May 15, 1951 A. T. BOATRIGHT 2,552,618

PIPE SLIP INSERT

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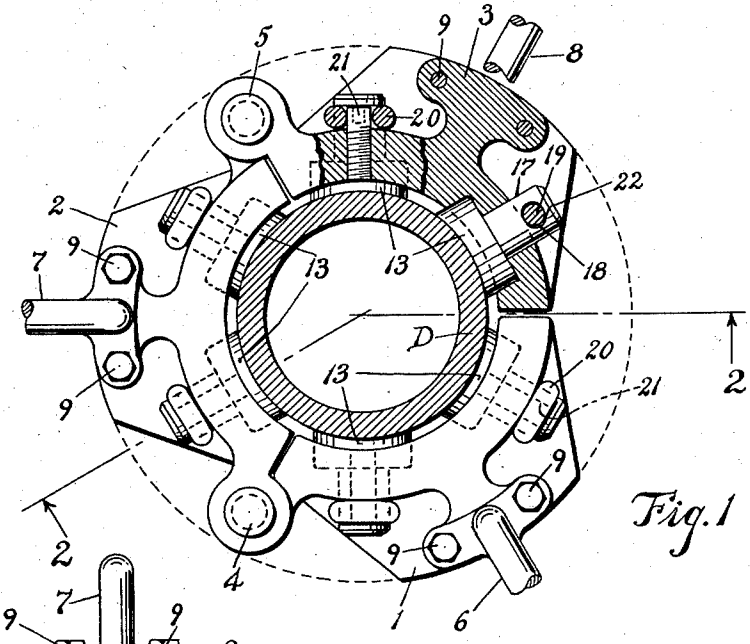


Fig. 1

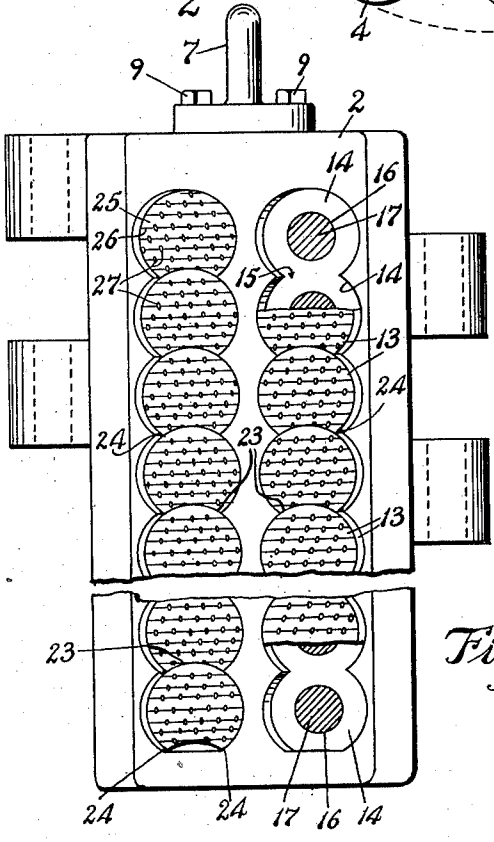


Fig. 3

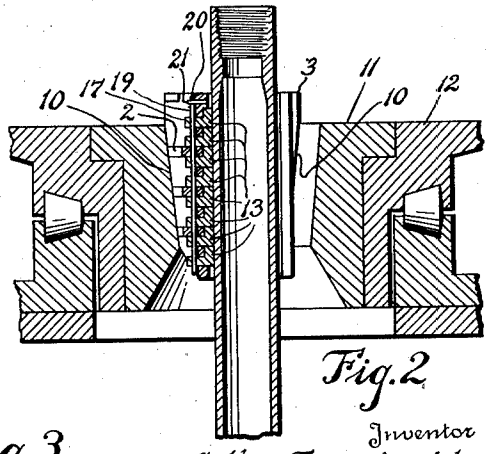


Fig. 2

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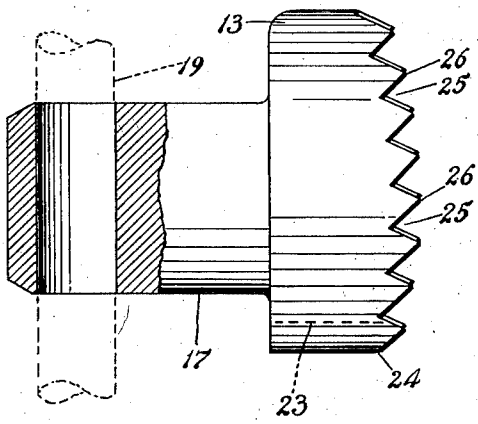


