liquid is somewhat inflammable but not explosive.

I have constructed a generator which answers all purposes and is safe. I am in hopes of having them made in quantities, so that if necessary, this culicide can be used extensively. It is absolutely certain that this culicide and disinfectant injures nothing but living things—the most delicate fabrics, metals, etc. I would be pleased to give any information to any one as to its efficiency. For lack of time, I can not speak further of this most wonderful agent.

I thank you all for your kind attention.

WILLIAM J. GIES,
Secretary.

SECTION B—PHYSICS.

THE annual meeting of Section B, Physics, of the American Association for the Advancement of Science, was held in the Physical Laboratory of Tulane University, in New Orleans, on December 29 and 30, 1905, and on January 1, 1906. The presiding officer was the vice-president of Section B, Professor Henry Crew, of Northwestern University. The other officers in attendance were the retiring vice-president, W. F. Magie; the secretary, D. C. Miller; member of the council (no election); member of the general committee, H. T. Eddy; members of the sectional committee, Henry Crew, W. F. Magie, D. C. Miller, A. Trowbridge (elected at this meeting to serve for five years), E. L. Nichols and F. E. Nipher; press secretary, J. R. Benton.

It was decided by the general committee that the next annual meeting would be held in New York City in convocation week, 1906–7; and that those sections desiring to do so might hold a summer meeting in Ithaca in the latter part of June. The desirability of such a meeting for Section B will be determined by letter ballot. The presiding officer for these meetings will be the vice-president elect, Professor W. C. Sabine, of Harvard University. The other officers for these meetings, so far as now determined, are:

Retiring Vice-President—Henry Crew.

Members of the Sectional Committee—W. C. Sabine, Henry Crew, D. C. Miller, A. G. Webster, G. F. Hull, F. E. Nipher, E. L. Nichols, A. Trowbridge.

Secretary—Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

On December 31 the retiring vice-president, Professor W. F. Magie, of Princeton University, gave a most interesting address on 'The Partition of Energy'; this address was printed in full in SCIENCE for February 2, 1906.

Because of mutual interest in the papers offered in Sections B and D, and because the programs were short, two joint sessions of these sections were held. The program of papers presented is given below, with abstracts of all but one of those belonging to Section B; the abstracts of the other papers will be given in the report of the secretary of Section D. There was ample time for full discussion of the papers, and advantage was taken of this opportunity, adding much to the enjoyment of those attending.

Although the attendance was small (there were about thirty-five present at each meeting), yet the quality of the meetings in every respect was quite up to the average, and all were unanimous in expressing the opinion that the sessions had been both profitable and enjoyable. Excursions to the pumping and drainage stations, to a sugar plantation and mill and to a sugar refinery, as well as the miscellaneous attractions peculiar to New Orleans as a city, were greatly enjoyed by those in attendance.

An Experiment on Easterly Deviation Beneath the Earth's Surface: F. W. MACNAIR, Michigan College of Mines.

During the investigation of the cause of divergence of long plumb lines hung in the No. 5 shaft of the Tamarack Mine[1] attention was drawn to the old Cornish method of plumbing a shaft by dropping a spherical shot, the vertical being assumed as the line joining the point of suspension with the point of striking at the bottom. A rough calculation of the probable easterly deviation which might be expected of a body dropping from surface to the foot of the lines, forty-two hundred feet, led to the announcement that it was in the neighborhood of four feet. This is obtained by taking the difference in velocity between points on the two cylinders about the earth's axis, one including the small circle of latitude and the other that through the foot of the plumb lines, and multiplying by the seconds allowed for the fall.

A deviation admitting of consistent measurement in feet was impressive enough to create a demand for an opportunity of witnessing it, and an experiment was devised to gratify this desire. It was performed at the close of a certain day's 'plumbing' in No. 5 shaft and consisted in suspending a steel sphere by a thread at the collar, getting it as quiet as possible, then burning the thread while observers below watched for its striking a prepared clay bed.

It was a little over five feet from point suspension of sphere east to shaft timbers. In a vacuum between sixteen and seventeen seconds would be occupied in the fall. The ball failed to appear at all.

