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A. P. ZADOR

3,403,499

IMPELLER SMOKE REMOVER

Filed Aug. 10, 1967

3 Sheets-Sheet 1

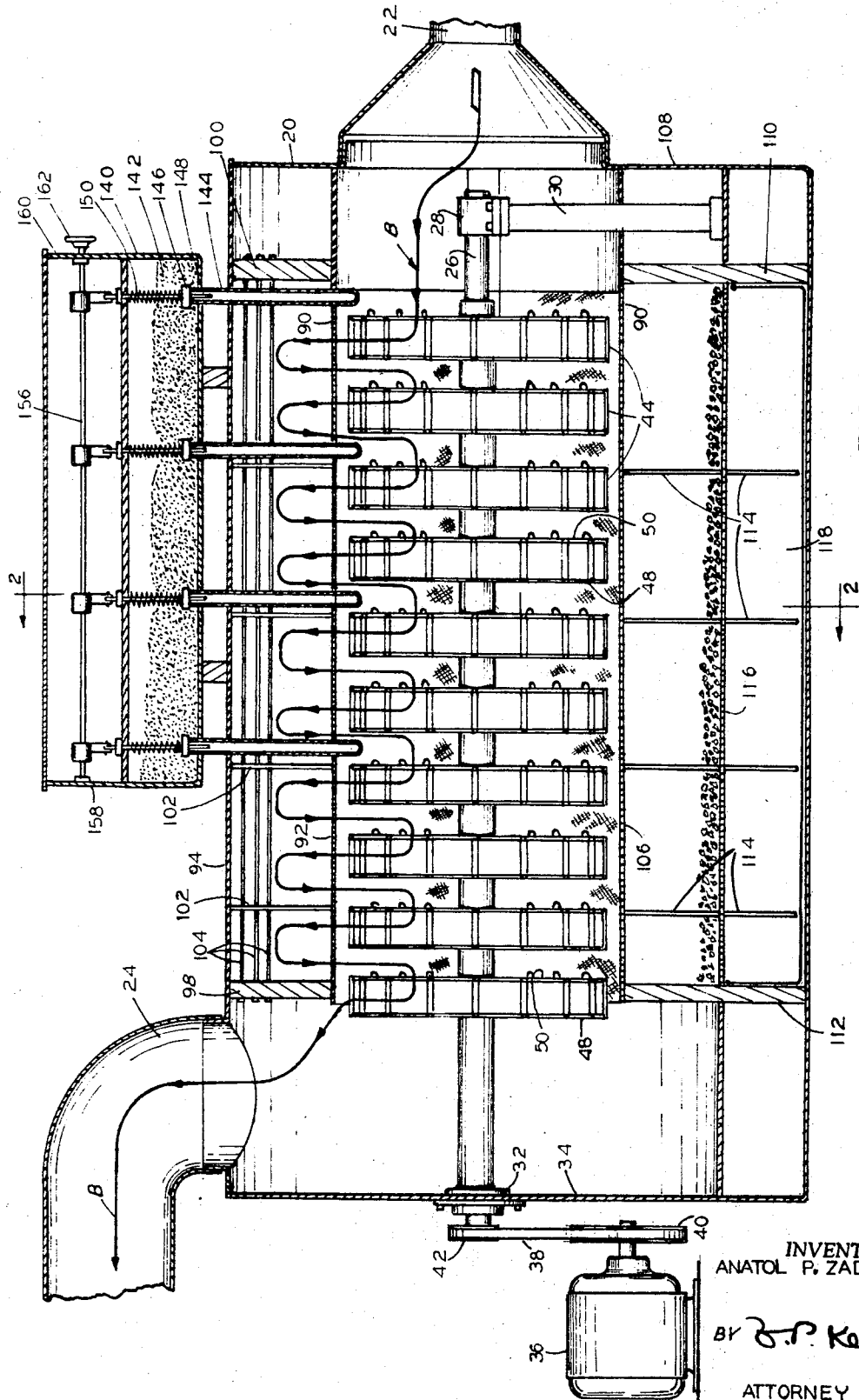


FIG. 1

INVENTOR.
ANATOL P. ZADOR.

