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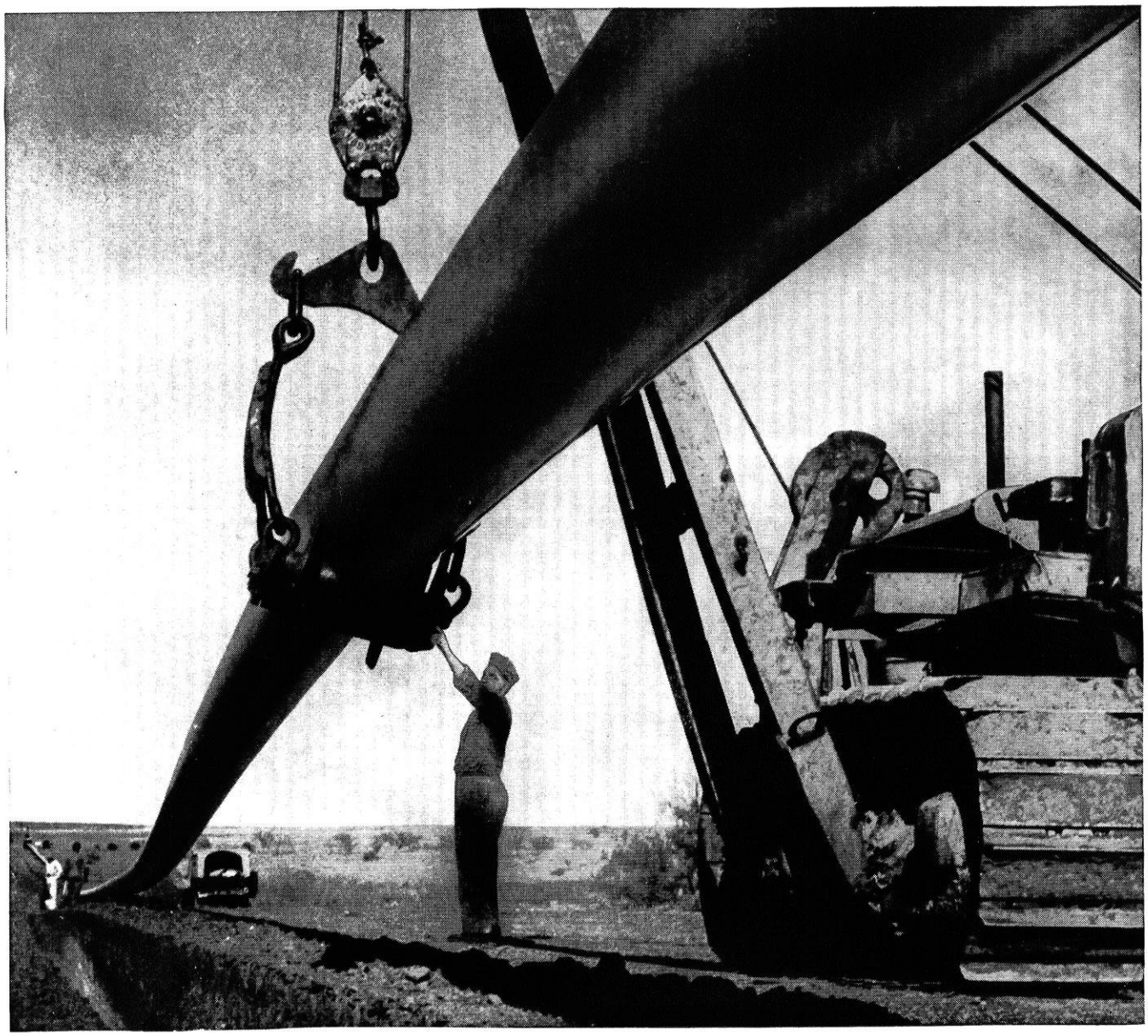
The Wisconsin

# engineer

February, 1950


15¢

# How America's "Underground" works for you



THERE are enough miles of oil and natural gas pipe lines in the U. S. A. to circle the world at the equator 16 times!

This vast, 402,000-mile network is made up of crude oil lines, oil products pipe lines and natural gas lines. This network has helped to make the benefits of gasoline, fuel oil and oil products readily available to everybody . . . it has helped to bring gas heating to many parts of the country.

But this constantly-expanding underground network is far from complete. It will require thousands more miles of pipe in the near future. To help meet this demand, United States Steel will put two more large-diameter pipe mills into operation in the next few months.

The steel industry is a growing industry, not only in terms of physical plants and facilities, but in terms of personnel, too. At the present time, the number of United States Steel employees participating in educational programs is exceeded in size only by the student bodies of a few of our largest universities.

The fundamental objectives of these programs are to assure employees maximum opportunity for personal development and to provide them with a sound foundation for advancement within the organization.

The training programs in United States Steel have become the "pipe line" to successful careers for hundreds of capable young men.




Hmmmm-*mmm!* Southern fried chicken, golden-brown and crispy. Man, oh, man . . . what a treat!

Well, mister, you can thank Methionine, an essential amino acid, for helping to bring better quality and less expensive poultry to the family table.

Chemistry and southern fried ???????

That's right, for today, chemistry plays an indispensable role in nutrition. For several years biochemists have recognized the nutritional importance of amino acids, the building block of proteins. Several of these amino acids are essential to the diet, for without them man and animal cannot grow or maintain life. Methionine is one of these essential amino acids.

Dow's continuing research, along with that of other investigators, has proved that critical deficiencies of Methionine can be corrected by supplementing chicken feed with this amino acid, produced synthetically. Chickens fed fortified diets grew ten per cent faster and consumed less feed for every pound gained. Such new developments make it possible for poultry raisers to market better quality birds more frequently and more economically.

Experiments with amino acids and their importance in the nutrition of man and animal, are but a small part of the continuing research program in many fields which is carried on by Dow—in the interest of producing more "Chemicals Indispensable to Industry and Agriculture."

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**DOW**

**CHEMICALS**

**INDISPENSABLE TO INDUSTRY AND AGRICULTURE**

# Glass that picks fire out of a light beam

**The electric lamps you see** between the boxes on the table are exactly alike—they generate both powerful light *and* intense heat.

If you should concentrate the beam of one of them with a reflector and plug it into an ordinary socket, you'd be practically blinded by its glare and your clothes scorched by the heat—unless you turned away fast!

But look what happens when you put them into the fixtures in the foreground, so their beams are covered by two different kinds of Corning glass.

The beam from the bulb on the left is cooled down so sharply that you can hold a wisp of newspaper in it for hours without its catching fire. Yet the light is almost as dazzling as ever.

Notice now that no light apparently shines from the bulb in the fixture on the right. But if you hold a piece of newspaper over it—in a matter of seconds you have fire in your hands!

**The explanation is:** One of the glass plates transmits the comparatively cool, visible rays generated by the bulb, blocking off most of the invisible heat rays. The other allows only the invisible heat rays to pass.

These pieces of glass are only two of the dozens of ray-transmitting or ray-blocking glasses that Corning makes—glasses that can pick out any segment of the light spectrum and put it where it's needed.

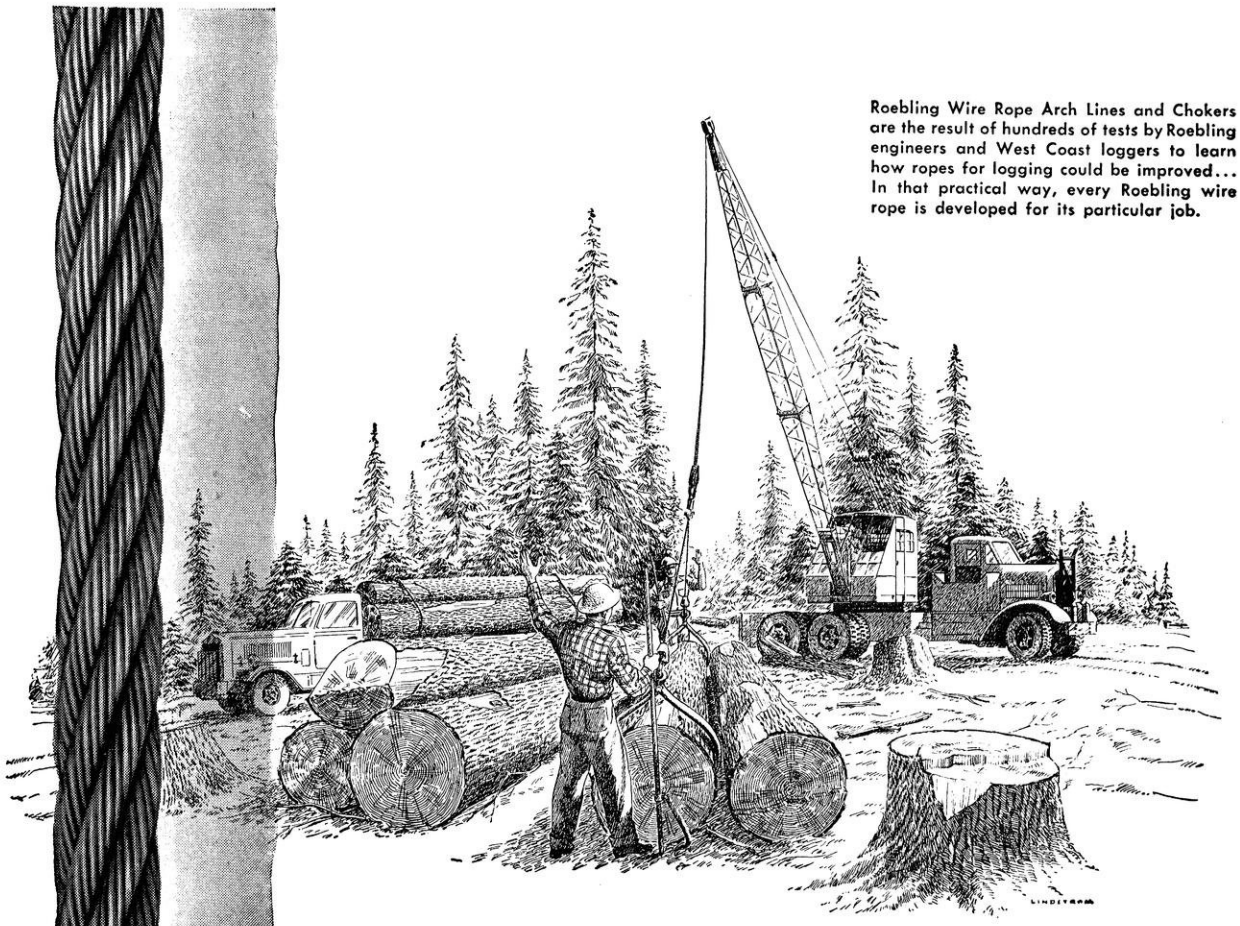
For example, a lamp shielded with a Corning glass which transmits *only* near ultraviolet rays lights automobile instrument panels without glare. Another kind of Corning glass transmits only invisible infrared rays and is used in electronically controlled burglar alarm systems.

Throughout industry, *Corning means research in glass*—and these ray-blocking, ray-transmitting glasses represent only one of a multitude of outstanding developments that have earned Corning this reputation.

We hope you'll keep in mind that Corning research and technical skill have made glass one of the most versatile engineering materials there is.

For when you're out of school and are concerned with product and process planning, you'll find it to your advantage to call on Corning before your plans reach the blueprint stage. *Corning Glass Works, Corning, New York.*

**CORNING**
**means research in glass**



Roebling Wire Rope Arch Lines and Chokers are the result of hundreds of tests by Roebling engineers and West Coast loggers to learn how ropes for logging could be improved... In that practical way, every Roebling wire rope is developed for its particular job.

# Why men who watch costs specify Roebling

Roebling Aircord contributes importantly to safe, sure "control in the air"

Roebling Oil-Tempered Spring Wire leads for automotive springs.

Roevar Magnet Wire insulation is 10 to 40 times tougher than other types.

WIRE ROPE made of "Blue Center" steel has extraordinary ability to withstand abrasion, shock and fatigue—a roundabout way of saying that it lasts longer and costs less! And "Blue Center" steel is an exclusive Roebling development—made only by Roebling. It is a matter of record that Roebling "Blue Center" Steel makes today's unbeatable wire rope for performance and economy.

Similarly, Roebling's full range of electrical wires and cables, high carbon specialty wires, aggregate screens and woven wire cloth are the standard of quality. Research, engineering and the most modern, precision manufacturing facilities give the whole wide line of Roebling wires and wire products an unsurpassed *plus* value throughout industry. ***THAT'S WHY...***

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***A CENTURY OF CONFIDENCE***

# WISCONSIN ENGINEER

Founded 1896

*Volume 54* FEBRUARY, 1950 *Number 5*

## *In This Issue . . .*

*Cover:*

A hopeful candidate in the beard-growing contest makes a precise measurement of the previous day's growth.
(*Oil by Severson*)

*Articles:*



*Departments:*



THE WISCONSIN ENGINEER

— YOUR MAGAZINE —

*Let's Read It!*



Entered as second class matter September 26, 1910, at the Post Office at Madison, Wisconsin, under the Act of March 3, 1879. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of Oct. 3, 1917, authorized Oct. 21, 1918.

