Spring 4-1949

Volume 60 - Issue 9 - April, 1949

Rose Technic Staff
Rose-Hulman Institute of Technology

ROSE TECHNIC

SUPERSONIC FLIGHT

Page 8

APRIL, 1949

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Rose Technic

Volume LX, No. 9 April, 1949

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In This Issue

FEATURES

COVER

An original cover by the ROSE TECHNIC illustrates the seemingly "unlimited horizons" offered by Supersonic Flight.

FRONTISPIECE

This Bureau of Mines shale retort is used for experimental work in extracting oil from shales mined in Colorado. If the cost of mining, if an efficient method of extracting oil from shale, and if research can find uses for the by-products, these shales offer a large reservoir of oil for this country.

Cut Courtesy **THE LAMP**, Standard Oil (N. J.)

**Printed by Moore-Langen
Printing and Publishing Co.
140 North Sixth Street, Terre Haute, Ind.**

Published monthly except June and July by the Students of Rose Polytechnic Institute. Subscription $2.00 per year. Address all communications to the ROSE TECHNIC, Rose Polytechnic Institute, Terre Haute, Indiana. Entered in the Post-office at Terre Haute as second-class matter, as a monthly during the school year, under the act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 13, 1918. This magazine is not responsible for the opinions expressed by the contributors.

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Publisher's Representative—Littell-Murray-Barnhill, Inc.
101 Park Avenue, N. Y. 1, N. Y. and 605 N. Michigan Avenue, Chicago, Illinois

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Rose Technic
Tech Engineering News
Wayne Engineer
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Congratulations and best wishes to the newest alumni — the graduates of April 23, 1949 — from the college and the Alumni Association.

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

Applications are being received for the class entering November 21, 1949

THE ROSE POLL

By Wayne Walter, sr., m.e., and Denzil Hammond, soph.

At a recent meeting of the Inter-Fraternity Council, President Wilkinson mentioned a plan whereby it may be possible for the fraternities to build their houses on the campus. As yet there have been no decisions made, so the project is still in the discussion stage.

It was thought that the houses would be built on the east side of the campus on the school's ground but of the fraternities' design. The building would be financed by the school with the loan being paid off at a low rate of interest over a relatively long period. Supposedly, this would make it more convenient for students to get to school, improve living conditions for students and center their social life on the campus.

This department, in the past month, has attempted to find the student reaction to such a plan. Each student was asked: "Are you in favor of moving the four fraternities to the campus?" Those who answered favorably were then asked, "Are you in favor of the school's building a student union as well as making the loan for and supervising the construction of the houses?"

Those questioned were separated as either organized or independent and the results were:

QUESTION: ARE YOU IN FAVOR OF MOVING THE FOUR FRATERNITIES ONTO THE CAMPUS?

Org. men	Yes- 67%	No- 33%
Ind. men	Yes- 72%	No- 28%
TOTAL	Yes- 69%	No- 31%

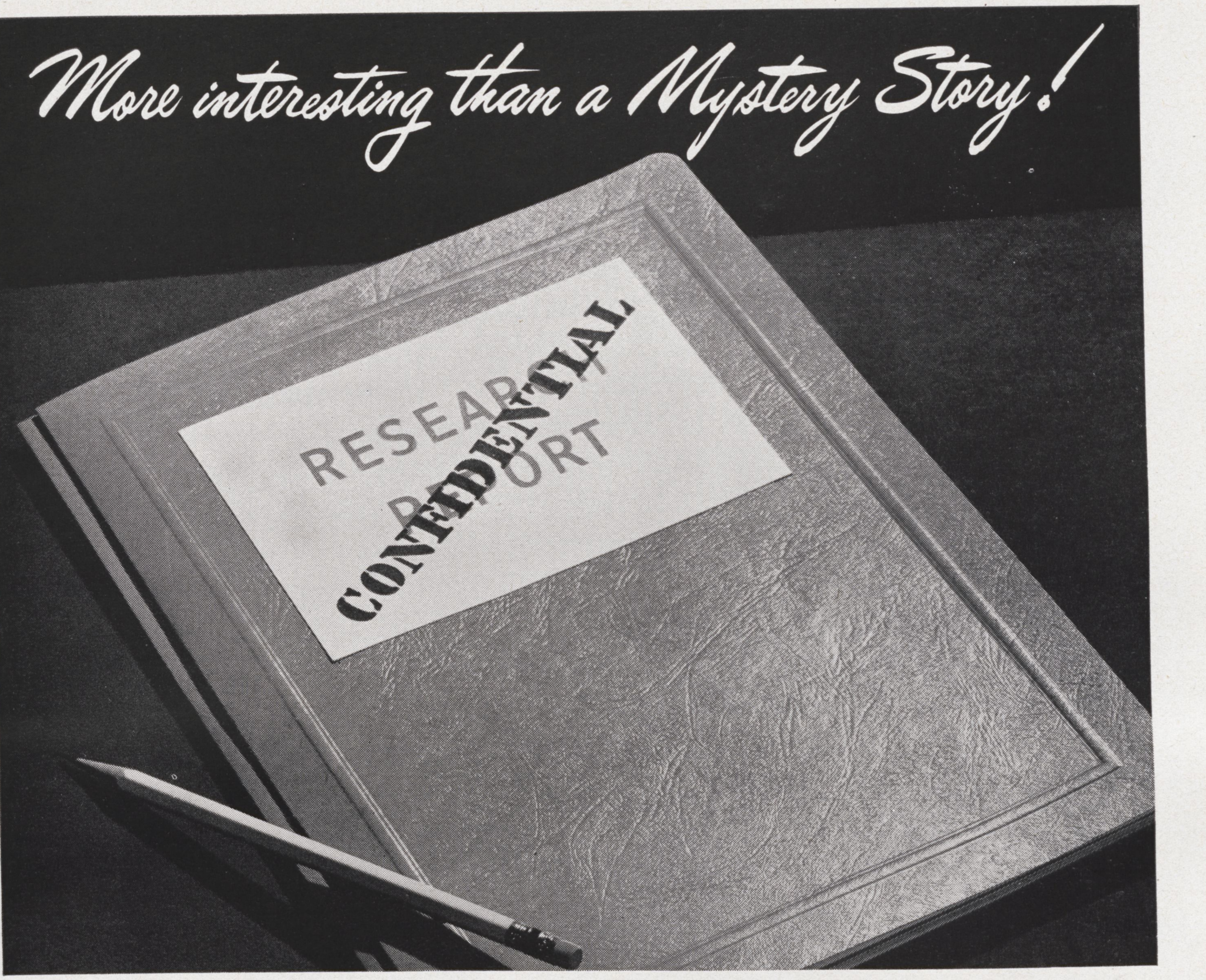
Those who answered yes were then asked:

QUESTION: ARE YOU IN FAVOR OF THE SCHOOL BUILDING A STUDENT UNION AS WELL AS MAKING THE LOAN FOR AND SUPERVISING THE CONSTRUCTION OF THE HOUSES?

Org. men	Yes- 95%	No- 5%
Ind. men	Yes- 91%	No- 9%
TOTAL	Yes- 94%	No- 6%

Several reasons for negative answers to the first question were noted. The most common were a feeling that the fraternities would be hampered in their social activities and that they would not be able to construct houses which would be a credit to the campus. In answer to the second question, some men thought that the union building would be a good idea whether the fraternities moved onto the campus or not. Affirmative answers were sometimes qualified with the provision that the tuition should not be raised and some opposition was encountered on the grounds that the money could be better spent on improving the educational facilities.

From the results of polling, it can be seen that the students, both organized and independent, are in favor of housing the fraternities on the campus. Perhaps nothing can be done, but the men at Rose definitely wish to see an increase in the recreational facilities provided by the school.



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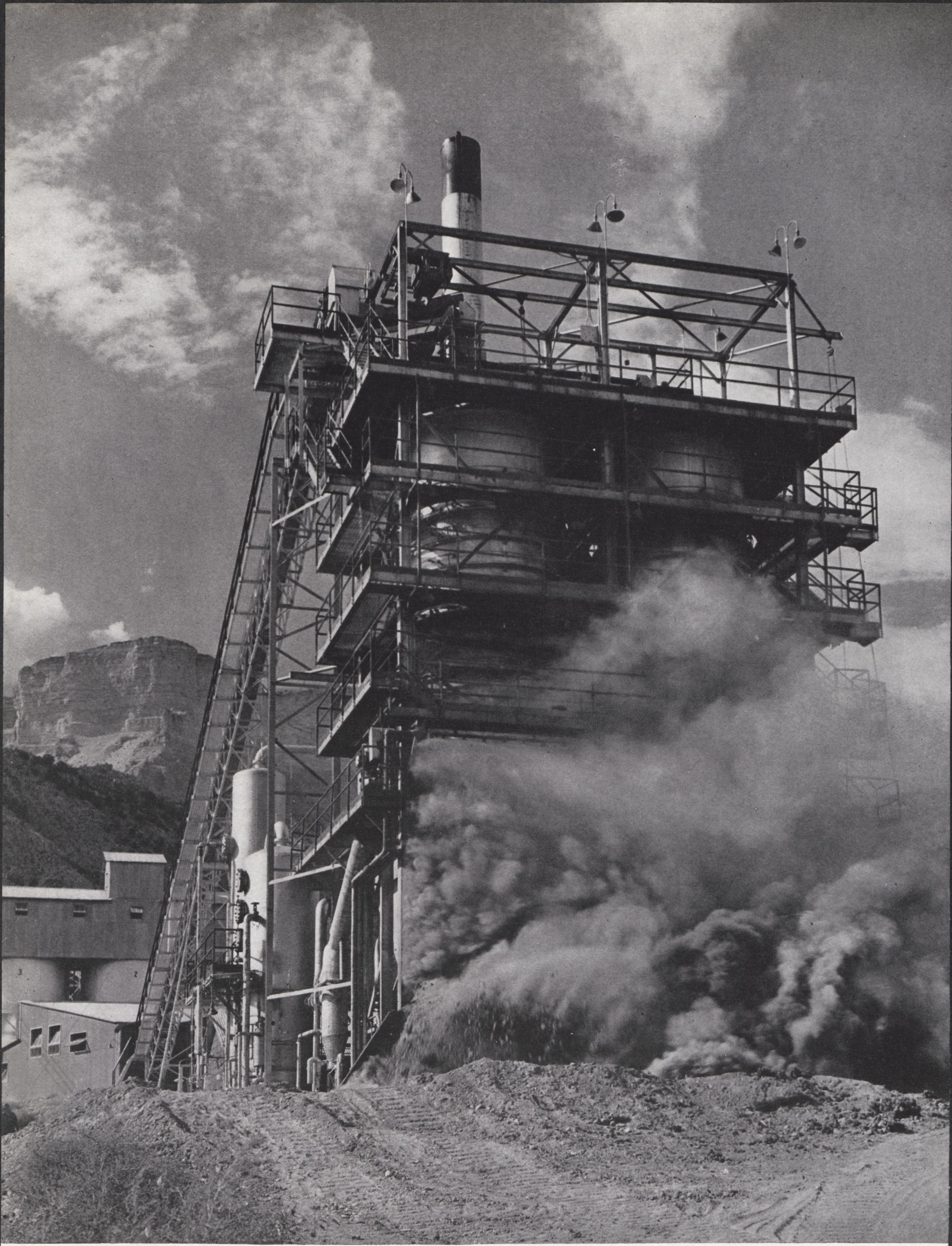

A SHALE RETORT in Colorado dumps its load of spent crushed ore after the oil has been extracted by heating. This type of retort, used now for experiments, is too slow for a potential shale-oil industry. Scientists are seeking a continuous process to handle millions of tons

Fair Deal?

Last November the American voters went to the polls and turned in one of the outstanding political upsets of U. S. history. Nearly everyone had been fooled—the experts, the Republicans big and little, even most of the people who thought at the time that they were casting a vote for the losing candidate. Almost alone, Harry Truman, the man whom only five months before "nobody wanted", remained confident and worked on.

When the astonishing results were tabulated, Harry Truman had won a tremendous victory. But, now that the people had returned him to office, he had a multitude of campaign promises which had to be fulfilled.

Heartened by the presence of a Democratic Congress, the President journeyed up to Capitol Hill to present his multi-billion dollar program for the public welfare. Requests were made for anti-inflation control, for allocation of short materials, for broader coverage of Social Security, for continued rent control, socialized medicine, and a host of other plans, all of which would afford to every citizen an all-around security hitherto unknown to mortal man. Thus was born the "Fair Deal".

Now must we, who have spent many painful years in the learning of the engineer's "how and why does it work?", if we wish to retain that vague title of "patriot," restrain our inevitable questions and trust the judgment of Washington, D. C.? Or shall we, as we were challenged to do by the great who went before us, dare to examine the current proposals in the cold light of logic?

Our government, at the present time, is an enterprise so cumbersome and overexpanded that it costs more than a billion dollars a year and the full time of nearly half a million workers just to maintain its own records! Notoriously inefficient, governmental bureaus know only one care for a poorly functioning department: hire more help. The National Life Insurance Division currently requires 350% more time than most commercial companies do to clear claims of beneficiaries, despite the fact that it employs 75% more office workers per person insured. Such inefficiency is characteristic of governmental projects in diverse fields of endeavor all over the world. Where the bill must be footed by a body as remote as "the people", there is lacking the personal interest and the desire for profits which keeps industrial concerns operating near their maximum efficiency.

But what of the new proposals? What will be the result of socialized medicine, of Representative Rankin's increased pensions? Who will pay for the hordes of new benefits which the people's champions are preparing to dole out to all who ask? Why, the taxpayers, naturally! As the President sees it, it will be a simple matter to increase corporate and high-bracket income taxes, thereby raising the increased funds. The only trouble is—but this is apparently of no concern to the administration—that businesses are supposed to make profits; when they don't, they collapse. A corporation whose tax bill is increased by a million dollars simply increases its prices so as to bring in an additional million dollars from sales. Thus the cost is passed on to the consumer, who pays more for the things he buys, thereby receiving less goods for a given amount of money. The individual with the high income, however, can do little to compensate for the new burden. Already his tax rates are so high that his take-home pay is nearly as large if he earns $50,000 a year as it would be if he earned $100,000. His incentive of monetary reward has been removed almost entirely.

