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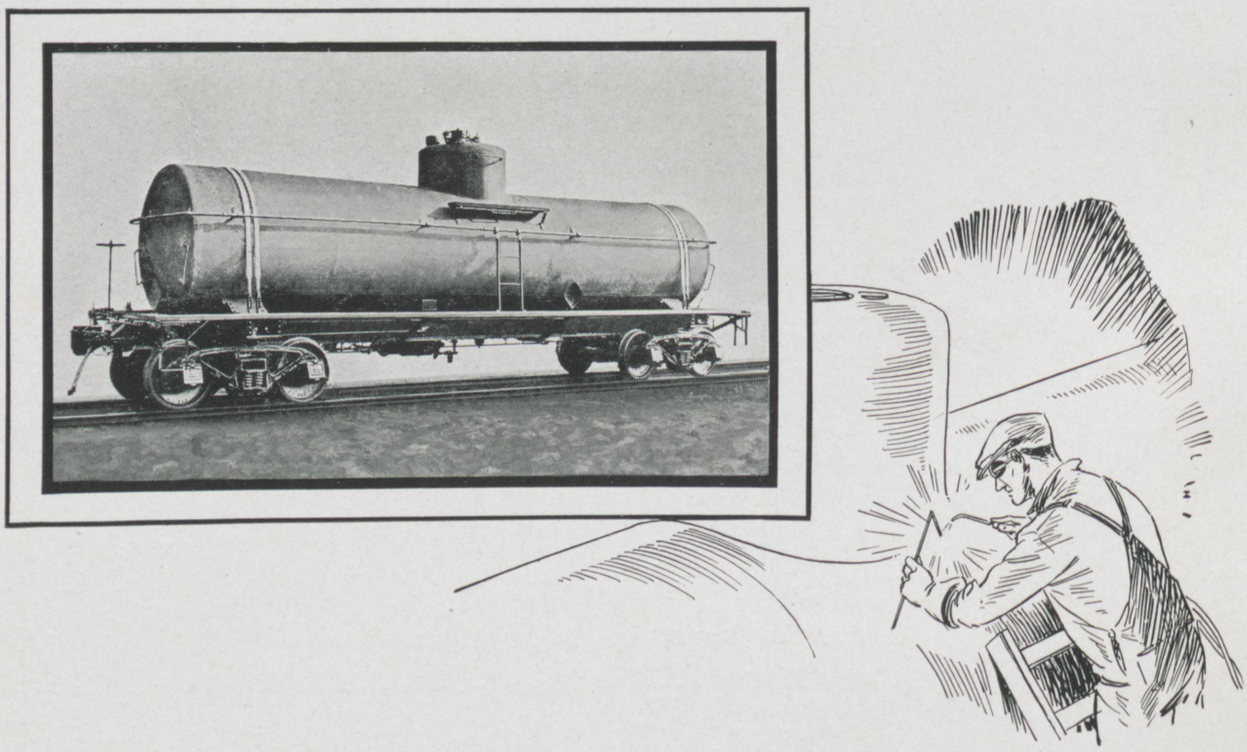

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Surveying This Issue

IN this month's lead article, Merton B. Scharenberg presents an interesting discussion of the application of modern optical instruments in machine shop practice.

ROBERT Averitt's article on Illumination gives a brief review of the development of this increasingly important field.

A FIELD of intensive research is viewed from an engineering standpoint by Robert Pearce in "Corrosion of Metals".

CLEM Lundgren presents a review of photometric methods that should be of interest to all.

C. R. W.

THE ROSE TECHNIC

FEBRUARY 1937

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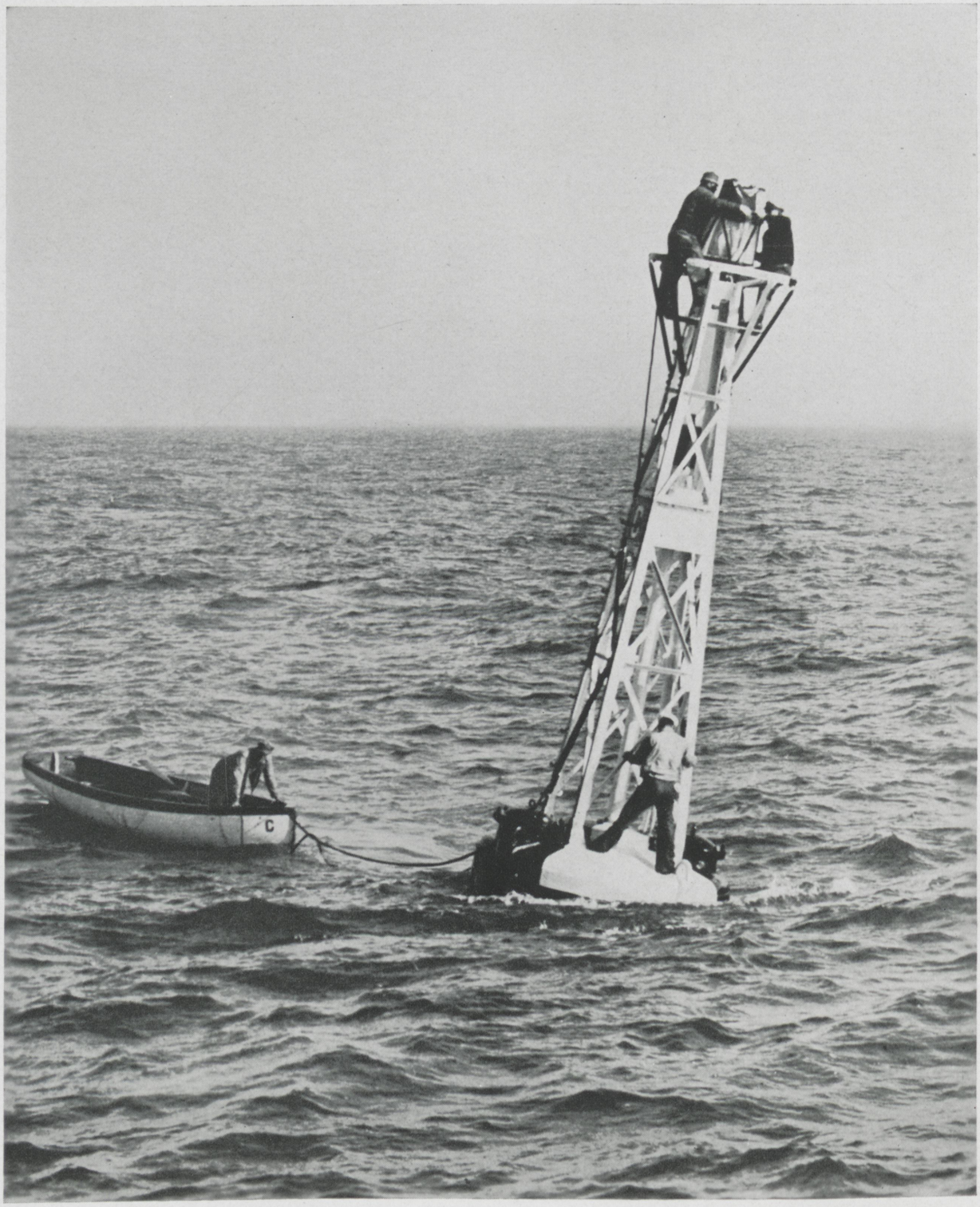

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THE ROSE TECHNIC

THE TECHNICAL JOURNAL OF THE ROSE POLYTECHNIC INSTITUTE

Volume XLVI FEBRUARY, 1937 Number 5

Optical Instruments in the Machine Shop

by

Merton B. Scharenberg, m., '38

ONLY a few years ago complicated optical instruments first found direct and practical application in industrial fields. Among the instruments so used, several have been utilized in machine shop practice as labor- and time-saving devices.

The instruments used in machine shop practice may be divided into three large groups: (1) Those instruments used on machines to obtain higher degrees of accuracy of settings and operations, (2) optical inspectors, (3) miscellaneous instruments used to simplify common shop problems.

Optical Instruments to Insure Accurate Settings

Optical instruments provide means to insure accurate settings of machines such as lathes and milling machines. Several new machines feature microscopic attachments which allow precision work to be accurate to 0.0001 in.

The example of the new Societe Genevoise "Hydroptic" jig boring and milling machine well illustrates the use to which optical instruments have been put on modern machines. On both the cross-rail and the saddle, precision scales are engraved on the inside of a box-shaped casting, which is open on one side to permit reading by a prismatic microscope. They are in this way sealed from dirt and other foreign matter in order to preserve their accuracy and are not subject to wear. The microscopes are movable by means of micrometer screws. The scale is graduated to 0.001 in., while the vernier permits readings to 0.0001 in. For locating the position of the table, a microscope and a micrometer drum are used in conjunction with a scale on the table, allowing it to also be set to within 0.0001 in. With such attachments on this machine, milling to close tolerances, as well as accurate boring, can easily be performed.

Optical Instruments for Measurement and Inspection

It is often difficult, or even impossible, to measure some dimensions with a suitable degree of accuracy by direct gaging. For such cases, several optical methods of measurement have been devised and are in commercial use.

These optical gaging systems

are of great value in the field of inspection. A large variety of shop tools, gages, and products can be easily and thoroughly checked as to specifications, tolerances, tool wear, distortion, and many other important details which could not be definitely measured by ordinary gaging methods.