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THE DU PONT DIGEST
FOR STUDENTS OF SCIENCE AND ENGINEERING

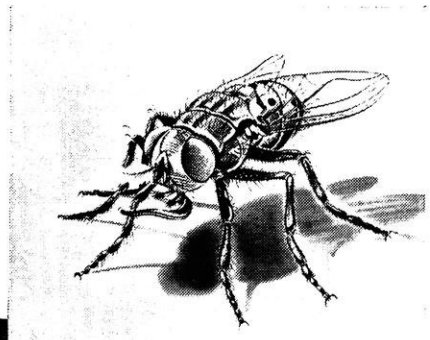
# BAD MEDICINE *for flies*

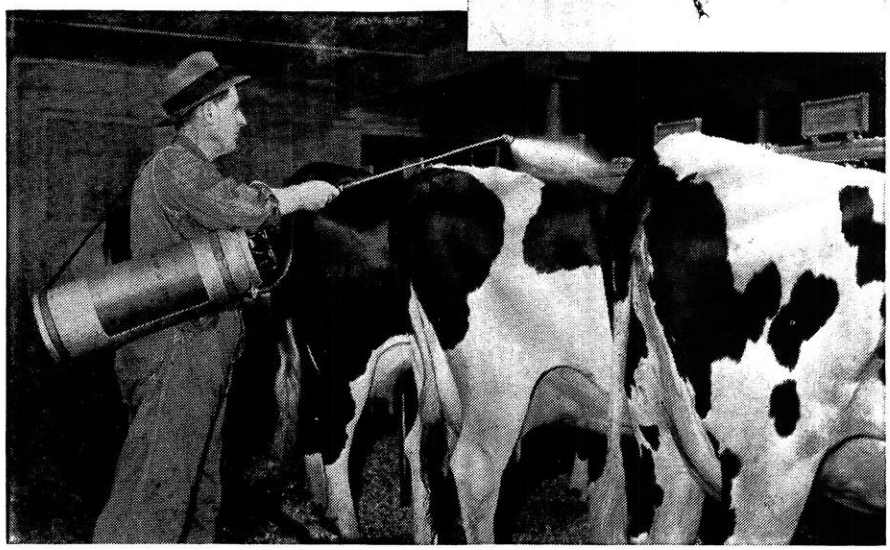
**Research that produced an insecticide safe to spray on cows may save millions for American agriculture**

Armed with only a fly-swatter, the farmer would get nowhere in ridding his dairy barn of disease-carrying insect pests. But he has to be careful in using insecticides around cows. A toxic spray may be absorbed through the animal's skin and show up in meat, milk and butter.

Next fly-season farmers and ranchers will be able to buy a fly-killer that is both powerful and safe. In Du Pont Marlate* 50% technical methoxychlor insecticide they will get this combination of properties that no single insecticide has ever offered before.

Methoxychlor is a recent Du Pont development. Du Pont scientists worked for eight years in the laboratory and in the field to develop its applications in agriculture.





**THE BITES** *of flies, lice, and ticks can cut down milk production as much as 20 per cent. One spraying of "Marlate" 50 will control these pests for several weeks.*

### A safer insecticide

"Marlate" 50 is a residual insecticide and remains an effective killer of flies, mosquitoes, fleas and lice for several weeks after application. When used as directed, this insecticide is exceptionally safe to human beings, livestock, pets and crops. This has led federal experts to recommend it not only for spraying in barns, milk houses and milk plants, but also on the animals themselves.

Besides its use on livestock, methoxychlor kills many insects that attack vegetables, fruits and forage crops. It is offered to flower growers as an ingredient in Du Pont Floral Dust. It is used in moth-proofing compounds so that dry cleaners can easily moth-proof woolens while cleaning them. Many stores carry aerosol bombs containing methoxychlor for household use. It can be used with safety in flour mills, freezing and canning plants, grain storage elevators, cereal manufacturing plants—wherever food is processed. This development of research can bring immediate cash savings of millions of dollars to American agriculture, industry and homes.

### The long fight

Exciting as the future of "Marlate" 50 appears, this does not mean that the use of other insecticides will not continue. Each has its special characteristics, and each has special uses for which it is outstanding. There are at least 10,000 kinds of insect pests, of more or less importance, in North America, and there can be no let-up in the scientific fight being waged against them.

Du Pont alone now makes over fifty different insecticides. The knowledge gained in making each one speeds the development of the next. By backing ideas with funds and facilities, Du Pont helps the farmer put more and better food on the American table. At the same time, in many other fields, Du Pont is helping to raise the American standard of living with continuous research aimed at developing new products and improving present ones.

*REG. U. S. PAT. OFF.

**"MARLATE"** *50 kills flies and many other insects attacking livestock, vegetables, fruits and forage crops.*

**SEND FOR** "Chemistry and the Farmer," an interesting, informative booklet on the development of pest control, etc. 34 pages. For your free copy, write to the Du Pont Company, 2503 Nemours Building, Wilmington, Del.

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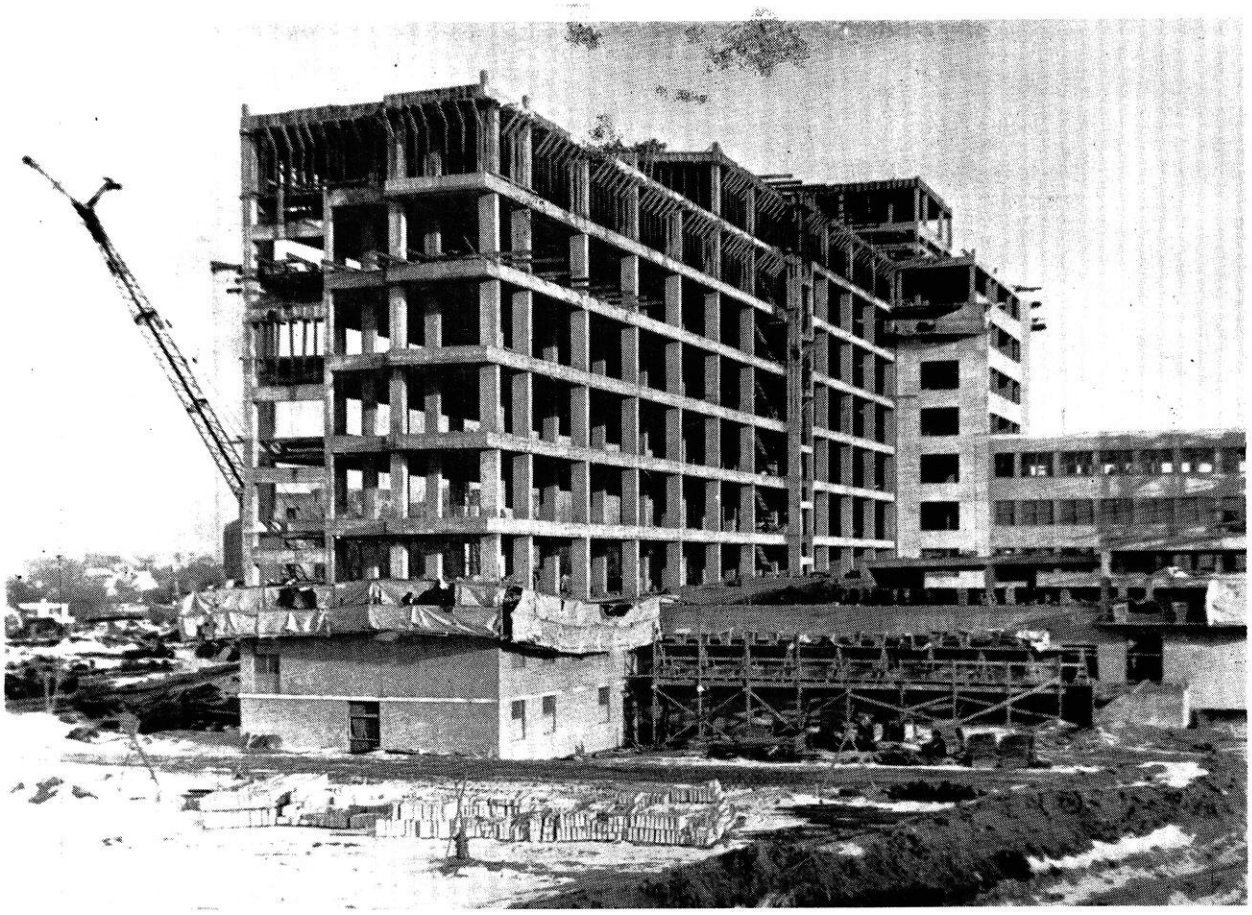
*Great Dramatic Entertainment—Tune in "Cavalcade of America" Tuesday Nights, NBC Coast to Coast*

# VETERANS HOSPITAL

*by Cecil Royce e'50*



*(Foton photo)*

The new Veterans Hospital now being constructed at Madison.

(*Foton photo*)

**East Wing of the Hospital.**

A short distance west of the Forest Products Laboratory, Madison's 11th hospital is being built. The Veterans' Administration is erecting a 500-bed unit for tubercular exarmed forces personnel, with facilities for caring for both men and women patients. Cases other than tubercular patients may be accommodated, but this will not be usual practice.

The general contractor for the building is the Newberg Construction Company, which has built similar units at Tomah, Wis., Ft. Wayne, Ind., and Iron Mountain, Mich. This unit is to be completed in June of 1951.

The present site was chosen because: the site was available reasonably, and was suitable for the buildings; it is near a city large enough to provide water and sewage facilities, and have enough recreational and educational opportunities to be attractive to the staff, and it is near a university with a good medical school that might provide part of the staff from the graduating classes.

The building is constructed of a reinforced cast concrete frame, with a brick sheath. No special insulation material is being used, and there is no steel beam construction. As far as load carrying ability is concerned, the limiting factor in building is soil conditions, rather than the limits of the reinforced concrete construction. In the present building, the foundation is not on bed rock, and no water seepage was encountered. About half the outer wall will be windows, using all steel sash. The interior will be primarily plaster and metal lath, though some rooms, and the wainscoting of others, will be glazed tile. Due to the type of service needed, there will be little fluorescent lighting; most rooms will have indirect lighting. There are to be 341 rooms, in wings eight stories high, with the elevator shafts to be two stories higher. The general floor plan is shown in the sketch. There are to be four Westinghouse fully-automatic passenger elevators, and one freight elevator. One of the new wrinkles in this hospital is a pneumatic tube system for inter-office communication, in addition to the phone and paging systems. Laboratories for routine testing will be provided, but no research is anticipated. There are to be two major operating rooms, with an additional minor one and one for emergency cases. There will also be an autopsy room, and an embalming room. One floor of one wing will be devoted to a complete, lead-protected x-ray and film processing setup. Additional portable x-ray machines will be available.

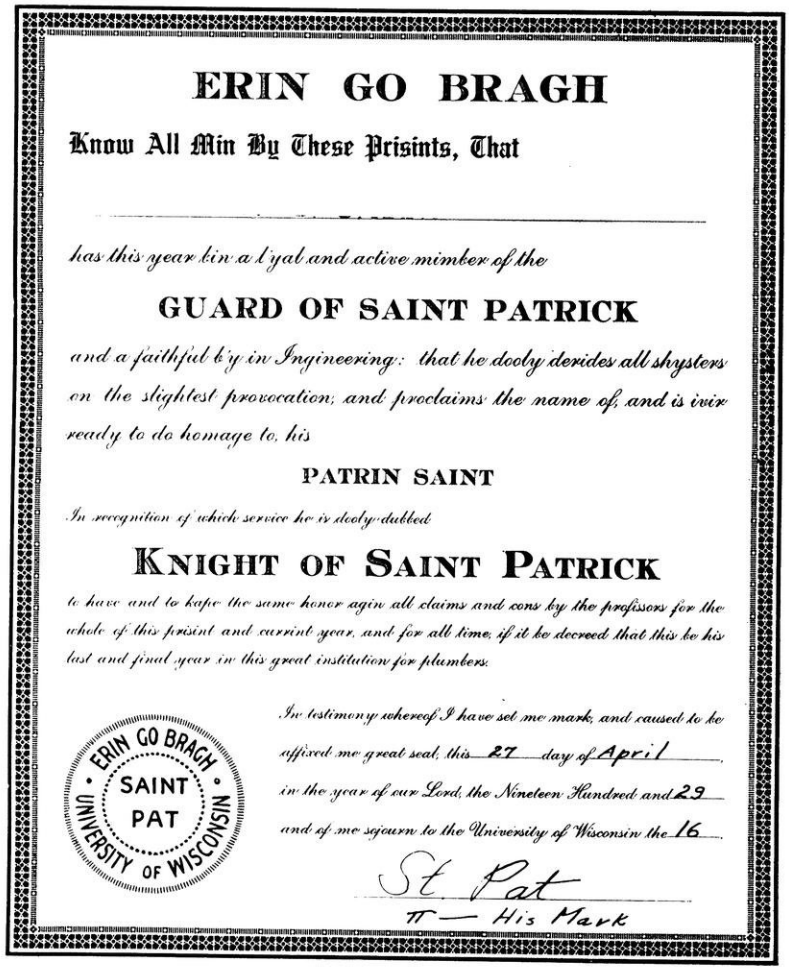
The water supply, electric power, and sewage disposal will be furnished by existing commercial companies. There is to be no auxiliary electric power supply, which is unusual for hospitals. The lighting system is to be four-wire, three-phase, and the electric power will be three-phase, 220 volts. The transformer substation will be part of the hospital property.

Steam power for heat will be supplied by three Babcock and Wilcox water tube boilers rated at 315 horsepower each at 165 psig. The units are to be coal fired, using Chicago automatic stokers with forced draft. They will be housed in a three story building that will also contain the laundry.

The unit will have its own laundry, tailor shop, beauty parlor, post office, recreation rooms, library, auditorium, and chapel. Chaplains are to be part of the operating personnel. Besides the main building, there will be four other quarters for the nurses, hospital manager, attendant, and medical staff. These will be in four separate buildings that will help make the unit a completely self-contained organization devoted to making healthier people.

# ST. PAT:

# Engineer



**ERIN GO BRAGH**

Know All Min By These Prisints, That

_____

has this year bin a l'yal and active mimber of the

**GUARD OF SAINT PATRICK**

and a faithful b'y in Ingineering: that he dooly derides all shysters on the slightest provocation; and proclaims the name of, and is ivir ready to do homage to, his

**PATRIN SAINT**

In recognition of which service he is dooly dubbed

**KNIGHT OF SAINT PATRICK**

to have and to kape the same honor agin all claims and cons by the professors for the whole of this prisint and currint year, and for all time, if it be decreed that this be his last and final year in this great institution for plumbers.