Another sphere hung in the center of the shaft compartment about three feet from the eastern timbers, when dropped, also failed to appear below. Afterward a sphere, presumably this one, was found lodged about eight hundred feet from surface. Further experiments were not then feasible.

Crude as was the whole proceeding and devoid of serious purpose, it yet drew the attention of those concerned to the possibilities offered by the deep vertical shafts of the copper district of Michigan for the investigation of easterly deviation.

The author suggests that an accurate mapping of the path of a falling body beneath the surface might possibly afford interesting data bearing on the distribution of the earth's matter. He hopes at a subsequent time to present a properly elaborated plan of investigation of this path.

A Device for producing an Instantaneous Arc at any Phase of an Alternating Current: Henry Crew, Northwestern University.

The essential features of this instrument are as follows: (1) A pair of electrodes, one of which has a motion of pure translation; the other, a motion of pure rotation. (2) The rotating electrode is driven on the shaft of a synchronous motor. (3) The arc is fed by the same transformer which drives the motor. (4) The phase of contact between the moving electrode and the fixed one is read off on a divided circle.

The object of this device is to obtain a comparatively cold (?) carbon arc in the neighborhood of zero-phase. The region between the poles of a continuously operated carbon arc shows no carbon bands, in its spectrum, at zero phase. But a carbon arc of the type indicated above shows the carbon bands at the lowest phases that can be examined, say, from 0° to 2°. The explanation of this difference lies probably in the fact that, owing to the greater heat, the current of the continuous arc at small phases is carried by the *ions of the metallic impurities;* while in the discontinuous (or instantaneous) arc the conduction is made

[1] See Science, Vol. XV., page 994. Also *Engineering and Mining Journal,* April 26, 1902.

possible by ionization, by incandescence, of *carbon,* the incandescence being secured by Joule heat.

Distribution of Gas Pressure in a Closed Tube Rotating on a Transverse Axis: FRANCIS E. NIPHER, Washington University. (To be published in the *Transactions of the Academy of Science of St. Louis.*)

The paper is a mathematical discussion deducing the pressure at the axis, and showing that it is independent of the length l, and angular velocity ω of the tube, if the velocity $v = \omega l$ is constant. The pressure at any other point is also determined, in terms of its distance r from the axis of rotation.

The pressure at the free end of the tube due to rotation is greater than the external pressure against the tube due to its motion through the external air. If the outer end terminates in an L with open mouth exposed to the air through which it is advancing the air within the tube is forced out in the teeth of the wind. If the tube be also opened at the axis, the air will pass out in a current through the open end of the L at the free end of the tube.

A New Type of Frequency Meter: A. S. LANGSDORF, Washington University. (To be published in *The Electrical World.*) Section D.

Report of Progress in Experiments on Ether Drift: EDWARD W. MORLEY and DAYTON C. MILLER, Cleveland.

At the Philadelphia meeting an account was given of experiments to detect ether drift. The observations indicated that there is no drift of the ether. It has been suggested that the negative result was due to the influence of the heavy stone walls of the building within which the apparatus was mounted. The interferometer has since been mounted on high ground near Cleveland and covered in such a manner that there is nothing but glass in the direction of the expected drift. Observations, though difficult, have been made; but cold weather interrupted them before a definite conclusion had been reached. The observations are to be completed at the first opportunity in the spring of 1906.

A Critical Analysis of Methods of Supplying Power to Branch Telephone Exchanges on the Common Battery: KARL KINSLEY, University of Chicago. Section D.

A New Form of Mercury Still: CHARLES T. KNIPP, University of Illinois.

