Spring 5-1954

Volume 65 - Issue 8 - May, 1954

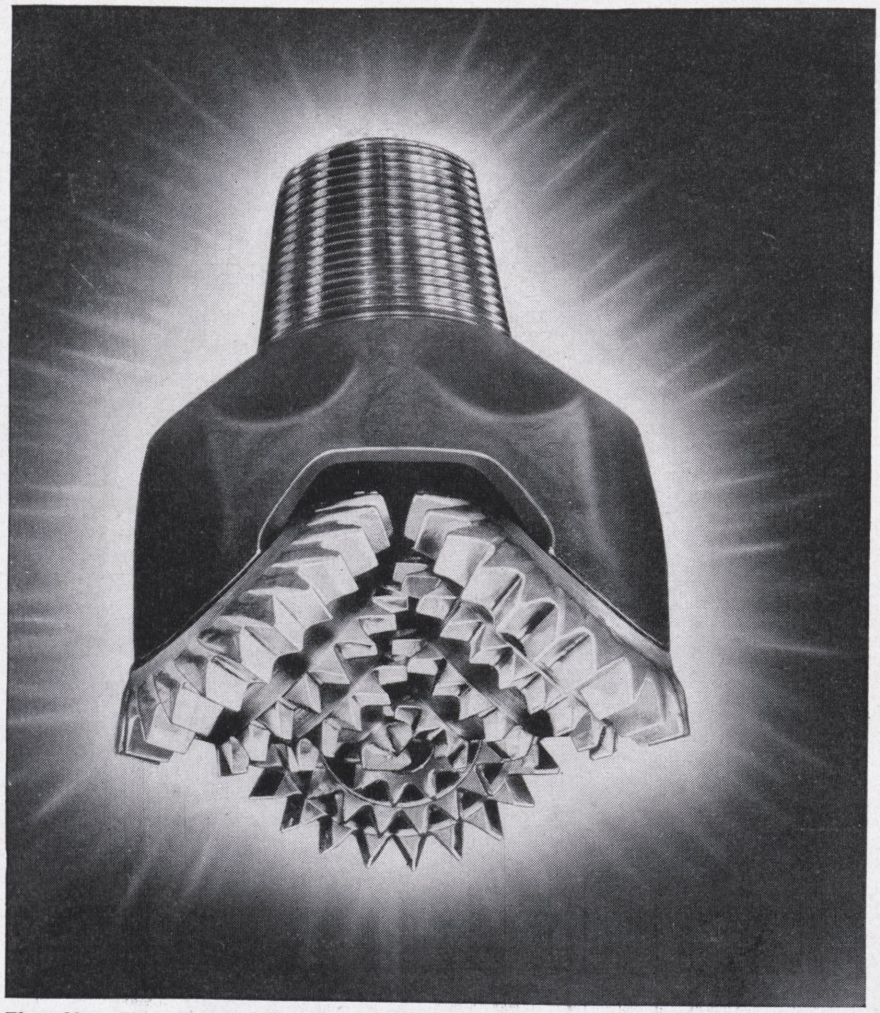
Rose Technic Staff
Rose-Hulman Institute of Technology

RoseTechnic

Member Engineering College Magazines Associated

May 1954

Only STEEL can do so many jobs so well



They Chew Their Way to Wealth. These teeth are capable of chewing through earth, sand and rock for thousands of feet until they reach Nature's buried treasures of gas and oil. Rock bits like this need super-strength, amazing toughness, high resistance to impact, abrasion, and shock. So, many of them are made from USS Alloy Steels. And United States Steel also provides many other essentials for oil drilling, such as wire lines, drill pipe, cement, drilling rigs.

Scoop! And a big one, too . . . it can scoop out 21.5 cubic yards of earth per minute, has a boom 215 feet long! The drag lines, boom support cables and hoisting ropes on a behemoth like this must have great strength, durability, flexibility, fatigue resistance. Tiger Brand Wire Ropes, made by U.S. Steel, meet all requirements.

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A Man Needs a Cookie once in a while! And when cookies are kept in a tight cookie tin like this, they'll be fresh and appetizing for him. The can is steel, of course . . . made out of the same USS Tin Plate that is produced by U.S. Steel to make millions of "tin" cans every year for the protection of food, oil, paint and countless other things.

For further information on any product mentioned in this advertisement, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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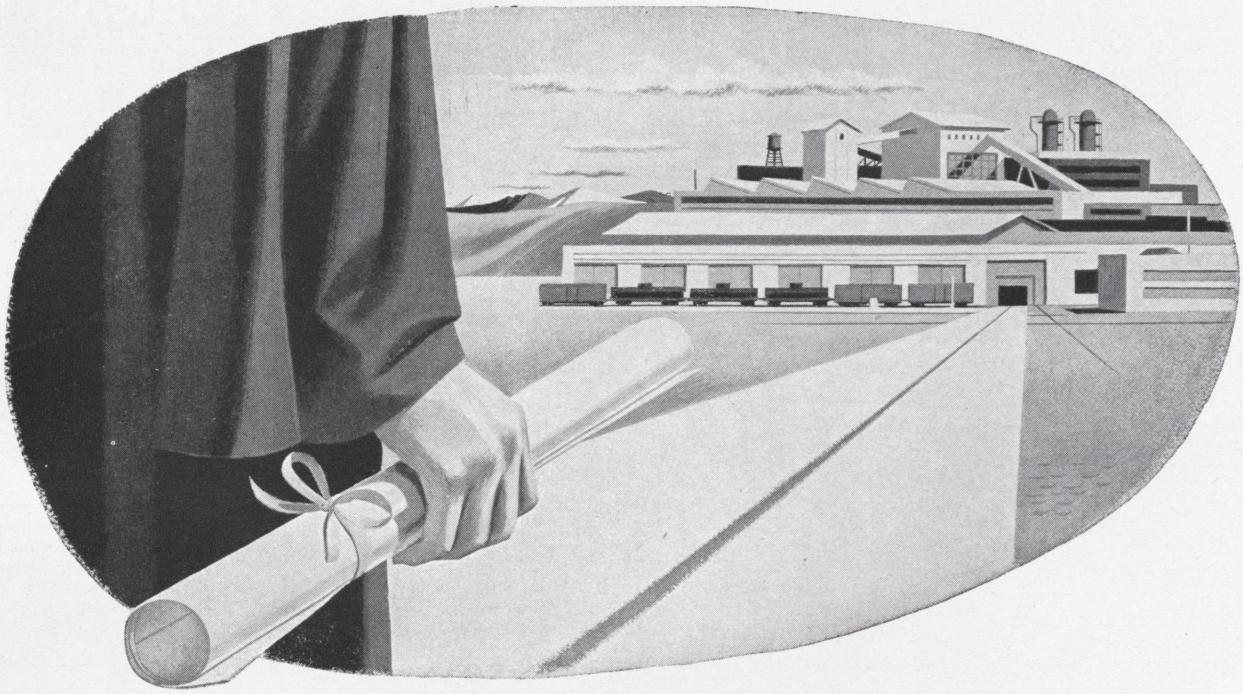
Spring thoughts on the subject of...

rambunctious sheepskins



AN engineering senior can hardly be blamed for feeling rambunctious now that the years of hard study are nearly over and the sheepskin's in view.

But the sheepskin comes at Commencement. Commencement means you're set to start on your career. And that's certainly worth some serious thought.

To help you decide which job to pick, you'd do well to weigh the many reasons for choosing an engineering career at General Motors—reasons like these:

- At GM, an engineer has a real chance to follow his natural bent and work in the field of his choice. That's because GM produces a variety of products — automobiles, trucks, Diesel engines, refrigerators, bombsights, just to mention a few.
- At GM, you get the chance to work closely with top engineers, sharing their knowledge and experience. That's owing to GM's decentralization: 34 manufacturing divisions, 117 plants in 57 towns and cities. Yet each division draws upon GM's vast central research laboratories.
- At GM, there's a congenial climate for the personal and professional advancement of engineers. We respect the engineering point of view, as shown by the number of key GM executives in both divisional and top management who began their careers as engineering graduates on GM drafting boards.

Naturally, all this spells genuine opportunity for the young man who has what it takes. Your College Placement Office can arrange an interview for you with our college representative. Or you can write direct to us.