By *J. P. Keiper*

ATTORNEY

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A. P. ZADOR

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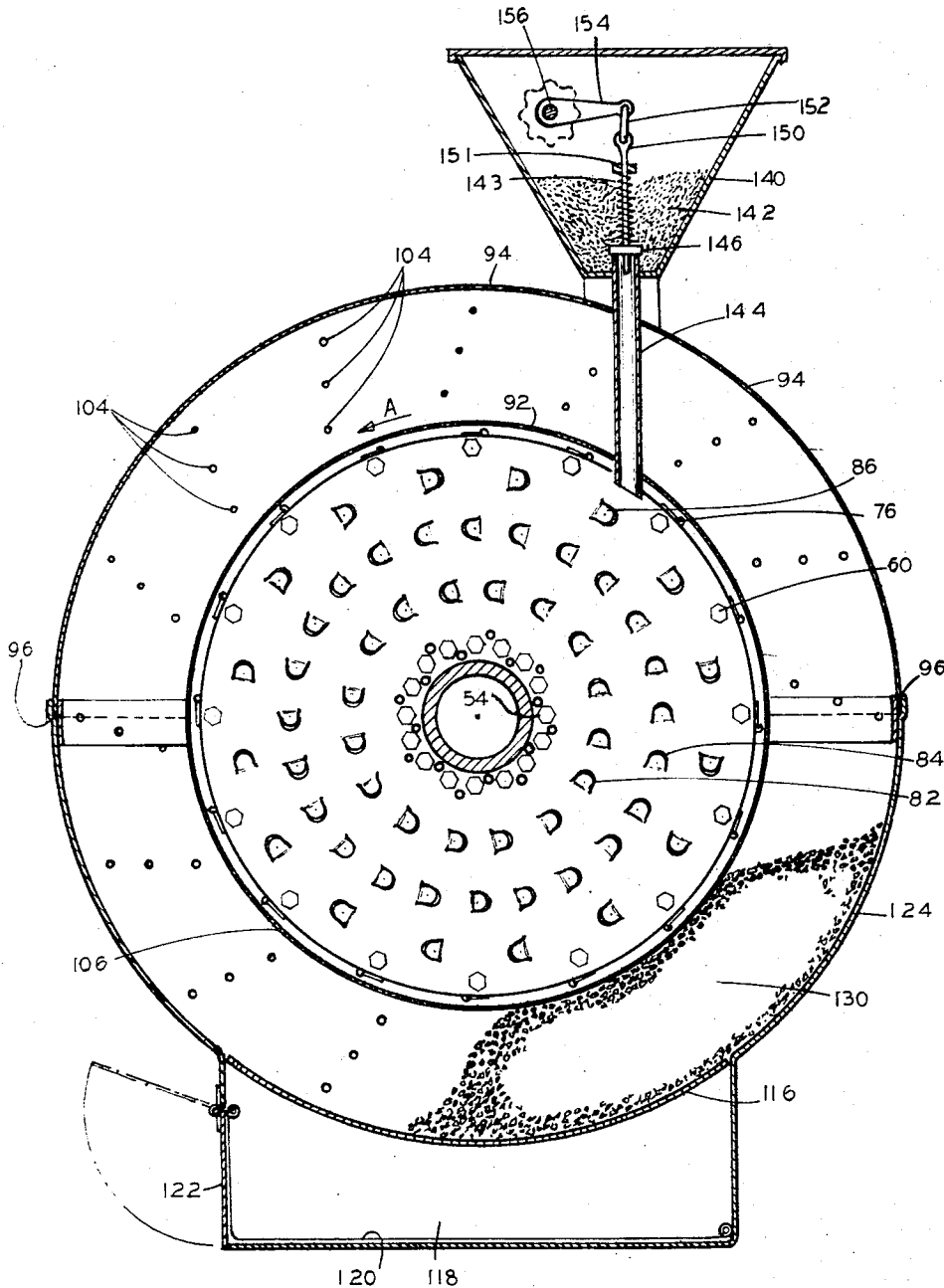


FIG. 2

INVENTOR.
ANATOL P. ZADOR.

