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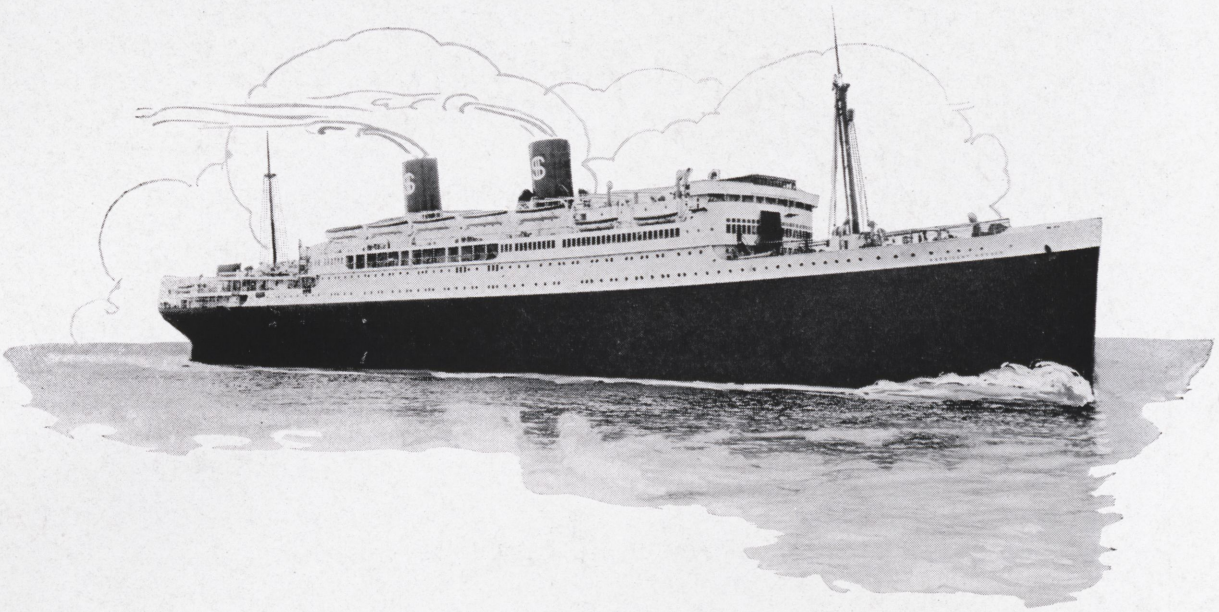

ROSE TECHNIC

Member
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Published by the Students of Rose Polytechnic Institute
Terre Haute, Indiana
APRIL 1932

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From the Editor's Note Book

ON THE cover this month is pictured a new American built ocean liner for service on the Pacific. This sort of modern vessel is largely responsible for the improvement of the U. S. Merchant Marine.

THE OUTGOING and incoming staffs of the *Technic* have worked in conjunction to publish this issue. Those members retiring this month do so with regret; those whose duties are just beginning look forward with anticipation to the work of the coming year.

WE ALL know that the mineral talc is used in the manufacture of talcum powder, but few of us know anything more about it. Mr. J. B. Aikman, a Rose graduate and a high official of the Vermont Talc. Co. has written a highly instructive article on the subject of talc and its production together with non-metallic minerals related to it. While Mr. Aikman is associated with a New England company, he reveals in his writing a world-wide outlook on problems of mineral production.

OF THE methods for measuring the flow of water in definite channels, the use of weirs is probably the most practical. The principles and problems involved in weir construction and the way in which weirs are used are set forth in the paper by C. A. Pratt, '32.

A NOVEL and interesting topic, citrus fruit growing, is the subject of Lester W. Glenn's article in this issue. Mr. Glenn sees in Palestine a future rival of America in the citrus fruit market, since modern methods of cultivation and transportation are rapidly being adopted in the Near East.

THE MANY disadvantages inherent in practically every form of battery on the market have induced engineers to attempt to develop improved types. Chris L. Schultz, '32 describes a new battery, the air-cell "A" type in this issue.

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Number 7

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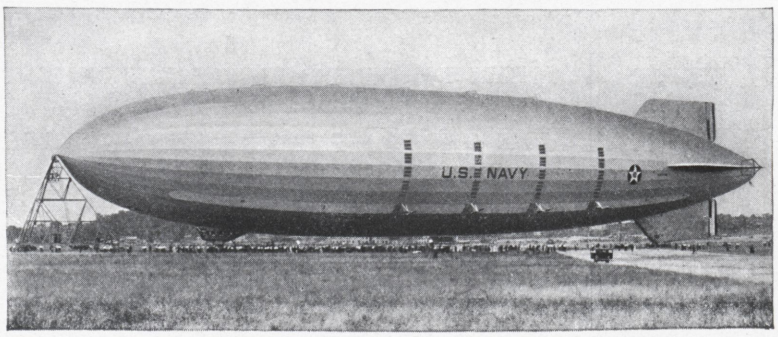
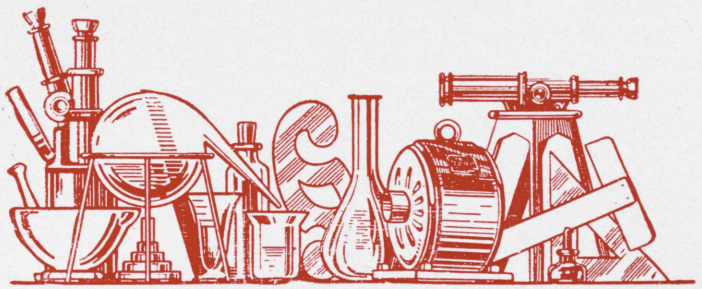


The Airship Akron



THE ROSE TECHNIC

THE TECHNICAL JOURNAL OF THE ROSE POLYTECHNIC INSTITUTE

Volume XLI APRIL 1932 Number 7

Talc and Other Non-Metallic Minerals

J. B. Aikman, '87

WHILE the subject to be treated in detail in this paper is talc and soapstone, it would seem desirable at the outset to discuss at some length nonmetallic minerals in general. This is justified by the fact that there is ample literature covering some of them, yet as to many others it is fragmentary and scattered and therefore not easily available.

Broadly speaking, these include minerals of organic origin used chiefly as fuel, such as coal, petroleum and natural gas; also natural bitumens and hydrocarbons such as asphalt, gilsonite—a particularly lustrous kind of asphalt found in immense quantities in Utah—, elaterite—a dark brown elastic mineral resin found in a soft flexible state—, building stone, limestone and its products, sand and gravel and cement materials.

Uses and properties of the foregoing list of materials are well known and run into great volume. Their production has extended over a long period of time and will not be considered in this article.

★

Mr. Aikman, a member of the third class graduated from Rose, has never lost interest in the Institute. Now, as manager and assistant treasurer of the Vermont Talc Co. of Chester, he contributes this comprehensive article on an important subject—the talc industry.

The Editor

The nonmetallic minerals to be considered are those of commercial importance which are mined and prepared for their own use rather than as sources of metals. Some of them, like, bauxite, have both metallic and nonmetallic applications, but it is the latter with which we will concern ourselves.

For lack of a better term, we may classify those in mind as the minor group to distinguish them from those first mentioned. The following list, means complete, includes perhaps the most important ones: asbestos, barytes, bauxite, bentonite, chalk and whiting, clays and clay products, especially China clay, diatomaceous earth, feldspar, fluorspar, fuller's earth, garnet, graphite, gypsum, magnesite, mica, slate, sulphur, talc and soapstone and pyrophyllite.

While many of these have been used in a limited way for generations or even centuries, their development to the present state of commercial importance has occurred within the last twenty or thirty years. Most of them, like talc and soapstone, must depend on future research for that liberal expansion of applications so essential to their profitable production and use. A few, like asbestos and gypsum, have already reached such dimensions in their outlet that their success in a commercial way has been fully established. With many others the situation is somewhat like that of talc. The uses, while rather extensive in variety, do not run into encouraging tonnage. The future outlook for most of them is promising but will be realized only through patient, long continued, and expensive research. However, when one considers what has been accomplished in this direction since the

opening of the present century and what it means for the natural resources of our country to stimulate such development, surely the laborious effort is both intriguing and encouraging.

A brief explanation of the origin, properties and uses of these minor nonmetallics should prove interesting and informative.

Asbestos is among those more fully developed and its products are familiar to all. The largest producing section in the world is the Thetford, Ontario, district. Some asbestos of acceptable quality is now being produced in Northern Vermont and a little in some other of our States.

Barytes is an inert mineral used in the paint industry and as a filler in rubber and linoleum. It is also used for making lithopone, and in barium chemicals. It comes chiefly from Georgia and Missouri.

Bauxite is used to the extent of 75% in the manufacture of metallic aluminum and the balance in the making of chemicals and abrasives. Arkansas furnishes 90% of our country's supply, with Georgia second in importance.

Chalking and whiting have various uses but the latter term covers a variety of materials. Genuine pure chalk comes mostly from England, where it is known as cliffstone. It is a soft, compact, fine-grained limestone entirely calcium carbonate when pure.

Whiting of best quality is pulverized chalk, and substitutes under the same name consist of ground limestone, marble or dolomite. It is the principal ingredient of putty, which is a mixture of whiting and linseed oil. It is extensively used in the paint industry and also as a filler in other products, especially rubber.

Clays and clay products form such an extensive subject that it can scarcely be treated in this brief paper. They may be described roughly as minerals which, either in the natural state or when finely pulverized, become plastic when mixed with water and will retain the moulded form when dried. When heated to a moderate degree the chemically combined water is driven off, and on cooling, the moulded products become hard like stone.

The wide variety of uses of various clays is generally known and will not be treated here. One of the most important, however, is Kaolin, especially English China clay, which is used in large volumes in paper making and also in the ceramic industries.

Diatomaceous earth is a unique mineral, very porous, with an infinite number of air cells. It is composed of the siliceous remains of minute aquatic organisms known as diatoms. It is a valuable product for insulation against heat and sound and one of the best filtering agencies. It is to be found in many of our States but an acceptable quality comes generally from California and other Pacific Coast States.

Feldspar is widely distributed throughout the United States as well as the world. Over 85% is used in ceramic and glass indus-

tries. It is also valuable as a scouring and cleaning powder. The chemical properties and behavior of feldspar are of first importance. It is probably one of the most hazardous minerals to produce because of this fact and because of the marked variation of such properties often in the same deposit. The largest producing states now are Tennessee and North Carolina, but a liberal tonnage still comes from Maine and New Hampshire.

Fluorspar is a mineral that is indispensable to the steel industry, where 90% of what is produced is used in open hearth steel furnaces. The main source of supply in this country is Southern Illinois and a few countries in Northern Kentucky. Small amounts are said to have been produced in New Hampshire but they are not enough to be of consequence.

Fuller's earth belongs to the clay group and about 85% comes from Florida with smaller amounts from Georgia, Texas and some of the Western States. Its chief value is as a bleaching agent. It has the power to absorb basic colors and remove them from the oils of animal, vegetable and mineral origin.