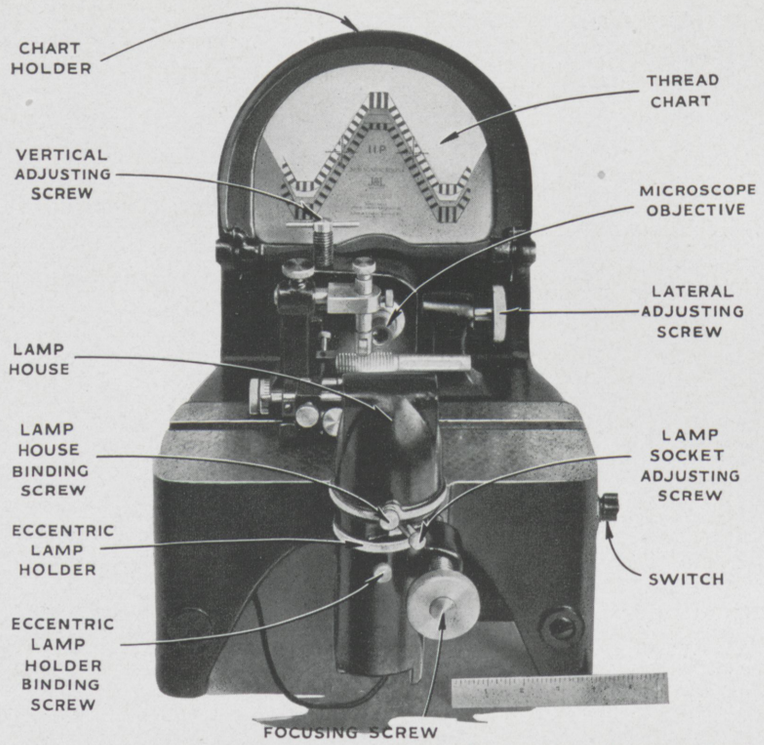
Particularly in the case of automatic screw machine products does such a measuring machine play an important role. The difficulty encountered in taking steps which are essential for controlling the product, such as making sure the tools are set correctly and periodically checking the product for signs of tool wear and approach of tolerance limits, is partially eliminated when optical measurement is employed. If a master outline is used in conjunction with such a machine, the accuracy of all measurements is revealed as rapidly as it may be tested with ordinary snap gages.

Most optical measuring instruments are projectors which measure the object by means of either a magnified shadow or a magnified reflection.

If the object is such that its surface cannot be projected by means of its shadow, a reflection system may be used. The surface to be studied is placed in the focal plane before the lens and is illuminated by a beam of light from a lamp which has passed through a prism. The brightly illuminated face of the object reflects through the projection lens and casts on the screen an enlarged view of the reflected surface.

The degree of magnification is dependent on the type of lens system used and may be varied conveniently from powers of 10 to 200 times, depending on the size of the object being inspected.

With an optical measurement system such as this, the applications that may be found are almost unlimited. Its limitations are of course based on the size of the object and the number of magnifications desired. A discussion of a few applications is contained in the following paragraphs.



Courtesy Jones & Lamson Machine Co.

Bench Type Comparator

Master outlines are usually used in conjunction with the projectors for purposes of comparison and inspection. These master charts may be prepared by several methods. If an acceptable master is available, the outline of its projection may be traced on translucent paper placed over the screen. If a tolerance chart is necessary, it may be drawn on translucent paper, necessary alterations of dimensions being taken for magnification. The chart should show both maximum and minimum acceptable dimensions.

An example for this method of inspection is checking screw threads, a relatively long process with mechanical gages. The tolerance chart is placed over the screen, and a master thread placed before the projection lens. The shadow of the master thread is then brought to coincide with the upper tolerance outline on the chart, thus representing a perfect screw in a perfect nut. The master thread can then be replaced by the product to be tested. If the projection of the product falls between the tolerance outlines on the chart, the product passes inspection, for the space between the outlines represents permissible tolerance for the class of fit required. In this manner, all elements of the thread are simultaneously compared with an accurate master gage, and unskilled labor is permitted to pass reliable judgment on the accuracy of the product being inspected.

Direct measurement of dimensions by use of such a projector necessitates the addition of several attachments. An angle measuring device consists merely of a graduated ring and vernier around the projection screen. Crosshairs on screen, which is made integral with the ring, can be made to coincide with the projected shadow or reflection, thus allowing the angle measurement to be read on the vernier. Vertical and horizontal measuring attachments consist of extremely sensitive micrometers, which are used in conjunction with size blocks. Comparison of settings of the micrometers with the object

and with the proper size blocks inserted reveals any error.

Miscellaneous Instruments

Numerous other instruments using optical apparatus have found application in machine shop practice or have a direct bearing on machine shop products.

Stroboscopes are important instruments for studying the functioning of rapidly moving machine parts while in motion. The part in motion is observed through a rotating slit disc, the speed of which can be regulated to coincide with that of the moving object. In this manner, the moving object will appear stationary to the eye. The "apparent" speed of the object, as viewed by the eye, can be regulated by slight variations of the speed of the slit disc. This study of motion often proves valuable in design and inspection of shop tools and parts.

Certain types of stroboscopes, being equipped with speed indicators, can be used as tachometers. In one case, a commercial stroboscope so equipped will measure any speed up to 140,000 revolutions per minute by optical means—that is, without being in contact with the rotating part. This type of observation is extremely valuable in such instances where it would be dangerous to approach the moving part too closely. The portability and compactness of such an instrument makes it suitable for observations both in laboratory and shop inspection.

Many other instruments, such as automatic optical pyrometers, visual magnified master gages, etc., too numerous to discuss fully, employ diverse optical principles and allow certain shop problems to be solved with little effort. New developments, such as an optical pyrometer that allows the temperature of a rapidly moving product to be taken in one-half of one second, and such as a visual gage that uses a magnification system of 5000 to 1 to obtain an accuracy of 0.000025 in., have contributed their share to the importance of optical instruments in machine shop practice.

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Illumination

Robert A. Averitt, e., '37

One phase of electrical engineering which has been developed to a very great extent during the recent years is illumination. In spite of the fact that many concerns have felt the need of curtailing expenditures for industrial and scientific research during the depression, vast sums of money have been spent for developing new methods and applications of illumination and lighting effects. It might seem that such expenditures were of little practical value were it not for the fact that approximately $200,000,000 was saved last year by the consumer of electrical energy for illumination as a result of the extensive research along this line.

History

The history of illumination is one which closely parallels the history of the human race. It is presumable that ancient men used fire not only for cooking and heat but also as a source of light. As civilization progressed the principle source of light came to be that of torches in which some sort of combustible fats or oils were used. Some time later, a very crude fuel oil lamp was developed and was of importance because of the fact that the flame itself was enclosed. This represented another step and was the forerunner of the modern kerosene lamp.

The candle was developed about 1800. It was the principle source of illumination for a number of years owing to the fact that it was inexpensive and considered fashionable. The candle is still widely used in religious ceremonies but is really dangerous because of its open flame. Later in the nineteenth century kerosene and gas lamps came into prominent usage. Gas lamps were used extensively during the 1890's and the early 1900's for both domestic and civic purposes.

In 1879, Thomas A. Edison invented the first electric lamp. Compared with modern lamps, it was a very crude affair. It consisted of a carbon filament enclosed in a glass bulb filled with air. The far reaching importance of this invention is evident when one realizes that this was the forerunner of the modern electron tubes used in other phases of electrical engineering. Edison's first lamp burned for nearly two days. Later in the same year, sixty of these bulbs were used in a demonstration at Menlo Park. The demonstration was a distinct success.

Sometime later it was realized that the lamp would burn for a longer period if the filament were not enclosed in an atmosphere containing oxygen. The next step was to evacuate the lamp bulb. The result was most successful. Later developments brought about the present day tungsten filament argon filled bulb.

Types of Lamps

In connection with the lamps themselves, many sizes and types have been developed for varied application. For instance, the so-called Grain of Wheat lamp is the smallest lamp manufactured. It consumes about three-tenths of a watt from a one and one-half volt battery. It finds extensive use in surgery. For use in photography, the photoflash and the photoflood lamps have great importance. Prior to the advent of the photoflash lamp, photographs were taken in poor natural light by means of flash powder, entirely exposed to the atmosphere. The photoflash lamp consists of a glass bulb filled with aluminum foil; the life of the bulb is very approximately one-fiftieth of a second. The largest photoflash lamp manufactured has a light output of about seventeen and one-half million lumens. This is equivalent to the light produced by one thousand one thousand-watt lamps. Photoflood lamps find wide application in studio and commercial photography. The photoflood lamp resembles ordinary bulbs in size and shape, but the filaments run at a much higher temperature. It has an average life of about two hours. High wattage lamps, such as the photofloods, have a tendency to blacken after moderate usage. The remedy for this situation is the placing of a cleaning powder in the lamp bulb. A vigorous twisting of the lamp causes the cleaner to act, and the discoloring disappears.

Perhaps one of the greatest contributions to domestic lighting from the laboratory is the Lumiline lamp. In general, it consists of a cylindrical bulb about one inch in diameter and about eighteen inches long. The lamp has two bases, one at each end. It contains a single coiled filament drawn out into a continuous line from one contact base to the other. The filament is supported by means of a small channel backbone inside the bulb running from base to base. The construction of the base caps incorporates a new technique of sealing the bulb. It is possible to connect the lamps end to end and produce a practically continuous line of light. The bulbs are made in four different colors and have wide application where beauty and unusual effects are desired.

