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EXPANDABLE TUBE PLUG

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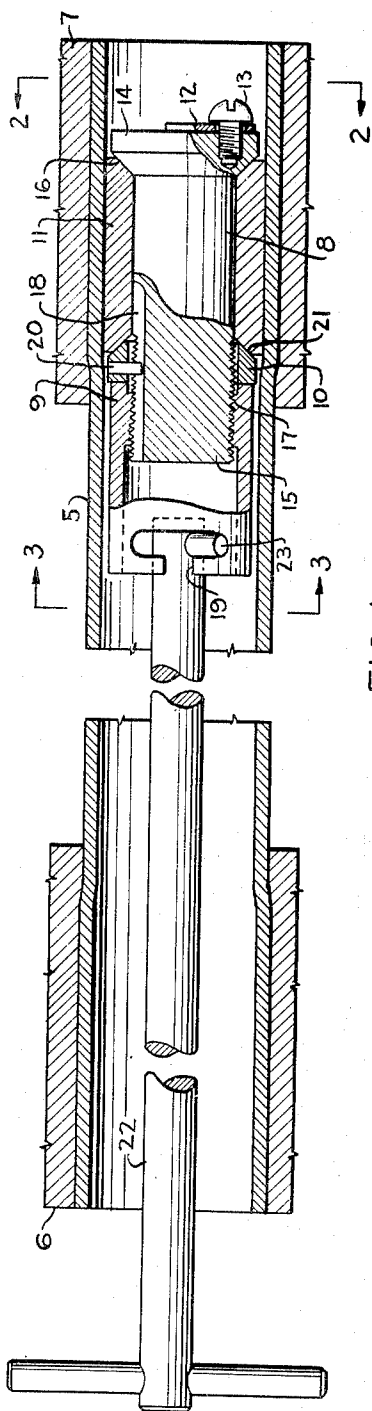


FIG. 1

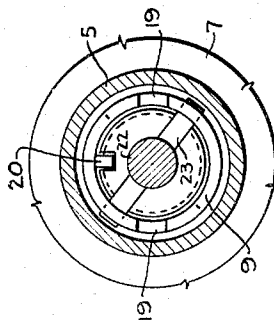


FIG. 3

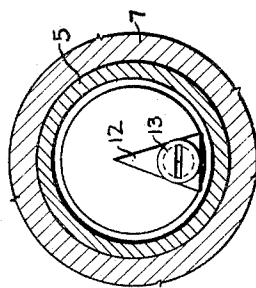


FIG. 2

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EXPANDABLE TUBE PLUG

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6 Claims. (Cl. 138—89)

The invention relates to devices for plugging tubes or pipes against passage of fluid, vapor and/or gas and is particularly concerned with a plug that is adapted for installation within an inaccessible part of a tube, i. e., remote from the exposed end thereof.

Expandable tube plugs of known constructions often include two abutment members that engage the ends of an intermediate member of yieldable material that expands radially into sealing engagement with the interior tube surface when the abutment members are drawn together. A drawback of most known plugs is that they can be installed only near the accessible end of a tube because of the necessity for drawing the abutments together, this being usually accomplished by drawing one toward the other by some screw-threaded means and necessitating one part to be held against rotation while the other is held. Devices for holding a part against rotation while inserted far into the tube are difficult to use.

Such tube plugging devices are useful for repairing a leak in a tube, and one or more plugs may be installed when the plug cannot be spotted accurately at the leak. For example, in repairing tubular heat exchangers, a leaky tube may be put out of service by installing a plug near each end of the tube. Such installation of plugs has heretofore necessitated the dismantling of the heat exchanger to the extent of exposing both ends of the tubes; the down-time of equipment and labor involved in such dismantling operation are considerable.

It is an object of this invention to provide an improved tube plugging device that can be readily installed at any position in the tube only one end of which is accessible.

A further object is to provide an improved expandable tube plug wherein the expandable member is mounted to avoid torsional stresses, whereby a dependable, leak-proof seal against the tube wall is attained, and wherein the possibility of leakage through the inside of the expandable member is avoided.