Garnet is an important mineral for use as an abrasive. It belongs to a hard crystalline group of minerals found mixed with various kinds of igneous rocks. It is easy enough to quarry or mine the rock with which it is mixed but is difficult to grind and still more difficult to separate from the other minerals with which it is associated. The production is not large and as a rule much below demand. It is found chiefly in New England and occurs mostly in mica schist rock.

Gypsum, like asbestos, is one of the nonmetallic minerals that has been developed to immense proportions, and its varied uses are a matter of common knowledge. It is widely distributed, extensive deposits being found in nearly every State as well as in Canada and Mexico, to say nothing of other foreign countries. It has been used for many centuries, even as far back as the time of the building of the pyramids in Egypt where it was employed to a large extent. The largest producing States are New York, Iowa, Michigan and Ohio. It is mainly used for plaster, stucco and similar products.

Graphite is a very soft black greasy-feeling material found in many states. It is from 85% to 90% pure carbon and is mainly used in making crucibles that are subjected to extreme heat. It is also one of the ingredients in foundry facings and lubricants. Smaller portions of it are used in making pencils, paints, stove polish, etc. It is widely distributed, being produced on a commercial scale in many of our states and in numerous foreign countries.

Magnesite is a magnesium carbonate and is the most important refractory agent known. It is used in lining various kinds of furnaces where very high temperatures are required: open hearth steel furnaces, for instance. Austria was by far the greatest pro-

(Continued on page 20)

Weirs for Water Flow Measurement

Clifton A. Pratt, c. e. '32

THE weir is the simplest and most accurate device for measuring exactly the flow of water. In general, it is a notched opening of fixed dimensions and shape made in the upper edge of a vertical wall or bulkhead, through which the water is allowed to flow. The opening is called the weir notch, its bottom edge the crest, and the depth of water passing over the crest the head. The horizontal distances from the ends of the crest to the sides of the weir box are called the end contractions, and the vertical distance from the crest to the floor of the weir box or channel is the bottom contraction, or crest height. If the water approaches the weir notch at a low velocity the weir is said to have complete contractions. To create this condition the banks or sides of the channel upstream from the bulkhead must be at least twice the maximum depth of water on the weir crest from the ends of the weir notch. The bottom of the channel must be lower than the weir crest by at least three times that maximum depth, and the velocity of approach must not exceed 0.3 feet per second.

In order to obtain the best results with the contracted weir, the channel upstream must be large enough to insure adequate stilling of the water. The stilling basin above the weir is called the weir box or weir pond. The sheet of water passing through the notch and falling over the weir is termed the "nappe". If the water surface downstream is far enough below the crest so that air has free access under the nappe, the flow is said to be free; otherwise, it is submerged.

In this article we shall discuss merely the three types of weirs in general use, namely: (1) the rectangular weir, of which the crest is horizontal and the sides vertical; (2) the 90° triangular-notch weir, formed by side slopes which are 45° from the vertical, meeting in a point; (3.) the trapezoidal weir of Cipolletti, which has a level crest and sides which incline outward from the vertical at slopes of 1 unit horizontally to 4 units vertically. If the sides and bottom of the notch of the rectangular weir are far enough removed from the bottom and sides of the resevoir to permit free lateral approach of the water in the plane of the weir, the stream

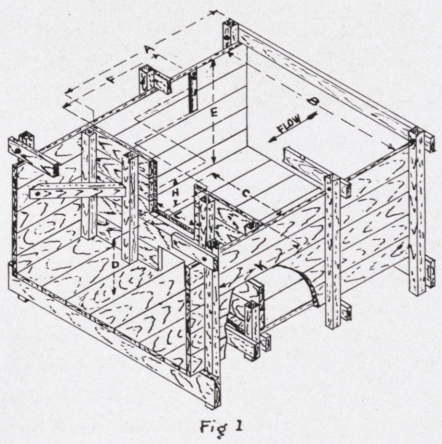


Fig 1

issues from the notch contracted and we have a contracted weir. If, however, the crest extends to the sides of the wall of the channel or reservoir, the end contractions will be suppressed and we have a suppressed weir.

It is of the utmost importance to have the crest and sides of the weir notch straight and the edges not more than one-eighth of an inch thick. If the notch is cut in a wooden bulkhead, it should be cut larger than the required size, using angle-irons one-eighth of an inch thick for the upstream edges as shown in the figure. A head of 0.1 foot over the crest will permit the flow of water to clear the downstream edge of the crest and sides.

In placing the weir box, a straight section in the channel should be chosen and the box set with the floor level in both directions and the sides vertical. The banks and bottom of the channel should be trimmed to conform approximately to the cross section of the box. Provision should be made for the prevention of undermining and washing around the structure. An opening should be provided in the bulkhead at the floor line for cleaning the weir box as shown in the figure. A removable gate or cover must be provided to close the opening when the weir is in operation.

The discharge in cubic feet per second over the weir crest is determined directly by the depth or head (H) in feet, and the length of the crest (L) in feet. Since the water curves downward for a short distance upstream from the crest, the head should be measured above the drawdown which should be not less than four times the maximum head to be run over the crest. A gauge is fastened vertically to the side walls with the zero reading level with the crest of the weir.

To determine the rate of discharge, values of L and H are substituted in the formulae given below in accordance with the type of weir used. Discharge values for heads up to 0.20 foot do not follow the formulae but are taken directly from the calibration curve.

RECTANGULAR WEIR

$$Q = 3.247\ L\ H^{2.48} \left\{ \frac{1 + 2L L^{1.8}}{0.566\ L^{1.8}} \right\} H^{1.9}$$

$$Q = 3.247\ L\ H^{1.48} \left\{ \frac{0.566\ L^{1.8}}{1 + 2L^{1.8}} \right\} H^{149}$$

90° TRIANGULAR NOTCH WEIR

$$Q = 2.49\ H^{2.48}$$

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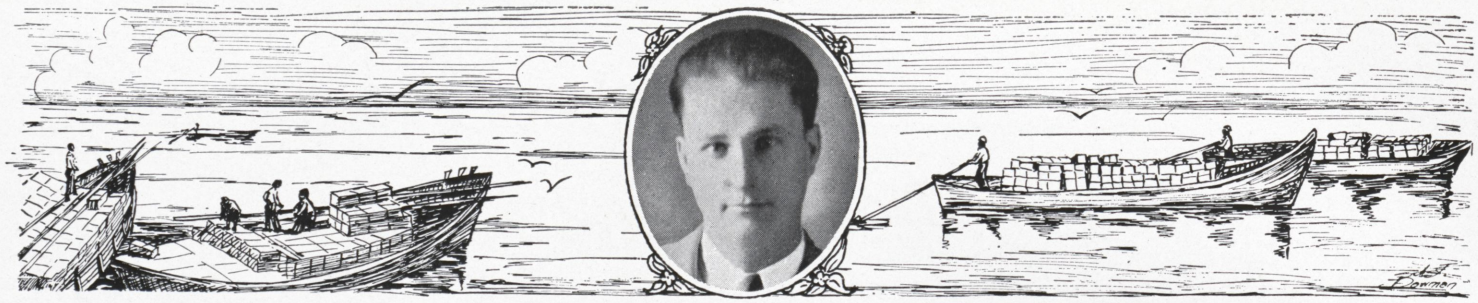


The Citrus Fruit Industry in Palestine

Lester W. Glenn, '25

THE CITRUS industry in Palestine is growing by leaps and bounds and the more optimistic of those who should know, expect a half million case increase per year for the next eight years. At that rate the exports for the 1938-1939 season will amount to nearly seven million cases.

The Palestine or Jaffa Orange is superior to the Florida and California orange, with a large amount of juice of excellent flavor, a loose, easily removed skin, and never over two or three seeds, if any. Because of cheap labor it can be marketed at a lower price than our own fruit and still show a greater profit.

Difficulties of a Near East Grower

However, the life of the Palestine grower is no bed of roses. There are many difficulties which must be overcome in order that the Jaffa orange may reach its markets in England and Germany in good condition.

The average shipping time is 16 days or over and transportation is made in non-refrigerated ships, often very poorly ventilated. The transit losses are therefore quite high and have a tendency to give the Jaffa fruit a bad name which only its wonderful quality has been able to overcome.

Because of the extremely close planting of the old groves, spraying is almost or quite impossible. Therefore stem end rot accounts for 8% of the crop in its early stages of maturity. In a test shipment to England in 1927 green mold caused a 6% loss and it is probable that ordinary shipments suffer to a much larger extent. Blue mold is second to green mold in importance, both coming from bruises. The extremely tender skin of the Jaffa orange is very susceptible to bruising by rough handling, and rough handling is at present quite general.

Aside from the picking and packing operations, the Jaffa fruit is subjected to much ill treatment because of the many poor roads, the fact that much of it is transported upon camels and lack of modern harbors and loading devices. Another big item in injury to fruit is the fact that the Jaffa fruit shrinks quickly and this shrinkage is not compensated for by a large bulge pack. The flat pack is used and in from two to four days after packing as tightly as possible with this tender fruit, shrinkage has loosened the pack until it is quite "sloppy." Very little imagination is necessary to picture what takes place inside a case of Jaffas during a Mediterranean storm.

A further difficulty has been the poor pack from the standpoint of appearance. Not only has the appearance suffered by reason of the "Arab" pack in which each fruit is directly above another fruit, but the carrying quality has suffered as well. In the "Arab" pack the fruit is in straight rows in either direction and is not as pleasing to the eye as the staggered arrangement.

The "Arab" Pack

In general the "Arab" or native pack, is made by crews of workers with nine persons to the crew, exclusive of the general labor for carrying fruit and closing and making boxes. Six persons inspect and grade the fruit, picking up and turning each fruit in the hand. Two persons wrap the fruit, using a double twist, that is, a pigtail at each end, and also size it by "hand and eye" sizing, this man must be an expert, indeed. This variation is responsible for much damage from too tight or too loose packs. The packing crews are paid by the season and often their greatest consideration is to "put in" their eight hours a day rather than to pack as much and as well as possible.

Our old friend the Mediterranean Fruit Fly, is a very real personality in all of the Mediterranean countries and no one doubts his presence there. Toward the end of the season, out of seventeen grapefruit, taken at random, and split in half by the writer, five were found infested. Of course, this should not be taken as anything like an average figure.

Because of the long shipment

and shipping conditions, primarily lack of refrigeration, washing is, so far, looked upon with disfavor, so that the fruit reaches the market with a poor appearance as compared with our own pampered product.

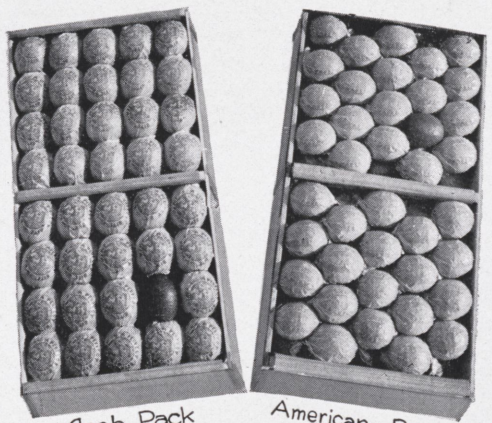
Weather Conditions Unfavorable

The annual rainfall in Palestine is only a fraction of what is needed, so the Jaffa grower must resort to expensive and troublesome electric and Diesel pumping plants. In addition to the lack of rain, there is a peculiar wind storm which blows quite often and causes considerable damage. Two such storms during the past season, caused the season to end on the 15th of March instead of the 15th of April, with a drop in exports from 2,700,000 cases last year to 2,350,000 cases this year in spite of the new groves that have come into bearing.