GM positions now available in these fields:

MECHANICAL ENGINEERING
ELECTRICAL ENGINEERING
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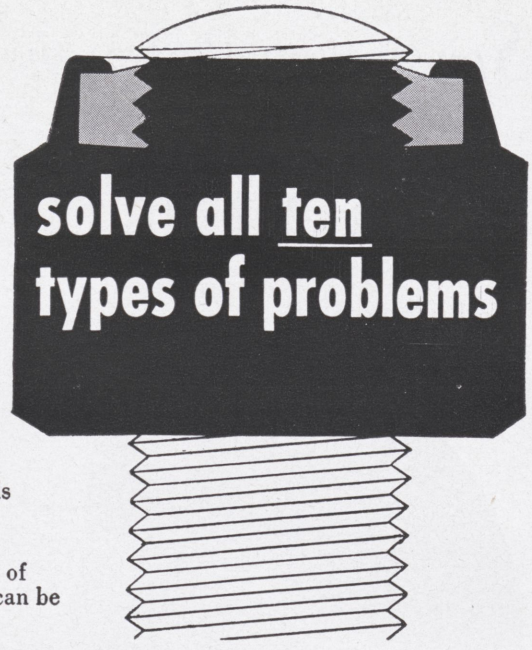
BUSINESS ADMINISTRATION

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan

elastic stop nuts solve all ten types of problems

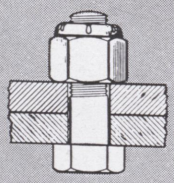


Here are ten typical fastening problems. One device, the ELASTIC STOP nut, solves them all—without additional parts or operations. Deliberately undersized in relation to bolt diameter, the red elastic collar grips the bolt with a perfect fit, exerting a continuing self-locking pressure against the threads, and holding the nut securely in place at any point on the bolt. It also provides a tight seal against the bolt threads, which prevents seepage and wear-producing axial play. And because the bolt threads are protected against moisture from without, the nuts are not "frozen" to the bolt by corrosion.

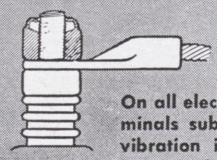
ELASTIC STOP nuts stay tight, right where you put them, in spite of vibration and stress reversals. Yet they are not jammed in place, and can be removed with a wrench and reused many times.

For further information on ESNA self-locking fasteners, mail the coupon below.

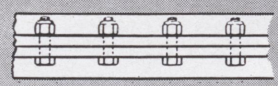
TIGHTENED AGAINST THE WORK



Wherever a vibration or impact proof bolted connection is desired.

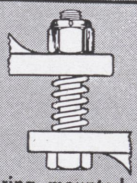


On all electrical terminals subjected to vibration in transit or operation.

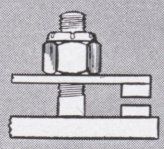


For uniform and precise prestressing of multiple bolt assemblies . . . adjusted by predetermined wrench torques.

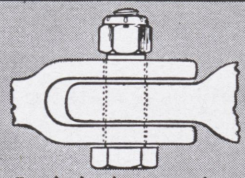
LOCATED ANYWHERE ON THE BOLT



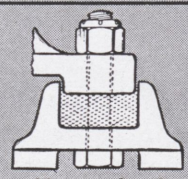
Spring-mounted connections or dynamic balancing, where nut must stay put yet be easily adjusted.



On make-and-break adjustment studs where accurate contact gaps are required.

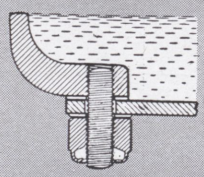


For bolted connections requiring predetermined play.

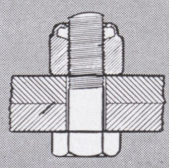


For rubber-insulated and cushion mountings where the nut must not work up or down.

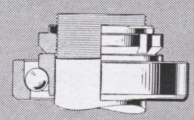
FOR MANY SPECIAL APPLICATIONS



To seal bolt threads where elimination of leakage past stud threads is necessary.



To seal bolt threads where it is necessary to protect them from corroding elements.



To obtain delicate adjustments for applications such as bearing locknuts where precise adjustment is essential.

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☐ Elastic Stop nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

☐ Rollpin bulletin

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Rose Technic

VOLUME LXV, NO. 8 MAY, 1954

Contents

Frontispiece

The biggest ball in the world, as high as an 18 story building, and using 3850 tons of steel, this huge sphere houses the prototype of an atomic power plant for submarnes. Courtesy of GENERAL ELECTRIC.

The Cover

Well, another school year is about over, and soon Rose men will scatter to the far reaches of the nation for a summer of work and a week or so of relaxation. Perhaps, in their wanderings, their paths will cross again, possibly on the shores of one of our country's many secluded lakes like the one shown on the cover, St. Mary Lake in Glacier National Park. Courtesy of CAST IRON PIPE NEWS.

Photo Credits

Pages 14 & 15, Eastman Kodak; page 28, Sylvania Electric Products.

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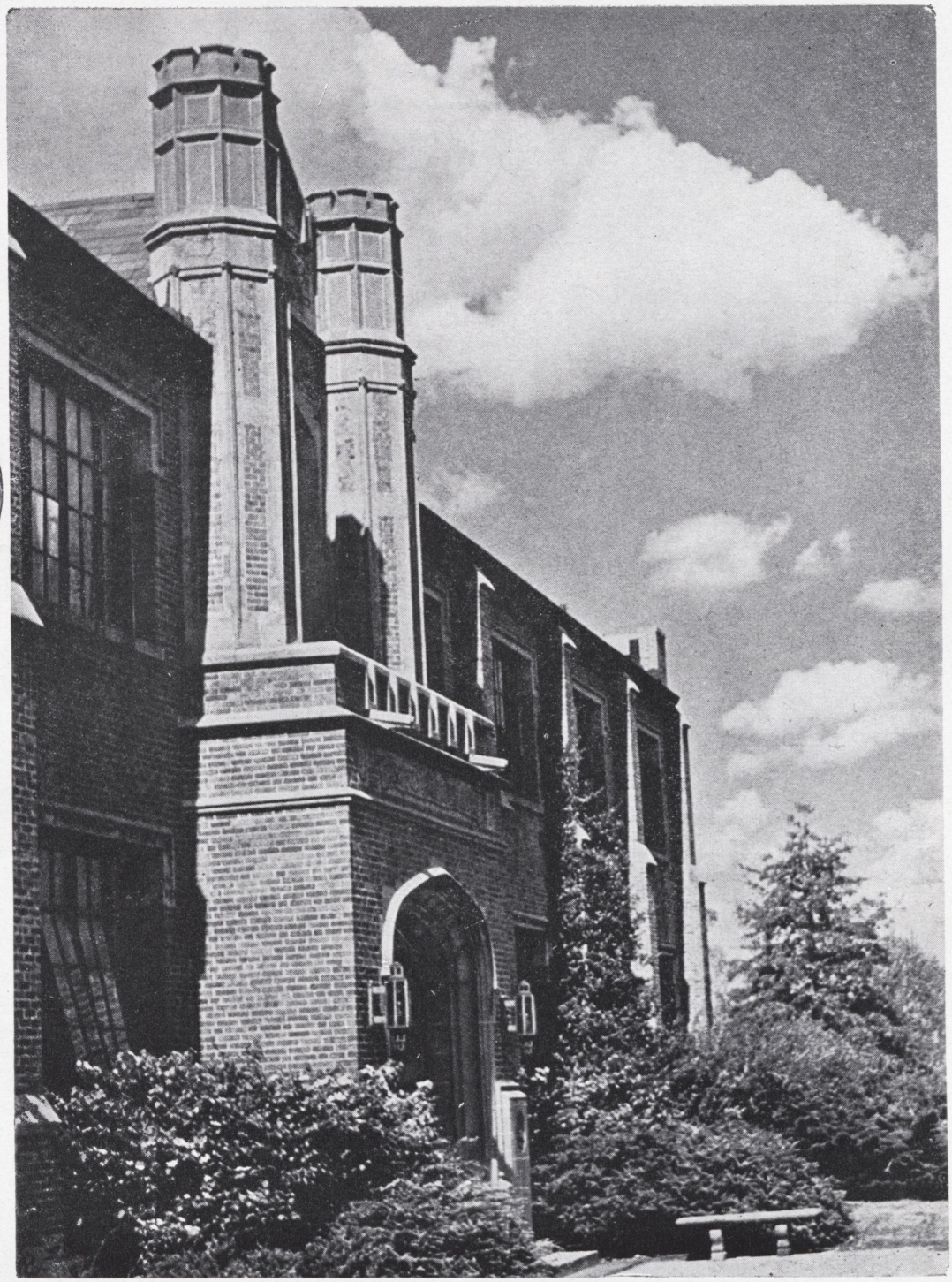

HIGH SCHOOL GRADUATES OF 1954

You are cordially invited to visit Rose Polytechnic Institute during the present school year to learn more about your college entrance and the highly accredited engineering courses available to you at Rose. The next freshman class will be admitted September 13, 1954.

NOBLE C. BLAIR

Admissions Counselor

ROSE POLYTECHNIC INSTITUTE

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"I chose Worthington for opportunities in international trade"

• "Worthington was my choice," Mr. Berger says, "because of the excellent training and the unusual experiences that are possible with a manufacturer having a worldwide reputation, and worldwide distribution. Then, when a company has seventeen divisions, including air conditioning, refrigeration, turbines, Diesel engines, compressors and pumps of all kinds, construction machinery, and power transmission equipment, a graduate engineer's chances for getting into his chosen field are even better.

"Supporting these divisions are research, engineering, production, purchasing, and sales, domestic and export. The real opportunity, however, is in Worthington itself. This is a company that is growing, just as it has for more than a century. It is always looking for new, related products and good men to engineer, produce, and sell them—at home and abroad.

