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APPARATUS FOR IMPROVING THE OPERATION OF APPARATUS SUBJECT TO
CONDITIONS OF HIGH PRESSURE AND TEMPERATURE

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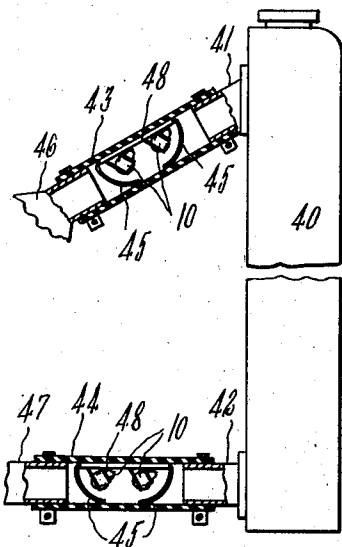


Fig. 1.

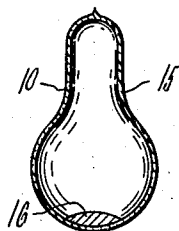


Fig. 2.



Fig. 3.

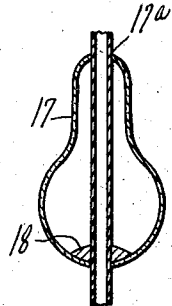


Fig. 4.

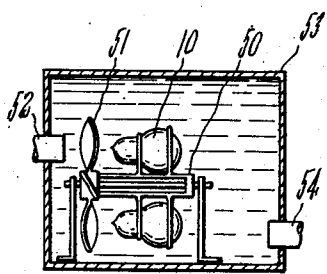


Fig. 5.

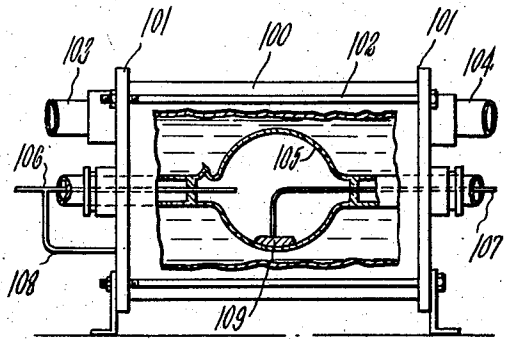


Fig. 6.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR IMPROVING THE OPERATION OF APPARATUS SUBJECT TO CONDITIONS OF HIGH PRESSURE AND TEMPERATURE

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Application April 27, 1938, Serial No. 204,546

3 Claims. (Cl. 123—198)

This invention relates to the treatment of apparatus, which is subjected in service to fluids under conditions of change of pressure or temperature, or both, with a view to improving its operation. Such apparatus may be, for example, internal combustion engines, whether operated by gas, gasoline, oil, or other suitable fuel, air or gas compressors, ordnance, or the like, and more particularly, though not limited thereto, apparatus wherein a cooling fluid is used to dissipate the heat produced, for example, by compression, combustion or explosion.

This invention will be more particularly described in its application to internal combustion engines, though it will be evident that it is applicable wherever similar problems arise involving contact of fluids on surfaces, and temperature interchange through metal walls where difficulties from corrosion or deposits on such surfaces or walls is to be anticipated. One of the primary causes of decrease in efficiency of internal combustion engines, for example, arises from the accumulation of a hard carbon scale within the combustion chamber, on the valves and the valve seats, and in the piston ring grooves. Another factor, in the case of water cooled engines, may be found in deposits of scale and corrosion in the cooling system impeding the circulation of the cooling water and causing inadequate contact of the water with the hot metal parts to produce satisfactory cooling. Analogous conditions may arise in connection with other apparatus of the types heretofore specified.

In accordance with the present invention the fluids contacting with the parts of the apparatus, these parts themselves, and the normal relations between these fluids and parts, or all of these, are so modified that there becomes a tendency for carbon, scale and corrosion to leave the metal parts rather than to adhere thereto. This prevents the accumulation of such deposits and facilitates and ultimately tends to remove such deposits as have already formed. Such modifications are effected in accordance with this invention by subjecting one or more of such fluids to the action of certain electrical fields, or disturbances which may be produced, as later herein described, of such a nature that when such fluids are brought into contact with apparatus parts, the desired relation therebetween is established. These actions, resulting in disturbances from normal relations are found to produce similar disturbances through transmission, induction or otherwise, from the normal relation of such parts to other fluids in contact

with neighboring faces. Certain apparatus by which these effects may be produced comprise one or more evacuated dielectric containers such as glass bulbs, each containing a substance such as mercury, capable of generating static electrical charges with sudden discharges, by relative movement of the material in contact with the container surface. The use of such apparatus per se in connection with fluids and containers is not claimed herein, but forms the subject matter of my application for patent Serial No. 139,447, filed April 28, 1937, for Method of and apparatus for treating fluids and surfaces in contact therewith. While other materials than mercury are capable of generating static charges and discharges by frictional movement over the container surface, mercury and amalgams so high in mercury content as to move over the surface in a similar manner to mercury have shown vastly superior results. Such apparatus when agitated sufficiently to produce such relative movement of the contents and the container surface produces electrical disturbances in the nature of a sequence of abruptly varying electrical impulses outside of the container of an alternating or oscillatory nature capable of being recognized and measured by suitable instruments. Presence of small quantities of inert gases such as neon, argon, nitrogen, etc. in the container appear to increase the frequency and decrease the amplitude of such disturbances and in general, at least in any amounts beyond a trace, are usually found undesirable. The character of the gaseous atmosphere within the bulb does, however, tend to determine the ionization voltage producing radio frequency radiation.

