

Dec. 19, 1933.

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1,940,332

DRILL PIPE PROTECTOR

Filed March 18, 1932

2 Sheets-Sheet 1

Fig. 1.

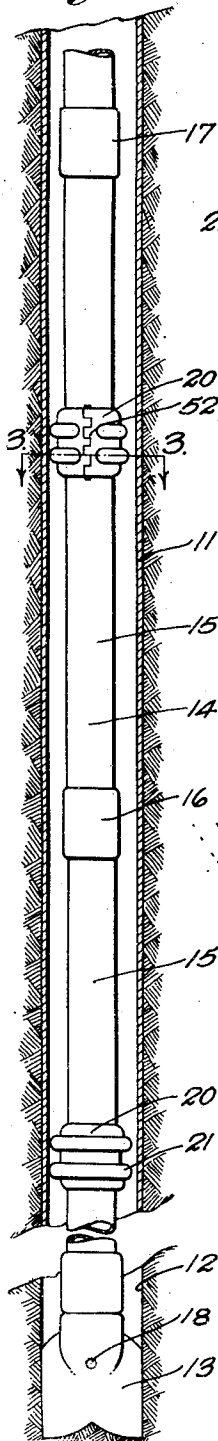


Fig. 2.

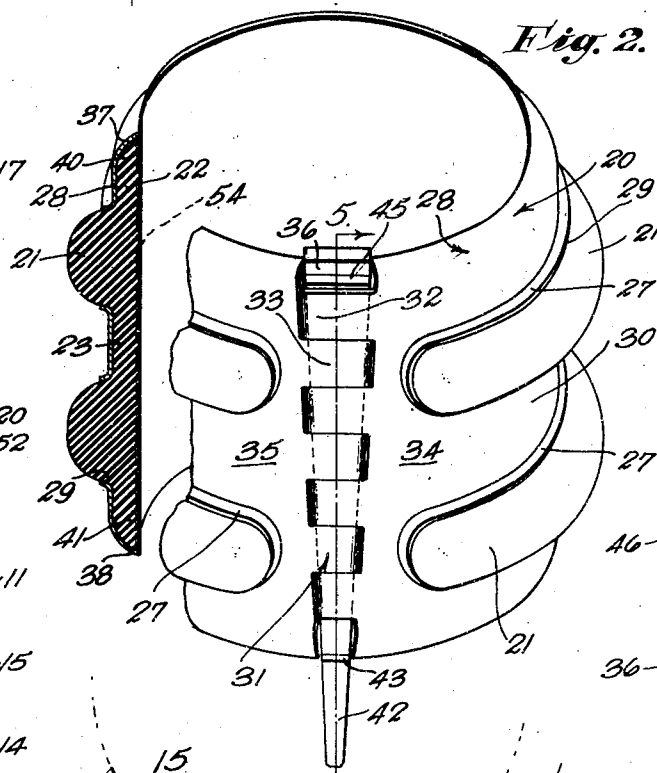


Fig. 3.

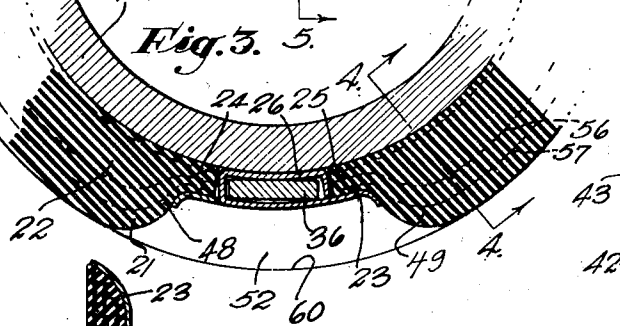


Fig. 4.

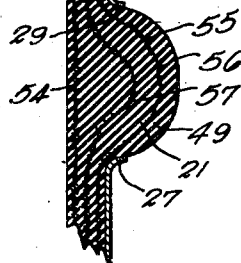
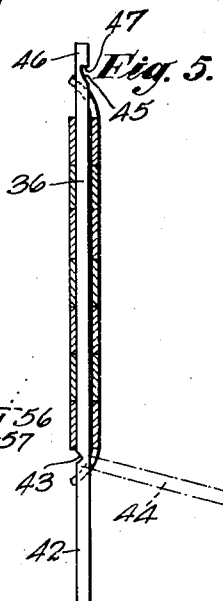


Fig. 5.



