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ASTRONOMY

JESUIT CONTRIBUTIONS TO OUR KNOWLEDGE OF SUN SPOTS

JOHN P. DELANEY, S.J.

Ancient Chinese records of sunspots from A.D. 301 to 1205 have been translated by Williams,[1] and this work was further extended from A.D. 188 to 1638 by Hirayama,[2] thus over-lapping modern telescopic study of sunspots which began about 1610. There is no agreement among historians as to the first European discoverer of sunspots. According to Helland-Hansen and Nansen[3] sunspots were discovered by the Englishman Harriot on Dec. 10, 1610 and by the German Joh. Fabricius on March 9, 1611. The same year, Nov. 12, 1611, appeared the first of the famous letters of Father Christopher Scheiner to Marcus Welser describing in detail Father Scheiner's own discovery and study of sunspots. Within a month Welser, on Jan. 6, 1612, communicated with Galileo who waited four months before replying to Welser challenging Father Scheiner's priority in the discovery and study of sunspots. The correspondence between Scheiner and Welser, Welser and Galileo, Galileo and Welser, forms a most fascinating volume in the rare book collection of the Congressional Library, entitled Istoria e Dimostrazioni, published by Galileo in Rome 1613, a volume most interesting not only for the lively, almost bitter discussion of sunspots, surprisingly detailed and advanced, but also for the fact that on the title page are found, written in ink, Dom. Prof. Rom. Bibliothec. Comm.

Whatever may be said on the point of priority of discovery, Father Scheiner's letters to Welser, filling more than fifty closely printed pages with diagrams and measurements, were the beginning and foundation of modern science of sunspots. The letters were widely published, in Latin, through Germany and other parts before their inclusion with Galileo's letters in the Roman edition. Scheiner wrote under the name Apelles latens post tabulam, vel si mavis Ulysses sub Aiacis clypeo, a pseudonym demanded, as Scheiner later explained in his Rosa Ursina, by the objection of his superiors to his publishing such an unheard of enigma as spots on the sun. In 1620, according to Clerke,[4] Jean Tarde, Canon of Sarlot, argued that the eye of the world

1. John Williams, Monthly Notices. R. A. S., 33, 370-375, 1873.
2. S. Hirayama, Observatory, 12, 217-219, 1889.
3. Helland-Hansen and Nansen, Smithsonian Institution Misc. Coll. 70, 1920.
4. Clerke, History of Astronomy, 146.

cannot suffer from ophthalmia, therefore the sunspots must be due, not to actual specks or stains on the bright solar disc, but to the transits of a number of small planets across it. To this new group of heavenly bodies Tarde gave the name of Borbonia sidera, and they were claimed in 1633 for the House of Hapsburg, under the title "Austriaca Sidera" by the Belgian Jesuit Father Malapert. Scheiner himself acquiesced and challenged Galileo on this point, among others, holding to the end that the spots were not on the sun, but some sort of heavenly bodies revolving about the sun, an attitude hard to explain in the light of his scholarly investigation. On the basis of his sun spot studies he determined both the sidereal and synodic period of rotation of the sun, he watched the sun spots grow and fade away, studied their umbra and penumbra, observed that the sun does not rotate as a rigid body, and according to Clerke[5] his observations plainly foreshadowed the theory that the sun spots were excavations in the photosphere. He was the first to publish sun maps and diagrams, which followed naturally on his invention of the helioscope.

The question of priority in the discovery of sun spots occasioned much bitterness between the two scholars, Galileo and Scheiner. In 1632, according to wolf,[6] when Galileo published his famous dialogue on the two chief world systems, the dialogue had been passed by the censor for publication, but Father Scheiner was alleged to have persuaded the Pope that it was he who was intended in the dialogue as Simplicio, the clumsy defender of the geocentric theory. It was this dialogue that stirred the whole learned world and brought on the storm to burst over Galileo's head. Galileo had sneered at the title, Rosa Ursina sive Sol, Scheiner's masterful treatise on sun spots which appeared in 1626, subsidized by Prince Orsini, a copy of which is prized today among the rare book collection of the N.Y. Public Library.

For upwards of two centuries after Scheiner, according to Clerke,[7] ideas on the subject of sun spots were either retrograde or stationary. The Belgian Jesuit Father Charles Malapert published a book entitled Austriaca Sidera Heliocyclica in 1663 but the words sidera heliocyclica are Scheiner's, and the term Austriaca has amused some historians of science, claiming the stars for the House of Hapsburg as Tarde had previously claimed them for the House of Bourbon.

Father John Baptist Cysat, (d.1657) pupil and successor of Scheiner, is celebrated in history as the discoverer of the nebula of Orion, but on the subject of sun spots his contribution appears limited to his work in collaboration with Scheiner.

As Scheiner and Cysat were completing their magnificent work at Ingolstadt another versatile genius, Father John Baptist Riccioli

5. Clerke, 54.

6. A. Wolfe, A History of Science and Technology and Philosophy in the 16th and 17th Centuries, p. 36.

7. Clerke, p. 146.

with his companion, Father Grimaldi, were continuing in Italy the illustrious work of their immortal predecessor, Father Clavius, who had been a bosom friend of Galileo. The Almagestum Novum of Riccioli, published in Bologne in 1651, considered by many the most important literary work of the Jesuits in the 17th century, was followed in 1665 by another elaborate work, Astronomia Reformata, (2 vol. Bologna) an excellent copy of which is on hand in the rare book collection of the Congressional Library. It is an amazing contribution to science, with its maps and diagrams and elaborate calculations and astronomical tables. According to Helland-Hansen and Nansen[8] it was Riccioli who first announced in 1651 that with a decrease in sun spots the temperature of the earth increases and with an increase of them it diminishes, a conclusion which is now almost universally accepted. This conclusion, in fact, must be attributed to genius, since it is only recently that Humphreys in his Physics of the Air has concluded that the agreement between sun spot curves and temperature curves is too close to leave any doubt of the reality of some sort of connection between sun spots and atmospheric temperature.[9] Unfortunately, despite his genius, Riccioli elaborated no less than 77 syllogisms to refute the error of Copernicus and Galileo, an effort that brought Wolfe and other historians to question his sincerity. However, the remarkable erudition of his two monumental works in astronomy, and also his discovery, in 1650, of the first telescopic binary Zeta Ursae Majoris (Mizar),[10] and most of all his pioneer work in selenography, all these assure his lasting memory in the annals of astronomy.

Undoubtedly one of the greatest astronomers of all time, Father Angelo Secchi, after spending nearly a year at Georgetown University, 1848-49, as exile from the Roman revolution, returned finally to the Roman College and began his brilliant career, catalogued 10,000 double stars, pioneered in the spectroscopic classification of four thousand stars, a classification still used by astronomers, invented his spectroheliscope, and contributed among over 800 other papers and books many brilliant researches on the subject of sun spots. His exhaustive treatise on the Sun, Le Soleil, was immediately translated into many languages and today it continues as a standard work, quoted again and again in the latest work on the subject by Abetti.[11] The researches of Father Secchi included such subjects as the structure of the penumbra of sun spots, the relation between sun spots and the amplitudes of terrestrial magnetic oscillations, the relation between protuberances and sun spots, the nature, origin and theory of sun spots, and the spectral observation of sun spots with his own invention, the first spectroheliscope. With his collaborator, Father Rosa,

8. Helland-Hansen and Nansen.
9. Humphreys, Physics of the Air, Second Edition, p. 592 ff.
10. Baker, Astronomy, p. 328.
11. Abetti, The Sun.

he annunciated the Secchi-Rosa Law that at epochs when the number of sun spots and prominences is a minimum the equatorial diameter of the sun is at its greatest, a law confirmed by R. Wolfe using data obtained by Hilfiker for the sun spot of 1870, the largest maximum known.[11] Though Father Scheiner had instituted a regular diary of sun spots, still it remained for Father Secchi, over two hundred years later, to lay the foundations of his unique "Sun Records" which have been continued to the present day. No other observatory in the world has maintained over so long a period so valuable a work of this character.[12]

