May 14, 1940. C. WHITE 2,200,760

PACKING FOR PISTON RODS

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Fig. 1.

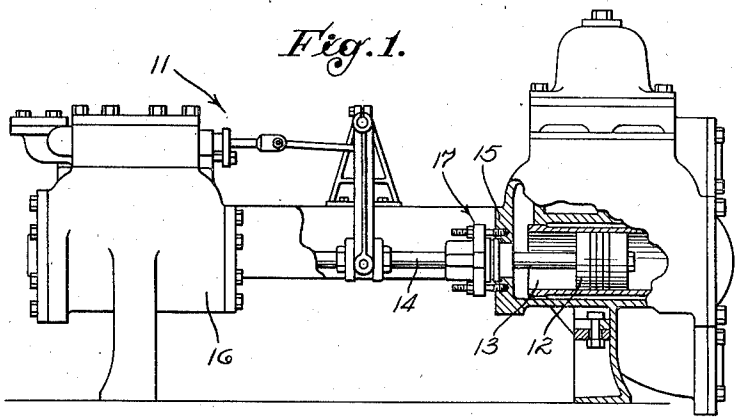


Fig. 2.

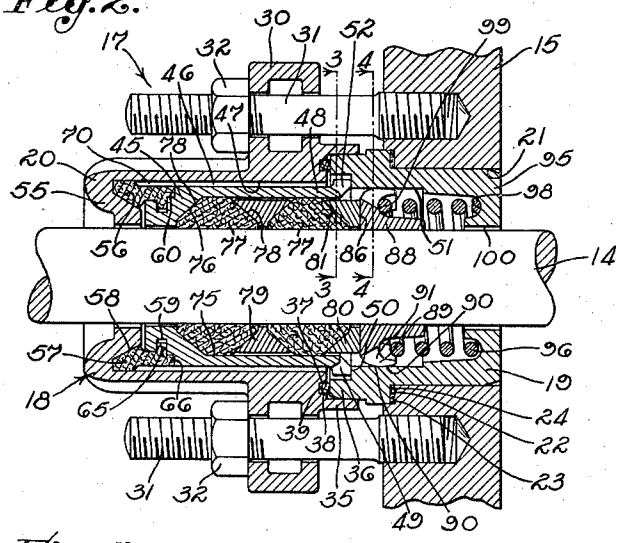


Fig. 3.

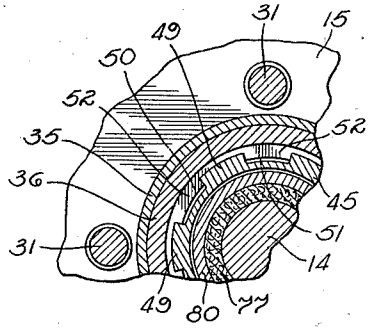


Fig. 4.

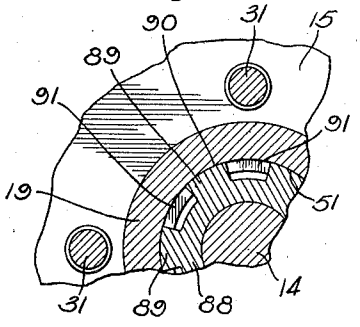
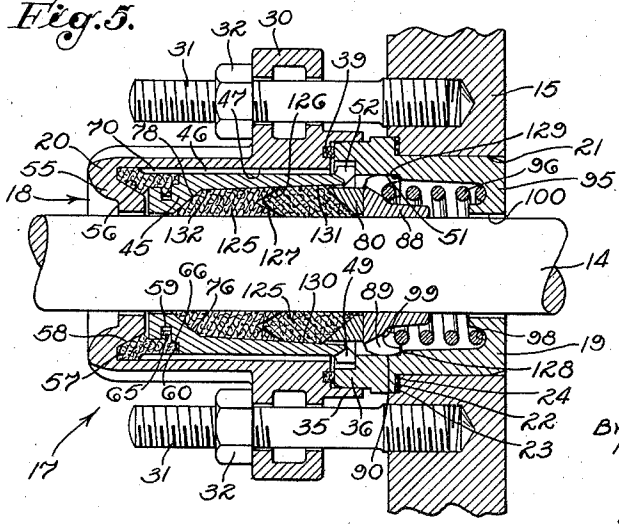


Fig. 5.



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Fig. 6.