Fig. 4

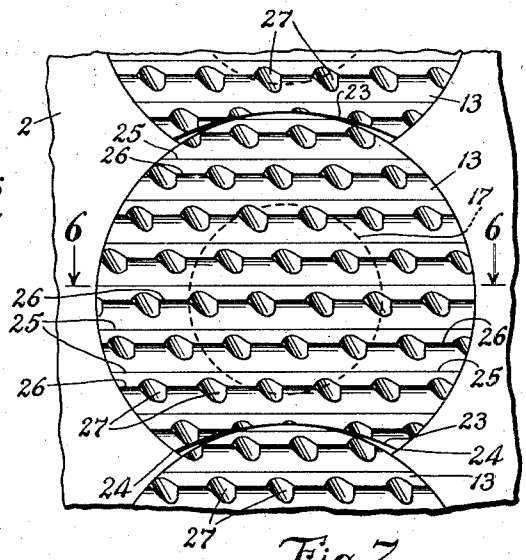


Fig. 7

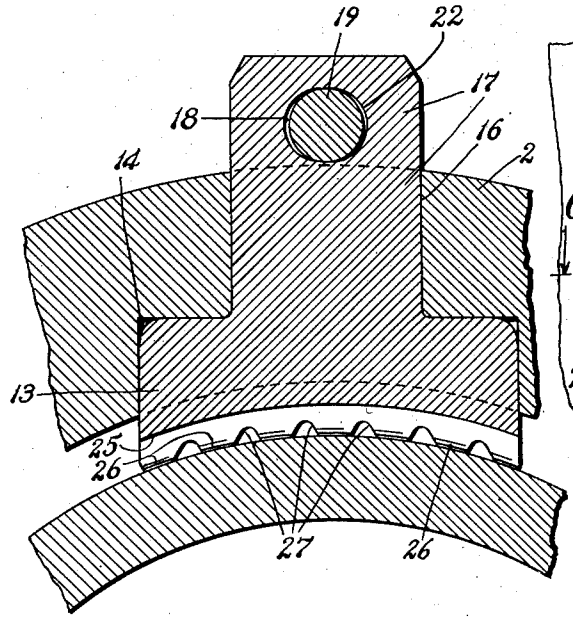


Fig. 6

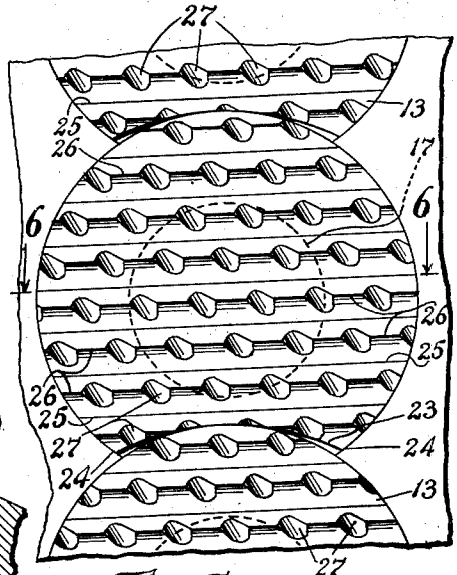


Fig. 5

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UNITED STATES PATENT OFFICE

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PIPE SLIP INSERT

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4 Claims. (Cl. 24—263)

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This invention relates to improvements in drill pipe slips used in the handling of drilling tool strings incident to the lowering or raising of such strings into or out of a well casing. The slip is a device which engages the rotary table at the top of the casing and which by a wedging or other clamping action operates to engage and hold the drill string suspended while sections of drill pipe are added or removed as the drill string is lowered or raised.

