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(54) BEARINGS FOR RAPPING SHAFT FOR ELECTROSTATIC PRECIPITATORS

(71) ELEX A.G., a Swiss Body Corporate, of Forchstrasse 2, CH-8032 Zurich, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The invention relates to electrostatic precipitators and more particularly relates to an electrostatic precipitator installation in which the rapping shaft bearings are subjected to a dust-laden atmosphere in use.

Electrostatic precipitators are provided with discharge and collecting electrodes which attract particulate matter from contaminated air streams passing through the precipitators. Particulate matter or dust which piles up on these electrodes must be removed by shaking or washing of these electrodes. Normally, the shaking is accomplished by vibrators or rapping devices. Generally, such devices have a rotating shaft with tumbling hammers fixed thereto and each of the hammers strikes a rapping rod linked to one or more discharge or collecting electrodes so as to shake or vibrate them. These rotating shafts are supported by bearings which are subjected to wear and tear during the rotation of the rotating shaft with the tumbling hammers affixed thereto.

Wear and tear of the bearings is generally due to the dust content in the gases to be cleaned wherein the dust or particulate matter in the gas streams penetrate into the bearings thereby producing wear and tear of the bearings as well as the shaft. In some operations chemical components in the gas stream contribute to corrosion of the bearings and shafts. And, even further, in other operating environments, the temperature of the gases which are passing through the precipitator, which in some cases are in the neighbourhood of 400°C, and higher, adds to the wear and tear of these

bearings and shafts. Thus, the atmosphere inside a precipitator together with the wear and tear from dust, as mentioned previously, do not allow for proper lubrication of the bearings.

In present day operations, it is common to use dry slide bearings without lubrication whereby the bearing sleeves and the shaft have to be replaced after the wear and tear has reached a certain level. For example, French patent number 1,361,746 teaches dry bearings with a back rest whereby the supporting parts can be re-adjusted from time to time. However, wear and tear of the shaft cannot be prevented by this type of bearing. Another French patent, French patent number 1,449,521, teaches a shaft resting on roller or ball bearings on which the inner rings of the bearings are sliding upon two supporting bolts so that when the roller bearing and their supporting bolts are worn they can be replaced. However, this has not completely alleviated the problem. Firstly, dust continues to penetrate into the ball bearings until the ball cage is pushed to one side and finally jammed at the supporting frame of the bearings. Secondly, in conjunction with the penetration of dust, the outer ring of the ball bearings starts to dig a groove into the rapping shaft which after a while will have to be replaced.

In the present invention it is recognized that it is desirable to provide bearings for a rapper shaft of an electrostatic precipitator which have a substantially long life with a minimum amount of maintenance.

Accordingly the present invention provides an electrostatic precipitator comprising a housing having a gas inlet, a gas outlet and a chamber therebetween containing a plurality of discharge and collecting electrodes suspended therein, said chamber further comprising a shaft extending across the chamber in close proximity to the said electrodes and

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electrode rapping means arranged to impact the electrodes upon rotation of the said shaft, said shaft being supported in bearings at least one of which comprises an assembly consisting of two spaced apart, shaft-supporting, rollers each of which is supported in turn by an elongate rod member mounted in a bearing block and a replaceable wear ring on the outer periphery of the shaft, the wear ring being disposed in use in contacting relationship with the said rollers.

Hereinafter the invention is further described by way of example and with reference to the accompanying drawings, wherein:-

Figure 1 is a sectional view illustrating the bearings for a rapping shaft according to the present invention;

Figure 2 is a side view partially in section taken along line 2-2 of Figure 1; and

Figure 3 is a schematic illustration of a portion of a typical electrostatic precipitator having conventional electrode rappers utilizing the preferred bearing assembly shown in Figure 1.

In the accompanying drawing, in Figure 1, a bearing assembly 50 of the present invention is shown, the bearing assembly 50 being provided with a shaft 1 upon which a hardened wear ring 3 having a circular outer surface and a tapering inner surface is fastened by means of a split taper sleeve 2, the split taper sleeve 2 being wedged between the outer surface of the shaft 1 and the inner surface of the wear ring 3. The split taper sleeve 2 and hardened wear ring 3 are further held in place by a threaded sleeve 9 and a locking washer 10, threaded sleeve 9 being disposed around the outer periphery of taper sleeve 2 with locking washer 10 being sandwiched between the sleeve 9 and the ring 3.

The shaft 1 is illustrated as being hollow and may be a tube with a relatively thin wall thickness, but it may also be solid. The hardened ring 3 rests and rolls upon rollers 4a and 4b which are turning on two rod members 5a and 5b, rollers 4a and 4b as well as rod members 5a and 5b being preferably of a hardened material or having their surfaces hardened by any known surface hardening treatment. Rod members 5a and 5b are illustrated as bolts having two flat opposed sides with arcuate sections disposed between the flat sides, the radius of curvature of the arcuate sections being approximately the same as the radius of curvature of the inner periphery of the rollers 4a and 4b.