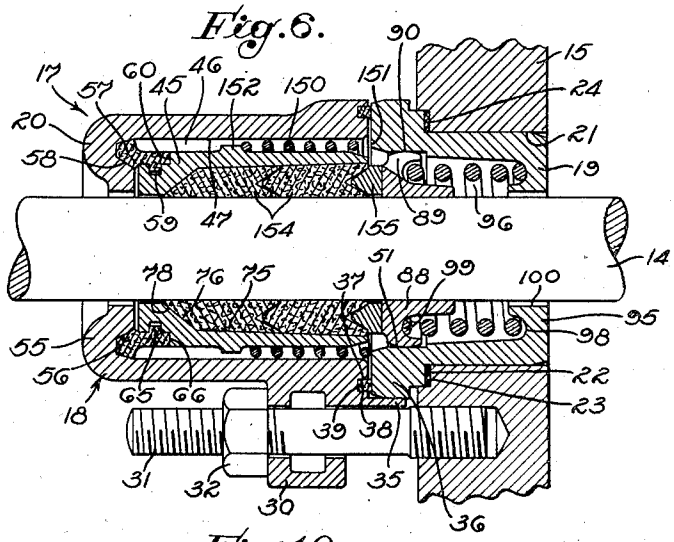


Fig. 10.

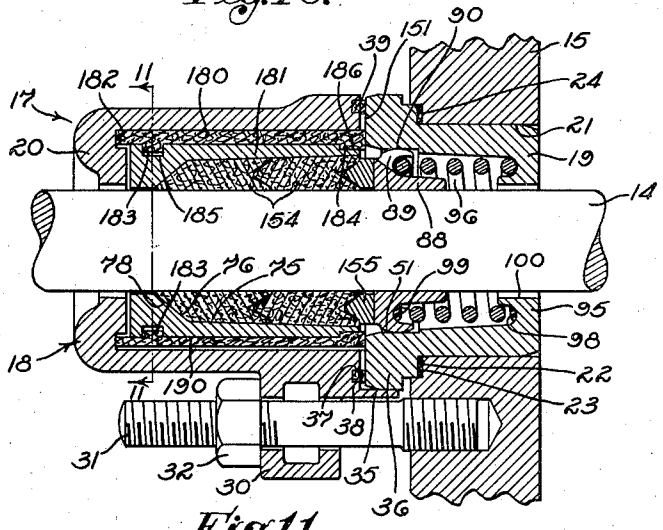
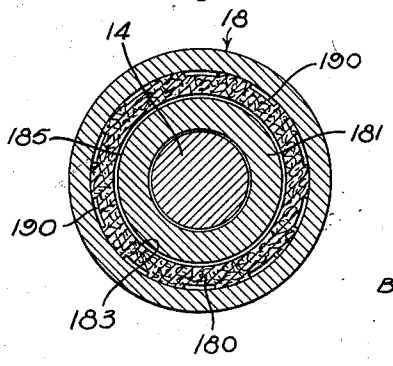


Fig. 11.



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Fig. 7.

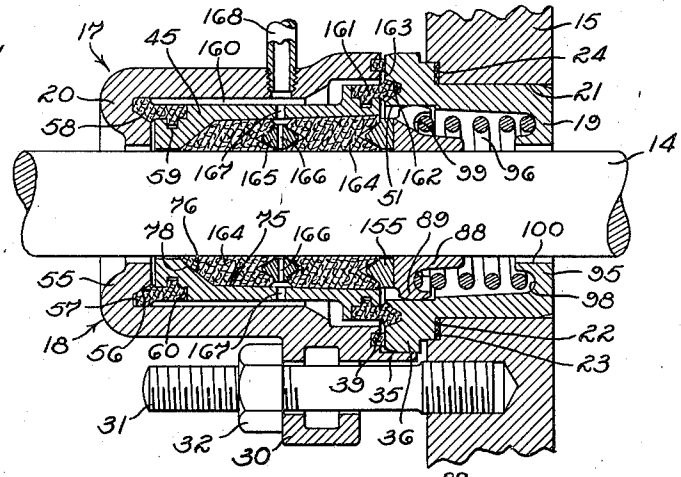


Fig. 8.