One of the most common forms of drill pipe slips in current general use is of the general type shown in United States Letters Patent No. 2,119,731 comprising two or more hingedly articulated body members, the outer faces of said members being shaped to form portions of an inverted frusto-conical surface, the axis of which is substantially coincident with the axis of the drill string. The inner faces of the body members form a cylinder through which the drill pipe passes and are provided with one or more series of vertically disposed, overlapping counterbores in which are located a series of disc-like inserts having pipe-engaging teeth adapted to grip the drill pipe by reason of the wedging engagement of the inclined outer face of the body members with the rotary table. The inserts are provided with integral shanks disposed centrally thereof and extending through holes in the sidewalls of the body members to the outer faces thereof where they are engaged by a suitable locking means usually in the form of a rod extending through holes in the shank elements of one group or series of inserts. The holes through which the shanks of the inserts in each series extend are spaced closer together than the diameters of the discs and the discs are therefore formed with abutting, flattened sides to resist any tendency to turn. These flattened sides are equidistant from the center of the disc and in the replacement of worn or dull inserts it is possible to place one or more inserts in an inverted position, resulting in such insert presenting to the pipe, teeth so disposed as to effect a decided reduction in the gripping efficiency of that insert and an increased risk of dropping the entire string. Recently, to overcome this danger at least in part, inserts have been provided with pyramid-shaped teeth so that regardless of how the insert may be applied, the same type of angle will be presented, although it is less efficient than the angle of a properly applied insert of the earlier type.

With the foregoing considerations in mind, it is an object of the present invention to provide a drill slip insert usable in a conventional form of drill slip body member which insert is so constructed that it cannot be placed in an inverted position.

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Another object of the invention is to provide a drill slip insert having the pipe-engaging teeth thereof disposed in staggered relation to each other for more efficient resistance to any tendency of the drill pipe to slip or to turn.

Still another object of the invention is to provide a drill pipe slip insert which is so constructed that upon any tendency of a drill pipe gripped thereby to turn, incident to the adding or removal of other sections of drill pipe, the insert will tend to turn about its own axis with consequent tighter engagement with the drill pipe.

A still further object of the invention is to provide a drill pipe insert having a periphery so shaped that the adjacent faces of adjacent inserts are disposed in close proximity to each other while at the same time permitting a slight amount of individual rotation whereby each insert is enabled to accommodate itself to such irregularities in the surface of the drill pipe as develop in normal usage.

Still another object of the invention is to provide a drill pipe slip insert in which at least one diameter of the pipe-engaging surface extends between points on the periphery of the surface which are disposed at different distances from the axis of the shank associated with the insert.

Still another object of the invention is to provide a drill pipe insert construction in which the teeth are formed as "rights" and "lefts" so that when a series of inserts are installed in a slip body in alternation, the tendency of the drill pipe to turn will be more efficiently resisted.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed and illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a top plan view of a drill pipe slip in which the present invention is incorporated; certain portions there being broken away for clearness of illustration,

Fig. 2 is a vertical, sectional view taken on the line 2—2 of Fig. 1,

Fig. 3 is a front elevational view of a slip body member supplied with pipe-gripping inserts of the present invention,

Fig. 4 is a side elevation of an insert embodying the principles of the invention,

Fig. 5 is a fragmentary, enlarged view of the

pipe-engaging face of a slip body member showing the tooth arrangement and the interengagement of the inserts in greater detail,

Fig. 6 is an enlarged fragmentary, sectional plan view taken on the line 6—6 of Fig. 3, and,

Fig. 7 is a view similar to Fig. 5, but showing a modification of the tooth arrangement on the face of the insert.

