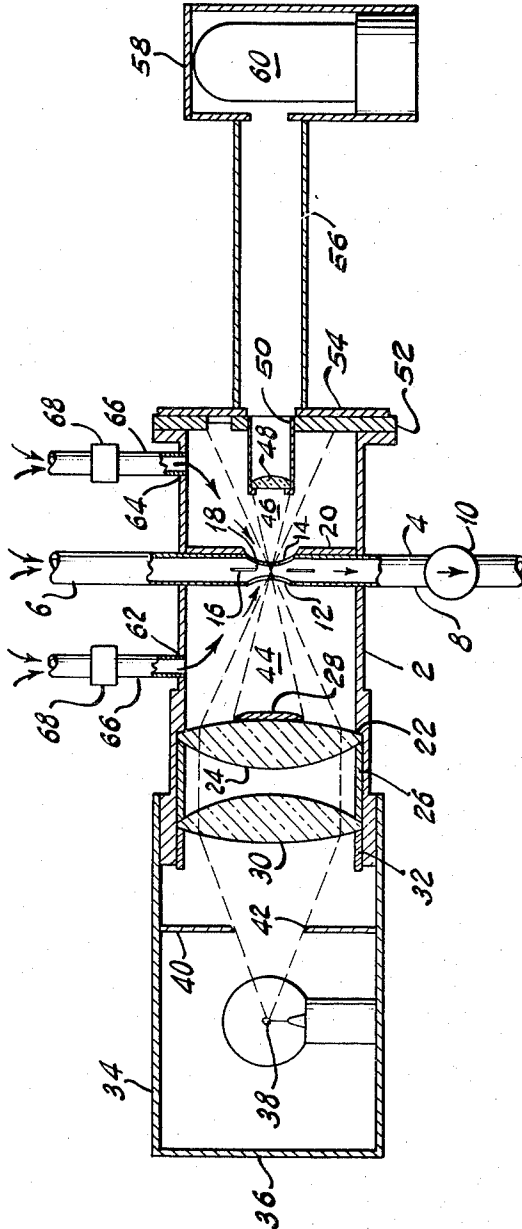


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D. SINCLAIR
SMOKE PHOTOMETER

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SMOKE PHOTOMETER

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2 Claims. (Cl. 88-14)

The present invention relates to a light-scattering apparatus whereby the degree of pollution of air may be determined. The apparatus involved is of a type which is generally known as a "smoke photometer" and includes a section in which smoke, air or other fluid to be tested is passed through a beam of light whereupon any particles in the fluid have a scattering effect on the light, which effect gives an indication of the degree of pollution. It is customary in such apparatus to pass the fluid therethrough by means of a tube having aligned openings in opposed portions thereof, the beam of light being projected through the openings. One of the major problems to be overcome in such apparatus is the tendency of the smoke to pour out of the opposed openings in the tube and into various portions of the instrument which results in a dirty instrument and inaccurate measurements. The primary object of the present invention is to provide a means whereby the aforesaid problem is overcome.

My invention will be more fully understood and further objects and advantages thereof will become more apparent when reference is made to the following detailed description and to the accompanying drawing which shows a longitudinal sectional view of the apparatus of this invention.

Referring to the drawing there is shown a generally cylindrical element 2 which defines a light-scattering chamber through which smoke, air or other fluid to be tested is carried by tube 4. One end 6 of tube 4 is connected to a source (not shown) of the fluid while the other end 8 is connected to a pump 10 by means of which the fluid is drawn through the tube. Where the tube 4 is intersected by the axis of cylinder 2, opposed wall portions thereof are provided with aligned openings 12 and 14, the centers of which lie on the axis of the cylinder. Positioned within tube 4 and extending longitudinally thereof is a small diaphragm 16 having a central aperture 18 therein. Positioned alongside tube 4 is a centrally apertured diaphragm 20 which forms a partition across cylinder 2. It will be noted that the aperture 18 in diaphragm 16 is considerably smaller than apertures 12 and 14 which, in turn, are somewhat smaller than the aperture in diaphragm 20.