In our own time Father Jerome Sixtus Riccard of Santa Clara University attained to high popular esteem as the Padre of the Rains for his long range weather forecasting based on his studies of sun spots. As previously mentioned, Father Riccioli's hypothesis that sun spots do affect earth temperatures has been confirmed by Humphreys,[9] and many others, including DeLury,[13] who has showed that the sun spot cycle not only has influenced terrestrial temperature curves but also that it has clearly influenced the weather, the growth of trees, even crop production and plant diseases and economic fluctuations. It was the immediate mechanism of this meteorological effect of sun spots that engaged Father Riccard's attention.[14] In a paper contributed in 1913 he wrote: "The modest quota contributed by the Santa Clara Observatory may be described as follows: As long as the period of maximum frequency of sun spots lasted, a desire for simplicity of view and result dictated that we should confine ourselves to a study of the western limb, which had at first attracted our attention as the scene of coincidences on the Sun and disturbances on the earth. As the result of a simple but very direct investigation, which we have carried on uninterruptedly since the year 1900, when an 8-inch equatorial was installed, the 3-day law concerning the western limb was found to hold generally and in consequence we published it." . . . "When a solar phenomenon, spot, faculae, or both combined reached a position which is within an average of three days from the western limb, a cyclonic area enters on the Pacific coast. . . . When a solar disturbance passes off behind the western limb, the anticyclonic area which always presses behind the cyclonic steps on the Pacific coast, causes a few flurries and quickly brings on fine weather. . . . The system rests on the physical basis of a long continued study of the U.S. Weather Map and the correlation of the recorded phenomena to the positions of solar phenomena." . . . . Such, in Father Riccard's own words, is the essence of his long range for-

12. Cath. Encycl., Secchi.

13. DeLury, Journal Roy. Astr. Soc. Canada, Mar. Apr. 1938.

14. Riccard, Latest Advances in Weather Forecasting by Sun Spots and Planetary Positions, Popular Astronomy, 22, 131142, 1913.
Also passim, C. Sommervogel, Bibiotheque de la Compagnie de Jesu, and Lalande, Astronomie.

casting method. His 3-day law, as was pointed out at the time, appeared to contradict the cosine emission law and probably for this reason it receives no further mention in scientific literature. His little paper, The Sun Spot, is on file at the Congressional Library, probably also at Santa Clara and other observatories.

Other famous Jesuits who contributed to the science of sun spots include Fathers Boscovich and Sestini. Father Ruggerio Giuseppe Boscovich, Professor of Mathematics at the Roman College and pre-eminent among scholars of his time, was honored by learned societies and universities, by popes and princes. Father Benedict Sestini, also Professor of Mathematics at the Roman College, came later to Georgetown where he made a series of sun spot drawings and published 44 plates in the Report of the Naval Observatory, volume of 1847 but printed in 1853.

"The sun he bade to stop, and at his bidding*
the earth began to spin—
Poland has nurtured him."

Tragic Irony! The above inscription is found on the wall near a bust of Nicolas Copernicus in the university church of St. Ann in Krakow, erected there in 1823 by the Reverend Father Count Sebastjan Sierakowski, Rector of the University. For some time it was assumed that the author was a Pole, and the sentiment expressed was one of praise. The truth of the matter is, that the lines as they appear in Polish are a translation from the German of Philipp Melanchthon, associate of Martin Luther and echoing the master's sentiments, "The fool will overturn the whole system of astronomy." How truly, indeed, "the new astrologer" has overturned the whole system of astronomy and "bade the sun to stop and bid the earth to spin." Today after four hundred years the whole world, inasmuch as conditions will allow, pay tribute to the true REFORMER in the midst of DISFORMERS. He re-formed the tottering universe of man and put the sun at its center, and courageously refused to de-form man's destiny and make the earth its center.

* See Nicholas Copernicus, a memorial booklet by Stephen P. Mizwa. The Kosciuszko Foundation, New York.

BIOLOGY

EVOLUTION AND HOMOLOGY

By William D. Sullivan, S.J.

One of the puzzling aspects of homology is the contradiction among scientists who define and use the term homology. What is this "homology"? According to Richard Owen, back in the year 1846, we have the definition of a homologue as follows: "The same organ in different animals under every variety of form and function."* Almost one hundred years later, Dr. Hyman writes as follows: "This question (of form and function) involves the concepts of homology and analogy, *which are understandable only in terms of the principles of evolution.* Homology is intrinsic similarity indicative of a *common evolutionary origin.* Homologous structures may seem unlike superficially but can be proved to be equivalent by any or all of the following criteria: similarity of anatomical construction, similar topographical relations to the animal body, similar course of embryonic development, and similarity or identity of specific physiological function or mechanism. A familiar example of homology is the wing of the bird, the flipper of the seal and the foreleg of the cat; investigation shows that they have a similar arrangement of bones and muscles, have the same positional relation to the body, develop in the same way from a similar primordium, and work physiologically by the same mechanism."** Such is the growth of homology! Which of the two are we to believe? Since the scientists don't seem to agree on the precise meaning of the term homology, this adds to the difficulties already inherent in the concept. Are homologous structures similar organs similarly arranged or are they this plus an evolutionary origin? To these questions the answer may be given that, according to the scientific method Owen's definition is certain, Hyman's is only probable. Why?

The scientific method, as employed today, has been used by all scientists for centuries; physicists, chemists, biologists, etc. and they have based the validity of their sciences on its extraordinary degree of thorough research. First, the scientists begin with an impartial observation of the natural phenomena before him. Collecting these phenomena they experiment with them and test them until with a high degree of certitude they can predict the effects of the phenomena

* The Quarterly Review of Biology for Sept. 1943—"Homology and Analogy: A Century after the Definitions of Homologue and Analogue of Richard Owen" by Alan Boyden (pg. 228).

** Comparative Anatomy by Libbie Henrietta Hyman (2nd Ed. pg. 3).

observed. A guess or impartial hypothesis is then made as to the causes of these results; which in turn are investigated by all types of experiments over and over again until no other cause but that of the hypothesis can explain the phenomena. If, however, there is doubt, the hypothesis, previously made, is abandoned and once again the facts are observed and a new hypothesis is proposed, based on the recent observation. So strict is the method that before this hypothesis can advance to theory every single experiment without exception must substantiate it. This theory will eventually give rise to a law. Time alone, however, will testify to the certitude of the theory based on the ironclad experimentation of the phenomena. This is the scientific method in a nutshell. And even though it is old-fashioned and so strict as to hold a scientist to a determined mode of inquiry, it is this very "old-fashionness" and this "strictness" which has established the method as a font of new cognition. There is no place for subjectivism or idealization; it is all objective, it must be objective. If it were not objective how could the observation of the facts be impartial? If it were not objective how could there be an unprejudicial hypothesis? If it were not objective would it not be very probable that only those experiments would be performed which would give, not the truth, but only the answer desired by the experimenter? A Subjectivist and Scientist cannot be one and the same man; the two notes are repugnant; for the very fact that he is a subjectivist makes the first three steps of the scientific method impossible, hence invalidating the last two, i.e. theory and law. As a subjectivist he cannot examine the facts as they exist in reality, but as they exist to him; he cannot experiment with any and every experiment but with chosen ones; his hypothesis cannot be impartial or unprejudicial but partial and prejudicial. Yet on such a contradiction is the explanation of homology laid down by the evolutionist.

Before this paper gets much further under way this fact must be stressed: evolution as such is not to be entirely cast aside; as a proven fact, yes; as a probable hypothesis, no. It is possible that evolution may have taken place, but until it is proved scientifically, I, at least, cannot understand why so many claim it as though it has already been proved. Scientifically and with certitude no one can hold it; it is, perhaps, possible to hold it with probability. Secondly, this paper is not a defense of "special creation". As to whether or not the first and second chapters of Genesis are contradictory, an argument the evolutionist uses against "special creation", I leave to the theologians to handle. It is outside our scope. Thirdly, I do not deny that homology may be ultimately explanatory through evolution. But this too demands scientific proof that we may believe. It is only probable that evolution explains the similiar structures in widely different animals, i.e. that these structures are similar because of a descent from a common ancestor.