It is interesting to note that most of the ordinary modern lighting systems have the lamps out in plain view. This is, in all probability, a left-over from the days of gas lamps when it was necessary to light each lamp individually. There is no reason why the electric lamps should not be concealed, thus avoiding glare. The result of concealing the lamps themselves and reflecting the light is the so-called method of indirect lighting. This method is much more desirable from the physiological point of view than the direct methods.

In a great number of bathrooms one will notice that the electric light is directly over the shaving mirror. The lamp in this position presents a problem to the shaver. Since the light is coming down on his face, the underside of his chin is completely in shadow. This is not conducive to a good shave. The situation could be remedied easily enough by placing a continuous row of Lumiline lamps around the mirror, thus giving an even glow with no shadows nor glare.

These are not by any means all of the recent developments in illumination. Research is constantly going on in many phases of the field. A great deal of time is being given to the study of monochromatic light. It is very probable that some of the results of this study will be particularly applicable to color photography. It is expected that in a few years new methods and applications will supplant those already existing.

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Corrosion of Metals

by

Robert E. Pearce, m., '38

The corrosion of metals and alloys is a chemical process characterized by the attack on the surface of metallic bodies of some surrounding medium, such as the atmosphere, moisture, or acids.

Corrosion, or rusting, of steel is one of the greatest economic wastes of the present day. Other alloys are also attacked, but steel is used so much more abundantly than other alloys, and is so easily attacked by damp atmosphere, that its corrosion is first in importance.

Corrosion is due to chemical attack. The metallic surface first becomes oxidized, or else converted to some compound such as a hydroxide or a carbonate, from the oxygen or carbonic acid in the air. Of the many factors that are known to accelerate the corrosion of metals, some of the most important are: the contact of dissimilar metals, the presence of active oxygen, non-uniformity of the metal, whether due to impurities or to segregation, internal stresses in metals, stray electric currents, which have often assisted in the destruction of water mains and street railway tracks, and elevated temperatures. First attack is known as staining, because it changes only the color of most metals. If the corrosion continues, the stain becomes a coating or surface, which may be a powder or may be adherent in the form of a hard scale on the metal.

Much has been accomplished in the prevention of corrosion in recent years, due to the realization that surface films may be formed by corrosion of so great a resistance that they will protect the metal underneath from further corrosion. This fact explains why the gray color taken on by aluminum, zinc, and other metals in the formation of their oxides is a protective layer. Iron has been warmed to produce a coating of oxide, which partially protects it from rusting. Methods are now being developed to produce less porous and more adherent coatings on iron and other metals.

It is a known fact that metals are made up of atoms which are held together by atomic bonds. In view of this fact, it is evident that the atoms on the surface will have atomic bonds extending into space and ready to grasp some atom for which they have affinity. If the atoms that are grasped will form chemical compounds with the grasping atoms, or the atoms underneath, then corrosion has begun. If the affinity of these unattached atomic bonds can be satisfied by supplying them with atoms which will not unite with the metal involved, then no ways will be left open for corrosion. This is assumed to be the case in the "passivity" of iron. When iron is wiped with a rag moistened with chromic acid, it is supposed that the oxygen atoms will be attached to the free iron-atom bonds and the path to attack by corrosive atoms is closed.

Some atoms are attached to bonds on the surface of a metal and remain inactive, without attacking the atoms underneath. This condition might remain until some force produced a tendency to attack. A difference of electric potential on the surface of a metal might produce such a force. Modern research seems to prove that various chemicals will not attack a metallic body in the absence of a difference of potential, but will corrode it vigorously if differences of potential exist. Irregularities in chemical composition, such as those caused by segregation and improper mixing, will cause corrosion. Gases contained in blowholes that have not been welded during mechanical treatment, remains of pipes not cut off in the mechanical process, or irregularities in the metal produced by unequalized strains persisting after rolling and forging will cause differences of potential. Finally, metal heat-treated non-uniformly, welds not subsequently annealed and brought to a uniform structure, and other irregularities introduced in physical processes will cause a difference in potential by excessive electrolysis. Therefore, we may conclude that corrosion is electrolysis.

Most metallic bodies are exposed to atmosphere more than to any other possible corroding agent. Iron and its compounds, because of their ready yielding to oxygen and carbonic acid, corrode very easily. Some metals and alloys may receive a coating of oxide when exposed to the air. This destroys the brightness and pure metallic luster of the metal, but usually protects it from further corrosion.

If the surface of a metal is exposed to some liquid which will act as an electrolyte, the extent of corrosion will depend more than anything else on the attack which this liquid makes; in other words, the surroundings of the metallic body have more effect on corrosion than the difference of potential or the conditions within the metallic body. The determining factors of the corrosion of a metal are the conditions of service in which the metallic body is placed. A survey of conditions should precede the use of any metal.

Whenever two metals are in contact in the same structure, relatively large differences in potential will exist. In this case the

presence of an electrolyte is all that is necessary to produce corrosion. The protection of the iron work of boilers, caused by hanging a piece of zinc in the boiler water in electrical contact with the iron, is a good example of this. The electric current in the electrolyte flows from the zinc to the iron; therefore, the zinc is rapidly corroded and the iron is protected.

The three principal means used to prevent or retard corrosion are: the use of protective coatings, neutralization or removal of the active elements in the surrounding medium, as in the treatment of corrosive waters with alkaline compounds, and elimination of electrochemical difficulties. The commonest method of protecting a metal from corrosion is by covering it with some coating such as paint, which will keep electrolytes away from it. Before this is done, every particle of scale, dirt, grease, or other impurity which might serve either as an electrolyte or to produce a difference of potential must be removed. Metals may be insured against corrosion by: galvanizing, tin-plating, terneplating, electroplating, slushing compounds, lead sheathing, and prevention by internal means.

Photometry

by

Clemens W. Lundgren, e., '38

RADIATION is energy and can be measured by converting the energy of radiation into some other form of energy, such as heat, and measuring the latter by having it heat one contact of a thermocouple. A galvanometer measures the voltage produced by the thermocouple, and the temperature rise produced by the energy of the radiation is observed.

The total radiation energy of a body for a given time can be measured by absorbing it and measuring the heat produced by it, as, for instance, the amount of ice melted in a calorimeter. Sometimes the power of radiation can be measured by measuring input and output loses. In an incandescent lamp the electric power lost by heat conduction and convection can be estimated.

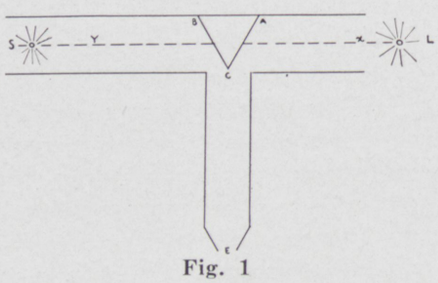

Fig. 1

Light, however, cannot be measured by any of the preceding methods, and the science of the measurement of light intensity is *photometry*.

The power of visible radiation can be measured and may be expressed in watts. However, the power of visible radiation is not proportional to the physiological effect, for one watt of green radiation gives many times as great a physiological effect as does one watt of violet radiation, besides a different kind of physiological effect, color.

The unit in which the brightness of a light source is expressed is the "candle-power" and is a physiological not a physical, quantity and has no logical relation to the unit of power, the watt. The candle power has been chosen by convention and is the light given off by five square millimeters of melting platinum, or by a flame burning a definite chemical compound, as amyl acetate or pentane, at a definite rate and under definite conditions.

The most accurate method of comparing light sources is the method in which the intensities of illumination produced by two sources of light, the one to be tested and the standard, are made equal by changing the relative distances of the sources. For equal intensities of illumination the source candle-powers are proportional to the square of their distances. This is satisfactory when the lights are of the same color.

In the simplest form of the Bunsen photometer, shown in Figure 1, two white screens A and B are illuminated, the one, A, by the light, L, which is to be tested, the other B, by the standard light source S. Then either L or S or both of them are moved until, seen from E, the two screens A and B are equally illuminated and the

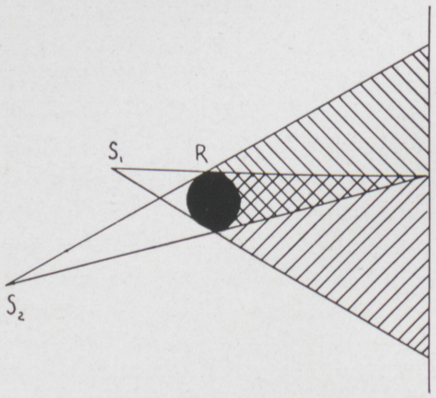

Fig. 2

dividing line C between them disappears. When this is the case, $L/S=x^2/y^2$, when x and y are the two distances of the sources from the screen.

Different modifications are commonly made. The screens A and B may be removed and a screen of white paper with a grease spot on it placed perpendicular to the light beams. The grease spot is more

translucent than the clean paper and for this reason appears darker by reflected light (since there is less light reflected from the spot). If such a screen is placed between sources which equally illuminate it with light having the same proportions of different colors, the grease spot will disappear. The loss in light reflected from the spot on one side will then be compensated by the increased amount transmitted from the other side. As the sensitivity of the eye to differences of illumination is not very great, usually a number of readings are taken on the photometer and then averaged.

