July 2, 1929. J. A. CADY 1,719,533

PIPE SLIP

Filed June 25, 1925

Fig. 4.

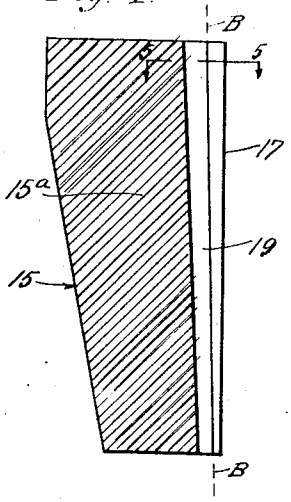


Fig. 1.

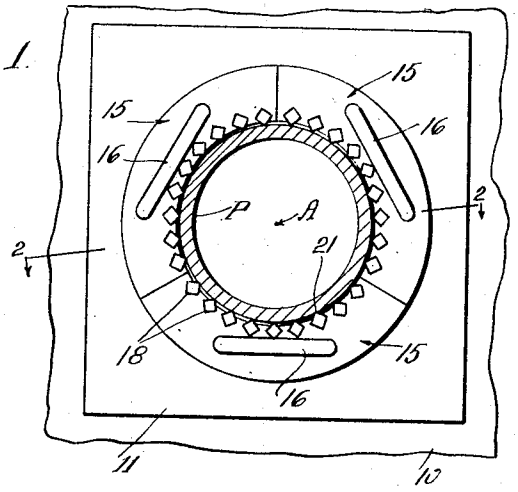


Fig. 6.

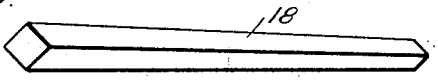


Fig. 2.

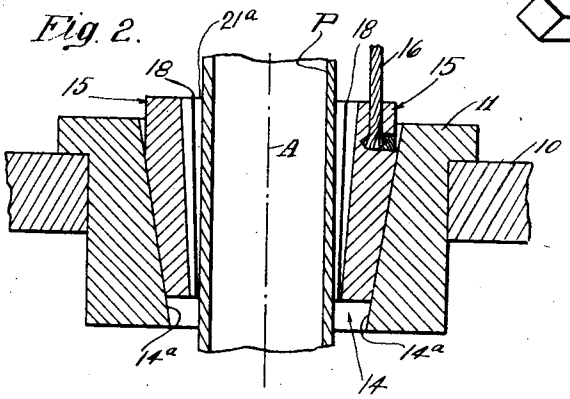


Fig. 5.

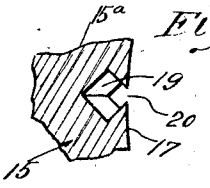


Fig. 3.

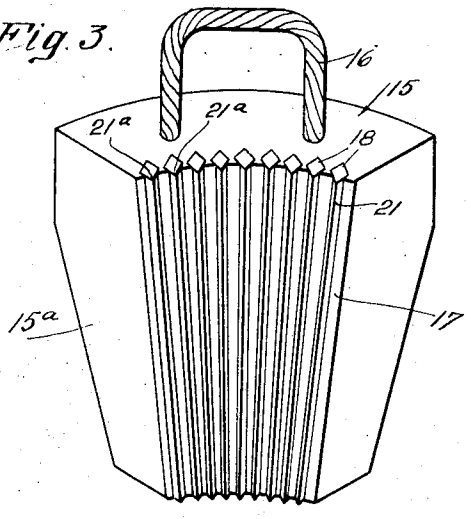
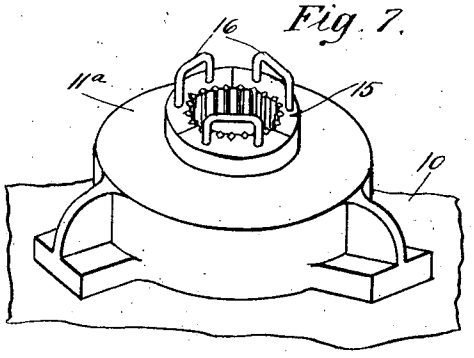


Fig. 7.



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UNITED STATES PATENT OFFICE.

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PIPE SLIP.

Application filed June 25, 1925. Serial No. 39,463.

This invention relates to slips used for suspending casing or drill pipe within well bores while lengths or stands are being added to or detached from "strings" during the operation of sinking artesian or oil wells.

While, in its broader aspects, the invention is applicable to pipe holding devices used in either the standard or rotary system of well drilling, it is especially adaptable to the handling of drill stem. Therefore, I will confine the major portion of the following description to the use of the slips in connection with rotary drilling mechanism, though this is not to be construed as in any way limiting the invention.

In order to point out certain conditions existing during well drilling operations, which conditions have direct bearing on certain structural features of slips, consider, for example, the process of lowering a string of drill pipe. The pipe is first set up on the derrick floor in "stands", each stand consisting of several lengths of pipe coupled end to end. By means of an elevator carried by the hoisting cable, the first stand is picked up and lowered through a so-called "table" or "master-bushing" in the center of the rotary table, and allowed to gravitate into the well bore. By braking the hoisting drum, the stand is brought to rest with its upper end protruding above the master bushing. Thereupon "slips" are used to suspend the string from the rotary table so the elevator may be detached and moved to pick up a second stand which is subsequently coupled to the first. Then the two stands are lifted slightly by the elevator so the slips may be removed, whereupon the coupled stands are lowered. This process is repeated until the entire string is in, and also every time a new stand is added while the drill is "making hole."