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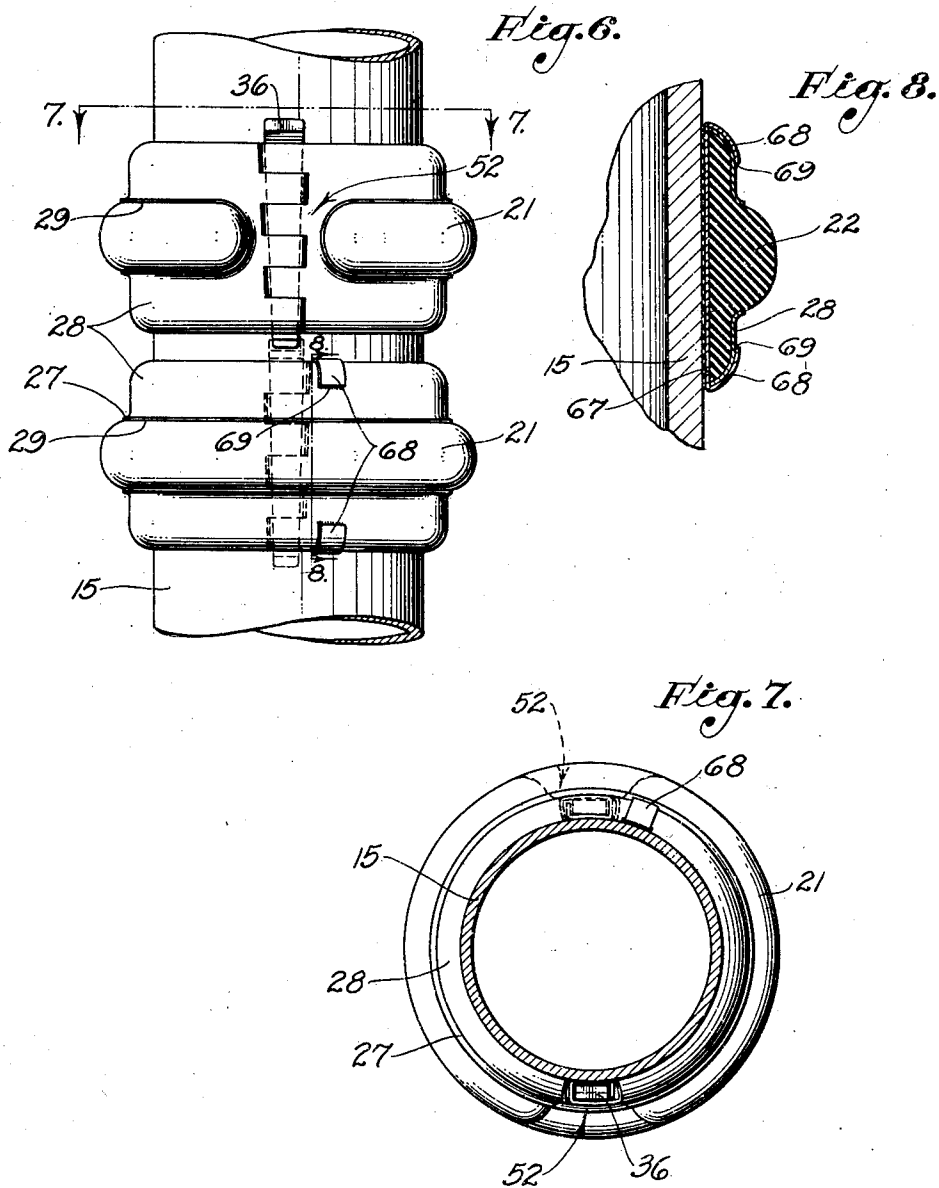
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

1,940,332

DRILL PIPE PROTECTOR

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Application March 18, 1932. Serial No. 599,743

15 Claims. (Cl. 308—4)

My invention relates to a protector for drill pipe adapted to prevent wearing engagement of the string of drill pipe with the casing or open wall of a well in which the drill pipe is rotated.