Another of the oldest and simplest types of photometers is the Rumford shadow photometer, shown diagrammatically in Figure 2. The shadows of a rod R are cast on a white screen by the sources S_1 and S_2, one of which is a standard light source. By adjusting the positions and distances of S_1 and S_2, the shadows may be made to touch and be of equal intensity. When this is the case, the intensity of light from each source is the same at the screen, since each shadow is illuminated solely by the source which casts the other shadow. Then the respective intensities of the two sources vary directly as the squares of their distances from the screen, when the screen is equally illuminated by both.

The most generally employed of the modern instruments for comparing the intensities of different sources of light of the same color is the Lummer-Brodhun photometer. The two sources S_1 and S_2 (Figure 3) illuminate to the same extent the opposite sides of a white opaque screen AB. These surfaces are viewed by an eye at E with the aid of two plain mirrors M_1 and M_2. In order to bring the two sides of AB into position together, as seen by the eye at E, the prism CD is used. This consists of two right-angle prisms, CGH and DGH, pressed very firmly together along the faces GH, which are

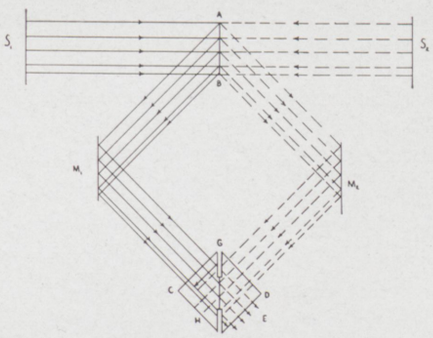

Fig. 3

made so as to come into perfect contact in certain places, but not to come into contact in other places. The light which comes to E through the part of GH in which the surfaces are in contact is light which comes from S_1, is reflected at M_1, and then passes without change of medium through the prism from the face CG to the face HD. But the light which comes to E from the parts of the face GH which are not in contact is composed entirely of rays which have come from S_2 by way of the mirror M_2, and have then undergone total reflection at the surface of the air film. Therefore, if the two sides of AB are exactly similar surfaces, and if M_1 and M_2 are exactly similar mirrors, it is only necessary to set AB at such a point between the sources S_1 and S_2 that the whole surface GH, as seen from E, is of uniform illumination. In order to eliminate any possible inequalities in the two sides of AB, or in the mirrors M_1 and M_2, the instrument is usually rotated through 180°. This interchanges the two sides of AB and also the mirrors. The mean reading of x and y before and after reversal is then taken as the correct setting.

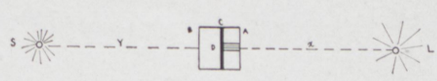

Fig. 4

A convenient form of photometer which gives good results even when the two lights are of somewhat different color is the Joly diffusion photometer. It consists of two rectangular blocks of paraffine separated by a sheet of tinfoil C perforated by a hole D (Figure 4). The block of paraffine then is held so that the side A is illuminated by the one lamp, L, the side B by the other lamp, S. As the paraffine is translucent and appears to scatter light throughout its entire mass, the block then appears luminous, and a beam of light is seen crossing the block from the hole D, on the side which receives less light. By moving the paraffine block between the lamps L and S until both sides are of the same illumination, the dividing line C and the beam cast by hole D disappear.

By the preceding four methods two light sources are compared by balancing the brightness of adjacent surfaces which are illuminated by the two sources. In this way, lights from sources of slightly different color can be compared with a probable error of about 1 or 2%. When the color difference is considerable as when red, blue, or green light is compared with white light in determining the transmission characteristics of colored glass or accessories for colored lighting, the measurements become extremely difficult and the errors in readings may be quite large.

There are two principal methods for measuring lights of different colors. The first is by flicker photometry and the second by spectrophotometry. The flicker photometer in its simplest form consists of a stationary disk illuminated by the one lamp, and a rotating half disk or sector in front of it which is illuminated by the other lamp. When the speed of rotation becomes sufficiently high, the flickering, characteristic of low speeds, disappears. The more nearly equal the effect on the eye of the two illuminations, that of the stationary disk and that of the revolving sector, the lower the speed at which the flicker disappears; and by adjusting the distances of the two lamps so as to cause the flicker

to disappear at minimum speed, the illumination of the two sources may be balanced.

An investigation has been made recently by the Lighting Research Laboratory at Nela Park to determine the accuracy with which the relative illuminating value of lights of decidedly different color can be measured with the flicker photometer. The test was conducted by determining the transmission characteristics of eight color filters by both the spectrum analysis and the flicker photometer method. This set of eight color filters was representative of practically all colors encountered in practice. Each observer made a set of readings on the flicker photometer with each color filter used to filter the light from a tungsten lamp. Assuming the results of spectrophotometry data to be correct, the flicker photometer gave, for these particular filters, values that were too high for the blue and too low for the red. The maximum error was within eight per cent.

According to A. H. Taylor—

"Spectrophotometry requires an analysis of the spectrum by which the luminous effect of the amount of energy radiated in the different wavelengths can be calculated. This is the most accurate method of color photometry but is long and tedious."

Quoting from a report of the O. S. A. Progress Committee—

"Every spectrophotometric apparatus consists essentially of two parts: (a) the spectral dispersing system, and (b) the photometric system. Spectral dispersion is usually effected by a prism system, although grating systems have been used. The photometric system consists ordinarily of a uniformly illuminated two-part photometric field with means available for varying the brightness of one or both parts in a continuous and known manner. It is obvious that any intelligent understanding of spectrophotometric apparatus and methods is dependent upon a knowledge of the theory and use of the spectrometer and the photometer as separate instruments."

In all the photometers described except the spectrophotometer, a standard source of light is needed, one that is accurate and easily reproducable. So far no absolutely reliable standard source has been found. In trying to produce a standard source, elaborate specifications for the making of candles were made. They covered the physical and chemical treatment of the wax and wick; the number of threads, size and degree of twist of the wick; the length, diameter, and weight of the candle; the height of the flame; amount of wax burned per hour; and the pressure, temperature, and humidity at the time.

Although all these precautions were taken, the standard candles of different countries were never identical. The international illumination candle now in use is one-tenth the light from a Hartcourt pentane lamp. The Hartcourt pentane lamp is one in which pentane vapor mixed with air is burned in a burner of specified dimensions and so adjusted to give a flame of specified height.

Steinmetz states that—

"Light, in the sense in which it is considered photometrically, is not power, but is the physiological effect of certain wave lengths of radiation, and therefore cannot be measured, physically, as power, but only physiologically, by comparison with other physiological effects of the same nature."

Since light is a physiological effect, photometric tests can never attain the accuracy of strictly physical determinations, and the inaccuracies must be taken into consideration when using the results.

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Thermocouple and Astronomy

Astronomy has long had the problem of measuring the radiation from stars and planets. This has been accomplished by utilizing the heating effect of those bodies. Until the advent of the thermocouple, a radiometer was used; but the radiation could not actually be measured by this method. About twenty years ago a successful attack on the problem was made through the use of the vacuum thermocouple. The instruments used today are extremely interesting, delicate pieces of apparatus.

The construction and use of one of these is described by Dr. Edison Pettit in a recent address. "To be sufficiently sensitive their (thermocouples') masses must be of the order of one thousandth that of a drop of water. The parts are laid under a microscope and welded with an electric needle."

When these vacuum thermocouples first came into use it took six months to complete one of the delicate instruments. They can be calibrated from known stars, and then when turned on a star of unknown radiating power, this unknown may be determined.

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Prosperity

Most people will agree that we have at last turned Mr. Hoover's much talked of corner. We are on the upgrade. The upward swing of the cycle has replaced the downward path, and we are once again on the way to the peak. This peak must be one with firm ground beneath it, not like that peak of eight years ago when the poor foundation of a pseudo-prosperity was the money-mad desire of the middle class American. And in this era, as for the past century and a half of the nation's life, it is this middle class that is the heartblood of the United States.

The problem now is to profit by the lessons of this recent depression, to educate the people economically that they may fully realize the depths to which we sank, and not, in the warmth of the sun of these happier times, forget the bitterness of the days just past. The thing that has been responsible for this come back has been, of course, the perseverance and courage of the American people, from which something should have been learned.

What happens when we do get to that goal of prosperity will again depend upon the reaction of the American people. During the depression some of the people acquired the false notion that somebody, usually the government, owed them something. This idea must be eliminated from their minds if we are to have permanent stability. The people of the United States must stand by themselves, as they have in the past, for if they lean on the government there will be no advance.

The Unlisted Course

In selecting a college you examined the catalogues to find which school offered the courses you desired. But every higher institution of learning offers a course not listed in its catalogue, which is nevertheless the most valuable one they offer. It will be applied every day of your life but is often unstudied and neglected.

College years can be the most productive ones of your life, because of the opportunities for fundamental enlightenment. This does not mean all knowledge should be of a "bookish" nature. In college you should learn the art of association with your fellow men. This is one of the most valuable assets a man can possess for advancement.

Prior to entering college you were fairly well protected by paternal influence. Now decisions are your own, and you are forced to make them in your relationship with your fellows. Fraternities, athletics, clubs, classes, and social activities all present opportunities for learning. These experiments must be carried out by the trial and error method, with a good sense of the rightness and balance of things. As they do in your other studies, the results will depend on your own efforts. Carry on your experiments through several outside activities wherein you must learn to respect other people's opinions. Practice estimating people when you meet them, and see how nearly right you are when you know them.

No set of formulas may be presented for the procedures to be followed in these relationships; common sense and a survey of results are your most valuable aids.