In testimony whereof I have set me mark, and caused to be affixed me great seal, this 27 day of April in the year of our Lord, the Nineteen Hundred and 29 and of me sejourn to the University of Wisconsin the 16.

ERIN GO BRAGH · SAINT PAT · UNIVERSITY OF WISCONSIN

St. Pat

π — His Mark

A relic of by-gone days, when men were men and the "shysters" and "plumbers" fought pitched battles to determine the vocation of their patron saint, Saint Patrick.

*by Fritz Kohli e'50*

With St. Patrick's Day less than a month away, the M.E. building is again alive with outlandish looking individuals wearing beards of all descriptions. There are full beards, Van Dykes, Abe Lincoln style, King Henry VIII, Arab style, Horace Greeley, Spanish style, Paddy Murphy, and just plain chin whiskers. The colors range all the way from light blond to jet black. The number of beards being grown this year is unofficially estimated at well over fifty. That makes this the biggest crop in many a year.

During the first few weeks in March the engineering campus will become a beehive of activity. The candidates from the five engineering schools will be leading their fellow civil, chemical, electrical, mechanical or mining engineers in selling buttons and dance tickets for the hotly contested honor of being St. Pat of 1950.

The climax of all these activities is, of course, St. Patrick's Day on March 17. The first event of the day will be the preliminary judging of the beard contestants. At this time all the accurate measurements of the beards as to length, diameter, curliness, color, etc., will be made to aid the Badger Beauties in their final judging.

Immediately following this preliminary judging the engineers will join in a mass parade across the campus to the men's gym for the annual basketball game between the engineers and lawyers.

The big event of the day is the semi-formal St. Pat's Dance held in Great Hall of the Memorial Union. Music will be furnished by Steve Swedish and his ten piece orchestra, fresh from the Modernistic Ballroom in Milwaukee, featuring vocalist Harry Lynn and Milton Mieritz at the piano.

And finally, the news everyone will have been waiting for — the winner of the contest, St. Pat himself, will be presented with the traditional loving cup brimming with Wisconsin's favorite amber liquid.

# So You Want to Get a Patent . . .

*by John Warner m'50*

Most all of us at one time or another have had an "invention." It may have come as the slow solution to a puzzle, or as a sudden insight.

At any rate, if our idea has seemed reasonable, we want to capitalize on it by putting the device or invention on the market. We thus hope to reap the reward for our ingenuity. Would that it were as easy as this!

Little do we realize what lies in front of us in our effort to market our idea. Little is realized of the time and patience required, of the hopes, and disappointments, to be experienced. What a blessing it would be if some step-by-step guide were available to follow, to use as a reference, and to lean on.

**Such a guide is soon to be published. It is the answer to the lay inventor's prayer, the answer to his questions, the guide to his actions.**

Entitled **A Case Record Guide For Inventors,** it will be published around the beginning of 1950 and will sell in the neighborhood of $3.50. It is the complete compilation of all the correspondence from the first patent application to the marketing of the invention. Compiled by the staff of United Industries of Madison, it is a complete authentic record of the entire patenting process.

The letters tell the story, with appropriate author's notes to explain certain points. Also included is a complete appendix containing patent application filing forms, drawings, specifications, bid quotations, contracts for manufacturing the invention and the like. They are the actual enclosures from the correspondence, and are listed in an orderly cross-indexed fashion for easy reference.

In compiling the notes, the invention used was a "Load Grip Clamp Hanger." Briefly, it is a metal hanger for supporting pipes, air ducts, wiring tubes and the like, from ceilings made of pre-cast concrete joists. Its unique properties are ease of installation, lack of holes in the joist, and adaptability to all kinds of suspended items.

A complete description of this invention will appear in the next issue of the WISCONSIN ENGINEER.

The booklet, of around 150 pages, is comprised of three main sections: applying for the patent, getting the product manufactured, and selling the finished product through an organized advertising program.

The first step is securing the services of a reliable lawyer. A Madison lawyer supplied the name of a reputable Washington patent attorney, and correspondence was initiated. The Washington attorney agreed to handle the case for the inventor. Photostats were then made and notarized in the presence of witnesses. This is an important step and should be made, for it discourages possible infringers.

**For this particular invention, the search of the files cost $25. The lawyer's fee was $125, and his draftsman's charge was $20. The application fee was $30. This totals $200 as the original expense.**

An interesting fact was mentioned in the letters from the lawyer to the inventor stating that, "A patent application cannot be filed in the patent office more than one year after the invention covered by it has been put into public use or offered for sale." Also, " . . . it is vital that an application be prepared in the name of and signed by the actual inventor or inventors. If you made the invention alone, the application would be invalid if filed in the names of two or more individuals."

A later letter from the attorney, after application had been made, states, "I would caution you not to disclose the filing date and serial number to anyone except persons in whom you have the fullest confidence . . . As you know, no infringement can be committed until the patent actually issues. Hence, we ought not to give anyone interested in copying the device the impression that he has a long time in which to copy it with impunity."

In the same letter, the first hint of trouble appears " . . . it will be about 15 months from now before the application receives first action. Almost invariably the first action is a rejection of some or all of the claims. Amendment and argument are required to convince the examiner that a patent should be granted. It follows that in the present case it will probably be two or three years before a patent can be obtained, and the further expense to you may be as much as $60 or $80."

These are but a few excerpts to indicate the thoroughness of a good lawyer, as well as the personal service that such an individual would give. It can't be recommended too strongly that a reliable lawyer is indispensable to the inventor's cause.

At last the notice of application arrived. The first step completed, the location of a buyer follows.

Drawings and a description of the device were sent to a number of firms that it was felt would have an interest in buying the rights to the patent. It was felt that this was the easiest and most satisfactory way to

(*please turn to page 24*)

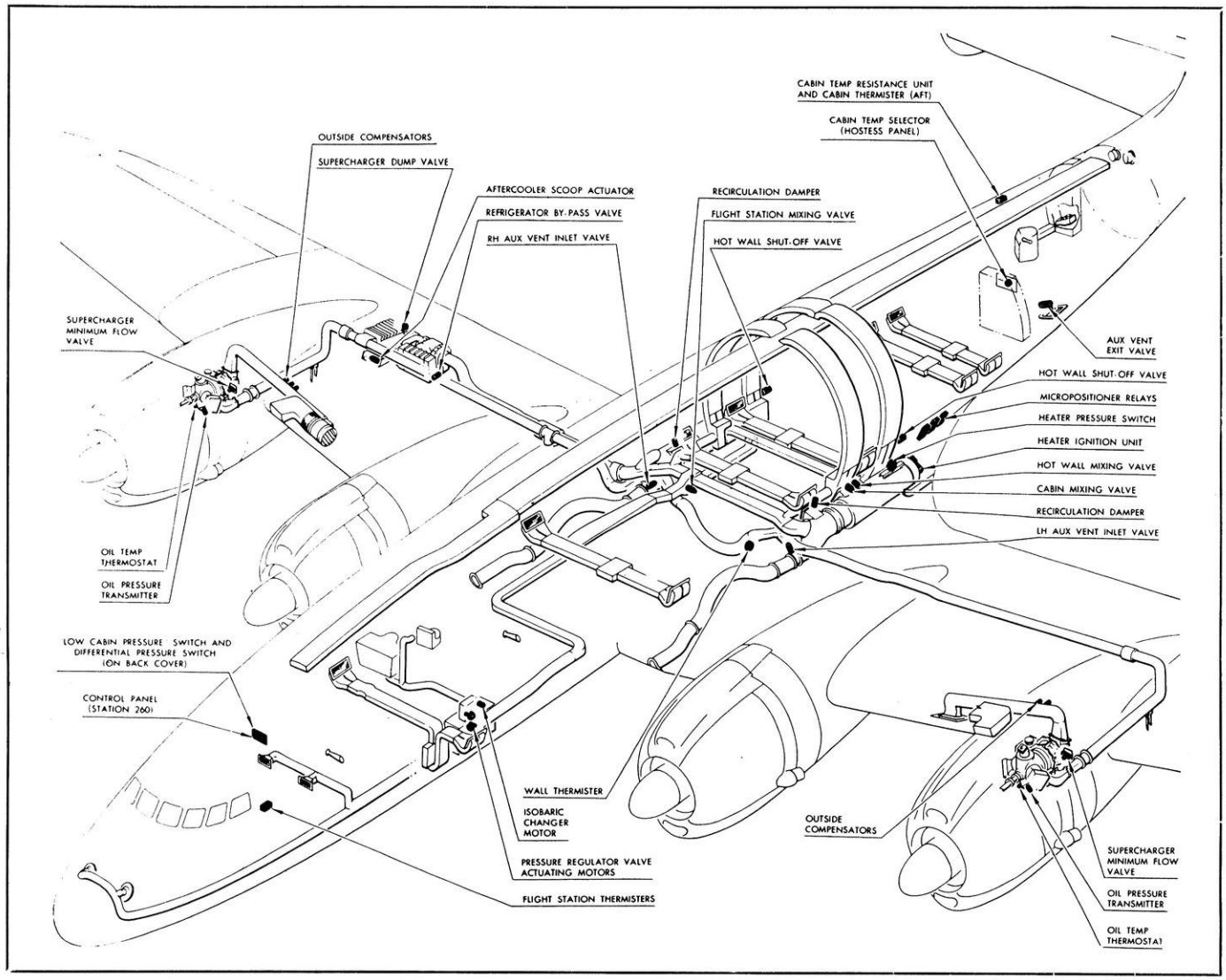



**Fig. 1 Air Conditioning System for Lockheed Constellation.**

*(Drawing courtesy Lockheed Aircraft Corp.)*

# Pressurized Flight

*by Charles A. White m'50*

Throughout man's stumbling in science in the past few thousand years, he has become aware that the globe on which he lives is surrounded by a gaseous layer known as the atmosphere. Most scientists like to look at the gaseous layer as a sea of air with man existing at the bottom. It is a recognized fact that air pressures decrease with an increase in altitude due to the compressible characteristics of air. This fact, however, was not of too much importance to man until he decided to take to the air for commercial and military reasons.

The importance of this lapse rate can be better understood when it is realized that one-half the weight of the atmosphere is below 18,000 feet. The field of aeronautics soon found out that these reduced pressures at higher altitudes were a limiting factor to operations, as the human body was not built to withstand the thin air and low oxygen content at higher altitudes. During the first World War more than one airman found himself getting faint because he had ventured too high above the earth. Military aviation's first answers to this problem was to supply its pilots and crews with oxygen equipment to supplement the deficiency. However, this only answered one of the

problems and the questions of extremely low pressures and temperatures experienced at altitudes were still unanswered.

Prior to World War II commercial aviation was restricted to below 10,000 feet due to the thin characteristics of the upper air. Both commercial and military aviation started demanding that the aircraft industries come up with some answer to the question of high altitude flight. In the latter part of the '30's the answer began to jell in the form of pressurized cabins. World War II really expedited the answer to the problem and with the birth of the Superfortress pressurized flight became a reality and for the first time man was able to fly at altitudes as high as 40,000 feet with comparative ease and comfort. Upon the termination of hostilities, commercial aviation also started to use pressurized aircraft and today most all major airlines of the world have at least one type of pressurized aircraft in service. Pressuriziation has become an accepted fact for the public today, although few people, including engineers, understand how or why it operates.

The problem of high altitude flight was overcome by designing an air conditioned airplane that could be heated, cooled, ventilated and pressurized at the will of the pilots or flight engineer. Basically a pressurized airplane is one in which pressures inside the airplane are maintained higher than those outside. In other words, more air is pumped into the cabin than leaks out.

At the beginning air conditioning systems were operated manually, but today the systems may be operated by one of three ways: manually, automatic or semi-automatic.

The Lockheed Constellation, as used by Eastern Air Lines, offers an example of one of the more modern air conditioned aircraft in use today. Figure 1 shows the general layout of the system in a phantom view of the ship.

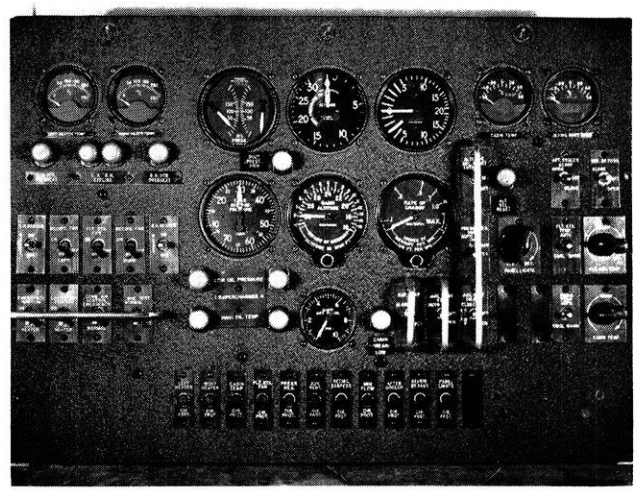
The air conditioned sections on the Constellation include the cabins for crew, passengers and the baggage or cargo compartments, contained within the fuselage. The system is supplied with superchargers or compressors, heaters, valves, ducts and thermostatic controls to govern the temperature, flow and pressures of the supplied air.

During periods when the cabins are being pressurized the air used for pressurization is supplied from two engine-driven superchargers that are mounted in the accessory section of the outboard engines. These superchargers are connected to the engines by means of drive shafts which are so geared that they turn 2.8 times as fast as engine speeds. The superchargers receive their air through openings that are on the bottom sides of the wings.

The general layout of air flow in the Constellation is from each supercharger to a common connection prior to sending the air through an aftercooler. In the aftercooler the air is passed through a number of small aluminum tubes where it is cooled by ambient air flow around the exterior of these tubes. The amount of ambient air flow around the tubes can be controlled automatically so as to gain the desired temperature of the cabin air as it leaves the aftercooler. If further cooling of the cabin air is desired it may be by-passed through a refrigerating unit prior to entering the cabin ducting system. The air may also be heated after leaving the aftercooler by passing it through two heaters before entering the cabin. The air is circulated through the ducting system so that it is distributed throughout the pressurized sections of the airplane. A pressure-regulating valve is placed in the system so that there is a means of exhausting cabin air to the atmosphere. The amount of air exhausted through this valve is dependent upon the pressure differential desired between cabin and outside pressure. The positioning of this valve so as to gain the desired exhausting effects, is accomplished by automatic electrical connections.