The sad truth is that we are quickly approaching the point when a minority of hardworking individuals with ability and initiative will be feeding, doctoring, and insuring all the rest of the population. This will place the average laborer in the position of having a substantial standard of living assured for himself and his family, regardless of whether or not he applies himself to productive endeavor. Are we to expect miracles? Surely even the most enthusiastic supporters of the "Fair Deal" cannot believe that an employee who has the choice of working hard for $40 a week, or doing next to nothing for $30, will choose the former. For, in our free enterprise system, a man who likes to work will, in all probability, be earning more than $40; but the man who dislikes work in general will welcome an opportunity to let his fellow citizens support him.

In conclusion, let us observe that neither money nor wealth can be invented by any law. Wealth must be created by the brains and brawn of men; progress is born only in imagination. Given the opportunity to operate freely, these natural forces will preserve and enrich our lives.

A. J. V.

Supersonic

The Bell XS-1, first rocket propelled craft to carry a human through the supersonic barrier.

Cut Courtesy Bell Aircraft Corp.

The breaching of the supersonic barrier is one of the most important scientific and engineering achievements in recent years. On Oct. 14, 1947, for the first time in history, the speed of sound was exceeded by a human. Capt. Charles E. Yeager, U. S. Air Force, accomplished this feat in an experimental Bell XS-1. Since that date, supersonic speeds have been reached repeatedly. The F-86, now being manufactured, will be the first supersonic combat aircraft, and the first supersonic plane to go into quantity production.

The purpose of this article is to present to the reader a discussion of the major problems encountered at high speeds. In order that an intelligent approach be made to these problems, it is imperative that the reader become acquainted with the basic phenomena associated with high-speed flight.

An article dealing with the problems of high-speed flight is incomplete unless the speed of sound is defined. The speed of sound is the rate of propagation of pressure variations in still air. In the case of an aircraft in flight, such pressure changes occur continually at the nose and wing edges. As a result, the relationship between the speed of the aircraft and the speed of sound becomes quite important.

The speed of sound varies in direct proportion to the square of the absolute temperature of the atmosphere from sea level to 35,000 feet. From 35,000 feet to 100,000 feet the temperature of the atmosphere remains constant for all practical purposes. Since the greater part of high-speed flight occurs in this range of constant temperature, the speed of sound is usually assumed to be the speed of sound at 35,300 feet—662 miles per hour.

The ratio of air speed to the speed of sound is a useful index of the density changes or compressibility of the air along the forward surfaces of an aircraft in flight. The relation:

$M = V/c$
V = air speed
c = speed of sound
M = Mach number

is evaluated and is known as the Mach Number. Hence, an aircraft has attained the condition of Mach 1 when its air speed reaches the speed of sound.

An aircraft in flight operates under the familiar fluid-flow equations. Using this fact as a basis, the theory of supersonic flight may be developed. As an aircraft passes through the air, its curved nose usually causes the initial disturbance of the air. As the air is pushed aside by the oncoming aircraft, there is a point on the nose surface at which the relative speed of the air and the aircraft is momentarily zero. This is the point at which the surface of the nose is perpendicular to the path of the aircraft. This point of zero air velocity is called the stagnation point and is usually located at the most forward surface of an aircraft.

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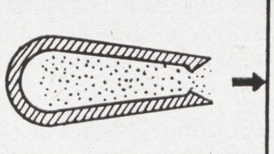
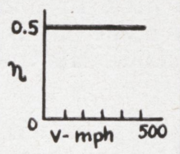
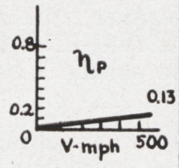
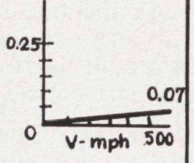
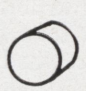
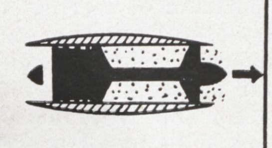
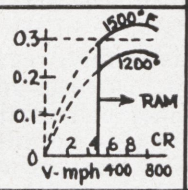
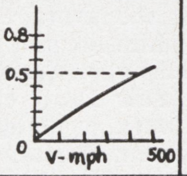
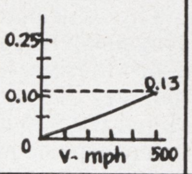
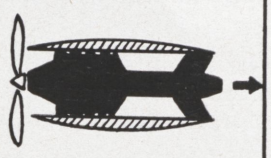
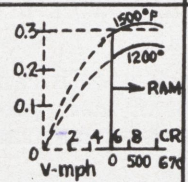
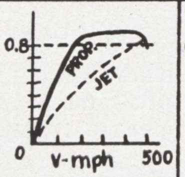
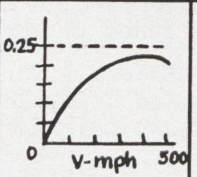
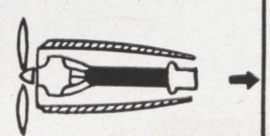
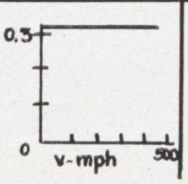
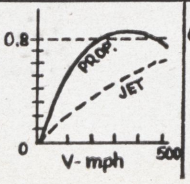
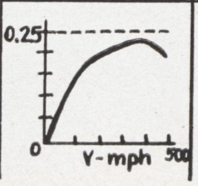
Rocket							Above 600
Gas-turbine jet							400 to 70
Gas turbine with geared propeller and exhaust jet							300 to 60
Supercharged reciprocating engine with geared propeller and exhaust jet							150 to 45

Flight

By David Mullen, B.S.E.E.

North American's F-86, which formerly held the world's speed record at 671 mph, now the first standard USAF plane to exceed the speed of sound.

Cut Courtesy North American Aviation, Inc.

Through utilization of the proper fluid-flow equations, it has been developed that, at the stagnation point, the air experiences a maximum pressure. Considering air a compressible fluid at high speeds, the high pressure at the stagnation point causes a point of high air density or compression.

In an incompressible fluid, which air may be considered to be at comparatively low speeds, the condition of maximum pressure occuring at the stagnation point is communicated instantaneously to all parts of the air. For example, in the case of an aircraft with an air speed of 200 miles per hour the condition of maximum pressure occuring at the nose is transmitted an infinite distance away from the stagnation point at the speed of sound.

At high speeds, air can no longer be considered an incompressible fluid since the aircraft is moving faster than the condition of high pressure can be propagated. Hence, the condition of compressibility occurs. At the stagnation point, the increased pressure compresses the air, creating a zone of dense air ahead of the aircraft. The nose of the aircraft must therefore move through air which is maintained at a high density and encounters an enormous increase of resistance to forward motion.

When an aircraft travels through the air at supersonic speeds, a new physical condition arises which completely changes the nature of the flow of air around an aircraft. To investigate this condition briefly, consider the aircraft nose of Fig. 1 moving at supersonic speed, V, and allow it to occupy positions 1, 2, 3, and 4 at times t_1, t_2, t_3, and t_4. At t_1 the nose disturbed the air at point 1, and this condition of maximum pressure is propagated through the air as a spherical wave at the velocity of sound, c. After a time (t_4-t_1) has elapsed, the radius of the spherical wave is c(t_4-t_1). In this same time, however, the aircraft has moved to point 4; therefore t_4-t_1=l^1/V and the radius of the sphere (by subtraction) is cl_1/V. Similarly the disturbances which started at points 2 and 3 have (when the aircraft reaches point 4) radii of cl_2/V and cl_3/V, respectively. Obviously a surface tangent to the spherical waves is a conical one with its apex at the nose of the aircraft. Such a surface represents the line of advance of the aggregation of high pressure conditions. This conical surface is a wave front or, as it is commonly referred to, an oblique shock wave. The Mach angle, x, may be seen from the figure to be given by the relationship x=arcsin c/V. In some cases the angle x can actually be measured and V calculated.

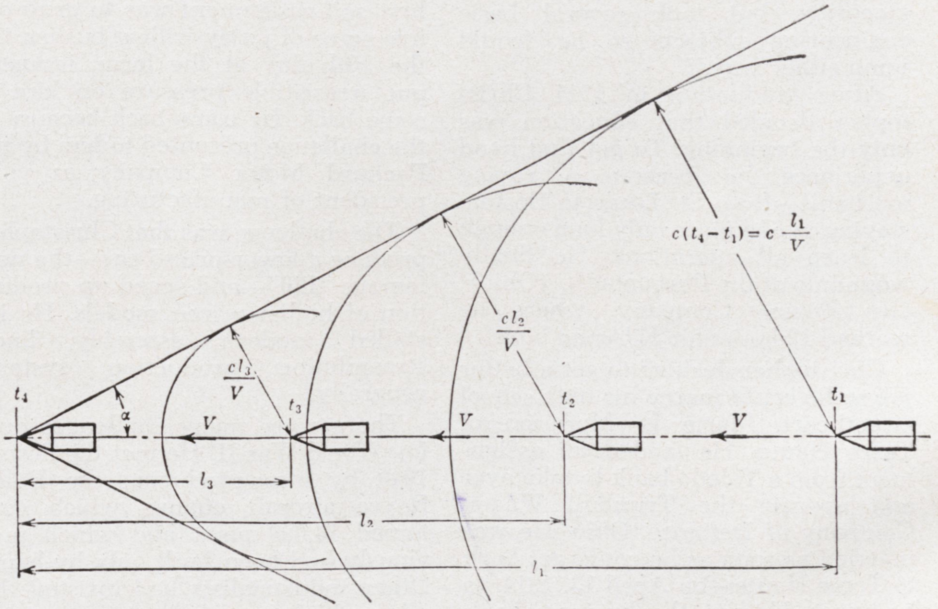
As an aircraft passes through the air at supersonic speeds it must, therefore, move through air which is continually maintained at a high pressure and under conditions of compression and high density. Obviously it will be substantially more difficult to pass through the air under such conditions than at low speeds.

For high speeds a propeller is useless as a means of driving a plane because of the compressibility effect encountered at speeds near that of sound which disturbs the flow of air along its blades. It is in this very range of speeds that the jet, inefficient at low speeds, begins to come into its own.

Jet propulsion is the generic term for reaction motors, which operate under Newton's classical Third Law of Motion which states that for every force there is an equal and opposite reaction. By one means or another jets of high-velocity air or gas, expelled from the rear of engines, exert their reactive forces to shove engines and airframe forward—much as an oarsman pushes masses of water backward to send his boat ahead. Within this new class are two broad divisions. One, called air-free, operates on a simple difference of momentum between inrushing air at the front of the engine and outrushing, heated, high velocity air at the tail. The other, self-contained as to oxy-

Continued On Page 20

Fig. 1. Depicting the flow of air as caused by supersonic speeds.



Alumni News

By Mort Hief, jr, m.e., Bill Bannister, soph.,
and Richard J. Kuehl, jr., e.e.

George T. Christopher

George T. Christopher, president and general manager of the Packard Motor Car Company of Detroit, Michigan, was born in a log cabin near Cloverdale, Indiana, on October 2, 1887. His father, W. H. Christopher, was a coal miner. George and his two sisters began working around the farm before they were of school age.

Christopher landed his first paying job by serving as a janitor after hours in the grade school which he was attending. He worked his way through high school by peddling The Terre Haute Star. At his mother's insistence, he enrolled in Rose Polytechnic Institute and worked his way through college by driving a biscuit truck. He majored in electrical engineering, but took several basic engineering subjects so he "could jump either way.'"

After graduation in 1911 Christopher decided that education was only the beginning. To get first hand experience he became a roving mechanic—from St. Louis to Boston, staying in one place only long enough to learn all operations. He finally wound up at the Portsmouth, (Ohio), Gas Engine Company, where he worked 12 hours for 17½c an hour.

Christopher decided to get a better job so he could marry his high school sweetheart, Marie L. Morrison of Terre Haute. He landed an assignment from a Toledo bank to take over and operate the Trunbull Wagon Company of Defiance, Ohio. He was married as soon as he could get back to Terre Haute—on April 13, 1914, to be exact. He put the business back on its feet in the subsequent year and a half, then returned to Terre Haute to work for the Standard Manufacturing Company. From that time on, he was connected with the automobile business in one way or another. Christopher was a superintendent at Standard, in charge of 400 men, when World War I began. He enlisted and received an ordnance assignment. He spent most of the war years at the Dodge plant in Detroit, as a lieutenant in charge of the inspection of recoil mechanisms for 155-millimeter guns.

In 1919, after the war, Christopher took a job with Delco-Remy as supervisor of manufacturing. That marked the beginning of a 15-year association with General Motors. He hit the top at Delco-Remy, which meant the top of the automobile accessory business, and he could have remained there indefinitely, but left because the job had "ceased to be a challenge." Christopher joined Oldsmobile, another GM division, in 1927, taking over the inspection and approval of all tools. In the fall of 1929, he moved over to Pontiac as vice-president of manufacturing, and in 1932, joined Buick in the same capacity.

Two years later, he decided to devote all of his time to his second love, agriculture. He had bought a 435-acre farm near Tipp City, Ohio, and his first self-assignment was to grub out five acres of pussy-willow bushes. On the 70th day at the farm, industry put irresistible pressure on him to come back. He came back because of the challenge presented to him by the Packard Motor Company as vice-president of manufacturing.

The challenge was that Christopher produce a lower-priced car—the now famous "120"—and speed up production of higher-priced models. He installed modern assembly lines, streamlining production systems generally.

There were many challenges during World War II. He met the first in 1940 by mass-producing the Rolls-Royce aircraft engine, which contained 14,000 parts and which previously had been built only by hand. Other industrialists had insisted the job couldn't be done.

On December 16, 1948, the Department of the Air Force awarded the "Certificate of Merit," signed by President Truman, to Christopher, "In recognition of your services in the engineering and mass production of aircraft engines which advanced the air supremacy of the Army Air Force and proved to be an invaluable contribution to the United States."

The six-foot, 190-pound executive does not approve of anyone who "throws his weight around and issues orders right and left." He does not like fiction or movies, but enjoys history or newsreels. He's quick to forget a man's mistake, but not a man's falsehood. His office reflects his shop background. His desk is invariably clean. He writes most of his own letters and believes a letter worth writing is worth signing. He even signs carbon copies.

In conversation, Christopher juggles industry and agriculture. When he talks about industry, he uses farm illustrations. When he talks about agriculture, he uses industrial illustrations. Newsmen like his press conferences because they do not get any doubletalk. If they ask an intelligent question, he gives an intelligent answer, minus unnecessary trimmings.

One of Christopher's favorite sayings, a good tipoff to his character, is: "The person who tells the truth never has to remember what he has said."

'05 Mr. J. S. McBride was appointed Chief Engineer-Consultant of the Chicago & Eastern Illinois Railroad, effective March 1, 1949 with headquarters at 6600 S. Union Avenue, Chicago.

