SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE INTERFERENCES OBSERVED ON VIEWING ONE COARSE GRATING THROUGH ANOTHER, AND ON THE PROJECTION OF ONE PIECE OF WIRE GAUZE BY A PARALLEL PIECE.

IT has often been a matter of surprise to me that the shadow bands observed, for instance, on looking through one distant picket fence at another, are so seldom referred to in the literature of physics; and moreover, that phenomena so ubiquitous and of such remarkable properties are sparingly, if ever, made use of by the practical physicist. I therefore thought it worth while to look into the subject experimentally, for my own satisfaction, and the results may be of interest to the reader. I hope to show that there is probably no more straightforward example of the diffraction method in geometric optics, or more instructive method of introducing it.

CERTAIN ALLIED SIMPLE PHENOMENA.

1. If a piece of wire gauze is placed on another with the wires nearly parallel, the well-known water lines invariably come out, oftentimes, if one piece of gauze is regularly or geometrically crumpled or dimpled, showing beautiful patterns. The explanation of this is at hand; the upper meshes being nearer the eye subtend a larger angle, and when both are projected on the same plane, two scales result, one a little larger than the other. Hence, similar to the case of the vernier or the analogous case of

cleared up by subsequent statements given by the authors, but on the whole the introduction seems very unsatisfactory.

Length, angle, mass and time are called measurable quantities because these attributes (to speak of them briefly) may be divided into parts, which by means of one or another kind of congruence, are judged to be equal or like parts, and these parts may then be counted. This fundamental notion which is due, we believe, to Helmholtz, is no doubt the real basis of quantitative relations in physics; and it should be remembered that, although we frequently speak of the measurement of an electric current, of a magnetic field and what not, we never do actually measure anything but lengths, angles, masses and time intervals.

In the first chapter, on electrical units and quantities, Vigneron and Letheule make a distinction between *electromotive force* and *potential difference*, which distinction, being largely in vogue among electricians and not being based upon the fundamental conception of potential, it is a disservice to perpetuate. A distinction, however, there certainly is between the two, and it is, according to Maxwell, as follows:

When electric charge is transferred from one point to another work is usually done. The amount of work done depends in general upon the path along which the charge is carried. The work done in carrying unit charge along a given path is called the *electromotive force* along that path.

In special cases the electromotive force is the same along any two coterminus paths. In such a case the common value of the electromotive force is called the *potential difference* between the terminal points.

Now it seems to us that no author should attempt to make any other distinction between electromotive force and potential difference than the above. In particular the distinction between the *total electromotive* force of an electric generator and the *electromotive force between the terminals of the generator* should not be confused with the distinction between electromotive force and potential difference. One may answer, indeed, that the practical electrician is concerned with the distinction between *total* and *external* electromotive forces of electric generators, and not at all concerned with the fine distinction, according to Maxwell, between electromotive force and potential difference. This is too true, but this is no reason why electricians should be permitted to misuse these terms without protest, for very certainly the distinction between total and external electromotive force of a generator has nothing essentially in common with the distinction between electromotive force and potential difference in the sense in which Maxwell uses these terms.

There is one thing in which we know of only one person (Heaviside) who agrees with us, namely, that the notion of electric potential might best be dropped in the subject of electrodynamics, and we are convinced that the preference of most electricians for the term *potential* to the term *electromotive force* is in their tongues, not in their heads.

W. S. FRANKLIN.

BOOKS RECEIVED.

Text-book of Physiology. Edited by E. A. SCHÄFER. Edinburgh and London, Young J. Pentland. New York, The Macmillan Company. 1900. Vol. II., pp. xxiv + 1365. $10.00.

The Theory and Practice of Hygiene. J. LANE NOTTER and W. H. HORROCKS. Philadelphia, P. Blakiston's Sons & Co. 1900. Second Edition. Pp. xvii + 1085. $7.00.

A Treatise on Zoology. Edited by E. RAY LANKESTER. Part II., *The Porifera and Cœlentera.* E. A. MINCHIN, G. HERBERT FOWLER and GILBERT C. BOURNE. London, Adam and Charles Black. New York, The Macmillan Company. 1900. $5.50.