The status question is: Must homology be explained through evolution *only*? Or is there another possible explanation? If there is another explanation the evolutionary argument cannot be claimed as a fact. If the evolutionist cannot prove scientifically that his theory (which must be remembered is only probable) is the ultimate explanation of homology, and if I can propose another explanation equally as probable, then my purpose is complete, because as a philosopher and a scientist I know that as long as there exists one other explanation for homologous structures, just as probable as the evolutionary one, then the argument from evolution must not be stated as "de facto" true. Until, then, the concept of the common method of handling problems of *environment* has been completely and overwhelmingly tossed aside as a probable explanation for the presence of homologous structures in widely different animals, I cannot see how any clear and logical mind can be convinced of the argument from evolution.

Since Dr. Hyman has taken for her examples the flipper of the seal, the wing of the bird and the foreleg of the cat, I shall also make use of the same examples to illustrate my point.

All admit of the similarity of the bones of these structures and their similar arrangements one to the other. It is, however, for the cause of this similarity that we are seeking. This is where the evolutionist becomes somewhat subjective. He claims that the reason for the similarity of these structures in the seal, the bird and the cat lies in the fact that there was at one time a common ancesor to these three and through heredity we have today the results of evolution in the seal, the bird and the cat, *clearly seen*. A "common ancestor"— What was this common ancestor? What did it look like? Where did it live? Here the scientific method is abandoned because either the evoluticnist cannot answer these questions to his own satisfaction, or he ignores them completely.

Why could not the environment of the animal be just as much an explanation? For, after all, what more suitable organ than the flipper could there be found to help the seal in its water habitation? What more suitable structure could there be in the bird to help it in its flight through the air? The whole question comes down to this: Has the seal its flipper that it may swim? or does it swim because it has a flipper? Has the bird its wings that it may fly? or does it fly because it has wings? The concept of finality, however, is repugnant to the materialistic evolutionist, hence he does not understand it or accept it.

Since, then, their explanation of homology is not the only probable explanation, it is rather difficult to see how they regard it as the only explanation; it is still a possible hypothesis only. Nothing daunted, however, the evolutionist reiterates: "Homologous structures are due to such an influence of heredity". This effect of the principles of heredity, I do not deny as an hypothesis; as a fact, however, the evolutionist has run into many difficulties in his proof, and as yet, he hasn't proved it. Experiments have been performed by both the evolutionist and the biologist; but these experiments cannot be said to be satisfactory, nor do they prove the evolutionary claim for homology, because they have been performed only on animals already closely linked in their relationship of one to the other. How far back, for example, can the evolutionist trace the ancestor of the seal? How far back can he trace the ancestor of the bird or the cat? Is there anywhere in the course of his research demonstrable evidence of "adaptive radiation" from a common ancestor? Where, I ask, is the first point of the scientific method—impartial observation? What are his observations?

The evolutionist too often satisfies himself with the argument, not the evidence, that even though he can't point out to us definitely the one common ancestor, nevertheless the forms as we know them today, i.e. the seal, the bird and the cat, as regards their homologous structures were related many years ago. This is mere speculation and a forsaking of the scientific method. On the supposition (and it is only a supposition) that these forms were once closely related, how is it possible that in the countless generations, which they claim have intervened, we have many different changes in these "related" animals while homologous organs remain unchanged? What is the principle of heredity that will allow such changes in the seal, the bird and the cat, and at the same time allow the flipper, the wing, and the foreleg to remain the same? What is this force that is acting and how does it act? To all these questions the evolutionist is silent.

HAVE YOU HAD YOUR ZINC TODAY!*

Zinc is one of the metals absolutely necessary in small quantities for human well-being, according to E. L. Hove of the Pillsbury Flour Mills Research Laboratory, by way of the Chemistry Leaflet. This metal is contained in the wheat grain in sufficient quantities, but its deficiency, like so many other modern ills, is caused by refinement methods demanded by modern civilization. Manganese is associated with calcium and the other well known elements in the strengthening of bone structure, according to the same publication.

* Chemistry Leaflet 17 3 114 (1943).

CHEMISTRY

THE WELCOME MURDERER: PENICILLIN

REV. R. B. SCHMITT, S.J.

Bacteria infections are often the cause of death. The medical profession depends upon the chemists to find materials to destroy these bacteria, to stop the multiplication of such destructive bacteria, and so, to prolong life and bring back health to the individual. An example of such a beneficial material we have in the sulfa-drugs. The story of this organic material: sulfanilamide and its derivatives, is interesting and phenomenal. Although, the after effect, in some individuals, is still awaiting improvement.

Another organic material has been found more potent than the sulfa compounds, and reacts more quickly with less harmful results. No group of drugs is more widely used than the antiseptics and disinfectants. The principles and discoveries of Pasteur, at first so difficult to impress upon the medical profession, are now embraced and used by the laymen. The brilliant history of the control of sepsis is marred not so much by its failures as by the myriad of misconceptions, which have been fostered in the public mind regarding the harmful nature of what often amounts to no more than normal bacterial flora and regarding what can be done to that flora by the use of bactericidal drugs.

The preparation of these antiseptics depends fundamentally on the research chemist; and the proper use upon the medical men in clinical practice.

This is one way of expressing the constant struggle that is going on, in the practice of fighting disease; i.e. by destroying harmful bacteria. One of the most thrilling chapters in medical-chemical history is that, which deals with the discovery of microorganisms and their relationship to disease. Of the many fields of research, which have grown from this epochal discovery, the investigation of chemicals effective against infections caused by pathogenic bacteria and protozoa has been one of the most interesting and fruitful. Almost from the beginning, there have been two main lines of endeavor; the development of germicides which would be active locally, and others, which would prove effective upon systematic administration. Even though an imposing number of antiseptics and germicides are known, there is not one that is *ideal*, for each, to some extent is toxic to tissue. Now, a new germicide has been found, which has properties more potent, than those known at the present time. It was the keen observation of Dr. Alexander Fleming, in his laboratory of the University of London, (1929) that first recognized on a culture plate a green mold, and around this spot a halo of clear fluid; he concluded, that this material was destroying the adjacent bacteria. This phenomena was new and worthy of further investigation. The first procedure was to identify the fluid, and it was found to be PENICILLIUM NOTATUM, a distant relative to the green mold found in certain types of cheese. About this time, the sulfa drugs became known and found very helpful for only a certain few serious infections. A few years later Dr. Howard Florey, of Oxford, remembered Fleming's work, namely that the fluid around the green mold on the culture plates destroys bacteria, and thought that may be this material might work in the bodies of humans. A group of physicians decided to investigate; and their first task was to obtain the mold and the liquid. After more research, they prepared a small portion of the yellow-brown powder, which was the direct result of the penicillin. Then more experimental work was necessary, namely to ascertain the properties of the new compound. The results were that the material would kill many different kinds of bacteria in test-tubes. This work also showed that the material was hundreds of times more powerful than the sulfa drugs. The most logical procedure was to try the new chemical on live animals, since their physiological condition is similar to human physiology. The results were most favorable and encouraging.

Dr. Florey needed help to extend his clinical work and so he turned to the Committee on Medical Research of the National Research Council and to the Department of Agriculture here in our own country, and asked for assistance to further the important phases of the problem.

The problem is far from complete and much research is still to be done. At present we do not know the chemical constituents of the molecule, nor do we know the molecular weight; nor how it can be made in large quantities.