'38 John E. Whitesell is now with the Indiana Public Service Co. at the Charlestown generating station. He is living in Clarkesville, Indiana.

'47 The Robert Briggs,' of South Bend, are proud to announce the birth of a son, Robert Fordyce, on January 22. He weighed 7 lb. 12 oz.

GREAT MEN OF SCIENCE

Biggest Name In Jet Engines

Air Commodore Sir Frank Whittle

By William Orbaugh, sr., ch.e.

Sir Frank Whittle.

Britain's Air Commodore Frank Whittle, the biggest name in jet engine development, began his work on centrifugal gas turbines as an R.A.F. air cadet. This work started in 1928, in time to whip Britain into jet leadership during the last war.

This shy, inventive Englishman of 41, who fathered the propellerless jet plane, has shown the way to a completely new era in flying. The whole of the aircraft industry has been quick to sense the far reaching implications of Frank Whittle's contribution in the engine development field. In the military category, all major budget allocations for engine development are earmarked for jet design. Long range strategic planning has taken a new turn to include performance and tactical ranges which, until recently, were considered as developments of the too-distant future.

That the traditionally reserved English are "tickled pink" about Whittle's contribution to his country's air leadership is seen in the fact that they have knighted him and given him an outright grant of 100,000 pounds (about $400,000) tax-free—the most generous show of appreciation which Great Britain has ever made to an inventor.

Incomparably faster, safer and easier to fly, cheaper and simpler to build and maintain, jets from a military standpoint are beginning to chase propeller-driven planes out of the sky. In this country alone there are more than 60 different jet designs either flying or in development stages; all are descendants of Frank Whittle's first successful jet engine, the "W-1." That engine powered the British Gloster "Meteor" which made the first historic jet flight in May, 1941.

Though Whittle is painfully shy, his career has been one of dash and defiance. Applying for admission to the R.A.F. apprentice school at 15, he passed the written examination, only to be rejected physically.

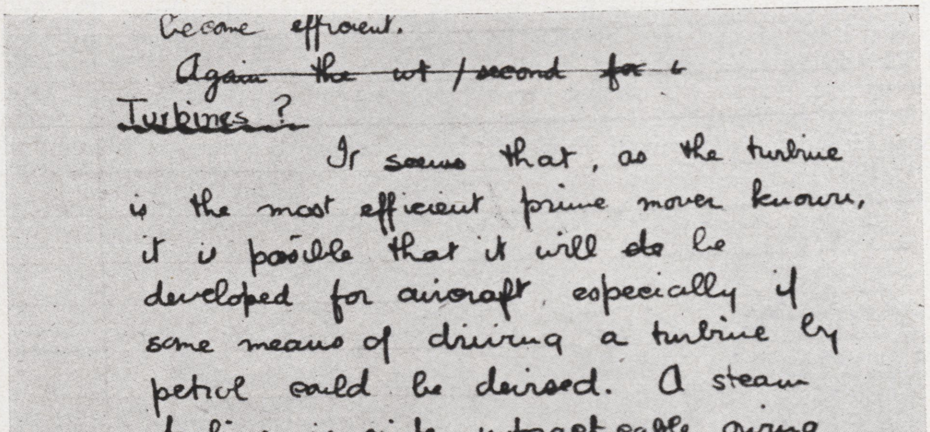
"I went to a sympathetic physical instructor," says Whittle, "who prescribed building-up exercises and a special diet. Although warned that once rejected, I wouldn't get another chance, I made another application, neglecting to mention the first failure, and passed."

After three years as an R.A.F. apprentice, repairing and servicing airplanes, Whittle was awarded a cadetship, one of six students in six hundred to make the grade. When he was graduated as a Flight Cadet at 21, his precocious thesis, "The Future Development of Aircraft" discussed the possibilities of jet propulsion. In 1928, such an idea was not only visionary, it was preposterous.

A year and a half later, Whittle conceived the idea of using a gas turbine for jet propulsion, and applied for his first patent. When he submitted his idea to the Air Ministry, he was told that it was impractical. Various private firms also turned him down. "So for five years, I continued my paper-work," says Whittle, "but financial backing to build my engine looked so hopeless, that I allowed my original patent to lapse." (Later Whittle took out subsidiary patents, turned them over to the British Government, and now they are reaping millions of pounds in royalties for the British Treasury.)

Today, Whittle explains that there was a good reason for the Air Ministry and others to cold-shoulder his revolutionary combination of the gas turbine and jet propulsion. As early as 1791, John Barber had patented

Concluded On Page 28



become efficient.

~~Again the wt / second for a~~

Turbines ?

It seems that, as the turbine is the most efficient prime mover known, it is possible that it will be developed for aircraft, especially if some means of driving a turbine by petrol could be devised. A steam turbine is quite impracticable owing the weight of boilers, condensers etc.

A petrol driven turbine would be more efficient than a steam turbine as there need be no loss of heat through the flues, all the exhaust going via the nozzles.

A page from the notebook in which Sir Whittle recorded his first ideas concerning the jet engine.

TITANIUM: New Hope of Designers

By Robert W. Schwier, sr., ch.e.

If the old adage "third time's a charm" holds true, surely titanium is the answer to the latest of engineering advancements and improvements pending today. Just as stainless steel and then aluminum revolutionized industry in their time, now titanium seems to be moving into "pole position" to again cause great advancements in the engineering world.

However, titanium's recent popularity is based on something a great deal more fundamental than mere superstition, for it not only combines many of the better qualities of stainless steel and aluminum but goes even farther in the improvement of their desirable physical and chemical properties. It has a very high weight compared to stainless steel, yet has a strength-weight ratio which is somewhat better than either aluminum or stainless steel; it has a high resistance to corrosion and heat, yet is easy to work. Research into alloying has just begun, but every indication points to new "super" alloys with properties far better than any known today.

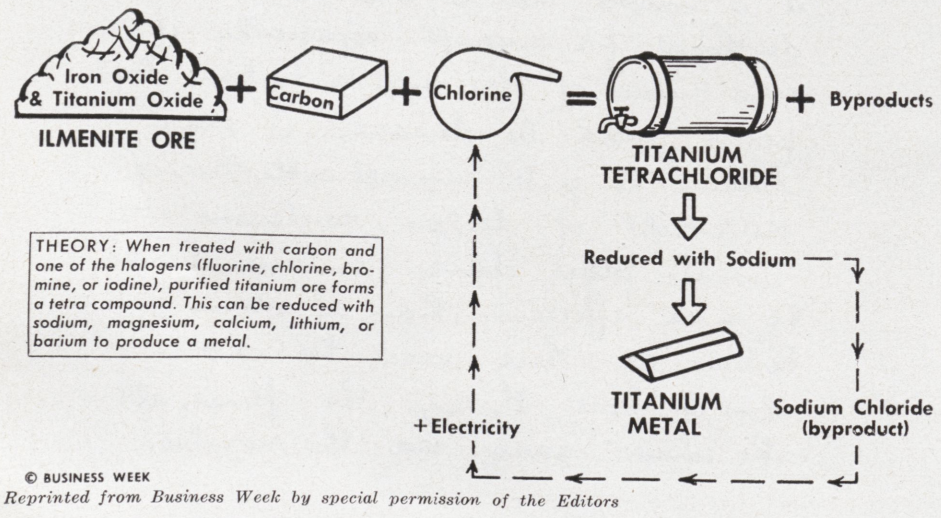
Titanium is not a newcomer to the field of metallurgy, having been discovered by an amateur chemist in 1791. William Gregor, an English clergyman, found the strange new substance in the black beach sands near his home in Cornwall, England. Titanium attracted no scientific interest until a few years later Klaproth, an Austrian scientist and minerologist, extracted the rust-resisting, silvery-white metal from an ore called rutile. The name Titanic Earth was affixed in respect for the mythical Titans, sons of the earth. Shortly thereafter an ore of iron containing titanium was found in Russia and was named ilmenite. Since titanium is the ninth most abundant element in the world, this ore appeared in many places, including America, Australia, Africa, Brazil, and India, where, for the most part, titanium was regarded as a difficult-to-remove impurity and in many places, such as Northern New York, the iron ore was left in the ground as unusable.

This "shunning" of titanium ores is not too difficult to understand, for titanium is a friendly element to the point of almost a complete bore. It grabs on to and tenaciously holds other elements to form oxides, nitrides, and similiar compounds. This makes the separation of the ore difficult and subsequent reduction of the oxide to the metal next to impossible in any commercial manner. The first successful attempts were conducted in 1908 by a Dr. A. J. Rossi who, working with Titanium Alloy Mfg. Co., managed to separate a crude oxide which he mixed with salad oil to call paint. After World War I, Du Pont grabbed up this invention and developed its "Duco" and "Dulux" finishes. These paints and finishes proved very superior to those of the day, due to the excellent covering properties or hiding powers of titanium oxide. From this small start the production of titanium dioxide has grown to the order of 225,000 tons per year going to such varied products as white-walled tires, glass, inks, and false teeth. You walk on it in linoleum floors and wear it in synthetic fabrics, where it is used to take out the unwanted lustre. However, the most important use of all lies in its position as a starting point for the production of the pure metal.

The next uses of titanium to be attempted were those of alloying. It was found that titanium in exceedingly small quantities toughens the parent metal, adds tensile strength, improves resistance to heat, and betters the grain structure and consequently the ductility. These properties are not the only advantages of titanium as an alloying agent, for it also tends to improve surfaces for enameling, reduces warpages due to oven heat, and generally reduces rejects in production. Statistical testification may be found in the 10,000 to 15,000 tons-per-year production of iron-titanium alloys.

The third popular usage of titanium to be attempted was gem production. Engineers found that the finely powdered oxide, when blown through the intense heat of an electric furnace, would form a molten mist that could be condensed on a silicate receiver to form a crystalline "boule." This boule resembles a rough gem, since it may be cut, ground, and polished to a greater-than-diamond brilliance. This is no idle boast, for the titanium gem has the highest index of refraction known to man today. Research men have found that slight impurities can change the color of the gems to produce synthetic amethysts, rubies, and emeralds, as well as diamonds. Industrially these gems are finding wide application in watch mechanisms and precision instruments. National Lead Co. now seems to be doing the greatest research with gem

ONE WAY TITANIUM METAL IS MADE



TITANIUM METAL is made by a process as shown in the schematic diagram. Actually any halogen can be adapted to the process.

production but jewelry, optical and electronic industries are maintaining astute observations of every advancement.

One of the more inconvenient axioms of nature seems to be that the more plentiful is a metal the more difficult it is to obtain, and therefore useful metals may be naturally classified into two rough compartments: "convenient" metals which are easy to refine such as copper, iron, and tin, and "plentiful" metals which are usually hard to refine such as aluminum, magnesium, or titanium. Indeed, if all the lead, zinc, tin, antimony, nickel, copper, gold, and silver were combined they would fail to equal the amount of titanium in the earth's crust. Today, as man has learned to better control the world about him, he has slowly made the shift from the "convenient" metals to the "plentiful" ones, and, in the change, has been able to utilize the better physical and chemical properties of these new metals. We need only to look to the engineering masterpiece of the isolation of magnesium from sea water or the reduction of alumina by electrolysis to get aluminum to see that these metals are definitely *not* convenient. And here lies the crux of titanium's slow-growing popularity, for, at present, there is no engineering feat to give us this metal in the few-cents-a-pound bracket.

A recent naval research symposium in Washington disclosed that, at present limited production, the price of titanium varies in the inhibitory vicinity of $5.00 per pound, while more favorable predictions for the future estimate the price to be only one-tenth of that.

There are many possible means for the isolation of pure titanium. The very pure element has been prepared by the Battelle Memorial Institute and Foote Mineral Co. using the iodide process. This process, though giving very pure titanium, is not readily adaptable to high production technique. The method in popular use now is an old process first designed for aluminum. Through the use of chlorine and carbon, titanium tetrachloride is formed from the ore. This is reduced with metallic sodium to give titanium metal and common table salt. The salt is then electrolytically separated into its components, sodium and chlorine, and their cycle is complete, ready for re-use. This process has two bad characteristics. First, due to temperature-pressure requirements, this is fundamentally a batch process and therefore the cost is higher, the labor needs more irregular, and the inventory higher. Second, the metal produced is in a spongy form and must be reformed by powder metallurgy, which is very expensive, or by induction melting in graphite crucibles, also expensive.

Since many of these processes are unpatentable it is at present very difficult to find valid information as to methods of production. One possible method, about which little information seems to be circulating, is the electrolytic reduction of the oxide. This process is closely analygous to the present method of aluminum reduction. The titanium oxide is dissolved in fused calcium chloride at several hundred degrees centrigrade temperature and then reduced by the passage of an electric current.

In the field of metal handling titanium again presents a challenge to industry. In the molten state titanium can worm through most crucibles and, if not, can climb up the sides like alcohol on glass. It contaminates easily and must be kept under vacuum or in a special atmosphere of inert gas such as helium. Its melting point borders on 3200°F and therefore there are few containers which will hold titanium. Hence, new refractory materials are being developed.

Having considered the problem in obtaining titanium metal, let us now view the other side of the economic balance — how much more can we get from this extra cost of the difficult production?