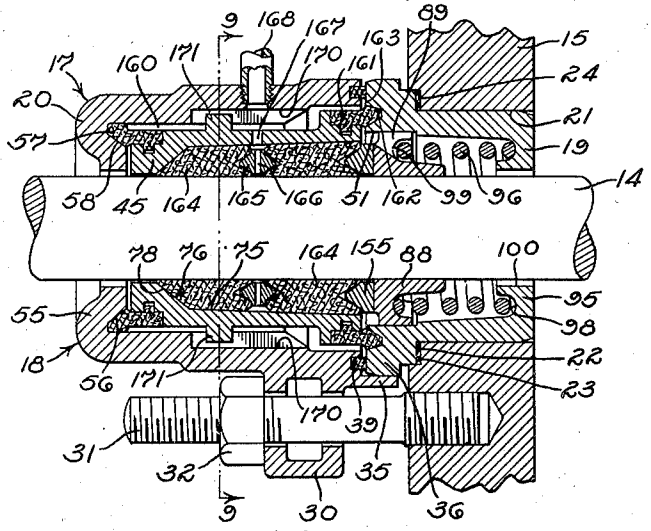
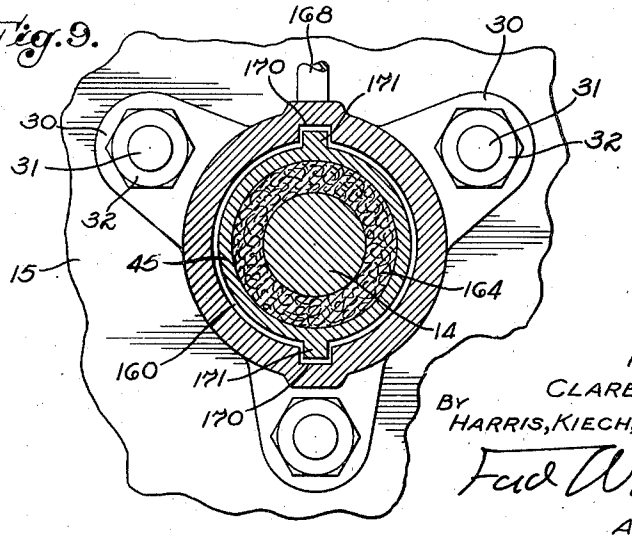


Fig. 9.



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2,200,760

PACKING FOR PISTON RODS

Clarence White, Walnut Park, Calif.

Application February 18, 1938, Serial No. 191,206

12 Claims. (Cl. 286—30)

This invention is an improvement over the ordinary type of metallic packing and is especially designed for packing the piston rods of slush pumps for use in the oil well drilling industry; and its object is to provide an efficient packing which will maintain a fluid-tight seal around a member such as a reciprocating piston rod, or in some instances a rotatable shaft under all conditions of service and be self compensating for wear.

Slush pumps used in the oil industry for pumping rotary mud to the bottom of the well being drilled usually comprise a steam cylinder and a mud cylinder, axially aligned, the piston in the mud cylinder being reciprocated by the piston in the steam cylinder, and the piston rods of the respective pistons being connected by a removable joint centrally between the respective cylinders. Thus the packing embodying the features of my invention can be applied and renewed, when necessary, without pulling the pistons and rods from the cylinders in order to do so.

An object of the invention is to provide a packing for such piston rods, valve stems, rotatable shafts, and the like, of a simple and reliable construction, which comprises a minimum of parts that will form a fluid-tight joint around movable shaft rods extending outwardly from a cylinder wall, or other chamber in which pressure is maintained during operation, and automatically adjust itself to compensate for wear, and which is adapted to have sufficient vibratory movement to compensate for any lateral vibratory play of the piston rod, stem, or other movable shaft, whereby a fluid-sealing joint will be maintained between the wall of the chamber or cylinder and the movable shaft or rod, whereby objectionable binding of the parts is prevented.

Various embodiments of my invention are shown in the alternative forms thereof described in the accompanying drawings, all of which include the feature permitting the sealing means to allow lateral movement of the shaft or rod while maintaining a fluid-tight seal between the shaft or rod and the interior of the chamber or cylinder, as above mentioned.

It is another object of my invention to provide a packing device including a shell surrounding a piston rod or movable shaft extending outwardly through a wall of a cylinder or chamber in which fluid pressure is maintained, together with means for attaching the shell to the cylinder wall, spring compressed sealing means within the shell sealing the space between the shaft and the shell, and passage means communicating between the interior of the cylinder and the interior of the shell, whereby the medium under pressure in the cylinder is utilized to assist in forcing the sealing means into sealing engagement with the rod or shaft and the interior wall of the cylinder or chamber.

