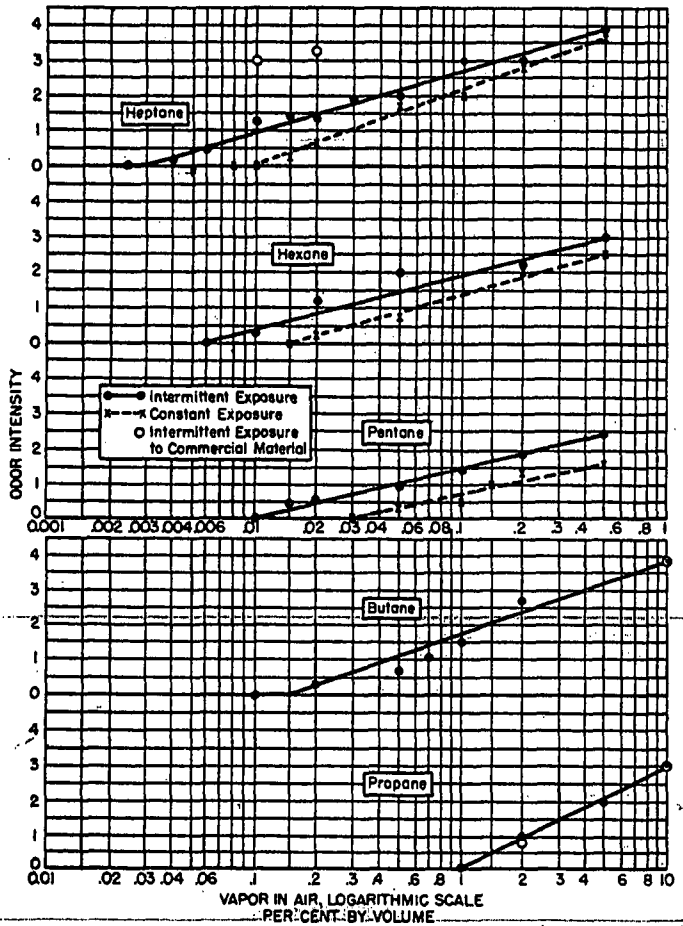

Figure 3. Relation between concentration of vapors of purified paraffin hydrocarbons and odor intensity.

B. PORTABLE RAPIDLY INDICATING DEVICES

Nearly all physical sampling methods are open to the same criticism: they are not specific, and it is sometimes impossible to tell whether the physical changes measured, especially small ones, are due to the presence of a particular gas or vapor or to some other cause; and in mixtures it is not always feasible to determine the percentage of each component. Nevertheless, the advantages of portability and

immediate availability of results make some physical instruments immensely useful.

1. Interferometer

Perhaps the most dependable and most widely applicable physical instrument yet developed for field use is the 50-cm. portable gas interferometer. This instrument accurately measures minute changes in refractivity, so that it may successfully be used to determine low concentrations of contaminating gases or vapors in the atmosphere, providing the refractivity of the contaminant is sufficiently different from that of air, which is 291.7×10^{-6} at 0° C. and 760 mm. Hg pressure. Since refractivity is a function of density, as well as of molecular structure, slight changes in pressure and temperature have an important bearing on results and must be carefully controlled. The light source must be of constant wave length and is usually an incandescent filament. The interferometer is a sensitive form of refractometer which, instead of measuring refraction directly, compares the refractivity of one gas to that of another. In air analysis, the usual standard of comparison is dry air, from which all carbon dioxide has been removed. This standard atmosphere must be at the same temperature and pressure as the atmosphere to be examined. An interferometer may be calibrated against known mixtures of vapor in air, of the same order of concentration as atmospheric mixtures in which it is to be employed. Also, it many be calibrated for absolute refractivity changes, that is, refractivity factor, by increasing the pressure of dry air in one cell referred to similar dry air at constant atmospheric pressure in the other.[9] Once the refractivity calibration has been accomplished, instrument scale readings may be translated to vapor percentages by employing any reliable data on the refractivity of vapors and gases. These data are perhaps most readily utilized when presented as unit refractivity change ($U\Delta R$), that is, the change in the refractivity of dry air at 25° C. and 760 mm. Hg pressure due to the admixture of 1 per cent by volume of vapor. The data given in Table 3 were obtained by vaporizing weighed amounts of solvents in a galvanized metal chamber having a volume of 604 cu. ft.

The concentration of a known vapor may be determined as follows:

$$\text{Percentage vapor in air} = \frac{\text{interferometer reading} \times \text{refractivity factor (of instrument)}}{\text{unit refractivity change (of vapor)}}$$

For example, in measuring benzene vapor, suppose the interferometer scale reading has increased 62 divisions or 0.62 revolution of the indicator dial above its reading in dry air, and each revolution is equivalent to a change in refractivity of 2.91×10^{-6}. The percentage of benzene would equal:

$$\frac{0.62 \times 2.91 \times 10^{-6}}{14.4 \times 10^{-6}} = 0.125 \text{ (1250 p.p.m.)}$$

[9] J. D. Edwards, *U. S. Bur. Mines Tech. Paper* No. **131**, 1919; F. A. Patty, *J. Ind. Hyg. Toxicol.* **21**, 469 (1939).