BY

T.P. Kasper

ATTORNEY

Oct. 1, 1968

A. P. ZADOR

3,403,499

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3 Sheets-Sheet 3

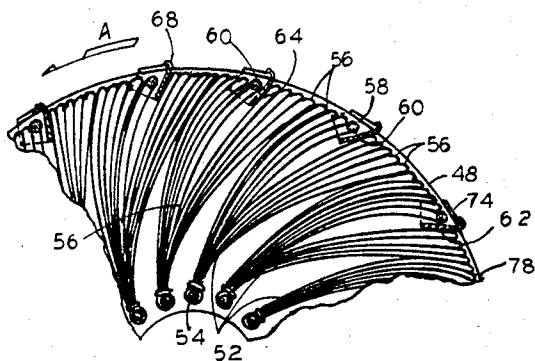


FIG. 5

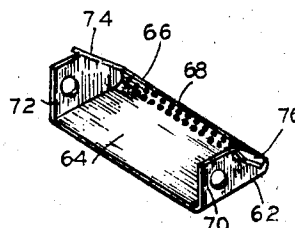


FIG. 6

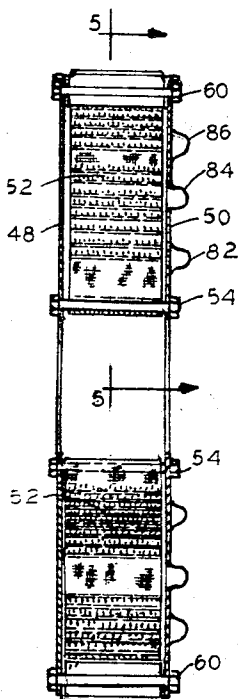


FIG. 4

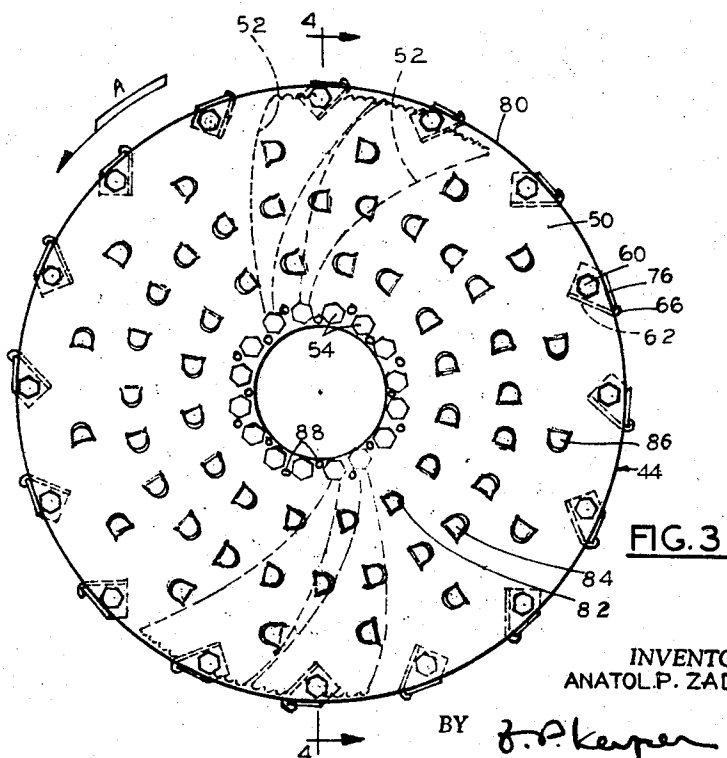


FIG. 3

INVENTOR.
ANATOL P. ZADOR.

