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**A. L. STONE**

**2,493,556**

SUPPORTING AND SEALING MEMBER

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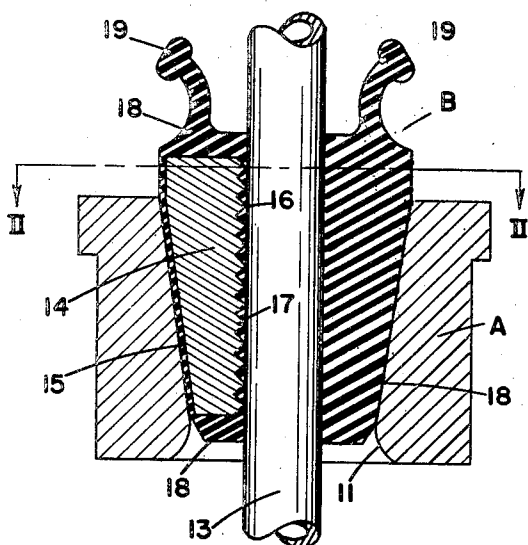


FIG. 1.

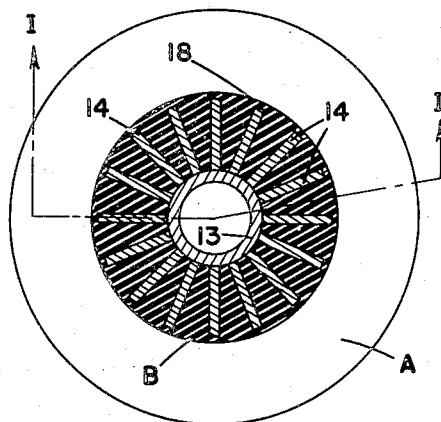


FIG. 2.

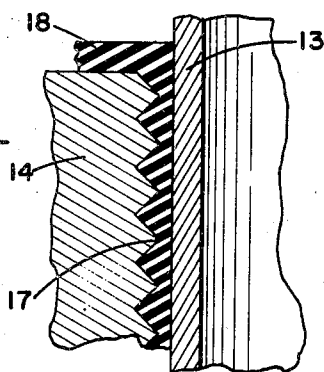


FIG. 3.

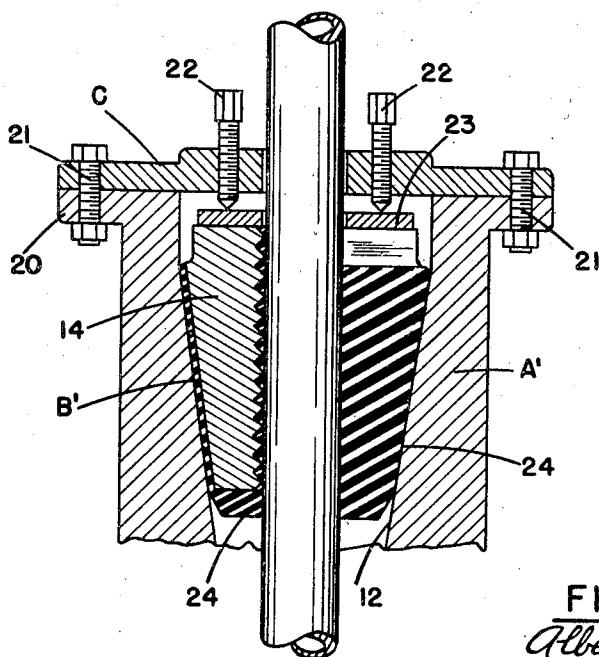


FIG. 4.

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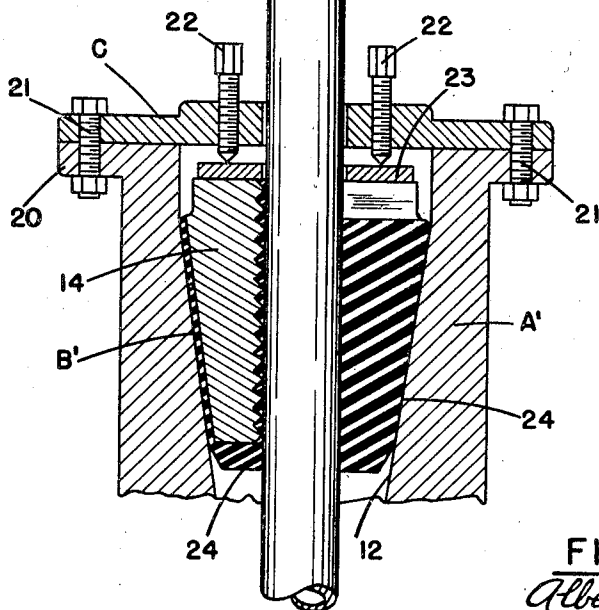


FIG. 5.

