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DRILL BIT AND METHOD AND APPARATUS FOR MAKING SAME

Original Filed May 9, 1966

2 Sheets-Sheet 1

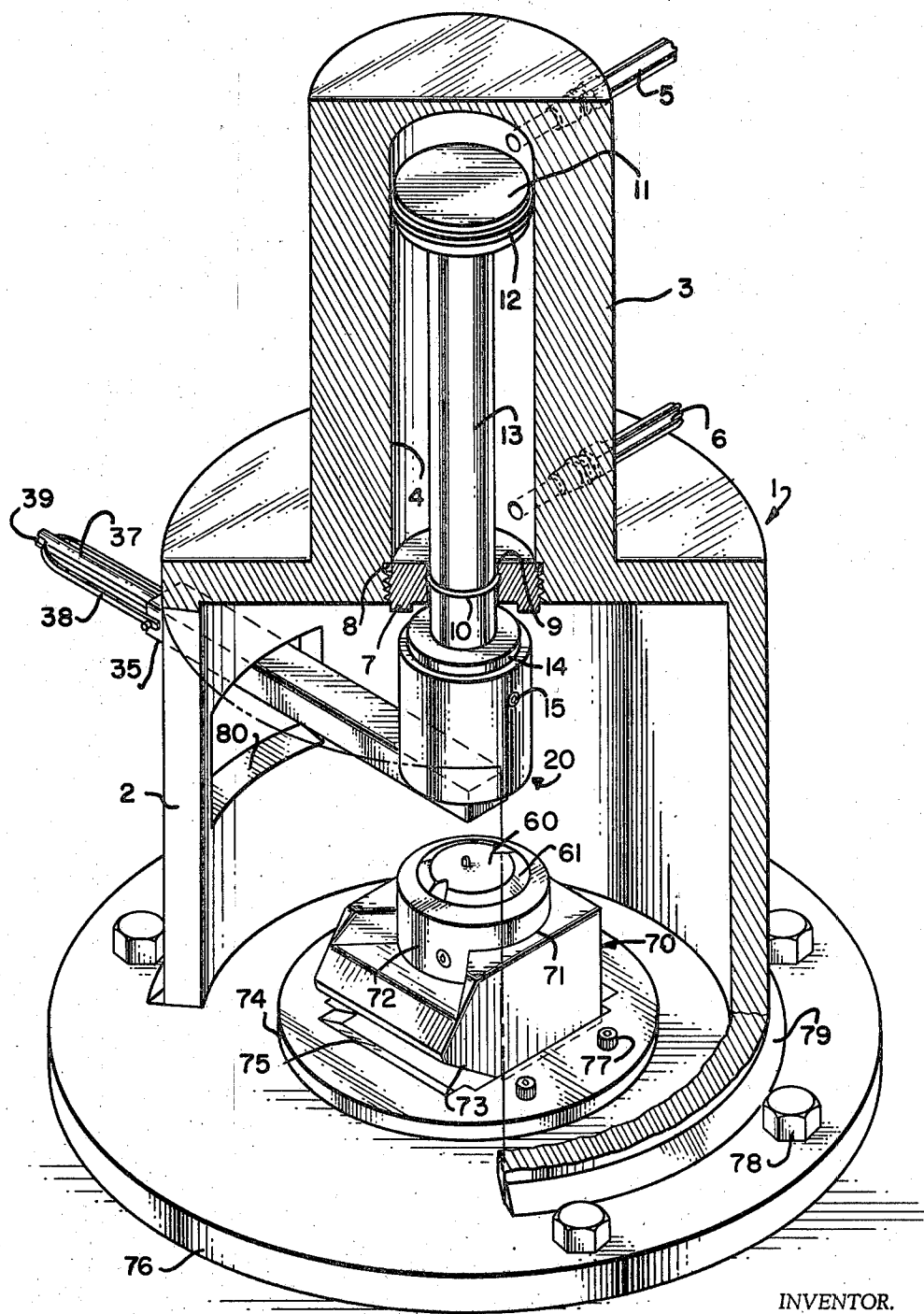


FIG. 1

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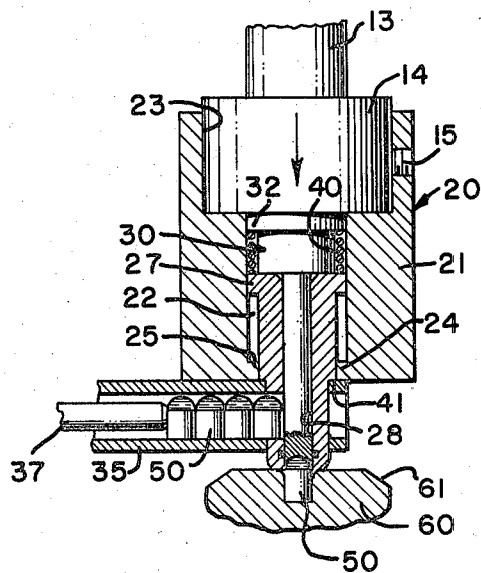