"I began my career with Worthington's training program in the Research and Development Laboratory, where full-scale equipment is designed, tested and improved. This experience gave me an understanding of the tremendous part the company plays in the everyday life of millions of people. Within fourteen months I was sent to Mexico to inspect the facilities of our distributors there.

"The opportunities for first-hand laboratory experience, sales training and contact, travel and field trips, among many others, make Worthington a first-rate company for the young engineer with a desire to learn and progress in his work."

When you're thinking of a good job, think *high*—think *Worthington.*

8.26

FOR ADDITIONAL INFORMATION, see your College Placement Bureau, or write to the Personnel and Training Department, Worthington Corporation, Harrison, N. J.

WORTHINGTON

THE SIGN OF VALUE AROUND THE WORLD

PROGRESS AND SCIENCE GO HAND IN HAND

OUR recently published annual report to stockholders tells more than the financial story of the progress of Standard Oil and its subsidiary companies in 1953. Its facts and figures also reflect the achievements of engineers and chemists.

For example, the report points out that:

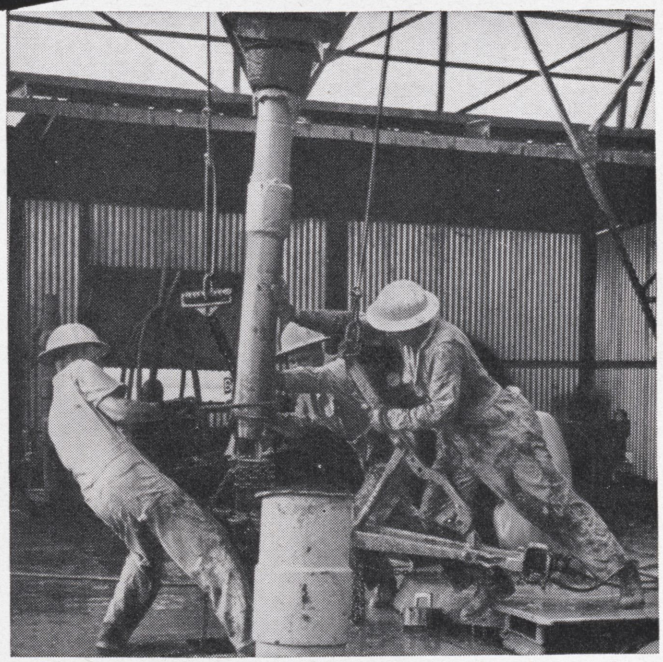
More new and improved products were introduced by our company last year than in any other year since World War II.

Our scientists developed the Ultraforming process, a new and better catalytic reforming method for improving the quality of the straight-run portions of gasoline.

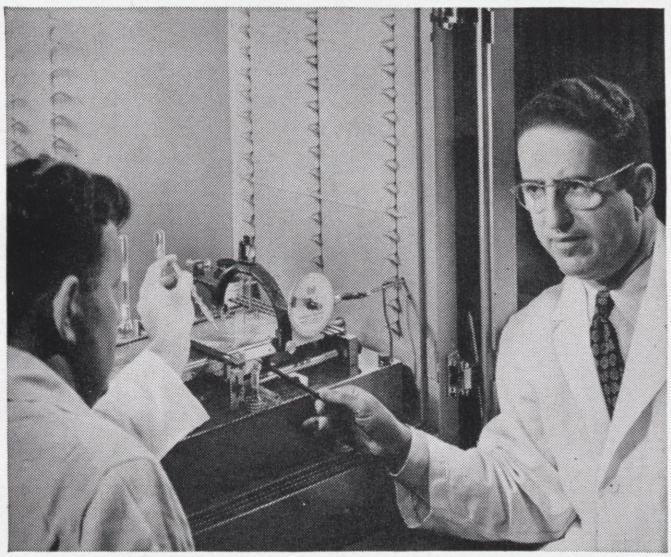
Three new research laboratories were completed.

More than $200 million was invested last year in new and improved facilities. (This year and next we expect to invest a total of about half a billion dollars.)

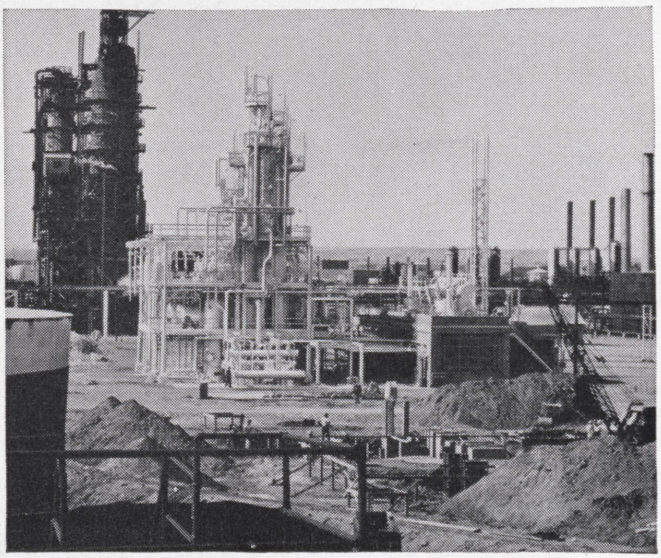
This continuing program of physical expansion and product development at Standard Oil provides many opportunities for engineers and chemists. Men with technical and scientific training have found great personal and professional satisfaction in our steady industrial advance.



Nearly a quarter of a billion dollars will be invested during 1954 and 1955 in development of new crude oil production and reserves.



Basic research on lubrication is one of the many activities at Standard Oil's extensive Whiting laboratories.



Almost a billion and a half dollars has been invested in expansion and improvement of facilities since 1945.

Standard Oil Company

910 South Michigan Avenue,
Chicago 80, Illinois

STANDARD

A Year to Remember

The end of another school is at hand. Soon finals will be completed and the Men of Rose will scatter for the summer, not to meet again until autumn. However, before we close the books on the year just past, perhaps it would be worthwhile to pause and consider the events which have made 1953-54 a year to remember.

In many ways this has been a year to be proud of; in other ways it hasn't. The new student center was opened early in 1954, filling a big gap in student life. However, while the student center was providing the social outlet, those relics in the boiler room persisted in springing leaks. The result was that no hot water was available in the main building throughout most of the winter, and the temperature in some class rooms left something to be desired. It is the hope of the student body that this condition will be partially corrected when a new boiler is installed this summer.

On the credit side of the ledger, the administration made a step in the right direction with the announcing of Saturday classes next Fall. Perhaps the time is not to far off when engineers will study five years instead of four, putting the profession on a par with that of law and medicine.

However, certain other things did not measure up to Rose tradition. In the opinion of the writer it is indeed sad that the Class of 1957 did not have the opportunity to engage in St. Pat's Day activities or friendly skirmishes with the upperclassmen. We must not allow hazing, the builder of school spirit, to be forgotten so easily.

Another sore spot was the cancellation of Parents' Day. Now that the nature of the errors made is known, we feel sure that Blue Key will rise to the occasion and not allow another failure next year or in the future.

Finally, Rose's athletic teams proved to the members of the Prairie Conference that engineers do something besides study, and early one warm spring morning an earth-mover materialized on the drive in front of the main entrance to the building. How did it get there? No one knows; well, almost no one. Incidentally, in connection with the earth-mover caper, we are of the opinion that the administration is raising considerably more fuss than the incident warrants.

Truly, this *has* been a year to remember.

R.A.L.

An M.E. gives the low-down on valves:

Poppet, Rotary, etc.

By Beuford Hall, jr., m.e.

I have long wondered why the single-beat poppet valve is used almost exclusively in internal-combustion and steam engines. This article is to justify the use of the poppet valve or to show that some other valve type would be better in these applications.

No work can be done by an internal-combustion engine unless a change of volume of the combustible components can be effected. The purpose of valves in internal-combustion engines is to permit this change of volume to occur, allow the gas to transmit its resultant force to the engine piston, exhaust the combusted products, and then repeat this cycle at a frequency high enough to allow the engine to develop its necessary power.

In steam engines the valves must open to allow the entrance of steam, close while the steam does its work on the piston of the engine, and then re-open to allow the piston to exhaust the water and partially condensed steam.

I have assumed that the reader has some knowledge of these basic engine cycles, but I have included some diagrams to simplify the material.

I have divided the valves into their basic types and further subdivided the types into specific cases. I have discussed the advantages and drawbacks of each of these cases and tried to evaluate the operation of each.

Poppet Valves

The poppet type of valve is so named because the valve pops up and down. These valves are always mechanically operated and are usually opened by a cam and closed by a light spring, although other methods have been used.

The poppet type valve presents few problems in wear, warping, heat control, and compression sealing; however, it does offer restrictions to the flow of the gases to and from the combustion chamber or steam expansion area. Another characteristic of the poppet valve is that it is inherently noisy in its operation. Also the spring return that is used in most poppet valve applications sometimes presents a problem, for at high engine speeds the inertia effect of the valve in opening prevents its closing rapidly and a floating motion is encountered which permits compression leaks and limits engine speed and torque.