If you take this course seriously it will prove the most remunerative one in college.

Safety

In the design of any engineering structure—a motor, a bridge, or an office building—the factor of safety is always of prime importance; its magnitude depends upon the use to which the structure will be put. In laboratory work students must likewise be mindful of the "factor of safety". One of the most frequent causes of accidents is improper use of the equipment, either because of ignorance or carelessness. None of the work at Rose endangers the student who pays attention to his work and uses the equipment properly. At the same time it must be remembered that by nature some of the equipment used every day is potentially death-dealing; it is, therefore, necessary to develop a healthy respect for this equipment. Let us maintain our good record for the safe use of our apparatus.

Far more frequent than injury to a student is injury or possibly destruction of laboratory appartus. The same causes are usually responsible: carelessness and ignorance. Every allowance is made for normal, or even abnormal, depreciation and breakage. A little thought along with common sense is a good guarantee of safety.

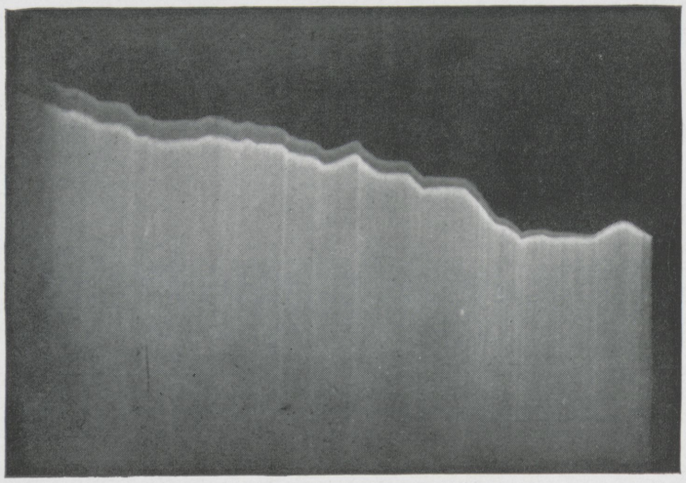
There is a great deal of popular misunderstanding today about courses such as Diesel engineering, aeronautical engineering, radio engineering and air-conditioning. These subjects are divisions of the major fields of mechanical and electrical engineering. The demands of industry and the opinions of experts coincide in favoring broad training in fundamentals rather than specialization. At Rose these specialties are taught as parts of the more important curricula. The Registrar will be glad to discuss these subjects with high school students who are interested.

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

Research and Progress

edited by
L. J. Giacoletto, e., '38



Cut Courtesy General Electric

Man-Made Lightning

At the High Voltage Engineering Laboratory of the General Electric Company, a power of twelve and one-half million kilowatts was recently produced for test purposes. This amount of power is approximately equal to the average output of all utility supply stations. Mr. K. B. McEachron, research engineer, was in charge of the high voltage tests. To obtain the enormous amount of power, a potential of five million volts was generated at a current of 50,000 amperes. This is the highest current ever obtained at such high voltages.

Experiments with man-made lightning led Mr. McEachron to advance a new theory of lightning flashes. His theory was that lightning as found in nature is not an instantaneous flash but rather a union of streamers eminating both from the clouds and from the earth. Thus when the electric charge in the cloud reaches a certain limit, a streamer starts toward the earth. This streamer approaches the earth in a series of jumps. That the earth prepares to receive this stroke was proved by the fact that streamers began to form on the earth's surface when the cloud streamer was still a few hundred feet away. The cloud streamer, traveling with a fractional part of the speed of light, finally connects with one of the earth's streamers. This phenomenon is shown in the cut. The earth's streamers vary from four to eight feet in length.

Mr. McEachron also presented photographs which disproved the general belief that lightning strikes but once in the same place. He showed that lightning struck not only twice but may strike a dozen or more times in the same place and within a few second's time. He also indicated that fires due to lightning are probably the result of a multiple stroke consisting of many successive discharges through the same object.

Dry Ice from the Desert

In previous years the carbon dioxide gas which was a by-product of some manufacturing company was used to make solidified carbon dioxide or dry ice. This manufacturing of dry ice in small quantities was started in many different parts of the country. However, the demand for dry ice has steadily increased. Since it takes an enormous volume of carbon dioxide gas to make a small block of dry ice, a cheap source of the carbon dioxide gas began to be a problem. About three years ago carbon dioxide gas was discovered, unadulterated, a short distance under the surface of the ground near Salton Sea in southern California. This territory is the scene of unexplained geologic phenomena, being well known for its mud geysers and paint pots. Speculators immediately began to find a use for the gas which could be obtained by merely drilling wells in the ground. One company built a small test plant for the manufacturing of dry ice. The venture proved successful and work was begun on a ten ton plant.

There was some uncertainty about the source of power as the nearest power station was four and a half miles away. The company finally decided to build its own power station using a 300 horse power diesel engine to furnish 440 volts to all the machinery. The carbon dioxide gas is first completely dehydrated and then compressed to a pressure of approximately 1,000 lbs. per sq. in. The compressed gas then enters the condensing chamber. Such an enormous amount of heat is liberated in this process that an ammonia compressor must be used to lower the temperature. The gas is then expanded into two 1,200-pound hydraulic presses. This expansion causes the gas to be cooled and thereby solidifying it into a snowlike mass. The presses then press this snowlike substance into the familiar dry ice blocks. When working at maximum capacity each press is capable of turning out 425 pounds of dry ice per hour. While the blocks are being formed in the presses some of the dry ice changes back into carbon dioxide. This gas is not wasted but goes to another compressor and then back to the condenser.

Recently ground was broken for another ten ton dry ice plant. In this case the carbon dioxide gas is to be piped four and a half miles to a convenient location of the plant.

Rolling Alloys to an Infinitesimal Thickness

Recently in the laboratories of the General Electric Company, strips of two metals, Copnic and Chromel, were welded together and then rolled to a thickness of six millionths of an inch. The separation between alloys of the resultant thin strip even when magnified 250 times could only be distinguished by the color difference.

This is the first time that two alloys have been welded together and then reduced to such a thin section by rolling, although gold has been beaten to a thickness of four millionths of an inch, and aluminum has been reduced to 10 millionths of an inch by the same treatment.

To produce a strip of such minute thickness, the welded strip of the two alloys, one an alloy of copper and nickel and the other of chromium and nickel, were placed between pieces of steel. The resultant combination was reduced in thickness by passing it between rollers. The final product is so thin that it must be handled with extreme care.

Cathode-Ray Compass

Airway corporations are always trying to make airplane flying as safe as possible. A prime requisite to safe flying is the ability to fly blind, that is, without the aid of any landmark by which the plane can be oriented. Blind flying is most successfully accomplished by some type of radio-directional guidance.

One of the first methods to indicate on-course flying was the A-N beacon method. In this method the pilot listens with earphones; a continuous tone, interrupted by an occasional identifying signal, denotes that he is on course. If he is to the right of his course he hears a dot and dash or A, and to the left he hears the N or dash and dot. Thus by listening closely to his earphones he can immediately correct for any small change in his true direction. This method did not prove as successful as it might seem. It requires both the constant attention of the pilot and the transmission of special code. It is also difficult to pick up the signal again if once it is accidentally lost.

Another rather elaborate method employed by the Pan American Airways for their Clipper ships utilizes the null type direction finder. In this case a signal is transmitted by the aircraft. This signal is picked up by two separate ground stations. The position of the craft is then calculated and transmitted to the pilot at regular intervals. This method has yielded very accurate results but necessitates an expensive and elaborate setup.

A third method determines the direction toward a certain radio station and also the deviation from that on-course direction. The successful operation of this method depends on properly phasing the signals received by both a loop and a non-directional antenna. This method requires accurate adjustment of the antenna circuit, and therefore requires periodical servicing. Also the pilot has no way of knowing during flight whether his radio compass is functioning properly. Even temperature changes as encountered during normal flight alter the antenna constants sufficiently to destroy the accuracy of the indicator.

A new type of aircraft compass has been invented by Edward J. Hefele. This device utilizes a cathode ray tube to show on-course flight. In tests made recently on this compass the results have been very satisfactory. It has been found that the compass has constant operating characteristics. It was also used in making flights through heavy atmospheric disturbances which would have rendered useless any other type of radio compass.

The chief improvement of the Hefele system is the combining of independently amplified directional and non-directional incoming signals in one indicator, the cathode ray tube. The non-directional and loop antenna are connected through separate amplifiers to the vertical and horizontal plates respectively of the cathode ray tube. The interaction of the non-directional and loop antenna in the cathode ray tube gives Lissajou's figures on the fluorescent screen depending in shape on the phase relation between the two antennas and depending in size on the intensities of the signals received. A straight line image results when both the plate signals are in phase. An ellipse shows misphasing which can be corrected by adjusting condensers in parallel with the loop antenna. If the plane of the loop antenna is perpendicular to the direction from which the incoming signal arrives, there is no horizontal deflection of the cathode ray beam. The resultant pattern is a vertical straight line. If the plane deviates either to the right or to the left, there is a corresponding tilt of the fluorescent line. The angle of tilt depends on the sensitivity of the apparatus and on the amount of deviation from the true path. By glancing at the cathode-ray compass, the pilot can determine both if he is off his course and the amount of deviation.

