

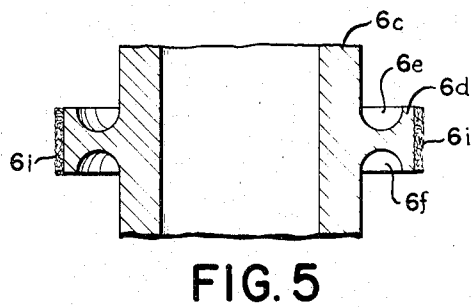
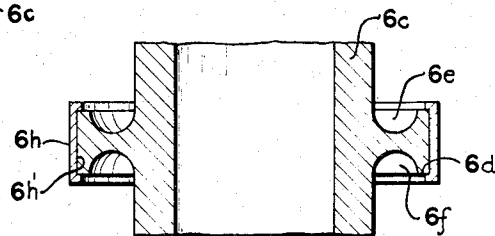
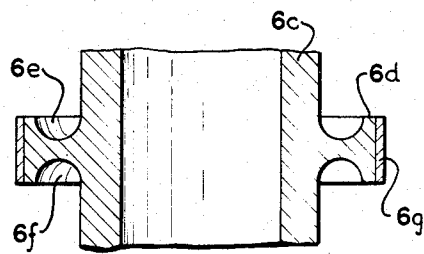
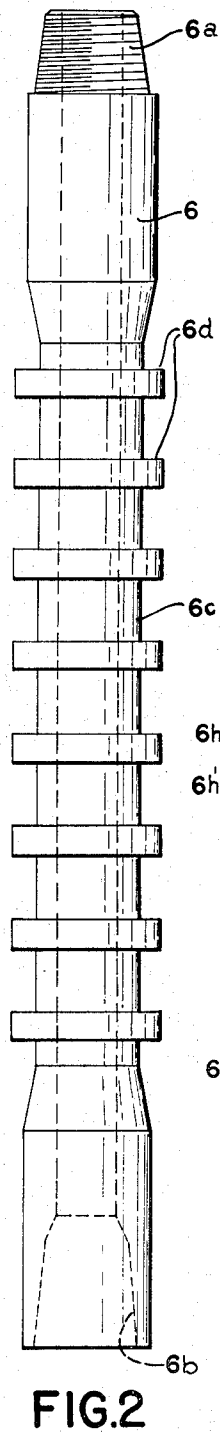
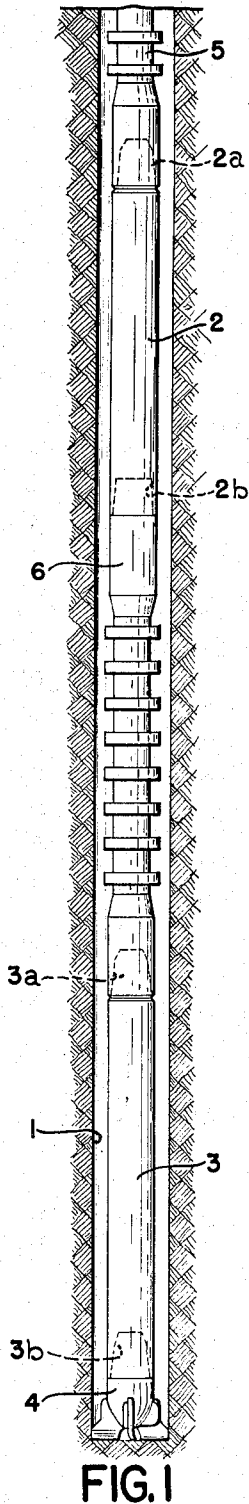
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COUPLING

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COUPLING

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This invention relates to couplings and it will be found particularly useful in rotary deep well drill stems.

The conventional rotary drill stem includes a number of drill pipe sections connected end to end, and a drill collar connected to the lowermost pipe section. The drill bit is connected to the lower end of the drill collar. And at times a plurality of drill collars are interposed between the lowermost pipe section and the drill bit.