Although clinical tests of penicillin and other therapeutic substances of microbial origin are unsolved, it is apparent that the material is particularly useful against certain infections resistant to treatment, and another excellent feature is that it is non-toxic. The drug can be administered by injection into veins or intra-muscular or applied locally to a particular spot, but it has proven to be ineffective when given by mouth. Excellent results were collected and summarized by the medical profession in Boston, New Haven, New York, Baltimore, Philadelphia, etc, etc.

Just today (Sept. 29, 1943) a news account tells of a laboratory costing nearly one million dollars to be built near Princeton, New Jersey for the research and manufacture of penicillin, which is more effective than the sulfa-drugs. The Heyden Chemical Corporation will operate the laboratory and the money loaned by the Government.

It will be interesting to follow the use and manufacture of this new compound called penicillin; and to notice the results to mankind.

LIST OF SOME RECENT BIBLIOGRAPHIES IN CHEMISTRY

Rev. Bernard J. Fiekers, S.J.

1) Alyea, Hubert N., "Bibliography for general chemistry from several periodicals. I. Chemical and Metallurgical Engineering, vol. 1 (1902) through 41 (1934)" in J. Chem. Educ., 13, 76 - 81, (1936).

2) idem. II. "Industrial and Engineering Chemistry, vol. 1 (1909) through 26 (1934)" in ibid. 13, 540-544, (1936).

3) idem. III. "Fortune Magazine, vol. 1 (1930) through 18 (1938)" in ibid. 16, 435-440, (1939).

(4 Fulmer, Ellis I., "A survey of the literature on synthetic rubber with special reference to its history, raw materials employed and its commercial production." Iowa Corn Research Institute, 3, no. 1. Iowa Agricultural Experiment Station. Ames, Iowa. 1943. pp. 62.

5) Gersdorff, W. A., "Bibliography of ethylene dichloride", U. S. Dep't Agriculture, Washington, D. C., 1932. pp. 60. $0.10 from the Superintendent of Documents.

6) Ludwick, M. T., "A bibliography of indium, 1934-1940". Part II. The Indium Corporation of America, 60 East 42nd St., New York City, (1676 Lincoln Ave., Utica, N. Y.). 1940. pp. 22.

7) idem. "1940 supplement, bibliography of indium". 1941, 8 pp.

8) idem. "A bibliography of indium, 1941-1942 (annotated)".

9) McKinley, Lloyd, "Bibliography of some achievements in chemistry." University studies, Bulletin no. 11, University of Wichita, Kan., 1942. pp. 60, $0.25.

10) Reinberg, Thelma R., "Batelle Memorial Institute, books, publications and patents, 1929-1940", Batelle Memorial Institute, Columbus, O., 1941. pp. 47.

11) idem. "Supplement, 1941-1942". Miscellaneous publications no. 117. 1943.

12) Ward, C. C., "Review of the literature on the construction, testing and operation of laboratory fractioning columns." Technical paper no. 600, Bureau of Mines. Superintendent of Documents, Washington, D. C., 1939. $0.10.

13) Willis, L. G., "Bibliography of references to the literature on the minor elements and their relation to plant nutrition". 3rd ed. Chilean Nitrate Educational Bureau, Inc., 120 Broadway, New York, 1939. pp. 488.

14) idem. "First supplement". 1940. pp. 82.

15) idem. "Second supplement". 1941. pp. 67.

16) idem. "Third supplement". 1942. pp. 78.

17) idem. "Fourth supplement". 1943. pp. 92.

18) idem. "Botanical Index". 1940. pp. 24.

19) Anon. "Determination of metals with no. 3092 diphenylthiocarbazone". Eastman Kodak Co., Chemical Sales Division, Rochester, N. Y., 1942 (?). 1 page.

20) Anon. "Bibliography of the dropping mercury electrode, E-94-1", Leeds and Northrup Co., 4907 Stenton Ave., Philadelphia, Pa., 1941. pp. 67.

21) Anon. "Bibliography of the Karl Fischer reagent for the determination of water", Eastman Kodak Co., Chemical Sales Division, Rochester, N. Y., 1942 (?)

22) Anon. "Levulinic acid, a literature reference". Division of Research Development. E. Staley Mfg. Co., Decatur, Ill., 1941 (?) pp. 38.

23) Anon. "Bibliography of patents on palladium as a catalyst." Baker & Co., Inc., 113 Aston St., Newark, N. J., 1939. pp. 24.

24) Anon. "Penicillin and other antibiotics produced by microörganisms (annotated)", E. R. Squibb & Sons, N. Y. 1943, pp. 91.

25) Anon. "Bibliography of polarographic literature, 1922-1941", E. H. Sargeant & Co., 155-165 East Superior St., Chicago, Ill. 1941 pp. 98.

26) Anon. "The quinhydrone electrode, no. 217", Eastman Kodak Co., Chemical Sales Division, Rochester, N. Y., 1942 (?) 1 page.
Anon. "Publications of silicates of soda and their applications." Bulletin no. 174. Philadelphia Quartz Co., 121 S. Third St., Philadelphia, Pa., pp. 8.

A great many of the above items are sent gratis when requested on official letterheads. Prices, dates, pagination, etc., are here given if known. This list omits publication and reprint lists of learned societies, museum literature and the like.

PHYSICS

CHLADNI NODAL PATTERNS OF VIBRATING HOMOGENEOUS PLATES

Stanley J. Bezuszka, S.J.

The statical developments of Galileo's investigation were paralleled in scope and importance by the mathematical theories of Euler and Daniel Bernoulli on the vibrations of solid bodies. But it was Chladni who investigated these modes and normal functions of motion experimentally with special attention to lateral flexures, longitudinal and torsional vibrations. The description of these systematic researches and the motives prompting them are given by Chladni in his own work "Die Akustik".[1] From notices in current journals dealing with the work of Abbé Mazzochi in Italy, Chladni utilized the idea of employing a violin bow to examine the vibratons of various sonorous bodies. And the discussion of Litchtenberg as given in the memoirs of the Royal Society of Göttingen suggested to Chladni the use of fine sand to visually represent the mode of the vibrating plate.