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## UNITED STATES PATENT OFFICE

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## SUPPORTING AND SEALING MEMBER

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4 Claims. (Cl. 285—22)

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The present invention is directed to an assembly for supporting a pipe and for sealing the space adjacent said supported pipe.

It is often desirable to support a section of pipe and to provide a fluid-tight seal for an annular space around the supported pipe. For example, in the completion of a well producing oil and gas it is customary to provide a string of tubing through which the production may pass. This string of tubing is customarily arranged within a string of casing and the tubing may be supported from the casing and the annular space between the casing and the tubing sealed off. In many wells it is customary to use a number of strings of casing arranged concentrically, and to support each of the inner strings of casing from the outer string of casing with the annular spaces between the strings of casing packed off. The conventional procedure for supporting and sealing a string of tubing within a string of casing is to locate the tubing at the proper height in the well, then place a rubber-like packer either above or below the set of slips; a Christmas tree is then attached above the sealing means and supporting means. If the packer is placed below the slips the weight of the slips keeps it under compression. If the packer is placed above the slip it is customary to use a self-sealing packer.

Another operation where it is sometimes desirable to seal the annular space between an inner and outer string of pipe is when drilling wells with the rotary method. Here when a blowout is feared it is desirable to seal the space between a string of casing cemented into the borehole and the drill stem while supporting the drill stem. At the present time it is conventional to provide a separate means for sealing off the space and another means for supporting the drill stem.

It is an object of the present invention to provide a means for supporting a section of pipe from a member while simultaneously sealing the space between the supported pipe and the member.

Other objects and advantages of the present invention may be seen from the following description taken in conjunction with the drawing, in which

Fig. 1 is an elevation partly in section showing an embodiment of the present invention;

Fig. 2 is a view taken along line II—II of Fig. 1;

Fig. 3 is a fragmentary view showing a portion of the device of Fig. 1 with no load or a light load supported from the assembly;

Fig. 4 is a fragmentary view of the same portions illustrated in Fig. 3 but showing the posi-

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tion assumed by the parts when a heavy load is supported; and

Fig. 5 is an elevation partly in section showing another embodiment of the present invention.

Turning now specifically to the drawing, a supporting assembly A of a generally annular shape has an inner wall 11 defining a central passage with an upwardly facing shoulder 12 tapering upwardly and outwardly to define a seat for the slip assembly. Assembly A may be a casinghead or a tubing head or may be the head of a blowout preventer. It will be understood that assembly A is shown only diagrammatically and if desired holes may be drilled in the flange for attaching other equipment. It will be understood by a workman skilled in the art that any one of a number of designs or patterns of heads may be employed for assembly A.

A section of pipe 13 is supported from assembly A by means of assembly B. Assembly B simultaneously serves the function of supporting pipe 13 from assembly A and sealing the annular space between the outer wall of pipe 13 and the inner wall of assembly A.

Assembly B consists of a plurality of segments 14. Each segment defines an outer wedge-shaped wall 15 and inner wall 16 provided with a plurality of teeth 17. Segments 14 are mounted radially in assembly B. A readily deformable or elastic structural material 18 bonds members 14 together to form a unitary structure having the form of a split annulus and in addition a layer thereof covers the upper surface, the lower surface, wedge surface 15 and the inner surface 16 of each slip member. In the drawing it will be seen that the teeth 17 project through openings in deformable material 18 and engage frictionally with pipe 13 to support it. It is preferred to shape the teeth 17 in the form of a pyramid so that when they project through the coating of deformable material they will grip pipes 13 without disturbing the seal provided by deformable material 18.

The deformable or elastic material 18 may be a synthetic rubber or natural rubber which is capable of being firmly bonded to segments 14 by vulcanization. In the manufacture of the assembly B it is usually convenient to mold material 18 as a solid sheet over the inner faces of segments 14 so that there will be no opening between the tooth and the face as the assembly comes from the vulcanization step. Then when the device is used to support a load the application of the load will cause the rubber to be compressed and caused to flow in such a manner that the sharp teeth will be forced through the thin layer of rubber.