A drill collar is a relatively heavy, rigid, tubular member provided with threaded pin and box connections whereby it may be connected to the bit and to the lowermost pipe section of the drill stem. Or a plurality of drill collars may be thereby connected together. And when the drill stem is rotated in the usual drilling operations, this results in a bending load on the pins, and the reversal of stresses fatigues and at times breaks the pins.

This invention has for one of its specific objects the provision of a new and improved coupling which may be used to connect a plurality of drill collars to each other, a drill collar to the lowermost pipe section of the drill stem, or a drill collar to the drill bit, the coupling being relatively flexible to prevent objectionable reversal of stresses in the said pin and box connections and thereby prevent failures thereof.

Another specific object of the invention is to provide a coupling which is relatively flexible and is so constructed as to prevent the concentration of stresses in the coupling itself.

A further specific object of this invention is to provide a coupling embodying wear resisting elements which may be readily replaced when worn.

The invention also has for its object the provision in a drill collar, or other drill stem member, of a body of heat treated material, an element of wear resisting material, and means to support the element on the body and to reduce the transfer of heat from the element to the body, so that the heat treated structure of the body will be protected from substantial injury when heat is applied to the element.

Other objects of the invention will hereinafter appear.

The preferred embodiments of the invention are illustrated in the accompanying drawings wherein Fig. 1 is an elevation illustrating one embodiment of the invention in an assembly in the well.

Fig. 2 is an enlarged view of the coupling included in the assembly of Fig. 1;

Fig. 3 is a fragmentary detailed view illustrating the flanges and wear resisting rings on the coupling shown by Fig. 2; and

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Fig. 4 is a fragmentary detailed view of another embodiment of the flange and wear resisting ring construction.

Fig. 5 is a fragmentary detailed view of another embodiment in which hard metal is welded to the periphery of the flange to provide a wear resisting surface.

Referring to Fig. 1 the well bore is indicated at 1, drill collars at 2 and 3 and the bit at 4. The new and improved couplings provided by this invention are indicated by the numerals 5 and 6. The coupling 5 may be connected to another drill collar or to the usual drill stem (not shown). It will be noted that the collar 2 has a threaded pin 2a shown in dotted lines and a threaded box shown in dotted lines at 2b, and that the collar 3 has a corresponding pin and box 3a and 3b.

It has been customary to screw the pin 3a of the collar 3 into the box 2b of the collar 2, and the pin 3a has been frequently broken by the resulting bending load, and reversal of stresses during drilling operations. In the embodiment of this invention shown by Fig. 1, the new and improved coupling 6 which is relatively flexible is connected between the drill collars 2 and 3 which are relatively rigid. Another flexible coupling 5 is connected between the drill collar 2 and another drill collar or the usual drill stem (not shown). It will be understood that the flexible coupling may be used to connect the drill stem (not shown) to the bit 4, or to connect the collar 3 to the bit 4. Various other desirable assemblies to meet various conditions encountered will be apparent to those skilled in the art.

Referring now to Fig. 2 which is an enlarged view of the coupling, the numeral 6 indicates the body of the coupling having a threaded pin 6a and a threaded box 6b which constitute the connecting means on the ends of the body, and a reduced section 6c therebetween. Upon the reduced section are a plurality of axially spaced annular flanges 6d the outside diameter of which is slightly greater than the outside diameter of the body 6, and the construction of which is more fully set forth in Fig. 3. Referring to Fig. 3, the reduced section is indicated at 6c and the annular flange at 6d. The upper surface of the flange 6d has an annular groove 6e therein adjacent the reduced section 6c and the lower surface of the flange has an annular groove 6f therein adjacent the reduced section 6c, the walls of these grooves being rounded as shown. On the periphery of the flange 6d is a ring of hard surfacing material 6g such as tungsten carbide which is applied with the usual torch. The pur-