FIG. 3

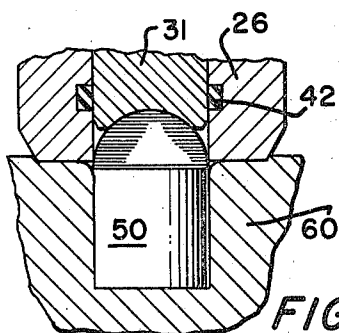


FIG. 4

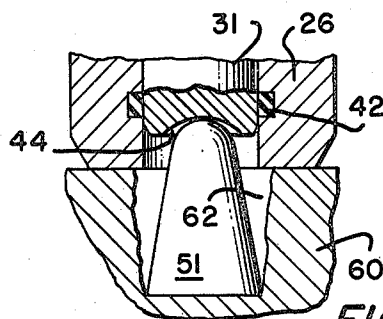


FIG. 5

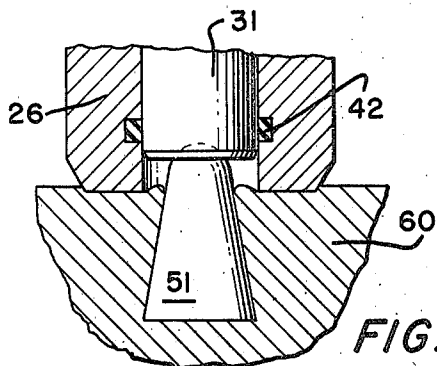


FIG. 6

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DRILL BIT AND METHOD AND APPARATUS FOR MAKING SAME

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Continuation of application Ser. No. 548,766, May 9, 1966. This application Sept. 16, 1968, Ser. No. 761,897
Int. Cl. E21c 13/00

U.S. Cl. 175—410

9 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for forming button type drill bits by forcing carbide inserts into a bit blank. The invention permits the manufacture of button bits without pre-drilling holes for the carbide inserts. The buttons are pushed into the bit blank by means of a hydraulic press.

This application is a continuation of Ser. No. 548,766, filed May 9, 1966, now abandoned.

This invention relates to a method and apparatus for forming a bit for drilling rock. More particularly, this invention relates to a method and apparatus for inserting "buttons" in a "button bit."

A "button bit" is known by those having ordinary skill in the art of rock drilling to be a percussion bit having a plurality of tungsten carbide or other hard material inserts or "buttons" which project out of that portion of the bit which contacts the rock face.

Prior methods of inserting carbide inserts into blanks comprise shrink fit or press fit. Silver brazing has also been used but this method has been abandoned to a great extent. In the press fit and shrink fit methods, it is necessary to drill a hole in the bit body or blank before the carbide button can be inserted. In press fit, a hole is drilled and then the button or insert is forced into the hole. In shrink fit, a hole is drilled into the blank, the blank is heated increasing the size of the hole and the button is inserted into the hole. When the blank cools, the button is held firmly in place.

Since both the press and shrink fit methods depend on the stretch of a hole in the bit body, accurate control of size of both the hole and the carbide is necessary to avoid overstresses. Production of multiple holes to the required tolerance and precision is expensive. Slight errors can cause the entire bit to be rejected. In addition to the necessity of the holes being accurately located and sized, the carbide inserts must also be of accurate diameter. Since the blank bit is a relatively soft material and the buttons are tungsten carbide, it has been discovered that the buttons may be pushed into the blank without first drilling a hole.

It is, therefore, the principal object of this invention to provide a method of forming drill bits which overcomes the above objections.

It is another object of this invention to provide a method of inserting buttons into a blank which reduces the number of operations necessary.

It is a further object of this invention to provide novel apparatus for forcing inserts into a blank.

In general, these objects are carried out by providing a housing which is open on one side and has a press in the upper portion. Attached to the press is a setter means which has an insert feeding means attached thereto. A jig for holding the bit blank is located on the floor of the housing. In order to insert a button into a solid metal blank, the blank is first heated and then held in the jig. A button is held adjacent the blank by placing the setter means and bit feeding means adjacent the blank. The press is operated and an insert or button

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is forced into the blank in the desired location to a depth such that the insert extends above the bit face a predetermined distance. When the insert is in the blank as far as is desired, the blank around the insert is crimped to prevent the insert from coming out. The blank is then cooled.

These and other objects will become apparent from the following description and drawings in which:

FIG. 1 is a perspective view of simplified apparatus for carrying out the method of this invention with certain parts broken away for purposes of clarity;

FIG. 2 is an elevational cross-section of a portion of FIG. 1;

FIG. 3 is a view similar to FIG. 2 showing the button being forced into the blank;

FIG. 4 is a detail showing the blank crimped around the insert; and

FIGS. 5 and 6 are details showing a different shape insert being forced into a bit blank.

