

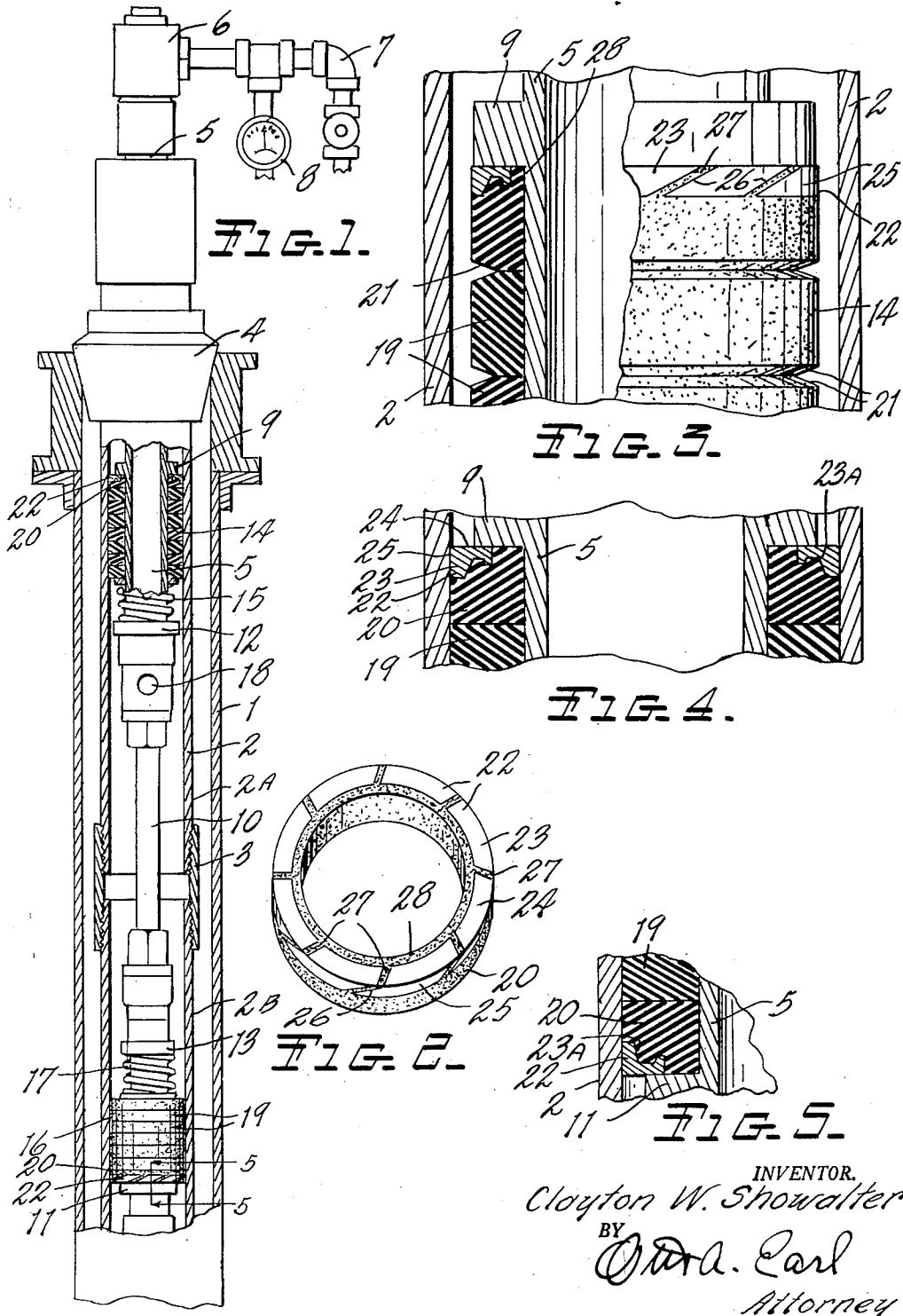
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PACKER UNIT AND PACKING RING FOR PIPE TESTING APPARATUS

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PACKER UNIT AND PACKING RING FOR PIPE TESTING APPARATUS

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This invention relates to improvements in packer unit and packing ring for pipe testing apparatus. The principal objects of this invention are:

First, to provide a packer unit capable of withstanding substantially greater pressures than packer units heretofore available.