The cabin of any pressurized aircraft is so constructed that leakage is at a minimum. Doors, hatches and seams are all made pressure tight. An abnormal leak in the system may be easily detected as it would be hard to maintain pressure in the cabin. At the present time the maximum amount of pressure that can be built up in the cabin is about 4.2 psi above outside atmospheric air. Although this figure does not sound too great, it does mean that a ship can cruise along at an altitude of around 20,000 feet while the cabin is kept at a comfortable 8,000 feet.

The control of cabin air conditioning and pressurizing is usually taken care of by the flight engineer. On the Constellation there is a separate control and instrument panel devoted entirely to cabin air conditioning. This panel is really the nerve center and brain of the whole air conditioning system. On this panel are located all the



*(Photo courtesy of EAL)*

**Fig. 2 "260 Panel" for Lockheed Constellation.**

manual and automatic controls for maintaining the desired temperatures and pressures within the cabin. This "260 panel," as it is called on the Constellation, also includes all the instruments necessary for giving visual indications of what is taking place in the system at any instant.

### Operation of Cabin Pressure

The manual pressurized cabin on the Superfortress was more or less a proving ground of things to come. On the Superfortress the cabin was usually not placed under pressure until an altitude of about 8,000 feet was attained with the airplane. This usually meant that the crew experienced an inrushing of air as the regulating valves were

*(please turn to page 28)*

# Lay That Slíderule Down!

*by Paul Grogan, me instr.*

As we progress through an engineering course, gaining proficiency in the use of the slide rule, we are inclined to lose sight of the fundamentals of arithmetic which were drilled into us along with "Readin' " and "Ritin' " throughout most of our grammar- and high-school years.

We would like to reawaken an interest in some of the well-worn principles, perhaps with a new switch, so that certain problem solutions might be both easier and more fascinating.

**Fun With Squares:** (Or, **Boppers Aghast**) There is nothing strange to us about the infinite succession of integers, 1, 2, 3, . . . 11, 12, 13, . . . 21, 22, 23, . . . Yet, for the lack of the decimal system, invented in Arabia, man often labored tediously and all but vainly to solve problems easily mastered by a sixth-grade student of today. We all understand how the integers follow endlessly, each a single unit greater in absolute value than its predecessor. We often do not understand, however, how easily the natural order of the simple integers may be made to do marvelous things for us if we handle them properly. For instance, by leaving out all even-numbered integers, we may establish the infinite sequence of odd-numbered integers, 1, 3, 5, 7, . . . 2n-1, . . . Then by making a summation of the terms in the series, we arrive at the squares of integers.

**TABLE I**

**Squares of Integers From 1 to 10 by Additive Processes**

| n | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2n-1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 |
| $\sum_{1}^{n}(2n-1) = n^2$ | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 | 100 |

Therein lies the germ of an idea which suggests the origin of the calculus. Should we inquire, how does the function $y = x^2$ vary when $x = 5$? By inspection above, we see y increases 9 units between 4 and 5, and increases 11 units between 5 and 6. Or, we may assume it is changing an average 10 units per unit increase of x when $x = 5$. Expressed in calculus, $y = x^2$, $dy/dx = 2x$, for $x = 5$, $dy/dx = 10$. Further inspection of TABLE I shows that the "second difference" between the successive squares is simply 2, and it holds for the entire range of x. Expressed in calculus, $d^2y/dx^2 = 2$, a constant for all x.

How may the foregoing be put to work for us? We have merely chanced upon an **identity,** a mathematical tool which holds for the general case and can be applied therefore to any particular case. Probably the most familiar example of an identity being, $\sin^2 x + \cos^2 x = 1$. There are a great many more that are equally well known and useful. The one suggested in TABLE I may be established in many ways. The simplest method likely being, $(x + 1)^2 = x^2 + 2x + 1$. Thus, we may proceed from $10^2$ to $11^2$ by merely adding $2x + 1$, or 21, to 100 to get the square of 11, which we will recognize as being 121.

If we rewrite the identity used previously,

$$(x + 1)^2 = x^2 + x + (x + 1)$$

we may use it for more difficult assignments. Thus, we may demonstrate

$$91^2 = 90^2 + 90 + 91 = 8{,}100 + 181 = 8{,}281.$$

Similarly, we may use another identity,

$$(x - 1)^2 = x^2 - x - (x - 1)$$

Solving for $99^2$ with the new relationship,

$$99^2 = 100^2 - 100 - 99 = 10{,}000 - 199 = 9{,}801$$

There are endless variations:

$$(x + 2)^2 = x^2 + 4x + 4$$
$$102^2 = 100^2 + 400 + 4 = 10{,}404$$
$$(x - 2)^2 = x^2 - 4x + 4$$
$$98^2 = 100^2 - 400 + 4 = 9{,}804$$

The student should use but a select few of the foregoing relationships, knowing them well, otherwise uncertainty of the results will often arise.

Another very useful identity, however, is

$$(x + \tfrac{1}{2})^2 = x^2 + x + \tfrac{1}{4} = x(x + 1) + \tfrac{1}{4}.$$

Thus, $1.5^2 = (1)(2) + \tfrac{1}{4} = 2.25$

And, $7.5^2 = (7)(8) + \tfrac{1}{4} = 56.25$

If we but imagine the immediately preceding example to be $75^2$, then the answer will be just 100 times greater than the value we obtained for $7.5^2$.

Therefore, $75^2 = 100(7)(8) + 25 = 5{,}600 + 25 = 5{,}625$

$$95^2 = 100(9)(10) + 25 = 9{,}025$$
$$205^2 = 100(20)(21) + 25 = 42{,}025.$$

**TABLE II**

**Properties of Squares From 20 to 30**

| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|
| 400 | 441 | 484 | 529 | 576 | 625 | 676 | 729 | 784 | 841 | 900 |

$$26^2 = 24^2 + 100 = 576 + 100 = 676$$
$$27^2 = 23^2 + 200 = 529 + 200 = 729$$
$$28^2 = 22^2 + 300 = 484 + 300 = 784$$
$$29^2 = 21^2 + 400 = 441 + 400 = 841$$
$$30^2 = 20^2 + 500 = 400 + 500 = 900$$

Now, assuming all the squares up to 25 are known, we may find the square of any number from 26 through 75 by using an identity which we may write as follows:

$$x^2 = 100(x - 25) + (50 - x)^2$$

Hence, $38^2 = 100(38 - 25) + (50 - 38)^2$

$$= 100(13) + (12)^2 = 1{,}300 + 144 = 1{,}444$$
$$= 100(13) + (12)^2 = 1{,}300 + 44 = 1{,}444$$

And, $69^2 = 100(69 - 25) + (50 - 69)^2$

$$= 100(44) + (-19)^2 = 4{,}400 + 361 = 4{,}761$$

# Science Highlights

*by Donald Miller m'50*

## CONTACT CONVERTER

The recent development of a magnetic alloy having a rectangular hysteresis loop has made possible the development of a contact rectifier of high efficiency. The contact converter is essentially a synchronously driven switch that reverses the output of an alternating current supply line every time the polarity of the line changes. At the standard frequency of 60 cps. the contacts must therefore open and close 60 times a second. At this frequency it has been difficult to prevent arcing of the contacts which soon destroys their usefulness.

Arcing may be eliminated by making and breaking the contacts exactly when the current passes through zero, but this is impossible since the contact would have to be made or broken within several microseconds. A change in load would also shift the zero point. The method used in the new converter depends upon the use of a special choke in series with the generator and the load which holds the current at zero for a time long enough for the contacts to be separated.

The special choke consists of a toroidal winding around a ring core composed of the rectangular hysteresis loop material. The choke has a high impedance when the current through its winding is low because it is operating in a region where the permeability of the material is very high. At high values of current the core is saturated and the choke offers a small impedance to the flow of current.

Contact converters appear to be most useful in supplying direct current at voltages from 50 to 300 volts and for currents up to 10,000 amperes. At low voltages selenium rectifiers are most used while at higher voltages vacuum tube rectifiers are most common.

*(Cut courtesy GE)*

**The new GE Spectrogoniometer.**

## SPECTROGONIOMETER

The instrument with this imposing title is used to explore unknown substances with X rays, and to determine in a few minutes what elements the substances contain and how the atoms in them are arranged. The device was developed by the General Electric X-Ray Corporation, Milwaukee, Wisconsin.

The method of operation is as follows. A sample to be analyzed is mounted in the center of a large table. An X-ray beam is passed through it, and a Geiger counter, moved by precision gears, rotates slowly around it, measuring the intensity of the X-rays scattered by the sample.

The manner in which a substance scatters X-rays is governed by the type of atoms it contains and the way in which they are arranged with respect to each other. In the new method used to pick up the diffracted rays, the intensities of the rays are recorded automatically on a moving strip of paper in the form of a graph. By this method it is possible to obtain faster and more accurate results than by the former photographic method.

## RADIATION DETECTOR

A new method of radiation detection is used in the "gamma survey meter", developed by General Electric engineers. The instrument operates on the principle that the gamma rays act on a phosphor, a material which gives off light in the presence of radioactivity. Light from the phosphor acts upon an electronic tube and is converted into electrical energy which is measured by a meter. The instrument is made so that it is possible to register the amount of radiation four feet away from the observer.

*(please turn to page 30)*

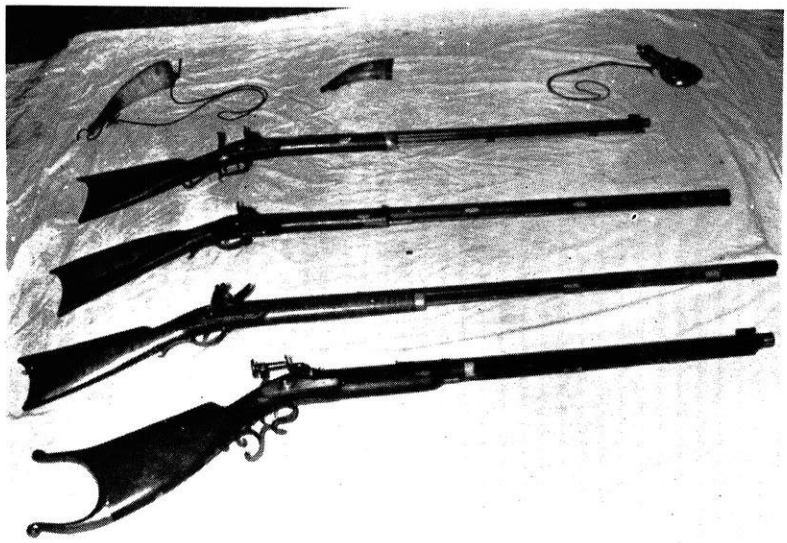
# Putting Fire in Firearms

*by David Petranek e'50*

This is the story of what happened because of a fight between two cave men which ended by one biting the other's big toe. The other then, for self protection, picked up a rock and beaned the first. This began a real war between the two, each developing weapons superior to those of the other; sticks, rocks, elaborate combinations, and spears. As the times passed, these weapons were replaced by similar ones made from better materials. With the discovery of iron, it was found that much stronger and more durable weapons could be made. The advantages of swords was soon discovered and they found their most glorified period during the Middle Ages.

Then came a new era; that beginning with the development of gun powder. Some say it had its origin in China, others say some Connecticut yankee used it during King Arthur's reign. Whatever its origin, it began a period to include wars far bloodier than any ever before encountered.

The earliest historic use of arms for the military in America was in the Revolution. The guns of the period were predominately English and French flint muskets brought from Europe by the immigrants.

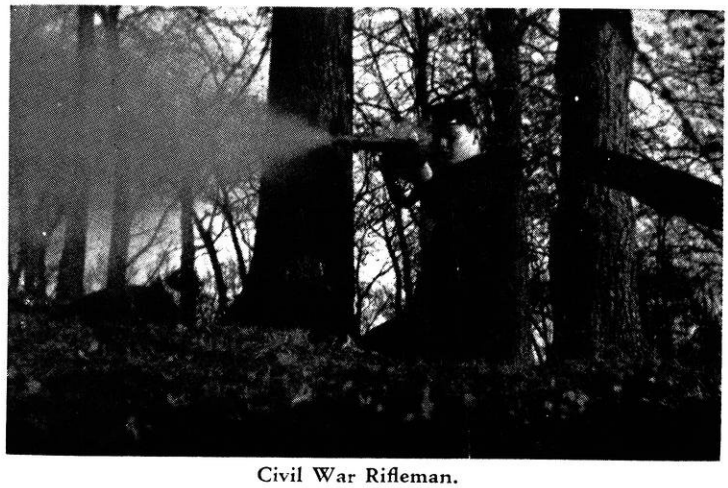


Flintlock Rifles.

The actual origin of this type of weapon is also lost to history, but as near as can be ascertained, was around 1630. It, like everything, was the outcropping of a sequence of ideas beginning with the matchlock, progressing to the wheel lock and the snaphaunce, and then the flint lock.

The wheel lock was the fine elaborate instrument of the period working, as the name implies, upon the action of a rough spinning iron wheel against a flint held such that the resulting sparks would ignite the priming charge thus discharging the gun.

Because of its rather complicated mechanism, it was expensive and was owned only by the elite. Developing at the same time was the snaphaunce, so named because of its resemblance to snapping hens. It is the true predecessor of the flintlock as we knew it in the revolution and was much more popular because of its simplicity, thus being within the financial reach of the common man. The actual flintlock was a refined snaphaunce. Although the system wasn't much good, being susceptible to moisture as well as being just plain temperamental, the Army used it until some time after 1822. At this time, the Model 1822 flint musket was converted to percussion, the new super system for discharge.



Civil War Rifleman.