BY *J. P. Keiper*

ATTORNEY

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3,403,499

IMPELLER SMOKE REMOVER

Anatol P. Zador, 367 Furman St.,

Syracuse, N.Y. 13205

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ABSTRACT OF THE DISCLOSURE

Impeller smoke remover apparatus comprising a housing having a high speed rotary shaft extending therinto and a plurality of impeller wheels driven by the shaft and disposed at uniformly spaced intervals, each of said wheels comprising spaced disks, with a plurality of groups of screen wire layers extending spirally between the disks, a coaxial smoke inlet in one end of the housing, the disks on the wheels facing the inlet having circular rows of louvers facing in the direction of rotation, cylindrical screening disposed around the wheels providing an annular space for small light weight pellets adapted to be projected around the screening upon high speed rotation of the wheels, an outlet in the side wall of said housing at the other end, and a compartment below the screening to receive solids and contaminants separated from the gases passing through the housing from inlet to outlet.

This invention relates to an impeller type smoke remover for preventing air pollution from the exhaust or flue gases from hydrocarbon burning engines, heaters and the like.

The increasing use of hydrocarbons as a fuel for power plants, transportation, heaters and the like has resulted, at least in some areas, in pollution of the atmosphere to such an extent as to become a hazard. The removal of smoke and pollutants from the exhausts of such installations has become a matter of prime concern.

The present invention is directed to apparatus of a impeller type which is adapted to clear the exhaust from burning hydrocarbons so as to eliminate or substantially reduce the polluting elements of such exhaust. More particularly the invention has to do with a multistage impeller gas cleaner having a labyrinth of interceptors for pollutants which removes or deposits the pollutants taken from smoke as it passes through the apparatus, the apparatus acting in a manner such that the deposits can be removed from the apparatus from time to time as accumulation takes place.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings wherein like reference characters indicate like parts:

FIGURE 1 is a longitudinal sectional view through the apparatus.

FIGURE 2 is an enlarged sectional view taken on the line 2-2 of FIGURE 1.

FIGURE 3 is a side view of a rotor.

FIGURE 4 is a sectional view through the rotor of FIGURE 3 taken on the line 4-4 of FIGURE 3.

FIGURE 5 is a fragmentary sectional view through the rotor taken on the line 5-5 of FIGURE 4, and

FIGURE 6 is a perspective view of a peripheral element employed at spaced intervals around each of the rotors.

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Referring to FIGURE 1, there is shown a housing 20 having an inlet 22 and an outlet 24, for receiving exhaust smoke and for discharging such exhaust after smoke removal, respectively. Within the housing, and coaxial with the inlet, is an impeller drive shaft 26 journaled in a front bearing 28 mounted on a pedestal 30, and a rear bearing 32 disposed in the end wall 34 of the housing. The shaft is adapted to be driven at a high rate of speed by a motor 36, or other suitable source of power, the motor speed being increased as by a belt drive 38 employing a large drive pulley 40 as compared to the driven pulley 42 keyed to the shaft 26.

Mounted on the shaft and keyed for rotation therewith are a plurality of rotors in the form of circular separating or screening impeller wheels 44, each of which may be alike. Such separating wheels are uniformly spaced along the shaft as by collars 46. The impeller wheels each comprise a circular back plate 48 and a circular front plate 50, between which are arranged plurality of groups 52 of spirally disposed screen wire, each group comprising a multiplicity of folded layers. Certain layers of each group are wrapped about a central bolt 54 extending between the plates while others extend inwardly short of such layers. Each group may be made of a single length of screen wire of the desired mesh and of a width to fill the space between the plates 48 and 50. Such length is folded into a plurality of spiral layers, the outward ends of which are folds at the periphery as at 56, and the center folds of which extend either to and around the bolt 54 or to a point inwardly short thereof as at 56, to provide a stack of an increasing number of thicknesses as the stack extends spirally toward the periphery. At least one of the intermediate folds 58 extends around the outer bolt 60, which also holds a spacer member and some of the peripheral folds of each group are ahead of the bolt 60 and the spacer 62, and the rest behind. The spacer comprises an inclined portion 64, terminating in a hook-like flange having perforations 68, and side flanges 70 and 72, through which the bolt 60 passes, and peripheral flanges 74 and 76 which overlie the peripheries 78 and 80 of the spaced disks 48 and 50 respectively.

