July 18, 1961 H. A. RUTH 2,992,486

SOUNDING ROD SEAL FOR A BLAST FURNACE

Filed Feb. 6, 1959

Fig. 1

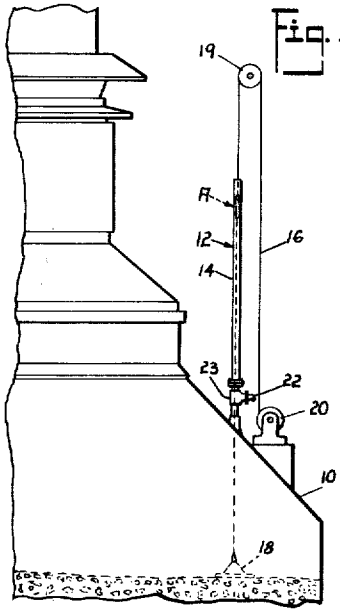


Fig. 2

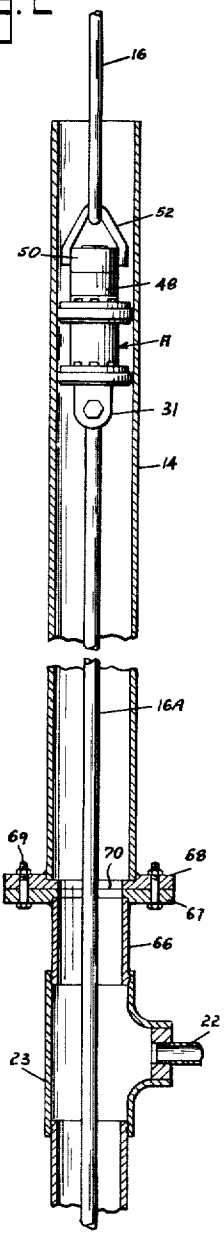


Fig. 3

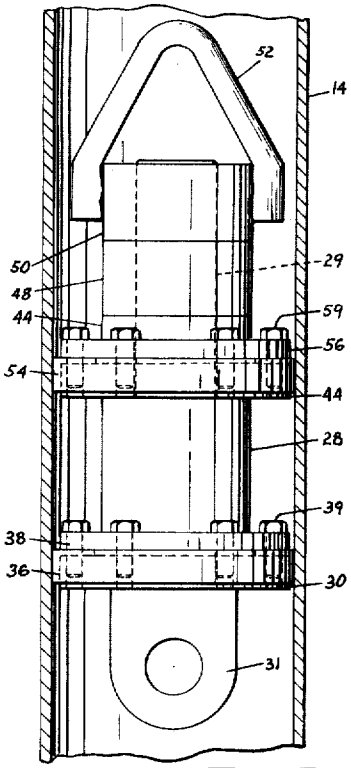


Fig. 4

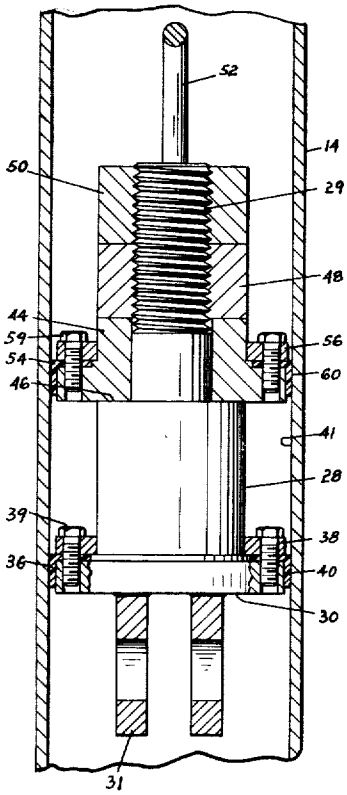
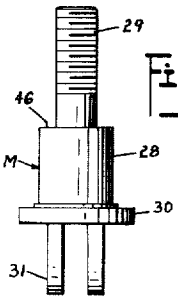


Fig. 5



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SOUNDING ROD SEAL FOR A BLAST FURNACE

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This invention relates to blast furnaces and more particularly to seal means for the test rod of such furnaces.

Many types of blast furnaces are provided with a test rod for determining the level of the burden in the furnace during the operation thereof. The test rod generally extends through a gland and has a weight at one end thereof, which is adapted, when lowered, to rest upon the top of the burden in the furnace. The upper end of the rod is connected to a cable which, in turn, is connected for movement to a power-operated winch. During operation of the furnace, there is a pressure differential between the interior of the furnace and the outside atmosphere, which causes the toxic dust-laden furnace gases to leak up and out of the test rod gland in the absence of proper sealing means therein. Such gas leakage constitutes a loss in efficiency of operation and is a serious hazard to personnel at the top of the furnace.