Single-beat Poppet Valves

The most common type of valve used in piston engines is the single-beat poppet valve. This valve is used almost exclusively in internal-combustion engines and finds many applications in steam engines.

Effectively, the valve is a cylindrical shaft with a "mushroom" top. A machined surface around the edge of the mushroom makes contact with a similarly machined surface in the engine block to close off the gas flow.

The single-beat poppet valve is cheap to produce and therefore offers no high initial cost. Repair costs on poppet type valves are generally reasonable; however, the cylinder head of the engine must always be removed before the valves may be removed for refacing.

Double-beat Poppet Valves

The double-beat valve is limited to steam engine applications. It was developed to overcome a problem in steam engine operation — that of opening a valve against a high internal cylinder pressure.

The double-beat valve is similar to the single-beat valve except that it has another mushroom on top of the first.

If the double-beat valve is to be opened with a pressure in the cylinder, this valve will be "pressure balanced" since the force (Force= Pressure x Area) tending to keep the valve closed is approximately equal to the force tending to open it. This means that the only work done in opening the valve is that in overcoming friction and inertia forces. Another advantage of the double-beat valve is that the absence of sliding parts permits the use of superheated steam.

The disadvantages of the double-beat valve are the real limiting factors in its applications. The production costs are high and great difficulties are encountered in seating both valve faces simultaneously over the complete range of engine operating temperatures.

Shrouded Poppet Valve

A variation of the single-beat poppet valve is the shrouded valve. It was developed in the Texas Oil Company's research laboratories by Ev Barber. The purpose of the valve is to give a turbulance in the intake charge of the engine, thereby atomizing the fuel more completely and allowing anti-knock operation when using low grade fuels in internal-combustion engines.

The valve is basically a single-beat valve except that the shaft is keyed to prevent any valve rotation during operation. On the underside of the mushroom is a shroud or deflector to direct the intake gas in a circular motion around the cylinder wall. This gives a high velocity, turbulent flow around the combustion chamber and cylinder wall. If the fuel is now injected in a direction opposite to this

flow it will be immediately atomized and upon ignition an even burning action will result.

The benefits of this valve are obvious. Cheaper fuels may be used with high-compression operation and corresponding high power outputs.

However, since the shrouded valve is restricted from rotation, wear and warping will be more prominent than in the standard single-beat valve.

Swing-Type Valves

Although the swing-type valve does not "pop up and down" it closely follows the characteristics of the poppet type valves.

The swing-type valve is merely the mushroom head of a single-beat valve with a curved arm replacing the valve stem. Its design permits the valve to swing free of the intake passage and allow a freer flow of gas into the combustion chamber, hereby improving efficiency.

This valve is used as the intake valve in one make of foreign engine and has most of the benefits of the single-beat poppet valve. However, uneven wear and warping will necessarily be present since the valve is always seated in the same position.

The valve-gear mechanism used to drive this valve is purely mechanical. The valve is both opened and closed by means of a crank mechanism; therefore, there is no valve floating and higher engine speeds are possible than with the spring return mechanism.

Sliding Valves

The sliding valve is merely a plate of metal which slides during the engine operation to block or give access to the intake and exhaust ports. The sliding valve may take many different forms; but the characteristics of all sliding valves are practically equivalent, and make it applicable only to steam engine operation.

The benefits of sliding valves are numerous. The sliding valve is simple in construction and is easily repaired or reset for varying steam expansion periods. It may be driven simply, is easily reversed, and runs well at all engine speeds. The main drawbacks to its usage come about from the high friction losses encountered due to its large area, and valve warpage at high temperatures. If the valve is exposed directly to the steam chest there will be an extremely high friction force on the valve; therefore, the valves are sometimes shielded from the high pressure in the steam case by a valve cover.

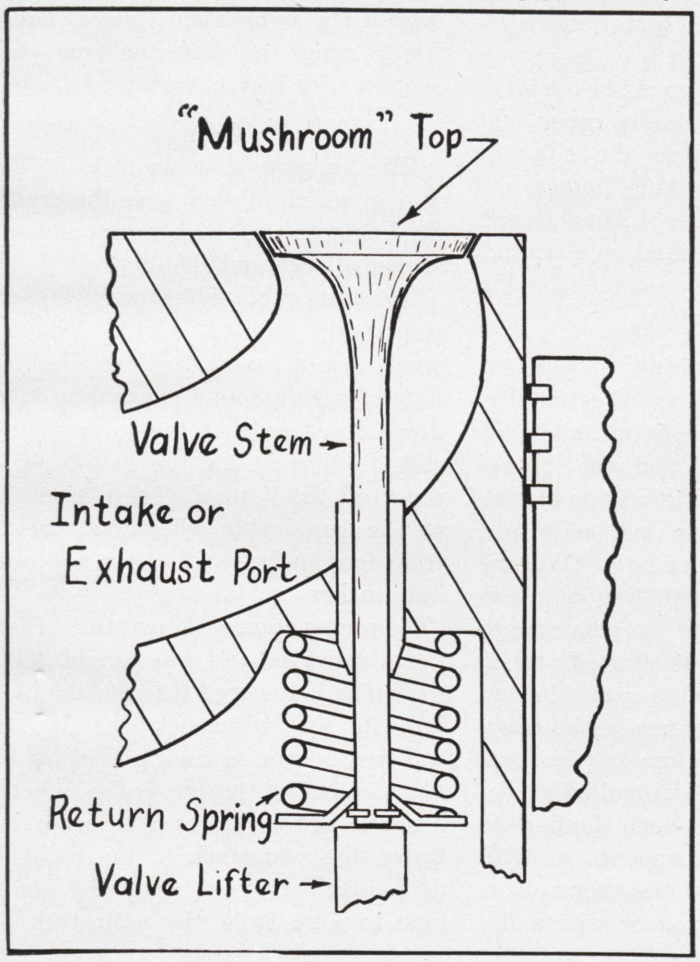
Variations of sliding valves have been used where the number of ports in the valve is increased to permit slower valve action or a shorter stroke. These are then called multiple-port valves.

Piston Valves

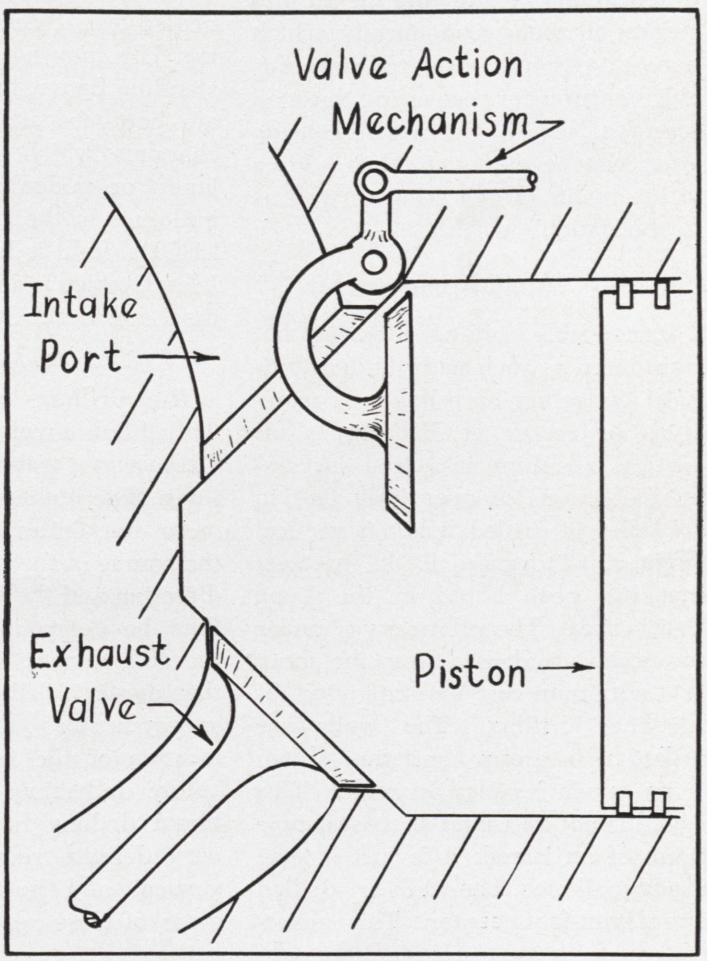
Piston valves are described quite accurately by their name. They merely effect the filling and exhausting of the chamber by sliding over the gas ports.