Referring to the drawings, the simplified apparatus for forcing a tungsten carbide or other hard material button into a bit blank comprises a housing generally designated at 1. The housing is secured to a plate 76 by any suitable means such as welding 79. One side of the housing is open, as at 2, to provide a viewing area and an entrance for the other apparatus. The upper portion 3 of the housing 1 includes a cylinder 4 having fluid supply connection 5 and 6. The cylinder 4 is closed at the end by a plug 7 which threadedly engages the cylinder. The plug is sealed by an O-ring. Slidably mounted in the cylinder 4 is a piston 11 having a sealing ring 12. A ram 13 is attached to the piston and moves through and opening 9 in the plug 7. An O-ring 10 in the opening 9 prevents leakage of fluid through the opening 9. The end of the ram 13 opposite to the piston 11 is enlarged as at 14.

A setter, generally indicated at 20, is attached to the ram. The setter comprises a cylindrical member 21 which has an axial bore 22 therethrough, as shown in FIG. 2. The bore 22 is counterbored at 23 so as to receive the enlarged end 14 of the ram. The setter 20 is held in place on the ram by a set screw 15 or other suitable means. The bore 22 is narrowed at the lower end 24 to provide a seat or stop 25. A plunger 26 having a shoulder 27 at its upper end is slidably mounted within the bore 22. The shoulder 27 is of such a size that it will rest on the stop 25. The plunger 26 has an axial bore 28 of constant diameter therethrough.

A spindle, generally indicated at 30, has a reduced diameter portion 31 which is adapted to slidably fit in the bore 28 of the plunger. The upper portion of the spindle has a shoulder 32. Between the shoulder 32 of the spindle and the upper portion of the plunger 26 there is a spring 40, the purpose of which will be explained hereinafter.

There is a feeding means which includes a hollow tube 35 fitted to the end of the plunger 26. The outer end of the tube 35 extends through an opening 80 in the housing 1. The tube 35 has an opening 36 through which the plunger extends. The plunger 26 has an opening 29 which is axially aligned with the opening in the tubular member 35. The member 35 fits onto the plunger 26 and is secured thereto by any suitable means so that it abuts a shoulder 41 and the end of the plunger extends beyond the bottom of the tubular member, as is best shown in FIGS. 2 and 3.

The feeder tube 35 is of such a size that a plurality of tungsten carbide buttons or inserts 50 will fit into it, as clearly shown in FIGS. 2 and 3. A rod 37 is slidably mounted within the member 35 and is biased forward against the inserts 50 by a resilient member 38 so that the buttons 50 will be forced into the bore 28 one at a

time. The end of the rod 37 has a notch 39 for holding the resilient member 38. When a button is pushed into the bore 28, it is prevented from falling out by a retaining ring 42. The button is now axially aligned with the spindle 30.

A metal bit blank 60 is held in a cylindrical member 72. This cylindrical member is held in a circular opening 71 of a jig 70. The forward edge of the jig is beveled at 73 so that, when it is desired to insert buttons into the gauge or edge 61 of the blank, the bit may be tilted to the proper angle. The jig fits into a plate 74 which has a squared opening 75 therein. The jig 70 may be moved so that when one button is in place, the blank may be repositioned and a second button may be put in. The plate 74 is fastened to a second plate 76 by any suitable means such as screws 77. The plate 76 is secured to a supporting table (not shown) by any suitable means such as bolts 78.

METHOD

A metal bit blank 60 is heated to the required temperature. This temperature depends on the amount of force used to push the button into the blank. In one test performed with a small hydraulic press, it was found necessary to heat the bit to around 1700° Fahrenheit. If a larger press is used, the heat may be reduced. The heated blank is placed in the cylindrical member 71 which is then placed in the jig 70. The jig 70 is then located in the desired position below the setter 20 so that the button will be inserted in the proper location.

An insert or button made of material harder than the blank is pushed into the bore 28 of the plunger 26 by the rod 37 and rests on the retaining ring 42.

Hydraulic fluid under pressure is supplied to cylinder 4 through the connection 5 and the piston 11. Ram 13 and setter 20 are lowered until the end 43 of the plunger contacts the face of the bit blank 60. The lower side of the cylinder is exhausted through connection 6. As more pressurized fluid is applied to the upper side of the piston 11, the setter 20 and spindle 30 continue to be lowered but the plunger 26 remains substantially stationary against the bit face. The plunger is lowered because the ram has positive contact with it, but the spindle is not lowered because most of the movement of the ram is absorbed by the spring 40. The setter moves downward and the spindle 30 moves downward through the bore 28 of the plunger.

