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PLUG FOR TUBES

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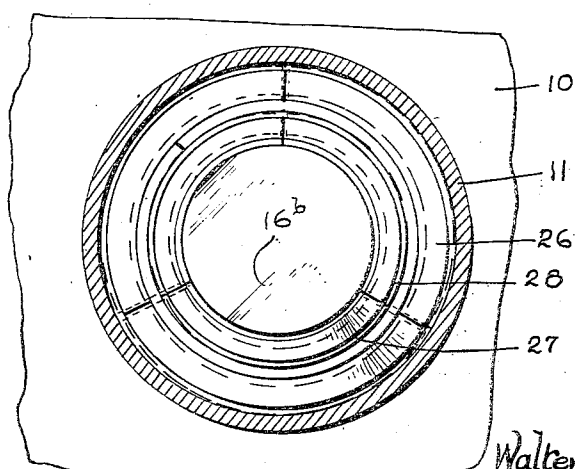
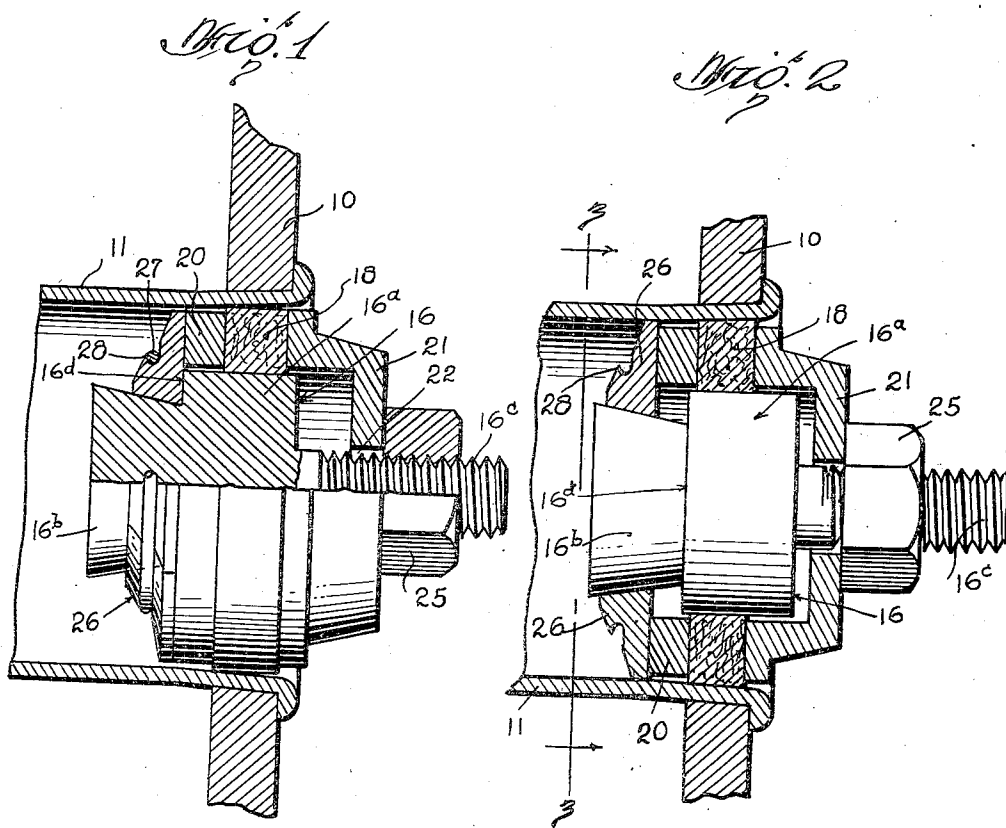


Fig. 3

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PLUG FOR TUBES

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This invention relates to improvements in plugs for boiler tubes.

In normal operation of boilers of the fire tube and water tube types, it frequently happens that a leak will occur in one of the tubes. To repair the leaky tube it is usually necessary to draw the fire from the boiler, thus to shut down its operation until repair of the leaky tube has been completed. Devices in the nature of plugs insertable into the leaky tube for the purpose of shutting off such tube from the rest of the boiler, whereby the boiler may continue operation, have been constructed previously, but in all such constructions there has been difficulty in applying the plug in such manner as to properly seal the tube from the boiler, or where proper sealing has been effected, plugs of exceedingly complicated and expensive design have been heretofore required.

Among the objects of the present invention is the provision of a tube plug, which will be exceedingly practical in operation and durable in construction and use; the provision of a plug of the aforesaid character which will be relatively simple and inexpensive in construction while at the same time may be applied in such manner as to effectively shut off and seal from the rest of the boiler the defective or leaky tube; the provision of a plug having the aforesaid properties which may be applied without danger to the workman and which may be inserted from both ends of the tube with facility and minimum of labor.

Other objects will be in part obvious and in part hereinafter pointed out in connection with the following analysis of this invention wherein is illustrated an embodiment of the invention in detail.