Still a further object is to provide an improved expandable tube plug that can be installed in and removed from the tube with but a single tool.

In summary, the plug device according to the invention comprises a pair of bodies having a screw-threaded connection and providing mutually facing, longitudinally spaced abutments, a sleeve of deformable material, usually metal, situated between said abutments, means on one member permitting free longitudinally passage of the plug through the tube but engageable with the interior of the tube to secure the member against rotation, and a coupler on the other body adapted for detachable, torque-transmitting engagement with an elongated tool.

The invention will be described in detail with reference to the accompanying drawing forming a part of this specification and showing one preferred embodiment by way of illustration, wherein:

Figure 1 is a longitudinal sectional view through a tube within which a plug according to the invention is installed, parts of the plug being shown in elevation;

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Figure 2 is a transverse sectional view taken on the line 2—2 of Figure 1, and

Figure 3 is a transverse sectional view taken on the line 3—3 of Figure 1.

Referring to the drawings in detail, the tube 5 to be plugged is illustrated as expanded at the ends thereof into supporting tube sheets 6 and 7, only the former of which need be accessible.

The plug comprises a first body 8, a second body or compression-adjusting screw 9, a follower ring 10, an expandable compression sleeve 11, and a locking device 12, pivotally connected to the first body by a retaining screw 13. The first body 8 has a head 14 somewhat smaller than the internal cross section of the pipe 5 so as to slide freely through it, and a shank 15 of reduced diameter. The head has a bevelled face 16 forming an abutment. The shank is externally screw threaded as shown at 17 and has a longitudinal slot 18. The second body 9 is shaped as a tube that is internally threaded and screwed onto the shank 15. It has a pair of diametrically opposite notches 19 that extend circumferentially beyond the width of the opening at the extreme end of the body, thereby forming a part of a bayonet-type coupling. The follower 10 is slidable on the shank 15 and has a tang or pin 20 extending radially inwardly into the slot 18 to retain the follower against rotation with respect to the abutment 16. The follower has one end thereof in engagement with the end of the body 9 and has a bevelled face 21 forming a second abutment directed toward the abutment 16. The sleeve 11 is made of deformable material, such as lead, tin, copper or alloys thereof and/or other plastic materials, and has the ends thereof bevelled to conform to the bevelled abutments 16 and 21. This sleeve has a snug fit on the shank 15, which preferably has a part thereof circumferentially continuous, i. e., the threads 17 and the slot 18 do not extend to the head 14. The bevel angle (measured between the longitudinal axis and the cone surface) is preferably between 20° and 45°, e. g., 45° as shown. Various locking devices may be used; in the embodiment illustrated, it includes a triangular lug 12 that is freely pivoted about the screw 13, the latter extending longitudinally and passing through the lug away from the center of gravity of the lug. The lug has a shape so that it can be turned to lie entirely within the outline of the head 14 for free passage through the tube 5 and to swing radially outward by gravity in certain positions of the body 8 to cause one of its sharp points to dig into the tube wall when a turning force is applied to the body.

In installing the plug the plug is attached to the end of a long tool 22 having a cross pin 23 by inserting the latter into the notches 19 and turning slightly, as shown in Figure 1. The plug is then pushed into the tube for the desired distance, i. e., into the tube sheet 7, at a position beyond the leak in the pipe tube. The tool 22 is then turned clockwise. Torque is transmitted to the body 9 by the coupling and frictional forces at the threads 17 initially cause a like rotation of the body 8. When the latter reaches a position at which the lug 12 is unbalanced, the link swings outward until the sharp point thereof comes into contact with the wall of the tube 5; this prevents further rotation of the body 8, and continued rotation of the tool 22 and body 9 causes the latter to be screwed toward the body 9. This slides the follower ring 10 toward the head 14 and causes axial compression of the sleeve 11. The axial compression tends to thicken the sleeve wall, and it is pressed radially inwardly against the shank 14 and radially outwardly against the tube 5, thereby effecting a liquid- and vapor-tight seal against both these parts. The tool 22 may then be disengaged from the body 9 and withdrawn. It is evident that a second tube plug, which may be of the same type or of the

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conventional type, is thereafter applied to the tube near or within the tube sheet 6, whereby the tube 5 is isolated entirely.

