1.7....8.2098	5.2....7.2844
1.8....8.0378	5.3....6.8204
1.9....7.8579	5.4....6.3479
2.0....7.6700	5.5....5.8668
2.1....7.4741	5.6....5.3771
2.2....7.2702	5.7....4.8789
2.3....7.0581	5.8....4.3721
2.4....6.8379	5.9....3.8567
2.5....6.6095	6.0....3.3328
2.6....6.3730	6.1....2.8003
2.7....6.1282	6.2....2.2593
2.8....5.8751	6.3....1.7096
2.9....5.6138	6.4....1.1514
3.0....5.3442	6.5....0.5846
3.1....5.0663	6.6....0.0092–20
3.2....4.7800	6.7....9.4252–30
3.3....4.4854	6.8....8.8326
3.4....4.1824	6.9....8.2314
3.5....3.8710–10	7.0....7.6216–30

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POLARIZATION OF SOUND

The term polarization, applied to a wave motion, is generally associated only with transverse waves, more especially with light-waves, as referring to a state in which certain qualities are different in certain directions at right angles to one another and to the direction of propagation. By its origin, however, the term may be used with the same justification for longitudinal waves exhibiting qualities that are different in different directions, irrespective of the nature of such qualities and the relation of the various directions to each other.

It is thus proper to speak of a polarization of sound when conditions prevail under which a quality like its pitch is of opposite character to opposite sides of a fixed plane or axis.

Such conditions may be brought about by putting the source, which for the sake of simplicity is supposed to produce a sustained sound of uniform pitch, through certain movements. It is well known that when such a source is in motion the pitch of the sound emitted into space will be a function both of the direction of the movement and its speed.

This is due to the relative displacement of the individual wave rings by the motion, and is readily observed by anyone standing close to a railroad track while a locomotive blowing its whistle is passing. At the instant of passage there is a sudden fall in the pitch of the blast, the fall being approximately proportional to the speed of the locomotive.

The pitch observed at any point may be expressed by the formula:

$$p = q\,\frac{v}{v-u},$$

p denoting the pitch observed, q the pitch produced, v the velocity of sound, and u the speed component of the movement in the direction of the observer, with due consideration of its sign.

If the source, instead of being moved at uniform speed in one direction, is made to perform a harmonic oscillatory movement at right angles to a plane P, and symmetrical to it, then the resulting sound will be of uniform pitch only at points located in this plane, assuming the extent of the movement to be small as compared with the distance to the point of observation. To either side of the plane the pitch will be undulating, the undulations reaching their maximum amplitude at points directly in line with the movement.

While the undulations will be of the same amplitude at any two points symmetrically located with respect to the plane, they will be opposite in phase and, therefore, of opposite character. Accordingly, if the source is made to emit sound while to one side of the plane only, *i.e.*, during alternate half oscillations, then, by the above formula, the resulting sounds will be of descending pitch to that side of the plane, while to the opposite side of it the same sounds will be of ascending pitch.

The sound may thus be said to have been polarized with respect to the plane P.

If the oscillatory movement of the source is substituted by a rotation at uniform speed about an axis A, results of a similar nature are obtained. In this instance, however, the resulting sound will be of uniform pitch only

at points directly in line with the axis, while aside of it the pitch will be undulating. The undulations will reach their maximum amplitude at points located in the plane of rotation, being of opposite character at any two points symmetrically located with respect to the axis.

In the terminology of optics, the sound may be said, in the latter case, to have been circularly polarized with respect to the axis *A*.

Polarized sound-waves may be of value in acoustic research, for investigations involving the direction of sound. They are also applicable to practical purposes, like fog signalling. The signals may be polarized in such a way as to enable a pilot to determine with ease and certainty, *and by the unaided ear*, the direction from which they are coming. A device for this purpose has already been constructed by the writer and has successfully stood the test, it being possible to locate the source within a "point" of the compass.

ANDERS BULL

CHICAGO, ILL.,
June 27, 1921

THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF CHEMISTRY OF MEDICINAL PRODUCTS

Charles E. Caspari, *chairman.*
Edgar B. Carter, *secretary.*

N-derivatives of arsphenamine. I. Introduction of fatty acids: GEORGE W. RAIZISS and JOSEPH L. GAVRON. *II. Aldehyde addition products:* GEORGE W. RAIZISS and ABRAHAM C. BLATT. The authors introduced various atomic groupings in arsphenamine and studied the biological properties of the resulting compounds. They observed that the amino groups have a controlling influence upon the toxicity of the drug. Five derivatives of arsphenamine each containing a fatty acid substituent in both amino groups have been prepared. On the whole they are less toxic than the parent substance. Addition products of arsphenamine and various aldehydes, in which two molecules of the aldehyde are combined with one of arsphenamine, have also been prepared. Some of these have characteristic colors and may prove to serve as a means of identification. The biological study of these compounds is still in progress. One has been found less toxic than arsphenamine and also exhibits marked trypanocidal properties.

Some recent observations on protoplasmic stimulus: G. H. A. CLOWES. It has long been known that the sperm of sea urchins and other marine forms may be stimulated to excessive activity and their fertilization capacity promoted by treatment with extracts and secretions of eggs of the same species. This substance has now been proved to be a volatile, readily oxidized, non-specific, organo substance, resembling the lower alcohols or mercaptans. Similar sperm stimulating and fertilization promoting results may be obtained by utilizing a large variety of organo substances at dilutions of one in a hundred million or more.

Significance of residue determination as a test for the purity in drugs and chemicals: H. V. FARR. Salts of potassium and sodium are apparently more volatile in the presence of vapors of other metals, making their determination by ignition difficult in such compounds as mercury salts. The results seems to indicate widely different interpretations of the ignition test by different chemists. A much more accurate definition of the U. S. P. requirement is essential.

A new use for edible oils in surgery: CHARLES BASKERVILLE. Numerous efforts have been made to introduce gaseous anesthetics, as ether vapor, into the lower bowel until Dr. J. T. Gwathmey, of New York, conceived the idea of utilizing the solubility of ether in oil and administering the mixture as an enema. Fundamental factors were established by the investigations of the author before the proposal was tried with human beings. He determined the rates of evaporation of ether from various oils, mainly vegetable, although Russian mineral oil was also used. It was conclusively proven that ether evaporates from its solution in or of various oils suitable for internal use at a definite rate at the temperature of the human body. Nearly 30,000 operations, every one successful from the patient's point of view, have been performed by using this method. Not a single untoward circumstance has been reported. Vomiting, post-anesthesia nausea and many other uncomfortable accompaniments have been reduced to a minimum. Gwathmey also introduced the oral administration of the oil-ether mixture to produce analgesia during the dressing of wounds. Some surgeons have utilized the method in civilian practise in dressings after operations.

Further study of saligenin and allied compounds: