Jan. 17, 1933. W. L. McLAINE 1,894,519

DRILL PIPE PROTECTOR

Filed April 28, 1930

Fig. 1.

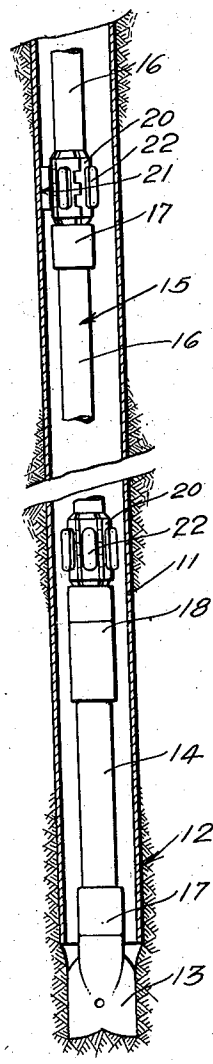


Fig. 2.

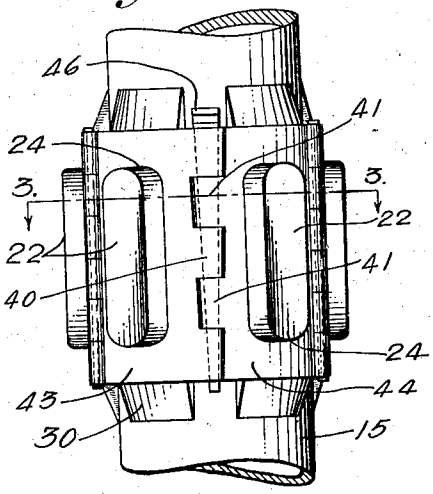


Fig. 3.

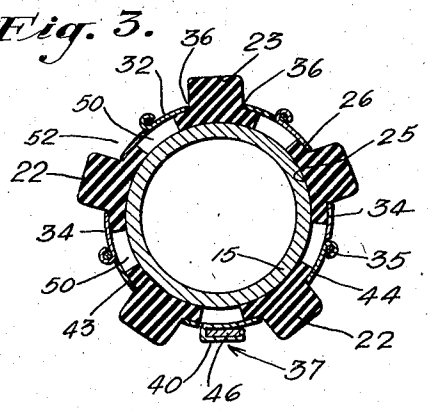
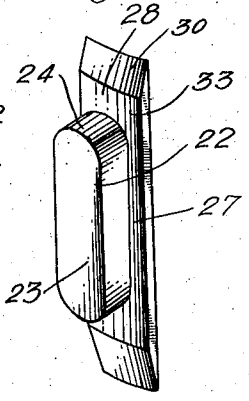


Fig. 4.



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UNITED STATES PATENT OFFICE

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DRILL PIPE PROTECTOR

Application filed April 28, 1930. Serial No. 447,911.

My invention relates to drill pipe protectors which are employed in the drilling of wells to prevent wear of the tool joints and couplings of a drill pipe against the casing or open wall of the well. In the rotary method of well drilling, to which the invention especially relates, a drill shaft is made up from lengths of drill pipe secured together by couplings and tool joints, and to the lower end of this drill shaft a drilling tool is secured. During the rotation of the drill shaft within the well, deflection occurs which brings portions of the drill shaft into engagement with the casing of the well or with the open wall of the well, with the result that the collars and tool joints of the drill shaft become rapidly worn so as to make replacement thereof frequently necessary, and in many instances the wear on the casing is such that holes are formed therein through which water may leak into the completed well, these holes being hard to locate and difficult to cement-off.

My invention comprehends a simple form of device which may be secured to the drill shaft adjacent to the couplings and tool joints thereof, which device is formed principally of a resilient wear-resisting material and projects outwardly to such an extent that engagement of the couplings and tool joints of the drill shaft with the casing or open wall of the well is prevented. The drill pipe protector includes a plurality of wear members having projecting engagement portions formed of a resilient material, such as a rubber compound, especially adapted for relatively non-frictional engagement with the well casing or open wall of the well. The engagement portions of the wear members project outwardly beyond the circumference of the couplings and tool joints by which the pipes of the drill shaft are secured together and therefore prevent wear on the drill shaft and reduce to a minimum the wear on the well casing resulting from the operation of the drill shaft therein.