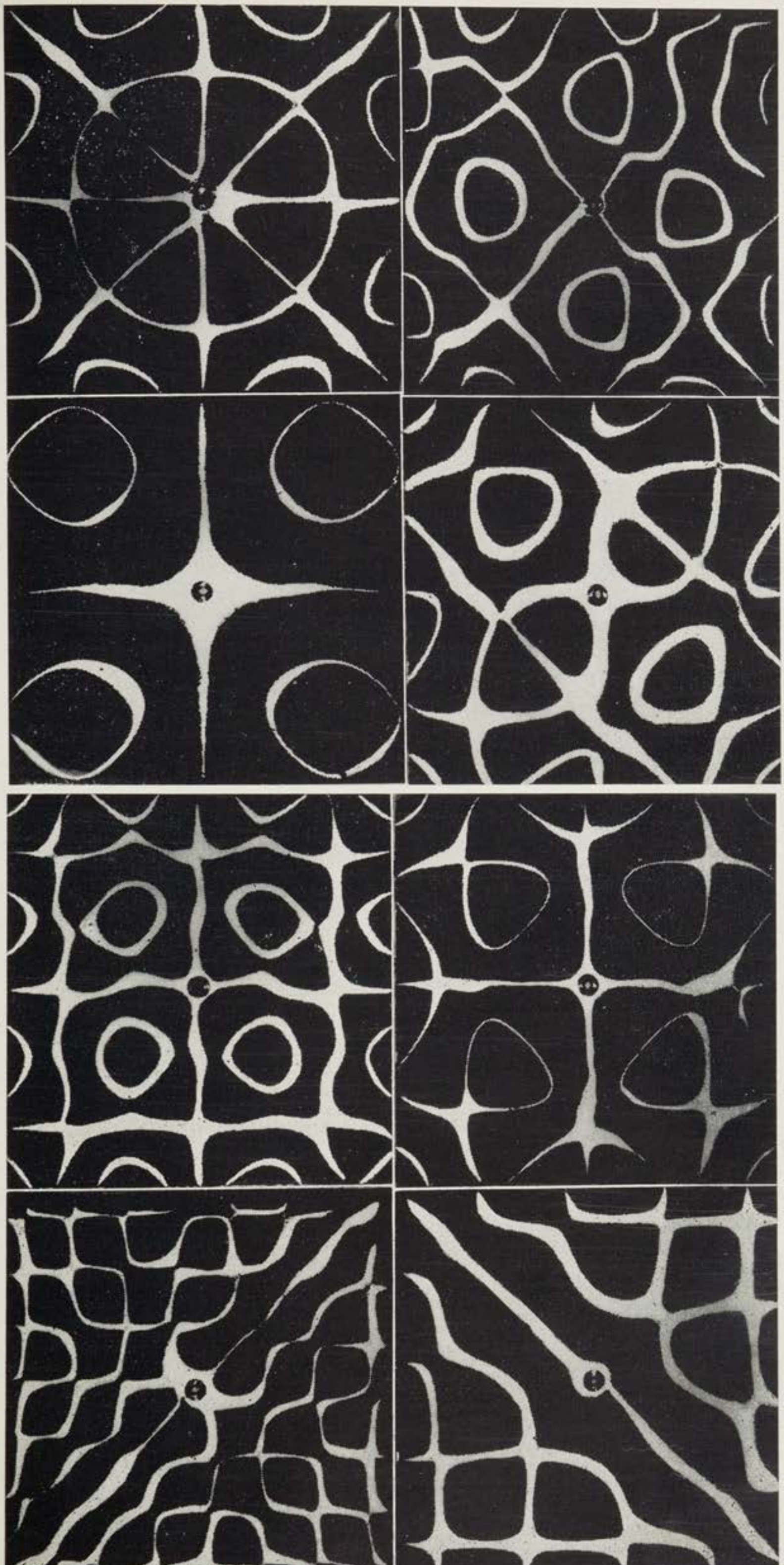
The results of all these experiments are well known, but the mathematical treatment has not as yet been thoroughly investigated or exhausted. Accordingly, the present descriptive beginning and experimental results are offered merely as a method of approach rather than as a comprehensive or original contribution to the solution of the problem. Moreover, since the predominant stress in treating this topic has been placed on the nodal patterns of circular plates, the material here has branched out into an equally interesting but more complicated discussion on square plates.

One approximate solution for the Chladni patterns on square plates has been calculated in the form[2]

$$W = A \cos \frac{mnx}{a} \cos \frac{nny}{a} - B \cos \frac{nnx}{a} \cos \frac{mny}{a} = o$$

A graphical examination of this equation shows that either term represents straight lines parallel to the sides of the square. When the constants A and B are assigned proper values and both terms are combined in proper proportion, all the complex nodal curves found by experiment can be derived. The factor to be stressed here is the

1. Ernst-Florens Chladni, Leipzig, 1802.
2. Stewart, J. K., Colwell, R. C. The Journal of the Acoustical Society of America. Vol. 11, No. 1 July 1939, p. 147.



statement that this solution is only approximate. Therefore, the assumption that the vibration of the plates can be investigated by analyzing the motion of a plate as though it were composed of individual bars parallel to the edges is (within limitations)[3] quite logical. Since the bars are, in turn, only a more complex extension of the theory of strings, then by treating the latter first and proceeding to bars and plates, the analysis will have a systematic progression.

A string is defined as an elastic body whose cross-section is so small as to offer no appreciable resistance to bending. If the boundary condition for deriving the equation of motion require that both ends be fastened and the displacement be small, the equation has the well known form

$$\delta^2 y/\delta t^2 = (T/p)\ \delta^2 y/\delta x^2$$

The vibrations of thin rods (which in the unstressed state are taken to be cylindrical or prismatic, so that homologous lines in different cross-sections are parallel to each other), or bars, straight and prismatic can be described as longitudinal, torsional or lateral. Love's[4] description of these various types is classical and is given in the following without any modification. Longitudinal vibrations are ordinarily characterized by the periodic extension and contraction of the central-line elements and accordingly referred to usually as "extensional". When instead of extension we have periodic bending and straightening of portions of the central-line at right angles to its equilibrium position, the motion is described as "flexural".

The investigation of these types of motion can be found in Rayleigh[5]. Only the equations will be given here. Thus for rods(and bars),

for extensional vibrations $\quad p\ \delta^2 w/\delta t^2 = E\ \delta^2 w/\delta s^2$

for torsional vibrations $\quad (pw\ K^2)\ \delta^2 y/\delta t^2 = C\ \delta^2 y/\delta s^2$

for flexural vibrations

$$p\ (\delta^2 u/\delta t^2 - k^2 \delta^4 u/\delta s^2 \delta t^2) = -\ E\ k^2 \delta^4 u/\delta s^4$$

And if in this last equation, rotary inertia is neglected, the approximation is given by $\quad p\ \delta^2 u/\delta t^2 = -\ E\ k^2 \delta^4 u/\delta s^4$

For the equation of the transverse vibration of a plate we have[6]

$$D\ (\ \delta^4 u/\delta x^4 + 2\ \delta^4 u/\delta x^2 \delta y^2 + \delta^4 u/\delta y^4) = Z$$

The complete analytical solution that will apply rigidly to the problem of free vibrations of a rectangular or square plate (especially if the edges are free and the plate fastened at the center) has not yet been

3. For particular cases where the application of the assumption is valid, cf. Lord Rayleigh, Theory of Sound, Vol 1., p. 372.

4. Love, A.E.H., A Treatise on the Mathematical Theory of Elasticity, p. 427. 1934.

5. Theory of Sound, Vol 1., Chapters VII and VIII, pp. 242, 256.

6. Webster, Arthur Gordon (Edited by Samuel J. Plimpton) Partial Differential Equations of Mathematical Physics p. 43, 1927.

developed.[7] An interesting graphical method has been worked out by Wheatstone. Though the forms thus derived are strictly applicable to membranes, they resemble the actual figures obtained by means of sand on a square plate more closely than might have been expected.

In the experiment carried out for this article, a brass plate 30 cm. square and 0.23 cm. thick, fastened at the center of a stand was used. An ordinary bow was applied to the sides and as the frequency varied, the nodal patterns assumed assorted shapes. For photographic reasons, salt instead of sand was used. The usual instruction given in fundamental texts to damp the motion of the plate by applying a finger at the opposite or adjacent edges is quite unnecessary. All the figures depend merely upon the frequency of the vibrating plate, and this frequency can be produced by ordinary bowing. The resultant figures are given in this article. As a general statement, the more complicated the design, the higher the frequency of the vibrating plate.

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7. For an approximate solution cf. Ritz. Ann. Phys. (4 te. Folge), Bd. 28, 1909. p. 737, or Ges. Werke Walther Ritz, p. 265.
See also Lord Rayleigh, Phil. Mag. (Ser. 6), Vol. 22, 1911, p. 225 or Scientific Papers, Vol. 6, p. 47.

NOTE ON ANOTHER METHOD FOR FAHRENHEIT—CENTIGRADE INTERCONVERSIONS

A formula for converting Fahrenheit readings on the thermometer to Centigrade readings and vice versa, as found in many of the texts, depends on algebraic treatment, and numerical substitution into, an equation of following or similar form:

$$9\,C = 5\,(F - 32) \qquad (1)$$

But some chemistry and physics texts base their method on the following:

$$5/9\,(F + 40) = (C + 40) \qquad (2)$$

Forty is added to the temperature to be converted, whether Centigrade or Fahrenheit, and this sum is multiplied:

1) by 5/9, if Centigrade is sought;

2) by 9/5, the reciprocal, if Fahrenheit, is sought.

Forty is then subtracted from this product. It is easy to remember to multiply by a fraction less than unity in converting, for example, from 68° F. to 20° C., and by one greater than unity in making the opposite conversion. This method is based on the fact that-40° C. is equivalent to -40° F. It might be well for professors to keep these two methods in mind, and thus prevent confusion arising from the use of a different method in some other science text, course or department.