One important advantage of the cathode-ray compass is that directional readings are independent of the phase relation between the two antennas. Although an out of phase condition produces ellipses on the screen, the axis of the ellipse still gives the direction of flight. Some other advantages of the cathode-ray compass are: (1) It can be used with any type of radio transmission. (2) Any failure of parts is immediately known since the pattern disappears. (3) The pattern is not influenced appreciably by interference from other stations or from heavy electrical storms. (4) It has the same accuracy during night flying although the "night effect" does produce a non-correctable ellipse.

By tuning a station in or near the city to which it is desired to go,

a complete blind flight can be made with the use of the cathode-ray compass since the compass not only indicates direction, but also tells when the plane is directly above the station. The pattern in this case changes to a circle.

Supersonic Vibrations

By a rather unique method Dr. R. W. Wood of Johns Hopkins University has succeeded in producing sound vibrations that have peculiar properties. These vibrations are sound waves vibrating at a high frequency and are known as supersonic or ultrasonic vibrations. To produce these sound waves Dr. Wood used a high frequency electric oscillator. The output of the electric oscillator, 30,000 volts alternating at a frequency of 300,000 cycles per second, is applied to a quartz crystal immersed in an oil bath. The crystal which is caused to vibrate by the alternating electric potential imparts its vibrations to the oil bath, the oil being thrown up to a height of several inches. If a vessel is now touched to the oil, the vessel vibrates at the same frequency as the oil.

The frequency of vibrations is too high to be heard by the human ear. The supersonic vibrations imparted to the vessel can form a colloidal suspension of two liquids such as oil and water which may be contained in the vessel. The vibrations can also be concentrated by a test tube the end of which has been drawn out into a thin thread. If this thin glass rod is touched with the fingers, the skin is burned as though the rod were actually heated. The rod will also char wood if brought in contact with it, and the wood may even commence to burn. By heating the end of the glass rod, reflections of the vibrations are prevented and the energy of the wave remains at the tip.

Sports

edited by
Robert N. Ladson, ch., '39

On January 8, 1937, the Rose Poly basketball team journeyed to Fort Wayne and played Concordia College of that city. This game was unexpected as it was not on the regular schedule, but was scheduled only two days before it was played. Concordia College, rated high in Indiana Conference basketball, combined its talents to win 21-13. The winning margin came as a result of superiority at the foul line. Concordia made five field goals to Rose's four, but collected eleven free throws. Rose Poly was successful on only five free throws.

Concordia used the zone defense, something new to the Engineers, and completely stopped the under-the-basket attack. Most of the Rose shots were taken from out on the floor. This was one of the "off" nights as far as basket accuracy was concerned, and, had the team made even a fair percentage of shots, they would have won. It was heart breaking to see shot after shot roll around the rim and fall off the wrong side. However, the two elongated centers, Duenweg and Colwell, did a nice job of following the shots and showed signs of leading the team to future victory.

On defense, the Rose players showed proficiency and held the high scoring Concordia team to a minimum of shots.

Opening the game with a rush, Concordia scored six points before the Engineers found themselves and connected with two foul shots and a long field goal by Smith. The score at the half stood at 8-4, each team collecting one field goal. In the second half Concordia again scored four points before Rose connected. The game was close until the last few minutes of play when the Rose cagers were overanxious and committed some fouls. After securing a lead the Concordia team stalled the remaining few minutes of the game.

The game was rough throughout, but the officials overlooked many minor offenses, and the game was very interesting as a result. This game was well played both on defense and offense but the superior free-throw making ability of the Concordia team assured their victory. Colwell was the Rose high scorer with five points as a result of a field goal and three free throws, while Captain Wodicka was next with two field goals.

On January 13, 1937, the Rose Engineers, still traveling, journeyed to Renssalaer, Indiana to play St. Joseph's College. This game was originally scheduled for December 19, 1936, but because of snow and impassable roads it was postponed. St. Joseph's won 30-27.

The St. Joseph's team, usually a high scoring team, and still the same kind, managed to get a lead early in the game and by seemingly unusual luck held it. The game was very fast and some remarkable shots were made by each team. The defensive work of Rose Poly was, as usual, very good close under the basket, but outside sniping by the St. Joseph's cagers kept the Engineers behind. Considering the fact that St. Joseph had only been beaten twice, and then only by small scores, the outcome was unusually good for Rose and predicts a bright future for the team.

In the first half, the scoring was fast, and most of it was done by St. Joseph. However, in the last half the Rose team distinctly outplayed them and outscored them.

At one time late in the game Rose pulled within one point of tieing the score, but a last-second basket by a St. Joseph forward made three points difference in the final score.

Up to this point in the season the team has improved with every game, and this game showed the improvement brought out by experience in playing together. The St. Joseph team scored only one more field goal than the Engineers, and that can be accounted for somewhat by the fact that individually the St. Joseph men were faster than the Rose men. Enough foul attempts were missed by the Rose team to safely put the game away. In the last few minutes of the game with only three points separating the teams, Rose missed three consecutive free throws. These, combined with a late basket would probably have won the game, as Rose could have stalled a few seconds at least.

The high scorers were Ladson, Colwell, and Dusza.

On January 15, 1936, the Rose Poly basketball team traveled to Anderson College. Again beset by hard luck the Rose team played very good basketball but lost 38-35. This game was a continuation of the rivalry begun in 1935. Each team won a game last season, and there was considerable spirit stirred up over this conflict. A whole section of the gymnasium was given over to the Pep Club of Anderson, composed mostly of feminine fans. This was an innovation to the Rose cagers, never having played before more than a handful of the fairer sex. Consequently the team put on its scoring togs and scored a large number of points, but proved rather lax on defense because of hurried glances toward the bleachers.

The game started off fast and furiously, and Rose immediately jumped into a lead 12-6 in the first ten minutes of the game. Then the attack suddenly dropped off, and at the half Anderson had forged into a lead of 17-16. Again in the first ten minutes of the second half the scoring by Rose picked up, and the team gained another six point lead. At this point in the game the Rose team again lost their basket eyes, and Anderson jumped into a lead of five points. From then on until the end of the game it was a battle. First one team would make a basket, and the other team would follow suit. Anderson continued to hold the lead and won the game by the three point margin.

As it was in the games last year, Byrd, small Anderson guard was the sparkplug of the attack. His excellent shooting scored a total of thirteen points. He was a very difficult man to guard as he flashed around the court. Continuing the improvement of former games, the team played the best ball of the season. On offense, the team was excellent at times, working the ball in nicely for short shots. Colwell was high man with nine points, and Eckerman was next with eight points.

Campus Activities

edited by

William A. Reddie
ch., '39

Rifle Club

The Rose rifle club has entered a team in the Fifth Corps Area match, and the first stages of the match have been fired, but as yet the results have not been announced. The team has fired in several postal matches during the past few weeks, but as yet has not enjoyed much success against the larger colleges. Some of the freshmen have developed into fairly good shots and have earned themselves positions on the team. Two teams will be entered in the Hearst Trophy Match, although the members of the teams have not been announced as yet. One team has been entered in the Society of American Military Engineers match.

A. I. E. E.

On Thursday, January 21, the Rose branch of the American Institute of Electrical Engineers held a meeting in the physics lecture room at which Dr. B. A. Howlett, head of the department of physics, gave a very interesting lecture on ionization and high voltage phenomena. Dr. Howlett presented several demonstrations to supplement his lecture.

The meeting was the regular monthly meeting of the Rose branch of the A. I. E. E. and was attended by the juniors and seniors in electrical engineering, several members of the faculty, including Professor Clarence C. Knipmeyer, head of the department of electrical engineering, Herman A. Moench, instructor in electrical engineering, Dr. Howlett, and several guests.

Glee Club

The glee club is scheduling concerts beginning the middle of February. The club has formed a double quartet which will do specialty numbers. Interest in the club is running high this year, and the club members practice every Thursday evening at the home of Mr. Clyde Bennett at 1025 South Center Street.

Chemicals Hear Lecture

On Friday night, January 8, there was given at Rose in the chemical lecture room a very interesting lecture by Mr. N. T. Shideler of the Riley Tar and Chemical Company of Indianapolis. Mr. Shideler explained the methods by which many coal tar products are derived, enumerated their various uses, and told of the difficulties that have been met in their manufacture and how some of these had been surmounted. He also described the methods employed at the plant with which he is connected.

The lecture attracted several well known local chemists. These included Dr. J. Martin, Dr. A. W. Campbell, and Dr. L. M. Pruess, all of the Commercial Solvents Corporation; H. L. Comin and Julius W. Ahrens, Rose class of 1912, both of the Indiana Gas and Chemicals Corporation; and John M. Sanford, Rose class of 1915, of the Sanford Laboratory, Terre Haute.

Radio Club

The Radio Club held a meeting at the school on Thursday, January 7, 1937. An announcement was made that Mr. Moench of the electrical engineering department would start a series of code lessons on Monday, January 11, from 6:30 to 7:30 on 1875 kilocycles. These lessons are now in progress. Steve Koos, senior electrical, then explained a series of lantern slides loaned through the courtesy of R. C. A. Radiotron Company which showed the various steps in the manufacturing of radio tubes. A discussion was then held concerning work to be done on the transmitter. A group of men volunteered to come out and work Saturday, January 9.

Several new members were recently welcomed into the club. They were: Carroll, Prewett, MacFarland, Foltz, and McWilliams.