In the light of the above trials and tribulations it might seem that the Palestinians would give up in despair and, very likely, such would be the case if there were not several compensating factors. Many of the following compensations are due to schools of packing operated by large growers, inspection methods inaugurated by the government and aid rendered through the Jewish National Fund and the Zionists.

While much fruit is damaged by the loading methods in the Jaffa port and by delay in loading during rough weather, it will be only a short time until the harbor at Haifa is completed and loading by lighters at Jaffa will be only a bad memory. When the harbor is opened there, practically all fruit will be shipped by rail to Haifa and loaded by modern methods.

The growers have seen the light and most new groves have been set out and are being set out with much more liberal spacing, allowing for proper spraying and cultivation. The trees are quite a bit smaller than ours but bear heavily, it being generally conceded that the average yield per acre is considerably greater than ours.



Arab Pack American Pack

The soil in Palestine is rich and heavy so that fair fruit is obtainable with no fertilizer other than an occasional light application of animal manure. However, the progressive growers have realized the value of artificial fertilizers and cover crops and are improving their fruit to a great extent. It is also quite possible that the application of the proper fertilizer will toughen the skin of the orange and eliminate the greatest source of loss.

Machinery Introduced

One American firm overcame the difficulties of packing the oval Jaffa orange by machinery and installed a complete modern house for the Pardess Cooperative Society at Rehoboth in February and March, 1931. The outcome of this house appears to be the keystone upon which the fate of machine packing rested and its success seems to the turning point in packing methods.

Every man of importance in the Palestine citrus industry attended a demonstration in the Rehoboth house on March 17th and all agreed that the industry had made the longest stride forward in its entire history.

The improvement in the pack and the perfect sizing of the Jaffa orange will make it compare very well with our own in appearance. The Pardess people have adopted the American pack with the exception of the bulge and it is possible that this will also be adopted next season. This would eliminate a large percentage of loss which has

(Continued on page 25)

THE AIR-CELL "A" BATTERY

Chris L. Schultz e. e. '32

"The air-cell type "A" battery is a high capacity, constant voltage, air-depolarized primary battery". It was developed especially for use with radio receivers using a new series of 2 volt tubes, and although it cannot be recharged, it has proved to be highly practical because of its unusually long life. The details of its construction and operation are described by Mr. Schultz.

The Editor.

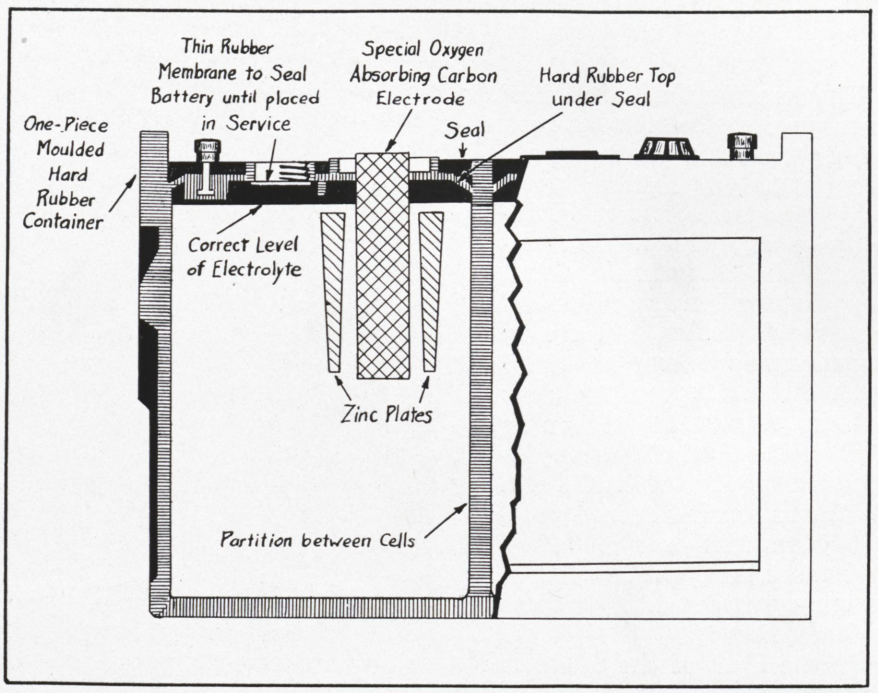


Fig. 1—Constructional view of the air-cell battery.

THE aim of engineers in designing new apparatus for the transformation of energy from one form into another is to make the process as efficient or economical as possible. And this was the aim in the development of the new battery operated radio receiver. Until recently the most economical type of filament supply for radio receivers was the ordinary "dry-cell". However, the use of these batteries has several disadvantages, namely, the life of the batteries is short; the voltage varies greatly throughout the life of the battery, which necessitates a manually operated rheostat, and as a result the tubes very seldom have the correct filament voltage; the tubes with which the batteries are used are noted for their microphonic properties, a decided hindrance to any receiver; and the cost of new batteries is high. The next best source to the "dry-cell" is the storage battery. With this type of filament supply it is important that the battery be kept fully charged, the charging being frequent, as the current drain with the storage battery type tubes is fairly high. In view of the fact that a more economical battery operated receiver should be designed, the manufacturers launched a program in which a new series of tubes and a battery for their filament supply were developed. The new series of tubes are the 2-volt tubes, Types '30, '31, '32, and '33, and the battery is known as the "air-cell" battery.

The air-cell type "A" battery is a high capacity, constant voltage, air-depolarized primary battery having electrical characteristics exactly matching the electrical requirements of the new 2-volt series of tubes. It has a terminal voltage of 2.53 volts when fresh, a maximum current drain of 0.65 amperes, and a capacity of 600 ampere hours. As the air-cell battery is a primary battery, it is not rechargeable. When exhausted it is worthless and must be discarded, but fortunately its low cost and unusually long life make this a painless process. Since it has become the custom to classify battery receivers according to the kind of battery used, "dry-cell battery sets", "storage battery receivers", etc., it is logical and natural that these new receivers should become known as "air-cell" receivers.

It is characteristic of all vacuum tubes that they demand a filament supply of practically constant voltage. The leeway between the upper safe limit above which seriously shortened life occurs, and the lower satisfactory operating limit below which the tube fails to function satisfactory, usually is quite narrow. The familiar forms of primary batteries, such as the dry-cell, are incapable of meeting this exacting demand for constant voltage, being inherently variable voltage devices. Fig. 2 illustrates graphically the wide range through which the voltage of a dry-cell varies during its useful life, and also serves to show the uniformity of the voltage delivered by the air-cell battery. Fig. 3 shows how the essential characteristics of the air-cell battery and the 2-volt tubes have been matched. The voltage delivered to the tubes remains well within the narrow ideal operating range until the battery is practically exhausted.

Construction

The battery consists of two cells assembled in a one-piece moulded container of hard rubber, and permanently connected in series. The dimensions are 13½ inches long, 6¾ inches wide, and 10 inches high over all. In the dry state before activation the weight is about 25 pounds; and when filled with water and ready for service the weight is about 37 pounds. Fig. 1 shows a cut-away view of the air-cell battery.

The electrodes are carbon and zinc in an electrolyte of sodium hydroxide (caustic soda or lye). The battery is manufactured and shipped dry, the electrolyte-forming chemicals being placed in the battery in solid form, and the battery hermetically sealed to prevent the chemicals losing any of their strength through possible contact with moist air. The seals are thin rubber membranes under the filler holes and cellophane seals over the tops of the carbon electrodes which project through the case of the battery. Thus sealed, the battery is inert, no depreciation occurs, and as a result it can be placed in service at the end of an elapsed time after manufacture and still deliver its full quota of 600 ampere hours.

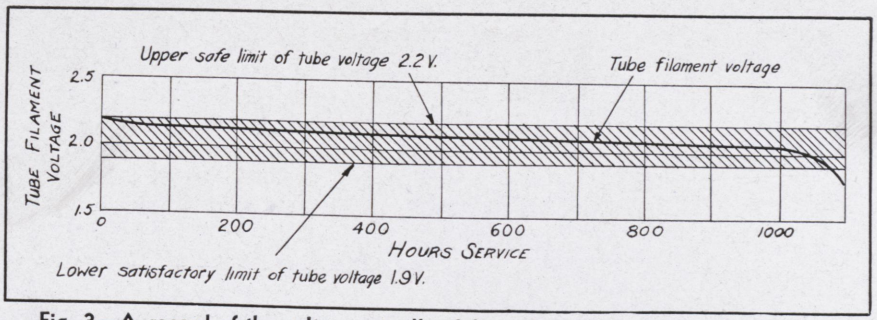


Fig. 3—A record of the voltage actually delivered to the filaments of a 7 tube receiver by the air-cell "A" battery.

Polarization and Depolarization

When current passes through the electrolyte of a battery a part of the electrolyte is dissociated into its constituent elements, one of which is hydrogen. The hydrogen ions travel toward the positive pole of the battery, where, unless promptly removed, they collect as gaseous hydrogen which insulates the electrode from the electrolyte and rapidly reduces the voltage. This action is called polarization. To counteract this undesirable effect, various materials rich in oxygen are introduced into the battery, the oxygen combining with the hydrogen to form harmless water. Some of the depolarizing materials used are potassium bichromate, copper sulphate, copper oxide, lead peroxide, and manganese dioxide. Thus, in order to depolarize batteries it has been necessary to put into them some potassium, chromium, copper, lead or manganese. These elements not only add to the cost of the batteries but also occupy valuable space in them while contributing nothing to their output, but are essential because of the oxygen associated with them. The air we breathe is well suited as a depolarizing material in this case, as it is free and contains 20% oxygen, the desired depolarizer. Air depolarization has the advantage of more ampere hours per dollar of cost and per cubic inch of volume. There is a further advantage, constant voltage, which makes the air-cell battery particularly adapted for radio work.

Air depolarization in the air-cell "A" battery is accomplished by a special form of carbon, used at the positive electrode, which has the unique ability to extract pure oxygen from the air and to make it available within the battery as required. This unusual kind of carbon wants oxygen above all other things, and when exposed to a mixture of gases containing oxygen will load itself with this particular gas and vigorously repel the invasion of any other material seeking admission. Because of this property, the carbon, although extremely light and porous, will remain bone dry, when immersed in the liquid electrolyte of the battery. It forms a perfect check valve, freely admitting oxygen to the interior of the battery, but blocking any flow of electrolyte in the reverse direction.