The rounded surface 44 on the end of the spindle 30 contacts the rounded surface of the button. As the ram 13 and spindle continue to move downward, the spring 40 is compressed and the spindle begins to push the button into the bit blank 60. This step is clearly shown in FIG. 3. Continued downward movement pushes the insert 50 farther into the blank. Because the spring 40 is being compressed, the force of the ram is being transferred to the plunger 20 and thus the plunger moves downward. The downward movement of the plunger 26, while the button is being pushed into the blank, crimps the bit face around the edge of the button 50, as is best shown in FIG. 4.

The downward movement of the press is limited so that the insert extends above the face of the blank a predetermined distance. The force of the hydraulic press is such that the button is pushed into the blank the desired depth, i.e., enough of the button 50 projects above the blank face to do the proper drilling. The press is designed so that it has insufficient force to push the button any farther into the blank. The ram 13 cannot be lowered any farther.

As the blank is cooled, the metal of the blank shrinks around the button and this, combined with the crimping, holds the button firmly in place.

The piston 11 is then raised along with the ram 13 and setter 20 by supplying hydraulic fluid to the lower side of the piston through the conduit 6. As the setter is

raised, the spring 40 biases the plunger away from the spindle 30, and the portion 31 of the spindle is raised past the opening 29, and another button is forced into the bore 28 and ready to be set. The jig and blank are then moved to a new location relative to the setter, and the next button is ready to be inserted.

With the method of this invention, it is possible to insert other shape buttons such as the tapered button shown in FIGS. 5 and 6. When this button is inserted, the bit blank tends to open up as large as the largest diameter of the insert 51. This opening 62 is best shown in FIG. 5 which shows the button being forced into the blank but before any crimping action. The opening 62 is closed by the crimping action, as clearly shown in FIG. 6.

Although a simplified apparatus has been shown for carrying out the method of this invention, other apparatus may be used. If desired, a forging press may be used rather than a simple hydraulic press. A forging press will hammer the buttons into place rather than push them in. More sophisticated setting and feeding devices may be used. Additionally, it is considered that it is within the scope of this invention to provide a plurality of setter means and presses so that many or all of the buttons may be inserted into the bit blank at the same time rather than at one at a time.

As is readily apparent from the above description, the number of steps required for inserting a button into a bit blank has been substantially reduced. By the method of this invention, it is not necessary to pre-drill a hole in the blank although this may be done, if desired. The necessity of making the buttons of accurate size is reduced. All that is required is that the blank be properly aligned so that the button is inserted in the proper location. Alignment is only required once, whereas, in prior methods, the blank had to be properly aligned at least twice, once for drilling and once for inserting the button.

Having described a preferred embodiment, it is intended that this invention not be limited in any way except by that which is within the scope of the appended claims.

I claim:

1. The method of making a drill bit comprising the steps of:

holding a bit blank having a solid surface;
holding at least one insert adjacent the surface of said bit blank; and

forcing each insert into said bit blank so that the portion of said insert which is below the surface of said bit blank is substantially completely surrounded by the material of said bit blank so that said insert is tightly held in said bit blank and movement of said insert relative to said bit blank is prohibited.

2. The method of claim 1 wherein each insert is forced into said bit blank until the top of the insert extends above the surface of said bit blank a predetermined distance.

3. The method of claim 1 wherein each insert is forced into said bit blank by the application of a steady force on the insert.

4. The method in accordance with claim 2 further comprising the step of crimping said bit blank around the insert.

5. The method in accordance with claim 4 wherein said blank is heated before the insert is forced into said bit blank.

6. Apparatus for forcing at least one insert into a bit blank to thereby form a drill bit comprising:

a first member having an axial bore therein;
spindle means mounted for reciprocating movement in said axial bore;

means for placing an insert adjacent said spindle means;
press means for acting on said spindle means to force said insert into the surface of a bit blank; and
means operable by said press means for crimping the material of a bit blank around said insert.

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7. The method of making a drill bit for drilling a hole in rock comprising the steps of:

holding a bit blank;

holding an insert which is dimensioned so that its base is larger than its top adjacent the surface of said bit blank; and

forcing said insert into said blank so that the base of said insert is embedded in said bit blank and the top of said insert projects above the surface of said bit blank and that portion of the insert which is below the surface of said bit blank is supported on all sides by said bit blank.

8. A drill bit for boring a hole in rock, earth or the like comprising a bit body and at least one hardened metal insert partially embedded in said bit body; said insert being dimensioned so that its base is larger in area than the cross-sectional area of the portion adjacent the surface of said bit body said insert being embedded in said bit

body so that its top projects above the surface of said bit body and that portion which is below the surface of said bit body is supported on all surfaces by said bit body.

9. The drill bit of claim 8 wherein said insert is substantially conical in shape.

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