This still makes use of the mercury vapor lamp. In it are found, roughly, conditions necessary for the purification of mercury, such as heat by the passage of the electric current, and a more or less perfect vacuum. By fusing to the mercury vapor lamp a properly shaped condensing chamber, mercury of a high degree of purity may be obtained. The electrodes of the apparatus are mercury and are in communication with two vessels containing the supply mercury through narrow tubes about 80 cm. long. The condensed mercury flows from the still through a long capillary delivery tube bent in the form of an S at its lower end. The action of the mercury dropping into this tube is that of a continuous mercury pump. The apparatus is initially exhausted by means of a power Geryk pump (or other equally effective pump). The arc is started by employing a side connection as described by Weintraub.[2]

In this form of still the rate of distillation is about one pound per hour, and the cost is approximately one cent per pound.

To test the action of the still zinc amalgams were used. The test for zinc was

[2] *Phil. Mag.*, Vol. VII., February, 1904.

made by the electromotive force method recently described by Hulett and Minchin.[3]

One millimeter deflection of the galvanometer corresponded approximately to .0005 volt. The results are given in the following table:

No.	Zinc Amalgam.	Distillate from Zinc Amalgam.	Defl. of Galv.
2*a*	1 : 700,000	——	2.17 mm.
5	——	1 : 3,000 approx.	1.51 "
3	——	1 : 10,000 "	1.69 "
100	1 : 370,000	——	4.00 "
a	——	1 : 1,740	.61 "
b	——	1 : 1,740	—.19 "
c	——	1 : 1,740	.55 "

From the above a deflection of 1 mm. corresponds to the presence of zinc in the ratio of 1:1,500,000. In numbers 5 and 3 the degree of zinc impurity was known only approximately, and since there was also present some lead and tin little weight should be given these results. In numbers *a*, *b* and *c* the ratio of zinc to mercury was definitely known. The distillate from this zinc amalgam condensed in three separate condensing chambers showed practically no trace of zinc. The mercury against which the above was balanced in the test cell was carefully and repeatedly purified by the 'wet' method. The degree of purity indicated above was altogether unlooked for, since the physical conditions in the still-temperature, vacuum, etc., are such as favor the vaporization of zinc too, and hence we should naturally expect zinc present to a more or less extent in the distillate. The result seemingly points to a suppressing action exerted by the electric forces upon the zinc ions. This phase of the phenomena is the subject of further inquiry.

Difference in the Coefficient of Discharge of Steam through a Single Orifice and through a Number of Orifices near Each Other: D. S. Jacobus, Stevens Institute of Technology. (To be published in the *Transactions of the American Society of Mechanical Engineers.*) Section D.

Note on the Distribution of Energy in Fluorescence Spectra: Edward L. Nichols, Cornell University.

The fluorescence spectra of solids and liquids are, so far as known, confined to the visible wave length. Observers in this field of optics have until very recently contented themselves with a description of the appearance of the fluorescence band or bands and an indication of its approximate limits towards the red and violet. Professor Merritt and the present writer have, however, succeeded in making spectrophotometric measurements of the fluorescence of numerous substances and have published curves in which the distribution of intensities of fluorescence spectra are expressed in terms of the intensities of the corresponding wave lengths in the spectrum of the acetylene flame.[4]

By means of measurements of this source of light made by G. W. Stewart and independently by W. W. Coblentz, using a mirror spectrometer with rock salt prism and a radiometer, a curve showing the distribution of energy in the visible spectrum may be plotted. The writer[5] has published in a recent paper a curve based upon these data which gives the distribution of energy in the acetylene flame and has checked the values thus obtained by means of spectrophotometric comparisons between the Hefner and the acetylene flames and Angström's curve for the distribution of energy in the spectrum of the Hefner flame.

This curve makes it possible to convert the spectrophotometric curves for the fluorescence of any given substance into curves of the distribution of energy in its

[3] *Phys. Rev.*, Vol. XXI., December, 1905.

[4] Nichols and Merritt, *Physical Review.*

[5] Nichols, *Physical Review*, Vol. 21, p. 147.

fluorescence spectrum and enables us to secure data for this distribution in the case of spectra the intensity of which is far too weak to admit of direct measurements of the energy. In the present paper such curves for four typical fluorescent solutions, sulphate of quinine in water, fluorescin, rhodamin and chlorophyll in alcohol (together with the energy curves of the absorption spectra of these substances), are presented. These curves and a discussion of their properties will be published in the *Physical Review.*

Conditions Which Change the Resistance of the Selenium Cell: F. C. BROWN, University of Illinois.