The same or comparable effects may be produced by other apparatus in which the energy for generating the electrical disturbances is derived from other sources, as, for example, an outside source of high potential electrical power, rather than by mechanical agitation.

For a more complete understanding of this invention reference may be had to the accompanying drawing in which:

Figure 1 is a fragmentary view partly in section of an automobile cooling system radiator and hose connections showing an application of this invention.

Figure 2 is a cross section through a treating unit.

Figure 3 is a typical oscillograph record produced by agitating a unit such as that shown in Figure 2.

Figure 4 is a cross section through another form of treating unit.

Figure 5 is a view partly in cross section showing one form of unit mounting.

Figure 6 is a view partly in side elevation and partly in section of another type of treating unit.

Apparatus for accomplishing the purpose of this invention may include a treating element or unit 10 shown separately in Figure 2. As shown, it comprises a container of bulb form 15 which is preferably of quartz glass or similar high melting point glass which has extremely good dielectric properties. This bulb is provided with a rarefied atmosphere and as shown contains a globule 16 of mercury or mercury amalgam which, when the bulb is agitated, moves over the internal surface of the container and generates static electrical charges with sudden discharges within the container. Such a relative motion between the mercury and the wall of the bulb produces electrical fields, emanations, or disturbances outside which are capable of being recognized and measured and which can be picked up by a neighboring antenna and after amplification by vacuum tube amplifiers may be caused to produce characteristic oscillograph records, one of which is illustrated in Figure 6. While records made from different bulbs may show marked differences, records made from any one bulb are of surprising uniformity, showing disturbances of an oscillatory or alternating nature of definite periodicity and characteristic wave form. Apparently bulbs which are most effective in producing the desired results are those which are capable of producing oscillograph records of good amplitude and having steep wave fronts *a* as in Figure 3. Bulbs which give such oscillograph records are those which are made of quartz glass, though high refractory glasses such as those known to the trade as Pyrex are almost equally as good. Other materials besides mercury are effective to produce such disturbances but of those tested, mercury appears to be preeminently suitable, producing disturbances of greatest amplitude and steepest wave fronts. Extensive investigations have led to the conclusion, however, that steep wave fronts per se are not of controlling importance, but are associated with high maximum voltage, which appears to be an important factor. The actions which appear to enter into the successful functioning of this apparatus appear to reside in the radio frequency waves, static charges and discharges, and the radiation of gaseous spectra produced by the static discharge through the gases contained in the bulb.

When the electrostatic voltage within the bulb increases to a point determined by the relationship between gas pressure and break-down voltage, the ionization of the gas permits a discharge. The characteristics of recurring charge and discharge are illustrated by the oscillogram. Accompanying the discharge through the gaseous atmosphere within the bulb is the radiation of radio frequency waves generated as the result of gas discharge, i. e. from sparks. High frequency oscillation of the electrons and ions are known to occur in the region of an ionized gas where electron and positive-ion concentration are approximately equal, and it is also known that the frequency of these oscillations is as high as 1200 megacycles. The presence of these radio frequency waves has been detected by the oscillograph, and has been shown to be continuous in wave lengths from the vicinity of five meters to

over three thousand meters and practically uniform in intensity.

When the bulb of this invention is agitated, the radio frequency waves are modulated by the static charge and discharge characteristics. The effect of the electro-static field and certain radiations of the gaseous spectra is to reduce the surface tension of the liquids which tends to free occluded gases therefrom. This may be important in reducing corrosion, oxygen being one of the gases ordinarily freed by this action. An effect of the rapidly recurring electro-static field and the radio frequency waves is their tendency to flocculate colloidal particles. This tends to throw out such particles as a fine sludge or mud instead of permitting them to crystallize out on the walls of their containers as a scale. There may also be other beneficial effects, the nature of which are at present obscure.

Another form of element is shown in Figure 4 in which a tube 17a, open from end to end for the passage of the fluid to be treated, extends transversely through the bulb 17 which contacts the mercury 18 in a rarefied atmosphere.