Industrial research advancements

Continued On Page 24

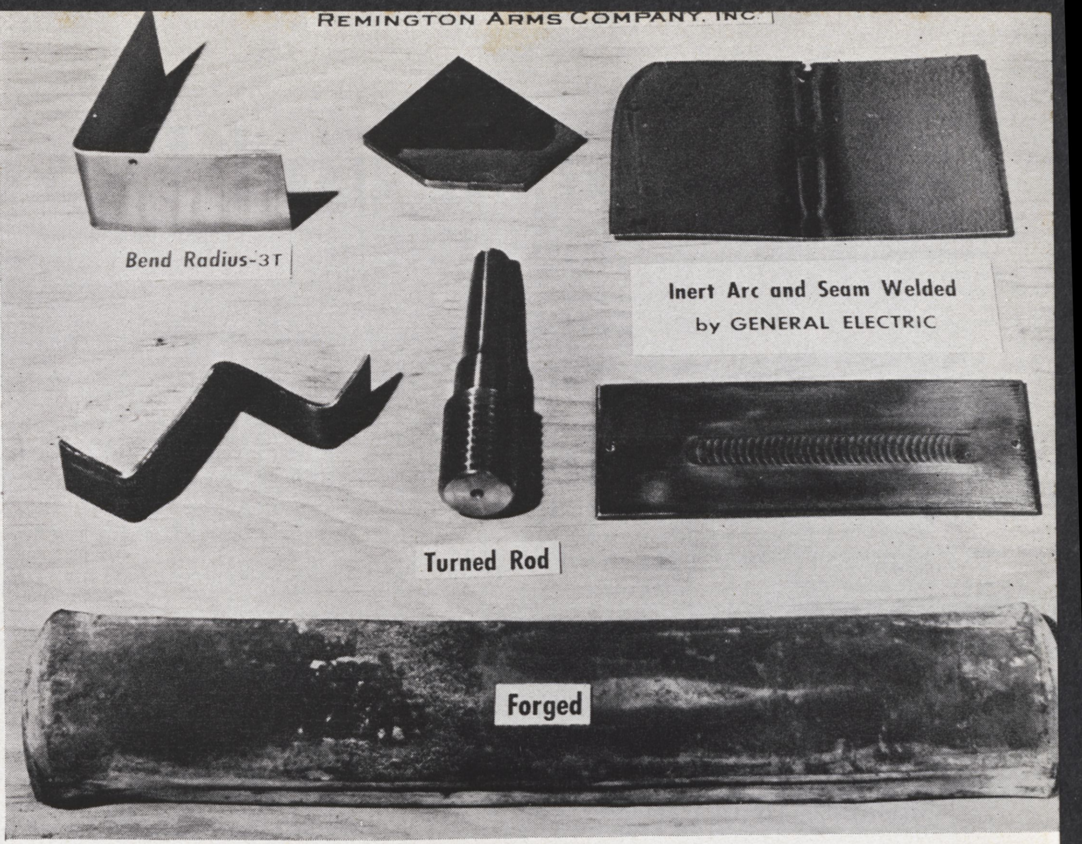


Photo Courtesy Remington Arms Co.

TITANIUM can be fabricated by most of the common methods; these pieces show titanium after being machined, forged, welded and formed.

TITANIUM SERVES MANY INDUSTRIES . . .

as PIGMENTS in . . .	in GEMS for . . .	as ALLOYING ELEMENT in . . .	as METAL for . . .
Paints, Enamels	Jewelry	Nickel Welding	Aircraft
Rubber	Dielectrics	Gas Turbine Parts	Textile Machinery
Plastics	Optics	Condenser Tubes	Automotive Pistons
Ceramics		Superchargers	Spring Balances
Paper		Cutting Tools	Sporting Goods
Glass		Enameling Steels	Gas Turbine Parts
Cosmetics		Magnets	Electrical Resistances
Inks			Television
Textile Printing			
Flooring			
Leather Finishes			
Wallboard			

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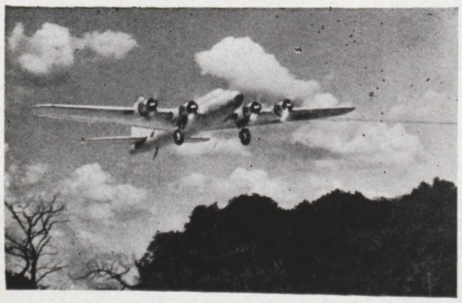
TITANIUM — Many forms for many industries.

Research and Development

By Dale Carey, jr., e.e.,
and George Eddy, jr., m.e.



Cut Courtesy USAF Material Command

Miniature Air Operations

A Tom-Thumb sized airport perched on a hilltop at Wright-Patterson Air Force Base, Dayton, Ohio is doing a man-sized job in the big and important business of model research.

This miniature flying field plays a vital role in the Air Materiel Command's beehive of aviation and development. The tiny airport is complete with runways, control station and all the facilities of its super-sized sisters. Its purpose is to provide a test ground for the flying models which augment wind tunnel studies in obtaining important pre-flight data on various types of planes.

The miniature airport's circular runway is 400 feet in diameter. In the center is a pylon — actually a control line base tower — for flying the models. Outside the circle, an operator sits in a conventional pilot's seat behind full-sized controls. Strong, thin wires connect to the model's control surfaces, enabling the operator to fly it as he would a full-scale plane.

While their movements are limited to a single axis, these control-line type models yield better rationalized proportional control data, and more nearly simulate actual flight control probems than do the radio-controlled models.

The tests are filmed by a camera which, riding the pylon cable, follows models through all maneuvers and speeds, maintaining continuous photographic contact at a constant distance.

The models are designed, built and fabricated by highly-skilled technicians in a big model shop laboratory. Out of this laboratory come some of the world's most detailed and exact replicas of our biggest aircraft.

The models usually take about three months of painstaking effort to build. They measure from seven to 18 feet in length, and some carry a price tag of more than $25,000. But, over a period of years these fabulous midgets are expected to save the government hundreds of thousands of dollars in research and development costs, not to mention time and lives. Though the tiny airport is only slightly more than a year old, it has already rung up several important experimental advances.

A series of two tests have been run with two similar models to investigate stability problems involved in air-to-air refueling. A dwarf B-17 with four real engines has roared around the hilltop undergoing stability tests, the results of which were later correlated with full-scale test results to yield valuable performance data.

At present, the models fly up to 200 mph with conventional reciprocating engines, but plans are underway to operate them at trans-sonic and super-sonic speeds utilizing rockets and jet engines. When this is achieved, extensive experiments will be made in the critical speed range—just at the sonic barrier—where other means of testing without risking personnel and full-scale aircraft are impossible.

Cut Courtesy RCA

Electronic Device Converts Reading Matter Into Sounds of Individual Letters

A recently developed laboratory model of an electronic device which converts reading matter into the sounds of individual letters has been tested recently.

In operation, a line of type is scanned letter by letter with a scanning mechanism containing a miniature cathode ray tube and an optical system. Each printed letter is scanned vertically with a pin-point of light at a rate of 500 cycles per second. The scanning, however, is not continuous but is carried out so that the scanning spot pauses momentarily at several points along its path, thereby creating the effect of a series of scanned spots arranged in a vertical line. To facilitate the recognition of signals from the individual spots of light, the spots are not present continuously but are made to appear one after the other in a time sequence. If the series of spots forming the vertical line is now moved manually along the lines of type, the light, normally reflected by the white paper, will be interrupted by the black portions of letters. These interruptions can then be transformed into electrical impulses by means of a phototube and amplifier.

As a result of the high-speed vertical scanning and the manual scanning along the lines of print, the signal output of the phototube amplifier will be in the nature of the scanning frequency, modulated by the interruptions of light.

Five to eight channels of spots of light are present in each vertical sweep of the scanning beam and are separated by a timing circuit and counted by electronic means. The total number of pulses is unique for most letters of the alphabet.

One of the ambiguities exists in the case of b and d, since the number of counts derived from these two letters is the same. However, closer examination of b and d will show a difference in the sequence in which the pulses in the various channels occur. In b, for instance, none of the scanning spots will be reflected at the start of the scanning because of the letter's vertical portion on the left. By contrast, the solid vertical portion of d is encountered by the scanning spots at the extreme right. The information thus collected by the scanning process can be combined with the balance of the scanning information to

differentiate between the two letters.

The output from the selector circuits is used to operate a magnetic tape reproducer arranged so that, as a letter is recognized, a single recording of that letter is reproduced through a loud speaker. The individual letter sounds are recorded on separate discs driven by firction from a continuously rotating shaft.

The instrument is believed to have possibilities as a recognition device for the translation of coded patterns such as those which form the basis of teletyped messages.

New Ductile Cast Iron Available

A new engineering material described as ductile cast iron, which combines the process advantages of gray cast iron, such as fluidity, castability and machinability, with the product advantages of cast steel, has recently been developed. Closing the gap between cast iron and cast steel, this material is characterized by a graphite structure in the form of spheroids, free from graphite in the flake form. Its excellent physical properties, particularly high elastic modulus, high yield strength and ductility, suggest its suitability for many applications hitherto considered beyond the scope of cast iron.

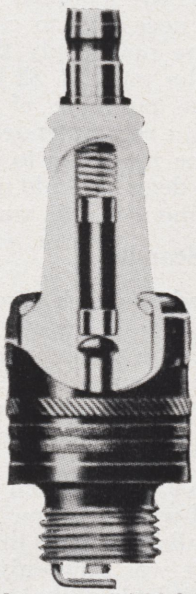
The production of this iron can be applied to common cast iron compositions melted in the cupola or in other kinds of furnaces, and is based on the introduction into the iron of a small but effective amount of magnesium or a magnesium-containing addition agent, such as nickel-magnesium alloy.

The new material will take its place along with malleable iron, gray iron and cast steel in providing the needs of industry. It will be advantageous to overall foundry practices as the new techniques should increase the importance of the foundry industry among metal-producing industries.

For pearlitic grades of cupola-melted material conatining 3.2 to 3.6% carbon and 1.8 to 2.8% silicon, the ductile iron provides, in the as-cast condition, a combination of 85/105,000 p.s.i. tensile strength, with some ductility. In contrast to gray cast iron, strength is only moderately affected by section thickness. Under stress it behaves elastically like cast steel rather than cast iron, having proportionality of strain to stress up to high loads, with a modulus of elasticity of 25 million p.s.i.

The metal magnesium has been considered by metallurgists as completely unalloyable with iron, but if properly controlled, it can be effectively incorporated in molten iron to bring about changes, one result of which is the formation of graphite wholly in the form of spheroids. One effective way of doing this is by incorporating a nickel-magnesium alloy in the molten iron. Operative with practically all the basic types of cast iron including hypo- and hypereutectic, ferritic, pearlitic, acicular and austenitic varieties, it has been found that this new process can be applied without difficulty in well-run foundries.

The potential applications for this new material are obviously many and varied. The automotive, agricultural implement and railroad industries could apply it, both as-cast and heat treated, in component parts too numerous to detail. Machinery in general including machine tools, crankshafts, pumps, compressors, valves and heavy industrial equipment ,such as rolls and rolling mill housings, could readily utilize its high strength and rigidity. Its ductility may provide thermal shock resistance far greater than has been available in high carbon castings heretofore and suggests that superior performance hight be obtained in items such as railroad car wheels nad ingot molds. The superior resistance to growth and oxidation gives promise of its use in many engine, furnace and other parts used at elevated temperatures. Other products include pipe, textile machines, electrical machinery, paper machinery and marine equipment. Service data will gradually accumulate to determine the improved quality, weight reduction, and economy available in specific applications.



Cut Courtesy International Nickel Company

Resistor Lengthens Spark Plug's Life

Research has shown that when a spark plug fires, only the first brief portion of the electrical discharge plays a useful part in igniting the mixture. The remaining, very much longer duration, discharge plays no part in normal ignition and serves only to erode the spark plug electrodes.

Insertion of a special 10,000 ohm resistor between the terminal and center electrode tip results in a spark plug with such low rates of electrode erosion that wider initial gap settings are made practical for the first time. Improved engine performance results from these wider gap spark plugs. Moreover, interference with radio and television is virtually eliminated.

One difficulty scientists had to face in designing these spark plugs was finding a material for the contact spring used between the terminal and resistor which would retain its spring properties up to 500° F. After testing a number of alloys, hard drawn Inconel, which may be used for static spring purposes up to 600° F., was chosen for this part.

One-Way Television Antenna

Like a traffic policeman in a one-way street, a new television antenna has been developed which will receive signals from only one direction at a time and will greatly improve reception of set owners in fringe areas which lie between stations on the same channel.

Consisting of an array of four eight-foot dipoles in the form of a square, with the opposite members eight feet apart, the direction from which the antenna receives can be changed by flipping a switch placed near the receiver. Inter-connection of the dipoles through a diplexing network makes this one-way effect possible.

The new antenna is not an answer to all antenna difficulties but is designed to cut down co-channel interference when the receiver is located betwen two stations and on the fringe of their transmission areas and to reduce interference of adjacent channel stations where the receiver is insufficienlty selective.

Many antennas now in use are not equally effective in receiving signals on the low frequency band, 54 to 88 megacycles, and the higher frequency band, 174 to 216 megacycles. Unless the low- and high-band stations happen to be ideally located in relation to the receiver, conventional antennas represent no better than a compromise and will not operate with complete satisfaction on all channels.

Efficient reception on high and low

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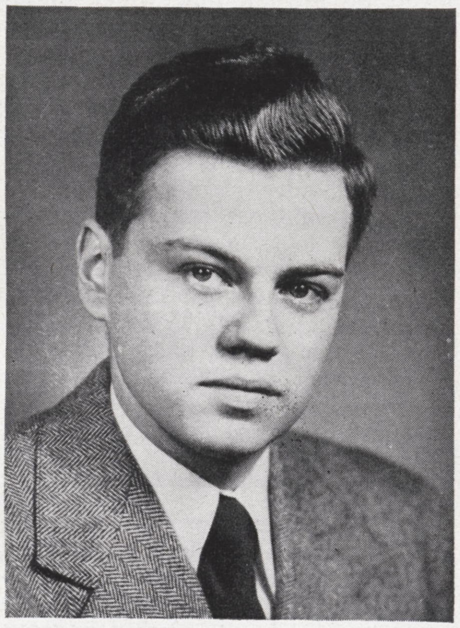
Campus Survey

By Harold Skelly, jr., e.e.

and Jim Gaston, jr., m.e.



John D. Winters

Fraternity Award Winner

At a recent province conclave held by the Alpha Tau Omega Fraternity, the outstanding senior of the province was named as the Thomas Arkle Clark Honor Award winner. The schools represented at the gathering included Illinois, Indiana, Purdue, Northwester, DePauw, Monmouth, and Rose.

Top honors were carried off by a Rose man, John D. Winters of Evansville, Indiana. Winning the province award makes him eligible for the national award.

Founded by Thomas Arkle Clark, Dean of Men at the University of Illinois, the award is based on scholarship, leadership, and character. This is the highest honor that the fraternity can bestow upon an undergraduate student.

Why Mr. Winters was selected may be readily understood by observing a record of his outstanding achievements. A mechanical engineering student who has won a schalarship for himself each year, John has had all A's except for one B on his card since entering Rose as a greencap. As fruits of his first year's labor, the bronze Heminway Medal reposes among his mementos.

In the way of leadership, he has served as the editor-in-chief of the Modulus, secretary of Blue Key, and treasurer of Tau Beta Pi. He is also a Rose Honor Man, serves on the Technic staff, and holds the post of financial secretary on the student council. The candidates for this latter position are selected by the school administration and elected by the student council.

Mr. Winters has been active in his fraternity, having held the office of vice-president and having served as rush chairman, as well as being a member of numerous committees.

Congratulations, John, from the Technic.

Veterans' Assembly

A meeting of all veterans in the school was held during the regular assembly period on March 17 at which World War II information blanks were passed out by Dr. Wilkinson. These blanks, when completed, will be placed in a permanent file along with those submitted by Rose graduates to form a comprehensive record of Rose Poly's participation in the war.