The paper reviews the conditions that produce change in the electrical resistance of the selenium cell—those that produce a remarkable change such as is not found in any other element:

Light, which changes the resistance as much as ten times.

Heat, which changes the resistance almost as much as does light.

Hydrogen peroxide decreases the resistance thirty per cent. when the selenium is placed three cm. from the surface of the liquid.

Increase of E.M.F. in the circuit may decrease the resistance as much as 1,000 times.

Hydraulic pressure decreases the resistance even more than sixty per cent. The accompanying curves show how uniform is the effect of pressure. The cells used were, in general, patterned after those of Bidwell.

In five of the curves which were shown, for three different cells, the pressure coefficient is quite constant, as is shown by the following approximate values:

.00103 ohms per gram pressure.
.00105 ohms per gram pressure.
.00120 ohms per gram pressure.
.00109 ohms per gram pressure.
.00107 ohms per gram pressure.

Other conditions which produce minor changes of resistance according to different investigators are: X-rays, radium rays, Hertzian waves, ozone treated caoutchouc.

The following data for one of the selenium cells at low temperatures seem to show that the resistance is not much different from ordinary room temperatures, and that the sensitiveness to light is about three times as great:

Resistance—ohms.	Temperature deg. Cent.	16 c.p. lamp 8 cm. from cell.
86,000	—61	off
82,000	—60	off
97,000	—60.8	off, room darkened
110,000	?	off
110,000	?	off
114,000	?	off
114,000	—58 to —60.8	off
21,000	—58	on
17,000	—55	on after 2 min.
17,000	—53	on after 4 min.
15,800	—57	on after 6 min.
15,700	—61	on after 8 min.
15,600	—61	off
25,600	—61	off after 1 min.
26,800	?	off after 5 min.
28,400	—58	off after 7 min.
32,000	?	off after 17 min.
33,000	?	off after 19 min.
45,000	—28	off after 45 min.
75,000	—10	off after 55 min.
119,000	room tem.	off after 5 hrs.

Those conditions which decrease the resistance very much probably do so for the same reason.

The theory that has been most generally accepted as to the cause of decrease of resistance, is that of Bidwell. He said that it was due to a selenide which was found more or less in every selenium cell, and which made the cell a better conductor when the light fell upon it. Up to the present time, we are not at all assured that a selenide plays any important part.

Another theory has been given, namely, that light produces crystallization, and since some kinds of crystals conduct better

than others, the change of resistance is due to the formation of crystals in unstable equilibrium.

Another theory is that in the selenium cell there is a form of selenium called metallic, which conducts electricity well and which is a sort of solution with the non-conducting selenium. Light causes the metallic selenium to make better contact and thereby reduces the resistance.

As selenium has a coefficient of expansion about five times that of ordinary metals, the author was led to the study of pressure effect, thinking that the change of resistance might be due to contact differences. But this is, at present, only a theory.

Elastic After-effects in Crystals: J. R. Benton, Geophysical Laboratory of the Carnegie Institution.

The elastic properties of solid bodies vary with different specimens of the same substance, and in the same specimen when it is subjected to varying preliminary treatment. There is reason to believe that the discrepancies are due to irregularity of structure, such as is known to exist in metals and many other solids. If this explanation is correct, there should be no irregularity in the elastic behavior of single crystals. To test this, experiments were planned for observing the elastic after-effect, elastic hysteresis and permanent set, in crystals. The present paper describes the first part of these experiments, which deals with elastic after-effect. Observations were made on the torsion of mica, and on the flexure of selenite, kunzite and rutile; they show that the elastic after-effect is not entirely absent, as was hoped would be the case, but is very small as compared with that in most solids. The reason why it appears at all probably lies in the fact that absolutely perfect crystals can not be secured for the experiments.

The Percentage Bridge: A. C. Longden, Knox College.