pose of the hard surfacing material 6g is to resist wear of the flanges 6d. As above stated, the reduced section 6c is flexible and when it flexes the rings 6g will bear against the wall of the drill hole 1 (Fig. 1) and reduce the wear on that part of the drill stem. The cutting of the grooves 6e and 6f in the flanges 6d will leave only a relatively small web, and this will reduce the transfer of the heat of the torch (used in applying the hard surfacing material 6g) to the reduced section 6c. This is important in this embodiment because the reduced section 6c will be heat treated before the hard surfacing material 6g is applied and the relatively small web just referred to will not transfer sufficient heat to the section 6c to destroy the structure of the steel produced by the heat treatment thereof. And as above stated, the walls of the grooves 6e and 6f are rounded to prevent the concentration of stresses in the coupling itself and consequent failure thereof. In this connection the radius between the web and the reduced section 6c may be made relatively large. When the hard surfacing material 6g has been worn away in use, a new coupling may be substituted for the worn coupling and the worn coupling may then be repaired in the field by the addition of hard surfacing material without danger of damaging the heat treated inner section 6g, or the worn coupling may be shipped to the plant for repair. Since the coupling is relatively small and light compared with the drill collars, it may be more readily handled and shipped.

Referring now to Fig. 4, in this embodiment the reduced section is indicated at 6c, the flange at 6d and the grooves at 6e and 6f, the only difference between this construction and the construction shown by Fig. 3 being that a ring of hard surfacing material 6h in the Fig. 4 construction is shaped to fit the flange 6d as shown and may be shrunk thereon at the drilling rig. In other words, the ring 6h may be made separately from the flange 6d, heated, and then placed upon the flange to cool. When the ring 6h cools, it will contact and will snugly engage the flange 6d as shown. To hold the shrunk ring 6h firmly in place, it may be provided with a groove 6i to receive the flange 6d, as shown. Therefore when the rings 6h become worn in use they may be removed from the flanges 6d and the new rings may be shrunk on the flanges to take the place of the worn rings.

In Fig. 5 the reduced section is indicated at 6c, the flange at 6d, and the grooves at 6e and 6f. In this embodiment, the hard metal is welded to the flange 6d at 6i to form a wear resisting surface.

It will be apparent from the foregoing that since the couplings 5 are flexible that the bending loads on the pins 3a and 2a will be relieved and consequent failure thereof prevented.

In the above description, the coupling section 6c, in Figs. 3, 4 and 5, is referred to as the "reduced section." It will be understood that the flange and wear resisting ring or surface may be used in combination with a drill collar, or with any other drill stem member.

The invention is not limited to the preferred embodiments herein disclosed. Various changes will occur to those skilled in the art, within the scope of the following claims.

Having described my invention, I claim:

1. A drill stem coupling having a tubular body, said body having connecting means on each end, a relatively inherently flexible reduced section forming part of the body between said ends, and a plurality of axially spaced annular flanges on said reduced section, the outside diameter of said flanges being slightly greater than the outside diameter of said ends so that said flanges will engage the wall of a well bore when the reduced section is flexed to protect the ends of the body from excessive wear, the upper and lower surfaces of said flanges having annular grooves adjacent said reduced section, the walls of said grooves being rounded, and the peripheries of said flanges being hard surfaced.

2. A drill stem coupling including, an elongated tubular body having its end portions of a predetermined diameter and having connecting means in said end portions whereby the coupling may be connected in a drill string, said end portions being relatively short as compared to the over-all length of the body, the elongate intermediate section of the body between said ends being reduced in external diameter and having sufficient length with respect to its diameter to impart flexibility thereto to thereby relieve the end connecting means of bending loads, a plurality of annular protector rings spaced longitudinally of the elongate intermediate section with each ring having an external diameter greater than the external diameter of the end portions of the body, and an annular web extending between each ring and the body, each web and ring being made integral with the body.

3. A drill stem coupling as set forth in claim 2, wherein hard surfacing material is welded onto the peripheral surface of each ring, and also wherein each web has an annular groove in its upper surface and a similar groove in its lower surface to reduce the thickness of the web and thereby decrease the transfer of heat from the ring to the body during welding of said hard surfacing material to said ring.

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