Although other types of seal means have been used in an effort to prevent the escape of furnace gases, they have not been satisfactory, particularly whenever the furnace is operating under a high top pressure. Such prior seal means are subject to excessive wear, because of the fact that the escaping furnace gases carry considerable quantities of fine ore and coke dust, which are blown through the gland. During operation of the furnace, such particles of ore and coke dust produce an erosive sand-blast effect against the sealing means, and, additionally, cause corrosion of the cable as well as the gland.

An object of the invention is to provide an effective seal for the test rod of a blast furnace sounding apparatus which is relatively free of friction and is subject to a minimum of wear and maintenance.

A further object of the invention is to provide a seal assembly for the test rod of a blast furnace wherein the sealing is effected by one or more cup seal packings which are detachably secured to a seal assembly and are adapted to travel within a tube.

Briefly, the foregoing objects are accomplished by the provision of a blast furnace sounding rod seal assembly which is slidably disposed in a tube and which has replaceable thermoplastic cup seal packings thereon adapted for sliding sealing engagement with the inner longitudinal wall of the tube. The seal assembly includes a cylindrical member having spaced flanges or piston members on the ends thereof. The packings fit over and substantially encase the piston members and are detachably secured thereto. Means are provided at each end of the seal assembly for detachably securing the same to the test rod flexible cable. With this construction, an effective seal is provided enabling quick and simple replacement of the sealing medium thereon.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings in which:

FIG. 1 is a partial side elevational view of the upper part of a blast furnace having a sounding test rod mechanism thereon and containing the seal assembly of the invention;

FIG. 2 is an enlarged side elevational view, partly in section, of the upper portion of the sounding test rod shown in FIG. 1, including the seal assembly of the invention therein;

FIG. 3 is an enlarged side elevational view of the test rod seal assembly shown in FIG. 2;

FIG. 4 is a side elevational view, partly in section, of the seal assembly shown in FIG. 3;

FIG. 5 is a side elevational view of reduced size of the seal assembly main cylindrical member shown in FIG. 4.

The present invention is directed to a seal assembly and tube adapted for use with a blast furnace test rod, wherein the seal assembly is slidably mounted within the tube in sealing engagement with the inner wall thereof.

Referring to FIG. 1, there is shown a section of the upper portion of a blast furnace **10** having a test rod sounding mechanism, generally indicated at **12** thereon. The test rod mechanism includes a tube **14** within which a cable **16** and a rod **16A** are movably positioned. The rod has a weight **18** secured to its lower end interiorly of the furnace, and adapted to contact the burden in the furnace, thereby enabling the operator to determine the height of the charge therein. Exteriorly of the tube **14**, the cable **16** is passed over a pulley **19**, or the like, to enable the weight **18** to be raised or lowered. The outer end of the cable **16** is connected to a winch **20**.

The flexible cable **16** and rod **16A** are connected to a cylindrical sealing member or piston assembly, generally designated as A (FIG. 2), which is slidably disposed within the tube **14** and functions to seal the escape of the dust-laden furnace gases from the interior of the furnace to the outside atmosphere. The seal assembly, in the preferred form, includes a unitary, main cylindrical member M (FIG. 5), comprising a central cylindrical portion **28** having a threaded stud portion **29** extending upwardly from the upper end thereof and having an annular peripheral flange or piston portion **30** at the lower end thereof, with a bifurcated eyelet **31** extending downwardly from such flange providing a lower attaching means for the rod. The flange **30** is adapted to receive a cup packing **36** (FIG. 4) thereon, which preferably comprises a thermoplastic or plastomeric material, and which has an interior configuration similar to the configuration of the flange so as to provide a snug fit therewith. The cup packing **36** substantially encases the flange **30** and is retained thereon by the washer **38**, which may be secured to the flange by any suitable means, such as bolts **39**. The outer portion or flange **40** of the cup packing **36** is adapted for sliding, sealing contact with the inner wall **41** of the tube **14**.

A similar packing or sealing structure is disposed at the upper end of the main cylindrical member M and, in the present instance, includes a separable apertured flange or ring washer **44**, which is placed over the stud **29** and is positioned on the shoulder **46** formed at the juncture of the stud and the cylindrical portion **28**. The flange **44** may be retained in such position by the lock nut **48**, which is threaded onto the stud **29** and bears against the top end of such flange. A second lock nut **50** may be threaded onto the stud **29** and on top of the nut **48**, such second nut having an eyelet **52** at its upper end providing an upper attaching means for the cable **16**. The flange **44** is adapted to receive a cup packing **54** thereon, which preferably also comprises a thermoplastic or plastomeric material, and which has an interior configuration similar to the configuration of the flange **44** so as to provide a snug fit therewith. The cup packing **54** substantially encases the flange **44** and is retained thereon by the washer **56**, which may be secured to such flange by any suitable means, such as the bolts **59**. The outer portion or annular flange **60** of the cup packing **54** is adapted also (along with the flange **40** of the cup packing **36**) for sliding, sealing contact with the inner longitudinal wall

41 of the tube 14. Accordingly, the cup packings 36 and 54 function as the sealing medium for the assembly A.