5 The art to which my invention particularly relates is the rotary system of well drilling, in which the well is bored by use of a rotary bit secured on the lower end of a shaft member or string of drill pipe consisting of lengths of pipe secured together by couplings and tool joints. The couplings and tool joints are of larger diameter than the pipe employed in the string of drill pipe, and in the ordinary practice of rotary drilling the drill pipe will deflect so as to cause one or more of the couplings and tool joints to wear against the well casing or the open wall of the hole extending below the well casing, with the result that these tool joints and couplings are rapidly worn down, and also in many instances holes are worn in the well casing, making necessary a cementing job to seal the casing against leakage thereof of water from the formations penetrated.

My present invention comprehends a very rugged and durable member adapted to be placed on the exterior of the drill pipe and having engagement portions projecting therefrom, preferably constructed of rubber or rubber compound. These engagement portions engage the casing or the wall of the well and prevent the string of drill pipe, its couplings and tool joints, from rubbing against the casing or the hole. It is found that rubber and compounds thereof are very efficiently lubricated by water or drilling mud so that the wear on the casing due to the engagement of the protector therewith is negligible.

It is an object of my invention to provide a drill pipe protector or wear preventer of this character which may be quickly and securely mounted on a string of drill pipe and which has projecting engagement portions of such character that they will not rapidly wear down or be torn off or otherwise destroyed as a result of operating under the severe conditions encountered in the drilling of a well.

It is a further object of the invention to provide a wear preventer of this character having radially projecting, circumferentially elongated engagement portions so formed that a vertical channel for upward circulation of drilling mud is provided even though the surfaces of the engagement portions adapted to engage the casing or the wall of a hole are extensive.

It is an object of my invention to provide a protector having a resilient body of flat form with engagement portions projecting outwardly therefrom, this resilient body adapted to be placed with its inner face against the surface of a shaft member such as a string of drill pipe, and a frame member adapted to be clamped or locked in closed

position over the flat body so as to securely hold the flat body against the surface of the shaft member, said frame member having an opening therein through which the engagement portions of the resilient body may project into position for engaging the casing or wall of a well.

A further object of the invention is to provide this frame member in the form of a cylindrical shell having the circular ends thereof bent inwardly so as to cover the edges of the resilient body and provide sloping approaches which will effectively prevent catching of the protector on projections which may be encountered thereby during vertical movement in the casing or open bore of a well.

It is a further object of my invention to provide a protector of the character pointed out in the foregoing paragraphs in which there is a plurality of circumferential engagement portions, each of which is less than a complete circle and provides a space between the ends thereof, and in which these circumferential engagement portions are positioned so that the spaces provided between the ends thereof are relatively offset in order that the combined circumferential engagement portions present a completely annular engagement surface.

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

Referring to the drawings, which is for illustrative purposes only,

Fig. 1 is an elevational view showing a portion of a string of drill pipe with protectors of my invention secured thereon.

Fig. 2 is a partly sectioned perspective view of my protector.

Fig. 3 is an enlarged cross section on a plane represented by the line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary view on a plane represented by the line 4—4 of Fig. 3, showing the manner in which reinforcement elements may be disposed in the resilient body of the protector.

Fig. 5 is a section on a plane represented by the line 5—5 of Fig. 2.

Fig. 6 is an elevational view illustrating an alternative form of my invention.

Fig. 7 is a sectional view taken on the lines 7—7 of Fig. 6.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 6.

In Fig. 1 I have shown a well structure consisting of a casing 11 set in the upper portion of a well bore 12 which has been formed by the use of a drill bit 13 located on the lower end of a drill shaft or string of drill pipe 14 consisting of a plurality of separate lengths of pipe 15 joined together by couplings 16 and tool joints 17. In accordance with ordinary practice, this

drill pipe is rotated by a rotary table situated at the surface of the ground, and during the drilling operation rotary mud is forced down through the interior of the string of drill pipe 14, this fluid being discharged near the lower end of the well bore 12 through outlets 18 in the drill bit. Due to various reasons, among which are the weight of the drill pipe and torque exerted therein, the drill shaft deflects from centralized position and generally engages the well casing 11 and the open wall of the bore 12 at one or more points. On this drill pipe I have shown protectors 20 embodying my present invention, these protectors having engagement elements 21 which project radially outwardly beyond the circumferences of the tool joints and couplings of the string of drill pipe 14 so as to contact the interior of the casing 11 and the bore 12 of the well so as to prevent engagement of the tool joints, couplings, and interconnecting pipes 15 with the casing and the open wall of the well, thereby preventing destruction of the couplings, tool joints, drill pipe, and casing due to abrasion, as occurs where a drill pipe is operated in a well without the use of protectors.