MATHEMATICS

THE DUALITY OF POINT AND LINE COORDINATES[1].

REV. J. A. MCGIVNEY, S. J.[2]

The general equation of the straight line in Cartesian coordinates is $Ax+By+C=O$, which can, without loss of generality, be put in the form $Ax+By+1=0$, an equation evidently symetrical in A,B and x,y. In the discussion of the equation of the straight line our elementary text-books in Analytic Geometry as a rule consider only the case where A and B are constants and x and y are variables. The symmetrical case where x and y are constants and A and B variables is not handled. The algebraic results and the operations leading to these results are the same in both cases save that x is interchanged with A and y with B: the geometric signification however of the algebraic symbols and operations is different. This double interpretation of the equation $Ax+By+1=O$ makes the treatment of the line neither essentially more easy or more difficult, but presents the subject in its proper light and gives it completeness. To bring out this proper setting and completeness is the object of these few pages.

POINT-COORDINATES	LINE-COORDINATES
1) Given the abscissa x and the ordinate y of any point P, or given any two numbers having a known relation to x and y, the position of the point is known.	1) Given the X-intercept a and the Y-intercept b of any line MN or given any two numbers having a known relation to a and b, the position of the line is known.
2) As x and y vary we obtain different points in the plane.	2) As a and b vary we obtain different lines in the plane.

In the general equation $Ax+By+1=0$, A and B, as is well known are equal to the negative reciprocals of the intercepts a and b of the line; knowing therefore A and B we can at once deduce the values of a and b, and hence the position of the line is known when A and B are given. It is convenient to use the symbols r and s for these negative reciprocals and in what follows we shall let $r=-1/a$ and $s=-1/b$.

1) Scott's Cartesian Plane Geometry, Part 1; Casey's Analytical Geometry; Ferrer's Trilinear Coordinates; Worthington's Trilinear Coordinates; Newcomb's Analytical Geometry, Part 3.
2) This paper first appeared in the Teacher's Review for April, 1911. It is reprinted here by request.

3) x and y are called the coordinates of the point P. They are called *point-coordinates* because they determine the position of a point.

4) The point whose coordinates are x and y is spoken of as the point (x,y). A fixed point is denoted by (x_1,y_1).

3) r and s are called the coordinates of the line MN. They are called *line-coordinates* because they determine the position of a line.

4) The line whose coordinates are r and s is spoken of as the line (r,s). A fixed line is denoted by (r_1,s_1).

5) Draw the lines (-1/5, -1/6), 1/2, 1/4), (-1/4, 1/7).

N. B. To draw the line (-1/5, -1/6) we mark the point 5 on the axis of x and the point 6 on the axis of y: the line joining these two points is the desired line.

6) We shall now consider in more detail the equation $rx+sy+1=0$. Remembering the meaning of r and s we see that this is only another way of writing the equation of the line in the intercept form $x/a+y/b=1$. The equation $rx+sy+1=0$ has now a two-fold interpretation: it may be considered as the equation of a line when r and s are constant and x and y vary, or as the equation of a point when x and y are constant while r and s vary. In either case the equation in the above form is called the Standard Equation.

$rx+sy+1=0$ Considered as the equation of a Point.

7)*Take a fixed point (x_1y_1). The standard equation becomes $rx_1+sy_1+1=0$. If r and s vary we get an indefinite number of lines all passing through the point (x_1y_1). If we think of a liine as revolving on a fixed point, the coordinates of the revolving line are subject to the condition $rx_1+sy_1+1=0$.

8)* The equation $rx_1+sy_1+1=0$ is called the line equation of the point (x_1y_1) because it is the condition satisfied by the coordinates of every line that passes through the point.

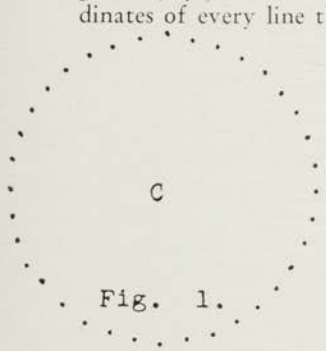

Fig. 1.

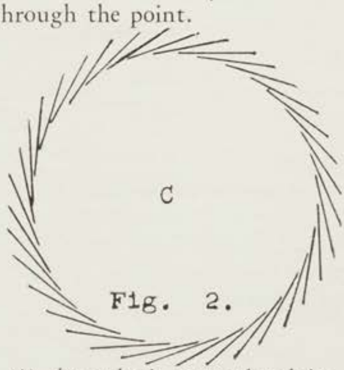

Fig. 2.

*In this and in all the paragraphs marked thus (*) the reader is requested to bring home to himself the duality of the line- and point-equations by making the following interchanges: "line" and "Point"; "point on a line" and "line through a point"; "r,s" and "x,y". Examples of this quality are given in sections 1 & 4.

9)* The equation of the point (5,6) i.e., of the point whose coordinates are 5 and 6, is $5r+6s+1=0$. And in general the equation of the point whose coordinates are M and N is $Mr+Ns+1=0$.

10)* Thus we have two ways of expressing the position of a line; first by its coordinates $r_1 s_1$; and secondly by the equation $r_1 x+s_1 y+1=0$. The first expresses the position of the line *directly;* the second expresses its position *indirectly* leaving us to infer the position of the line by the information supplied as to all the points lying on the line.

11)* Applying to the standard equation $rx+sy+1=0$ the ordinary formulae of Analytic Geometry we obtain at once the following information in regard to the line, expressed in terms of the line coordinates r and s.

The slope of the line $(r_1 s_1)$ is $m_1=-r_1/s_1$

The slope of the line $(r_2 s_2)$ is $m_2=-r_2/s_2$

The lines are parallel when $m_1=m_2$; i.e. when

$-r_1/s_1=-r_2/s_2$ or $r_1s_2-r_2s_1=0$.

The distance from the point (h,k) to the line

$r_1x+s_1y+1=0$ is

$$d=(r_1h+s_1k+1)/\sqrt{r_1^2+s_1^2}$$

The distance from the origin to the line is therefore

$$1/\sqrt{r_1^2+s_1^2}$$

12)* A line through the origin does not lend itself to this mode of representation; for if the line goes through the origin, $a=0$ and $b=0$; hence $r=\infty$ and $s=\infty$ and the equation becomes indeterminate. This is similar to the case of a point at infinity whose coordinates are $x=\infty$ and $y=\infty$.

LOCI AND ENVELOPES.

13) In Fig. 1 thirty-six points are represented all at the same distance from the point C; in Fig. 2 thirty-six lines are represented all at the same distance from C. Fig. 2 shows that all the lines are associated with a curve and it indicates this quite as clearly as do the thirty-six detached points in Fig. 1. The more points or lines we mark the more clearly is the curve indicated. In the above figures it is clear that all the points lie on a circle and that all the lines are tangent to a circle. The circle on which the points lie is called the *locus of the points;* the circle to which the lines are tangent is called the *envelope of the lines.*

14) The *point-equation of a curve* is the equation satisfied by the coordinates of every point on the curve: thus $y^2 = 4px$ is the point equation of a parabola. Likewise, the *line-equation of a curve* is the equation satisfied by the coordinates of *every line tangent to the curve.* On this account the *line-equation* of a curve is sometimes called its *tangential equation* and *line-coordinates* are called *tangential coordinates.* In problems involving a system of lines it is often more convenient to find the line-equation of the envelope of these lines than to find its point equation. Illustrations of their use in this connection are given below.