After the packing assembly A has been assembled as aforedescribed, the cable 16 is attached to the upper end and the rod 16A is attached to the lower end thereof, as shown in FIG. 2, after which the assembly may be telescoped into operating position within the tube 14.

A steam pipe 22 may be secured to the tube 14 adjacent the lower end thereof by means of the T-fitting 23 to provide for the introduction of steam into the tube. The pressure of such steam is greater than the pressure of the gases in the furnaces, hence, the steam forms a partial seal against the escape of the gases. Additionally, the steam functions to wet the inner longitudinal wall of the tube 14, thereby providing a lubricant for the reciprocating seal assembly A. Welded or otherwise secured to the upper end of the T-fitting 23 is a suitable pipe or tube 66 having a flange 67 at the upper end thereof. The tube 14 contains a coacting companion flange 68 secured to the lower end thereof, which may be connected directly to the tube flange 67 by the bolts 69, to define, in conjunction with tube 66, a constriction 70 adjacent the lower or proximal end of the mechanism, above T-fitting 23, and completes the tube assembly.

The cup packings 36 and 54, may be formed of any suitable sealing material. However, in the preferred form, such cup packings are formed of a thermoplastic material having lubricating characteristics; reference may be had to United States Patent No. 2,708,772 (column 3, lines 71–75, and column 4, lines 1–3) issued May 24, 1955 to Leslie John Moncrieff, which refers to the known thermoplastic material polytetrofluorethylene and the fact that certain thermoplastic materials including the latter have lubricating characteristics.

The interior surface 41 of the tube 14 may be honed out to remove scale and rust and thereby provide a relatively frictionless surface for the reciprocating seal assembly A.

I claim:

1. A blast furnace test rod apparatus comprising a tube carried by the furnace, a flanged piston slidably disposed in said tube for longitudinal movement therein, a cup-shaped packing member detachably secured on said flanged piston for sealingly engaging the interior wall of said tube, and a constriction in said tube adjacent its proximal end having a diameter less than the diameter of the flange on said piston, support means for said test rod on said piston, and means on said piston for attaching a cable thereto.

2. A blast furnace test rod apparatus comprising an upright tube carried by the furnace, a main cylinder piston member disposed in said tube for reciprocal axial movement therein and having a plurality of spaced peripheral flanges thereon, apertured cup packings disposed in tight-fitting engagement on said flanges for sealingly engaging the inner longitudinal wall of the tube, a constriction in said tube adjacent its proximal end having a diameter less than the diameter of the flanges on said piston, support means for said test rod attached to the lower end of said piston, and means on the upper end of said piston for attaching a cable thereto.

3. A blast furnace test rod apparatus comprising an upright tube carried by the furnace, a cylindrical piston member disposed in said tube for reciprocal axial movement therein and having a plurality of spaced peripheral flanges thereon, cup packings disposed in tight-fitting engagement on said flanges for sealingly engaging the inner wall of the tube, retaining means disposed on said cup packings and secured to said flanges for retaining the cup packings in position thereon, a constriction in said tube adjacent its proximal end having a diameter less than the diameter of the flanges on said piston, support means for said test rod attached to the lower end of said piston, means attached to the upper end of said piston for attaching a cable thereto, and means disposed below said constriction for introducing gas under pressure into the lower end of said tube.

4. An apparatus constructed in accordance with claim 3 wherein the retaining means comprises washers disposed on said cup packings and bolted to said flanges to retain the cup packings in position thereon.

5. A blast furnace test rod apparatus comprising an upright tube carried by the furnace, a cylindrical piston member disposed for reciprocal axial movement in said tube and having a peripheral flange at its lower end and having a threaded stud of reduced diameter at its upper end, a separable apertured flange telescoped onto said stud and positioned at the juncture of the stud and the cylindrical member, a lock nut threaded onto said stud and against said apertured flange to retain the same in position on the cylindrical member, cup packings disposed in tight-fitting engagement on said flanges for sealingly engaging the inner wall of the tube, and retaining means disposed on said cup packings and secured to said flanges for retaining the cup packings in position thereon, a constriction in said tube adjacent its proximal end having a diameter less than the diameter of the flange on said piston, support means for said test rod attached to the lower end of said piston, means on the upper end of said piston for attaching a cable thereto, and means disposed below said constriction for introducing gas under pressure, such as steam, into the lower end of said tube.

6. A blast furnace test rod opparatus comprising an upright tube carried by the furnace, a flanged piston slidably disposed in said tube for longitudinal movement therein, a cup shaped packing member detachably secured on such flanged piston for sealingly engaging the interior wall of said tube, said packing member being formed of a thermoplastic material having lubricating characteristics, a constriction in said tube adjacent its proximal end having a diameter less than the diameter of the flange on said piston, support means for said test rod on the lower end of said piston, and means on the upper end of said piston for attaching a cable thereto, and means below said constriction for introducing gas under pressure, such as steam, into the lower end of said tube.

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