As shown in Fig. 2, the engagement elements 21 project outwardly from a resilient body 22 which also includes a base portion or flat wall 23 which is in cylindrical form. This resilient body and its parts are preferably made from rubber or a suitable wear resisting rubber compound. The length of the flat wall 23 is such that the ends 24 and 25 thereof reach nearly around the pipe 15, as shown in Fig. 3, leaving a relatively narrow vertical space 26 therebetween. The resilient body 22 may be made cylindrical, or it may be molded in flat form and then curved to cylindrical form when applied to the pipe 15. The engagement elements 21 are circular or circumferential in form and reach nearly to the ends 24 and 25 of the wall 23. In cross section these engagement elements 21 may be semi-circular or semi-oval, as clearly shown in Fig. 2.

For the purpose of securely and immovably holding the resilient body 22 on the pipe 15, I provide a frame or shell 28 having a cylindrical wall 30 with circularly elongated openings 29 through which the engagement portions 21 outwardly project and with constricting means 31 at the ends thereof consisting of interlapping projections 32 and 33 formed at the ends 34 and 35 of the cylindrical wall 30. These projections 32 are in the form of flat loops adapted to receive a tapered, flat locking pin 36, and the loops decrease in circumferential length progressively from one end to the other of the frame 28 so that as the locking pin 36 is driven into the position in which it is shown in Fig. 2, the ends 34 and 35 of the cylindrical wall 30 will be drawn together, and the effective circumferential dimension of the frame will be reduced so as to constrict and compress the wall 23 against the pipe 15. The circumferentially elongated openings 29 are framed by outwardly extending ribs 27 which rest tightly against the sides of the engagement portions 21 and present faces of such width that the engagement portions 21 are centralized in the openings without danger of cutting into the resilient material from which the engagement portions are formed. The upper and lower edges 37 and 38 of the frame 28 are turned inwardly above and below the edges 40 and 41 of the thin wall 23 so that inwardly sloping approaches are provided at the ends of the frame 28 and so that the edges of the wall

23 will be thereby protected. The loops or projections 33 rest in the space 26 between the ends 24 and 25 of the wall 23; therefore, the locking or constricting means 31 is held close to the surface of the pipe 15 and principally below the circle defined by the outer face of the wall 23. As shown in Fig. 5, the tapered locking pin 36 has a leading end 42 projecting therefrom, and dividing this leading end from the main body of the pin 36 is an inwardly faced notch 43 at which the leading end 42 may be broken from the pin 36, after the pin has been driven into locking position, by bending the end 42 outwardly as indicated by dotted lines 44. To facilitate removal of the locking pin 36 when it is desired to remove the protector from the pipe, I provide a lateral groove 45 adjacent the upper end 46 which may be engaged by a chisel-end tool whereby to drive the pin outwardly relative to the loops 33. The upper face 47 of the groove 45 is perpendicular to the longitudinal axis and therefore provides an abutment for engagement of the tool employed in removing the pin 36.

As clearly shown in Fig. 3, the engagement portions 21 are of such circumferential length that the ends 48 and 49 thereof are adjacent the ends 24 and 25 of the wall 23, and the outer surfaces of the engagement portions 21 define a circle larger in diameter than the exterior faces of the couplings 16 and tool joints 17. By making the circumferential length of the engagement portions 21 less than a full 360°, I provide a vertical space 52 between the ends 48 and 49 through which drilling fluid, such as drilling mud, may freely circulate in upward direction even though the external dimension of the protector approaches closely to the internal dimension of the casing 11.

In Fig. 2 I show the resilient body with a single sheet of reinforcing fabric 54 therein adjacent the inner face of the wall 23. In addition to this reinforcement, my invention comprehends, as shown in Figs. 3 and 4, reinforcing means 55 extending from the wall 23 into the ends 48 and 49 of the engagement portions 21. This reinforcing means 55 may consist of sheets 56 and 57 of a fabric of either metal or fiber strands, the shaping of the sheets 56 and 57 so that they will project outwardly into the ends 48 and 49 being clearly shown in Figs. 3 and 4.