It is an object of the invention to make a wear preventer of extremely simple construction having the wear receiving parts thereof replaceable and having a simple device for securing them in operative position on the drill shaft.

A further object of the invention is to provide a wear preventer having longitudinal circulation spaces or channels therein of ample size to permit a non-restricted flow of drilling mud upwardly around the drill shaft. Contributory to this feature of the invention, the replaceable wear members are made of longitudinal form and are held in place on the drill shaft in such circumferentially spaced relationship that longitudinal portions of the drill shaft are exposed between the longitudinal edges of the wear members, thereby forming circulation channels which extend along the surface of the drill shaft between the wear members.

A further object of the invention is to form laterally projecting flanges on the inner portions of the wear members and a clamping member adapted to extend around the outer faces of the flanges whereby the flanges may be forced inwardly against the surface of the drill shaft so as to securely hold the wear members in place.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawing which is for illustrative purposes only,

Figure 1 is a fragmentary elevational section illustrating the manner in which my invention is employed on a drill shaft within a well.

Fig. 2 is an enlarged elevational view showing a preferred form of the invention mounted on a fragment of a drill shaft.

Fig. 3 is a cross section on a plane represented by the line 3—3 of Fig. 2.

Fig. 4 is a perspective elevation of a wear member forming part of the invention.

For the purpose of illustrating the utility of the invention I have in Fig. 1 shown a portion of a casing 11 extending vertically within a well 12 which has been drilled by use of a drill bit 13 and other cooperating drilling tools. The drill bit 13 is secured by means of a drill stem 14 to the lower end of a string of drill pipe or drill shaft 15 consisting of lengths of drill pipe 16 secured

together by means of sleeve couplings 17 and tool joints 18. It is impossible to operate a drill shaft, such as the drill shaft 15, concentrically within a well of any considerable depth. In order to prevent engagement of the couplings 17 and tool joints 18 of the drill shaft 15 with the casing 11 or the open wall of the well, protectors 20 of my invention are placed on the drill shaft 15 at suitable intervals, it being customary to place these protectors 20 adjacent to the couplings and tool joints, in the manner shown. As clearly indicated, the protectors 20 each have a plurality of wear members 22 which, when the drill shaft 15 deflects, will engage the casing 11 or open wall of the well in the manner illustrated at 21, thereby preventing engagement of the drill shaft, its couplings, and its tool joints with the casing or wall of the well. As shown in Figs. 2, 3, and 4, the wear members 22 each consist of a body of a wear-resisting material, such as a rubber compound, such body having an outer wear receiving portion 23 of vertically elongated form and with rounded ends 24, as clearly shown in Figs. 2 and 4. The members 22 also each have an inner or shaft engaging portion 25 which includes a laterally projecting flange 26, such flange 26 consisting of relatively narrow side portions 27 and end portions 28 which are preferably chamfered, as indicated at 30. The inner face of the flange 26 is preferably continuous with the inner face of the complete wear member 22 of which the flange 26 forms a part. A plurality of these wear members 22 are spaced around the exterior of the drill shaft 15 and are securely held against displacement by securing means 32 adapted to engage the outer faces 33 of the flanges 26 and by inward pressure to compress the flanges 26 tightly against the shaft 15. The simple form of securing means 32 shown in the drawing includes a plurality of arcuated plates 34 joined together by hinges 35 and each having an opening 36 therein of such size and configuration that an outer or wear receiving portion of a wear member 22 may project therethrough. The portions of the arcuated plates 34 surrounding the openings 36 bear against the outer faces 33 of the flanges 26 and compress these flanges forcibly inwardly against the shaft 15, thus securing the wear members 22 in properly spaced positions on the shaft 15. The securing means 32 constitutes a cylindrical frame of contractile character, and a simple device 37 is provided for circumferentially constricting this securing means or frame 32 around the flanges 26 of the plurality of wear members 22. The device 37 consists of a plurality of interengaging or dovetailing flat loops 40 and 41 formed on the longitudinal edges of the extreme plate members 43 and 44 of the assembly of plate members forming the securing means or frame 32. The loops 40 and 41 decrease in width as they progress downwardly so as to correspond to the taper of a flat locking pin 46 which is driven down into the loops 40 and 41, in the manner shown in Fig. 2, to accomplish a drawing together of the edges of the extreme plate members 43 and 44 whereby to produce a reduction in the effective circumference of the securing means 32, which will result in clamping the flanges 26 of the wear members 22 tightly against the shaft 15. The securing means 32 holds the wear members 22 in such spaced relationship that circulation channels 50 exists between the opposing edges of the flanges 26, these channels 50 extending between the inner faces of the plate members 34 and the outer face of the shaft 15 and cooperate with the external vertical circulation channels formed by the circumferential spaces 52 existing between the outer or wear receiving portions of the wear members 22, thus giving ample space through which the upwardly moving drilling mud may pass as it flows toward the mouth of the well or well casing. The wear members 22 may be readily and economically replaced when they become worn and may be made with the flanges 26 thereof arcuated, in the manner shown in the drawing, or flat, if desired, it being evident that when the securing means 32 is applied to an assembly of wear members 22, the flanges 26 will be curved to arcuate form corresponding to the surface of the shaft 15.