In the impeller wheel shown in FIGURE 3, sixteen groups of spirally disposed layers of such screen wire are indicated, each group being secured in position by one of the sixteen bolts 54 and one of the sixteen bolts 60. Each group may comprise nine peripheral folds with three overlapping folds around the bolts 54, and five folds intermediate of the circle on which bolts 54 are disposed, and the periphery of the wheel, as is indicated at 56 (see FIGURE 5). The plate 50 of each impeller wheel is provided with two circular rows of louvers 82 and 84 facing in the direction of rotation as indicated by the arrow A, and an outer circular row of louvers reversely directed as at 86. In addition each of the plates 50 are provided with a plurality of small central apertures 88 disposed in staggered relation in respect to the bolts 54. The plate 48 is preferably imperforate.

Disposed around the series of impeller wheels is a cylindrical shell of screen wire 90 which may be in separate semi-cylindrical sections, parting on a horizontal plane passing substantially through the axis of the shaft 26. Between the upper section 92 of the screen wire 90 and the upper portion 94 of the housing, which housing is likewise in two parts preferably separating as at 96 on the horizontal plane disposed on the axis of the shaft 26, are end partitions 98 and 100, arcuate in form and intermediate arcuate partitions 102, four in number, disposed on transverse planes disposed between adjacent pairs of the turbine wheels 44. A number of wires as are indicated at 104 extend lengthwise between the end partitions 98 and 100.

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The lower half of the cylindrical screen wire 106 is supported upon lower partitions 110 and 112 and intermediate partitions 114 are provided in alignment with the partitions 102. Such partitions extend to the screen wire 106 and along their lower edge, support screening 116, below which is a collection chamber 118. Such collection chamber is provided with a removable oiled cloth liner 120 to which solid matter tends to adhere and the chamber if provided with an access door 122 which when opened, permits the removal of the cloth 120 and any solids collected on the cloth.

Within the space between the cylindrical screen 92 and the outer housing composed of the lower section 124 and the upper section 94, is a quantity of light weight pellets of irregular contour and of an over-all size of about $\frac{3}{16}$ " or $\frac{1}{4}$ ". Such pellets are a size too large to pass through the mesh of the screen wire 92 or 116. Such pellets may be of light weight aluminum or of an even lighter metal or alloy, and when the apparatus is inoperative such pellets tend to collect in the bottom portion of the space between the screen wire 106 and the screen wire 116 and outer housing wall 124 as is indicated in FIGURE 2.

When the impellers 44 are rotated by the motor 36 at a high rate of speed, such as 5,000 revolutions per minute, or more, and in the direction of arrow A, as indicated in both FIGURES 2 and 3, such pellets are caused to fly around in the annular space between the screen wire 106, 92 and 116 by reason of the helical circulation of the gases within the space as caused by the rotating impeller wheels. The pellets in flying around in the space have their paths of movement interrupted and altered by repeatedly striking from time to time one or more of the wires 104. Smoke laden exhaust enters the apparatus through the inlet 22 and by reason of the louvers 82 and 84 in the impeller wheels, tends to be drawn into each wheel through its louver plate 50 and discharged outwardly through the labyrinth of screen wires formed by the groups 52, the discharge being from the periphery of the wheels into the space between the screen wire 92 and the housing 94.