Second, to provide a packer unit which is not damaged in use and which can be repeatedly used.

Third, to provide a radially extensible and axially compressible packer unit and ring which will not be extruded and torn between the abutment of the packer unit and the wall of a well in which the unit and ring is mounted.

Fourth, to provide novel and inexpensive means for reinforcing a packer ring to firmly support the ring on an abutment while permitting radial expansion of the ring on the abutment.

Fifth, to provide a packer ring with metallic reinforcing elements arranged to abut against the supporting abutment and well wall in which the ring is mounted to prevent damage to the ring by these members.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings illustrate one use of the packer unit and one form of reinforcing element incorporated in the packer ring and unit.

Fig. 1 is a fragmentary longitudinal cross sectional view through a section of a well with a well testing apparatus and packer unit embodying the invention mounted therein.

Fig. 2 is a perspective view of one form of packer ring employed in the packer unit shown in Fig. 1.

Fig. 3 is an enlarged fragmentary vertical cross sectional view through the upper packer unit shown in Fig. 1 and showing the packer unit in retracted non-sealing position with respect to the well wall.

Fig. 4 is a fragmentary vertical cross sectional view similar to Fig. 3 but showing the packer unit in extended sealing engagement with the well wall.

Fig. 5 is a fragmentary cross sectional view showing the operative relationship between the packer unit and the well wall with the lower packer unit in extended condition corresponding to the condition illustrated in Fig. 4.

It has heretofore been demonstrated that well pipes and tubes and particularly the joints therein may be effectively tested by inserting axially spaced packer units into the pipe and introducing liquid under hydraulic pressure between the packer units to expand the packer units into sealing engagement with the walls of the pipe and exert test pressure against the intervening portion of the pipe wall to test the pipe for leaks. Apparatus for performing this test operation is illustrated in Fig. 1 in which 1 represents an outer well casing and 2 represents an inner well tubing made up of pipe sections 2A and 2B connected by coupling sleeves 3. The inner tube 2 is supported within the case 1 by a grip collar 4 and a hollow test rod 5 extends into the tube 2 from a fluid coupling 6 adapted to introduce fluid under pressure into the tube

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from a fluid pressure source 7. A gage 8 is connected to indicate the pressure in the tube. The test tube 5 has a downwardly facing radially extending shoulder 9 formed thereon and constituting a fixed abutment that is spaced radially from the inner wall from the pipe 2. An extension rod 10 connected to the bottom of tube 5 is provided with an upwardly facing radially extending shoulder 11 constituting a lower fixed abutment on the test tube. Axially adjustably mounted on the lower end of the test tube as by being threaded thereon is an upper movable abutment 12 disposed in opposed relation to the upper fixed abutment 9. A similar lower movable abutment 13 is mounted on the lower end of the extension rod 10 in opposed relationship to the lower fixed abutment 11. An upper packer unit 14 is sleeved around the test tube 5 between the upper fixed end movable abutments and a compression spring 15 holds the packer unit against the upper fixed abutment. A lower packer unit 16 is urged against the lower fixed abutment 11 by a compression spring 17 bearing between the lower packer unit and the lower movable abutment 13. The lower end of the hollow test tube 5 is provided with a port 18 opening between packer units to exert hydraulic pressure on the packer units and on the inside of the pipe between the packer units. The structure thus generally described is old and is not claimed as a part of this invention except as the structure is improved by elements which will now be described.