I claim as my invention:

1. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members having a shaft engaging portion for engaging said shaft and an outwardly projecting wear receiving portion; and means for clamping said wear members inwardly against said shaft with longitudinal spaces between the shaft engaging portions thereof to permit circulation of fluid longitudinally of said shaft.

2. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members having a shaft engaging portion for engaging said shaft and an outwardly projecting wear receiving portion; and a clamp of cylindrical form engaging external faces of said wear members for securing said wear members in spaced relationship on said shaft member and with longitudinal spaces between the shaft engaging portions thereof to permit circulation of fluid longitudinally of said shaft.

3. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members

having a shaft engaging portion for engaging said shaft and an outwardly projecting wear receiving portion, said shaft engaging portions including laterally projecting flanges extending laterally outward on four sides and being of less radial thickness than said wear members; and means of smaller circumference than the circumference defined by the outer faces of said wear receiving portions for engaging said flanges so as to secure said wear members on said shaft.

4. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members having a shaft engaging portion for engaging said shaft member and an outwardly projecting wear receiving portion, said shaft engaging portions including walls of less radial thickness than said wear members; and a clamp of cylindrical form for securing said wear members in spaced relationship on said shaft member and with longitudinal spaces between the shaft engaging portions thereof to permit circulation of fluid longitudinally along said shaft member, said clamp having an external circumference less than the circumference defined by the outer faces of said wear receiving portions of said wear members and being adapted to engage said walls of said shaft engaging portions.

5. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members having a shaft engaging portion for engaging said shaft member and an outwardly projecting wear receiving portion, said shaft engaging portions including walls of less radial thickness than said wear members; and a clamp of cylindrical form for securing said wear members in spaced relationship on said shaft member and with longitudinal spaces between the shaft engaging portions thereof to permit circulation of fluid longitudinally along said shaft member, said clamp having an external circumference less than the circumference defined by the outer faces of said wear receiving portions of said wear members and being adapted to engage said walls of said shaft engaging portions, the inner face of said clamp being spaced from the surface of said shaft member.

6. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; and means for securing said wear members on said shaft member, said means consisting of a cylindrical frame having a plurality of circumferentially spaced openings of a size to permit passage of the outer portions of said wear members, said frame engaging the outer faces of said flanges of said wear members and compressing said flanges against said shaft member.

7. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; means for securing said wear members on said shaft member, said means consisting of a cylindrical frame having a plurality of circumferentially spaced openings of a size to permit passage of the outer portions of said wear members, said frame engaging the outer faces of said flanges of said wear members and compressing said flanges against said shaft member; and means for reducing the circumferential length of said frame whereby to constrict said frame around said flanges of said wear members.

8. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; and means for securing said wear members on said shaft member, said means consisting of a plurality of arcuated plates hinged one to the other and having openings therein through which the outer portions of said wear members may project, said plates bearing against the outer faces of said flanges of said wear members and compressing said flanges against said shaft member.

9. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; means for securing said wear members on said shaft member, said means consisting of a plurality of arcuated plates hinged one to the other and having openings therein through which the outer portions of said wear members may project, said plates bearing against the outer faces of said flanges of said wear members and compressing said flanges against said shaft member; and locking means operated between the extreme plates of said securing means to circumferentially constrict said securing means so as to clamp said flanges of said wear members against said shaft member.

10. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body

of wear resisting material having a laterally projecting flange at the inner portion thereof; and means for securing said wear members on said shaft member in such circumferentially spaced relationship that longitudinal circulation channels will exist between the edges of said flanges of said wear members, said means consisting of a cylindrical frame having a plurality of circumferentially spaced openings of a size to permit passage of the outer portions of said wear members, said frame engaging the outer faces of said flanges of said wear members and compressing said flanges against said shaft member.

11. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; and means for securing said wear members on said shaft member in such circumferentially spaced relationship that longitudinal circulation channels will exist between the edges of said flanges of said wear members, said means consisting of a plurality of arcuated plates hinged one to the other and having openings therein through which the outer portions of said wear members may project, said plates bearing against the outer faces of said flanges of said wear members and compressing said flanges against said shaft member.

12. A protector of the character described, including: a plurality of wear members adapted for placement on the exterior of a shaft member, each of said wear members consisting of a longitudinally elongated body of wear resisting material having a laterally projecting flange at the inner portion thereof; means for securing said wear members on said shaft member in such circumferentially spaced relationship that longitudinal circulation channels will exist between the edges of said flanges of said wear members, said means consisting of a plurality of arcuated plates hinged one to the other and having openings therein through which the outer portions of said wear members may project, said plates bearing against the outer faces of said flanges of said wear members and compressing said flanges against said shaft member; and locking means operated between the extreme plates of said securing means to circumferentially constrict said securing means so as to clamp said flanges of said wear members against said shaft member.

13. As an article of manufacture, a wear member for a protector of the character described, comprising a body of resilient wear resisting material having a laterally projecting flange at the inner portion thereof which extends laterally outward in four directions and is adapted to be compressed against the surface of a shaft member.

14. As an article of manufacture, a wear member for a protector of the character described, comprising an elongated body of resilient wear resisting material having a laterally projecting flange at the inner portion thereof which extends laterally outward in four directions and is adapted to be compressed against the surface of a shaft member.

15. As an article of manufacture, a wear member for a protector of the character described, comprising an elongated body of resilient wear resisting material having a laterally projecting flange at the inner portion thereof which extends laterally outward in four directions and is adapted to be compressed against the surface of a shaft member, the inner face of said flange being continuous with the inner face of said body.

16. In a drill pipe protector the combination of: a plurality of wear members adapted for placement on a drill pipe; separate means adapted to engage said wear members for clamping same to said drill pipe; and holding means for holding said wear members in predetermined positions on said drill pipe.

17. In a drill pipe protector the combination of: a plurality of wear members adapted for placement on a drill pipe; separate means adapted to engage said wear members for clamping same to said drill pipe; and holding means cooperating between said wear members and said separate means for holding said wear members in spaced relation around said drill pipe.

18. In a drill pipe protector the combination of: a plurality of wear members adapted for placement on a drill pipe; separate means adapted to engage said wear members for clamping same to said drill pipe, said separate means including band means adapted to engage external surfaces of said wear members and constricting means for said band means; and holding means for holding said wear members in predetermined positions on said drill pipe.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 22d day of April, 1930.

WILLIAM L. McLAINE.