This percussion system used a fulminating cap placed over a cham-

(*please turn to page 26*)

# ON the Campus

*by Fritz Kohli e'50*

## POLYGON BOARD

Kieth H. Jensen, C.E. 4, was chosen to be President of Polygon Board for the 1950 spring semester in an election held on January 10. His predecessor was Gilbert E. Kempka, M&M 4, who headed the Board during the fall semester.

In addition to directing Polygon Board's routine activities, Jensen will be general chairman of the St. Pat's Day activities and dance.

John E. Helm, M&M 4, succeeds William J. Byan, E.E. 4, as secretary of the Board, and Robert B. Wilson, M.E. 3, was re-elected treasurer.

Polygon Board is composed of fourteen directors representing the seven engineering societies, AIChE, AIEE, AIME, ASCE, ASME, IRE and SAE. One director is elected from each society at the end of each semester for a term of one year on the Board. By thus over-lapping the terms of office, the Board is able to function continuously, as half its directors will always have served on the Board for at least one semester.

Polygon Board's function is primarily that of service to the societies. Rather than deriving its operating funds from levies on the societies or through sale of membership cards, it sponsors the annual St. Patrick's Day Dance and button sale. The proceeds are split among the Board and the societies.

The Board works in conjunction with the Placement Office in presenting job conferences; it represents the Engineering school in such campus functions as the Freshman Circus and the Campus Carnival; and it sponsors an annual smoker to stimulate extracurricular interest. It, in addition, takes care of special problems affecting the engineering students. It is currently conducting an investigation to determine the ways and means of providing a satisfactory form of compensation for students injured in laboratory mishaps.

## KAPPA ETA KAPPA

Due to the graduation of two of its officers, Vice President Harold A. Cork and Executive Board Director Glenn R. Petersen, and the expiration of two other terms of office, Kappa Eta Kappa held a special election on January 9, 1950. William J. Beranek and Neal G. Jenewein were elected to replace Cork and Petersen, respectively.

Thomas J. Maresca, Floyd L. Peronto and Harold G. Fischer were elected for regular terms as Executive Board Director, Social Chairman and Assistant Social Chairman, respectively.

## TRIANGLE

Just before Christmas vacation, the members of Triangle and guests danced away the evening to the music of Wally Stebbins and his band. It was the annual Christmas Semiformal dance held in the Pompeian room of the Loraine Hotel. The decorations consisted of large Christmas Cards complete with verses addressed to the girls from their escort. Mr. and Mrs. Cromer E. Chapman were the chaperons.

Two new pledges have joined the ranks of Triangle; they are: James R. Collins and Robert W. Spaude.

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## BUTTON DESIGN CONTEST

A button design featuring a bearded figure of St. Pat brandishing a slide rule won the first prize of fifteen dollars for John M. Frase, M.E. 4. Second and third prizes of dance tickets were awarded to Arnold W. Johnson, C.E. 4, and Ramond F. Crupi, M.E. 4.

The essential features of the 1950 St. Pat buttons will be taken from the prize-winning designs.

## ST. PAT CANDIDATES

Three of the five engineering schools have elected their St. Pat candidates. They are: Bob Claypool, Civil; John F. Allcuis, Mechanical; and Peter Kirchhoff, Mining and Metallurgy. The Electrical and Chemical candidaets will be announced later.

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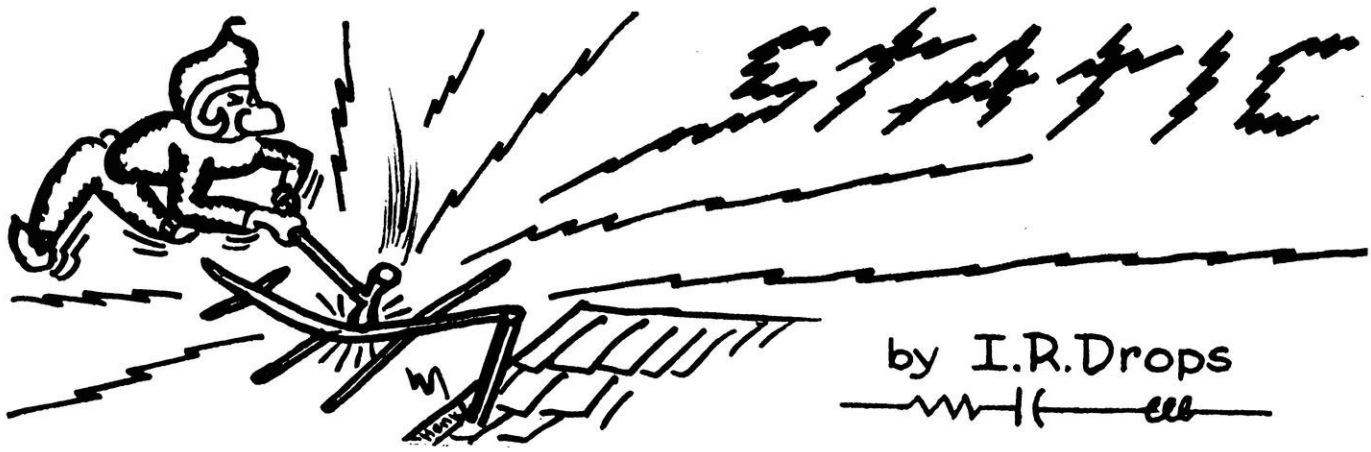
## A.S.C.E.

The student chapter of A.S.C.E. began the spring semester activities with a meeting in the Hydraulic Laboratory, Feb. 14, 1950.

Presiding over the meeting were the newly elected officers for this semester: Bill Larson, president; Rod Johnson, vice president; Jerry Riddiough, secretary, and Tom Wilson, treasurer.

The speaker for the evening was Mr. George P. Steinmetz, chief engineer, Wisconsin State Public Service Commission. Mr. Steinmetz spoke of his experiences on a recent trip to Germany.

Other new officers for this semester are Bob Binning, Polygon Board representative; Jim Sivley, publicity manager, and Bob Claypool, St. Pat representative.




**It's amazing what some women can do and still keep their amateur standing.**

* * *

Money doesn't bring happiness. The man with ten million dollars is no happier than the man with nine million.

* * *

Old maid's epitaph: "Who said you can't take it with you."

* * *

Housemother: "Young man, we turn off the lights at ten-thirty."

E.E. 2: "That'll be just swell!"

* * *

**A girl doesn't mind losing her heart to a man as much as she hates to have him search for it.**

* * *

## MY SLIDE RULE

This is my slide rule
There are many like it, but this one is mine.
My slide rule is my friend,
And I shall learn to love it as a friend,
I will obey my slide rule,
When my stick tells me that 5 x 5 is 23.875648352,
then, by God, five times five is twenty-three point, etc.
I will learn the anatomy of my slide rule.
Though I die in the struggle, I will use faithfully every scale; the black scale and the red, the inverted C and the inside-out log; the reversed A and the multiplied D. I will master them all and they will serve me well
They Will!
I will cherish my slipstick, and will treat it kindly,
I will call it my baby, and never shall profanity sear its long and graceful limbs!
My slide rule shall be my brother in suffering.
Through long hours of midnight toil we will work together, my slide rule and I.
And great will be the day when my slide rule and I
Have finished our appointed task and the problem is done and the answers are right,
I will take that darn stick, and have one heck of a fire
I will!

Minister: "Son, do you think that you can live a good Christian life at college on $90 a month?"

Student: "Sir, I'm afraid that's about all I can do."

* * *

And then there was the widow who told the bachelor: "Take it from me—don't get married."

* * *

Drunk: "Loowit that sign."
Drunker: "Whazzit shay?"
D: "Shez 'ladies ready-to-wear clothes'!"
D: "Well, ish about time."

* * *

**She: "Does your husband still find you entertaining?"**
**Her: "Not if I can help it."**

* * *

She was only the Butler's daughter, but oh, how she loved being maid.

* * *

"This means a good deal to me," said the poker player as he stacked the cards.

* * *

The one who thinks our jokes are poor,
Would straight-way change his views,
Could he compare the jokes we print
With those we could not use.

* * *

The difference between amnesia and magnesia is that the fellow with amnesia doesn't know where he's going.

* * *

She: "Where's your chivalry?"
Sr. M.E.: "I turned it in for a Ford."

* * *

The M.E. instructor held the chisel against the rusted bolt. He looked at the M.E. student and said, "When I nod my head you hit it."

They're burying him at noon today.

* * *

She: "I'm so discouraged. Everything I do seems to be wrong."

He: "What are you doing tonight?"

A man was staring at another man in the cafeteria line.

"What are you staring at?"

"Oh, I beg your pardon, but . . . ah . . . I . . . if it weren't for the mustache, you'd look just like my wife."

"But I haven't got a mustache."

"Yeah, but my wife has."

* * *

"Say, do you know an easy way to find out the horsepower of a car?"

"No. How?"

"Lift the hood and count the plugs."

* * *

**All those who think that "evening" means the same thing as "night" should note the effect that it has on a gown.**

**A gold digger died and all of her worldly possessions including a parrot were being auctioned off to the public.**

**"What am I offered for this beautiful bird?" quizzed the auctioneer.**

**"A dollar," bid a bystander.**

**"Two dollars," roared another.**

**"Make it five," croaked the parrot, "and I'll give you a kiss."** * * *

The couple had just been rescued from a tiny island after three days and nights. The girl extended her hand to the man and said: "Charlie, you're a dear, and thanks for being such a gentleman. It's too bad you didn't know this gun was empty, isn't it?"

(*please turn to page* 19)

# *Alumni Notes*

*by Hank Williams e'50*

C.E.

**Gerald G. Fintak,** ('41), has been transferred to Boston, Massachusetts, as field engineer for the Allis-Chalmers Manufacturing Company.

**Edward N. Rein,** ('47), is a hydraulic engineer for the U. S. Corps of Engineers in Portland, Oregon.

**James R. Cleasby,** ('49), holds the rating of Engineer I with the Wisconsin State Highway Commission. He is engaged in paving inspection in Division I which has headquarters in Madison.

**Robert O. Schindelholz,** ('49), is with the Wisconsin Highway Commission doing design and construction work.

**Dean R. Peterson,** ('49), is employed with the Oliver Iron Mining Company of Duluth, Minn.

**Edward J. Moakler,** ('49), is with the Bureau of Reclamation at Coulee Dam, Washington. He is doing design work.

**Bernard A. Dupont,** ('49), is an engineer for the Carnegie-Illinois Steel Corporation.

**George R. DeYoung,** ('49), is employed with the Wisconsin Highway Commission. At present, he is stationed in Milwaukee.

**William R. Kachel,** ('49), is with the U. S. Coast and Geodetic Survey at St. Petersburg, Fla. He is working in the Engineering and Administrative Departments.

E.E.

**Robert Cockrell,** ('49), is in the Design Department of the Boeing Airplane Company of Seattle, Washington.

**Edmund J. Hermsen,** ('49), is in the Signal Division of the Milwaukee Road railroad.

**Edgar O. Schoenike,** ('49), is an engineer for the Collins Radio Corporation of Cedar Rapids, Iowa.

**Charles A. Larson,** ('49), is employed with the Wisconsin Electric Co-op of Madison, Wisconsin.

**James H. Kark,** ('49), is with the Allen-Bradley Company of Milwaukee, Wisconsin.

**Warren E. Foote,** ('49), is an engineer for the Northern Indiana Public Service Company. His business address at present is Warsaw, Indiana.

**William C. Richards,** ('49), is in the Water Department of the City of Fond du Lac, Wisconsin. He is doing engineering and administrative work.

**Val E. Herzfeld,** ('49), is with the Illinois Northern Utilities Corporation at Dixon, Illinois.

M.E.

**Arne H. Anderson,** ('49), is a construction engineer for the American Steel and Wire Company. His present business address is Waukegan, Illinois.

**Werner K. Schimmeyer,** ('49), is with the A. O. Smith Corporation of Milwaukee, Wisconsin.

**Glenn C. Erdmann,** ('49), is a design engineer for the Globe Union Company of Milwaukee.

**Russell J. Cotts,** ('49), is an engineer for the Kraft Food Company of Green Bay, Wisconsin.

**Charles E. Mueller,** ('49), is doing administration and engineering work for the Wisconsin Furnace Company of Madison.

**Earl C. Thayer,** ('49), is an engineer for the J. I. Case Company of Racine, Wisconsin.

**Robert E. Zuleger,** ('49), is employed with the firm of Geuder, Paeshke and Frey of Milwaukee as a safety engineer.

**Don C. Holloway,** ('43), is in the production and design department of the G. B. Lewis Company of Watertown, Wisconsin.

**Orval D. Nelson,** ('49), is a safety engineer for the St. Paul Indemnity Company of St. Paul, Minnesota.

**Howard L. Timian,** ('49), is a maintenance engineer for the Pittsburgh Plate Glass Company. At present, he is working in Milwaukee.

**Erwin E. Wiese,** ('49), is a design draftsman for the Lippmann Engineering Works of Milwaukee, Wisconsin.

**Jack Harold Beck,** ('49), is assistant service manager of the L. J. Mueller Furnace Company of Milwaukee, Wisconsin.

**Cecil Even Harter,** ('49), is maintenance engineer for the Oliver Mining Company of Hibbing, Minn.

**Delmore Ehlers,** ('49), is employed with Jos. Schlitz Brewing Company of Milwaukee.

**Richard E. Dunning,** ('49), is doing research work for the Bjorksten Research Laboratories of Madison.

**Donald H. Westermann,** ('49), is an engineer for the Marathon Corporation of Menasha, Wisconsin.

**Jacob William Johnson,** ('49), is on the technical supervisor's staff of the Anaconda Wire and Cable Company of Marion, Indiana.

M. & M.E.

**Robert St. Clair,** ('49), is employed at the Duquesne Works of the Carnegie - Illinois Steel Company. He was a former business manager of the Wisconsin Engineer.