THE LINE-EQUATION OF THE CONICS

15) THE CIRCLE. Let the center be (a,b) and the radius R. If the variable line (r,s) moves at a constant distance R from the fixed point (a,b) then according to 11)

$$R = ar + bs + 1 / \sqrt{r^2 + s^2}$$

Therefore $\quad R^2(r^2 = s^2) = (ar + bs + 1)^2$

And this is the Line-equation of the circle

$$(x-a)^2 + (y-b)^2 = R^2$$

Cor. If the circle has its centre at the origin, then (a,b) is (0,0) and the equation becomes

$$R^2(r^2 + s^2) = 1$$

16) THE PARABOLA. The point-equation of a parabola is $y^2 = 4px$. The tangent at (x_1,y_1) is $y_1y = 2p(x + x_1)$, which reduced to the standard form becomes

$$x/x_1 - y_1y/2px_1 + 1 = 0:$$

Therefore $\quad r_1 = 1/x_1, \quad s_1 = -y_1/2px_1$

$$s_1^2 = y_1^2/4p^2x_1^2 = 1/px_1$$

Since $\quad y_1^2 = 4px_1$

Therefore $\quad ps_1^2 = 1/x_1 = r_1$

Letting the line vary we obtain from (r_1s_1) the line equation of the parabola: $ps^2 = r$.

17) We may derive in a similar way the line-equation of the other conics.

The ellipse has for its standard equation

$$(ar)^2 + (bs)^2 = 1$$

The hyperbola has for its standard equation

$$(ar)^2 - (bs)^2 = 1$$

18) PROBLEM. Find the envelope of the system of lines $y = mx + p/m$, m being the parameter of the system. This equation reduced to the standard form becomes

$$(m^2/p)x - (m/p)y + 1 = 0$$

hence $r = m^2/p \qquad s = -m/p$

hence $s^2 = m^2/p^2 = r/p$, and the envelope is therefore, $ps^2 = r$, a parabola. (16)

19) The problems of finding tangents to a curve from an external point and the tangents common to two curves are solved neatly by line-equations.

Example. Find the equations of the tangents to the parabola $y^2 = 4x$ from the point $(-2/3, 5/3)$.

The line-equation of the parabola $y^2 = 4x$ is $s^2 = r$, since $p = 1$.
The line-equation of the point $(-2/3, 5/3)$ is
$-2/3r + 5/3s + 1 = 0$ or $2r - 5s - 3 = 0$, (9). Solving the equations of the parabola and of the point as a pair of simultaneous equations in r and s, we obtain the coordinates of the lines passing through the point and tangent to the parabola.

Solution: $2r - 5s - 3 = 0 \qquad (2s+1)\ (s-3)\ 0$

$s^2 = r \qquad s = -\tfrac{1}{2}\ \&\ r = \tfrac{1}{4}$

$2s^2 - 5s - 3 = 0 \qquad s = 3\ \&\ r = 9$

The coordinates of the tangents are therefore $(\tfrac{1}{4}, -\tfrac{1}{2})$ and $(9, 3)$ and their equations are

$$\tfrac{1}{4}x + (-\tfrac{1}{2}y) + 1 = 0$$

$$x - 2y + 4 = 0$$

and $9x + 3y + 1 = 0$

20) Find the common tangent to the parabolas $y^2 = 4x$ and $x^2 = 4y$
The line-equation of the parabola $y^2 = 4x$ is $s^2 = r$ (16)
The line-equation of the parabola $x^2 = 4y$ is $r^2 = s$
Solving for r and s we find the coordinates of the tangent to be (1, 1). Hence the equation of the common tangent is

$$1 \cdot x + 1 \cdot y + 1 = 0 \text{ or } x + y + 1 = 0. \quad (6)$$

THE ANGLE POINT[1]

BY FREDRICK J. SOHON

In the gnomonic projection all great circles project as straight lines. The *center of the map* (also called the point of tangency) is the point on the plane of the map nearest to the center of the sphere. The straight line drawn from the center of the map at right angles to a projected great circle is called the *line of measures* of that projected great circle, and it intersects the projected great circle in the *near point* of the same projected great circle.

The *angle point* of a projected great circle is either of two points on the line of measures of a great circle, at a distance from the near point equal to the distance of the latter from the center of the sphere.

The distance between the near point and the angle point is ob-

[1]This is a summary of a paper given at the New York Section Meeting last summer.

tained graphically as the hypotenuse of a right triangle having for one leg the portion of the line of measures lying between the near point and the center of the map, and whose other leg is drawn from the center of the map parallel to the projected great circle and is made equal in length to the distance between the center of the map and the center of the sphere.

The name *angle point* comes from the following important property. Lines drawn to two projected points from the angle point of their projected great circle include an angle equal to the great circle distance between the two original points.

Any point on a projected great circle is equally distant frem its angle point and from the center of the sphere.

The locus of the angle points of all projected great circles passing through a given projected point is a circle whose center is the given projected point and whose radius is the distance between the center of the sphere and the given projected point.

To project a point in latitude ϕ, longitude λ gnomonically on a plane tangent to the sphere in latitude ϕ_o, longitude λ_o proceed as follows:

Draw a vertical straight line to represent the projected central meridian of longitude λ_o, and on this line mark the centre of the map 0. Through the center of the map 0 draw the line of measures of the projected central meridian at right angles to the latter, and on the line of measures lay off OJ equal to the radius of the sphere drawn to scale. J is the angle point of the projected central meridian. On the projected central meridian find the point Q so that the angle QJO is equal to ϕ_o the latitude of the center of the map or point of tangency. Q is the near point of the projected equator. On the projected central meridian find the point P so that the angle QJP is a right angle. P is the projected north pole. With P as center and with PJ as radius describe a circle. All the angle points of the projected meridians will lie on this circle. Draw a straight line through Q at right angles to the projected central meridian POQ. The line so drawn represents the projected equator.

The projected central meridian POQ is the line of measures of the projected equator. Find S on POQ so that QS is equal to QJ. The point S is the angle point of the projected equator. Find T on the projected equator so that the angle QST is equal to λ-λ_o. Then the projected meridian of longitude λ must pass through T. Draw a straight line through P and T to represent the projected meridian of longitude λ.

With T as center and with ST as radius draw a circular arc cutting the locus of angle points of the projected meridians in the point U. the point U will be the angle point of the projected meridian PT of longitude λ. Draw the reference line UT. On the projected meridian PT find the point V so that the angle TUV is equal to ϕ-ϕ_o. The point V will be the gnomonic projection of an original point in latitude ϕ and longitude λ.

HOW DO YOU EXPLAIN IT?*

Why are all quantities raised to the zero power equal to one?

A common definition of a "Power" is the "Product of a number by itself a certain number of times."—the product of two or more equal factors. If you multiply x by itself once you get x squared. Why is this the second power rather than the first power? You have multiplied x by itself only once; if you do not multiply it by itself at all have you a "power" of x? If you have, why should you not call it the zero power, since there has not been any multiplication?

Here is one way of looking at it. The power of a number is the product obtained by multiplying 1 (unity) by the number a certain number of times. If you multiply unity by the number once you have the first power of the number; if you multiply by the number again, you have the second power of the number; when you have used the number "n" times in succession as a multiplier you have the nth power of the number. If you start with one, and do not multiply it at all by the number, you may properly call this multiplicand, i.e. unity, the zero power of the number.

If we start with some power, say the fourth, of some number x, and have therefore x^4, and divide this by x, we step down to the next lower power or the third power, or x^3. By successively dividing by x we step down from the fourth to the third; from the third to the second; from the second to the first, and finally from the first to the zeroth power, which will evidently always be one, no matter what the number was whose higher power we started with. If we keep on dividing by x, we get the reciprocals of the powers and for convenience we call the quotient below the zeroth power the minus powers.

*In each Issue of the Bulletin, the Editor will present some question vexing to science teachers with a proposed answer. The answers will be given by a member qualified by long experience teaching the subject in question. Are you vexed? Send your question to the Editcr. Have you any further light to shed on the questions proposed? The Editor will be glad to hear from you.

NEWS ITEMS

BOSTON COLLEGE

PHYSICS DEPT.