Sometimes this valve action can be accomplished by using the piston of

(*Concluded on page* 26)

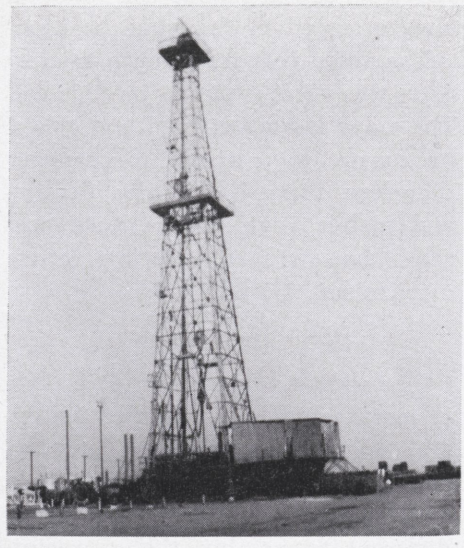


Single-beat Poppet Valve



Swing-type Valve

A new "slant" on the business of oil drilling.



By Bill Scharpenberg jr., c.e.

Directional Drilling

Introduction

Recent developments in the equipment and technique of controlled directional drilling have simplified the practicability of directing the bit into certain oil zones economically, which heretofore were considered unprofitable ventures for recovering these oil reserves. New sub-surface oil bearing areas can be exploited, thus adding to the frofits of operating as well as to the nation's wealth.

Applications

Inaccessible drilling sites are not considered as such with the feasibility of deflecting bore holes, in many areas in access of 45 degrees off vertical, resulting in actual successful deflections of over 3000 feet in 5500 feet of drilled hole. A vertical angle of 67 degrees is the greatest that has been bored in the Long Beach area. The oil reserves under the ocean are drilled from the shore at a minimum cost by employing directional drilling. The wells are drilled in a group consisting of ten wells, which is called an island. This island is not an island as most people think of an island; it is just a term used by oil men. The wells are drilled on eleven-foot center. This means that the ten wells can be drilled on an area of 5000 square feet. For example, ninety-five per cent of the wells that the Long Beach Oil Development Company owns have been drilled by controlled directional drilling. This may not seem to be an outstanding figure, but most of the wells are bottomed under the ocean, the channels which form the shipping lanes, or under private homes and buildings in the city of Long Beach. LBODs' field is located on Terminal Island, which is a man-made island in the Long Beach Harbor.

Technique

The drilling of a directionally-drilled hole involves determining the distance to travel and the limitations. The higher the drift angle the more the deflection tool will turn the course of the bore hole. With the direction and the angle known, it can then be determined at what depth the deflection is to be started. When that depth is drilled, a multiple-shot survey is run to determine the exact location of the bottom of the hole before deflection. Controlled directional drilling has been limited to very definite requirements in both vertical and horizontal control in areas of close spacing or where the proposed bore hole will be drilled through an area where other wells have already been drilled. As a result, hypothetical cylinders have been used where the drilling is confined within the cylindrical limits. These limits range in diameter from ten feet to fifty feet in radius.

Tools

The removable whipstock is the tool to which oil men give the credit for being the most important in controlled directional drilling.

The removable whipstock is a new, improved, chrome nickle alloyed steel casting averaging ten feet in length, with a round concave groove down the face that tapers from inside a collar at the top to the periphery at the bottom. The diameters of the removable whipstock range from four inches to thirteen and one half inches.

The preparation and operation of removable whipstocks was simple. The drill pipe is lowered through the collar; in the whipstock the bit is screwed on and is then pulled up to engage the bit in the collar where a shear bolt is inserted to securely fasten the whipstock to the bit and drill pipe. By orienting the drill pipe into the hole, the whipstock is

seated on the bottom of the hole facing the required direction. Weight is applied to force the chisel at the bottom of the whipstock into the bottom of the hole, firmly seating it in the hole. Additional weight is then applied to break the shear bolt, freeing the bit and drill pipe from the whipstock. After a hole of ten to twenty feet is made below the whipstock, the whipstock is pulled up and taken off the drill pipe. A specially designed follow-up bit is then lowered into the hole to ream out the initial deflection hole. After reaming, it is pulled up, the regular drill bit is put on, and drilling is continued without further changes. Depending upon the formations encountered, drillers may use from one to twenty whipstocks in acquiring the desired deflection.

Survey Equipment

The fine, compact, delicate surveying instruments, combined with the special deflection tools, have made an art of directional drilling. Both the instruments and deflection tools have continued in perfection and now have a place in the ever-improving methods of drilling. The survey instruments, with directional control as well as vertical control, are the multiple shots and the single shots. The multiple shots depend upon either drill pipe orientation, magnetic compasses, or gyroscopic compasses for drift angle directional control. These photograph automatically upon movie film, at specified intervals, the position of the plumb-bobs and compass units. With the multiple-shot instrument, a continuous record is made of these units on one trip out of the drill pipe. The single-shot survey instruments serve to guide the driller in determining his next operations. These surveys are taken at intervals to determine the sub-surface location of the bore holes at all times. They are run down through the drill pipe so that they are seated in the demagnetized collars which are just above the bit. The single shot has greatly increased the speed and accuracy of directional drilling.

Orientation of the Whipstock

LBOD is at present using the projected vertical method of orienting deflection tools. The projected vertical plane orientation method is a simple, fast, and accurate method for seating deflection tools. The tool is aligned on the surface to the desired azimuth at which it is to be faced on the bottom of the bore hole. An orienting clamp is set on the drill pipe, and the sighting bar is placed in the clamp and adjusted to a fixed distant point. Another clamp is set at the top of the stand of drill pipe. A derrick telescope is inserted into the clamp, and the adjusting screw turned until the cross-hairs of the clamps lines up; the lower clamp is removed and the drill pipe lowered after another stand is set at the top of the stand in the derrick. The telescope is inserted and adjusted to align the cross-hair to the sighting bar below. This procedure is repeated on each stand and thus keeps a vertical projected plane on the drill pipe until it reaches bottom. When the last orienting clamp comes down to the rotary table, the sighting bar is inserted into the clamp, and the drill pipe is turned until the bar is aligned onto the fixed distant point used when the deflection tool was at the surface. The tool is then faced in the desired direction for setting.

LBOD has been instrumental in developing a new method of orienting the deflection tool. This method, though still in experimental stages, is swiftly developing into a simpler and faster method. The method employs a non-magnetic sub, into which combination compass units are lowered to determine the direction of the deflection tools. The tool may then be turned in the desired direction for drilling.

There are two other methods of orienting deflection tools; the algebraic summation of angles of rotation and the bottom hole method.

Production

LBOD is at present producing six of the seven zones that are in the Long Beach area. Their first zone is the Tar zone, which is from 2000 to 2300 feet deep and is the fifth producer of petroleum in the producing zones. The Ranger zone, which is the second zone, lies between 2300 and 2900 feet. This zone produces the most petroleum and is the largest reserve in the field. Ranger Oil Company discovered this zone and named it after their company. In 1936, General Petroleum Company drilled Terminal number one which tapped the Upper Terminal zone. Upper Terminal, between 2900 and 3400 feet, is second in production. The Terminal zone was divided into two divisions for production purposes. The Lower Terminal zone lies between 3400 and 4000 feet. It ranks third in production. Union Pacific Railroad Company developed the fifth zone, the Union Pacific zone. This zone is 4000 to 4800 feet below the surfaces and ranks fourth in production. The well that tapped the Sixth zone was drilled on the Ford Motor Company property and thus was called the Ford zone. Rating sixth in production, the Ford zone lies between 4800 and 5600 feet. The 237 zone, 5600 and 6000 feet, gets its name from the fact that it was the 237th well drilled on Union Pacific land that first produced the zone. Petroleum engineers expect no production from the basement. A few wells have been drilled to the basement, and some have produced from the fractures in the schist, but it is not economical to produce from this zone.

LBOD is a producing company. They contract their drilling to major drilling companies. The field is drilled in small areas called leases. These leases contain numerous ten-acre leases. The ten-acre leases are all underground around the bottom of the well that is tapping the zone. The ten-acre plot is projected to the

(*Concluded on page* 30)

