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ODORMETER

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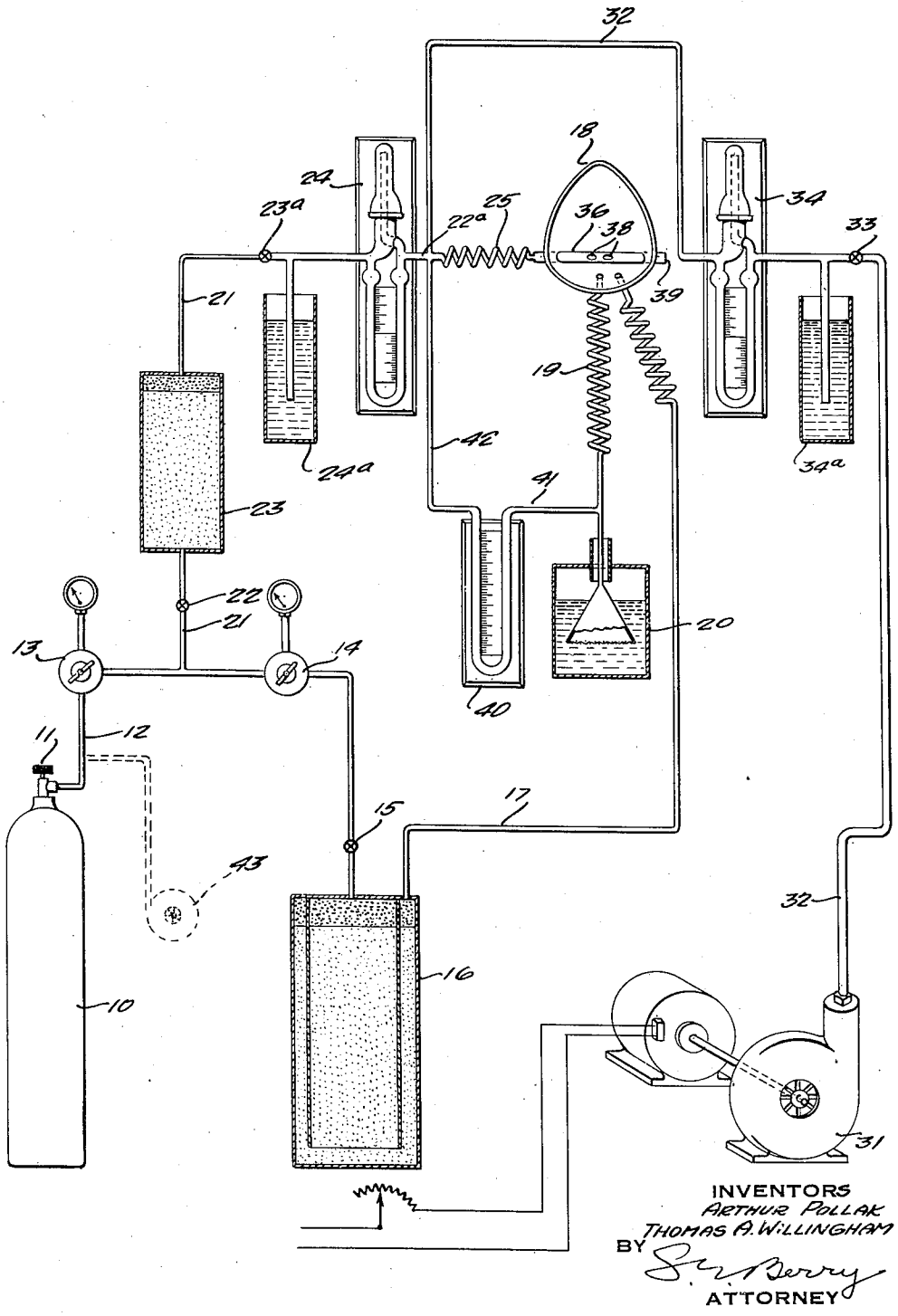

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ODORMETER

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Our present invention has to do with a device and method for evaluating odors. Various industrial processes give rise to odors in the neighborhood surrounding the plant or factory in which the process is being carried on, such processes being for the most part the subject of study to determine ways and means for abating the odor. In order to measure results obtained by such ways and means, it is desirable to know quantitatively what degree of abatement, if any, for example, may result from a given operation having as its object the amelioration of the odor.

It is therefore an object of our invention to devise an odormeter by means of which an odor may be quantitatively determined, whereby the odor in a given locality may be compared with that in another. While the olfactory nerves are remarkably sensitive to certain odors, there is no way in which the olfactory sense, unaided, may determine the intensity or concentration of such odors.

A still further object of our invention is to provide an odormeter which is compact and portable.

Other objects to be attained and the advantages thereof will be apparent as the description proceeds, reference being had to the ensuing detailed description taken with the annexed drawing, in which the single figure shows diagrammatically the apparatus employed in an illustrative embodiment.

In carrying out our invention we provide preferably a source of air which is entirely uncontaminated and which may be stored under pressure in a suitable container. Means are provided whereby this air is breathed by the operator so as to rest the olfactory nerves until such time as they are sensitive to the odors (if any such exist) of the surrounding air (or of the air being tested); it also has the purpose of diluting the ambient air down to the threshold value. Also, a feature of my invention is the means to introduce at will in the region of the nostrils of the operator, portions of the diluted ambient air whereby such air is inhaled for very brief periods so as not to fatigue the olfactory nerves.

Making now detailed reference to the drawing, 10 denotes a source of pure air under pressure, such air having been obtained in a region where it is known to be without odor. The air passes from the source or bottle 10 through a valve 11, tube 12, pressure regulator 13, reducing valve 14, valve 15, filter 16 containing activated carbon, pipe 17, to mask 18. From said mask the air passes through flexible tube 19 and out of the system through a pressure regulator 20. The pipe 12 branches off into the pipe 21 ahead of valve 14 and conducts a portion of the pure air at a slightly higher pressure than that passing through filter 16, through a valve 22 and a filter 23, thence through valve 23*a* to a flowmeter 24 of known construction. Pipe 21 also has a pressure control device 24*a* whereby sudden increases in pressure are prevented from overloading the meter 24. From meter 24 the air passes through a flexible tube 25 leading to a mask 18. Air is respirated from the mask and is exhaled into the mask and leaves the same through pipe 19 into pressure regulator 18 above mentioned, and thence out to the atmosphere.

Polluted air, as for example the circumambient air, passes through blower 31, pipe 32, valve 33, flowmeter 34 similar to flowmeter 24. In this line is also a pressure regulator 34*a* similar to regulator 24*a*. A stream of the polluted air passing through the pipe 32 is diluted by a stream of the pure air passing through pipe 21. The diluted air passes through the flexible tube 25, thence to a tube 36 passing through mask 26. The tube 36 is open-ended (the open end 39 being outside the mask) and has preferably two perforations 38 within the mask.

A differential manometer 40 has one leg 41 connected to pipe 19 in the circuit of the purified air, while the other leg 42 is connected to the pipe 22*a* through which the air to be tested is flowing. Thus the operator can at all times make sure that the pressure in the mask from the source of pure air is greater than that of the impure air to be tested so that no air escapes through the holes 38 until such time as the operator stops the end 39 of tube 36 as with his finger, whereupon sufficient pressure is built up in the tube 36 to permit the diluted stream of polluted air to pass through the holes 38 into the proximity of the nostrils of the operator.

The operation of our improved device is fairly apparent from the foregoing. The operator adjusts the valves 23*a* and 33 so as to give the maximum or threshold dilution of the air in the pipe 32, which will be detectable by the operator. The operator thereupon notes the readings of the two flowmeters 24 and 34 and calculates the rate of flow through each. The odor intensity or concentration is then most conveniently expressed by the relationship

$$p^0 = \log \frac{\text{flow rate of pure air plus odorous gas (i. e., flow through 24 plus flow through 34)}}{\text{flow rate of odorous gas.}}$$

This value for hydrogen sulfide is substantially

6.11, for ammonia 4.3 whereas for a gas which is inodorous or substantially so the p^0 value will be 0 or very nearly 0.

It will be obvious that, as described, the odormeter actually measures the concentration of the odorous substance in either the ambient air or a source other than the ambient air. If the latter is a stream of stack gases, for example, the flow data for which are known, i. e., the cubic feet per minute, then by measuring the concentration of the odorous substance in the stack the actual quantity thereof can be computed. Where it is desired to compare a source of odorous gases with the ambient air (for example, where the ambient air is without odor), instead of using compressed air in the bottle **10** the blower **43** is used to pump the ambient air through the system comprising the lines **12**, **21**, etc.

A further field of application of our improved odormeter is that of air conditioning. When air is recirculated sufficiently a residue of impurities and odorous substances accumulates, and it is desirable to have a quantitative measure of these, for which purpose our improved device is well adapted.

It will be understood that various changes may be made in the embodiment described in the foregoing which do not depart from the spirit of our invention or the scope of the appended claims.

We claim:

1. The method of estimating the concentration of odor in a gas, which comprises continuously diluting a stream of the gas to be tested with pure air, admitting substantially continuously to a region confining the nose of the operator, pure air for breathing from a source other than the ambient air, conducting the diluted gas to said confined region, momentarily displacing the air therein with said diluted gas while olfactorily testing same, varying the amount of dilution of said odorous gas until, when olfactorily tested in said confined region, the threshold value is reached, and measuring the degree of dilution of said gas at said threshold value.

2. In an odormeter adapted for use in the measurement of the odor of the ambient air, a breathing device adapted to insulate the breathing orifices of the observer from the ambient air, a source of supply thereto of relatively pure air for breathing, means for passing an odorous gas thereto to be tested, means for diluting the odorous gas with pure air from said source prior to the admission of such diluted odorous gas to said breathing device, a flow measuring device for said odorous gas, a flow measuring device for said air for dilution, and means for admitting at will and for brief intervals said diluted odorous gas to said breathing device whereby the nostrils of the observer are purged of the odorous gas by air from said source of relatively pure air except at such short intervals when the diluted odorous gas is breathed.

3. In an odormeter, a mask adapted to insulate the breathing orifices of the observer from the ambient air, and for permitting the breathing of samples of air to be tested, means for passing an odorous gas thereto, means for diluting the odorous gas with pure air prior to its admission to said breathing device, means to measure the flow of said odorous gas and means to measure the flow of said air for dilution and means for admitting at will said odorous gas to said mask, said means comprising a tube passing through said mask and extending open-ended beyond the same and being perforated within said mask whereby said diluted odorous air escapes into said mask only when its pressure is greater than that of said pure air, as when said open end is obstructed.

4. The method of estimating the concentration or odor in the ambient air which comprises continuously diluting a stream of said ambient air with pure air from a source provided, admitting substantially continuously to a region confining the nose of the operator a stream of said pure air for breathing, conducting the so-diluted ambient air to said confined region, momentarily displacing the pure air therein with said diluted ambient air while olfactorily testing same, varying the amount of dilution of said ambient air until, when olfactorily tested in said confined region, the threshold value is reached, and measuring the degree of dilution of said ambient air at said threshold value.

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