Of these main divisions there are 14, covering the entire range from normal acid to normal alkaline reaction. The 125 mm. disk is mounted by means of a central pivot on a second disk, having its scale of voltage around the circumference of the first. The range of the latter extends from 0.24 to 1.17 volts. Concentric with the disks is a movable arm of transparent celluloid, with a radial hair-line scribed upon it, to facilitate making readings. The points on the voltage scale corresponding to the potentials of tenth-normal, normal and saturated KCl calomel cells are marked, as a matter of convenience. The temperature for which the slide-rule gives correct readings is 25° C.

To use the instrument, the zero mark of the circular scale is set on the voltage corresponding to the reference electrode being used. The hair-line is set to indicate the measured voltage, and the corresponding p_H and C_{H^+} readings appear under the hair-line on the inner disk. Settings are possible to an accuracy of ± 0.5 millivolt.

The slide-rule can be used equally well when the reference electrode, instead of being the usual calomel half-cell, is a hydrogen electrode of known potential relative to the standard solution in which it is immersed. Whatever the nature of the fixed electrode, the change in potential difference at the terminals of the gas chain is 59.1 millivolts for each decimal change in the concentration. The graduation of the inner disk is based upon this assumption, which makes it applicable to any case.

Because of the fact that so few data are available on the variations of gas chain electromotive forces with temperature, it seems advisable, pending an accumulation of reliable information on this point, to make measurements at a temperature of 25° whenever this is possible.

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MATHEMATICS IN SPANISH-SPEAKING COUNTRIES

The Spanish-speaking countries publish only one journal devoted to advanced mathematics, which is now called *Revista Matemática Hispano-Americana* and is published at Madrid, Spain, under editorship of J. Rey Pastor. In view of the fact that the professors of mathematics in so many countries can obtain no other advanced mathematical journal in their own language one might suppose that this periodical would not suffer for want of suitable manuscripts or sufficient financial support.

Such a supposition is, however, not in accord with the facts, judging from a call issued recently by its editor. In this call it is stated that there is now an almost complete lack of Spanish mathematical production and that it has been necessary therefore to publish an excessive number of articles by the same authors. It is also stated that nearly all Spanish professional mathematicians occupy the position of spectators and critics, and thus place the burden of doing the work connected with the periodical on the shoulders of one or two men.

In view of the fact that in the English-speaking countries of America the mathematical journals are now overcrowded by suitable manuscripts offered for publication it is interesting to note that just the opposite is true in the Spanish-speaking countries of this continent. As was noted in Science, N. S., volume 34, page 372, the Spanish-speaking people organized a mathematical society in 1911. This society has been fairly successful in awakening among them an interest in the newer fields of mathematics, but, judging from the call noted above, which was directed to the members of this society, it seems that this interest is still far from being general and effective.

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THE EARLIEST BEES, WASPS AND ANTS

It seems desirable to correct some statements appearing in text-books of geology, which lead students to imagine that we are acquainted with bees, wasps and ants from Mesozoic strata. Thus, Professor J. W. Miller,

in his "Introduction to Historical Geology" (1916), says (p. 232):

> Insects such as bees, ants and wasps made their first appearance in the Jurassic.

Dr. C. Schuchert, in "Historical Geology" ("Text-book of Geology," part 2), 1915, p. 812, states that "with the Comanchian . . . insects (beetles, flies, ants, bees, wasps) took their rise." As a matter of fact, the oldest known bees are from Baltic amber (Oligocene Tertiary), and the oldest known true wasps and ants are from the Eocene. In the Jurassic, the peculiar family Pseudosiricidæ, apparently related to the modern Siricidæ, were well represented. One species of this extinct family (*Megapterites mirabilis* Ckll.) has lately been described from the English Eocene. There is a very dubious Jurassic Hymenopterous insect from Spain, supposed to be related to the Ichneumonidæ. These Hymenoptera were not in any way adapted to be pollinators of flowers. Considering the development of the Hymenoptera in the Eocene, it may be presumed that the wasps and ants, at least, originated as early as the Cretaceous, but there is no direct evidence on the point.

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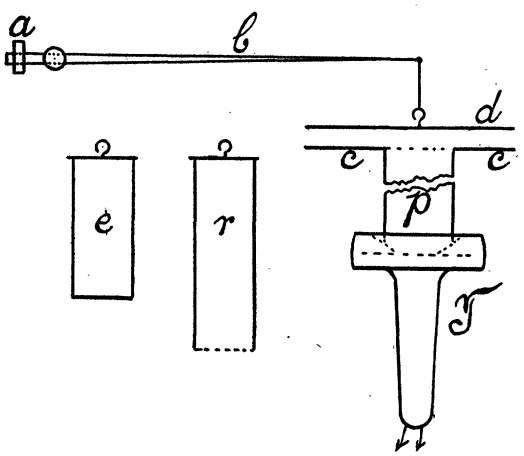
SPECIAL ARTICLES

THE PNEUMATIC PARADOX IN ACOUSTICS

1. THE following pretty experiment is very instructive in its bearing on the Mayer-Dvorak effect, as well as on the experiments of the present paper. In the figure, *b* is the light wooden beam (30 cm. long, counterpoised at *a*) of a horizontal torsion balance, the torsion wire (of brass, .02 cm. in diameter and 18 cm. long on either side normal to the diagram) being seen at *w*. A light disc of cardboard *d* is suspended in equilibrium from the end of the balance. Below this is the telephone *T* to which the brass pipe *p* (13 cm. in length and 2.6 cm. in diameter) has been cemented, to form of a closed *c″* organ pipe of which the telephone plate is the bottom. The open top of *p* is surrounded by a fixed annular disc *cc* of metal parallel and close to the movable disc *d*.

When the telephone is strongly energized and emits a rising note (motor break and rheostat), no effect is produced until its frequency is in resonance with the pipe *p*, whereupon the disc *d* is at once attracted. Since the pipe *p* is closed above by this process, the telephone frequency must be slightly reduced to keep the discs in cohesion. On breaking the current *d* is at once released.



This is of course nothing further than a modified example of the familiar pneumatic paradox. When the pipe howls, the distance from which *d* may be attracted and held is perhaps 2 cm. beyond which the couche of diminished static pressure is ineffective. The thickness vanishes with the intensity of sound.

2. If now *cc* is removed and the disc *d* is replaced by the closed paper cylinder *e* of a diameter (2.1 cm.) sufficiently small to enter the mouth of *p* easily, the results of the experiment are the same. Here however the cylinder *e* may be made to enter the pipe as much as 1 cm. or more by successively decreasing the pitch, conformably by the gradually stopped mouth of *p*. Supposing the total displacement to be 2 cm., the force indicated by the torsion balance would be .7 dyne and the mean pressure decrement for the area 3.5 cm.^{2}, therefore .2 dynes/cm.^{2} But as both the disc and cylinder come down with a jerk, the maximum forces are probably larger.

If there were a pin hole in the bottom of *e*,