Other objects and novel features will be disclosed in the following part of the specification and the structural details and mode of operation thereof will be fully explained in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation of a standard type of slush pump utilized in oil well drilling operations, this view having portions broken away to show the arrangement of the packing means for the mud cylinder of the slush pump which embodies the features of my invention.

Fig. 2 is a vertical section through the packing member and a portion of the end cylinder wall of the pump, shown in Fig. 1.

Fig. 3 is a fragmentary section taken as indicated by the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary section taken as indicated by the line 4—4 of Fig. 2.

Fig. 5 is a vertical section through an alternative form of packing member embodying the features of my invention.

Fig. 6 is a vertical section through an alternative form of the packing member and a portion of the end cylinder wall, but including an auxiliary spring forcing the sealing member against the outer end wall of the shell to augment the force of the fluid under pressure from the interior of the cylinder to form an efficient seal.

Fig. 7 is a vertical section through another form of packing member which includes means for delivering fluid or lubricant under pressure from the exterior of the shell rather than from the interior of the cylinder to force the sealing means into sealing engagement with the piston rod or shaft and the walls of the shell.

Fig. 8 is a vertical section through another form of the device similar to that shown in Fig. 7, but which is particularly designed for rotary shafts and is provided with means for preventing relative rotation between the sealing means and the shell.

Fig. 9 is a vertical section taken as indicated by the line 9—9 of Fig. 8.

Fig. 10 is a vertical section through an alternative type of packing member showing a sealing means confined by the attachment means securing the shell to the wall of the cylinder or

chamber in addition to spring compressed packing means engaging the shaft.

Fig. 11 is a vertical section taken through the outer end of the packing member shown in Fig. 10, as indicated by the line 11—11 of Fig. 10.

Referring to Figs. 1 to 4 of the drawings, I show in Fig. 1 a slush pump of a type used in oil well drilling operations, generally indicated by the numeral 11. The pump has a reciprocating piston 12 in a mud cylinder 13, the piston 12 being connected to a rod 14 extending through the end wall 15 of the mud cylinder and in turn connecting with a piston (not shown), which reciprocates in a power cylinder 16, for reciprocating the piston 12 in the mud cylinder.

The packing member embodying the features of my invention, and generally designated by the numeral 17, includes a shell 18 which surrounds the rod 14, the shell being formed in two parts, an inner part 19 and an outer part 20. The inner part is dimensioned to be seated snugly in a bore 21 in the end wall 15 of the mud cylinder and has a shoulder 22, preferably receivable in a recess 23, formed in the outer surface of the end cylinder wall 15, and having a larger diameter than the bore 21. A gasket 24 is interposed between the shoulder 22 and the wall forming the recess 23 in sealing engagement therewith.

The outer part 20 of the shell 18 is provided with a flange 30 through which stud bolts 31 extend and which connect with the end wall 15 of the cylinder 13 in the manner shown, there being nuts 32 threadedly engaging the bolts 31 in contact with the flange for urging both the inner and outer parts of the shell towards the wall 15.

The outer part 20 of the shell 18 is provided with an annular rearwardly extending sleeve portion 35 surrounding the outer end 36 of the inner part 19 and provides a recess 37 forming a shoulder in which is provided an annular seat 38 for a resilient ring 39 formed of rubber or the like, which is compressed in the seat 38 by the outer end of the inner part 19 as a result of the inward threading of the nuts 32 on the stud bolts 31.

Disposed within the outer part 20 of the shell 18 is a tubular member 45 which is of such diameter as to provide an annular space 46 between the interior wall 47 of the shell 18 and the tubular member 45, substantially as shown. Formed on the inner end 48 of the tubular member 45 are a plurality of projections 49 which extend radially outward from the tubular member a sufficient distance to bear against a shoulder 50 formed by a reduced diameter bore 51 provided in the inner part 19 of the shell 18. As shown in the drawings, the projections 49 serve to form passages 52 which are continuous with the space 46 surrounding the tubular member 45.

An outer end wall 55 of the outer part 20 of the shell 18 is formed to provide an inwardly tapered annular surface 56.

Carried on the outer end of the tubular member 45, and secured thereto by any suitable means, is a sealing member 57 formed of compressible material which has a tapered surface 58 of such configuration as to seat on the tapered annular surface 56.

In the preferred form of the invention the outer end of the tubular member 45 is stepcut to provide an annular channel 59 adjacent the end thereof and a vertical shoulder 60 disposed rearwardly of the channel 59, substantially in the manner shown. The sealing member 57 is provided with an annular rib 65 which extends into the channel 59, and an inwardly extending peripheral flange 66 which abuts the shoulder 60 of the tubular member 45. In the preferred embodiment, the annular passages 46 form a continuation of an annular peripheral depression 70 formed in the sealing member which depression ends a short distance inward from the outer end thereof, for a purpose to be hereinafter explained.

The bore 75 of the tubular member 45 terminates at the outer end thereof in an inwardly tapered surface 76. Disposed within the bore 75 of the tubular member 45 is a plurality of packing members 77 having annular surfaces 78 tapered toward the outer periphery thereof, the tapered surfaces 78 of the outer packing member bearing against the inwardly tapered surface 76 of the tubular member 45 substantially as shown. In the preferred form of the invention, the packing members 77 are formed of resilient material, such as rubber or the like, and only two are utilized. As shown in the drawings, illustrating this form of the invention, the packing members 7 are separated by a spacer 79 having tapered surfaces conforming substantially to the tapered surfaces 78 of the packing member which it engages.

Disposed partially within the bore 75 of the tubular member 45 is a packing follower 80 having an annular tapered surface 81 adapted to engage the innermost packing member 77, substantially as shown.

In abutment with the inner end 86 of the follower 80 is a compression member 88 which also is provided with radial projections 89, the outer surfaces 90 of which are slidable within the bore 51 of the inner part 19 of the shell 18, so as to provide passages 91 which communicate with the passages 84 in the follower 80 and the annular space surrounding the tubular member, through the passages 52 formed in the inner end of the tubular member 45. In the preferred embodiment of my invention, the outer surfaces 90 of the projections of the compression member 88 are arcuated to facilitate lateral play of the shaft 14, as shown.

Confined between the inner end wall 95 of the inner part 19 of the shell 18 and the compression member 88, is a compression spring 96 provided for the purpose of compressing the packing members 77 into engagement with the tapered surface 76 of the tubular member, and which through the medium of the tapered surfaces of the spacer 79 and the tapered surface of the follower 80 serves to compress the packing members 77 against the surface of the reciprocating piston rod 14 in sealing engagement.

In practice the inner wall 95 of the inner part 19 of the shell 18 is provided with an annular groove 98 in which the spring 96 is seated, and each of the radial projections 89 of the compression member 88 is provided with a notch 99 in which the opposite end of the spring 96 is seated, to maintain axial alignment of the spring.

As shown in the drawings, it is intended that the inner wall 95 of the inner part 19 of the shell 18 be provided with a bore 100 of larger diameter than the reciprocating rod 14 so that the fluid from within the cylinder 13 may have access to the space 46 between the tubular member 45 and the shell 18 through the bore 100, the passages 91, and the passages 84 and 52.

In the operation of the embodiment of the in-

vention shown in Fig. 2, it will be clear that the fluid from the interior of the cylinder 13, which is under high pressure, will flow through the bore 100, the passages 91 and 52 into the annular passage 46 and will exert a pressural force upon the sealing means 57 to constantly press the tapered surface 58 thereof into sealing engagement with the tapered surface 56 of the outer end wall of the shell 18.

In addition to the sealing engagement between the sealing member 57 and the wall 56 of the shell, the spring 96, with the cooperation of the pressure member 88 and the packing follower 80, serves to compress the packing members 77 into sealing engagement with the reciprocating rod 14 to prevent leakage of the fluid within the cylinder 13 between the rod 14 and the packing members 77.

With reference to the alternative embodiments of my invention, I show in Fig. 5 a different type of packing member than that disclosed in connection with the form previously disclosed. For convenience, numerals identical with those used in the previously described form are used in connection with the form disclosed in Fig. 5. In this form of the invention, I show a packing means disposed in the bore of the tubular member 45 which comprises a pair of packing members 125, the first of which has an annular inwardly V-shaped groove 126 in the inner wall thereof, and the second of which has an outer end 127 formed to substantially fit the V-shaped groove 126 of the first packing member, the first packing member being compressed against the tapered end wall 56 of the shell 18, as in the embodiment described before, and being pressed into sealing engagement with the reciprocating rod 14 by the compression spring 96 similar to the manner discussed in connection with the previously described form of the invention.