Referring first to Figs. 1, 2 and 3, there is shown a drill pipe slip body assembly comprising body members 1, 2 and 3 which are hinged together at 4 and 5 and which are provided with handle portions 6, 7 and 8 secured thereto by suitable bolts 9. The inner faces of the body members are curved and unite to form a circular outline of somewhat greater diameter than the drill pipe. The outer faces 10 of the body members are inclined upwardly and outwardly to form portions of an inverted frusto-conical surface, which portions engage the upper end of a main bushing 11 associated with the rotary table construction 12. The body members at their inner faces are provided with hardened steel inserts 13 adapted to engage a drill pipe and to be pressed into tight engagement therewith by the wedging action effected by the engagement of the outer inclined faces 10 with the main bushing 11 under the influence of the weight of the tool string which may be several tons. In the most common form of slip body members in current general use, the inner face thereof is provided with one or more series of vertically disposed counterbores 14 which are located closer together than the diameter of the counterbores, wherefore they intersect to form a relatively wide, shallow channel 15, the sidewalls of which are in the form of a series of pairs of opposed segments of circles. Extending through the wall of the body member to the outer face thereof at the center of each counterbore is a hole 16 through which the shank 17 of the insert extends. It will be noted from Fig. 1 that the series or sets of counterbores and the holes 16 are radially disposed about the axis of the drill pipe D so that the gripping pressure of the inserts is exerted in directions normal to and intersecting said axis. At its outer end, each insert shank is provided with a vertically disposed, transverse hole 18 and a rod 19 extends through these holes in each vertically disposed series of shanks to hold the inserts in assembly with the body member. Any suitable means may be used to secure the rod 19 in place, as by forming the rod with an eye portion 20 through which a screw 21 extends and is threaded into the body member. Thus this single screw serves to hold an entire series of inserts in place, facilitating the replacement of inserts as is frequently necessary. All of the foregoing construction is known in the art and the present invention is particularly directed to improvements thereover which will now be specifically described.

Heretofore, the inserts employed in body members of the type described have been formed with abutting flattened sides disposed at the points of intersection of adjacent counterbores. Further to acccommodate this construction, the bottom counterbore of each series was formed with flat sidewall to engage the lower flat side of the lowermost insert of each series of inserts. Since the inserts were formed with parallel, flat sides equidistant from the axis of the shank, they could be placed in the body member in inverted position with disadvantages that have been mentioned. Also, since these flat sides were of considerable length and were held in abutting relation, rotation of the inserts was effectually prevented.

In normal use, the ends of drill pipe sections become worn or acquire scores or other irregularities from frequent engagement with slips or wrenches incident to the adding or removal of sections. If the insert is permitted to rotate slightly, about the axis of its shank, it is enabled to accommodate itself to such conditions and to engage the pipe at the sides of the insert, since the effect of such rotation is to, in effect, adapt the pipe-engaging face of the insert to a slightly lesser diameter of pipe. To this end it will be noted that the hole 18 in the insert shanks is made slightly wider as at 22 so that this movement may take place without sacrificing the closer fit of the rod 19 in the holes in the direction of the axis of the shank.

The pipe-engaging face of each insert is circular in form and is of such diameter as to fit within one of the counterbores. Each insert at its lower edge is cut away as at 23 to receive the upper face of the insert immediately below and this cut-away portion is given a somewhat larger radius than the radius of the insert fitting therein to provide clearance whereby the inserts may each partake of limited rotative movements about axes of the counterbores, the projection of the lower insert into the cut-away portion of the upper insert serving as a stop to limit the extent of movement of the upper insert. The points 24, 24 at each side of the cut-away portion of each insert are disposed near the points of intersection of adjacent counterbores and thus in the case of the lowermost insert of each vertically disposed series, these points will engage the flat sidewall of the lowermost counterbore in each series and will be prevented from turning and by the interengagement previously described, each insert will prevent the insert above it from more than the limited rotative movement provided for. Further, since the lowermost insert of each series or group can be placed in its counterbore in only one position, it follows that all of the other inserts in the group can be inserted only in a corresponding position, making it impossible to place any insert in the body member in an inverted position.

The toothed pipe-engaging face of each insert is curved to fit the size of drill pipe for which it is intended as best shown in Figs. 1 and 6. The teeth are formed by cutting a series of grooves 25 transversely of the face of the insert, the grooves being so spaced and of such depth as to produce a series of sharp edges having the desired radius to accommodate the drill pipe. An economical manner of cutting these grooves is to place a number of inserts in a circle in a suitable fixture and to cut a thread having a minor diameter equal to the diameter of the drill pipe in the faces of the inserts. This produces grooves which have a slight inclination with respect to the horizontal as most clearly shown in Figs. 3 and 5. Alternatively, the grooves may be milled in so as to produce a horizontal tooth face as shown in Fig. 7, or if an extreme angle is desired, a double or triple thread may be cut in the manner described above. Following the cutting of the teeth in any suitable manner, the teeth are notched as at 27, the notches preferably being staggered so that a considerable vertical space will exist between at least a portion of each tooth and the next tooth vertically above it. Also, if desired, the inserts may be formed

as "rights" and "lefts" either by cutting the grooves as right and left hand threads or by the arrangement of the notches 27 or both as may be found most expedient.