In the drawing—

Fig. 1 is a part vertical section through a tube end and a plug of the present invention introduced therein, with the plug parts being shown in their position prior to securement with the tube;

Fig. 2 is a view similar to Fig. 1, with the plug shown in operative plugging relation with respect to the tube;

Fig. 3 is a detail illustrating features of the plug shown in Figs. 1 and 2.

Referring now to the drawing wherein like reference characters denote like parts throughout the several views, reference character 10 designates a tube sheet such as the front tube sheet of a conventional boiler, with which is associated in known manner a tube 11 which, for the purpose of the following description, will be considered as a leaky tube which it is desired to shut

off from the remainder of the boiler. It will be understood that in any boiler construction there is a plurality of such tubes as tube 11, in any one of which the plug to be described may be introduced.

Such a plug may advantageously include a swedge block generally designated at 16, having a substantially cylindrical body portion 16a, a wedge portion 16b extending from the relatively inner end of the body portion, and a threaded bolt portion 16c extending from the other or relatively outer end of the block body portion and being arranged coaxial with respect thereto. The diameter of the body portion 16a is appreciably less than the inner diameter of the tube 11, and the wedge portion 16b is in the nature of a truncated cone whose smaller diameter is appreciably less than the diameter of the cylindrical body portion 16a. The conical wedge portion preferably terminates in the abrupt shoulder 16d arranged between the cylindrical and wedge portions of the plug as illustrated.

Carried by the cylindrical portion 16a of the swedge block 16 is a gasket 18, the arrangement being such that the gasket is disposed snugly on the cylindrical portion 16a of the plug, its outer diameter being such as to clear the inner wall of the tube prior to compression and radial expansion of the gasket by the means to be described.

On the relatively rear side of the gasket 18 is arranged a gasket back ring 20 whose inner diameter is such that it may ride loosely on the cylindrical portion 16a of the swedge block, and its outer diameter being less than the inner diameter of the tube 11. Arranged on the relatively outer side of the gasket 11 is a recessed pressure cap designated 21 having its inner vertical face adapted to bear against gasket 18 and having a central aperture 22 through which bolt portion 16c projects, the aperture 22 being of slightly greater diameter than that of the bolt. The recess of the cap provides an air space which aids in cooling the cap and thus inhibits burning out thereof under the intense heat to which it is subjected. Arranged on the bolt 16c is a compression nut 25 normally bearing against the pressure cap 21, and adapted to move the cap inwardly, its outer diameter being less than the inner diameter of the tube.

Operatively related to the wedge portion 16b of the swedge block is a segmental positioning ring generally designated at 26, and preferably comprising three arcuate or segmental ring parts which, when relatively retracted, as in Fig. 1, constitute substantially a ring element

which engages against the gasket back ring 20 and bears against the shoulder 16c of the swedge block 16.

The relatively lower edges of the segments are tapered complementarily to the taper of the wedge portion 16b and, by the provision of a frangible element such as a wire 27 engaging an upstruck rim 28 formed on the relatively inner face of the ring parts, such ring parts are normally held in retracted position as illustrated in Fig. 1, in which position the outer diameter of the segmental ring is substantially that of the gasket back ring 20 and less than the inner diameter of the tube 11.

In introducing a plug as described into a tube such as the tube 11, the plug is introduced as a unit to a position in which the face of the pressure cap 21 is approximately flush with the outer surface of the tube sheet 10, thereby arranging the gasket 18 in substantial alignment with the tube sheet, with the outer surface of the gasket bearing lightly on the inner surface of the tube 11. It is notable that the plug may be maintained as a unit for insertion into the tube as aforesaid by the provision of the compression nut 25 which may be threaded down on the bolt portion 16c sufficiently to hold the parts together, without exerting pressure on the gasket 18 to the extent to cause radial expansion thereof. In this position the frangible element 27 holds the parts of the split ring 26 in their retracted position.

When it is desired to seal the tube by the plug aforesaid, compression nut 25 is threaded down on the bolt portion 16c and through its engagement with pressure cap 15 exerts pressure on the gasket 18 in the direction of its axis whereby to expand the gasket radially into sealing engagement with the inner wall of the tube 11. Simultaneously, the threading down action of the nut 25 causes movement to the right (Figs. 1 and 2) of the swedge block 16. This movement by reason of the camming or wedging action of the portion 16c of the block with relation to the segmental parts of the split ring assembly 26, tends to move the split ring parts also to the right, but this movement is resisted by the gasket and the back ring 20, with the result that the ring parts are forced outwardly (radially) into holding engagement with the inner tube surface. During such outward movement the element 27 is fractured and, as the threading down of compression nut 15 continues, the relatively narrow outer edges of the split ring parts bite into the inner tube surface with proportionately increasing pressure, with the result that the plug is effectively anchored in the tube. Further continued threading of the compression nut 25, through the medium of the movable pressure cap 21, exerts pressure on the gasket 18 to cause further radial expansion thereof and a tighter seal between the peripheral surface of the gasket and the inner tube, whereby the end of the tube is effectively sealed.