The packer units 14 and 16 consist of a plurality of axially inner packer rings 19 and axially outer end packer rings 20. All of the packer rings are formed of deformable elastic material such as rubber or synthetic plastic and desirably have beveled edges 20 to facilitate axial compression and radial expansion of the packer rings and units.

It is pointed out that the fixed abutments 9 and 11 are spaced radially from the inner wall of the pipe 2 and that the packer units and rings in their uncompressed condition are similarly spaced from the wall of the pipe to permit easy movement of the packer units within the pipe. When the packer units are radially extended they must bridge the annular space between the fixed abutments and the wall of the pipe. In order to permit the packer units and rings to be subjected to the high pressures such as are encountered in deep oil wells for testing the inner pipe at corresponding pressures, the axially outer packer rings 20 are provided with metallic reinforcing ring 22 which are expansible with the elastic material of the rings and of sufficient radial width to bridge the annular space between the fixed abutments and the pipe wall.

The form of reinforcing ring 22 as illustrated in Figs. 1 to 5 consists of a plurality of segmental pieces or sections 23 having a flat annular end face 24 in slidable abutting relation with the fixed abutments 9 and 11 and a generally cylindrical outer surface 25 adapted to seat against the inside walls of the pipe 2. Within the body of the ring 20 the cross section of the segments is desirably curved irregularly as at 23A to provide increased bonding area and a good gripping engagement with the elastic material of the end packer rings and it is desirable but not necessary to bond the segments 23 to the elastic material of the rings. The ring segments 23 have beveled axially overlapping ends 26 that are separated by thin layers of the elastic material of the packer ring as at 27. It is thus possible for the reinforced rings 22 to expand radially with the packer rings as the packer rings are axially compressed. Desirably but not necessarily a substantial portion of the end packer rings 20 is disposed on the inside of the reinforcing rings 22 as at 28 to assist in retracting the segments of the reinforcing ring when axial pressure is released from the packer units.

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With the reinforcing ring incorporated in the end packer ring of the packer unit as described, the end packer ring cannot be forced or extruded into the annular space between the fixed abutments and the pipe walls as was heretofore common and not only will the packer unit withstand much higher pressures but it will wear longer because there can be no damage to the end packer ring by reason of the ring being squeezed and cut between the fixed abutment and the pipe wall.

Having thus described the invention, what is claimed to be new and what is desired to be secured by Letters Patent is:

1. A packer unit for a well comprising, a rod adapted to be inserted into the well and having a radially extending axially facing shoulder, a plurality of annular rings of deformable material sleeved around said rod with the end ring abutted against said shoulder, and a plurality of segmental metal blocks arranged in a ring and embedded and molded into the end of said end deformable ring, said blocks having side surfaces abutting said shoulder and adapted to bridge the annular space between said shoulder and the wall of said well, said blocks further having radially outer surfaces adapted to be pressed against the wall of said well and axially overlapping beveled ends embedded in and spaced by the deformable material of said end ring.

2. A packer unit for a well comprising, a rod adapted to be inserted into the well and having a radially extending axially facing shoulder, an annular ring of deformable material sleeved around said rod with the end of the ring abutted against said shoulder, and a plurality of segmental metal blocks arranged in a ring and embedded in the

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end of said deformable ring, said blocks having axially overlapped end surfaces and side surfaces abutting said shoulder and adapted to bridge the annular space between said shoulder and the wall of said well, said blocks further having radially outer surfaces adapted to be pressed against the wall of said well.

3. A packing ring comprising, an annulus of deformable material having parallel end surfaces, and a reinforcing ring of radially expansible character embedded in one end of said annulus along the radially outer corner thereof with a substantial thickness of deformable material disposed radially inwardly of the reinforcing ring, said reinforcing ring being bonded to the material of said annulus, said ring including a plurality of separate segmental metal sections having axially overlapping bevelled ends and axially and radially outer surfaces exposed to the corresponding surfaces of said annulus.

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