But—and this is a more important point—should the oxygen content of the carbon become exhausted in any manner, it will then proceed to load itself with the nearest thing, which in this case is the liquid electrolyte. When robbed of its oxygen the carbon will soak up electrolyte just as a lump of sugar soaks up hot coffee, and, like the sugar lump, goes absolutely and thoroughly to pieces; disintegrates, rendering the battery useless. This harmful action will result from over-loading the battery by drawing more current from it than it is able to generate with safety. The demand for oxygen is directly proportional to the current drain and the ability of the carbon electrode to extract oxygen from the air is limited. Consequently, excess current

(Continued on page 25)

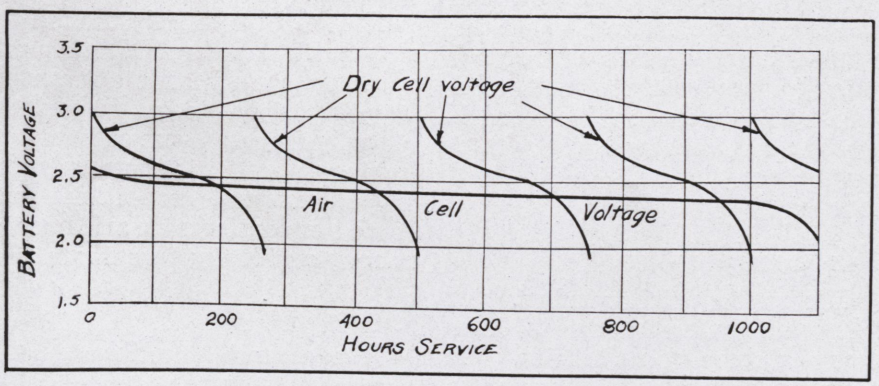


Fig. 2—Comparative voltage characteristics of the air-cell battery and dry-cell batteries used to supply the filaments of a 7 tube 2 volt receiver. Over four dry battery installations, each consisting of 8 standard cells, connected in series parallel, were exhausted in giving service equivalent to that obtainable from one air-cell battery.

Published Monthly by the Students of Rose Polytechnic Institute

The Rose TECHNIC

A Magazine Pertaining to Engineering and Allied Sciences

Member of Engineering College Magazines Associated

THE new rule placing the responsibility for class attendance among the upper tenth of the students on their own shoulders, in other words making it optional, has been in effect since early in the present semester. The idea, which, with some variations, has been adopted in several schools of the country recently, is one of the greatest forward steps in modern education. Responsibility is one of the most important traits in anyone, particularly an engineer, and while this plan will, perhaps, not actually produce such a sense, it at least recognizes it and offers some reward to those possessing it.

To continue elementary school principles in college merely because they are principles is folly. The objective of a college course is mastery of the subject covered in the easiest possible manner, not the cultivation of promptness of arrival at classes and patience in sitting through them during the year. If all students had sufficient will power and ability to take an assigned textbook, follow through it successfully by themselves, and then pass an examination on the material, the professors would be saved considerable energy, the students would save time, and nothing would be sacrificed. Professors would be available to offer help and explanation when needed by individuals, but the entire group would not have to submit to tedious explanations for the slower members.

Of course this plan would not be practicable. Most people require some threat hanging over them to force them to study, such as fear of a quiz, or of being called upon for recitation. Then and only then will they work. Of course, there are many students also who are actually incapable of mastering a subject without assistance.

The plan adopted at Rose strikes a happy medium between the idealistic and the old plans. Students who have proved their ability by past records are allowed to miss classes if they so desire, while those less ambitious or less able are required to attend as before. Thus a material reward is placed on scholarship, and a strong incentive to high grades is offered.

Air Conditioning

The rapidly rising industry of air conditioning seems to have many future possibilities. It seems unbelievable that with the hundreds of inventions that have been made to increase our comfort and pleasures of life practically nothing has been done until recently to control weather conditions.

Dreams and radical plans for controlling weather itself have come and gone, but spending such a large part of our lives in buildings shut away from the open air, we still have been forced to accept low humidity in winter and high humidity and excessive heat in the summer as necessary evils of this planet.

Now much progress is being made with devices which not only simulate outside conditions but vastly improve on them. If their cost can be reduced sufficiently to make them available to the general public their manufacture will certainly become one of our major industries.

It seems very likely that in the near future, during hot and humid weather, our attitude of wanting to get outdoors to get some fresh air will change to one of horror at having to g out into the poorly controlled natural conditions and leave our comfortable and healthy rooms, artifically "weathered."

Post-Mortems

"An examination for the purpose of determining the cause of anything that has just taken place", is the dictionary definition of a post-mortem. The hold-

ing of such examinations, in any except the criminal or legal sense, is often criticised on the grounds that bygones should be bygones. If one does poorly on some piece of work he should forget about it and try harder in the future. If he does well, he should also forget it and keep on trying.

This attitude loses all sight of the value of retrospection and self-analysis. Of course, there is no value in regretting some failure or gloating over a success if that is as far as it goes, but a careful study of the causes for the failure or success cannot help but be a benefit.

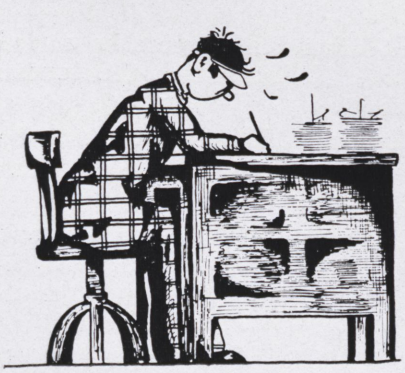
Self-examination is one of the most valuable aids to progress but is the most often neglected and sometimes even feared. It is very difficult for most people to think objectively and critically of themselves, usually due to a perverted sense of vanity. No one likes to admit failure even to himself, but the sooner he learns to do so the more rapid will be his progress.

Post-mortems should not be spurned; they should be practised, not as morbid musings about what is past, but as valuable preparations for what is to come.

Oliver Heaviside

Some of the characteristics of a good engineer are brought out admirably by a brief study of the life and work of Oliver Heaviside, the inventor of operational calculus. Anyone will profit by reading of the development of this very interesting and unorthodox system of mathematics.

Heaviside did not limit himself with previously established mathematical principles. He was far more an engineer than a mathematician; his prime object was



result rather than method. Many times he defied established custom to the horror of the pure scientists, but always ended with results of great value to the engineer. He was guided by "a cultivated intuition and a physical grasp of the problem in hand". Much of his work appeared to be guessing, but if guessing establishes a principle which is born out by subsequent use and experiment, it cannot be criticised.

Much of his work was not generally accepted, and some is still doubtful, but engineers are realizing more and more what a tremendous amount of work he accomplished.

True, he was inclined to become caustic and bitter when referring to his adversaries and was almost as narrow-minded about being "broad-minded" as they were about adhering to accepted principles, but this fault is far outweighed by his more admirable traits. Recognition of his accomplishments, as is so often the case, has been slow, but there is little doubt that in the near future Heaviside will be considered one of the great figures of the engineering world.

The Age of Machines

Are machines causing the downfall of modern civilization? This question is often discussed by philosophers and thinkers and the affirmative answer is often reached. Some go so far as to say that unless the world returns to a pastoral existence and again obtains its living directly from the soil civilization is doomed. These are not all wild alarmists; many serious men are entertaining slightly less radical ideas.

There are certainly many indications that some change must take place soon. Industrial development coupled with selfish motives of employers have produced conditions which cannot continue if we are to continue to advance. Socialism, Communism, and the like are artificial attempts to remedy affairs, not by changing the conditions themselves, but by distributing the burdens and advantages more uniformly.

The correct solution goes back to the old question of education. Civilization is better equipped now than ever before for a Utopian existence in every respect save the human element. All that is lacking is a broader, higher type of intellectuality to take advantage of the opportunities. In this respect we seem to be making little if any progress. Education is becoming more and more universal, to be sure, but true intelligence, or better intellect, is not making any great strides. Proof of this is given in the fact that increased earning power is so much more potent a reason for higher education than the mental and spiritual improvement accompanying it.

Nevertheless, the machine age need not be considered as the brink of ruin. With proper education and mental development it can be one more step in the ever higher growth of the world. We do not need to study agriculture instead of engineering to provide for the future, if, along with the engineering, we study people, ideals, and the higher factors of life. If we continue being narrow and selfish, trying to make more money than others regardless of its effect on them, we may be plowing and sowing again after all.

ALUMNI

Richard K. Toner, ch. '34

IN A LETTER to the Editor, Harold B. Hood, '24, of the firm of Hood & Hahn, Patent Attorneys, tells of a patent which he recently found in his search for another patent on an entirely unrelated subject. To quote from Mr. Hood's letter—"As you undoubtedly know, there has been a great deal of development in quite recent years in the use of light-sensitive cells—the so-called 'electric eye'. Most people are under the impression (as I was) that the light-sensitive cell is something quite new. The patent which I accidently discovered was issued in 1885 upon an application filed on March 17, 1884. The drawing forming a part of the patent shows a register adapted to be actuated by a solenoid in such a manner that each energization of the solenoid will advance the register one step. The solenoid is connected to be controlled by a selenium cell upon which are to be directed the rays from a kerosene lamp. The patentee states that the cell may be set up on one side of a passageway and the lamp on the other side and that, as persons pass between the lamp and the cell, the light rays falling upon the cell from the lamp will be interrupted, whereby the solenoid will be energized to advance the register; with the result that the number of persons passing through the passageway will be automatically counted."

'86 Harry G. Brownell visited Rose to see his nephew, Frank Mansur.

'96 Twenty-eight Electrical and Mechanical Engineers met at an informal gathering on April 26th and 27th 1907 to inspect a special exhibit of electrical apparatus for use in iron and steel plants and to listen to technical discussions covering matters of general interest to the iron and steel industry.

Mr. James Farrington, then Electrical Superintendent of the LaBelle Iron Works at Steubenville, Ohio, suggested the formation of a national organization of the men in charge of the electrical departments of the iron and steel industry, to meet at stated intervals to discuss the subjects of common interest to electrical engineers and superintendents in their industry. Mr. Farrington's suggestion met with the hearty approval of the twenty-seven engineers from the iron and steel industry, who were present at that meeting, and thus the Association for Iron and Steel Electrical Engineers was instituted and formed.

To Mr. James Farrington and the twenty-seven engineers who were present at the meeting the Association owes its present existence. It would have required a good deal of vision and imagination at that time to have been able to predict that the Association would grow and develop into an international organization and that today it would enjoy the prestige and position that it now occupies in international engineering circles.

Mr. Farrington is a graduate of Rose, having graduated in the class of 1896.

—Iron and Steel Engineer

'03 Harry S. Braman is now located at 707 Central Tower Building, Youngstown, Ohio.

'06 Earle S. Butler visited the school, March 24, to see his two sons, Frank and Earle.

Addison W. Lee has been advanced from general superintendent to vice-president in charge of operations at the Louisville Gas and Electric Co., Louisville, Ky.

'08 H. Earl Schmidt is with the Shell Petroleum Corporation as Superintendent of Retail Operations at Chicago.

'15 Joseph S. Gillum, formerly of Terre Haute, recently suffered the loss of his wife, Mrs. Katharyn Ellett Gillum, in New Castle, Pa.