A bearing block 6 with a U-shaped cradle is provided with a pair of rod member receiving means therein, the rod member

7b at the upper extremity thereof, slot 7a being on one side of each leg and the slot 7b being on the opposite side of the leg. In a preferred embodiment, it is noted that the slots extend in a downward and inward direction so that they converge in cross sectional view and the bolts 5a and 5b rest within said slots. Further, slots 7 are in spaced alignment with opposing slots 7 in the opposed vertically extending leg 8b so that the bolts 5a and 5b are in parallel. Slots 7a and 7b are generally slightly larger than the bolts 5 received thereby so that the bolts 5 may be removed from the block 6 with very little difficulty.

As wear and tear of the bolts 5 and rollers 4 reach an inoperable stage, in order to replace these worn parts of the bearing assembly, the shaft 1 is pushed up and lifted upon the opposite roll. For example, if roller 4b and bolt 5b are to be removed, the shaft 1 is pushed up and lifted upon the opposite roller, roller 4a, wherein the roller 4b together with the bolt 5b are removed from the block 6 with the fingers. Further, if the bolt 5b has been damaged by wear and tear only on one side then the worn side is mechanically re-worked or turned down and the bolt with its roller reset into working position. When wear and tear of both the bolt and roller are beyond re-working, both parts may be replaced by a new pair of bolts and rollers at a minimal cost.

Another advantage of the present invention is that since the rapping shaft is not subject to wear and tear, it is possible to use a tube with a relatively thin wall thickness. Such a tube has the advantage of lighter weight compared to solid shafts and also reduces the friction in the bearings and as a consequence causes less wear and tear on the bearing assembly.

In Figure 3, there is illustrated one electrostatic precipitator utilizing the bearing assembly as previously described and shown in Figures 1 and 2. As shown, an electrostatic precipitator generally designated by the numeral 40 is provided with a housing 11 which directs a flow of particle-laden gases past a plurality of discharge electrodes 12 and a plurality of collector plates 13. The discharge electrodes are supported by structural members 14 which are themselves supported by support frame 30 and elongate support member 31. Hanger rod 15 is provided to extend through insulator 16 which electrically isolates the hanger rod 15 from the motor housing 33, shell 11 and collector plates 13. The hanger rod 15 extends downwardly and is drivingly connected to rotatable shaft 1. Shaft 1

a channel-shaped member which rests upon elongate support member 31. The latter, in turn, is a channel shaped member which extends across the top of the housing 40.

5 The discharge electrodes 12 are supplied with high voltage electric current by means of any conventional system (not shown) which are known in the art.

10 As the particle-laden gas passes through shell 11, the particles are charged in the ionization field between the discharge electrode wires 12 and collector plates 13. The charges particles migrate toward the flat surfaces of plates 13 and collect thereon.

15 These collected particles must be removed periodically to maintain efficient collection.

A rapping drive source 17 is connected to the hanger rod 15 so that vibrations generated from the rapping source are transmitted to the electrodes 12 through the structural members 14.

20 The collector plates 13 are supported by structural members 18 which are an integral part of shell 11. Plates 13 are also rapped by a rapping source 19 similar to source 17, connected to the plates 13 by a rod 20. Thus, when the rapping sources are energized, the electrodes and plates are vibrated thereby dislodging accumulated dust particles which fall into a hopper 21 from which they are periodically removed.

30 As viewed in Figure 3, the particle-laden gas is flowing between the lanes formed by collector plates 13 and away from the observer. The lanes may be several feet long so that several hanger rods 15 may be positioned along the lanes, one behind the other. Rapping drive sources 17 will similarly be positioned.

40 It is realized that other changes may be made to the specific embodiment shown and described without departing from the principles of the present invention as defined in the appended claims.

45 WHAT WE CLAIM IS:-

1. An electrostatic precipitator comprising a housing having a gas inlet, a gas outlet and a chamber therebetween containing a plurality of discharge and collecting electrodes suspended therein, said chamber further comprising a shaft extending across the chamber in close proximity to the said electrodes and electrode rapping means arranged to impact the electrodes upon rotation of the said shaft, said shaft being supported in bearings at least one of which comprises an assembly consisting of two spaced apart, shaft-supporting, rollers each of which is supported in turn by an elongate rod member mounted in a bearing block and a replaceable wear ring on the outer periphery of the shaft, the wear ring being disposed in use in contacting relationship with the said rollers.

65 2. An electrostatic precipitator according

to Claim 1 wherein said rod members are bolts having two flat opposed sides with arcuate sections disposed between said flat sides, the radius of curvature of said arcuate sections being approximately the same as the radius of curvature of the inner periphery of said rollers.

3. An electrostatic precipitator according to Claim 1 or Claim 2 wherein said bearing block includes a pair of spaced apart vertically extending legs, thereby defining a U-shaped cradle, said legs containing slots in spaced alignment for receiving the elongate rod members.