Where an installation such as shown in Figure 1 is applied to an automobile engine, the motion of the vehicle as it travels is amply sufficient to produce the necessary relative motion of the container or bulb and its contents, and where the fluid being treated is in motion somewhat resilient mounting of the containers permits sufficient motion thereof from the motion of the fluid itself. Not only is the fluid treated so effected that the tendency of deposits to form on the surfaces in contact therewith is either eliminated or much reduced, but in the case of metal surfaces there appears to be a surprising effect on the surface material itself such that the same effects are produced between other fluids contacting with other portions of the metal which tend to reduce or prevent encrusting deposits from such other fluids thereon. Thus the treatment of the cooling water of the internal combustion engine cooling system is found to have a useful result in tending to prevent the deposit of carbon in the combustion spaces of the engine and parts closely associated therewith. Referring to Figure 1, there is shown at 40 an automobile engine radiator which is connected at top and bottom through the pipes 41 and 42 and the hose connections 43 and 44 with the engine block as at 46 and the pump connection at 47. Preferably one or more units, such as 10, is held in one or both of these hose connections as by means of the spring wire frames 48 carrying such units and having spring fingers 49 engaging the inner wall of the hose connection so as to hold these units in position therein and insulated thereby from the metal portions of the circulating system. The motion of the vehicle is sufficient to give all the motion needed between the mercury and the containers to produce the desired results. The first noticeable effect from such an installation is the removal of the usual rust deposit about the throat of the radiator at its upper end, this action gradually extending throughout the cooling system and acting through the metal of the cylinder walls upon those surfaces exposed to combustion so that the tendency to carbonize is much reduced or prevented. A surprising result observed from such an installation is its action in removing rust and corrosion from the engine exhaust pipes, such rust and corrosion becoming spongy and flaking

off or being readily removable after some time of operation of the apparatus.

In cases where insufficient motion of the treating elements may be produced in normal operation, as for example, through the normal motions of an automotive vehicle or the effects of the passage of fluids therepast when it is mounted resiliently, other means may be provided for producing the necessary agitation. For example, in Figure 5 the units may be mounted to rotate in a frame 50 provided with an impeller 51 against which incoming fluid from the pipe 52 may be passed, this mechanism being supported within a suitable tank 53 having an outlet pipe 54.

While in the various specific examples of the invention heretofore given the energy input has been shown as produced through mechanical agitation of the bulbs, it may be otherwise produced. For example, comparable results may be obtained by applying the energy in electrical form. An apparatus for accomplishing this is illustrated in Figure 6.

Referring to this figure, at 100 is shown a tube of glass, or the like, having its ends closed as by bronze cover members 101 which may be clamped together as by means of the bolts 102 to form with the tube 100 a fluid tight container. The end covers may be provided with pipe connections, as at 103 and 104, through which the fluid may enter and flow out from the interior of the tube 100, it being intended that this tube should be maintained full of fluid being treated, except for the presence of the treating element. The treating element, as shown, comprises a bulbous container 105 of quartz, glass or other suitable dielectric having sealed thereto the high potential leads 106 and 107. One of these leads, as 106, is placed in electrical connection with the fluid within the tube 100 as by the lead 108. The other lead 107 within the container 105 is directed to a conductor element 109 which partly surfaces the inner face of the container 105. In order that this surface contact may be as complete as possible, and further, in order to provide for a desirable low pressure gaseous atmosphere within the container, the conductor element 109 may be a globule of mercury. The container 105 thus forms a dielectric of a condenser, one plate of which is formed by the mercury 109, and the other of which is formed by the conductor fluid within which the container 105 is positioned. The voltage applied between the leads 106 and 107 must be sufficiently high to insure ionization of the gaseous atmosphere within the container

105, the necessary magnitude depending, as in the case of the agitated bulbs previously described, upon the constituents and the pressure of the gaseous atmosphere.

In operation of this mechanism the application of alternating or pulsating high potential between the leads 106 and 107 causes rapid charge and discharge of voltage within the container and results in the recurrent static charge and discharge effects and the production of radio frequency waves as by the agitation of the bulbs previously described. The action of this apparatus is substantially identical with the action of the mechanically agitated bulbs as previously described.

From the foregoing description of the method and certain structures adapted to carry out this method, it should be recognized by those skilled in the art that various changes and modifications might be made without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. The combination with a water cooled internal combustion engine and a cooling water circulation system comprising a radiator and hose connections between said radiator and engine, of a resilient holder sprung into one of said hose connections, and an evacuated dielectric bulb containing mercury carried by said holder and about and in contact with which the water of said system flows.

2. Mechanism comprising a water cooled apparatus and a cooling water circulation system for said apparatus, said system comprising a radiator and water connections between said radiator and apparatus, an evacuated dielectric bulb containing mercury, and means supporting said bulb in said system in position for the water in said system to flow about and in contact with said bulb.

3. Mechanism comprising a water cooled apparatus and a cooling water circulation system comprising a radiator and water connections between said radiator and apparatus, of an evacuated dielectric bulb containing mercury, means supporting said bulb for motion in said connections in position for the water of said system to flow about and in contact with said bulb, and means for causing the flow of water in said system to move said bulb to cause movement of the mercury with respect to said bulb.

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