'21 Robert C. Walker is now state agent for the Liverpool, London, and Globe Insurance Co. Ltd., at Indianapolis, Ind.

'24 Robert L. Wolf moved from Mt. Vernon, Ohio, to 1423 Maple Avenue, Terre Haute, Ind.

G. Raymond Fitterer, M. S. Carnegie Tech '27 and Ph. D at the University of Pittsburg has been engaged as a lecturer in the manufacture of iron and steel.

'27 Lee C. Akers of the Northern Indiana Public Service Co., of Hammond, Indiana, recently visited Rose.

William F. A. Hammerling formerly of Public Service Co., of Colorado has taken a position as field service representative with Kelvinator Sales Corp., of Detroit, Mich.

William Hillis recently moved to 2671 Bellevue Ave., Cincinnati, Ohio.

Davis W. Hoffman can now be reached at 903 South 55 St., Philadelphia, Pa.

ex '27 John M. Wilson, and registered civil engineer is running for county surveyor at Terre Haute.

(Continued on page 22)

Campus Activities

Tom H. Batman, ch., '33

THE ROSE Polytechnic Institute was the recipient of the above mysteriously abstruse message from Chicago not long ago. Ye Editor, on scanning its contents, felt his long nose quiver and tremble with expectancy. This untoward activity of the probscis is an absolute unequivocal indication of news. And news is to a journalist what an unsolved problem is to an engineer. When an engineer sees something he doesn't understand, he immediately tries to find out its be all and end all.

The true spirit of the engineer is made manifest in the recent Bluebeard case which has occupied such a large portion of our newspaper front-pages. This modern Bluebeard, named Porter, I believe was to be hanged for the murder of several women and a few children. Before he degenerated, he was an engineer.

At the sight of the gallows, some criminals have been known to break down and weep like children. Some alchemy effected by the sight of that barren, uncompromising symbol of man-made justice penetrates the most hardened exteriors with devasting results. Consequently, wardens are scrupulously careful until the last minute to keep the condemned away from the gruesome sight of the gray, grim gallows. Not so Mr. Bluebeard. He himself broached the subject of his hanging. He said, in referring to the gallows, "How does that thing work?" He was an engineer to the last.

In view of these facts, it is not hard to understand the uproar and commotion caused by the receipt of this telegram at an engineering school. Immediately on its advent, it was posted on the bulletin board. Word passed from student to student like wild-fire. "The world's coming to an end!" became the password. Students clustered in the halls discussing its significance, portent, and truth. Members of the faculty read, looked wise, but offered no comments.

C152 50 8 Extra-F1 Chicago, Ill. 24 11074
Rose Polyticetric Institute
Terre Haute, Indiana

You have almost reached the stage in radio amplication that will turn our planet back into its original state a ball of fire see Leonard Crow for a consultation in the laws of vibration and sound he knows my word is true=

EARL K. SHOULTZ
Your redeemer and commander in chief of sound.

Not often does there come to a Campus Activities Editor such an opportunity; the chance appears out of the void not only for a plump morsel of news, but also for an interpretation of this message into a fitting philosophy as the theme of the Editor's swan song. For this is my swan song, my last taste of the manna of journalism. Let us therefore attack this missive with a will, and see what it contains.

It will be noticed that there are three mistakes in the cable. The meaning of "Politicetric" is unmistakable; there may be some doubt as to the intended meaning of the other two misspelled words. Let us assume "amplification" and "consultation" to be correct.

We all know how radio has been developed to a most remarkable degree in the past few years, and we no longer are amazed at new applications of radio to industry, science, and even philosophies of life. Consequently, only a mild surprise is occasioned when radio amplification is offered as a means of getting our good old planet back into its original state, that of a ball of fire.

Now the human mind is a peculiar thing. (Trite, but trite true.) Any telegram, by the mere fact of its being a telegram, assumes an entirely disproportionate importance in the human mind. A message which would otherwise be discounted as foolish, futile, or preposterous, would, if received by way of a telegraph system, immediately become a thing of conjecture, a thing of greatest import.

Then, too, the cable is ended with words of certitude: "He knows my word is true." A truly convincing finale. Can Mr. Shoultz be correct in his statement? This is the question which serious-minded Rose students are asking themselves. They are considerably upset by this fiendish letter seemingly calculated to muddle brains tired by exams, experiments and other responsibilities. I believe that I can state without fear of contradiction that a great

(Continued on page 23)

SPORTS

Harry H. Richardson, '35

Spring Sports

THERE will be plenty of fun for everyone on the Rose campus this spring. Coach Brown has planned tennis tournaments between the different departments to settle the always debatable question: of which department is the best. There will also be a singles tournament to decide the championship of the College.

The baseball teams of the department will soon be going strong. There are some good ball players in school this year, and the competition in both leagues will be stiff at all times.

After the ground has set, spring football will take form and most any night now the boys will be found on the football field instead of at Gillis's. The object of spring football is to get the fellows interested in their old love, the gridiron. Coach Brown will preach upon the subject, "Get your man before he gets you" which is nothing but the truth. Phil Brown has the knack of building a good team out of almost nothing; however, he must get the men into shape for if one fellow is injured, the whole season might be ruined. Rose would like to see more fellows out for the team. With the smallest squads in the history of the school, Rose has been able to produce her best teams. Come out fellows, and let's have a real team! "Remember we play NORMAL?"

The Test of a Real Man

The test of a man is the fight he makes,
The grit that he daily shows,
The way he stands on his feet and takes
Fate's numerous bumps and blows,
A coward can smite when there's naught to fear,
When nothing his progress bars,
But it takes a man to stand up and cheer
When some other fellow stars.
It isn't the victory after all
But the fight that a fellow makes,
The man who, driven against the wall,
Still stands erect and takes
The blows of fate with his head held high
Bleeding and bruised and pale,
Is the man who'll win, in the bye and bye,
For he isn't afraid to fail.
It's the bumps you get and the jolts you get
And the shocks your courage stands
The hours of sorrow and vain regret
The prize that escapes your hands
That test your mettle and prove your worth.
It isn't the blows you deal,
But the blows that you take on this good old earth
That shows if your stuff is real.

—*Author Unknown*

State Beats Rose in Final Game of Season

Rose finished its season at the State Gym by dropping the game 37 to 21. Yet Rose gained a moral victory by the fight she put up. It can never be said that Rose lacks fight for that is one thing the ENGINEERS are proud of; any player lacking that quality does not stay on the team long. The Rose men broke up pass after pass but were not able to hit the hoop with their hard earned floor work. State's team was not so classy, but due to some freak shooting on the part of Chestnut they were able to roll up the score.

The whole Rose band were good, and it can not be said that any one was better than the rest.

Summary:

STATE—(37)	F.G.	F.T.	P.F.
McCallum, f	0	0	1
Spence, f	1	0	0
Pierson, f	1	1	0
Blubaum, f	3	0	3
Chestnut, c	8	5	3
Tarpin, c	0	0	0
Dowden, g	2	1	0
Untilis, g	0	0	0
Stirling, g	0	0	3
Booty, g	0	0	3
Totals	15	7	13

ROSE—(21)	F.G.	F.T.	P.F.
Sawyers, f (c)	1	3	2
Gillette, f	0	0	0
Morrison, f	0	0	4
Pratt, f	0	0	1
Hess, c	4	0	1
Richardson, g	0	2	0
Griffith, g	2	2	3
Totals	7	7	11

Officials—Referee, Goldsberry; umpire, Jensen.

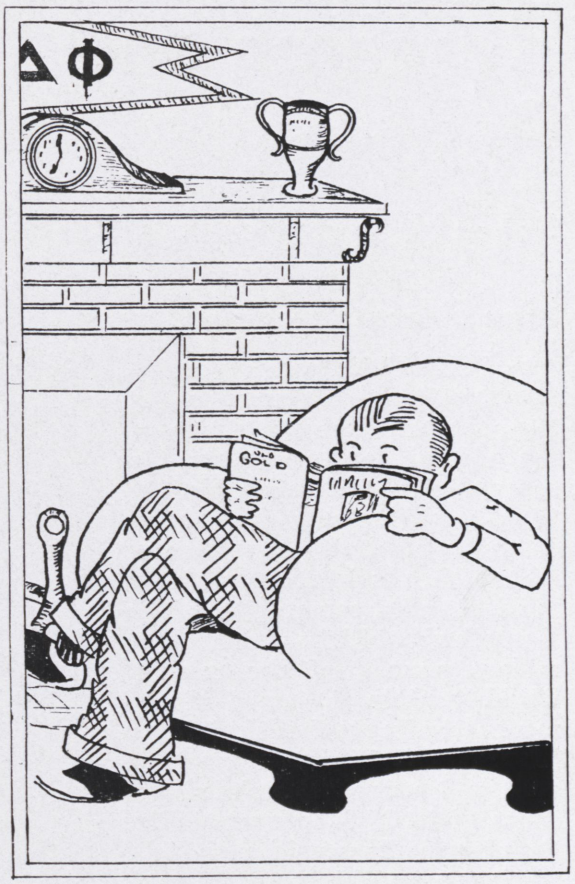
Rose Wins Over Anderson

Rose grabbed an early lead and coasted to a 45 to 22 victory over the Anderson netmen in a loosely played basketball game at Anderson.

Hess, Rose center, carried off scoring honors with a total of 15

(Continued on page 22)

Fraternities



Alpha Tau Omega

At the end of basketball season Gamma Gamma found six of her men with letter awards, including one manager. Those men to receive letters were Captain Sawyers, Pratt, Gillett, Morrison, and Hess of the squad, and senior manager Hineline. Gamma Gamma is proud of the showing these men made during the past season. The work of McGurk and Wiles as assistant managers has also been commendable.

A number of Gamma Gammas attended the Alpha Tau state dance held in the Hotel Antlers, Indianapolis, Saturday, March 12. The dance was preceded by a banquet in the afternoon. Music was furnished by the Woodstock Country Club Orchestra.

Sigma Nu

Beta Upsilon of Sigma Nu is proud to announce the formal initiation on the afternoon of Sunday, March 13 of the following men: Earle B. Butler of Bogota, N. J., E. P. Ervin and Edmund C. Horst of Indianapolis, Ind., Jay F. Hall and Harry F. Richardson of Cleveland Heights, Ohio, Joseph H. DeWitt and Edmundson Carrico of Louisville, Ky., and Herman B. Taylor, Byrne Terhorst and John R. Burget all of Terre Haute, Ind.

And now these men proudly wearing the star of Sigma Nu are getting into the swing of the work along with the rest of the chapter on the all-important mid-term exams and the Rose Show.

Theta Xi

Loud and gaudy attire cast a whirlwind of gayety about the Chapter House on the evening of March 19, when Theta Xi broke the calm sea of society with their annual Bowery Ball. It was given in honor of the new Pledge Brothers.

Brother Fred Reed and his social committee displayed signs of unsuspected ingenuity with the decorations. All windows and doors were covered, the front door being fitted with a "peep hole" in order to survey all comers before admitting them. A bar room that enthralled all the merry-makers was placed in the basement, where near beer and pretzels were served over candle-lit tables while a radio on the bar added a finishing touch. Pictures and signs were everywhere; lights were low and colored.