Mrs. Yeager informed the men that those who have a greater entitlement than that necessary to complete the course here may apply their excess time at the rate of $2.10 per day toward the purchase of books and supplies. She recommended, however, that anyone intending to continue to a graduate degree should not decrease his entitlement in this way.

The Big Scandal

Rose tradition took a severe beating on March 18 as the Freshmen nosed out the Sophomores five to four in the annual battle. It looked as though the Sophomores had the trophy cinched after the first two events. They won the basketball game 20 to 9, giving them two points. The tug-of-war was won in two out of three falls, bringing their total to four. There was now only one more event, and it looked like a dead cinch.

The officials had prepared things well for this final event, the flag race. Forty pounds of the best cup grease had been spread with a lavish hand the full length of the pole. They had selected a tough old basketball shirt for the flag and had nailed it securely to the pole. They made just one mistake, but it proved to be a very tragic one. They had made this event worth five points.

Things went along very badly for a while, and then they got worse. The Greencaps slid up and down the pole until most of the grease was rubbed off, and then one of them managed to get a grip on the flag. He was forced to come down without the flag, however, when the judges ruled a foul because he stepped on a crosspiece attached to the pole. But then, with the alloted ten minutes for the event almost gone, one of the Freshies got a death grip on the flag and tore off a big chunk of it.

Even then the Sophomores didn't give up hope. After all, did part of the flag constitute the whole? When the results were announced at the St. Pat's Dance, it developed that it did. And that's when it hit the fan!!

Speculation and alibies ran rampant. The big question was this: Who should be laked? Opinion was divided. The upper classmen were in favor of laking the Sophomores. The Sophomores felt that the officials were responsible. The Greencaps were happy about the whole thing, and they seemed to be in favor of laking anybody in sight.

One thing seems to stand out as a dead certainty. The Freshmen are going to need a lot more education before they realize their humble position on the campus. What everyone wants to know is who's going to educate 'em.

Civils Get Educated

After receiving instructions about getting there from the "man-who-doesn't know the name of the streets," Mr. William Hollis, the civils headed East to the Indiana State Highway Bureau of Materials and Tests Building in Indianapolis.

Upon their arrival, they had their picture taken and were divided into groups before starting their inspection tour. In each department very interesting lectures were given, along with demonstrations, about the

Everyone helps the Freshmen celebrate at the St. Pat Dance.

method of testing the road building material. (Don't ask Forsythe about the soil laboratory lecture; he didn't hear any of it, unless he was dreaming about it while he slept.) One thing the boys learned was all these "silly" tests that they are having in Highway Engineering and Foundations actually do have some practical use after all.

Although the fellows were a little tired about 4:30 p.m. as they started home, they were also "somewhat wiser."

Tau Beta Pi Election

The "brains" met at the Theta Xi house, Thursday evening, March 3rd, to decide who the "Great White Father" was to be for the next year. After the dust cleared, it was found that A. J. Vogl was "Chief" with R. Smith his successor in case of disaster. Sid Zeid is to be the recording secretary and P. Gottfried is to hold down the corresponding side, while J. Winters guards over the valuable treasury.

Glee Club

The Glee Club and Octet gave a concert at Garfield High School on March 30, and the Octet appeared before the Terre Haute Management Club on March 17. On April 9, the Octet will sing at a meeting of the Bar Association at which more than 200 lawyers from ten counties will be present. Miss Jackie Cultice, a senior at Garfield High School, now sings with the Octet.

Saint Pat's Dance

To climax a day of contests the party boys of Rose tripped the light fantastic to the tune of Jimmy Holler's band.

The highlight of the evening was the presentation of the huge wooden pipe to the Green-caps as an award for their efforts earlier in the day. Yes, it was a great day for the Green-caps as well as the Irish!

With the playing of Jimmy Holler's theme song, the boys escorted their lassies to further merriment or took their sweet young things home and then went for more merriment.

ASCE

The ASCE junior branch gave a banquet April 1 at the Hoosier Room of the Deming Hotel. After the dinner, they were addressed by a Rose alumnus, Mr. Arthur D. Kidder, '02, who retired recently from a surveying partnership in Washington, D. C. Mr. Kidder exhibited slides along with his discussion of the location of property lines and the layout of parks.

The Mid-West sectional meeting of the ASCE will be held April 23 at Northwestern University. Activities at the meeting will include a banquet and dance. At least fifteen members of the local chapter are expected to attend.

Happy! . . They put one over on the Sophomores.

Tau Nu Tau

At a recent meeting, ten new advanced military students were initiated into the fraternity. They were Max Clingerman, George Eddy, Bill Gray, Bob Haswell, Dick Kuehl, Bill Miller, Don Owens, Bob Ragsdale, Hal Skelley, and Bill Slagley.

Rose Bowling League

The Rose Poly Engineers Bowling League got under way in fine fashion on February 6 with eight teams entered in the competition. The league is sanctioned by the American Bowling Congress and must observe the ABC rules.

The high single game so far is 225, bowled by Andy Hallden of the Spooks. The second high score is held by Jack Marshall of the Sigma Nus with a 222.

The teams bowl alternately at Shamrock and Ten Pins at 2:30 every Sunday afternoon, four teams bowling at each. Individual and team averages and the next Sunday's schedule are posted the first of each week on the bulletin board in the front hall.

At this point things were looking gloomy for the Freshmen.

Tempus fugit, and the Freshmen won the field events.

Fraternity Notes

Sigma Nu Bowling Team. Left to right, Jack Marshall, Bob Atherton, Bill Slagley, Harold Skelly, and Bill Miller.

Sigma Nu

Many members of Beta Upsilon chapter of Sigma Nu attended the recent Hoosier Rally held in the Claypool Hotel at Indianapolis. Though the rally itself included only a banquet, Epsilon Mu chapter at Indianapolis arranged a very successful dance which was held immediately after the banquet. Everyone seemed to be quite pleased with this first post-war rally and promised to return next year. The speaking roster at the banquet included many prominent men of the day who were once active members of Sigma Nu fraternity.

School sessions were held in the morning and afternoon of the days of the rally. Officers and interested active members from all the chapters in District Four attended these sessions. Many discussions and meetings were held in which many of the problems facing fraternities today were discussed. Kenneth Roswell Sheetz, Commander of Beta Upsilon, was present for these sessions.

At this writing, the Sigma Nu bowling team is tied for first place in the Rose Poly Engineers' Bowling League. Beta Upsilon is the only fraternity on the campus that is represented in this activity. Our team recently purchased some new bowling shirts; good advertisement they say. The two men with the single highest games in the entire Rose Poly Engineers' League are brothers in Sigma Nu. Andy Hallden holds the first place position while Jack Marshall takes second place.

Nominations for new officers for Beta Upsilon will be held near the end of this term. Elections will take place at the last meeting before the between-term vacation. The new officers will begin their terms of duty at the regular stag party which opens each term at Beta Upsilon.

A guest-night has been instituted at Beta Upsilon by unanimous vote of the members. Each Saturday night everyone dresses for dinner. Many members take their girl friends out to Beta Upsilon for dinner on these evenings. Indeed a very pleasant, and inexpensive, way to take the girl friend to dinner.

Congratulations are in order for brother William Slagley. Bill recently "pinned" Miss Norma Deverick of this city. Incidentally, Bill is also the new president of the Junior I Class.

Beta Upsilon is proud to announce that the following brothers were recently elected to offices in the newly reorganized Rose Poly Debate Club: Paul Ford, President; Donald Newkirk, Vice-President; and Max Scott, Secretary-Treasurer. These men are all active members in Sigma Nu.

Brother Jack Bailey became engaged to Miss Betty Hazlett of Eminence, Indiana, recently. They plan to be married in July.

Alpha Tau Omega

During the recent A.T.O. Province Day doings, small but mighty Gamma Gamma came in for a fair share of honor and praise. We are extremely fortunate and very proud to have as one of our brothers the province Thomas Arkle Clark Award winner, John D. Winters. Eligibility for the award is based upon scholarship, leadership, and character. Each chapter nominates a senior, and from this group the province winner is selected. The National Winner is then selected from the Province Winners. This is the highest honor that the fraternity can bestow upon an undergraduate student.

The A.T.O. province scholarship award for the past year has again found its rightful place, right with Gamma Gamma, here at Rose.

The main speaker at the banquet was Fred Huebenthal, a Chicago realtor, who delivered an address upon the debt which college men owe because of their educational training.

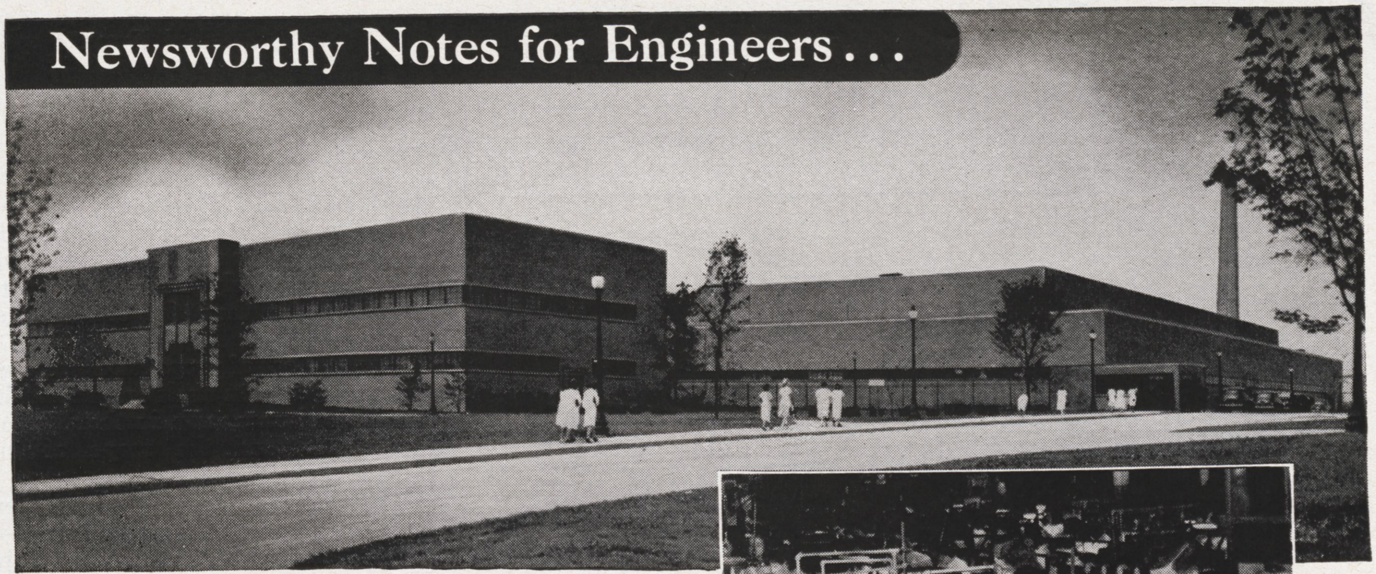
The singing trophies were awarded to the three top choral groups, Indiana, Illinois, and Monmouth. Perfect attendance trophies went to DePauw and Indiana, while Monmouth was the recipient of the distance trophy.

At a recent initiation ceremony, the following pledges were welcomed into the active chapter: Dick Minnick, Bill Herod, Bill Kestermeier, Ed Burget, Fred Reynolds, Bill Rinker, Jim Phillips, Warren Allen, Glen Bickel, Roy Deal, and Riley McKeen.

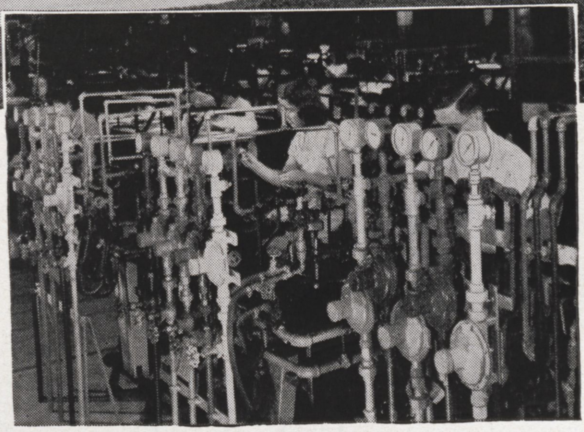
Seems as how there has been a great movement afoot these days to cement the fraternity-sorority bond through the media of closer boy-girl relationships, preferably nose to nose at three centimeters. The male principles involved in this scheme have publicized their intentions by ridding themselves of one Maltese Cross. Establishing more friendly relations with the Gammas of State is Mark Orelup, who recently lost his pin to Miriam Rippetoe. Dick Minnick has parted with his brand new pin to Alpha Katy Cane. Bob Schwier has sought greener pastures at I.U., where the proud wearer of his pin is a Gamma Zeta, Marjorie Ray. Bob

Continued On Page 32

Newsworthy Notes for Engineers . . .



New electronics plant of Western Electric at Allentown, Pa.



Over 40 miles of pipes deliver 13 needed services to working locations. These are hydrogen, oxygen, nitrogen, city gas, city water, deionized water, soft water (cold, hot, cooling) high pressure air, low pressure air, process steam and condensate return.

Complex job for Engineers

This new "controlled atmosphere" plant, which produces electronic equipment for your telephone service, posed many interesting problems for engineers at Western Electric—manufacturing unit of the Bell System.

For example, a speck of dust or a trace of perspiration may seriously impair the efficiency of vacuum tubes, thermistors, varistors and mercury switches manufactured here. To meet these problems, the new plant is completely air conditioned, with strict control of temperature and humidity—sealed except for doors, and slightly pressurized to keep out dust.

Assembling miniature electron tubes—typical of the high precision work at Allentown—calls for finest lighting. It is provided by a scientifically designed system containing over 13,000 fluorescent tubes.

Other "musts" in planning included proper illumination for high precision work—a complex network of piping to deliver 13 needed services—a gas generating plant—a highly efficient chemical waste disposal system.

But beyond the problems solved in helping to design the plant itself, Western Electric engineers met many a challenge in working out highly efficient manufacturing layouts, machine design and production techniques to assure a steady flow of highest quality electronic devices of many types.