4. An electrostatic precipitator according to Claim 3 wherein said slots are disposed at the upper extremity of said vertically extending legs and at opposite ends of each said leg.

5. An electrostatic precipitator according to Claim 4 wherein said slots are arranged so that in cross sectional view they converge in a downward direction.

6. An electrostatic precipitator according to any of Claims 3 to 5, wherein said slots are slightly larger than the parts of the rod members received thereby so that the rod members may be removed from the bearing block with very little difficulty.

7. An electrostatic precipitator according to any preceding claim wherein said wear ring has a cylindrical outer surface and a conical inner surface and is attached to the rapping shaft by a split tapered sleeve, said split tapered sleeve having securing means whereby it can be wedged between said wear ring and said shaft.

8. An electrostatic precipitator substantially as described herein with reference to the accompanying drawings.

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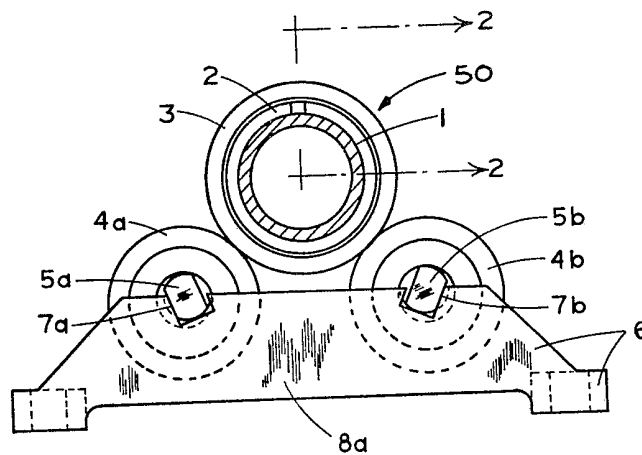


FIG. 1

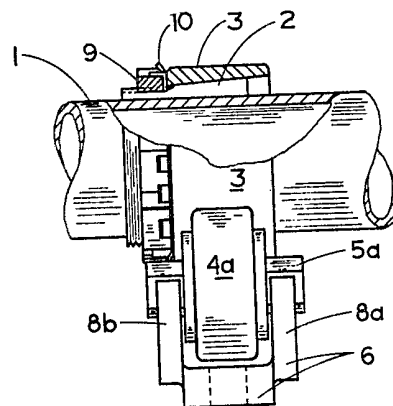


FIG. 2

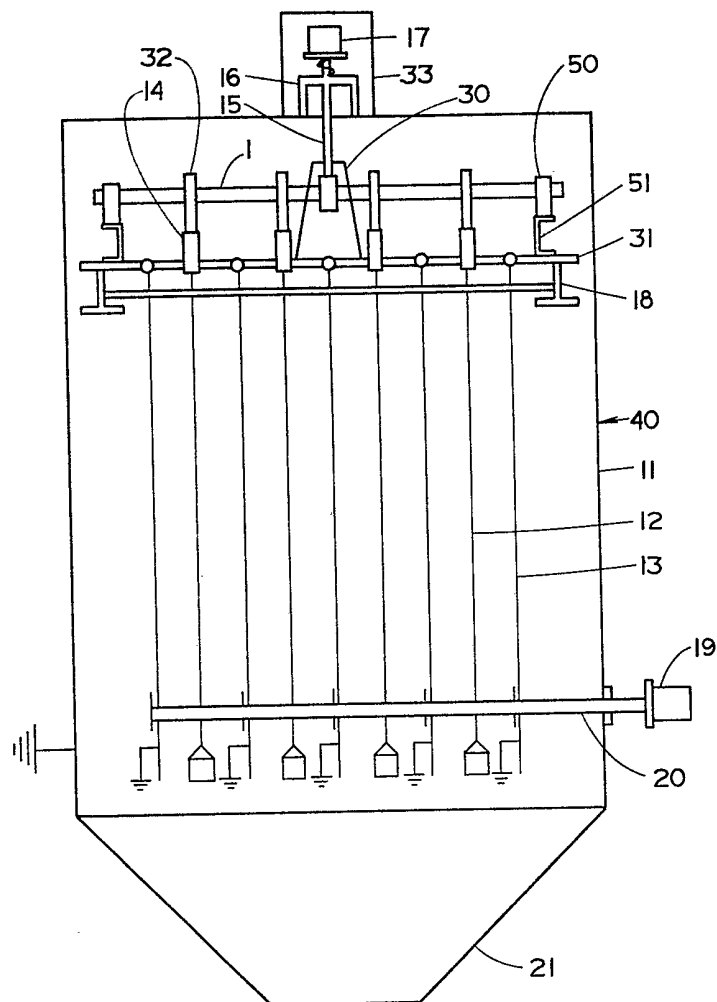


FIG. 3