A blue print program of unique design announced that H. C. Gray and Harve N. Chinn of the faculty had been dubbed "bouncers' for the evening. They were assisted by their wives in this stupendous task.

The affair was very well attended by the active Brothers, Alumni, Pledges and many guests, all of whom enjoyed the evening immensely.

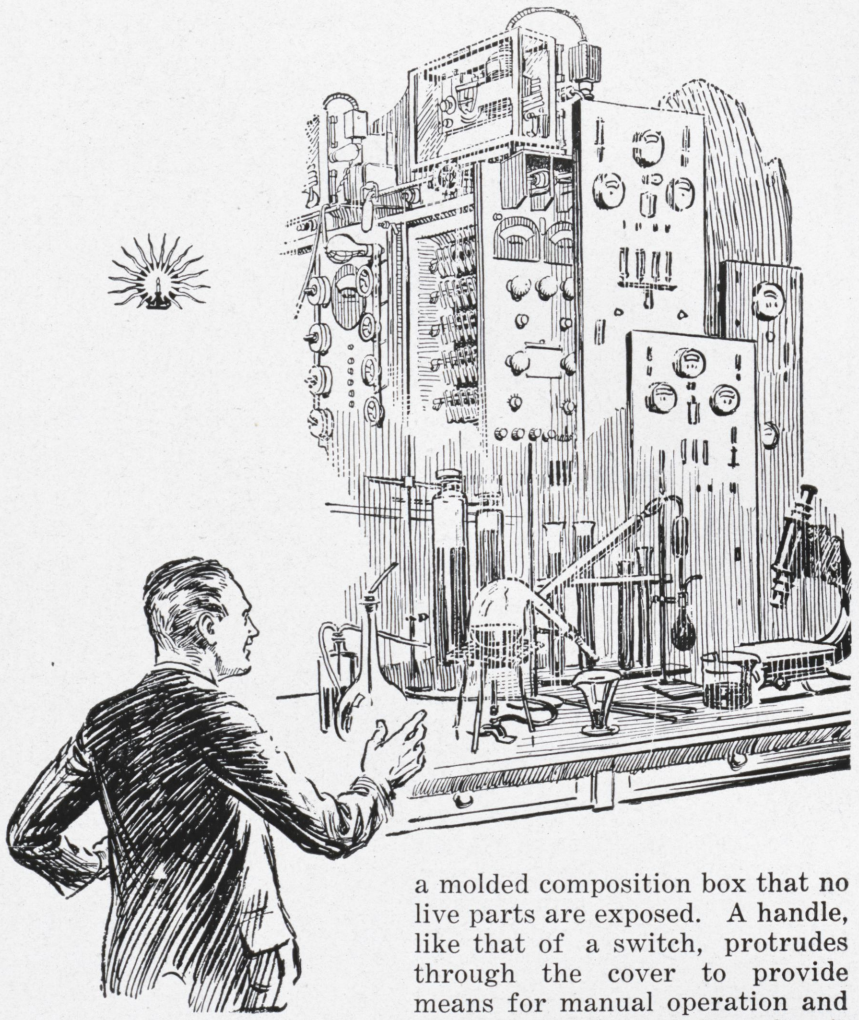
We are happy to announce Brother Norris Engman's election to Tau Beta Pi, and hope he will now exert his utmost efforts toward rushing his less fortunate Brothers.

Word has been received that Brother Carson Harpold passed away in Newark, N. J., March 19. Carson is well remembered by many of the active Brothers, and his loss will be keenly felt by the Chapter.

At a sunrise initiation on the morning of February 27, Brothers Carter, Engman, Withers, Weinbrecht and Pledge Brother Dalrymple were initiated into Tau Nu Tau, an honorary engineering military fraternity. Theta Xi now has about one third of the members of this organization.

Research and Progress

Robert H. Swoboda, ch. e. '33



New Element Discovered

RECENTLY Dr. Jacob Papish, professor of spectroscopy, Cornell University, Ithaca, N. Y., announced the discovery of the element No. 87, thereby leaving only element No. 85 unidentified. The new element is found in a lustrous, velvet-black mineral called samarskite, which is worth about $2.00 a pound. Two million pounds of the mineral would contain 1 pound of element according to the calculations. Element No. 87 is an insoluble solid and cannot be isolated because of its high inflammability. It is unusually sensitive to light and because of this it may have interesting possibilities for use in connection with photoelectric tubes and the like.

—*Machine Design.*

Hot Cathode Sodium Vapor Lamp

A positive column, hot cathode sodium vapor lamp, demonstrated for the first time in this country during the January Science Forum of the New York Electrical Society, has recently been developed in Germany by Dr. M. Pirani, Director of Research, the Osram Company, Berlin. It is the most efficient light source yet developed; it has an efficiency of 70 percent, which is three to four times as efficient as neon light and gives six times as much light for the same current as the 40-watt tungsten lamp.

The increased efficiency of the sodium vapor lamp is due to the fact that practically all the radiation from the element sodium falls very nearly in that part of the spectrum which is most sensitive to the eye. Thus, 70 percent of the electric energy passed through the vaporized sodium is converted into light.

For circuit protection in building homes, industrial plants, mines—in fact, wherever electricity is used—a safe, flashless device has been developed to perform the function heretofore left to carbon circuit breakers or fuses.

A number of advantages over fuses and carbon circuit breakers are claimed for this new breaker: unlike a fuse it has nothing to be replaced or renewed, it can be reclosed by anyone as quickly and easily as a switch, it cannot be held closed against an abnormal overload or short circuit, nor can it be blocked to prevent opening the circuit; its rating cannot be changed by unauthorized persons; it has a time lag preventing unnecessary tripping on slight, momentary overloads.

The recently developed breaker requires only about 70% as much mounting space as a carbon breaker. Unlike the latter, it opens a short circuit without flash or undue noise.

The mechanism is so enclosed in a molded composition box that no live parts are exposed. A handle, like that of a switch, protrudes through the cover to provide means for manual operation and for reclosing the breaker after it has been tripped, but the remainder of the device is entirely enclosed.

The operating mechanism is arranged to provide quick make and quick break. The contacts, which are trip free of the handle, are held in the closed position by a toggle composed of two sets of links, one of which is fulcrumed to the contact mechanism, and the other on a cradle beam pivoted on the frame at one end and latched to the trip mechanism on the other end. The trip mechanism consists of a bimetal thermal unit calibrated to trip at 125% over load. On breakers of 50 amperes or more an additional trip of the magnetic type trips the breaker instantly on short circuits.

Upon being released by the trip mechanism, the cradle beam moves, permitting the toggle linkage to break and the contacts to open at high speed.

When the contacts open, the arc is drawn through a series of small parallel plates one-sixteenth of an

(Continued on page 23)

Industry takes a hint from the kitchen

The domestic art of baking is closely paralleled in telephone manufacture at Western Electric, where plastic molding is an exact science.

Telephone bell boxes, for instance, are no longer formed of metal. They are molded from a phenol plastic compound—containing carbolic acid, formaldehyde and other ingredients—because Western Electric manufacturing engineers saw the way to make a better product at lower cost. These men developed a new and exceptionally efficient type of plastic molding press—and determined precisely how long to bake the mixture and the exact temperature to use.

In quickly taking advantage of the new art of plastic molding, Bell System engineers once more showed that they have the kind of imagination that keeps American industry forging ahead.

BELL SYSTEM

A NATION-WIDE SYSTEM OF INTER-CONNECTING TELEPHONES

Talc and Other Non-Metallic Minerals

(Continued from page 6)

ducing country before the world war. Since then, more deposits have been developed in the States of Washington, California, and Nevada. United States consumes more than half the world's supply.

Mica is a useful mineral of which there are three kinds of commercial grades, the chief being muscovite which is produced in sheets and also in powder. The chief source of the highest grade of sheet mica is India. It is almost indispensable for certain electrical purposes, especially in sheets and punched or circular shapes. Ground mica has various uses, the largest being for the surfacing of prepared roofings. New Hampshire continued as the greatest producing State of mica from 1803 until 1868, when extensive deposits were developed in North Carolina.

Slate is another of the larger nonmetallic industries concerning which everybody is well informed. For many years it was quarried chiefly for use in roofing slate and school slates, but in later years its uses have been greatly extended in the finely ground state. The greatest quantities of satisfactory slate have always come from Pennsylvania, Vermont and Eastern New York.

Sulphur

Sulphur (also known as brimstone) is simply elemental sulphur (S). The largest deposits are in sedimentary accumulations combined with gypsum and limestone, with hydrocarbons, carbonates and sulphates. The United States now furnishes over 75% of the world's supply which comes chiefly from Louisiana and Texas. Three companies operating in these States have a daily capacity of about 9,000 tons. Prior to 1903, very little was produced in this country. It is mined from deposits 1000 ft. or more in depth by unusual processes involving the use of hot water and compressed air. Next to the United States, the largest producing countries are Sicily and Japan.

It is used as a source of supply for sulphur dioxide required in the sulphite process of wood pulp manufacture. It is likewise used in the manufacture of sulphuric acid, as a fertilizer, in insecticides and, to some extent, in the rubber industry.

Bentonite is a greenish-yellow, very plastic clay-like mineral, highly absorbent. When mixed with water it will absorb more than three times its weight and from seven to nine times its volume. Its production is not a large industry but an important one. The mineral is used in the manufacture of medical dressings, as a facial or beauty clay, as a retarder in making gypsum wall plaster, as an ingredient in soap making, and in many other small ways. Its chief sources of supply are the states of Wyoming, California, and South Dakota.

Silicates

Tripoli is a form of silica (SiO_2). There are two distinct kinds of this mineral, one known as the Missouri-Oklahoma type and the other as the Illinois-Tennessee type. The first is an extremely porous, light weight material, quite soft so it can be cut with the finger nail and easily crushed between the fingers, but the fine grains are so hard that they will scratch steel. It is quite absorbent and will take up one-third of its weight of water in five minutes.

The Illinois-Tennessee type is much harder, cannot be crushed with the fingers, nor cut with a knife without difficulty, and is only slightly absorbent. It is used mainly in the manufacture of foundry facings and liberally as a washing powder. It is also a valuable filtering agency, and a desirable ingredient in certain kinds of paints. As above indicated, the chief producing states are Missouri, Oklahoma, Illinois, and Tennessee.

Pyrophyllite is a hydrous aluminum silicate which chemically seems quite different from talc, the latter being a hydrous magnesium silicate. Despite this fact, the physical properties of the two are so nearly identical that they are used for practically the same purposes and hence this material is ordinarily mined, prepared, and marketed as talc. The chief source of supply is North Carolina.

So much for a brief explanation of the leading nonmetallic minerals other than talc and soapstone which we will now consider somewhat more fully because the writer is engaged in the production of talc and naturally is in better position to discuss it than the others.