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When such a manufacturing process is employed there will be no opening adjacent each tooth 17 until after the assembly B has been loaded.

Fig. 3 is a fragmentary view showing the appearance of the readily deformable material 18 adjacent the inside faces 16 of the segments 14 when assembly B is under no load or light load conditions. Under these conditions there is not sufficient force to deform the layer of material 18 adjacent teeth 17 so that the contact between the pipe 13 under no load or light load conditions and that of assembly B is merely a contact between pipe 13 and the inner face of deformable material 18. This is true even though the device is manufactured with openings adjacent the teeth or manufactured as heretofore explained with no openings adjacent teeth 17 and then loaded so that the teeth have been forced through the layer of material 18 adjacent thereto. However, in order to illustrate more clearly the present invention the fragmentary view of Fig. 3 shows the layer of material 18 as a section and does not indicate openings adjacent teeth 17.

Fig. 4 is a fragmentary view showing the appearance of the layer of deformable material 18 when the assembly B is supporting a load. The teeth 17 project through the deformable material 18 so that frictional contact is made between teeth 17 and pipe 13 and the load is supported by the metal teeth of the assembly. It is to be noted that while the assembly supports the load by frictional contact between the metal teeth, the deformable material 18 forms a seal between adjacent teeth so that the load 13 is simultaneously supported and the space adjacent thereto sealed in a fluid-tight manner. After the device has supported a load as shown in Fig. 4 and the load has been removed, the layer of deformable material 18 will assume its initial shape with its inner surface projecting beyond the points of teeth 17 as illustrated in Fig. 3.

Another embodiment of the present invention is shown in Fig. 5. In this embodiment the supporting member is designated as A' and the supporting and sealing assembly is designated as B'. Cooperating with these two assemblies is assembly C.

The assembly A' of Fig. 5 differs from that of assembly A described in the preceding paragraphs in that it is provided with a flange 20 tapped to receive bolts 21. Assembly A' is provided with an inner face tapering upwardly and outwardly and designated as 12 since it may be identical with the corresponding portion of assembly A heretofore described. Assembly B' consists of segments 14 bonded together by readily deformable material 24. Material 24 may be a synthetic or natural rubber capable of being vulcanized so that the material 24 and the several segments form a single unit.

The embodiment of Fig. 5 differs from that precedingly described in that the assembly B' is not provided with handles 19 and in addition a means is provided for exerting a downward bias on assembly B to insure that the inner and outer surfaces thereof make a fluid-tight seal with member A' and the supported load. This means is provided by assembly C which is shown as a flange provided with a plurality of holes around its periphery for receiving bolts 21 and being tapped for receiving cap screws 22 which are parallel with the axis of supported pipe 13. Annulus 23 is arranged to fit around pipe 13 and rest on the top of assembly B'. Assembly B' and annulus 23 are proportioned so that the upper

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surface of annulus 23 will be slightly below the lower surface of assembly C when the assembly is fastened to head A' with bolts 21. By tightening cap screws 22 annulus 23 is forced downwardly and in turn exerts a bias against assembly B' thereby resisting any fluid pressure within head A' and below assembly B' which would tend to force assembly B' away from surface 12, which in turn would break the fluid-tight seal. In usual operations the load exerted by pipe 13 may be expected to exert a sufficient downward force that assembly B' serves to support load 13 while sealing the annulus against upward flow of fluid around assembly B' but under conditions where a substantial fluid pressure is exerted against the lower portion of assembly B' the load may not supply an adequate force in which case the arrangement of assembly C' enables sufficient bias to be exerted against assembly B' to maintain it in sealing relationship against such pressures.

In the construction of the device of the present invention it will be found that the assembly may be formed easily and cheaply. For example, the separate segments may be readily formed with the segments stamped out by a drop forging operation and teeth 17 formed by machining inner face 16. The desired number of segments to form an assembly B may be placed in a mold and the readily deformable material then bonded to the segments. As heretofore explained, this material may be natural rubber or a synthetic rubber. The art of bonding natural and synthetic rubbers to metal by vulcanizing is well known. The bonding of the segments 14 by vulcanizing the material 18 as heretofore explained may produce a finished article ready for immediate use.

The sizes of the parts employed may be varied over a considerable range and satisfactory results obtained. For example, if desired, segments 14 may be as thin as  $\frac{1}{4}$  inch or as thick as  $1\frac{1}{4}$  inches when constructing an assembly adapted for supporting  $4\frac{1}{2}$  inch drill pipe and satisfactory results will be obtained.