Valley Radio Club

A demonstration and discussion by Herman Moench of the electrical engineering department of Rose was presented Friday evening, January 8, for members of the Wabash Valley Amateur Radio Association. Mr. Moench addressed members of the association in the physics lecture room at the school. His topic was "Proportioning of Coils in Link-Coupled Circuits." Mr. Moench is licensed amateur W9NZH. President Wayne Walters of Jasonville, licensed amateur W9PHV, was in charge of the meeting.

Library Addition at Rose

Shelf space for 5,000 more volumes has been provided in the library at Rose. A superimposed addition at the end of the building has recently been completed. Work on the addition was started several weeks ago. A circular stairway leads from the main library to the new addition.

The Rose library, which ranks as one of the most complete engineering libraries in the middle west, already contains more than 20,000 volumes concerning various phases of engineering.

Junior Prom

John R. Hayes of Indianapolis has been named general chairman for the annual Junior Prom of Rose, to be held early in May. Hayes will direct activities of a general committee composed of the following chairmen: Joseph A. Dillahunt of Sullivan, orchestra; Max L. Stanfield of Robinson, Ill., place and chaperons; Norman G. Wittenbrock, Terre Haute, finance; John E. Whitesell, Terre Haute, decorations and programs, and Jack F. Shake, Terre Haute, publicity. A nationally known orchestra will be engaged for the event.

Debate Club

The following men have been chosen to represent Rose in debating this year: Joseph Dillahunt and Robert Kahn (both members of the debate team last year), James Ducey, Lawrence Giacoletto, Max Eyermann, Vernon Whitehouse, Karl Hessler, Riley Halstead, and David Reifenberg.

The question for debate this year is "Resolved, That the Extension of Consumer Co-Operative Would Contribute to the Public Welfare." The members of the team are diligently preparing material, and meetings are being held every Tuesday night at the University Club. Debates are scheduled with DePauw, Indiana State, Hanover, and Evansville, and the team has entered in a two-day tournament at Manchester College.

Newman Club

Though meetings of the Rose-State Newman Club are usually scheduled for every other Wednesday, meetings were held every week during January with the exception of the week of final examinations. This change was only temporary and was done to stimulate interest in the club and to make up in part for the lack of meetings during the month of December.

During the meeting held Wednesday, January 13, Reverend Father Doyle of the Saint Mary of the Woods' faculty gave a most interesting short talk.

Lawrence Giacoletto, as chairman of a committee appointed to revise the constitution of the club, rewrote it bodily after finding it inadequate in many respects. Most of the changes in the articles of the constitution were made so as to include Rose Poly in what was previously only an Indiana State club.

An informal dance was held at the Deming ballroom, Friday night, February 5. Lowell Tennis and his orchestra furnished the music for the occasion. Two students from Rose headed committees for the dance. They were William Schilling and Lawrence Carroll. Ed Eckerman, James Ducey, and Walter Zehnder assisted on various committees.

Alumni Notes

edited by Norman G. Wittenbrock, ch., '38

Leon J. Willien

Leon J. Willien, who graduated from Rose with the class of 1906 and is operating gas engineer with the Public Utility Engineering and Service Corporation of Chicago, received the Charles A. Munroe Award at the eighteenth annual convention of the American Gas Association held at Atlantic City, in October, 1936.

The award was made for his "rational and consistent research, success and number of applications, generosity of contributions, originality and usefulness to the industry, in the field of advanced processes for manufacturing, mixing and transmitting gas."

Mr. Willien has been honored for his work a number of times before this. In 1928, he received the Beal Medal for contributing the most valuable technical paper presented before the meeting of the Association during the previous year. He has been a member of many technical committees of the A. G. A., and was elected an honorary member of the Pacific Coast Gas Association in 1932 in recognition of the production of a high-B. t. u. gas manufactured with existing equipment, which could be used as a substitute in case the supply of natural gas should fail. This development was voted the most valuable on the Pacific Coast for that year.

The Rose Technic wishes to congratulate Mr. Willien on receiving these high honors.

Edward D. Frohman gives Carnegie Library Collection of Books

Edward D. Frohman, who died recently in India, bequeathed his collection of rare books and first editions, valued at ten thousand dollars, to the Carnegie Library. Mr. Frohman graduated from Rose in 1894.

The donation is the largest and most valuable single collection which the library has ever received. There are 1,724 bound and unbound volumes.

The most valuable book in the collection is Stephen Crane's "The Red Badge of Courage." Other books in the collection are Charles Kingsley's "Water Babies," a first edition of Charles Dickens' "Bleak House," and four volumes of Theodore Roosevelt's "The Winning of the West."

Art Nehf

Art Nehf graduated from Rose in 1914. He first played professional baseball with Terre Haute in the Three I League.

Nehf was one of the greatest money pitchers in baseball history. For six years he was the backbone of the Giants' pitching staff, during which time they either won the pennant or came close to it each year. Whenever the Giants were in a tough spot, Nehf was the man who was sent in to carry them through. The Cardinals, the Cubs, the Pirates, and the Reds always had to work against Nehf in the pinches.

Mr. Nehf left professional baseball after the 1929 season, when he was with the Cubs. He went to Phoenix, Arizona, where he established himself in the insurance business. At the present time he is doing very well in his business.

Obituaries

Mr. Arthur W. Hedges of the class of 1886 died at Clinton, Indiana, on September 23, 1936.

Etna Rector Lawrence, who graduated from the electrical engineering course at Rose in 1911, died January 20, 1937, at Philadelphia, Pennsylvania. At the time of his death Mr. Lawrence was the Senior Housemaster at Girard College at Philadelphia.

Weddings

Mr. Robert Harold Andrew was married to Miss Wilma Winifred Wittenberg of Terre Haute at St. Stephen's Episcopal church in December, 1936. The couple will be at home in Chicago in January. Mr. Andrew graduated from Rose in 1925 and he is now employed as a research chemist by Armour & Company.

Mr. George Ewing Farrington was married to Miss Evelyn Hume of Baltimore, Maryland, on February 5. Mr. Farrington graduated from Rose with the class of 1933. He is now employed by the Wheeling Steel Corporation at Steubenville, Ohio.

Here and There with the Grads

'91 Abe Balsley has returned to Chicago.

'03 H. E. Wiedemann has recently been elected chairman of the St. Louis Section of the American Institute of Chemical Engineers.

'05 J. Edward Daily, with the Youngstown Sheet and Tube Company, has been made manager of the Chicago district.

'08 Frederic H. Deiss, with the Commercial Union Insurance Company, has been transferred from Detroit to Cleveland.

H. Earl Schmidt is president of the Boudreaux Laboratories, Chicago, Illinois.

'09 Richard L. Smith has received his commission as Major in the United States Army.

'23 H. J. McDargh, who is with the Portland Cement Association, has been recently appointed Regional Southeastern Manager of the Association with headquarters in Atlanta, Georgia.

'24 F. Ray Martin has set up his own business as the F. R. Martin Boiler Works at 1430 Ash St., Terre Haute.

'26 Clarence W. Ellis is Product Manager for the Raub Supply Company of Lancaster, Pennsylvania.

'28 Valentine J. Mitch is a patent lawyer in the office of Solon J. Carter, Indianapolis, Indiana.

'29 Theron S. Bell has taken a position with the General Electric Company at Schenectady, New York.

'32 Robert W. Broadhurst is with the United States Gypsum Company at Southard, Oklahoma.

'33 Merrill L. Bradfield, with the Thomas A. Edison, Inc., has been transferred to Washington.

Charles Grogan is enrolled in the October Class of the Army Flying School at Randolph Field, Texas.

Charles B. Sipple is employed by the Wadhams Oil Company at East Chicago.

'34 Noble C. Blair is with the Ray W. Chanaberry Company, Consulting Engineers, of Louisville, Kentucky.

Edward N. Ketchum is with the Fidelity and Guaranty Company of Chicago.

'35 John A. Bradley has a position with the Standard Oil Company at Whiting, Indiana.

E. Ewing Carrico is with the State Inspection Bureau of Memphis, Tennessee.

James H. Hoffman, who received his M.S. from Alabama Polytechnic Institute last June, is employed at the Commercial Solvents Corporation in Terre Haute.

John F. Mayrose is Assistant Engineering Inspector with Loewensohn, Pearson and Solomon, consulting engineers of Kankakee, Illinois.

Harry H. Richardson, who is with the Steel and Tubes, Inc., has been transferred to Detroit.

'36 William R. Creal is with the Wadhams Oil Company at East Chicago.

Hubert Lyon has taken a position with the Owens-Illinois Glass Company in Terre Haute.

John W. Mann is employed by the Wadhams Oil Company at East Chicago.

Births

Mr. and Mrs. Martin Long have announced the birth of a daughter, Sara Linda, on January 13.

FRATERNITY NOTES

MARKS.

Theta Kappa Nu

Indiana Gamma chapter of Theta Kappa Nu wishes to announce the pledging of John F. Kowinski, of Clinton, George M. Paton, Alexander Peters, of Universal, Indiana, and John C. Smith, of West Terre Haute.

Alpha Tau Omega

On Monday, January 4, Indiana Gamma Gamma of Alpha Tau Omega held a joint meeting with the local alumni chapter. The meeting was followed by an informal smoker held at the chapter house. Refreshments were served during the evening.