The exhaust is drawn back into the space between pairs of wheels and again centrifugally thrown outwardly through the screen wire labyrinth of the next impeller wheel. The general path of the air or gases in passing through the apparatus is generally indicated by the continuous arrow B, which will be seen to extend outwardly through each of the impeller wheels and finally outwardly of the last impeller wheel at the left hand end of the apparatus as viewed in FIGURE 1, whereupon the gases escape through the outlet 24. The passage of the smoke laden gases through the labyrinth of screens and through the space between the screen 90 and the housing walls 94 and 124, loosely filled with flying pellets 130, results in the pellets and the screen labyrinth separating all oily solids or other contaminants from the smoke entering the apparatus, with the result that the gases leaving the apparatus through the outlet 24 are in effect cleansed and clear of contaminants.

Mounted above the housing 94 is a reservoir 140 containing a supply of relatively fine sand 142. Such reservoir is provided with four outlet tubes 144 which extend downwardly through the housing 94 and the screen wire 92 to a point ahead of the impeller and at three points located intermediate of the first, second, third and fourth pairs of impeller wheels. Each of the conduits 144 is provided with a cap-like valve 146 having a guide 148 extending into the tube 144 and a control rod 150 extending upwardly to a link 152 connected to a crank arm 154. Crank arms 154 are keyed to a rock shaft 156 which is journaled in the end walls 158 and 160 of the reservoir 140. The rock shaft 156 extends through the end wall 160 and is provided with a control knob 162. From time to time

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while the impeller wheels are spinning at high speed the rock shaft 156 is turned counterclockwise slightly as seen in FIGURE 2, to lift the valve caps 146 from their respective conduits 144, whereby to discharge a small quantity of sand into the cylindrical region wherein the impeller wheels are disposed. Such sand has a sand blast effect in passing through the screen wire labyrinths and upon the pellets 130 and the sand carries the contaminants downwardly through the screen wire 116 to deposit the contaminants on the removable oiled bed cloth 120 in the base of the apparatus 118. The valve caps 146 are normally urged closed by a compression spring 143 threaded on the rod 150, and bearing against the rail 151.

While a single form of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. An impeller smoke remover apparatus comprising a housing, a shaft extending into the housing and journaled for rotation therein, a plurality of impeller wheels affixed to the shaft at uniformly spaced intervals, each of said wheels comprising spaced disks, a plurality of groups of screen wire layers extending spirally between said disks, a smoke inlet in one end of the housing and disposed coaxially with respect to the shaft, the disks on said wheels facing the inlet having circular rows of louvers facing in the direction of rotation, cylindrical screening disposed around the impeller wheels and defining with said housing an annular space for gas currents set up by wheel rotation, and a plurality of small light weight pellets disposed in said space adapted to be projected around said screening upon high speed rotation of said impeller wheels, said pellets being of a size larger than the mesh of wire screening, an outlet in the side wall of said housing at the other end, and a compartment below said screening to receive solids and contaminants separated from the gases passing through the housing from inlet to outlet.

2. Apparatus according to claim 1 comprising means to drive the impeller shaft at high speed.

3. Apparatus according to claim 1 comprising a reservoir for fine sand disposed above the housing and having conduits with valvular means leading into said housing to points between spaced impeller wheels, whereby quantities of sand may be introduced into the impeller area to provide a sand blasting effect.

4. Apparatus according to claim 1 wherein the compartment is provided with an access door, and a removable oiled covering for cleaning from the compartment solids and contaminants deposited on the oiled covering.

5. Apparatus according to claim 1 wherein the housing and cylindrical screening are formed in two sections separable substantially on a plane extending through the shaft axis.

6. Apparatus according to claim 1 wherein the space between the screening and housing is provided with a plurality of spaced impingement wires extending lengthwise through the space.

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CARLTON R. CROYLE, *Primary Examiner*.