The invention comprehends a drilling shaft, such as a string of drill pipe 14, having the protectors 20 placed thereon in such position that the vertical passages 52 thereof will not be vertically aligned but will be offset in the manner shown in Fig. 1 so that when adjacent protectors 20 are resting in engagement with the wall of the casing, the continuous surfaces of the engagement portions 21 of one of these protectors will be in contact with the casing during the time the space 52 of the adjacent protector 20 is faced toward the same side of the casing as that engaged by the previously mentioned protector 20. The drilling member constructed or equipped in this manner is amply protected against destruction of couplings and tool joints. Passages 52 are provided for upward circulation of drilling fluid as it passes toward the top of the well; yet the bumping action, due to engagement of the ends 48 and 49 of the engagement members 21, is reduced to a minimum.

In most uses of the device this bumping or pounding action due to engagement of the ends 48 and 49 with the interior surface of the casing

is very small for the reason that the casting is circular in cross section and the inner face 60 thereof is engaged by the ends 48 and 49 in the manner shown in Fig. 3.

5 In the practice of my invention in the form disclosed, various objects hereinabove enumerated are practically and satisfactorily attained. The engagement portions are of ample size to be very rugged and therefore are not readily
10 torn or injured due to use under severe conditions encountered in a well. The wearing faces presented by these engagement portions 21 are of ample size to reduce wearing away of the engagement portions due to abrasion to a satisfactory minimum. The circumferential dimension
15 or length of the engagement portions 21 is such that a circulation space 52 is provided without sacrifice of the area of resilient material presented to the casing or open wall of the well.

20 In Figs. 6 and 7 I illustrate a form of my invention in which the engagement portions 21 are included in separate protectors. These protectors are each constructed in accordance with the foregoing description except that in place
25 of two engagement portions 21 in each protector there is only one. In this form of my invention I prefer to utilize two protectors which are so positioned that the spaces 52 provided between the ends of the circumferential engagement portions are relatively offset. In the drawings I have
30 shown the spaces as being diametrically opposed. In Fig. 7 it is clearly shown that by offsetting the spaces 52 the two engagement portions 21 provide a fully annular engagement surface.
35 This may be preferred since there will be no bumping action due to flat spots which are provided where the spaces 52 occur.

As shown in Fig. 8, extending across or vertically through the resilient body 22 near the
40 inner surface thereof and preferably adjacent the fabric 54, is a retaining bar 67, the ends of which project from the resilient body and are bent outwardly and inwardly around the frame or shell 28, as indicated at 68. If desired, these ends
45 may be welded to the frame 28 as indicated at 69. The purpose of this retaining bar is to retain the central portion of the resilient body in place and also to prevent spreading of the frame or shell 28 between the ends thereof.

50 I claim as my invention:

1. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and a circumferential engagement portion extending outwardly from said wall and said circumferential engagement portion being sufficiently long to almost entirely encircle said shaft member; and a frame for compressing said body against said shaft member, said frame including
55 a circumferential wall structure having a circumferential opening, which opening extends almost entirely around said shaft member and through which said engagement portion projects and means for circumferentially constricting said
60 frame whereby to compress said thin wall against said shaft member.

2. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and a circumferential engagement portion extending outwardly from said wall and said circumferential engagement portion being sufficiently long to almost entirely encircle said shaft member; and a frame for compressing said body
70 against said shaft member, said frame including a

circumferential wall structure having a circumferential opening, which opening extends almost entirely around said shaft member and through which said engagement portion projects, upper and lower edges sloped inwardly to provide chamfered ends, and means for circumferentially constricting said frame whereby to compress said thin wall against said shaft member. 80

3. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and a circumferential engagement portion extending outwardly from said wall and being of such circumferential dimension that said circumferential engagement portion almost entirely encircles said shaft member and having the ends thereof approach close to engagement but spaced apart so as to provide a circulation space between such ends; and a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having a circumferential opening through which said engagement portion projects and means for circumferentially constricting said frame whereby to compress said thin wall against said shaft member. 85 90 95 100

4. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and upper and lower circumferential engagement portions extending outwardly from said wall and said circumferential engagement portions being sufficiently long to almost entirely encircle said shaft member; and a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having upper and lower circumferential openings, which openings extend almost entirely around said shaft member and through which said engagement portions project and means for circumferentially constricting said frame whereby to compress said thin wall against said shaft member. 105 110 115

5. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and upper and lower circumferential engagement portions extending outwardly from said wall and said circumferential engagement portions being sufficiently long to almost entirely encircle said shaft member; and a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having upper and lower circumferential openings, which openings extend almost entirely around said shaft member and through which said engagement portions project, upper and lower edges sloped inwardly to provide chamfered ends, and means for circumferentially constricting said frame whereby to compress said thin wall against said shaft member. 120 125 130 135

6. A protector of the character described, including: a resilient body comprising a relatively thin wall curved to fit the exterior of a shaft member and upper and lower circumferential engagement portions extending outwardly from said wall and being of such circumferential dimension that said circumferential engagement portions almost entirely encircle said shaft member and having the ends thereof approach close to engagement but spaced apart so as to provide a circulation space between such ends; and a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having upper and lower circumferential openings through which said engagement portions project. 140 145 150

ject and means for circumferentially constricting said frame whereby to compress said thin wall against said shaft member.

7. A protector of the character described, including a resilient body comprising a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement portion projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and a retaining bar extending in back of said opening and engaging the upper and lower parts of said frame.

8. A protector of the character described, including: a resilient body comprising a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall and being of such circumferential dimension that the ends thereof approach close to engagement but are spaced apart so as to provide a circulation space between such ends; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement portion projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and a retaining bar extending in back of said opening and engaging the upper and lower parts of said frame.

9. A protector of the character described, including: a resilient body comprising a wall curved to fit the exterior of a shaft member and upper and lower engagement portions extending outwardly from said wall; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having upper and lower openings through which said engagement portions project; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and a retaining bar extending in back of said openings and engaging the upper and lower parts of said frame.

10. A protector of the character described, including: a wear preventer body having a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall and being of such circumferential dimensions that the ends thereof approach each other but are spaced apart so as to provide a circulation space between the ends thereof; means for securing said wear preventer body in place, said means including a frame having a circumferential wall structure surrounding said wear preventer body and holding same securely against the exterior of said shaft member, said frame having a circumferentially extending opening through which said engagement portion of said wear preventer body projects; and retaining means extending in back of said opening in said frame and being connected to the upper and lower parts of said frame to prevent same from spreading.

11. A protector of the character described, including a wear preventer body having a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall and being of such circumferential dimensions that the ends thereof approach each other but are spaced apart so as to provide a circulation space between the ends there-

of; means for securing said wear preventer body in place, said means including a frame having a circumferential wall structure surrounding said wear preventer body and holding same securely against the exterior of said shaft member, said frame having a circumferentially extending opening through which said engagement portion of said wear preventer body projects; and retaining means extending transversely in back of said opening in said frame, and being embedded in said wear preventer body and being secured to the upper and lower parts of said frame.

12. A protector of the character described, including: a resilient body comprising a wall curved to fit the exterior of a shaft member and an engagement means extending outwardly from said wall and being of such circumferential dimension that the ends thereof approach close to engagement but are spaced apart so as to provide a circulation space between such ends; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement means projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and a retaining bar extending in back of said opening and engaging the upper and lower parts of said frame.

13. A protector of the character described, including: a body comprising a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement portion projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and reinforcing means extending in back of said opening and bending back over the edges of said frame to prevent spreading of the edge portions thereof.

14. A protector of the character described, including: a body comprising a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement portion projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and reinforcing means extending in back of said opening and engaging the upper and lower edge portions of said frame.

15. A protector of the character described, including: a body comprising a wall curved to fit the exterior of a shaft member and an engagement portion extending outwardly from said wall; a frame for compressing said body against said shaft member, said frame including a circumferential wall structure having an opening through which said engagement portion projects; means for circumferentially constricting said frame whereby to compress said wall against said shaft member; and reinforcing means extending in back of said opening and engaging the upper and lower edge portions of said frame, said reinforcing means engaging said body so as to hold the same in operative position relative to said opening.

WALTER G. L. SMITH.