Research and Development

30-INCH KODAK CONTOUR PROJECTOR

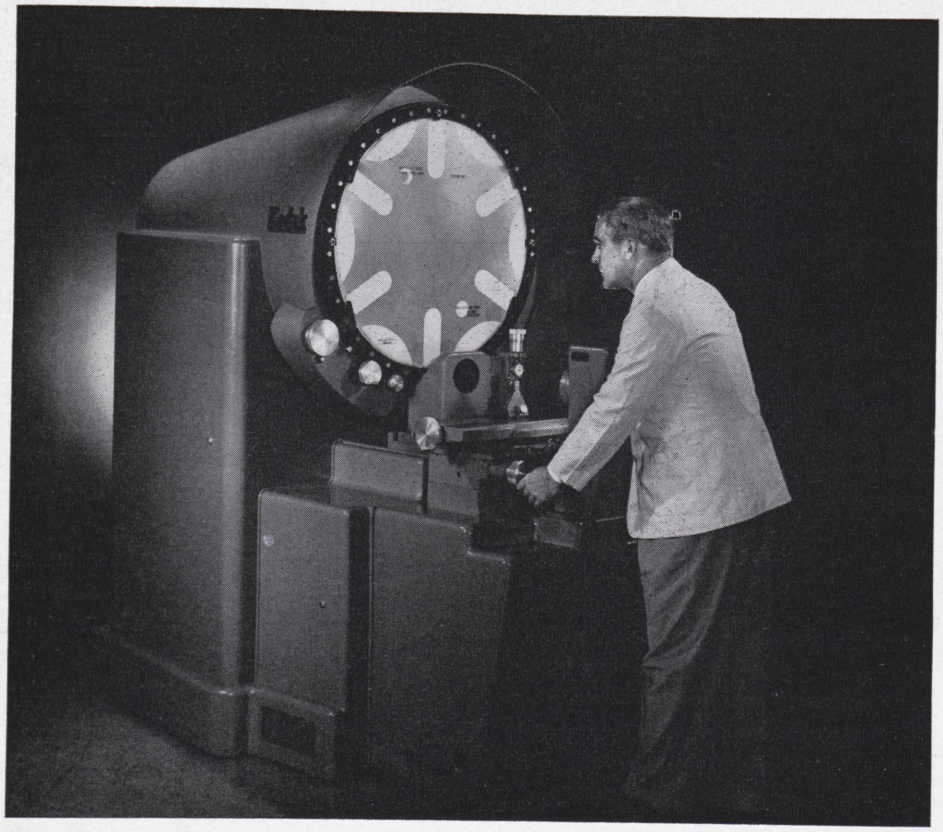
A big new Kodak Contour Projector featuring a 30-inch viewing screen was introduced in Philadelphia today by the Eastman Kodak Company. At the same time, the Company also introduced a new 14-inch projector, the Model 4, designed for routine product or line gaging.

The new projector is intended for use both in precision micrometry and on the production line. In either of these fields its size permits easier inspection of complete parts, or greater ease and convenience in inspecting portions of very large parts.

Company officials stated that the new unit has been built in response to many requests for a 30-inch model incorporating the same optical refinements first introduced in Kodak's 14-inch projectors. These features include a choice of either shadow or surface illumination at the flick of a switch; ordinary room-light operation; instant changes in magnification without refocusing; and unvarying 8-inch distance between the lens and the plane of the object under observation.

In addition the new model offers a staging area with a 17-inch throat; eight-inch horizontal and eight-inch vertical table travel; a built-in helix table with a worktable rotation of 15° off center in either direction for setting helix angles; horizontal and vertical micrometers which are guaranteed to .00005″ over their entire 1-inch range; a direct reading screen for angular measurements which can be read without vernier from a percision engraved dial calibrated to 2′ of arc; and a built-in 1,500-watt light source for the surface inspection of cavities, blind holes, and surface details with the Kodak Normal Surface Illuminator.

New Kodak Contour Projector with 30-inch screen



Illumination for shadow projection is provided by a 500-watt light source which gives a sharp, easy-to-read, screen image across the full 30-inch diameter.

The projector is available with a choice of six inter-changeable lenses —10x, 20x, 31¼x, 50x, 62½x, and 100x, any of which may be mounted in a motorized turret to provide instant change of magnification. No focusing or other adjustment is necessary when magnification is changed.

In the design of the new unit, projection lenses and mirrors are both mounted on a single member. This provides maximum rigidity and alignment for these critical parts even under rigorous shop conditions.

INDUSTRIAL TELEVISION SOLVES MYSTERY WATCHING THIEVES AT WORK

Industrial television turned detective during the past summer and solved a case by giving police an eye-witness view of thieves at work.

The locale was a stockroom of an RCA television service branch in Hollywood. Inventories had disclosed that television equipment was being stolen on a substantial scale—some $38,000 worth was missing on the initial check.

Officials on the spot, recalling the success of RCA industrial television equipment in functioning as an "eye" in locations too dangerous or inconvenient for human obesrvers, decided to try the device as an electronic witness to the crime. Summoning the police, they concealed the camera unit among the rafters of the stockroom with the lens focused on the loading platform. The rest of the unit — the TV receiver and viewing screen — was placed in a second floor room some distance away.

Every day for two weeks, the TV "eye" was trained on the loading platform as police watched at the

By
Bill Cade, soph., e.e.

receiver. The camera recorded the routine activities at the platform — but it also recorded the suspicious actions of one clerk, who casually placed a number of boxes of TV tubes on the loading platform during the lunch hour on Tuesdays and Thursdays when few other people were around. At apparently prearranged intervals, a pick-up truck would back into the driveway, the boxes would be put aboard with the help of the suspect, and the truck would pull away — all before the gaze of the camera and the interested watchers at the TV screen.

Once the facts had been made clear by the TV unit, the trap was set. The police at the receiver waited until the truck took off with another load of tubes. As they moved in to arrest the clerk, a police car trailed the truck to its destination and seized the driver and two alleged confederates.

The hero of the story is an industrial TV unit which already has been put to scores of uses — patrolling, guarding, transmitting fingerprints and signatures, checking numbers of freight cars, supervising operations of machinery at a distance, riding rockets, and generally fitting itself handily into locations where direct view is required and the human eye cannot go.

Its efficiency in these operations, and in its newly-acquired detective role, stems from the compactness of the camera and the fidelity with which it transmits what it sees. The RCA Vidicon tube, heart of the system, is only six inches long and an inch in diameter. The camera that is built around the tube is no larger than a 16-mm movie camera and is easy to handle.

The unit is completed by a connecting cable and a compact control monitor with a ten-inch viewing screen. Other receivers can be attatched to the monitor if required, and the controls allow the camera focus to be controlled from the receiving end.

Although TV in this compact form has been available to industry for less than ten years and has been developed by RCA engineers into its present state within the past two years, it has already carved a vital role for itself in a wide variety of jobs. Its recent performance in Hollywood was a new departure, however, and its success as a witness to the crime promises to open a broad field for TV as an electronics arm of the law.

ARTIFICIAL SOLAR RAYS

Solar rays found only in the outer atmosphere are being reproduced artifically by a new device which will simplify scientific exploration in a little-known region of fundamental research.

The device, developed by engineers of the General Electric Company, records the reaction of various crystals to vacuum ultra-violet radiation, the more powerful cousin of ordinary ultra-violet rays that cause sunburn.

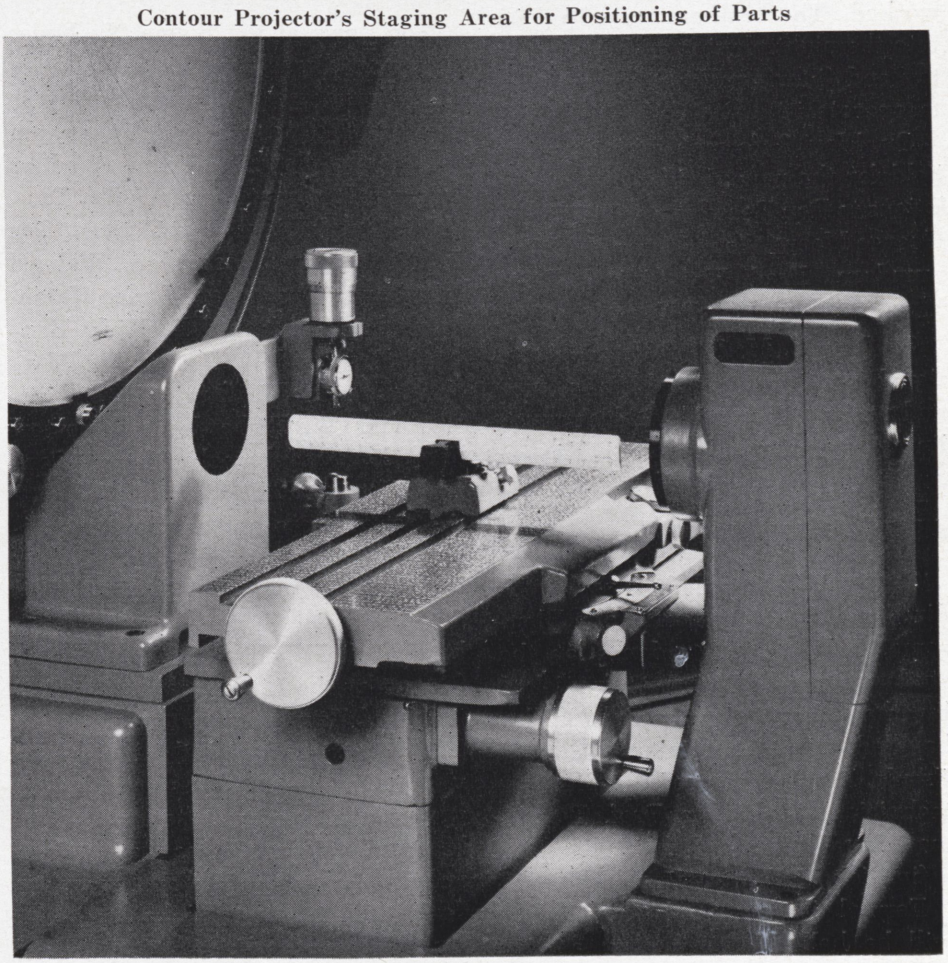
A characteristic peculiar to vacuum ultra-violet light is its rapid absorption by air, with the result that the rays never penetrate the earth's layer of atmosphere.