The cylinder 2 is provided with an internal shoulder 22 against which a lens 24 is held by means of a sleeve 26. On the face of lens 24 toward tube 4, there is provided an imperforate black mask 28, the details of which will be hereinafter described in greater detail. A second lens 30 is held in alignment with lens 24 by means of a second sleeve 32 cooperating with sleeve 26. A cylindrical element 34 having one closed end 36 extends over the end of cylinder 2 and forms a housing for a light source 38. A centrally apertured diaphragm 40 is also provided within the cylinder 34.

Aperture 42 in diaphragm 40 is of such a size that light emanating from source 38 is prevented from striking the peripheral portions of lens 30. Light striking lens 30 is transmitted to lens 24, and by reason of imper-

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forate black mask 28, a hollow converging cone of light is transmitted from lens 24 through aperture 18 of diaphragm 16, i. e., the mask 28 casts a conical shadow 44 within the converging cone of light. It will be noted that corresponding diverging cones of light and shadow appear on the opposite side of diaphragm 16 from the lenses 24 and 30. The aperture 18 is made of a size which is large enough to contain the image of light source 38, and the apertures 12 and 14 and the aperture in diaphragm 20 are made large enough so as not to interfere with the passage of light through diaphragm 16. Mask 28 is made of such a size that the shadow 46 cast on the opposite side of diaphragm 16 will cover a lens 48, i. e., the lens 48 will normally not be illuminated by light source 38.

The lens 48 is mounted in a cylindrical element 50 secured in a central aperture in cover plate 52. A second cover plate 54 is secured to plate 52 and supports a cylinder 56 having at the opposite end thereof a housing 58 in which there is mounted a photomultiplier tube 60.

At one side of the cylinder 2, and preferably at the side thereof at which end 6 of tube 4 is located, there are provided openings 62 and 64 in the cylinder wall. Mounted in each opening 62 and 64 is a tube 66 connected through filter elements 68 to the atmosphere.

In operation the fluid to be tested (smoke, for example) is drawn through tube 4 around diaphragm 16 by means of pump 10 and filtered air is at the same time drawn through openings 62 and 64 and thence through apertures 12 and 14 into tube 4. By reason of the air passing through apertures 12 and 14 into tube 4, the fluid drawn through the tube is prevented from passing outwardly through the apertures into the chamber defined by cylinder 2. It will be apparent that any particles in the fluid being tested will cause a scattering of the light in the cone passing through aperture 18 in diaphragm 16 and that a part of the light so scattered will pass through shadow 46 and be transmitted by lens 48 to the photomultiplier tube 60. The degree of pollution of the fluid tested may be derived from the amount of light thus transmitted by lens 48 to the photomultiplier, and it will be apparent that by reason of the principle involved, accurate readings depend upon a fairly constant and uniform flow of fluid through the tube 4 as well as upon a clean instrument. It is therefore absolutely necessary that none of the fluid should escape through apertures 12 and 14.

The apparatus disclosed, while extremely simple in construction, has been found to be exceedingly efficient for the purpose intended. No difficulty has been encountered with nonuniformity of fluid flow through the instrument which even when employed for testing smoke has remained entirely clean, and consequently, accurate readings are easily attained.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. An apparatus comprising means for establishing a path of light through a chamber, a tube extending through said chamber and through said path of light, said tube having apertures in opposed portions thereof which permit passage of said light therethrough, a fluid source connected to one end of said tube, suction means connected to the other end of said tube, openings in said chamber each communicating with the atmosphere through a filter means, and a diaphragm mounted in said tube and extending perpendicular to the general direction of said path of light, there being an aperture in said

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diaphragm which permits the passage of light there-through.

2. A light-scattering apparatus comprising a light source, lenses for transmitting a converging cone of said light, a mask for casting a shadow within said cone, a collecting lens positioned within the diverging cone of said light, said mask being of such a size as to cast a shadow on said collecting lens, a chamber containing said lenses and cones of light, a tube extending through said chamber and through said cones of light, said tube having apertures in opposed portions thereof which permit passage of said light through said tube, a diaphragm within said tube extending perpendicular to the axis of said cones and having a central aperture aligned with but smaller than the apertures in said tube, a fluid source

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at one end of said tube, suction means at the other end of said tube, and openings in said chamber each communicating with the atmosphere through a filter means.

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