It will be seen that the assembly of the present invention embodies substantial advantages over conventional assemblies for supporting a cylindrical member and simultaneously sealing the space between the supported member and a supporting member. The portion of the assembly for gripping the pipe includes segments 14 which, in effect, are wedges having a wedge surface in contact with the slip bowl. The assembly provides a large number of thin wedges each of which can readily be brought into contact with the cone of the slip bowl. The readily deformable material bonding the segments together and interposed between the segments and slip bowl allows each segment to move through a limited distance with respect to the adjacent segments. This arrangement allows each separate segment to assume a position with respect to the slip bowl which will compensate for abnormal conditions. For example, if the pipe to be supported by the assembly be out of round, some of the segments must move outwardly a greater distance than other segments in order to distribute the load substantially uniformly. The readily deformable material 18 allows some to move outwardly a greater distance than other segments thereby enabling each segment to support its proportional load. As another condition, particles of sand may accumulate between assembly B or B' and the cone surface of assembly A or A', in which case the readily de-

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formable material 18 adjacent the particles deforms, and the supporting assembly A or A' seats in the slip bowl to support the load and seal the space between the load and the slip bowl. It is to be emphasized that the assembly of the present invention provides a means for supporting a pipe under abnormal as well as normal conditions and will at all times maintain a fluid-tight seal between the supported pipe and the supporting member.

The employment of readily deformable material between the segments enables the slip assembly to resist torque as well as to support the weight of a section of pipe. For example, if an attempt be made to rotate the pipe with respect to body A or A', the separate segments 14 will move slightly away from radial position causing an edge of each segment to bite into the pipe, thereby resisting the torque exerted on the pipe. It will be evident that when the assembly is resisting torque, it is adapted to maintain a fluid-tight seal between the supported pipe and the supporting member.

Another advantage of the present application is the relatively light weight of the assembly B or B'. For example, if natural rubber is selected as a bonding material, it has a specific gravity of slightly more than 1.3 while steel has a specific gravity of 7.8. The arrangement of relatively thin flat segments of steel separated by the deformable material having a low specific gravity enables the construction of an assembly which is relatively light in weight.

While I have disclosed a specific embodiment of the present invention it will be apparent to a workman skilled in the art that changes in the sizes, shape and proportions of the parts of said assembly may be made without departing from the scope of the invention.

Having fully described and illustrated a preferred embodiment of the present invention, what I desire to claim as new and useful and to secure by Letters Patent is:

1. An assembly for supporting pipe comprising, in combination, an annular member defining an upwardly facing supporting shoulder tapering upwardly and outwardly, a slip assembly adapted to cooperate therewith for holding a section of pipe comprising a plurality of radially arranged segments provided with inner toothed faces and outer wedge faces, readily deformable structural material securing a plurality of sections together in a fluid-tight assembly with readily deformable material covering at least a portion of the inner face of each segment.

2. A device adapted for sealing and supporting pipe comprising, in combination, an annular shaped member defining a central passage with

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an upwardly facing shoulder adjacent thereto and sloping upwardly and outwardly away from said central passage, an assembly adapted to cooperate with said annular member for supporting said section of pipe comprising in combination a plurality of wedge segments each segment having an inner toothed face and an outer wedge shaped face having substantially the same slope as said shoulder and readily deformable structural material bonding a plurality of segments together radially to form a fluid-tight annulus with readily deformable material covering at least a portion of the inner face of each segment.

3. An assembly adapted for supporting pipe combination comprising, in combination, an annular member having a portion of its inner surface defining a central opening and an upwardly facing shoulder joining thereto and defining a shoulder tapering upwardly and outwardly, a plurality of slip segments each segment defining an inner surface having a plurality of pyramid teeth and an outer wedge-shaped surface tapering upwardly and outwardly at the same angle as the shoulder of the annular member, readily deformable structural material bonded to each of said segments to form a unitary annular mass with a radial slot extending the length thereof and with at least a portion of said deformable material on the inner face of each slip member.

4. A slip assembly comprising, in combination, a plurality of slip segments each having an inner toothed face for engagement with a tubular member to be gripped and an outer wedge face for contact with a slip bowl and readily deformable structural material bonding a plurality of segments together radially to form a fluid-tight annulus with readily deformable material covering at least a portion of the inner face of each segment.

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