Five or six years ago, a paper entitled 'A Percentage Bridge' was presented to the American Association for the Advancement of Science, and also to the American Institute of Electrical Engineers, by Mr. H. C. Parker, of Columbia University.

The instrument as described by Mr. Parker is essentially a four-gap slide wire bridge in which the two inner gaps are used for the comparison of resistances, and the auxiliary resistances in the outer or end gaps have such a relation to the resistance of the bridge wire that a change of a hundredth of one per cent. in the ratio of R_1 to R_2 shall produce a change of one millimeter in the position of the balancing point on the bridge wire. The test coil, however, is not balanced directly against the standard, but one of the resistance gaps, R_1, for example, is used as a substitution gap, and a standard resistance in this gap is balanced against a resistance approximately equal to it, and then the test coil is *substituted* for the standard and the bridge is again balanced. The distance in millimeters on the bridge wire between the two balancing points indicates the difference between the two coils in hundredths of one per cent.

This method seems to have a number of real advantages over the Carey Foster method for comparing standard resistances.

The simplicity of the percentage method is greatly in its favor and ought at least to entitle it to serious consideration. It does not *eliminate* the resistance of the end connections, nor does it necessarily make them so *small* as to be negligible, but it makes the total value of the end resistances so *large* that even if they differ by a hundredth of an ohm, the error in the result will only be one part in twenty million!

A mercury commutator is suggested for

substituting one coil for another in the percentage bridge, which is less complicated than the Carey Foster commutator.

The most serious disadvantage of the percentage method is pointed out and a remedy suggested.

The percentage bridge is an instrument of great simplicity, great sensitiveness and relatively great range; and one in which the standard resistances are automatically protected from heavy currents. It is not only a very superior instrument for the comparison of standard resistances, but one which lends itself admirably to a variety of special purposes, such as calibrating rheostats, determining temperature coefficients, etc.

Priming Caused by Poor Circulation in a Boiler: D. S. JACOBUS, Stevens Institute of Technology. Section D.

Dual Degree for Engineering Courses: P. C. NUGENT, University of Syracuse. Section D.

Panama: Discussion of Present Conditions and the Prospect: F. L. WALDO. Section D.

Panama: A Sea-Level Canal: W. R. WARNER, Cleveland. Section D.

DAYTON C. MILLER,
Secretary.

THE SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY.

THE ninth annual meeting of this society was held, in conjunction with the meetings of the Western Branch of the American Society of Naturalists and the Affiliated Scientific Societies, at the University of Michigan, Ann Arbor, Mich., December 27, 28, 29, 1905, under the presidency of Professor E. C. Jeffrey. Though small in point of numbers, the meeting was otherwise one of great profit and enjoyment. In effect it was a joint meeting with the Botanists of the Central States, for this society held sessions only in the mornings and the Botanists of the Central States only in the afternoons, each society attending the sessions of the other. The new members elected were Messrs. Mel. T. Cook, of the Agricultural Experiment Station of Cuba, Raymond H. Pond, of Northwestern University, and W. W. Stockberger, of the United States Department of Agriculture. The society voted to accept the constitution recommended by its committee on union of botanical societies in case it is accepted by the Botanical Society of America and the American Mycological Society, and on this basis to unite with those societies into a single new society to be called the Botanial Society of America. Pending the action of the other societies no new officers were elected, but the officers of this meeting were continued until the union of societies should be effected, or until the next annual meeting, with authority to perfect all details of the union. The address of the president, entitled 'Morphology and Phylogeny' has appeared in full in SCIENCE. The society expressed by a special vote its great appreciation and thanks for the gracious hospitality of the university, and for the admirable arrangements of the local committee, which contributed so much to the interest and success of the meeting.

Since the Ann Arbor meeting the Botanical Society of America and the American Mycological Society, at their meetings at New Orleans, have taken action with respect to a union of botanical societies similar to that taken by this society at Ann Arbor. Accordingly a union of these three societies into a single society of the widest scope has been agreed upon and is expected to be brought into effect during the present year. The Ann Arbor meeting, therefore, was the last to be held by this society