Free-hand Perspective. VICTOR T. WILSON. New York, John Wiley & Sons. London, Chapman & Hall, Limited. 1900. Pp. xii + 268. $2.50.

Dynamo Electric Machinery. SAMUEL SHELDON. New York, D. Van Nostrand Company. 1900. Pp. 281. $2.50.

Die Lehre von Skelet des Menschen. F. FRENKEL Jena, Gustav Fischer. 1900. Pp. vi + 176. M. 4.50.

Among the Mushrooms. ELLEN M. DALLAS and CAROLINE A. BURGEN. New York, Drexel Biddle. 1900. Pp. xi + 175.

The Principles of Mechanics. FREDERICK SLATE. New York and London, The Macmillan Company. 1900. Pp. x + 299.

Die Ursprüngliche Verbreitung der angebauten Nutzpflanzen. F. Höck. Leipzig, Teubner. 1900. Pp. 78. M. 1.60.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbeltiere. Albert Oppel. Jena, Gustav Fischer. 1900. Part III. Pp. x + 1180 and 10 plates.

A School Chemistry. John Waddell. New York and London, The Macmillan Company. 1900. Pp. xiii + 278.

SCIENTIFIC JOURNALS AND ARTICLES.

Popular Astronomy for October contains an excellent sketch by Professor C. D. Perrine of the late James Edward Keeler, of Lick Observatory, accompanied by his photograph. The opening address by Dr. A. A. Common, F.R.S., F.R.A.S., at the Bradford meeting of the British Astronomical Association for the Advancement of Science is begun in this number and will be concluded in the November number. Also the first part of Kurt Laves' paper on 'The Adjustment of the Equatorial Telescope' is given. Tables for the observation of the planet Eros and an illustrated article upon that planet by the editor, W. W. Payne, together with a résumé of recent work at the Lowell Observatory are important features of this issue, as well as the usual spectroscopic, planet, comet and general notes.

SOCIETIES AND ACADEMIES.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

At the meeting of the Society on October 13th, Mr. O. H. Tittmann told in an informal way of some of the incidents of the marking of the provisional boundary between Alaska and the British possessions, at the head of the Lynn Canal, during the past summer.

Dr. Artemus Martin read a paper on 'A Method of Computing the Logarithm of a Number without making use of any Logarithm but that of 10 or some power of 10.' The method in this paper consists in modifying some of the ordinary forms of logarithmic series so that the logarithm used in the computation is the logarithm of 10 or some power of 10.

Dr. T. J. J. See read a paper on the 'System of Uranus.' It combines a statement of some of the recent results of observations, a comparison of these with former results and a critical statement of the uncertainties involved in the present knowledge of the system.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the first meeting of the autumn, held on the evening of October 15th, there were sixteen persons present. Mr. William H. Roever, of Washington University, presented an elaborate paper, discussing in detail the subject of the establishment of the method of least squares. Professor F. E. Nipher presented two papers, entitled respectively 'Positive Photography,' with special reference to eclipse work and the frictional effects of railway trains upon the air; and Mr. C. F. Baker exhibited an interesting collection representing nearly all of the species of fleas thus far known, which he had prepared for the United States National Museum.

Four persons were elected to active membership.

William Trelease,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

ARITHMETICAL NOTE.

In the second edition of the *Exercices d'arithmétique* of MM. Fitzpatrick and Chevrel (Paris, Hermann, 1900), there is given the following interesting application of the binary system of notation (p. 490). Russian peasants, when they have to perform a multiplication, in general proceed thus: They divide the multiplicand by 2, and at the same time double the multiplier; if the multiplicand is odd, they discard the unit remainder and mark the multiplier with a sign. This being done as often as possible, the multipliers affected with the sign are added together to obtain the result. Thus, for example, the multiplication of 35 by 42 proceeds as follows:

35	42 +
17	84 +
8	168
4	336
2	672
1	1344 +

$42 + 84 + 1344 = 1470.$

It is easy enough to construct a similar process, *e. g.*, for the ternary system of nota-