This new Western Electric Plant at Allentown is a measure of the ingenuity and thoroughness of Western Electric engineers—electrical, mechanical, industrial, civil, structural, chemical, metallurgical—who provide equipment that helps make Bell telephone service the best on earth.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

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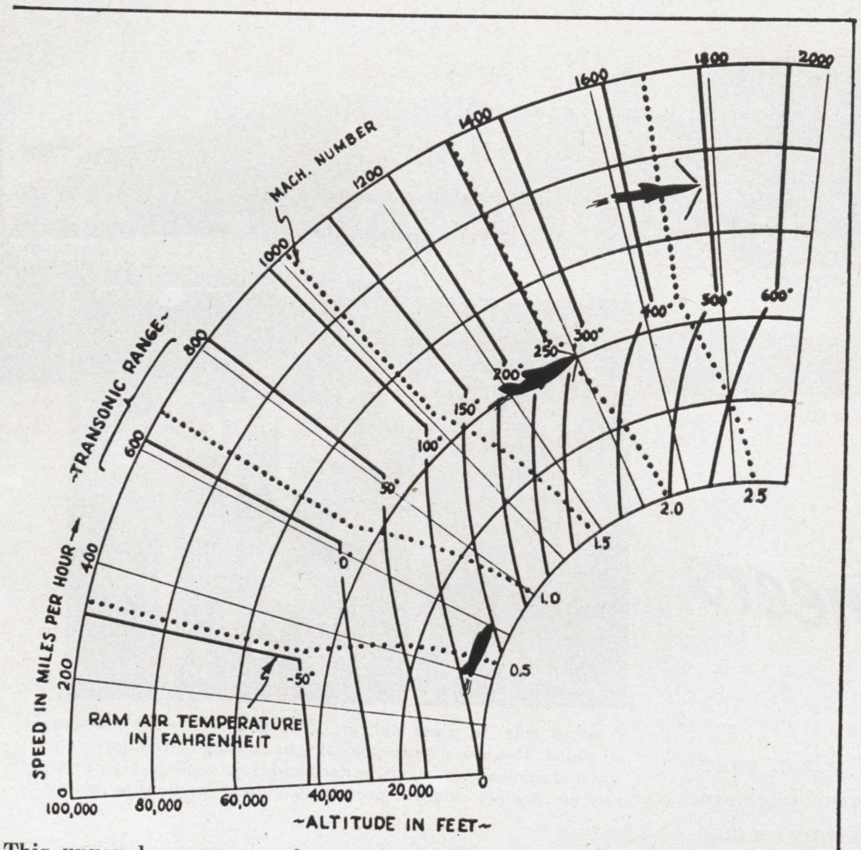

This unusual nomogram shows the effect of speed and altitude upon aircraft surface temperature while showing the relation between speed in mph and mach number.

gen and fuel, using no air from the atmosphere, operates as a pure rocket.

The extent of these new developments is indicated by the fact that horsepower is no longer the measure of its achievements. The conventional internal combustion engine has a constant energy output that increases with the velocity of the engine itself, sliding up to incredible peaks at high speeds. The measure here is thrust. Thrust is the reactive force in pounds of pressure exerted by the engine's heated air and combustion gases directly on the engine itself to propel it forward. One pound thrust equals one horsepower at 375 miles per hour. This means that an engine of 4000 pounds thrust develops the equivalent of 4000 horsepower at 375 miler per hour. Similarly, an engine of 4000 pounds thrust would develop the equivalent of 8000 horsepower at 750 miles per hour. The faster these engines go, the more power they develop. This, plus simpler design, gives them enormously higher power-to-weight ratios than the conventional engine.

The subject of propulsion at supersonic speeds is in itself an inexhaustible topic; hence, any further discussion is beyond the scope of this article.

The human element also enters into any comprehensive discussion of the problems of supersonic flight. This is a new problem, one as complex as the human machine itself, and efforts to solve it have produced a new type of aviation medical team. Pooling their knowledge and techniques are doctors, engineers, designers, psychologists, physicists, and pilots.

They have found that flight at high speeds is not in itself injurious. The physical capabilities of pilots are taxed by the excessive accelerations and decelerations, the energies created by heat vibrations, and noise. In addition, man's mental processes are not capable of employing conventional methods to navigate a plane traveling at high speeds.

The researchers know what direction their efforts must take. New protective gear must be created to allow pilots to withstand high G-forces and a basically new cockpit design may be required. Refrigeration units must be used to cool the cockpit against the extremely high outside temperatures and heating must be available for other conditions. The job of flying must be simplified and pilots must be selected and trained more carefully. New methods of escape in emergency

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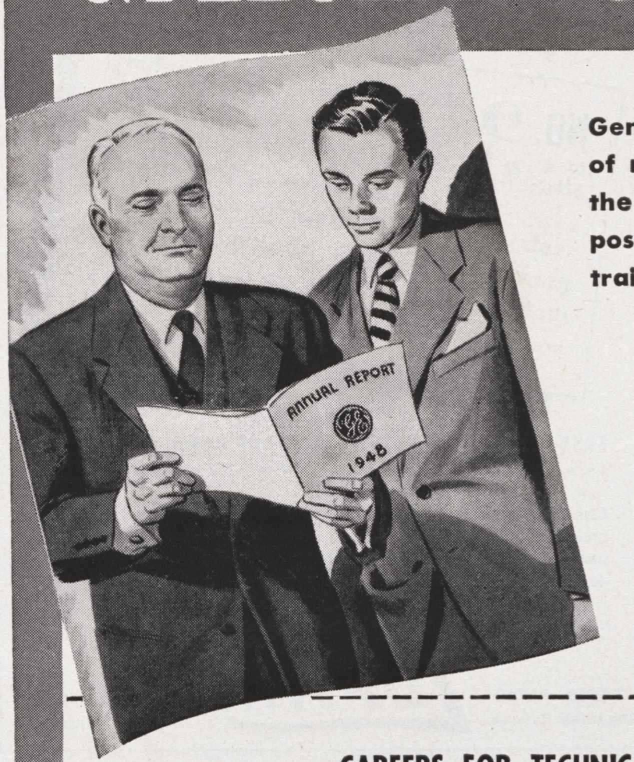
CAREERS AT GENERAL ELECTRIC



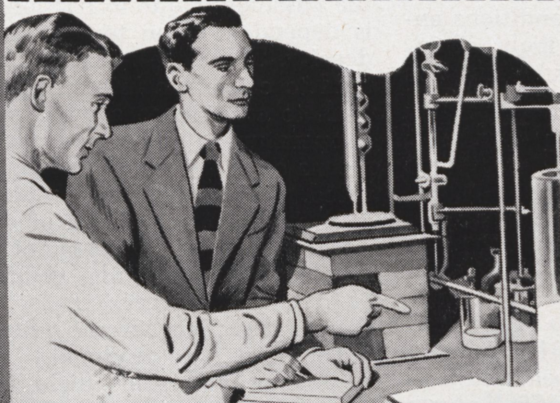
General Electric is not one business, but an organization of many businesses, offering opportunities in virtually all the professions. Here three G-E men brief the career-possibilities which the company offers to the business trainee, the technical graduate, and the chemist.

FROM BTC TO TREASURER

J. D. Lockton (Michigan), Treasurer of the company: "As an alumnus of the G-E Business Training Course, I consider it as one of the best possible avenues by which the liberal arts or business administration graduate can enter into the business life—and the opportunities—of General Electric. Every year sees BTC-trained men rise to financial and administrative positions of real responsibility within the company."

CAREERS FOR TECHNICAL GRADUATES

K. B. McEachron, Jr. (Purdue), Manager, Technical Education Div.: "There is no substitute for real, on-the-job experience. So we have carefully planned each of our educational programs to include 'learning by doing.' A wide variety of technical courses are available to those who want to extend the studies they began in college, whether they are electrical, mechanical, or chemical engineers, or physicists, chemists, or metallurgists."



CHEMICAL WRITER

Tony Forni (R.P.I.) of the G-E Chemical Dept.: "At General Electric I've been able to combine my interest in chemistry —I'm a chemical engineer—with an interest in advertising. Result: I'm responsible for advertising and sales promotion of the amazing new heat-resistant synthetics called silicones. With research constantly developing new products needing promotion, there's many an opening in this technical side of General Electric advertising."

For further information about a BUSINESS CAREER with General Electric, write Business Training Course, Schenectady, N. Y. — a career in TECHNICAL FIELDS, write Technical Personnel Division, Schenectady, N. Y.

GENERAL ELECTRIC

Supersonic Flight

Concluded From Page 20

will have to include an auxiliary propulsion unit to prevent excessive deceleration as well as employ pressurization features. Effects of ultrasonic vibrations arising in flight must be investigated.

To approximate the conditions encountered in high-speed flight, complicated experimental equipment has been built. Tests are being conducted in an effort to maintain pace with the rapidly developing technical fields.

The friction heating effect at high speeds is well known and modern high-speed aircraft are equipped with refrigeration units as standard equipment. For example, the Lockheed F-80, the Republic F-84, and the Boeing XB-47, at top speed, experience a temperature rise of 70°F above free air temperature at sea level. This may bring cockpit temperatures as high as 170°F on summer days, well above comfort and dangerously near the limit of human endurance.

As the aircraft begins to climb, however, a large number of factors become increasingly important. Not only does the atmospheric temperature vary radically at different altitudes, but the density of the air varies also. The degree of heat generated in the surface of an aircraft by the passing air due to friction effects is dependent upon temperature and density. These fluctuating quantities tend to cause the interior of an aircraft to experience a wide range of temperatures unless an adequate means of heating and cooling is provided. This range of temperatures may extend to extremes of warmth and cold, and consequently the problem of maintaining comfortable cockpit temperatures under conditions of flight has become quite great.

The task of producing aircraft capable of supersonic flight has not been easy. This discussion has touched upon only a few of the many problems involved in supersonic flight. The task has been a long and difficult endeavor, but science has once again enabled man to overcome the confining laws of natural phenomena.

Variety of Equipment used by

SUPERIOR METAL TREATERS, INC.

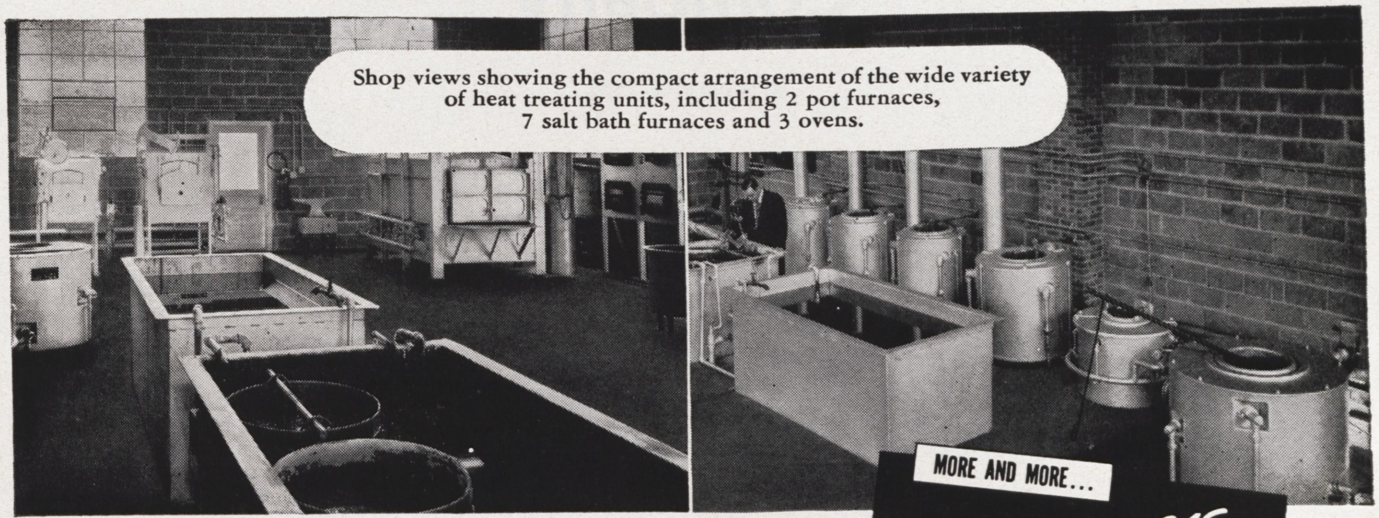
Emphasizes the Versatility of GAS

VARIETY is one of the most characteristic features of a commercial heat treating shop—variety of customer demands and variety of equipment required to fulfill them.

With a background of 22 years experience, Evan D. Ehmann, President of Superior Metal Treaters, Inc., knew just what to look for when he established his Newark, New Jersey, shop. This modern plant has the productive capacity to cope with the miscellaneous requirements of many customers.

Key feature of the installation is the versatility of the equipment. Each unit was chosen for its ability to perform under a number of different conditions. In selecting this equipment Mr. Ehmann determined to use GAS because, as he expresses it, **"During my years in this business I discovered that Gas Equipment provided the accurate control, economical operation, and versatility we needed. The precise temperatures and speed of heating we obtain with GAS mean a lot of extra production in our shop."**

Whether the heat treating process is a production-line application, or a commercial shop operation, the flexibility of GAS and the versatility of modern Gas Equipment are important economic factors. The characteristics of GAS make it stand out in any comparison with other available fuels for heat processing.



Shop views showing the compact arrangement of the wide variety of heat treating units, including 2 pot furnaces, 7 salt bath furnaces and 3 ovens.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVE., NEW YORK 17, N. Y.

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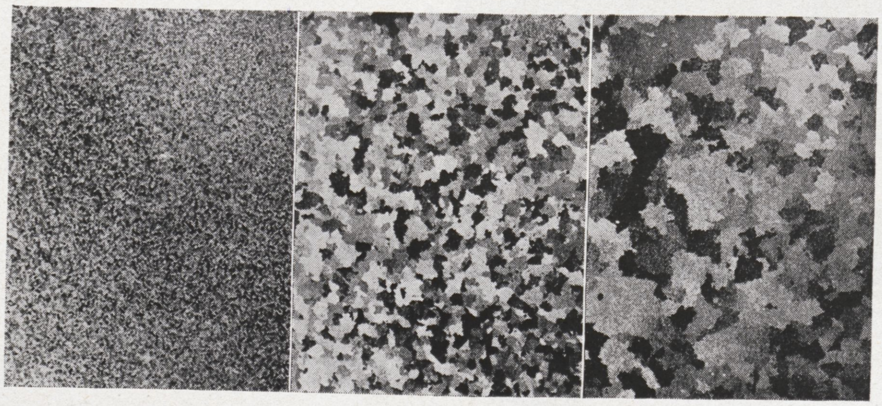

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TITANIUM helps other metals. Photomicrographs of aluminum containing 6% copper and 1.2% silican, showing how grain structure improves as titanium content increases. Left 0.015%; center 0.114%; and right 0.147% titanium. Magnified 25X.

fall naturally into a chain reaction type of events. It is really very similar to two runners with their hands tied together. One runner is new construction techniques and design and the other is new materials. At present, due to the war impetus, technology and design are far ahead of available materials and these new advances, such as high compression engines, jet turbines, etc., have made the need for and research on new materials very important. Titanium, at present, is the subject.