**Edward H. Nimmer,** ('49), is an engineer for the Briggs and Stratton Company of Milwaukee.

**David A. Mickelson,** ('49), is in the Sales Department of the Sunbeam Corporation of Chicago.

**Karl J. Loescher,** ('49), is doing sales work for Schaar and Company of Chicago.

**Arnold D. Arnaut,** ('49), is in the Research Department of Sylvania Electric Products, Incorporated, of Flushing, N. Y.

# Static . . .

(continued from page 17)

"Are you a member of the crew?"
"No."
"Then stop stroking me."

* * *

"But, darling, why aren't you wearing my fraternity pin?"
"All the fellows say that it scratches their hands."

* * *

Father: "I never see a girl blush any more. It was different in my day."
Son: "Why Dad, what in the world did you say to them?"

* * *

Confucius say "Clothes make the man; with a woman, however, they just serve to show how she's made."

* * *

**The moon was yellow, the lane was bright,**
**as she turned to me in the night.**
**Every gesture and every glance**
**gave the hint that she craved romance.**
**I stammered, I stuttered, and time went by—**
**the moon was yellow, and so was I.**

* * *

"Paper, Mister?"
"No, just resting."

* * *

Pat: "How did Brother Jones die?"
Mike: "He fell through a scaffolding."
Pat: "What was he doing up there?"
Mike: "Being hanged."

* * *

"You've read that sentence wrong, Miss Adams — it's 'all men are created equal' — not 'all men are made the same way'!"

* * *

**The tightwad out of town on his wife's birthday, sent her a check for a million kisses as a gift. The wife, annoyed by his extreme thrift, sent this postcard.**
**"Dear Jim: Thanks for the perfect birthday check. The milkman cashed it this morning."**

* * *

"Say, I hear you lost your job. Why did the foreman fire you?"
"Well, you know what a foreman is — he's the one who stands around and watches his men work."
"What's that got to do with it?"
"Why, he got jealous of me. People thought I was the foreman."

* * *

Dr. Whalin: "If we take an atom of gold — (atomic weight 199) — and bombard it with a beta particle, we may get an atom of atomic weight 198. What has happened to the other neutron?"

Shocked voice from the rear of lecture hall: "Don't NOBODY leave the room!"

* * *

**Mary had a little lamb**
**The lamb had a halitosis**
**And every place that Mary went**
**The people held their noses.**

* * *

"Good morning, Mrs. Kelley," said the doctor, "did you take your husband's temperature as I instructed?"
"Yes, doctor, I borrowed a barometer and placed it on his chest. It said 'very dry', so I bought him a quart of beer and he's gone back to work."

* * *

Working in a tin can factory, a man caught his coat in a revolving wheel, and was whisked up and hurled around and around until the foreman managed to shut off the machine.

Up rushed the foreman. "Speak to me. Speak to me," he pleaded.

The victim looked up. "Why should I?" he said. "I passed you six times, and you didn't speak to me."

* * *

"Don't you love me any more, Honey?"
"Sure, I'm just resting."

* * *

Slightly inebriated: "Do you know what time it is?"
Bar tender: "Yes."
S.I., staggering away: "Thanks".

* * *

A private sin is not so prejudicial in this world as a public indecency.

* * *

Did you hear about the magician that walked down State Street and turned into a saloon?

* * *

Of all the fish that swim the sea,
I dearly love the bass;
He climbs up on the seaweed trees,
And slides down on his hands and knees.

# New Courses

*by Sylvester Campbell e'50*

The Electrical Engineering curriculum has had several changes and additions since the war's end. However, the curriculum today is by no means in a static condition, as witnessed by the introduction of new courses this fall, and with work underway in preparation of new courses.

The increasing use of electrical devices in industrial control methods has led to the introduction of E.E. 115—Open and Closed Cycle Control Systems. Contrary to general expectations, this is not a course in servomechanisms. It is more a study of the devices which make up the elementary units in a servomechanism.

The first part of the three hour course consists of a study of open cycle controls. An open cycle control system is one in which a part of the control is in the hands of an external agent. A closed cycle control system is one in which an error signal from the operating equipment is automatically fed back to a device, which in turn causes a change in the operating system to overcome the error. For example, a man operating the throttle to control a steam engine's speed is the external agent of an open cycle system. The flyball governor takes his place to form a closed cycle system.

At present, the devices studied in the order of their presentation are: amplifiers (relay, rotating, electronic, and magnetic), motors (transient response, and phase and amplitude response vs. frequency), pilot devices (thermostats, switches, thermocouples, and solenoids), step and continuous control of motors, and fundamental requirements and applications of closed cycle control systems. The latter part of the course will consist of applying the various transient devices already studied into complete sets of the more widely used servomechanisms.

Mr. Schmitz, who is in charge of the course, has had experience in both the development and application of control systems. He was a development engineer with Cutler-Hammer and has worked in several plants employing industrial control schemes.

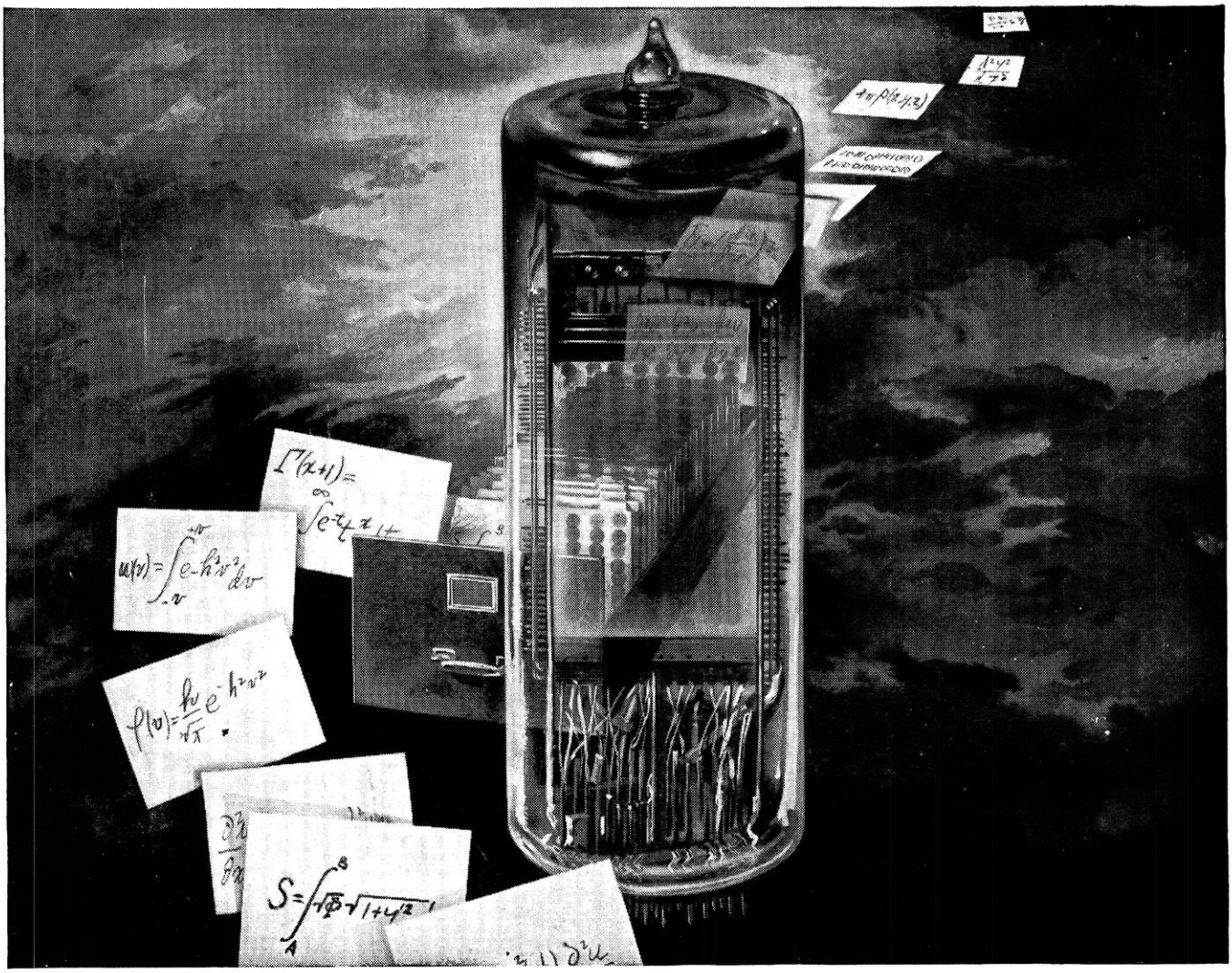
### Future Plans

Several members of the E.E. faculty are working on two new graduate courses. One of the courses deals with waveforms, a study of the methods and circuits used to produce the many waveforms needed in electronic devices. The other course is a study of computers, both electrical and mechanical. This course is not a rigorous analysis of individual computing units, but is concerned primarily with the basic theory of operation of computers in general. The electronic computer recently acquired by the department will be used for illustrative purposes throughout the course. These two courses are now offered.

### "English for Engineers"

The long-awaited courses in technical writing for engineers are now an actuality, with the introduction of the "99" courses. The Committee on English for Engineers in its meeting last May recommended the introduction of three hour courses in writing as soon as an adequate staff was available. The committee also recommended that the individual departments assign a member of their staffs to teach the students in their departments, as is being done now.

The increasing need for engineers to be able to express their ideas in communicable form has long been felt by both employers and educators as well as engineers themselves.



New RCA electron tube gives today's amazing computing machines an indispensable memory.

## ***Tube with a memory*** *keeps answers on file*

So complex are present scientific studies—such as in atomic research—that working out the "arithmetic" could take all of our scientists' time.

Short cut through this drudgery is found in huge electronic computers, able to add or multiply numbers as large as a thousand billion in *millionths of a second.* But such speed is valueless unless—with comparable speed—the results of countless computations can be kept "on file" and taken out again.

**Such a "file" now exists in a "memory" tube, developed at RCA Laboratories. It retains figures fed into calculating machines, stores them, memorizes new ones—speeds solutions through mazes of mathematics.**

Uses of RCA's "memory" tube are many. It will help atomic scientists acquire new knowledge . . . provide new information on supersonic flight . . . even help make rapid weather predictions! It is an invaluable instrument in the scientist's campaign to penetrate the unknown.

**For your benefit:** Development of the "memory" tube is another basic advance pioneered at RCA Laboratories. Continued leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

*Examples of the newest advances in radio, television, and electronics—in action—may be seen at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.*

### Continue your education with pay—at RCA

**Graduate Electrical Engineers:** RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

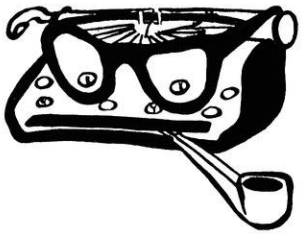
- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

*Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.*

**Also many opportunities for Mechanical and Chemical Engineers and Physicists.**

**RADIO CORPORATION of AMERICA**

*World Leader in Radio—First in Television*



# The Way We See It

Quite a time ago a very wise man wrote a fable, a fable about four blind men and an elephant. Briefly, the story is this: The blind men wished very much to understand what an elephant was like, and examined one in order to satisfy their curiosity. Each one, however, came in contact with a different part of its body: one felt its trunk, another its side, the third its tusks, and the fourth its leg. Naturally, their conceptions of what an elephant looked like differed greatly, and a heated argument arose.

The engineer of today is not blind, but he is often ignorant of all the factors in a given problem. It is the job of the engineer to gather as much data as he can and from this data arrive t satisfctory solution. Engineering usully 0involves approximations, and for the approximations to be at all satisfactory they must be based upon unshakeable facts.

Know the facts. Do not seek them in the manner of the blind men, but try to gain an over-all picture of a given problem. Without a fairly complete idea of the whole problem, a seemingly valid solution may turn out to be completely ridiculous.

This principle may be extended beyond its applications to engineering. How many times have you formed an opinion about someone or something without knowing much about the factors which influenced your decision? If you are like the rest of us, your answer will be "Often." All too often we are influenced by factors which have little or no bearing upon the case at hand. Very seldom do we know the facts.

Facts are elusive, but the trouble expended in finding them will be amply repaid by the satisfaction of being sure. Prejudice is almost always tre result of insufficient facts. The more we understand, the more facts that we possess, the better we know the world and the people that live in it.

Know your facts. In knowing them you will become a better engineer and, what is more important, a more tolerant person.—**A.M.N.**

While browsing through a recent issue of the North Dakota Engineer, I came across the following joke(?):

> A stout lady on the scale was eagerly watched by two small boys. The lady put in a penny but the machine was out of order—it registered only seventy-five pounds.
>
> "Good God, Bill," gasped one of the kids, "she's hollow."

The lady in the joke seems remarkably analogous to a great percentage of the students enrolled in Engine school. Although a great many reasons why can be advanced, they still are "hollow", and many of them realize it. Eighteen to twenty credits is admittedly a tough grind to get through. Yet all of the credits offered by the College of Engineering are not enough to prepare a student to be a citizen able to accept his responsibilities in the society into which he will graduate.

The lack of engineers participating in campus activities, the lack of interest in reading or writing anything not assigned in class, and the open hostility of many toward the few non-engineering courses required by the school are but a few examples of the deficiency in so many engineers' training.

Many worthwhile organizations are perpetually in need of active, hard-working people that will do more than show their face once every two weeks so they can get the organization listed under their name in the Badger when they graduate. The experience that can be gained in managing people and dealing with them is invaluable toward the training of tomorrow's leaders. The contacts made often lead to good jobs after graduation, jobs that require more than a degree and a blank look to hold down.

Why not look into the possibilities next time you feel a bit "hollow"? It may mean a lot more later than it seems right now.—**R.G.**

# Patents . . .

(continued from page 9)

handle the invention. Considerable expense and risk are thereby avoided. However, none of the firms contacted were too interested in buying the rights. It therefore remained up to the inventor to assume these risks if he wished to see his idea materialize.