While the slip is holding the drill string suspended incident to the addition or removal of sections of drill pipe, the slip must frequently resist the turning movement of the pipe. The cut-away portion at the under side of the insert in addition to its rotation-preventing function possesses another advantage in that since its upper edge is farther away from the axial line of the shank than the lower edge, any tendency of the drill pipe to turn will cause each insert also to tend to turn about its axis with resultant tighter engagement of the drill pipe by the side portions of the inserts, an action which cannot be obtained when the pipe-engaging area of the insert is uniformly disposed about the axis of its shank as has been the practice heretofore.

Thus it is that there has been created an insert for drill pipe slips which may be installed in existing slip body structures which cannot be wrongly placed therein and which therefore may be provided with the most efficient form of pipe-engaging teeth. Further, by the improved construction, each insert is free to adjust itself to the surface conditions of the drill pipe. Still further, any tendency of the drill pipe to turn is resisted by the creation of a tighter engagement with the slip.

While I have shown and described a specific embodiment of my invention, I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

In the foregoing specification, the invention has been described in connection with drill pipe slips and it will be of great value for that purpose. It is not intended by such description, however, to limit the invention to that use since the principles may be used with equal advantage in tubing and casing slips or other places where it is desired to hold a pipe by a series of removable inserts so mounted as to have capacity for independent accommodation to the surface of the pipe, tube or casing engaged thereby.

I claim:

1. The combination with a drill pipe slip body member having on the inner face thereof a shallow, vertically disposed channel formed by a series of overlapping counterbores, of a series of pipe-engaging inserts loosely secured to said body member and disposed one in each of said counterbores; each of said inserts comprising a shank portion mounted in said body member and an integrally formed pipe-engaging portion in the form of a disc axially aligned with said shank and seated in one of said counterbores; said disc having an end face provided with pipe-engaging teeth projecting beyond said inner face and being curved to conform to the surface of a drill pipe to be engaged thereby, said disc portion further having at one point on its periphery a concave recess into which the convex edge portion

of an adjacent insert may extend; the engagement between said recess and said convex edge serving to permit limited, independent, rotative movements of said inserts.

2. As an article of manufacture, a pipe-engaging insert for use in drill pipe slips, said insert comprising a cylindrical shank portion and an integral pipe-engaging portion in the form of a disc axially aligned with said shank, said pipe-engaging portion having an end face provided with pipe-engaging teeth arranged to conform to the periphery of a drill pipe to be engaged thereby and having an edge thereof provided with a concave recess into which the edge portion of another insert may extend to limit the extent of rotative movement of said insert.

3. The combination with a pipe slip body member having on the inner face thereof a vertically disposed channel, of a series of pipe-engaging inserts disposed in said channel and having shanks mounted in and extending through said body member with capacity for limited rotative movement about the axes of said shanks, and means for securing said inserts in said body member comprising a vertically disposed hole in each of said shanks and a rod extending through all of said holes; said holes being wider transversely of the axes of said shanks than parallel thereto to permit said limited rotative movement while preventing endwise movement of said shanks relative to said rod.

4. The combination with a drill pipe slip body member having on the inner face thereof a shallow, vertically disposed channel formed by a series of overlapping counterbores, of a series of pipe-engaging inserts loosely secured to said body member and disposed one in each of said counterbores; each of said inserts comprising a shank portion mounted in said body member and an integrally formed pipe-engaging portion in the form of a disc axially aligned with said shank and seated in one of said counterbores; said disc having an end face provided with pipe-engaging teeth projecting beyond said inner face and being curved to conform to the surface of a drill pipe to be engaged thereby; said disc portion further having at one point in its periphery a concave recess into which the convex edge portion of an adjacent insert may extend; the engagements between the said recesses and convex edges of said inserts being effective to prevent inverted installation of any insert in the series.

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