Probably the most important characteristic of titanium is its weight-strength ratio. This ratio is superior to stainless steel and far superior to aluminum. If titanium is substituted, section for section, over stainless steel, the saving will be 40% on weight. This immediately clinches it for the airplane industry. The next important advantage of titanium is its corrosion resistance. On sea water and marine atmospheric corrosion tests, titanium surpasses austenitic stainless, Monel, and the cupro-nickel alloys, while the search for an equally resistant material reveals Hastelloy C and *Platinum.* This, of course, labels titanium for marine and naval applications as well as chemical processes. In the latter field Remington Arms Co. has made a rather thorough survye of titanium's resistive properties.

It shows resistance to:

Nitric acid at 25°C in all concentrations up to 95%.

Nitric acid of 65% concentration at boiling.

Relatively dilute warm hydrochloric acid.

Relatively dilute warm sulfuric acid.

Concluded On Page 26

New RCA 16-inch direct-view television tube fills gap between popular 10-inch tubes and the projection-type receivers.

"Inside story" of a bigger, brighter picture on your television screen

The screen on which you are accustomed to seeing television is the face of an electron tube—on which electrons "paint" pictures in motion.

And the size of the picture, unless projected, is determined by the size of the tube.

Working to give you *bigger*, brighter pictures, RCA engineers and scientists developed a new way to make large, direct-view television tubes. They found a method of "welding" large areas of glass and metal . . . while keeping a vacuum-tight seal!

Using this development—ideally suited to mass production—RCA can now build television tubes of light, tough metal . . . using polished glass for the face, or "screen."

An achievement of research

Development of this new way of making television tubes is a continuation of *basic television research* which began at RCA Laboratories. Such 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 W. 49th St., New York. 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.

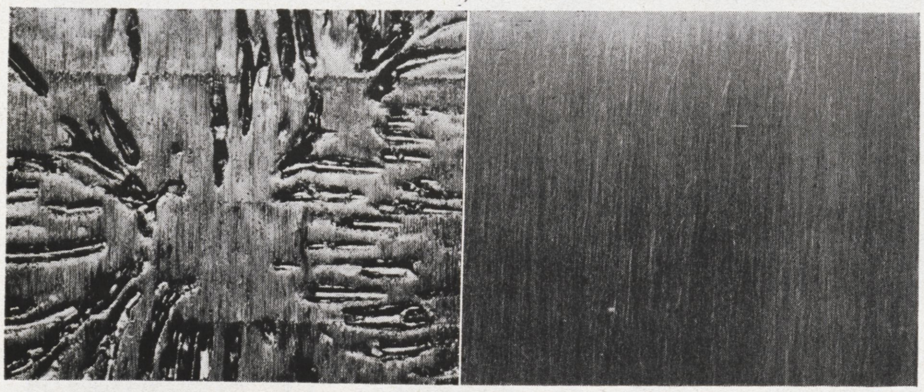
Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

Concluded From Page 24



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TITANIUM additions control physical properties. The nickel-iron alloy at left has no titanium in it; the same alloy at right has 0.13% titanium.

Aqua regia at 30°C.
Water-chlorine mixtures at 80°C.
Ferric chloride, 10% solution to boiling.
Calcium chloride, 28% solution to boiling.
Sodium hydroxide, 10% solution to boiling.

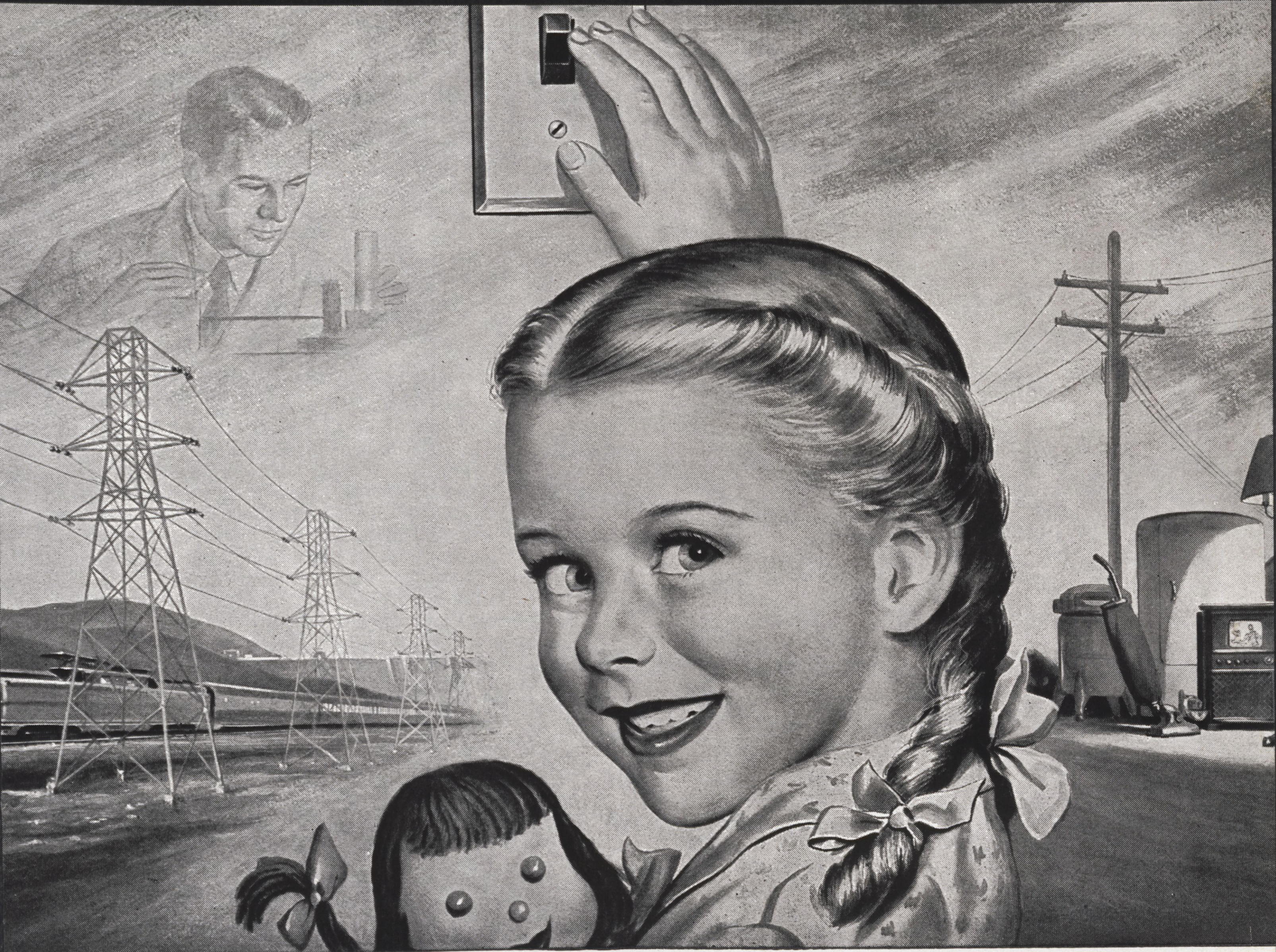
The next logical consideration is temperature resistance. Here titanium again takes the lead, since it retains many of its favorable properties through a great temperature range. This makes the metal a "natural" for jet turbine blades or other high temperature, high pressure applications.

Other properties of titanium, though not excelling greatly, hold up with stainless steel and aluminum very favorably. It can be forged in the region of 1600 to 1800°F and can be spot welded, seam welded, and joined to other titanium by inert-gas shielded arc welding. It can be surface hardened, which qualifies it for uses such as pistons or cylinder liners.

All of these properties do not cease here, for titanium may be very favorably alloyed to improve almost all of its characteristics. P. R. Mallory and Co. have taken the lead in this field with experiments with hydrogen, beryllium, boron, aluminum, indium, carbon, silicon, zirconium, nitrogen, vanadium, oxygen, chromium, molybdenum, tungsten, manganese, iron, cobalt, and nickel as alloying elements. Those which proved successful were aluminum, manganese, beryllium, boron, silicon, and chromium-molybdenum-tungsten mixtures.

Alhtough it is agreed that titanium may not be the "Cinderella Metal" that some have dubbed it, it is certainly well recognized that here is a new material which offers a combination of light weight, corrosion resistance, high strength, and good intermediate temperature properties, to allow the engineer to reach into unexplored areas of design and construction.

"He that invents a machine augments the power of man"— HENRY WARD BEECHER



How electricity "lightens" our lives...

TWO HUNDRED SIXTEEN BILLION kilowatt hours—nearly four billion dollars worth . . . is a lot of electricity! Yet that vast quantity supplied the United States for just one year (1947).

This tremendous flow of electric power couldn't have been put into the country's power lines without carbon. You'll find carbon, too, in the switches and control equipment that distribute electric power . . . in most of the electric devices in your home . . . in the batteries for your radio, flashlight, hearing aids. Your telephone is voiceless without carbon.

Better materials contribute immensely to improved electric service. Hydrogen gas keeps huge generators cool . . . nitrogen gas is kept under pressure in important cables to warn when the protective casing is pierced . . . plastics give insulation that is more efficient yet thinner, tougher and longer lasting; also provide construction material that is insulation in itself. Alloys give metals of better electrical and strength properties.

The people of Union Carbide provide these and other materials for supplying electricity. They also produce hundreds of other materials for the use of science and industry —to the benefit of mankind.

FREE: *Let us send you the new illustrated booklet, "Products and Processes," which shows how science and industry use UCC's Alloys, Chemicals, Carbons, Gases and Plastics. Just write—*

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LINDE Oxygen and Hydrogen • PREST-O-LITE Acetylene • PYROFAX Gas • SYNTHETIC ORGANIC CHEMICALS

Whittle . . .

Concluded From Page 11

the first gas turbine in England, but all efforts to produce one failed, owing to a lack of the necessary heat-resistant alloys. The first break came with the introduction of special steels for steam turbines at high temperatures, and for aero-exhaust valves.

In 1935, Whittle was able to raise 2000 pounds to start his development of experimental models. The Germans, too, were going ahead on jet development, and, in 1939, the German magazine *Flugsport* published seven detailed drawings of Whittle patents. From these, no doubt, came many of the deadly German jets which flew circles around our fastest propeller planes toward the end of the war.

Shortly thereafter, in Whittle's restrained prose, "The Air Minstry ceased to regard the development of jet propulsion as a matter of long-term research" and authorized the design for a twin-jet interceptor fighter. Built by Gloster in 1941, this was the prototype of the Gloster Meteor, which first saw action against the V-1 "buzz-bombs." "Did you ever hear how the first Meteor knocked down a buzz-bomb?" Whittle asks. "It flew along in formation with the 'doodle-bug' and tipped it over with its wing-tip."

Whittle was born in Coventry, capital of the English automotive and precision-tool industries. His father and grandfather were engineers, and since boyhood Whittle has had his head in the clouds; an early picture of Sir Frank shows him, age 4, holding a model airplane.

Whittle personally brought the jet engine to America when, in 1941, a Whittle engine was flown to Washington with a set of working drawings and a team of technicians. He lived in Boston under an assumed name and commuted to General Electric's Lynn laboratories in Massachusets, where he worked to help put the Bell Airacomet into the sky.

Now Sir Frank Whittle is working as technical advisor to the British Overseas Airways Corporation on aircraft gas turbines.

DU PONT *Digest*

For Students of Science and Engineering

Chemists in Pictures

How Du Pont and studio scientists solved the problem of noisy film

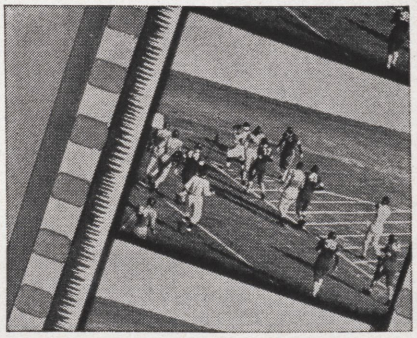
Who'd ever expect to find Du Pont chemists in Hollywood? When motion pictures suddenly started to talk, a whole new series of perplexing scientific problems was born, not the least of which was "noisy" film.

As you know, sound is usually recorded directly on film. If you hold a strip of motion picture film to the light, the sound track is seen as a narrow band of irregular lines. A light ray passing through the moving sound track falls on a photocell with rapid interruptions or changes in intensity. The photocell converts these interruptions into electrical impulses which, amplified, reach the theater audience as voice and music.

If the film has a coarse grain structure, it tends to give lines that are not sharp and uniform in density. Such irregularities interrupt the light ray—come out as distracting noise.

What could be done about it? Du Pont scientists of the Photo Products Department started a program of research, in cooperation with technical experts from the studios in Hollywood. They made and tested scores of film coatings. Finally there were developed films of exceedingly fine grain structures.

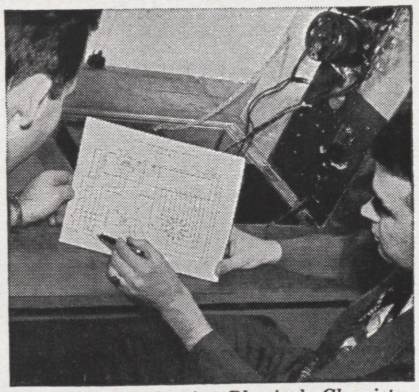
M-G-M and Paramount were among the first to use the new type Du Pont films. The development was heralded by the press as "another milestone in the technical progress of the industry," and in 1943 Du Pont received an Academy Award of Merit for its achievement. Now the use of fine grain films is practically universal in Hollywood. Actors, actresses speak their lines, with no technical restrictions to cramp their artistry.