Standards of Purity

Like all nonmetallic minerals it is customary to compare the natural with the theoretically pure mineral. Therefore the formulae for theoretically pure materials have been devised as a standard with which to compare what nature furnishes.

Soapstone is usually associated with talc and most reports of one involve the other. As a matter of fact soapstone is talc except that it is much more impure than the mineral described as talc. Moreover, it usually comes in a more stratified form and the method of reclaiming it is largely that of quarrying in blocks like building stone and marble. In a commercial sense, the relation between them is far apart, because soapstone has in the past chiefly been used in blocks or slabs for various purposes, the waste being abandoned. More recently, however, as these waste piles have increased, producers have installed grinding machinery and reduced the waste to a fine powder which has proved a serious competitor for high grade talc, especially for those uses where its impurities are not a disadvantage.

Theoretically talc is a hydrous metasilicate of magnesium, the complete formula being $H_2Mg_3(SiO_3)_4$. The formula for theoretically pure talc which of course has never been found in nature is silica (SiO_2) 63.5%; magnesia (MgO) 31.7% and chemically combined water (H_2O) 4.8½.

Obviously the nearer a natural talc approaches this formula the purer it is. However, the nearest we have to it in this country is a beautiful talc that comes from the Death Valley region in Southern California near Los Angeles. Be-

cause of its extreme purity it naturally meets favor in the manufacture of complexion powders.

Three Kinds of Talc

In general, talc is classified under three kinds: first, fibrous material like that found in the St. Lawrence County region of Northern New York and usually marketed under the trade names of "Asbestine" or "Agalite"; second, the massive or granular talc, which is more widely distributed throughout the country but is particularly abundant in Vermont; and third, the foliated talc, which is the most beautiful of all, though the hardest to grind. As a rule talc from California belongs to the third class.

The so-called impurities found in talc are Alumnia (Al_2O_3), iron oxides in the form of Fe_2O_3 or FeO, and sometimes lime as calcite ($CaCO_3$). In many cases these chemical combinations in talc are for certain purposes desirable, while in others they are objectionable.

As to volume of production, New York and Vermont far exceed all other States, though, as already mentioned, California in late years has come to be an important source of supply in tonnage and especially in quality. Talc is produced in smaller quantities in Washington, Wisconsin, Virginia, Maryland, New Jersey, Pennsylvania, North Carolina and Georgia. The New York product commands a higher price because of its superior white color but it is inferior when compared to Vermont talc in slip or soapy feeling, which for some purposes is the property urgently required. Virginia is now not only the largest State producing soapstone in blocks, but practically the only one.

Uses of Talc

Though the use of talc for complexion purposes is the one with which most people are familiar, it is from a tonnage standpoint of no great importance, amounting to less than 3% of all talc consumed. The greater consumption goes into paper making, the manufacture of rubber products, as an ingredient in the insulating compound for making insulated wire, one of the materials required for foundry facings and, in the case of New York talc, in the manufacture of paint. In a similar way, talc finds application in perhaps more than one hundred uses but these are of little consequence to producers as few of them are able to take it in carload quantities, and such units of sales are essential to profitable operations.

A marked property of talc is its extremely low coefficient of expansion. Because of this, after baking where the temperature is raised to red heat, or about 1800°, the material becomes hard enough to cut glass, though in the natural state most talcs are soft enough to scratch with the finger nail. In this change of temperature practically no expansion or contraction takes place. Because of this, relatively pure, homogeneous talc, sometimes called lava talc, is fashioned by milling, turning and drilling to the nicety of a thousandth of an inch, while in the soft state, to make fittings for switch boards, gas stoves and other equipment subjected to heat. It is subsequently hardened as above described.

Valuable Properties

Its colloidal and absorptive qualities are those which make it of greatest use in the ground state. Such properties are the basis of its use in paper making, where it exceeds other fillers in retention. Similarly it is indispensable in the rubber industry to prevent rubber compounds sticking to the hot rolls. These qualities also make it more useful than other materials in the insulated wire and cable industry, and for toilet and foot powders, foundry facings, lubricants, twine making and in the preparation of certain chemicals.

The United States is by far the largest consumer and produces around 65% of the total. France supplies about 15%, Italy 8% and the balance comes mainly from Germany, Austria and Canada. Incidentally, it might be stated that the quality of talc from Italy is higher than that from any other country.

At the end of 1930 there were twenty-eight talc producers in the United States as reported by the United States Bureau of Mines. This is far greater than the consumption of such material demands. As evidence of this it may be interesting to note that in only one year since the close of 1913 has the total volume of talc and soapstone business of this country reached three and one-half million dollars. In most years it has been in the neighborhood of two to two and one-half million dollars and at times it has dropped below two million dollars.

The total amount in tonnage produced and sold annually has been in the vicinity of 200,000 tons, with a change now and then of 10,000 tons above or below this figure. Even this would indicate a small average business for each of the twenty-eight producers, but the fact is the actual situation is far worse because more than half the talc and soapstone of the country has always been furnished by not more than half a dozen concerns. Hence the amount left for the remaining eighteen or twenty plants is insignificant.

Since most of the minor nonmetallic industries are comparatively new in their development, the hope of a promising future for all of them, including talc, is justified as new uses of volume are developed through further research.

(Continued on page 22)

Talc

(Continued from Page 21)

Moreover, all continue to suffer in a commercial way from the lack of standardized methods of grading that are recognized and acceptable alike to consumers and producers.

The business of producers of all the minerals herein described is suffering keenly in the present business depression because these minerals are all raw materials with the consumers which are employed in their manufacturing processes. Naturally such products are among the first items to feel the effects of reduced consumption, so the hope of all future commercial success must rest on the same basis as that of all business enterprises in the present trying economic situation.

Alumni

(Continued from page 14)

'28 Frederick J. Franzwa is mechanical engineer with the Delco Products Corporation, a Division of General Motors, at Dayton, Ohio. where he assumed his new duties on the second of April.

Charles E. Graves is now located at R. R. 3, Jasonville, Indiana.

John F. Shaw who was traveling, is now in charge of the Terre Haute Sales Office of the Indiana Consumers Gas and Byproducts Co.

'29 E. Sheldon Johonnott moved from Solon Mills, Ill., to 2128 North Eleventh St., Terre Haute, Ind., last summer.

Emil A. Krockenberger is now residing at 1041 Seventh Ave., Terre Haute, Ind., having migrated from Pittsburgh, Pa.

'30 Kenneth E. Alexander formerly of P. and E. Railroad, Indianapolis, is with the State Highway Department at Vincennes, Ind.

Carson Harpold passed away in Newark, N. J., at the age of 27 years. The body was brought to Terre Haute for burial. He is survived by his parents and a sister.

Jacob Schainblatt has moved from Camden, N. J., to 841 Jackson Ave., Elizabeth, N. J.

'31 James A. Barrett is now working in Indianapolis with the National Malleable Steel Casting Co.

Kenneth Mason adds another representative of Rose at the National Malleable Steel Casting Co.

Lowell L. Ray who has been with General Electric Company at Fort Wayne, Ind., has been transferred to Schenectady, N. Y., where he assumed his new duties on the second of April.

Andrew Spence is entering Chicago University to undertake graduate work.

ex '32 Ewing Farrington is planning entering the University of Pittsburgh next fall.

Sports

(Continued from page 16)

points, while Galke and Ahrendt led the Anderson attack. Three Anderson regulars were ejected from the contest during the second half with four personal fouls.

Summary:

ROSE—(45)	FG.	FT.	P.F.
Sawyers, f	3	2	2
Morrison, f	2	0	3
Batman, f	1	1	1
Pratt, f	0	1	0
Hess, c	6	3	0
R. Richardson, c	1	0	0
H. Richardson, g	3	2	1
Griffith, g	1	0	3
Price, g	0	0	1
Gillett, g	0	1	1
McAninch, g	0	1	1
Totals	17	11	13

ANDERSON—(22)	FG.	F.T.	P.F.
Brize, f	1	0	1
M. Galke, f	3	4	0
Miller, f	0	0	0
Ahrendt, c	2	0	4
Matthew, g	0	0	4
Byrd, g	1	2	4
Schiltz, g	1	0	1
D. Galke, g	0	0	1
Dickson, c	0	0	0
Totals	8	6	15

Referee—Boyer.

The following men were awarded letters in basketball.

Paul Sawyers (Captain)
H. F. Richardson
H. H. Richardson
Edward Griffith
A. G. Morrison
William Hineline (Manager)
T. Batman
Logan Gillett
Clifton Pratt
Arthur Hess
As cheer leader: Tom Stanley.

Campus Activities

(Continued from page 15)

percentage of Rose students expect that such a condition will actually come to pass (especially those men studying under Messrs. Hunter and Moench).

Thus it evolves upon me, the Campus Activities Editor, in this my last editorial, to set those tired minds at rest. I think my readers will agree with me that this is a great responsibility, a mission of utmost importance.

Men of Rose, that message is a gross exaggeration. We may take as our authority on the question Mr. Moench, of "Electronics" fame at Rose. He knows very Moench about the subject. In search of the elusive Cosmic Ray, he has lowered his apparatus into snow-fed Alpine lakes. He has delved into the intricacies of Emily Post's little blue book. His other qualifications are too numerous to mention. When cross-questioned, he admitted reluctantly: I don't think that even an Electrical Engineer could accomplish such a feet." (In all fairness to Mr. Moench, I should add that this statement was made in an unguarded moment at a meeting of Chemical Engineers. He was Moenching cosmic rays at the time.) What more convincing argument can I offer than these words of Mr. Moench? I think none.

So my dream has finally been realized. My presence on this *Technic* staff might conceivably have been predestined solely to slay the dragon of unrest created by this telegram. In my meteoric flight through the skies of engineering journalism I have at least done a bit. I have, by a few strokes of my journalistic sword, vanquished that hideous spectre—a world of fire. That would be hell.

Research and Progress

(Continued from page 18)

inch apart. Between the plates a radial magnetic field is created by a nearby coil. The arc creates another magnetic field which moves the arc into the radial field. The plates absorb so many free ions that the arc is destroyed.

In factories and buildings, this type of circuit breaker replaces fused knife switches, safety switches, and carbon breakers, for motor circuits and general light and power distribution. As a replacement for safety switches it is mounted in a steel enclosure. The case and the operating handle covers are hinged and can be locked to prevent operation by unauthorized persons. A small red indicating lamp shows when the breaker is closed.

The use of such flashless breakers reduces the size of switchboards. A 600-ampere breaker occupies a space 8¼" wide, while a 600-ampere carbon breaker requires a space 22" wide.

The 15 to 50-ampere breakers will be available in 1, 2, and 3 pole combinations, 125 and 250 volts. The 55 to 600 ampere breakers will be available in 2 and 3 pole combinations up to 575 volts.

Weirs

(Continued from page 7)

CIPOLLETTI WEIR

$$Q = 3.247\ L\ H^{1.48}\left\{\frac{0.566\ L^{1.8}}{1+2L^{1.8}}\right\} H^{1.9} - 0.609\ H^{2.5}$$

$$Q = 3.247\ L\ H^{1.98}\left\{\frac{0.566\ L^{1.8}}{1+2L^{1.8}}\right\} H^{1.9} - 0.609\ H^{2.5}$$

L in feet H in feet Q in sec. feet.