In this form of the invention, Fig. 5 in addition to the compressive action of the spring 96, the reduced diameter bore 51 of the inner part 19 of the shell 18 is shortened so that the inner ends 128 of the projections 89, similar to those described above, abut an annular shoulder 129 formed within the bore 51 substantially as shown.

It will be seen that in that form of the invention portrayed in Fig. 5, I do not depend entirely upon the compression spring 96 to press the packing members into sealing engagement with the inwardly tapered surface 56 of the outer part of the shell 18 and the rod 14, these packing members being in part initially compressed by the threading action of the nut on the stud bolt 31. However, if wear or fatigue should occur in the packing members, the spring 96 is intended to compress the packing members independently of the stud bolt 31 so that no leakage will occur during normal operation.

Preferably, in connection with the form of packing just described, the bore 130 of the tubular member 45 is tapered outwardly so that the inner end 131 of the bore is of larger diameter than the outer end thereof adjacent the end wall 76 of the tubular member, which facilitates the sealing engagement between the packing members 125 and the rod 14 when the packing members 125 are urged or forced against the end wall 76 of the tubular member.

Fig. 6 includes all of the features of Fig. 2 and in addition a compression spring 150 confined between the outer end 151 of the inner part 19 of the shell 17 and a shoulder 152 formed on the exterior periphery of the tubular member 45, functioning to augment the fluid pressure from the interior of the cylinder to force the sealing member 57 into fluidtight engagement with the surface 58. In this type of the invention a cam follower 155 is provided with a conical surface, as shown, which under the influence of the spring 96 assists, in conjunction with the pressure from the interior of the cylinder, in compressing the packing member 154 into sealing engagement with the outer end of the tubular member 45 and the rod 14.

In Fig. 7 I show an annular space 160 between the annular member 45 and the outer end 20 of the shell 17 which is sealed from the interior of the cylinder by a resilient sealing member 161 carried on the rearward end of the annular member, and which is seated in a recess 162 formed in the outer end surface 163 of the inner part of the shell 17, substantially as shown. Confined within the tubular member 45 is a pair of packing members 164 separated by a conical faced spacer 165 having radial passages 166 therethrough which communicate with ports 167 formed in the tubular member 45, substantially in the manner shown. Threaded into the outer end 20 of the shell 17 is a tube 168 provided for the purpose of introducing as a sealing means a lubricant under pressure into the space 160 between the tubular member 45 and the outer part 20 of the shell.

In other instances the tube 168 may be utilized to introduce a plastic sealing material into the space 160 and through the ports 167 into the interior of the tubular member to fill the space occupied by the packing members 164 and the spacer 165.

As shown, this embodiment also includes the outer arcuate surface provided on the pressure member 88 for the purpose of facilitating flexibility of the rod 14.

The form of the invention shown in Figs. 8 and 9 is designed for rotating shafts rather than reciprocating shafts, and differs from the form shown in Fig. 7 only in that it is preferably provided with a pair of longitudinally extending, diametrically disposed slots 170, into which a pair of lugs 171 extend to prevent relative rotation between the shell 17 and the tubular member 45 carrying the sealing members similar to the sealing members 57 and 161 of Fig. 7 and which confines the packing members 164 of this form which are identical with the packing members of Fig. 7.

Still another form of the invention is shown in Fig. 10. In this form an alternative type of sealing means is provided in the form of an elongated resilient member 180 disposed between the outer part of the shell 17 and a tubular member 181, the outer end of the elongated resilient member 180 being seated in a notch 182 in the outer end wall of the shell 17, and the resilient member 180 being provided with inwardly extending annular flanges 183 and 184 formed adjacent the outer and inner ends of the member 180 which extend into annular grooves 185 and 186 formed in the tubular member 181. As shown in the drawings, the resilient member 180 preferably abuts the outer end surface of the inner part of the shell 17, whereby sealing engagement is attained by the threading action of the nut 32 on the stud bolt 31 to seal the space between the inner and outer parts of the shell 17, and likewise the space between the outer end wall of the shell 17 and the tubular member 181.