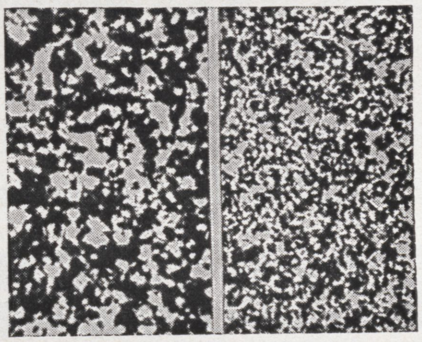
Voice and music *appear as a continuous band of irregular lines on this movie sound track. Any irregularity means noise.*

You may have a place in Du Pont research

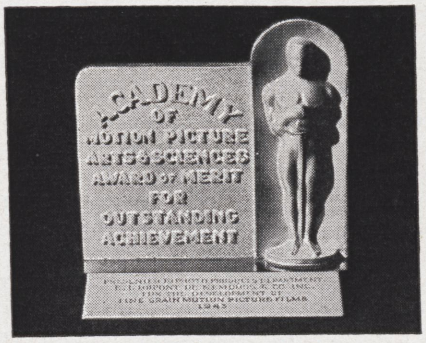
Had you been a member of a Du Pont Photo Products research team since 1931, you might have shared in many outstanding achievements, two of which have been recognized by "Oscars."



W. L. Foy, *Ph.D. in Physical Chemistry, Clark University, 1947, and A. C. Lapsley, Ph.D. in Physics, Virginia, 1947, discussing details of Color Densitometer Wiring Diagram used in connection with research on color photography.*



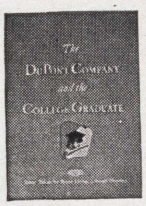
In coarse grain films, *the particles of silver are large and scattered. Compare with Du Pont fine grain film, right.* (*Magnified 1000 times.*)



Achievements *of Du Pont scientists over the years have won two "Oscars" from Academy of Motion Picture Arts and Sciences.*

The Photo Products Department, however, is just one of ten Du Pont manufacturing departments, all of which engage in continuous research. Operated much like separate companies, each holds challenging opportunities for young, college-trained chemists, engineers and physicists. Du Pont not only tries to select young men and women of promise, but makes a conscientious effort to help each one develop as rapidly as possible. Whatever your interests, you will find here the cooperation and friendly interest you need to do your best. As a member of a small, congenial working team, your ability can be seen, recognized and rewarded.

Don't miss reading this new booklet about Du Pont



Send for your copy of "The Du Pont Company and the College Graduate." This fully illustrated, 40-page booklet answers your questions, describes many fields which may be new to you. Tells about opportunities in research, production, sales, etc. Explains how recognition of ability is assured. For free copy, address: 2518 Nemours Bldg., Wilmington 98, Delaware.

WRITE TODAY for "The Du Pont Company and the College Graduate"

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

More facts about Du Pont — Listen to "Cavalcade of America" Monday Nights, NBC Coast to Coast

RESEARCH . . . .

Concluded From Page 15

bands is achieved with the new device by attaching open-wire "V's" to each leg of the four dipoles. This, in effect, "shortens" the dipole, which is designed for low frequency reception, and permits optimum reception of high frequency signals.

Method of Connecting Tubes Increases Power Television

A new method of combining transmitting tubes in groups or "clusters," which materially increases the power of television stations operating on ultra-high frequencies (300 to 3000 mega-cycles), is now undergoing tests. The new method makes it possible to handle the normal band of frequencies involved in television transmission with greater signal strength than has heretofore been attained.

In this method, two transmitter tubes, or two complete transmitters, are teamed through a special network called a duplexer, which permits the combined output of the tubes to be fed into one antenna, thereby doubling the effective power output without narrowing the width of the frequency band transmitted. Since the output of the duplexer with the combined power of two tubes acts as a single unit, it is possible to combine two or more duplexers to multiply the output proportionately. This process can be continued to any extent desired.

A developmental television transmitter has been built utilizing four output stages combined with three duplexers. With the four stages operating at a carrier frequency of 850 megacycles, the final output of the transmitter is four times the power obtained from a single stage.

The system makes it possible to remove any one of the transmitters in the cluster without interrupting the signal on the air, although the power radiated from the antenna will be decreased in proportion.

The system is not advocated as a means of obtaining high power from many small tubes. It is expected to be useful, however, when existing tubes have reached their maximum ability to handle power. When that point is reached, this method of duplexing offers one more means of increasing the useful output of the television station.

ALAN LADD now co-starring in "WHISPERING SMITH", a Paramount Picture. Color by Technicolor.

How a group of American pioneers has held the price of Aluminum down

Charles Martin Hall, founder of America's aluminum industry, had a special kind of gleam in his eye. Every one of us has it too.

He was bound and determined to find a way to make aluminum cheaply. The schoolbooks all tell how he did it, where the world's greatest scientists failed.

Bluntly speaking, Charles Martin Hall set out to cut the world price of aluminum.

He was the first of the men and women of Aluminum Company of America. He licked a process. We who followed him—engineers, chemists, metallurgists, physicists, production experts—have been at it ever since.

But the gleam is the same. It's bumping elbows in the research lab with men who, in fifty years, have accomplished most of the finding-out that took fifty centuries, with the age-old metals.

It's working in the mill and having it seem that every shining sheet racing over the rolls is your own.

It's typing a letter in answer to a simple query, and having the deep-down feeling that you may be in at the birth of a new business, taking root in aluminum.

We propose to keep on being pioneers in broadening the usefulness of aluminum. Alcoa Aluminum sold in 1939 for 20 cents a pound. It sells today for 16 cents.

We are pioneering with microscopes and calipers and rolling mills. We'll stack them against axes and squirrel rifles and spinning wheels, for a place of importance in the history of our America.

To know other stories of the Alcoa family and the growth of aluminum's usefulness to you, write for free copy of "Aluminum—Its Story", ALUMINUM COMPANY OF AMERICA, Gulf Bldg., Pittsburgh 19, Pa.

ALCOA FIRST IN ALUMINUM

FRATERNITIES NOTES

Continued From Page 18

Ricketts has gone into Illinois to the State Normal School to lose his Cross to Barbara Woodrum.

Future social plans for the chapter?—a skating party and a stag.

Theta Xi

All the Theta Xi brothers are looking forward to the 6294 banquets which will be held in Chicago, Indianapolis, and Louisville. Most of the active members are planning to attend and all the alumni who wish to attend had better make their reservations soon. You can mail them to the house and we'll see that they are forwarded. The date is April 30.

Plans are under way for a three-team softball tournament between the T X chapters at I. U., Purdue, and Rose. The loser will have to furnish the refreshments for the other chapters. The last two years have found us footing the bill for the enjoyment of the boys from Purdue, but we hope to do better this year.

We wish to congratulate our new brothers who were initiated March 11. They are Tom Albright, Gus Arpante, Jack Oberle, and John Shaw. Also congratulations to Walt Flanagan, who won the chapter scholarship award. We know it surprised Walt as much as it did us.

All the boys are looking forward to the Interfraternity Sing and practice sessions are under way. Our leaders in this project are Cliff Hennig, Bob Campbell, and Myron Hawks.

See you at 6294.

Lambda Chi Alpha

On March 19, a number of the actives attended the Indiana State Concrave in Indianapolis. A Founders Day luncheon was enjoyed in the Travertine Room of the Lincoln Hotel, and following the luncheon various discussion groups met. While the members were in conference, the wives and dates were the guests of the H. P. Wasson Company of In-

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FRATERNITY NOTES

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dianapolis at a showing of the latest spring styles. The inter-chapter sing, won last year by Theta Kappa, was held in the afternoon following the conferences. In the evening the State Day Dance was held in the Egyptian Room of the Murat Temple. Highlights of the occasion was the crowning of the Queen, Indiana's Lambda Chi Girl of 1949.

The Wittenberg Conclave was also held on March 19, on the campus of Wittenberg College in Springfield, Ohio. Delegates from twenty-seven chapters representing the Ohio River-Great Lakes Region were in attendance. Bill Pittman went as a delegate from the local chapter. Several of the members also attended the Purdue Conclave on April 1-2.

Initiations were held on March 4, and the following men were added to the list of actives: Sam Lynch, Dick McLaughlin, Jim Ellington, and Fred Garry.

George Kyle has announced his engagement to Miss Betty Jane Moulten, the marriage to take place on Easter Sunday. Mr. and Mrs. Ray Watkins are the proud parents of a new baby. Undaunted, Jack Gladdin gave his pin to Miss Catherine Bradley. The cigars were enjoyed by all including former member Don Spencer, now a second lieutenant in the Army, who spent the week-end at the house before going overseas and by Dick Dunham, Traveling Secretary of Lambda Chi Alpha, who visited recently.

Social Chairman Jim Boyd has announced the coming month's social program.

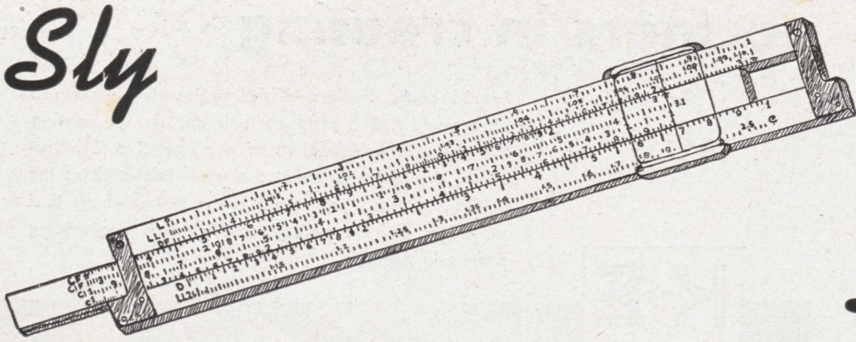
Saturday, March 19—State Day Dance Indianapolis

Friday, March 25—House Party (Barn Theme)

Saturday, April 2—Skating Party at the Wigwam

Saturday, April 9—Juke Dance at Edgewood Cabin.

Sly



Droolings

By "Saint" Miller, soph.

A small town contractor went down to the station to welcome his daughter back from college.

"Ain't you a mite fatter than you was?"

"Yes, father," she confessed, "I weigh a hundred and forty pounds stripped for gym."

"Who in thunder is Jim?"

* * * * *

Breathes there a man with so much abnormal,
That he isn't stirred by a low-cut formal.

* * * * *

Overheard at the Dorm.

First Cook: "Say, the garbage man is outside."

Second Cook: "O. K., tell him to leave three cans today."

* * * * *

Fashion Note

The most popular shades this spring are those left up in the dorm windows at State.

* * * * *

A young man was looking for an apartment. He said just a place big enough to hang his hat and a few friends.

* * * * *

And then there is the one about the EE who was in a telephone booth talking to his girl but they had to get out because someone wanted to use the phone.

* * * * *

"Jack, are you sure it is I you are in love with and not my clothes?"

"Test me darling, test me."

* * * * *

Sergeant: "Where is the balance of your rifle?"

Freshman: "This is all they gave me."

* * * * *

The heaviest penalty for bigamy is two morthers-in-law.

An asylum patient who had been certified cured was saying goodbye to the director of the institution. "And what are you going to do when you go out into the world?" asked the director.

"Well," said the patient, "I have passed my bar examination, so I may practice law. I have also had quite a lot of experience in college dramatics, so I might try acting."

He paused for a moment, deep in thought. "Then, on the other hand," he continued, "I can always be a tea-kettle."

* * * * *

A women's college is an institution of higher yearning.

* * * * *

Mary: "Boy, you have to hand it to Bill when it comes to petting."

Betty: "Why, is he lazy?"

* * * * *

He: "Let's go over to my house and play checkers."

She: "Checkers?"

He: "Yes, you move and I'll jump."

* * * * *

A married couple checked into a hotel and, after cleaning up forgot to turn off the faucets in the tub. A short time afterwards, the guest in the room directly under them opened the window and stuck out his head.

"Turn off that water," he screamed. "What the *!-?$*! is the matter with you?"

"Stop your swearing," the first returned. "I've got a lady up here."

"And what the — — do you think I have down here—a duck?"

* * * * *

"You know George proposed to me last night."

"Doesn't he do it beautifully, though."

He: "Mind if I turn off the hall light?"

She: "Not at all."

He: "The ceiling light?"

She: "Why, of course."

He: "The floor lamp?"

She: "Yes, Johnny."

He: "Now, that it is dark in here, may I ask you a question?"

She: "Yes, dear?"

He: "Do you think this luminous dial watch is worth forty dollars?"

* * * * *

"How are you getting along?"

Young Rose Graduate: "Fine, I have been promoted."

"You have, how's that?"

"I used to be a 'drop' engineer; now I'm a sandwich engineer. The Boss used to come around and say to me, 'Drop whatever you are doing and take this work.' Now he comes around and says, 'Sandwich this in between whatever you are doing.' "

* * * * *

"Joe, there's something down my back."

"Cut it out dear, those jokes were all right before we were married."

* * * * *

B. W.: "It might do some good for wives to go out on strike sometime."

Mr. B. W.: "Go right ahead dear, I've got a peach of a strikebreaker in mind."

* * * * *

Reporter: "What made you a multi-millionaire?"

Multi-millionaire: "My wife."

Reporter: "Ah, her loyal help."

Multi-millionaire: "No, no. I was simply curious to know if there was any income she couldn't live beyond."

All size 42 —yet no two alike

Now, photography with its speed and accuracy measures a man for his clothes quickly and with precision in every dimension.

Recently a striking new idea hit the headlines—an idea aimed at fitting made-to-measure clothes more accurately than ever before. It was the idea of Henry Booth of Amalgamated Textiles, Ltd., and he named it "PhotoMetric."

In the PhotoMetric method, photography scans you with a wink of its precise eye from before, behind, above, and from the side. With the click of a shutter it gets all major measurements plus all the individual variations from a "perfect" size. It oversteps the limitations of the tape and records contours, proportions, shape, and posture as well.

Later, in the pattern room, the film is projected and, in effect, there you stand while the craftsman with special calibrated devices measures your image in three dimensions—getting some thirty highly accurate readings.

PhotoMetric installations are already going in from coast to coast. It is a fine example of how photography is serving business, science, and industry—speeding methods, refining technics, improving products. It may be well worth your while to look into what the photographic process can do for you.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

Advancing business and industrial technics—

Functional Photography

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MILDER, BETTER TASTE.
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Joan Crawford
STARRING IN
FLAMINGO ROAD
A MICHAEL CURTIZ PRODUCTION
RELEASED BY WARNER BROS.
Chesterfield
CIGARETTES
LIGGETT & MYERS TOBACCO CO.
CHESTERFIELD
"I'm a 100% Chesterfield smoker. I've tried other brands but always come back to Chesterfield. They buy fine light tobacco, ripe, sweet and mellow."
L. E. Thomason
TOBACCO FARMER AND WAREHOUSEMAN, PARIS, KY.
(FROM A SERIES OF STATEMENTS BY PROMINENT TOBACCO FARMERS)
Always Buy CHESTERFIELD
MAKE YOURS THE MILDER CIGARETTE ... They Satisfy