The slips are in the nature of segmental wedges which fit within a tapered bore in the master bushing and ordinarily have annular serrations or "wickers" on their inner faces for gripping the pipe. They are lowered into the master bushing and around the pipe just before it is desired to stop gravitation of the string, the segments being wedged towards the pipe until they grip it with sufficient tightness to support the string without the aid of the elevator. Especially when called upon to suspend great lengths of pipe, the slip serrations wear away rapidly, so the useful life of the slips is comparatively short. The consequent necessity of frequently replacing the slips or of re-sharpening the wickers, after first annealing the slips, are matters of considerable expense, and, at best, these operations consume valuable time.

Furthermore, the annular wickers bite into the pipe across its grain (the grain running longitudinally of the pipe) tending to crush the pipe and greatly weakening it. Since the slips are always applied to the same point on a given length of pipe, repeated slip application soon weakens the pipe to such an extent that pipe failure often results. Observations in the field prove that "twist-offs" most frequently occur at points of slip application.

Therefore, it is among the objects of my invention to provide slips having replaceable, hardened steel dies (the body of the slips may be of softer, cheaper metal) which may be easily and quickly inserted in or removed from the body portions of the slip segments. As a further feature, the cross-section characteristics of the dies are such that a given die has several surfaces adapted to be presented to and engage work, so when one such surface wears, the die may be turned about to present a new, sharp work engagement surface.

The dies are in the form of elongated keys, which extend longitudinally in parallelism with the axis of the slips and therefore with the grain of the pipe gripped thereby. As a consequence, the gripping edges of the die do not tend to cut or crush the pipe across its grain.

Other novel features and objects of the invention will be made apparent in the following detailed description, reference being made to the accompanying drawings, in which:

Fig. 1 is a top plan view of a slip embodying my invention and shown in connection with the master bushing of a rotary table;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a perspective view of a slip segment made in accordance with my invention;

Fig. 4 is an enlarged section through a slip segment showing the die receiving way or recess;

Fig. 5 is a section on line 5—5 of Fig. 4;

Fig. 6 is a perspective view of a die used in connection with the slips; and

Fig. 7 is a perspective view of my novel

slips as used in connection with a "spider" or "ring."

In the drawings, numeral 10 designates a rotary table of usual construction, through the center of which extends a usual table or master bushing 11. Drill pipe (during casing setting operations, well pipe or casing is substituted for drill pipe) extends through and normally rotates freely within open bore 14 of this bushing.

Bore 14 tapers inwardly and downwardly to form wedge face 14ª to receive the similarly tapered wedges or segments 15. The complete assembly of the several segments (usually three or more in number) making up a complete pipe gripping device, will be termed "a slip." Bails or handles 16 are secured to the segmental members in any suitable manner (for instance, the bail ends may be "leaded in") and provide means for manually raising and lowering the segments from and to operative position.

Without now specifying my particular improvement, it may be explained that segments 15 are normally kept entirely clear of the master bushing. When it is desired to suspend pipe P by means other than the usual elevator, the wedges are lowered into the positions illustrated in Figs. 1 and 2, their inner, arcuate faces 17 being concentric with the common axis A of the assembled slips, master bushing and pipe P, so said inner faces or gripping elements extending therefrom, frictionally engage the pipe. The pipe, in its limited continued downward movement draws the wedges downwardly, and the latter, in coacting with the face of tapered bore 14, are wedged into tight contact with the pipe and finally bring it to rest.

The body portion 15ª of each individual wedge or segment may be a casting or forging of relatively cheap metal, while the work engaging dies 18 carried thereby and extending outwardly beyond face 17, are preferably of hardened steel, so as to stand up well under the severe service conditions to which they are exposed. Dies 18 are in the form of elongated tapered keys of polygonal cross-section throughout their longitudinal extent, the degree of taper being such that they may be readily driven from their seats in complementary receiving ways or recesses 19 in body portions 15ª.

The axis B of each way 19 extends longitudinally of the associated segment, but is inclined with respect to the inner face of the segment and therefore with respect to the axis A of the slip. Preferably the angle of inclination of axis B is equal to the angle between the longitudinal axis of a given die and one of the die corner edges, and the way is so located that said axis B is removed from face 17 by a distance less than one half the corner to corner dimension of the die. Consequently, the way opens at 20 to face 17, the opening being in the nature of a constant width slot through which the corner edge 21 of die 18 is adapted to extend. There may be any desired number of spaced ways and associated dies.

From the above it will be seen that edge 21 projects beyond face 17 and extends longitudinally in substantial parallelism therewith. Consequently, when the segments are wedged inwardly, edges 21, throughout their longitudinal extent, are adapted to bite into pipe P and grip it firmly, the uppermost, sharp corner 21ª being especially effective as a grip. The dies thus extend substantially parallel to the grain of pipe P and therefore have lesser crushing tendencies than in cases where the dies or segment serrations cut across the grain.

When a given die becomes so worn that it is no longer fully efficient as a gripping element, it may be easily driven from its seat and replaced by a sharp die. By making the dies symmetrical in cross-section, they may be inserted in the body ways with any selected corner edge extending through the way slot. When that particular corner wears, the die may be driven out, turned to present a new corner edge to slot 20 and driven back into place. The economic advantage and time saving qualities of this feature are obvious.

In Fig. 7 segments 15 are shown in operative position within a ring or spider 11ª used, in certain situations, in place of master bushing 11.

It will be understood the drawings and description are merely illustrative of and not restrictive on the claim appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claim.

I claim:

In a work-holding device of the character described, a segmental body member, and an elongated and longitudinally tapered die tightly fitted in a recess provided in the body member, said recess being tapered complementary to the die, said die being arranged in the recess with its longitudinal axis at an angle with the concave face of the body member and having a gripping edge extending transversely beyond the concave face of the body member and extending longitudinally in parallelism therewith.

In witness that I claim the foregoing I have hereunto subscribed my name this 8th day of June, 1925.

JOHN A. CADY.