The plug can be removed by engaging the tool 22 and turning in a counter-clockwise direction. In this case the friction of the expanded sleeve 11 prevents rotation of the body 8, whereby the body 9 is backed off the threads. This serves to relieve the stress forcing the sleeve against the tube, and makes it possible to retract the plug by applying a sufficient force to the tool. In instances in which the pipe has become fouled by deposits it is preferable to push the loosened plug forward beyond the tube sheet 7, this being feasible because the plug is usually left in position until the heat exchanger is fully stripped for major overhaul. The plug can be used again after replacing the sleeve 11 with a fresh one.

We claim as our invention:

1. An expandable tube plug adapted for passage through and installation within an inaccessible part of a tube by a single elongated tool including a pair of bodies having a screw-threaded connection about a longitudinal axis, means on one of said members adapted for detachable, torque-transmitting engagement with the end of said elongated tool and the other body having means engageable with the inner face of the tube and operable prior to relative movement between said two bodies for securing the latter body against rotation, an abutment for each said body movable longitudinally therewith, and a sleeve of deformable material having the ends thereof in engagement with said abutment, said sleeve being adapted to be deformed into sealing relation to the tube wall and sealed to at least one of said bodies when said bodies are drawn together.

2. A tube plug as defined in claim 1 wherein said abutments and ends of the sleeve have bevelled surfaces extending continuously to the outermost portions of the abutments with bevel angles between about 20° and 45°.

3. A tube plug as defined in claim 1 wherein at least one of said abutments is a ring rotatable with respect to the corresponding body, said abutments having means retaining the abutments against relative rotation.

4. An expandable tube plug adapted for installation within a tube including a pair of bodies having a screw-threaded connection about a longitudinal axis, means on one of said members adapted for detachable, torque-transmitting engagement with the end of a tool and the other body having a lug loosely mounted thereon for free pivoted rotation about a longitudinal axis eccentric to

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the tube plug and situated away from the center of gravity of the lug, said lug being shaped to lie entirely within the outline of the other parts of the tube plug body in one position of the lug and having a point adapted to project beyond said outline for engaging the inner face of the tube wall in another position of the lug and thereby securing the latter body against rotation, an abutment for each said body movable longitudinally therewith, and a sleeve of deformable material having the ends thereof in engagement with said abutment, said sleeve being adapted to be deformed into sealing relation to the tube wall and sealed to at least one of said bodies when said bodies are drawn together.

5. A tube plug as defined in claim 1 wherein said means for engagement with the tool includes one part of a bayonet-type coupler, whereby said plug can be pulled out of the tube when engaged to the tool.

6. An expandable tube plug adapted for installation within an inaccessible part of a tube including a first body having a head peripherally engageable with the inside of the tube with clearance and a shank of reduced diameter extending in one longitudinal direction, said head having a bevelled abutment in said direction and said shank being externally screw-threaded and having a longitudinal slot; a second body having a sleeve part in threaded engagement with said threaded part of the shank; a follower ring surrounding and in slidable engagement with said shank having a tang extending into said slot, said ring being in engagement with the end of said second body and having a bevelled abutment facing said head; a sleeve of yieldable material having bevelled ends conforming to the shapes of said abutments disposed about said shank and interposed between the abutments adapted to be deformed into sealing relation both to the tube wall and to said shank when said abutments are drawn together; coupling means on one of said bodies for detachably engaging an elongated tool in torque-transmitting relation; and means on the other body for engaging the inner face of the tube for securing the latter body against rotation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,558,161	Gunderson	Oct. 20, 1925
2,390,461	Racz	Dec. 4, 1945
2,475,748	Leroy	July 12, 1949
2,538,485	Tessier	Jan. 16, 1951