The next thing to do was to find a suitable manufacturer. A number were contacted and those interested were sent drawings with specifications and bid sheets. Copies of the bid sheets are in the appendix. A number of bids were received, and the most satisfactory one was accepted. Notices of contract requirements were included in the completed bid sheets.

All the correspondence then ensues in which contract terms are decided upon. It might be well to mention here that one of the outstanding factors in the compilation of the **Guide** is the inclusion of the mistakes and errors in judgment to which the uninitiated inventor might succumb. It is possible to avoid these by using care and the **Guide's** mistakes as examples.

In due course, the contracts were signed and the order placed.

At this time a discouraging blow fell. A letter arrived from the patent attorney stating that the application had been rejected on all but one of the seven counts. While this really was to be somewhat expected, it would come as a shock, since all was in readiness for production.

The examiner claimed that the patent conflicted with an existing British patent. A hurried letter was posted, inquiring as to whether manufacture should be continued, since the idea was infringing on a British patent already in existence! Here again the advisability of having good legal counsel is amply verified. As it turned out, the conflict was a minor one; their principle was different.

An interesting sidelight pops up here. From a letter from the attorney, "A British patent cannot be infringed except by making, using, or selling in England the invention that the patent covers. Nothing that you do in the United States, or elsewhere except in England will infringe this patent."

An important move was then made by the attorney. No monopoly could be granted the inventor for any of his claims that were broad enough to include what the British patent showed. "Our problem was therefore to restrict the scope of our claims so as to exclude from them the British device." The attorney then amended, ever so slightly, by the use of different phraseology and wording, the original application so as to conform with the above quoted idea.

The amendment is still in process. Additional trouble, at least of a new nature, is not anticipated.

Having satisfactorily placed the patent before the Patent Examiner and received the first shipment of sample hangers, the advertising and selling end of the game come into view.

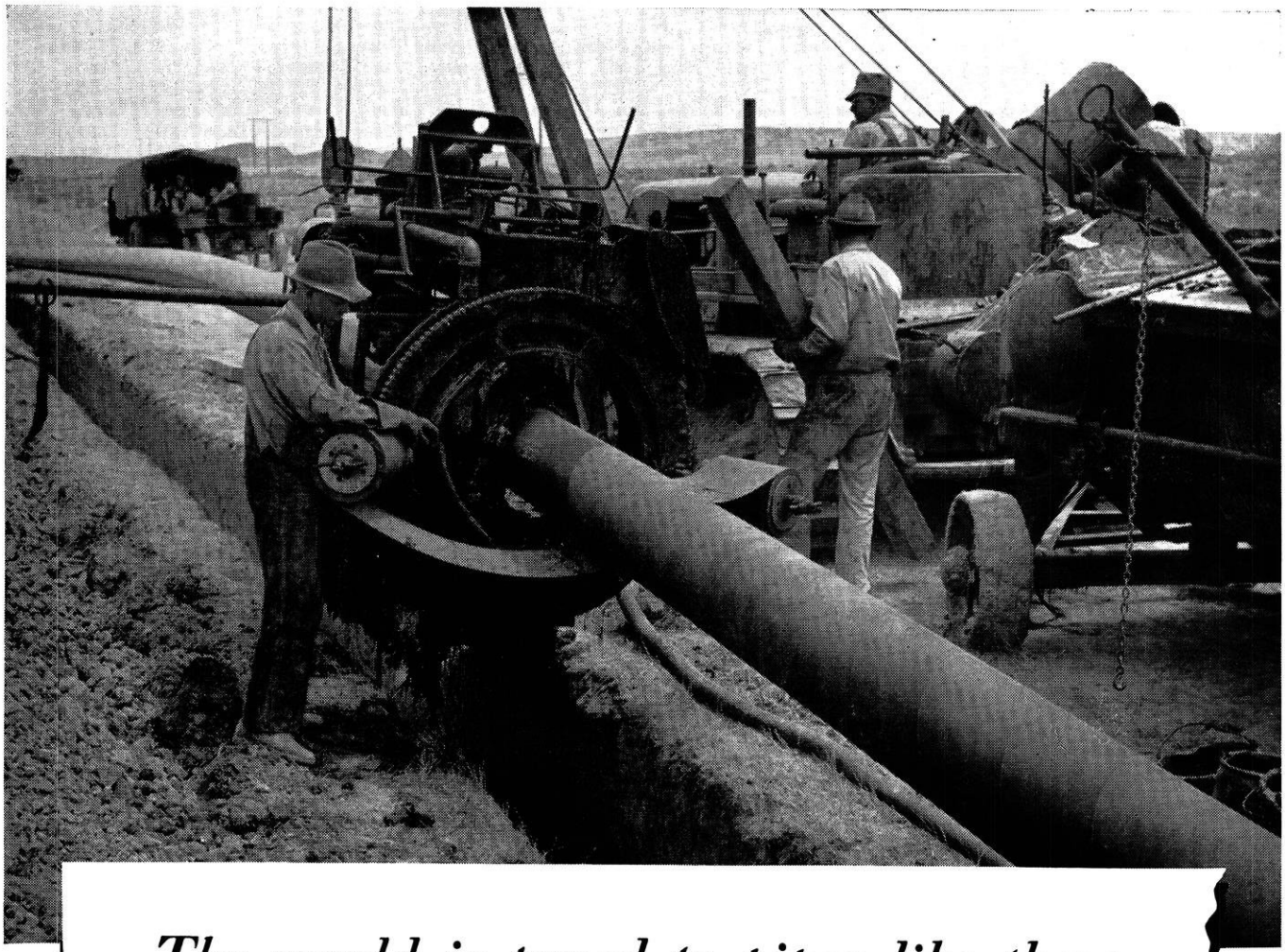
It was felt that the most likely way of attracting attention was through the use of circulars, mailed to all likely users, or dealers. Such a listing was obtained by a mailing list house in New York. These houses supply mailing lists with 98% accuracy for any business available. If necessary, they will perform the complete addressing and mailing of the circulars for an additional fee. A number of other services are available through these companies.

The inventor then had to have circulars printed up describing his product in an attractive, easy to read, and appealing form. For this he chose an individual skilled in advertising layout and of artistic ability.

When a satisfactory circular was made, it was sent to local printers and bids accepted. It was interesting to note the wide variance in bids from the printers. Some greatly exceeded others. It was similar with the bids for the actual manufacture of the hanger.

**An inventor should not take the**

(please turn to page 26)



# *The world is tuned to pipes like these*

PETROLEUM, as a fuel and as a lubricant, has become the basic material of progress —and petroleum products could not be made available in great quantities at low cost if it were not for pipelines.

Oil transporters pioneered low-cost, long-haul methods of handling liquids in large quantities. Today the users of oil (which includes just about everybody), and of many other products as well, live better because petroleum research men and engineers found ways to get the job done.

Here at Standard Oil we are developing new methods to increase the efficiency and economy of pipelines. Externally, our lines now have cathodic protection; an electric current is imposed on the line to prevent dissolving the metal of the pipe at points where it is in direct contact with soil. Internally, corrosion is inhibited by the injection of sodium chromate solutions that form a protective film. Both methods minimize costly shutdowns of our pipelines. Even more improved methods are now being sought.

From their work with pipelines, as from their work with all other phases of our business, Standard Oil scientists can feel the satisfaction of accomplishment and the challenge of all that remains to be done.

## Standard Oil Company

(INDIANA)

STANDARD

# Guns...

(continued from page 14)

bering nipple such that when hit by the hammer, the barrel charge was ignited directly rather than through a priming charge. By making this cap moisture proof, a soldier could usually feel pretty sure the outfit would go off. This system, with variations in the capping system, lasted until well after the Civil War.

While the Army is well known for its good equipment, as always, it was years behind the times. Its flint guns were still in use long after the merits of the percussion system were known. It refused to issue a gun "you could load on Sunday and shoot all week" (the Spencer Repeating Rifle) until well into the Civil War because of the typical reaction; a soldier would be able to shoot too quick thus wasting ammunition.

Paralleling the military line of fire arms, but far ahead in development, was the sporting rifle, typified by the highly publicized Kentucky rifle. Certainly if anything is representative of early American ingenuity and workmanship, it was the Kentucky rifle. The gunsmithing profession among the pioneers was a highly respected job. With the immigrants came some of Europe's best craftsmen with their ideas to influence the growth of American fire arms.

One of the greatest ideas adapted to American arms and developed through American drive, was the use of rifling. First used in Germany, it was developed in America to the high degree of usefulness as now known. The German idea was, that by using an oversized ball and hammering it with a steel ramrod and a mallet into the barrel, the rotational advantages would be used to the utmost. Because of the pains thus involved in loading, the guns turned out tended toward large calibre, with short barrels. American riflemen found that a patch would have the same effect; i.e., that of

# Patents...

(continued from page 24)

**first bid that comes along thinking that all the others will probably be in the same neighborhood.**

Ultimately, a satisfactory printer was contracted to print up a number of copies.

In addition, an advertising program was planned, and appropriate magazines of the builders' trades were chosen and ads contracted for in these publications.

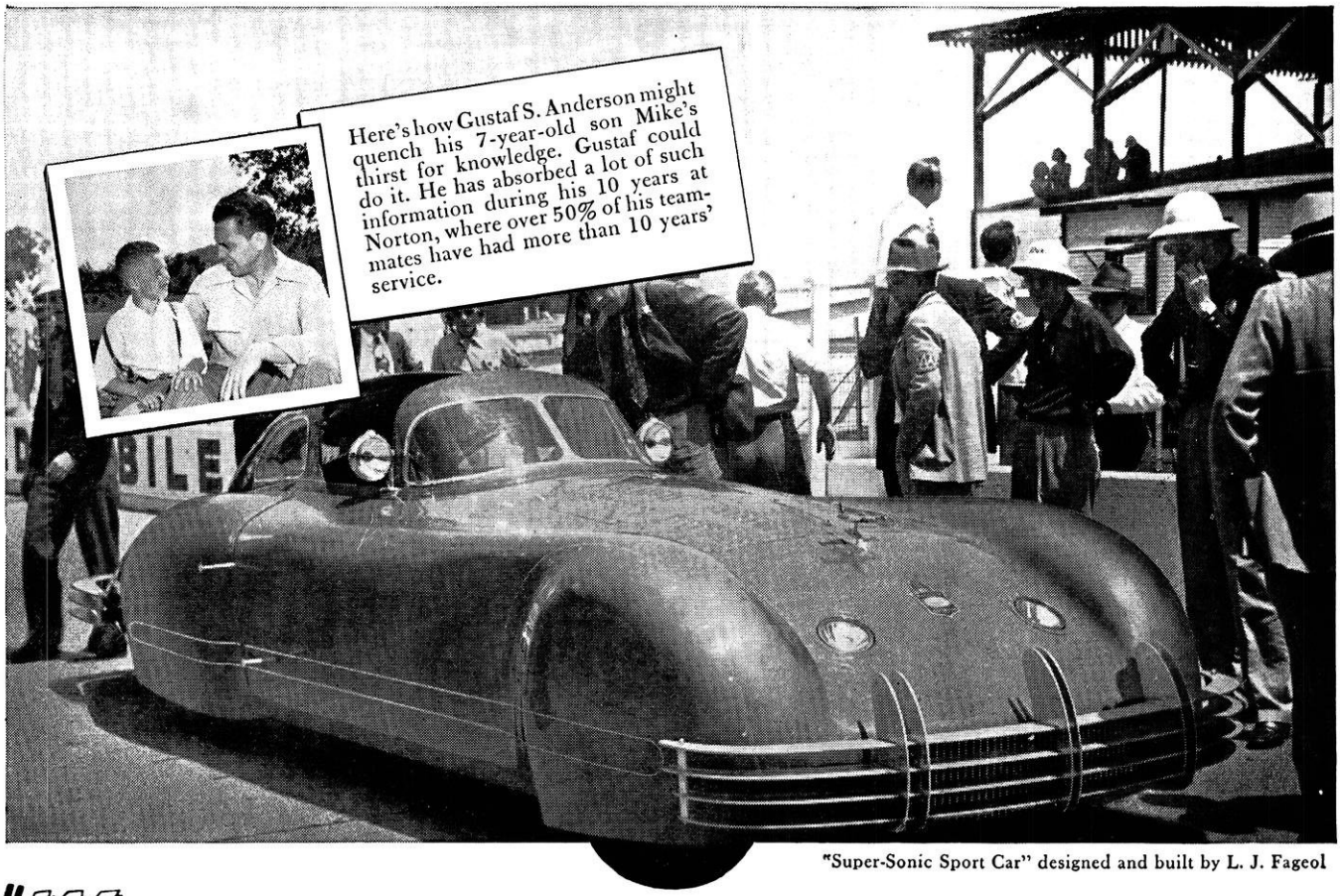
Much has been eliminated from this discussion, of course, but it is hoped that a genuine interest has been developed for a look at the **Guide.**

---

filling the grooves, so that an undersized ball could be used and still have the advantages of rifling. Thus, with a much easier loading arm, the barrels could be lengthened, becoming in some instances as long as 60 inches thus allowing greater accuracy. As such they were capable of barking squirrels at fabulous distances and in the hands of capable men could be a dangerous threat in any man's army. Since most of the soldiers in the Revolution were required to furnish their own rifles, many of these Kentucky rifles saw action. In the Civil War, the Berdan Sharpshooters used a gun quite similar to this rifle and reports indicated they were terrific weapons.

Comparing these Kentucky rifles of the early 1800's with a modern hunting rifle is like comparing Caruso with gravel groan Godfrey. They were real things of beauty; full length curly maple stocks with many silver and brass inlays, octagon barrels, and brass patch box all highly polished, set triggers, and fine open sights.

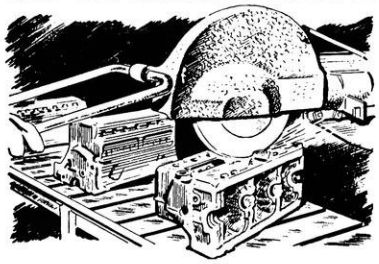
It seems a far cry from the Kentucky rifle to the modern sporting rifle. If the original rifle makers knew that the outcome would be cannons, machine guns, bombs, and atom bombs, what would they have done differently?