In practice the resilient member 180 is pro-

vided with longitudinally extending grooves 190 provided for the purpose of adding resiliency to the material, substantially as indicated in Figs. 10 and 11.

It is likewise intended that this form of the invention include packing members similar to the packing members of Figs. 5 and 6 and that the pressure member urged outwardly by spring means be provided with an arcuated annular periphery to allow lateral twists of the rod 14 of the pump. It should be understood that the sealing member 180, being of resilient material such as rubber, will allow lateral movement or twist of the rod 14 and still maintain the sealing engagement between the inner and outer parts of the shell 17.

I have herein described the features of my invention and have illustrated the invention in several practical forms. However, it should not be assumed that I intend to be limited to the disclosure of this application, but intend the scope of the invention to be interpreted by the appended claims.

I claim as my invention:

1. In a piston rod packing of the character described, the combination of: a shell surrounding said rod, said shell being attachable to a wall of a cylinder through which said rod extends; a wall at the outer end of said shell formed to provide an inwardly tapered annular surface; a tubular member within said shell of such diameter as to provide an annular space between the interior wall of said shell and said tubular member; a sealing member of compressible material carried on the outer end of said tubular member and having a tapered face formed to seat on said tapered surface of said shell; compressible packing members in the interior of said tubular member in contact with said rod; a follower engaging said packing members for compressing the same into sealing engagement with said rod; and a compression member associated with resilient means for forcing said follower against said packing members, said follower and said compression member being formed to provide passages communicating between said annular space and the interior of said cylinder whereby the medium under the internal pressure of said cylinder may exert a force on said sealing member to press the same against said tapered surface of said shell.

2. In a piston rod packing of the character described, the combination of: a shell surrounding said rod, said shell being attachable to a wall of a cylinder through which said rod extends, said shell having a peripheral wall and an outer end wall; a tubular member within said shell of a size to provide a space between said tubular member and said peripheral wall of the shell; a sealing member of compressible material disposed between said outer end wall of the shell and said tubular member; compressible packing members in the interior of said tubular member in contact with said rod; means for compressing said packing members in sealing contact with said rod; and means for delivering the medium under pressure within said cylinder to said space surrounding said tubular member whereby said sealing member is compressed against said outer end wall of said shell in sealing engagement.

3. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of a cylinder through which said rod extends, said shell having an outer end wall disposed at an angle relative to the axis of the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod; means for limiting the longitudinal movement of said sealing means toward said cylinder; a sealing member of resiliently deformable material disposed between said end wall of said shell and said sealing means; means for conducting fluid under pressure to the interior of said shell, said sealing member having two surfaces on opposite sides thereof engaging said end wall and said sealing means respectively and having a face disposed to have applied thereto the pressure of said fluid in the interior of said shell and adapted to tend to be forced inwardly by said pressure so as to tend to expand the sealing member between said two faces.

4. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of a cylinder through which said rod extends, said shell having an outer end wall and an inner end wall each disposed at an angle relative to the axis of the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod; axially directed spring means interposed between said sealing means and said inner end wall; a sealing member of resiliently deformable material disposed between said end wall of said shell and said sealing means; means for conducting fluid under pressure to the interior of said shell, said sealing member having a first face in end thrust engagement with said sealing means, a second face engaging said end wall and a third face disposed to have applied thereto the pressure of said fluid in the interior of said shell and adapted to tend to be forced inwardly by said pressure so as to compress said sealing member against said outer end wall.

5. In a piston rod packing of the character described, the combination of: a cylindrical shell surrounding said rod and comprising inner and outer parts, said inner part being insertable in a bore in a wall of a cylinder through which said rod extends and having an inner end wall, said outer part being attachable to said cylinder wall and having an outer end wall formed to provide an inwardly tapered annular surface; sealing means between said inner and outer parts of said shell; a tubular member within said shell of such diameter as to provide an annular space between the interior wall of said shell and said tubular member; a sealing member of compressible material carried on the outer end of said tubular member and having an annular tapered face formed to seat on said tapered surface of the outer part of said shell; compressible packing members within said tubular member in contact with said rod; means for compressing said packing members in sealing contact with said rod; and means for delivering the medium under pressure in the cylinder into contact with said sealing member to compress said tapered annular face of said sealing member into sealing engagement with said inwardly tapered annular surface of said outer part of said shell.

6. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of the cylinder through which said rod extends, said shell having an outer end wall and an inner end wall each disposed at an angle relative to the axis of the body of said shell; sealing means in the interior of said shell encircling and contacting said rod and comprising inner and outer compression rings and compressible packing

therebetween; a sealing member of resiliently deformable material disposed between said end wall of said shell and said sealing means; spring means between said outer ring and a longitudinally intermediate portion of said shell adapted to urge said ring outwardly; and spring means between said inner ring and said inner end wall.

7. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and comprising inner and outer parts, said inner part being insertable in a bore in a wall of a cylinder through which said rod extends, and said outer part being attachable to said wall of said cylinder and having an outer end wall; a tubular member within said shell of a size to provide a space between said tubular member and the inner peripheral wall of said shell; a pair of sealing members formed of a compressible material carried by said tubular member within said shell and respectively engaging said outer end wall of said outer part of said shell and the outer end wall of said inner part of said shell in sealing engagement therewith; compressible packing members within said tubular member in contact with said rod; means for compressing said packing members; and means for delivering a fluid into the space between said tubular member and said peripheral wall of said shell to force said sealing members into sealing contact with the walls of said shell.

8. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of the cylinder through which said rod extends, said shell having an outer end wall disposed at an angle relative to the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod; a bearing ring slidably mounted on said rod and engaging the inner surface of the bore of said shell in a manner to permit a rocking motion of said sealing means with respect to said shell; and a sealing member of resiliently deformable material, said sealing member having a surface engaging the end wall of said shell, a surface engaging the interior bore of said shell and a surface having end thrust engagement with said sealing means.

9. In a piston rod packing, the combination of: a rod; a cylinder wall through which said rod passes; an inner shell surrounding said rod; a first compressible sealing means between said inner shell and said cylinder wall; an outer shell surrounding said rod; a second compressible sealing means between said inner and outer shells; packing around and contacting said rod; an outer compression member between said packing and said outer shell, the inner end of said compression member having an end thrust contact with said inner shell; a third compressible sealing means disposed longitudinally between said outer compression member and said outer shell; bolt means for clamping together said outer shell and said cylinder wall; an inner compression member abutting said packing; and a spring interposed longitudinally between said inner compression member and said shell, the several said elements of said piston rod packing being shaped and assembled to provide passage means within said inner and outer shells adapted to conduct the fluid medium under pressure within said cylinder into compressive relationship with said third compressible sealing means.

10. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of a cylinder through which said rod extends, said shell having an outer end wall disposed at an angle relative to the axis of the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod, said sealing means being formed adjacent its outer end with an annular groove, opening circumferentially outwardly; means for limiting the movement of said sealing means toward the cylinder; means for conducting fluid under pressure to the interior of said shell; and a sealing member of resiliently deformable material disposed between said end wall of said shell and said sealing means, said sealing means being formed with an annular ridge extending inwardly and cooperatively seated within said groove and being further formed with a face engaging the end wall of said shell and a face disposed to have applied thereto the pressure of said fluid and adapted to tend to be forced inwardly by said pressure so as to force said sealing member against said outer end wall.

11. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of a cylinder through which said rod extends, said shell having an outer end wall disposed at an angle relative to the axis of the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod, comprising inner and outer compression rings and compressible packing therebetween; means for limiting the movement of said inner compression ring toward said cylinder; a sealing member of resiliently deformable material disposed between said end wall of said shell and said outer compression ring, having a first face engaging said outer end wall, a second face having end thrust engagement with said outer compression ring and a third face exposed to the interior of said shell; means for conducting a fluid under pressure to the interior of said shell for application to said third face, said sealing means being provided with passageways for the movement of said fluid under pressure to that portion of the surface of said rod contacted by said sealing means.

12. In a piston rod packing of the character described, the combination of: a shell surrounding said rod and attachable to a wall of the cylinder through which said rod extends, said shell having an outer end wall disposed at an angle relative to the body of said shell; a sealing means in the interior of said shell encircling and contacting said rod; a bearing ring slidably mounted on said rod and engaging the inner surface of the bore of said shell in a manner to permit both a longitudinal sliding and a rocking motion of said sealing means with respect to said shell; resilient means mounted in said shell for urging said sealing means toward the outer end of said shell; and a sealing member of resiliently deformable material, said sealing member having a surface engaging the end wall of said shell, a surface engaging the interior bore of said shell and a surface having end thrust engagement with said sealing means.

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