Weirs when properly set and maintained are the most accurate means of measuring flowing water but when used in the field they are often unreliable, due to the fact that water passing through earth channels carries more or less sand and sediment which is deposited in the weir box thus destroying the bottom contraction distance and increasing the velocity of the approaching water. At first this is slight, but it increases appreciably as the deposits approach the level of the crest. The notch must be sharp edge, but it must not deteriorate, as this would increase the discharge.

A weir requires sufficient grade and head so that the water downstream will not come up to the crest level; otherwise there would be a decrease in discharge.

TABLE WEIR-BOX DIMENSIONS

(The letters refer to those in figure)

RECTANGULAR AND CIPOLLETTI WEIRS

Discharge	H Maximum head	L Length of weir crest	A Length of box above weir notch	K Length of box below weir notch	B Total width of box	E* Total depth of box	C End of crest	D Crest to bottom	F Gauge distance
Sec.-ft.	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
½ to 3	1.0	1	6	2	5½	3½	2¼	5½	4
2 to 5	1.1	1½	7	3	7	4	3¾	2¼	4½
4 to 8	1.2	2	8	4	8½	4½	3¼	2¾	5
6 to 14	1.3	3	9	5	12	5	4½	3¼	5½
10 to 22	1.5	4	10	6	14	5½	5	3½	6

90° TRIANGULAR-NOTCH WEIR

½ to 2¼	1.00	----	6	2	5	3	2½	1½	4
2 to 4 1/3	1.25	----	6½	8½	6½	3¼	3¼	1½	5

*This distance allows for about 6 inches freeboard above highest water level in weir box.

Humor

Edmund C. Horst, '35

Chemist: Fashions may come and go, but there's always a demand for cosmetics.

Electrical: Yes, women can't go wan forever.

—*Pennsylvania Punch Bowl.*

"How come you let your daughter go out with that traveling salesman?"

"I overheard a college boy say he was going to ask her to the Prom."

—*Brown Jug.*

Popular songs:

The cribber's song: Just a little closer.

The interior decorator's song: Just One More Chintz.

The Wrigley song: When you gum to the end of the day.

—*Selected.*

Junior: "I'm going to quit school."

Senior: "If you do, you will have wasted three years."

Junior: "And if I don't, I'll waste four."

—*Pitt Panther.*

A professor at Dartmouth says that college students are superior in mentality to Mongolian idiots. He didn't specify whether that included engineers or not.

Burglar (to belated assistant): "You're late. I told you 'arf past one."

"Young Burglar: "I forgot the number of the 'ouse and I've had to break into every one on this street." —*Passing Show.*

He: 'He who laughs last laughs best."

She: "Yeah, but he soon gets a reputation for being dumb."

—*Pathfinder.*

Convict: "When I get outta this pen I'm going to have a hot time, aren't you?"

Second of Same: "Don't know, I'm in for life."

Italian Hot Dog Slinger: "Hey, I gotta' da winner.

Race Fan: What's his name

I. H. D. S.: Hot winner wit da mustard on it.

—*Western Reserve Red-Dat*

Mr. Ducrot, what is an outboard motor boat?

Sir, it's a row boat with athlete's phut! —*West Point Pointer*

GREEK LULLABY

Silver spoons from the Court Cafe!
Sleep my little! Sleep my pretty one!
Towels marked Frisco, or Santa Fe!
Dear little—queer little you!
Daddy will come to his babe in the flat,
Four cunning ash-trays concealed in his hat,
All of your trinkets were gathered like that
You're the sweet-heart of Sigma Nu! —*College Humor.*

He: There's a certain reason why I love you.

She: My goodness!

He: Don't be absurd.

—*Lafayette Lyre*

Lecturer: I say again, ladies and gentlemen, we're having too many hasty courtships and whirlwind marriages.

Freshman: Sure it isn't the other way around, prof?

—*Cornell Widow*

"What was that explosion on Si's farm?"

"He fed a chick some *Lay or Bust* feed, and it turned out to be a rooster. —*Black and Blue Jay*

"Honey," she said, "you don't mind if I wear serge instead of georgette, do you?"

"No," he replied, "I'll love you through thick or thin."

—*Minn. Ski-U-Mah*

Famous Last Words: The absent-minded husband returned home from the office, embraced his wife affectionately, and said, "Take a letter."

—*Pennsylvania Triangle*

A Scotch traveling salesman, held up in the Orkney Islands by a bad storm, telegraphed to his firm in Aberdeen: "Marooned here by storm; wire instructions."

The reply came: "Start summer vacation as from yesterday."

—*Pennsylvania Triangle*

A native station master on an East Indian railway had orders not to do anything without authority from the superintendent, which accounts for the following message:

"Superintendent's office, Calcutta: Tiger on platform eating conductor. Wire instructions."

—*Powercrax.*

Citrus Fruit Industry

(Continued from page 9)

been caused from too tight and too loose packs.

Transportation from grove to packing house to port is being improved with the construction of modern roads. Many growers are operating fleets of trucks and dispensing with the slow, jolting camel.

With reference to the prejudice against washing, it may be stated that most of the dirt on Jaffa fruit may be removed by a spiral polisher, as is being done at Rehoboth.

Palestine may be considered by many as one of the backward countries but it must be borne in mind that it is only since the war that progress has been possible. The Palestinians are, on the whole, a progressive people, drawn as they are, from all corners of the earth, and once a new idea has proved itself they are quick to adopt it.

Many acres of grapefruit will be coming into bearing in the next few years although heretofore the grapefruit export has been negligible. From present indications, about the time England and Germany become "grapefruit conscious" as a result of American advertising, Palestine will be in position to reap a very fair return from our efforts. The Jaffa grapefruit, in the writer's opinion, seems to average slightly poorer than Florida fruit but it is possible that with proper cultivation it will surpass our own.

The sum of the entire situation is that very shortly Palestine will be a rival with which the American industry will come into direct and strong competition in European markets and must not be considered too lightly.

The Air-Cell "A" Battery

(Continued from page 11)

drain exhausts the oxygen supply and the carbon will soak electrolyte and the battery will become useless.

The maximum rate at which the carbon can extract oxygen from the air corresponds to a current drain of only 0.65 ampere. Under no circumstances should the battery be subjected to a load in excess of this, as to do so will ruin it. In order to insure the safety of the battery on accidental overload, a fuse should be inserted in the load circuit. This limited output restricts the field of usefulness to the operation of receivers using the 2-volt tubes, whose requirements match the battery characteristics.

Activating the Battery

In order to energize the battery for service, all that is necessary to do is to remove the cellophane cover from the electrodes, so that the depolarizing oxygen can enter, punch out the filler hole membranes and fill both compartments with cold water. Distilled water is not necessary, so that any water suitable for drinking purposes may be used. The capacity of each cell is about three quarts, and being two cells, about six quarts are required for the battery. The solid chemicals go into solution readily without stirring. As they dissolve, the level of the liquid gradually drops, the dissolving process taking about four hours, although the battery is in condition to operate a receiver within an hour after filling. In view of this natural falling of the solution level, it is absolutely necessary that more water be added to the battery, not sooner than four hours after the filling, to bring the solution to the correct level as shown by the indicating wire inside each cell directly beneath the filler hole. Otherwise it will leave a section of the carbon electrode exposed to the moist air inside the battery, and a failure may result due to the condensation of this moisture on the carbon. This condensed moisture will gradually penetrate into the carbon until it is no longer able to "breathe". If this happens, the battery will lose voltage and become useless. Therefore, the solution level should be inspected monthly and if found low. brought up to the correct point by adding water. The monthly inspection will be often enough, as the only way moisture can be lost is through evaporation. The air-battery does not gas or bubble as does a storage battery, and, unless installed close to a heater, will

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not lose enough water in a month to do any harm.

Operating Precautions

A cold air-cell battery is more easily overloaded than one having normal temperature. If the temperature goes low enough, the normal current consumption may become an overload and the battery will fail. This means that the battery should not be called upon to deliver current when the temperature is 40°F. or lower. Low temperature does not harm the battery, either before or after activation so long as it remains idle while cold.

The cellophane covers must be removed. This may seem to be superfluous warning, but several batteries have failed because those activating them forgot to remove the cellophane covers. The purpose of the cellophane covers is to keep the air out of the carbons before the battery is activated, to prevent losses of capacity. When in service the battery must breathe air through the carbon "lungs". If the cellophane covers are not removed the battery suffocates, the electrodes wet up and disintegrate from lack of oxygen, and the battery is ruined.

Each filler cap has a small hole in it to permit free expansion and contraction of the air inside the battery as the temperature varies. If these holes should become plugged, the expanding air will cause a slight internal pressure which will actually force some of the solution into the pores of the carbon, which will cause it to wet up and disintegrate, just as though it had been overlooked or exposed to low solution. It is a characteristic of the solution that if exposed to air in small quanities and allowed to evaporate, large masses of hard white crystals will be formed. This being so, if any solution should slop up into the filler caps, the resulting formation of crystals is almost certain to plug the vent holes. Therefore, if an activated battery is moved about in any matter likely to slop the solution up into the filler caps, the caps must be thoroughly dried, inside and out.

Briefly, the only likely causes of battery failure are, overload on the battery; low solution; plugged vent holes; operation at low temperatures; and failure to remove the cellophane covers from the carbon electrodes. If precautions are taken that these five things are not existing when the battery is in use, no trouble should be experienced with the battery.

In conclusion let it be understood that at the present time the only application for the air-cell is in radio receivers designed for its use. However, do not let that fact cause an under-rating of the battery. Correctly designed receivers using the Type '30, '31, '32, and '33 tubes with the air-battery as filament source give as fine performance as the electric sets, and with average use of the set no battery renewals are required for one year after being placed in service. There are now about eighteen different commercial makes of air-cell receivers on the market. Although the manufacturer does not guarantee the air-cell battery for use with home-built receivers, if proper precautions are taken no difficulty should be encountered.

Founded

in

1874

Good Engineers

are an Asset to

Any Country

INDUSTRIAL PROGRESS

depends upon technically trained men for Leaders.
The students of technical schools must
assume this responsibility of leadership

Rose Polytechnic Institute

Terre Haute - Indiana

A Light Beam TALKS

FROM the flickering light of a neon tube on the skyline of New York City, a speech was sent to the *S. S. President Hoover,* 3000 feet away. The small neon tube changed the electric impulses from a microphone into light waves, which were directed to the ship in a narrow beam. A photoelectric tube in the center of a receiving mirror on the ship changed the light impulses back into sound, and the speech was heard on board.

The use of light that can be heard, and of sound that can be seen, has many applications. It can be used for speech communication; it can serve in fog to guide aircraft on their course and into port; and it can be used for radio and television broadcasting.

The development of future forms of transmission, whether in sound or light waves, will largely be the responsibility of college-trained General Electric engineers. To-day, these men are planning, producing, and testing electric equipment which will help maintain General Electric's leadership in its field.

95-926DH

GENERAL ELECTRIC