TERM PROGRAM OF THE SEMINAR IN EXTERIOR BALISTICS

September 20, 1943

ANGELO ANNACONE .... "ARTILLERY."

Analysis of the general types: fixed and mobile; seacoast (harbor defence), anti-aircraft, and field. Discussion of relative merits of gun, howitzer and mortar.

ROBERT BOUSQUET .... "BOMBS AND GRENADES."

Description of demolition, fragmentation, and chemical bombs. Consideration of practice bombs and arming devices.
Historical and descriptive treatment of grenades.

* * *

September 28, 1943

GERALD CALLAHAN .... "CONSTRUCTION OF ARTILLERY"

Progress in gun construction from the Civil War to World War II. Descriptive exposition of the three chief types: built-up, wire-wrapped, and cold-worked. Discussion of casting, centrifugal casting, boring, machining, and finishing.

MOVIES .... "THEORY OF AERIAL GUNNERY"

"THEORY OF AERIAL BOMBING."

"THEORY OF BOMBING."

"FIRE CONTROL FOR SEA COAST ARTILLERY: COMPUTING AND SETTING FIRING DATA."

* * *

October 5, 1943

JOSEPH CAVAN .... "THEORY OF RECOIL AND RECOIL SYSTEMS."

General treatment of the recoil mechanisms: brake, Counter-recoil, and buffer. Description of hydro-spring and hydropneumatic systems, as well as of French types. Recoil length and velocity.

MOVIES

"ELEMENTARY PRINCIPLES OF THE RECOIL MECHANISM."

"RECOIL MECHANISM, FRENCH 75 *MM* GUN, MODEL 1897."

"FIRE CONTROL FOR SEA COAST ARTILLERY: POINTING METHOD AND REFERENCE NUMBERS."

October 12, 1943

PAUL DAWSON ...... "SMALL ARMS AND SMALL ARMS AMMUNITION"

Development of the rifle from medieval times: study of characteristics of modern barrels and mechanisms. Historical and mechanical study of automatic weapons: recoil, gas, and blow-back action.

Ammunition and construction of modern cartridge.

MOVIES

"CALIBER .50 AIRCRAFT MACHINE GUN."

"THOMPSON SUB-MACHINE GUN."

"FIRE CONTROL FOR SEA COAST ARTILLERY: BRACKET METHOD OF FIRE ADJUSTMENT."

* * *

October 19, 1943

PAUL O'NEIL ...... "BOMBING FROM THE AIR"

Growth in importance since World War I: the Spanish Civil War as a test, the South Pacific as an effect. Mathematical analysis of path of bomb for high altitude bombing; comparison with dive-, skip-, and torpedo-bombing.

FILMS

"PROJECTILES. PROPELLANTS."

"FUZES."

"BOOSTERS."

* * *

October 26, 1943

JOSEPH KREBS ...... "PROBABILITY AND BALLISTICS"

Mathematical analysis of the several "means" used in statistical work. Their accuracy and usefulness, together with their place in control of gun-fire.

MOVIES ...... "THE NORTH AFRICAN FRONT"

* * *

We regret the departure of four former members of this Seminar, Naval Reservists, now studying at the University of Notre Dame: Messrs. John Delaney, John Eichorn, Joseph Sullivan, and Joseph Tracey.

We wish to express our appreciation to the Film Library at Signal Corps Headquarters, First Service Command, for their generous assistance in supplying films for our meetings.

CANISIUS COLLEGE

CHEMISTRY DEPT.

Rev. Lourdu M. Yeddanapalli, S. J., has been engaged as Assistant Professor of Physical Chemistry at Canisius College. Father Yeddanapalli, a native of India, received his M. S. at the University of Calcutta and his Ph. D. from Princeton University. Previously he taught in the 1943 Summer Sessions at Fordham University.

Father Yeddanapalli will teach elementary Physical Chemistry in the undergraduate school and a course in Chemical Kinetics and special topics in the graduate school at Canisius.

Mr. Austin V. Signeur, Assistant Professor of Chemistry at Canisius College, together with Walter K. Brauer, Paul R. Corcoran, Eugene E. Lorence, Francis S. Sayles and Walter J. Ziemba, members of the Chapter of Student Affiliates of the American Chemical Society, attended the September meeting of the ACS at Pittsburgh.

The first lecture in the 1943-1944 series under the auspices of the Chemistry Department was given on October 11, 1943 by Lieutenant James R. Barrett of the Buffalo Police Department. Lieut. Barrett spoke on "Scientific Crime Detection."

Two new courses have been added to the Graduate Program for 1943-44. "Recent Advances in Analytical Chemistry," and "Unit Processes in Organic Chemistry." Both of these courses will have laboratory work as well as lectures.

HOLY CROSS COLLEGE

Chemistry Dept.

On October 31, 1943, the second class to leave this year graduated from Holy Cross. Five of the civilians who graduated came back to us on the first of November to start as graduate assistants in the chemistry department. One of them came to us as a B.S. in chemistry magna cum laude with the Flatley Prize in philosophy, and a second held his degree cum laude. On the twenty-first of November three of the older graduate assistants left the college, one going to the Esso laboratories, one to the U. S. Rubber and one to Texaco.

For the first time in years, Bachelor of Science in Physics candidates appeared on the quantitative inorganic chemistry class list with ambitions to avail themselves of the training in precision of instrumentation that the rigid requirements of any such course can offer.

Registration to date (November 23) tallies in this department: 107 civilians and 174 Navy students (Total 281). Though this figure is somewhat lower than that of the July 1st term, it bespeaks a spread over nine courses: some with large, some with small enrollment; some given by professors at both first and second term levels; some with many laboratory sections, some with only one; some on shared locker basis; some in certain types of laboratories and on schedules that crowd them to the doors; some where but a few students with misfit schedules are practically tutored. By March 1, 1944, this modest figure is expected to increase beyond 400. Certainly this is a strain on equipment. But it is at once a tribute to the patriotism and loyalty of professors, graduate assistants, work-staff and students and a mighty contribution to the war effort.

The Chemistry Leaflet for April 1943 reprints again from the Hormone (8, (1935) 49-56) John A. Bergman's article: "Silver among the Latins". The Hormone at various times has received favorable publicity of this type in the Science Digest, The Catholic Digest, Chemical Abstracts, the Journal of Chemical Education and the Chemistry Leaflet. Quinquennial indices for volumes 1 - 5 and 6 - 10 respectively have been prepared in manuscript, due to the generosity of the Jesuit staff. The index for volume 11 - 15 was published in December 1942. The staff of the department is preparing theses abstracts that go back to 1927. The Hormone's future is still uncertain. It would be deplorable if this student expression of culture and science should have to succumb to the exigencies of the times.

ST. JOSEPH'S COLLEGE

Physics Dept.

The courses in Engineering, Science and Management which constitute the civilian part of the U. S. Offices of Education War Training Program are now under way at the College.

An initial enrollment of over two hundred indicates the very favorable response to the project and courses listed below are being given under the auspices of St. Joseph's at the Frankford Arsenal, at the Ordinance Department's Office in downtown Philadelphia, as well as on the campus.

The organization of the program has been under the direction of Fr. T. J. Love, assisted by Fr. Molloy and O'Conor.

Courses Offered

CHEMISTRY.

1. General Chemistry
2. Organic Chemistry
3. Analytical Chemistry
4. Chemical Literature
5. Chemical Mathematics
6. Paper Chemistry
7. Unit Industrial Processes
8. Fermentation Processes
9. Pharmaceutical Chemistry
10. Distillery Practise.

PHYSICS

1. Engineering Statistics; Statistical Methods of Quality Control
2. Basic Electricity I D. C. Circuits and Machines
3. Basic Electricity II A. C. Circuit theory
4. Electronics I Introduction to Radio Communication
5. Electronics II Application of Electronic Devices to wider problems of communication energy propagation and control
6. Physical and Geometrical Optics } These courses to
7. Analytic Mechanics } be given alternately