At the completion of rush week Indiana Gamma Gamma wishes to announce the pledging of Tom Reed of the class of '38 and the following members of the class of '40: John G. Appel, William H. Bradley, of Pittsburgh, Maurice W. Cannon, Robert H. Colwell, Richard P. Davis, James E. Ducey, of Pittsburgh, Otto E. Duenweg, William C. Egloff, of Brazil, Maurice C. Fleming, Adrian R. MacFarland, of La Grange, Illinois, J. Wayne McIntyre, of Brazil, C. Lewis McWilliams, J. Edward Taylor, Paul Temple, and Allen T. Wilson.

Formal pledging ceremony was held for these men on Friday evening, February 5.

Sigma Nu

Beta Upsilon enjoyed a very successful rush season and is pleased to announce the pledging of the following men: Morris S. Stout, Carrol H. Deahl, Ernest J. Palison, Robert G. Brittenbach, David C. Reifenberg, William F. Blair, Allen S. Stewart, Franklin B. Stewart, Max L. Mitchell, Boyd E. Congleton, Carroll H. King, George R. Taylor, Raymond E. Chausse, David M. Huggins, Joe E. Keiser, and Richard A. Mullins. Sigma Nu extends its heartiest greetings to these men.

A dinner was held in honor of the new pledges and was attended by actives, old pledges, and alumni. Several alumni visited the chapter house during rush week and complimented the present members upon the appearance of the house.

Tau Nu Tau

Tau Nu Tau welcomes its new members, who were initiated at sunrise on January 16th after an all night session of drill and examination. The following men were initiated: Kenneth Buis, Richard Dennis, Edward Eckerman, Allen Greenland, John Hayes, Clemens Lundgren, George Neyhouse, Merton Scharenberg, John Weinbrecht, John Whitesell, Norman Wittenbrock and William Wolf.

A dance for the new members will be given February nineteenth at the Elks' ballroom, with Wayne McIntyre's orchestra providing the music.

Theta Xi

After a very successful rush week Kappa of Theta Xi is very pleased to announce the pledging of the following men: Emil G. Christiansen, Sharon, Pennsylvania; Kenneth Curts, Catlin, Indiana; Stanley C. Dusza, Plainfield, New Jersey; Milton M. Hosack, Pittsburgh, Pennsylvania; Maurice W. Johns, Brazil, Indiana; Robert S. King, Mt. Vernon, Indiana; Edward R. Koch, Vincennes, Indiana; James A. Lohr, Linton, Indiana; Bert E. Loy, Paris, Illinois; Joseph S. Robinson, Brazil, Indiana; Vernon E. Whitehouse, Louisville, Kentucky; Clarence A. Wilkinson, Elwood City, Pennsylvania; Walter T. Zehnder, Louisville, Kentucky; all of the class of 1940.

A banquet and dance will be held in the near future in honor of the newly elected pledges.

Humor

edited by

George W. Smith IV

m., '39

After a period of two or three years in the electrical industry, most engineers adopt the following method of procedure when dealing with their wives:

When a woman is sulky and will not speak .....Exciter
If she gets too excited—Controller
If she talks too long..Interrupter
If her way of thinking is not yours ..... Converter
If she wants to be an angel...
.....Transformer
If she wants chocolates....Feeder
If she is a poor cook...Discharger
If she eats too much.....Reducer
If she is wrong.....Rectifier
If she gossips too much.Regulator

—*Tex Croaks*

I have discovered that the flu is both affirmative and negative. Sometimes the eyes have it and sometimes the nose.

"I'm afraid," responded the cashier with part of his eye on the check, "you haven't endorsed it correctly."

"Indeed!"

"No; it's made out to Benjamin H. Pine and you've written just Benjamin Pine."

"But Benjamin Pine is my name."

"Ah, but you don't quite understand me," barked the exasperated cashier. "What I mean to say is you left out the H."

"Oh, so I have," he exclaimed as he took out his pen and wrote: Age, thirty-five.

The following was once fixed to a barbed wire fence some miles outside of San Francisco:

NOTIS

Trespassers will B persecuted to the full extent of 2 mungrel dogs which never was over sochible to strangers & 1 dubble brl shot gun which ain't loded with sofa pillors. Dam if I ain't getting tired of this hell raisin on my place.

—*Tex Croaks*

"I fell down the stairs yesterday with two pints of whiskey."

"Did you spill any of it?"

"No, I kept my mouth shut."

—*Mississippi Mis-A-Sip*

A man from New York was gazing into the depths of the Grand Canyon—"Do you know," said the guide, "it took millions of years for this great canyon to be carved out?"

The man was tremendously impressed. "You don't tell me," he commented. "Why, I didn't know this was a government job."

Carnegie Tech Puppet

"Why is a corset like an ash-cart?"

"Because it goes around gathering up the waste."

—*Lafayette Lyre.*

"For miles and miles we walked without seeing a human face."

"Why, where in the world was that?"

"At a nudist camp."

Temperance lecturer: "And in conclusion, my dear fellow citizens, I will give you a practical demonstration of the evils of the Demon Rum.

"I have two glases here on the table: One is filled with water and the other with whiskey. I will now place an angle worm in the glass of water. See how it lives, squirms, vibrates with the very spark of life."

"Now I will place a worm in the glass of whiskey. See how it curls up, writhes in agony and then dies. Now, young man, what moral do you get from this story?"

Delt: "If you don't want worms, drink whiskey."

The squad of riflemen had been out to rifle range for their first try at marksmanship. They knelt at 250 yards and fired. Not a hit. They moved up to 200 yards. Not a hit. They tried at 100 yards. Not a hit.

"'Tenshun!" Captain Stevenson bawled. "Fixed bayonets! Charge! It's your only chance."

Hot Spell story that we liked is about the girl who went swimming in the raw in a secluded mill pond. Along came a little boy who started to tie knots in her clothes. She flopped around, found an old wash-tub, held it up in front of herself and marched toward the little boy saying, "You little brat, do you know what I'm thinking?"

"Sure," said the little brat. "You think that tub has a bottom in it!"

—*Tex Croaks*

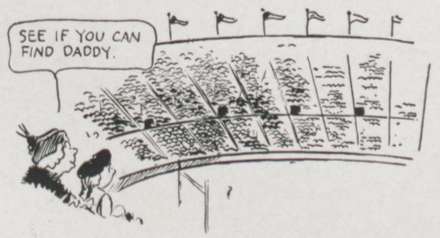
G-E *Campus News*

LOSE A NEEDLE?

Not a needle in a haystack, but perhaps a needle in a rug. During the manufacture of rugs, needles may become broken and embedded in the finished product. Former methods of inspection were tedious and time-wasting, but a new magnetic device indicates the exact location of the steel fragment.

This iron detector, developed in the General Engineering Laboratory of the General Electric Company, consists of a test coil, a motor-generator set, and an amplifier. The rug is passed through the magnetic field twice in directions at right angles. The presence of a broken needle causes a distortion in the magnetic field and consequently an unbalanced voltage in the secondary coil. This unbalance is amplified, and the relays cause signal lights to glow.

Detectors of similar principle have previously been developed for such uses as detecting scrap iron in sugar cane and in scrap cellophane. The General Engineering Laboratory is constantly receiving problems from industrial concerns and is developing equipment or giving suggestions to solve these problems.

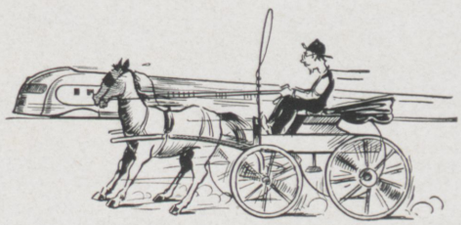


MICROANALYSIS

Two millionths of a gram of material present in a 25-cubic-centimeter sample is almost as inconspicuous as one man in a group composed of the combined populations of New York City, Chicago, and Detroit gathered in one huge stadium, yet the phototube and the recently developed spectrophotometer can accurately determine such microscopic quantities. This detector has been commercially developed in the laboratories of the General Electric Company from the original design by Professor A. C. Hardy of M. I. T.

In medical science, the spectrophotometer should prove very useful. The presence and amount of almost any element which will form a colored compound when combined with some reagent can be determined. In the industrial field, paints have been studied and the effects of heat, light, ultraviolet radiation, humidity, and surface greases have been measured. This has proved a reliable guide to purchase of these materials.

The spectrophotometer is admirably adapted to the study of problems involving colored substances. Its scope extends far beyond chemistry, physics, or industry. In fact, it is in the biological sciences that the instrument will probably find its most important applications.



BY A NOSE

A century ago there was a race between a horse and a locomotive. No such race will be necessary to determine the supremacy of the steam-electric locomotive being built for the Union Pacific Railroad by the General Electric Company. This new unit will get its first trial run on the test tracks at the Erie, Pa., Works early this year.

This new passenger unit will carry a steam-turbine electric generating plant to feed power to the traction motors. The turbine will exhaust through condensers, using the same water over and over with small additions to make up for leakage. A new, highly efficient type of steam boiler has been built, and heavy fuel oil similar to that used in present-day locomotives will be used.

The new unit will be a double-cab locomotive, streamlined, practically smokeless, and provided with power equipment for air-conditioning the trailing passenger cars. It is rated at 5000 horse-power and is capable of hauling 1000-ton trains at a speed of 110 miles an hour. The efficient fuel consumption will allow runs of hundreds of miles at top speed without a stop.

The many desirable constructional features of the modern high-speed electric locomotive will be incorporated in the design as a result of General Electric's many years of experience in building and equipping electric locomotives.

96-353DH

GENERAL ELECTRIC

..one of the first pleasures of 1937

Enjoy Chesterfield

—for the good things smoking can give you