It will be understood that a plug of the aforesaid character may be introduced into the other end of the leaky tube 11 and operated in the manner above described to effect sealing of said other end of the tube whereupon the tube is effectively shut off from the rest of the boiler.

The plug as described is simple in construction and may be manufactured at relatively low cost in that practically all of the parts can be cast and little machining is required. The parts may be readily assembled for introduction into a tube, and from the above description it will be further

noted that the operation of the plug following its insertion into the tube is exceedingly simple and can be effected with a minimum of time and labor.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A plug for boiler tubes comprising, in combination, a swedge block including a body portion, a wedge portion at one end thereof, and a threaded bolt portion extending from the other end thereof, a gasket carried by said body portion and operative upon compression in the direction of its axis to expand radially, plug anchoring means carried by said wedge portion and operative upon relative axial movement therebetween, said means comprising a segmental ring, the segments of which are movable radially from a retracted position to a position in which their outer edges are adapted to bite into the inner tube surface whereby to secure themselves to the tube, a gasket back ring disposed between the segmental ring and the gasket, the back ring being positioned by the segmental ring and having a face against which the gasket is adapted to be compressed, an axially movable pressure element operative to compress the gasket, and means carried by the bolt portion and acting through the pressure element to compress the gasket against the gasket back ring.

2. A plug for boiler tubes comprising, in combination, a swedge block including a body portion, a wedge portion at one end thereof, and a threaded bolt portion extending from the other end thereof, a gasket carried by said body portion and operative upon compression in the direction of its axis to expand radially, plug anchoring means carried by said wedge portion and operative upon relative axial movement therebetween, said means comprising a segmental ring the segments of which are movable radially from a retracted position to a position in which their outer edges are adapted to bite into the inner tube surface whereby to secure themselves to the tube, a gasket back ring disposed intermediate the segmental ring and the gasket, the back ring being positioned by the segmental ring and having a face against which the gasket is adapted to be compressed, a pressure cap carried by the bolt portion, the outer diameter of the operative pressure face of the cap being less than the inner diameter of the tube, the cap being recessed to provide an air space therein, and a nut adapted to be threaded on to the bolt portion whereby to cause the pressure cap to move against and compress the gasket against the gasket back ring.

3. A plug for boiler tubes comprising, in combination, a swedge block having a body portion and a wedge portion, a radially expansible gasket carried by said body portion, the wedge portion being shaped in the manner of a truncated cone, the smaller diameter of which is adjacent to and substantially less than the diameter of the body portion of the block whereby to provide a shoulder between the body and wedge portions, a segmental ring carried on said wedge portion the segments of which are movable radially from a retracted position in which they are located by said shoulder to a position in which they are adapted to bite into the inner tube surface

whereby to anchor the plug to a tube, frangible means for normally securing the segments in their retracted position aforesaid, the segments each having a surface complementary to the cone surface of the wedge portion whereby, upon axial movement of the block, the segments of the ring are moved radially, and means operative to actuate the block axially and thereafter to compress the gasket whereby to expand it radially.

10 4. A plug for boiler tubes comprising, in combination, a swedge block having a body portion and a wedge portion, a radially expansible gasket carried by said body portion, the wedge portion being shaped in the manner of a truncated cone, 15 the smaller diameter of which is adjacent to and substantially less than the diameter of the body portion of the block whereby to provide a shoulder between the body and wedge portions, a segmental ring carried on said wedge portion the segments of which are movable radially from a retracted position in which they are located by 20 said shoulder to a position in which they are adapted to bite into the inner tube surface whereby to anchor the plug to a tube, frangible 25 means for normally securing the segments in their retracted position aforesaid, the segments each having a surface complementary to the cone surface of the wedge portion whereby, upon axial movement of the block, the segments of the ring 30 are moved radially, a gasket back ring disposed between the segmental ring and the gasket, the back ring being positioned by the segmental ring and having a face against which the gasket may 35 be compressed, and means operative to actuate

the block axially and thereafter to compress the gasket against the gasket back ring.

5 5. A plug for boiler tubes comprising, in combination, a swedge block having a body portion and a wedge portion, a radially expansible gasket 5 carried by said body portion, the wedge portion being shaped in the manner of a truncated cone, the smaller diameter of which is adjacent to and substantially less than the diameter of the body portion of the block whereby to provide a shoulder 10 between the body and wedge portions, a segmental ring carried on said wedge portion the segments of which are movable radially from a retracted position in which they are located by 15 said shoulder to a position in which they are adapted to bite into the inner tube surface whereby to anchor the plug to a tube, frangible means for normally securing the segments in 20 their retracted position aforesaid, the segments each having a surface complementary to the cone surface of the wedge portion whereby, upon axial movement of the block, the segments of the ring are moved radially, a gasket back ring disposed 25 between the segmental ring and the gasket, the back ring being positioned by the segmental ring and having a face against which the gasket is adapted to be compressed, the block having oper- 30 atively related thereto a bolt portion, an axially movable pressure cap through which the bolt portion extends, and a nut carried by said bolt portion and operative to actuate the block axially and thereupon to move the pressure cap whereby to compress the gasket against the gasket back ring.

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