 are positioned and secured in the jacket 16, the bit 10 may then be lowered into the well bore.

In some situations, the molded jacket means 16 may be molded with a recess or opening 17 for access to the jets 14 as shown in FIGS. 5-7. In such case, the recess may be formed by suitable means as described with regard to FIGS. 1-4 so that when jacket means 16 is molded, the recess 17 may be formed therein. The jacket means 16 in FIGS. 5-7 includes passage means 20, fluid pressure responsive means 21, and passage portion 23. Its configuration and construction are generally similar to that described with regard to FIGS. 1-4. Also, it is formed on a bit 10 having a construction similar to that previously described.

In FIG. 5, the jacket means 16 is shown as having been previously formed on the bit 10 and the bit 10 now positioned for forming insert means in situ in the recesses 17 in the jacket means 16.

The bit is shown as being turned upside down to rest on its shank 11 on a suitable support 2a having an opening 2b therein. Also, jets 14 of a suitable size and configuration for use with the drill bit 10 are shown as having been installed in the enlarged openings in the end of passages 13a.

Prior to lowering the bit in the well bore, the insert means either of the FIGS. 1-4 form must be inserted and positioned in the recesses 17, or the insert means, such as shown at 40 in FIG. 7, must be formed in situ.

The insert means of FIGS. 1-7 protects the jets as the bit is lowered into the well bore in that the insert means prevents the clogging of the jets by mud, debris, or anything else.

To form the insert means 40 of FIG. 7 in situ, suitable hollow tubular means 41 are positioned so that one end is received or positioned in each of the jet means and the other end positioned in the passage means 20. At least one end of the hollow tubular means 41 should extend outwardly of the bit 10 or passage means 20 so that it can be removed after the insert means 40 is formed. As shown, the tubular means 41 extends out the passages 13a and through the shank passage in the bit. The tubular means within the recess may be provided with a mold release agent to prevent the mass of material from which plug 40 is to be formed from sticking thereto.

After the tubular means 41 is thus positioned, a suitable epoxy resin and catalyst may be mixed and positioned in recesses 17 surrounding tubular means 41 as shown at 43 in FIG. 6.

After the mixture has hardened sufficiently, the tubular means 41 may be withdrawn by engaging the ends 44 and pulling them out as shown in FIG. 7. This forms a passage 45 in the insert means 40 in its finished state as shown in FIG. 7.

It should be further noted that the mixture 43 may be shaped as it hardens to conform with the configuration of the body of the molded jacket 16.

This enables the passage means 20 to communicate with the passage 13a and drill string connected with the drill bit. The passage means 18c in the form of insert shown in FIGS. 1 and 2 and in FIGS. 3 and 4 also is for the same purpose. As previously noted, the insert 18 in FIGS. 1-4 is premolded and inserted and sealed in the recess 17 as previously described just before the bit 10 is run in the well bore.

In the present invention, a void 50 may be formed in the jacket means 16, or a suitable substance such as a relatively stable foamed material 51 may be positioned therein to eliminate unnecessary volume of material forming jacket means 16.

After the bit 10 is lowered into position in the well bore, it may be either drilled off by rotating the well string so as to wear the epoxy resin and aggregate, or other type resin and aggregate down until the cutting surfaces of the cones 13 are exposed, or if desired, the portion of the jacket means 16 in front of the cones 13 may be removed by increasing the hydraulic pressure within the well string with which the bit 10 is connected whereupon the pressure acts in cooperation with the pressure responsive means to enable removal thereof. The portion of the jacket means 16 which is removed will be cut up by the cutting surfaces of the bit, and the balance of the jacket means 16 on the bit will be worn off and flushed up the well bore with the cuttings in a well-known manner.

Generally speaking, most bits which incorporate jet nozzles usually employ three jet nozzles that are arranged circumferentially at equally spaced intervals. Each of such jet nozzles is arranged in the end of the passages 13a for discharge of fluid therefrom in a predetermined manner. The present invention permits one or all of the jets to be installed, removed, or replaced as desired.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape, and materials as well as in the details of the illustrated construction may be made without departing from the spirit of the invention.

What is claimed is:

1. A guide and protector arrangement for a drill bit which has openings therein for receiving removable jets comprising:
   a. molded jacket means for covering the bit cutting surfaces;
   b. there being access openings in said molded jacket means for access to the openings in the bit for installation and replacement of removable jets; and
   c. said jacket means including passage means therein having one end for communicating fluid between the access openings in said jacket means and the
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7 well bore through the passage means formed in said molded jacket means.

2. The invention of claim 1 including fluid pressure responsive means within said jacket means and communicating with the passage means intermediate the ends thereof, said fluid pressure responsive means being responsive to fluid pressure to aid in removing said jacket means for exposure of the bit cutting surfaces.

3. The invention of claim 1 including preformed insert means for inserting in the access opening.

4. The invention of claim 3 wherein said insert is split longitudinally to aid in removal and replacement thereof.

5. The invention of claim 3 wherein said insert is provided with passage means therein which generally conforms with the configurations of the removable jet positioned in the bit and extending thereinto.

6. The invention of claim 3 wherein said insert is formed of an elastomeric material which may be compressed to fit within the access opening formed in said jacket means.

7. The invention of claim 3 wherein said insert is formed of generally the same substance as said jacket means and an adhesive for bonding said insert in position in said jacket means.

8. The invention of claim 1 including an insert formed in situ in the access openings after the jets are positioned in the bit openings.

9. The invention of claim 8 wherein the insert formed in situ includes tubular means having one end inserted in the end of the passage means communicating with the access opening and the other end extending into the jets so that when said insert is formed in situ passage means will be formed therein between the end of the jets and the passage means formed in said jacket means.

10. The invention of claim 9 wherein said tubular means extends relative to the bit whereby the tubular means may be removed after the inserts are formed in situ.

11. The invention of claim 1 wherein said jacket means is sectioned, and means for bonding said sections together after they have been positioned on the bit.

12. The invention of claim 7 wherein said insert is split longitudinally to aid in removal and replacement thereof.

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