The company's General Engineering Laboratory developed the device as an improvement over existing bulky and complex apparatus.

G-E scientists say that although it produces radiation found only at altitudes of 150 to 200 miles, the new research tool is not intended as a

(*Continued on page* 28)

Contour Projector's Staging Area for Positioning of Parts



Fraternity Notes

THETA XI

During the past few weeks Kappa has been pretty busy working on the house. The outside trim is in the process of being scraped and painted, and the basement is going to be finished. We also purchased a dining room set to replace some of our old chairs and tables.

On April 24 a large delegation from Kappa went over to Indianapolis to celebrate Theta Xi's ninetieth anniversary at a dinner sponsored by the Indianapolis Theta Xi Club. Everyone agreed that the meal and the refreshments were more than adequate.

With the approach of warm weather, the brothers decided to try out the air conditioner which came with the house. The proper switches were thrown and valves opened, and lo and behold, after standing idle for more than fifteen years, it still worked. The brothers stayed up far into the night playing with their new toy and figuring what it would cost to operate it.

On May 2 formal initiation was held for the new pledges. Congratulations to Ron Boesenberg, Bill Came, George Moore, Gene Mrava, Ted Solmundson, Fred Von Allmen, Bill Waggener and Jack Wilcox.

On May 7, M. S. McNay, the national president, payed us a visit and presented us with a plaque outlining the purpose of Theta Xi.

Charles Hirshfield

ALPHA TAU OMEGA

On April 24 the pledges under the direction of their captain, John Bloxsome, held a pledge dance at the student center. Music was furnished by the record player, Bob Miller handled the entertainment, and Frank Rendaci served as lighting technician. Thanks to Prof. Baughman, Mr. Tinker, and their wives for a fine job of chaperoning.

Formal initiation of the pledges will be held May 16, after a help week project of cleaning up the boy scout camp is completed by the actives and pledges of the four Rose fraternities.

This summer Alpha Tau Omega will hold its National Congress in Atlanta, Georgia. Kermit Morris was elected official representative of Gamma Gamma Chapter, with Ken Hannum and Jack Hills serving as alternates. Also planning to attend are Lafe Stewart, Don Powers, Chuck Hayward, Carter Smith.

Big news around the ATO house this month is the pinning of our Worthy Master, John Gregory, to Miss Mary Jane Mansholt. Also captured by "sweet essence of spring" were Ken Hannum and Bill Povlin, who gave up their pins to Jean Lewis and Maggie St. Clair.

Art Masters

SIGMA NU

Top news at the Sigma Nu house this month was the election and installation of new officers. When the dust settled in the balloting room, the newly elected officers stood as follows: Eminent Commander, Donald C. Wood; Lieutenant Commander, L. B. Kellam; Recorder, Richard Matthews; Treasurer, James Tatooles; Chaplain, Philip B. Kirk; Sentinel, Raymond V. Fischer Jr.; Marshall, Hugh M. Davis; Historian, Thatcher W. Richardson; Reporter, John R. Rhodehamel; Alumni Contact, George T. Rezek.

The brothers and pledges coordinated their time and work during the week of April 5th through April 10th to assist in the building of a baseball field behind the Rose Home for use by the Little League baseball teams of Terre Haute.

A picnic was planned for and carried out by the brothers and pledges one bright Sunday afternoon. The brothers and their dates ate hot dogs and drank cokes at Turkey Run until dark when the chore of Sunday night studies loomed and the group forced themselves to break up early.

On the athletic side, Sigma Nu is slowly but surely molding a fierce team of softball players from a mixture of actives and pledges. This tough team is in the last stages of development, operating on a policy of frequent position rotation.

John Rhodehamel

LAMBDA CHI ALPHA

The chapter welcomes its most recent pledge, Dick Neugent of Paris Illinois.

"Casey" Teague and the Lambda Chi softball nine, have lengthened the perfect record of the '53 season by starting this season with two wins. This brings the Chi nine streak to eight successive victories.

Hurler Don Snape, backed up errorless defense, shut out Theta Xi 11-0 in the first tilt of the season. The offense was sparked by Dick Gordon's homer in the first inning. Eight additional hits accounted for Lambda Chi's other tallies.

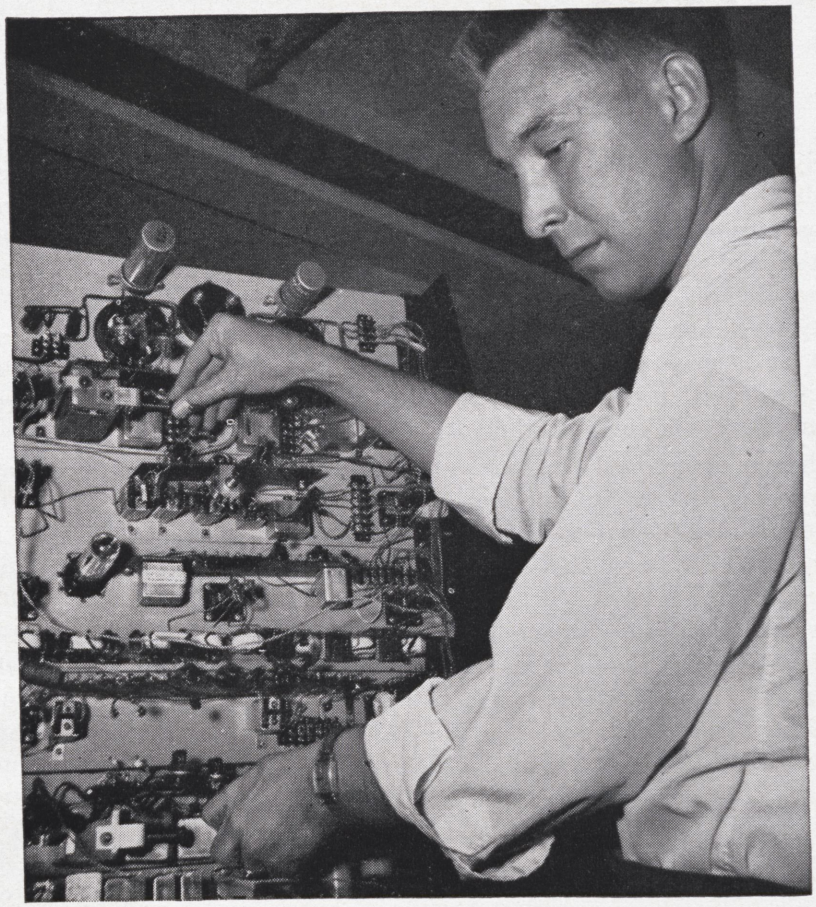
The second game, Lambda Chi vs. Sigma Nu, turned into a slug fest between the teams' top hitters. The six hits of Sigma Nu were topped by fourteen from the home team. The slugging of Bud Hall's homer and "Mac" McCulloch's grand slam homer led the team to a 20-3 victory. Don Snape went the distance on the mound.

The overall record at the plate stands at 23 hits for 60 official at bats, for a team batting average of .383. Six of the starting nine are batting above a .400 clip. The chapter has high hopes of retaining the IF softball trophy. Future contests include two games with ATO and return engagements with Theta Xi and Sigma Nu.

News has reached the chapter indicating that Jim Calabro will soon be on his feet again. We all wish Jim a very speedy recovery and hope to see his smiling face soon.

Jerry Fromholz

A CAMPUS-TO-CAREER CASE HISTORY



Bob Wilson uses a "breadboard" circuit, studying the electrical properties of a carrier system

"My first assignment at Bell Labs"

Fresh out of school, Bob Wilson, '53, was put to work on a Transistor project at Bell Laboratories. He explains why he never had time to be awed.

(*Reading time:* 39 seconds)

"In some ways it was hard to believe. I had received my B.E.E. at the University of Delaware in June, 1953, and a week later I was working in the world-famous Bell Laboratories.

"But I didn't have time to be awed because they put me right to work. They gave me responsibility fast.

"My group was working on the experimental application of transistors to carrier systems. My assignment was the electrical design of a variolosser for the compressor and for the expandor to be located in the terminals.

"The supervision I received and the equipment I had were tops. I quickly discovered that I had to rely on my ingenuity as much as on the college courses I had taken. Perhaps that's one reason for the great new discoveries continually turned out by the Labs.

"Now I'm in the Communication Development Training Program, continuing my technical education and learning what all the Laboratories sections do and how their work is integrated.

"In a year I'll be back working with the group with which I started."

• • •

Assuming responsibility fast is a common experience among the engineering, physical science, arts and social science, and business administration graduates who join the Bell System. Bob Wilson went with Bell Laboratories. There also are job opportunities with the operating telephone companies, Western Electric and Sandia Corporation.

BELL TELEPHONE SYSTEM

Binary Counters

By
Erwin Ulbrich
sr., e.e.