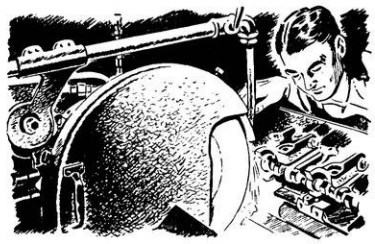

"Super-Sonic Sport Car" designed and built by L. J. Fageol

# "WHAT WILL CARS BE LIKE WHEN I GROW UP, DAD?"

"Well, son, you can be sure *your* first car will pack more power, ride smoother and cost less to run than today's cars. The automobile makers know folks always want improvements, so they make better cars every year."



"Norton grinding wheels help — and they start on the first rough castings. Our hones make cylinder walls smooth and long-lasting. Dies and tools are manufactured and maintained with Norton grinding wheels.



"Camshafts must be true, or engines won't run smoothly. Norton Cam-O-Matic grinding machines finish cam contours to close precision. In fact, these speedy, automatic grinders help lower mass production costs.

"New cars look better every year. And their smoother surfaces for better paint jobs come from things like Behr-Manning abrasive discs. Behr-Manning, remember, is an important member of the Norton family."

"Of the thousands of parts that make up a modern car, nearly all of them are made better by the touch of products made by the Norton family. That also applies to just about every other industry, large or small. That's why I like my job of making better products to make other products better."

NORTON

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*Making better products to make other products better*

ABRASIVES · GRINDING WHEELS · OILSTONES · ABRASIVE PAPER & CLOTH

GRINDING AND LAPPING MACHINES · LABELING MACHINES · NON-SLIP FLOORING

REFRACTORIES, POROUS MEDIUMS & LABORATORY WARE · NORBIDE PRODUCTS

**NORTON COMPANY, WORCESTER 6, MASSACHUSETTS**

BEHR-MANNING, TROY, N. Y. IS A DIVISION OF NORTON COMPANY

# Flight . . .

(continued from page 11)

placed in operation and that the changes of pressure experienced were pretty much dependent upon the skill of the flight engineer.

Today the automatic systems allow for a greater flexibility in the operation of cabin pressures. The usual procedure now is to start pressurizing at the time of take-off and to cease upon landing. A plan such as this allows the airplane to climb at any desired rate independent of the cabin's rate of climb, which can be controlled by a cabin altitude rate of change selector. It has been found that most people cannot even notice a change of 200-400 feet per minute so that cabin pressures are usually increased or decreased somewhere in this range. With this slow rate of controlled change in cabin pressures the modern pressurized airplane is now free to climb at any rate from 100 to 1,000 feet per minute without having any effect on passengers or crews.

A typical flight plan is shown graphically in Figure 3 showing the relationship of cabin altitude to airplane altitude on a typical flight between Miami, Fla., and Newark, N. J.

Basically there is nothing against a pressurized cabin. However, one question is always asked. What effect is

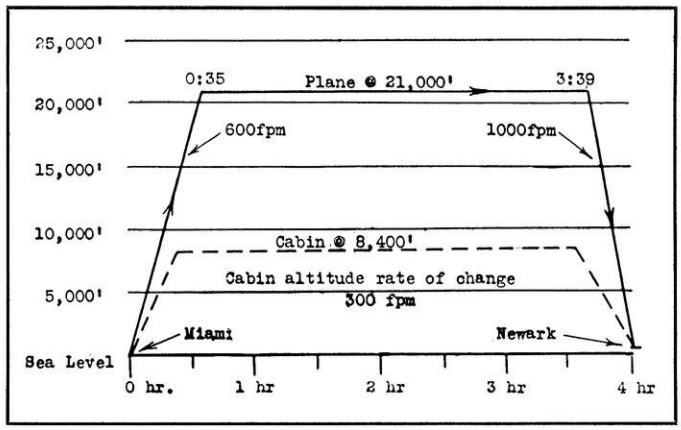


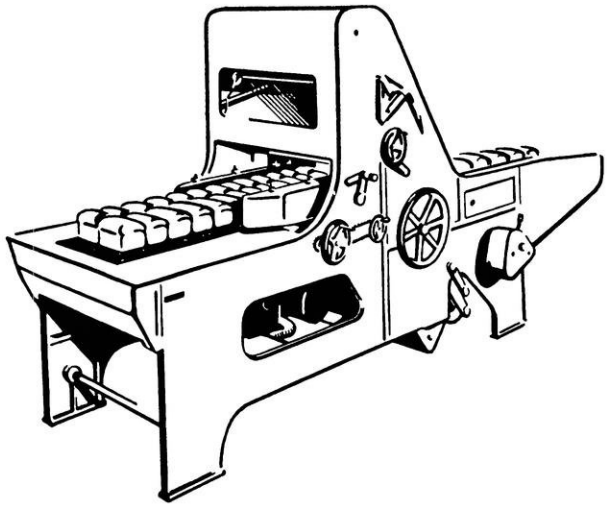

**Fig. 3 Cross sectional view of pressurized flight between Miami, Fla., and Newark, N. J.**

there on the human body if there is a sudden loss of pressure due to failure of superchargers or a blown hatch?

The first part of this question is easily answered. Most all systems are provided with two superchargers mounted on separate engines as on the Constellation. Under this dual arrangement a failure of one compressor does not mean that the system will be unable to operate as the whole system may be maintained with a single compressor. A failure of both compressors is another situation, however, but the odds are high against the failure of both compressors at the same time.

(please turn to page 32)

*Another page for* **YOUR BEARING NOTEBOOK**



## How to help a bread slicer carve a name for itself

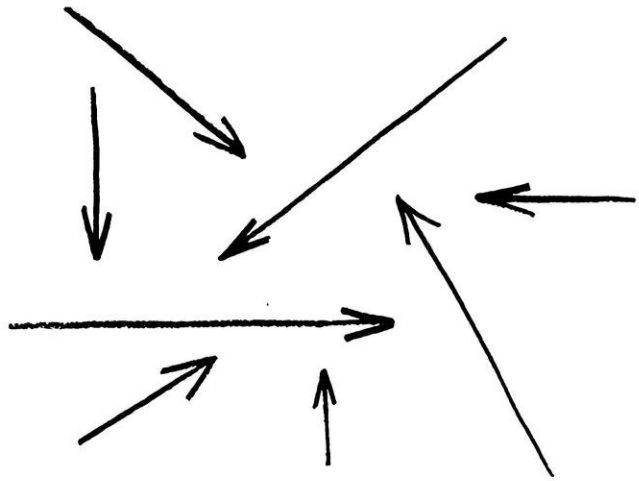
Designers of a new, 75-loaves-a-minute bread slicer were looking for a way to insure long-term accuracy and minimum maintenance. They found the answer in Timken® tapered roller bearings.

Timken bearings keep the knife drum shafts in rigid alignment, maintain precision movement of parts. They require minimum attention, normally last the life of the machine. And they permit tighter closures that keep the lubricant on the bearings . . . off the bread.

---

## Why they all look alike to a TIMKEN® bearing

Loads from any direction—radial, thrust or combinations of both—are carried by Timken bearings, thanks to their tapered design. Timken tapered roller bearings make auxiliary thrust bearings and thrust plates unnecessary . . . simplify design, save space, cut costs.



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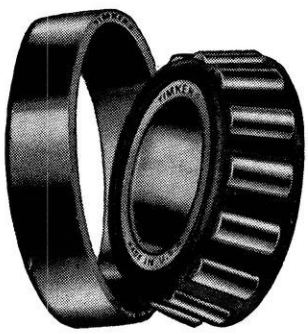

**TIMKEN**

TRADE-MARK REG. U. S. PAT. OFF.

*TAPERED ROLLER BEARINGS*

## Want to learn more about bearings?

Some of the important engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. For additional information about Timken bearings and how engineers use them, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

---

**NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬭ AND THRUST →⬭← LOADS OR ANY COMBINATION**

# Science . . .

(continued from page 13)

## RADIOACTIVE TRACERS IN PLATING

A long standing problem in electrochemistry has been solved at the National Bureau of Standards by the use of radioactive tracer techniques. The problem was to determine whether chromium, when plated, was deposited out of the bath from the trivalent state or the hexavalent state. Both hypotheses have been held, but it had not been proved until this test that metallic chromium is deposited out of the bath from the hexavalent state.

Different plating baths were prepared, some containing the ordinarily used chromic chloride and others containing radioactive chromium compounds in both the trivalent and hexavalent states.

After the chromium was deposited the radiation of the different samples was measured by a gamma ray counter. It was found that only the chromium deposited from the radioactive hexavalent chromium baths was radioactive. Thus it was proved that chromium is deposited from the baths from the hexavalent state.

## FATIGUE TESTER

A novel method of fatigue testing is used by General Electric engineers to test the strength of metals. The metals are prepared in the form of thin strips which are then placed in a stream of air and set into vibration. The principle is exactly that used in a harmonica. The metal strips vibrate at their natural frequency until they fail.

The number of vibrations necessary to cause failure is determined by multiplying the number of vibrations per second by the time of the test in seconds. The frequency of vibration is determined exactly by the use of a beam of light and a photoelectric tube which counts the vibrations electronically.

Because of the high frequencies which can be produced on this tester, the tests are often run at frequencies which equal in 24 hours the number of vibrations ordinarily obtained in three weeks on a mechanically operated tester.

## AIRCRAFT OIL FOAMING

From experimental work done at Stanford University, sponsored by the National Advisory Committee for Aeronautics, a new method of preventing the foaming of aeronautical lubricating oil has been found.

Glycerine - Aerosol OT mixtures were found to be completely effective as antifoaming agents until the glycerine disappeared from the system as a result of gradual evaporation. The mixture retains its antifoaming property without any deleterious effects on the engine. It is more effective than the commercial antifoaming agents now in general use.

As part of the studies, various other materials were tested as possible replacements for glycerine, however, the two agents which provided good antifoaming action also produced sticky residues in the engine. This ruled out the use of these materials as practical defoamers.

# It's a good thing he doesn't dress for every industry he serves

**He's a Square D Field Engineer.** There are others like him in Square D branches in more than 50 principal cities of the United States, Canada and Mexico. These men are liaison between Square D and industrial America. Their full-time job is contacting industries of every type and size. It is through them that we are able to do our job effectively. That job is three-fold: To design and build electrical distribution and control equipment in pace with present needs—to provide sound counsel in the selection of the right equipment for any given application—to anticipate trends and new methods and speed their development.

If you have a problem in electrical distribution or control, call in the nearby Square D Field Engineer. He makes a lot of sense in finding **"a better way to do it."**

*For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.*

**SQUARE D COMPANY**

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

# Flight...

*(continued from page 28)*

The latter part of the question is one that concerns some people both in and out of the aviation world. Blown hatches are not impossible as a few of these failures have happened in the past. The direct effect of a pressure change from 8,000 feet to 25,000 feet due to a blown hatch, depends a lot on the individual. Many crews on Superfortresses during the world war experienced the effects of suddenly depressurized cabins. The general consensus of these crews were that they did not notice the change as they were either too surprised or too busy looking for their oxygen masks. It is of general opinion now that although a sudden depressurization while not beneficial would not do any great harm to a normal individual, providing oxygen were immediately supplied.

The greatest danger involved in a sudden loss of cabin pressure from a blown hatch or window is being too close to the blown member. The velocities created by the venturi action through the opening is something that would astound most people. It was rumored that in a Superfortress velocities of around 400 miles per hour were realized in the connecting tunnel between the aft and forward cabins upon instantaneous depressurization and this tunnel was some 3 feet in diameter. It is known that forces great enough to suck a person out of the airplane do exist if he is within a foot or so of a blown hatch.

To the layman the advantages of high altitude flight requiring pressurized cabins are not readily seen. In aviation it has been found that generally the higher you go the better off you are as engine and aircraft performance increase at higher altitudes. Greater speeds can be obtained due to the thinner air. Gas consumption is greatly decreased thereby lowering the cost of operation. Every thousand feet of altitude added to aircraft performance increase the flexibility of operation. Flights at higher altitudes can often get over or by pass existing weather conditions that prevail below 18,000 feet, thereby giving both passengers and crew a safer and more comfortable ride.

### Future of Pressurized Flight

The introduction of jet flying to the world has now put further demands upon more efficient cabin pressurization and air conditioning. The present demands are to push the cabin pressures down as close to sea level as possible. The reason for these demands are so that much more rapid ascents and descents may be made. Present day experimental cabins can now be maintained at sea level up to and including 21,500 feet and an approximate 4,000-foot cabin can be maintained at 30,000 feet.

Much research is being directed along this line and it is believed that the pressurized cabins that we know today will seem as crude in 20 years from now as the Model T Ford does to most youngsters today.

# Photography can make this page

this  small

## *IT'S DONE WITH MICROFILM MAGIC*

TINY AS IT IS, the little rectangle above is this page in black and white—as it appears on microfilm. Everything there, condensed to a mere spot, but ready to be brought back full size with all its features intact. For photography can reduce tremendously without losing a detail.

*As a business or professional man, you can utilize photography's reducing ability in any of many important ways.*

You can utilize it to save space . . . to speed reference. With Recordak microfilming, you can "debulk" files 99% . . . keep the records at hand for quick viewing, full size, in a Recordak Reader.

You can utilize photography to make sales presentations more complete, more resultful. With motion pictures, you can "pack" a plow, a plant, a whole process into a small can of film . . . travel it where you will, show it off "large as life" and much more dramatically.

Only a suggestion . . . this . . . of what photography can do because it is able to condense. And because it has many other unique characteristics as well, photography is becoming an increasingly important tool all through science, business, and manufacturing.

Whenever you want to improve methods of recording, measuring, testing, teaching, or countless other functions, be sure to consider the unusual abilities and advantages of photography.

**Eastman Kodak Co., Rochester 4, N. Y.**

## **Functional Photography**

**—is advancing business and industrial technics.**

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