The increased technology of recent years has emphasized man's need to be able to measure or count things, both tangible and intangible. Physical measurements, or counting, can be defined as a process in which the quantity to be measured or counted is put into the form of a number of identical unit quantities, and then the number of these units is counted. In many applications, this counting must be done very rapidly. This need has been met in industry by the binary counter which is becoming more and more widely used. These binary counters, and the ideas behind their operation are the subject of this article. First, the uses and types of the counters will be discussed, then the arithemtic of the counters and finally something will be said about how the devices actually operate. Details concerning the actual construction will be omitted.

Basically, a counter is used to register during some time period the number of occurrences of a repeated event that is happening too rapidly to be counted mechanically. Thus, counters are utilized in radiac instruments, precision timers, and various pulse counting devices. The basic idea behind each of these operations is that the counter takes the number of events as its input, and divides this by some constant factor to get a smaller output number which can be indicated mechanically. In another kind of application, a counter is used to register the total number of events that has been put into it. Such counters are used in computers and in specialized telephone switching circuits.

The counter genus contains three subdivisions: relay types which are growing obsolete, transistor types which are comparatively new and undeveloped, and electronic types which are most commonly used. The electronic type of device is extremely versatile and can be used at very high speeds (up to 10,000,000 numbers per second)! The relay type of counter, which is hindered by comparatively slow operation (up to approximately 100 numbers per second), has been widely used, because it is cheap and simple. In modern electronic designs, new levels of reliability and low cost are being achieved, and this is another reason why electronic systems are supplanting the mechanical or relay counters.

Now, having mentioned the counters themselves, it is appropriate that we consider the mathematics of their operation. We have noted that these devices count events or signals, and we know that we need a system of registration which will allow us to tell how many events have occurred. In our civilization, the system most commonly encountered for this registration is the decimal system with its ten symbols (0-9). This decimal system is represented in part A of the chart, and the use of the base ten is clearly indicated in forming the numbers zero through fifteen. It has been found, however, that the basic laws of nature show no special partiality for this base number of ten, which after all, is just the result of men having ten fingers. Instead, in many instances, a more logical number system is the binary system which has a base number of two and correspondingly, two symbols, 0 and 1. It is this system which answers best to any situation in which there are two possibilities; for instance, in logic, the answer to a problem can generally be resolved to yes and no; in a relay system, switches and relays are either on or off; and in an electronic circuit, tubes can be either conducting or at cut-off. The full development of this system which is used in modern counters is seen in part B of the chart (from 0-15 as with the decimal system). As a general conclusion, it can be seen by inspecting the two number systems that the primary advantage of the decimal system is its compactness, while that of the binary system is its simplicity of notation (only ones and zeros).

Having developed the arithmetic of the device, the actual operation of the counters will now be explored. It was explained earlier that a counter is basically a divider that at any given time indicates what state it is in. A more precise definition will now be given: "In its operation, a count-

(*Concluded on page* 34)

A. *The Decimal System*					B. *The Binary System*				
10^3	10^2	10^1	10^0	Numbers	2^3	2^2	2^1	2^0	Numbers
1000	100	10	1		8	4	2	1	
			0	0				0	0
			1	1				1	1
			2	2			1	0	2
			3	3			1	1	3
			4	4		1	0	0	4
			5	5		1	0	1	5
			6	6		1	1	0	6
			7	7		1	1	1	7
			8	8	1	0	0	0	8
			9	9	1	0	0	1	9
		1	0	10	1	0	1	0	10
		1	1	11	1	0	1	1	11
		1	2	12	1	1	0	0	12
		1	3	13	1	1	0	1	13
		1	4	14	1	1	1	0	14
		1	5	15	1	1	1	1	15

Number Systems

teeth for a 1000 h.p. bite . . .

Undoubtedly you will recognize this application of a familiar technique for studying stresses. In this case, it was used to develop gears that are less than 5 inches in diameter yet easily transmit over 1000 horsepower.

Inherently, the design and development of aircraft engines offers unusual opportunities for applying basic engineering principles learned in school. In few other places can a technical graduate utilize his education and abilities more fully — gain recognition and advancement.

Many of our engineers who had important roles in developing the most powerful jet engine known to be in production — rated in the 10,000-pound thrust class — are still in their twenties.

To those young graduates who can see the career possibilities in the rapidly evolving field of aircraft propulsion, we can offer a real opportunity for growth and professional development.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

Library Notes

By Carson W. Bennett and Nina J. Mahaffey

"In science read the newest works; in literature, the oldest"

Stairway to the Stars

Our recent assembly program featuring Dr. Harold C. Urey was received with such enthusiasm that we wish to make suggestions for your further investigation in the field of astronomy.

First of all, there is the book which Dr. Urey mentioned: Baldwin, Ralph B. *The Face of the Moon.*

In this interesting volume the author examines and rejects all but one of the processes previously suggested to account for the lunar craters, rays, mountain ranges, and lava flows. He selects and clearly demonstrates as the most probable cause the impacts of giant meteorites on the rocky lunar face and their resultant explosions. The energies released from millions of such collisions throughout the lifetime of the moon have blasted its rocky surface into the present tortured wasteland.

Chapters are devoted to a description of the strange and beautiful formations found on the moon, to a discussion of modern and ancient meteoritic craters known to exist on earth, to an analysis of the impact theory in the light of knowledge of man-made explosion pits, to an investigation of the possible effects of a lunar atmosphere, to the dating of the major changes on the face of the moon, and to a consideration of the possibility of meteoritic infalls on other planets.

This book presents an internally consistent picture of the past history of the moon in which great numbers of meteorites, large and small, formed craters in the lunar crust and induced the operation of other secondary mechanisms. But, since the moon has always been the companion of the earth, the history of the former is only a paraphrase of the history of the latter. Not only does this book tell the story of a nearly dead body 240,000 miles away; it also tells the story of the earth itself.

Other titles you may find of interest are:

Abetti, Geargio. *The History of Astronomy.*

Couderc, Paul. *The Expansion of the Universe.*

Gamow, George. *The Birth and Death of the Sun,* stellar evolution and subatomic energy.

Gamow, George. *The Creation of the Universe.*

Gaposchkin, Cecilia P. *Stars in the Making.*

Hill, G. W. *The Radiant Universe.*

Hoyle, Fred. *The Nature of the Universe.*

Kuiper, G. P., editor. *The Atmospheres of the Earth and Planets.*

Marshall, R. K. *Sun, Moon, and Planets.*

Rey, H. A. *The Stars,* a new way to see them.

Rice, L. L. *The Universe*: its origin nature and destiny.

Urey, H. C. *The Planets,* their origin and development.

Speedway Special

In the spring a young man's fancy lightly turns to thoughts of the 500 Mile Race (among other things). This race, being traditionally run with automobiles, we want to call your attention to the Rose Library's offering of books about cars.

History and Development

Auto 1953

They're all here — American and foreign.

Cleveland, R. M. *The Road is Yours*: the story of the automobile and the man behind it.

The complete chronicle.

Clymer, Floyd. *Those Wonderful Old Automobiles.*

Generously illustrated.

Clymer, Flody. *Treasury of Early American Automobiles,* 1897-1925.

More of the same.

Musselman, M. M. *Get a Horse!*

Fewer pictures but more facts.

Purdy, K. W. *The Kings of the Road.*

Bugatti, Mercer, Duesenberg, Stutz, Cord, Stanley, etc.

Rolt, L. T. C. *Horseless Carriage.*

The motor-car in England.

Stern, P. V. D. *A Pictorial History of the Automobile,* 1903-1953.

As seen in Motor magazine.

Stein, Ralph. *Sports Cars of the World.*

Ford Motor Company. *Ford at Fifty,* 1903-1953.

Look and drool department.

Throm, E. L. *Popular Mechanics Auto Album.*

Includes a look into the future.

General Motors. *Buick's First Half-Century.*

For the Buick fans.

Longstreet, Stephen. *A Century on Wheels.*

Studebaker.

For the M.E.'s

Crouse, W. H. *Everyday Automobile Repairs.*

Heldt, P. M. *Automotive Chassis.*

Heldt, P. M. *Torque Converters.*

Purvis, Jud. *Automatic Transmission Simplified.*

ETC.

American Automobile Association. *Sportsmanlike Driving.*

Jennison, Keith. *The Half-Open Road.*

To be taken with a cup of salt.

Partridge, Bellamy. *Fill 'er Up!*

Mitchell, Frank. *How to Buy, Keep and Enjoy Your Car.* Ω

Compatible color television will eventually reach every TV home

The rainbow you can see in black and white!

RCA brings you compatible color TV. Lets you see color programs in black and white on the set you now own!

"When a modern and practical color television system for the home is here, RCA will have it . . ."

Echoing down through the years, these words—spoken in 1946 by David Sarnoff, Chairman of the Board of RCA—have a ring of triumph today.

Behind this great development are long years of scientific research, hard work and financial risk. RCA scientists were engaged in research basically related to *color* television as far back as the 1920's . . . even before *black-and-white* television service was introduced.

Since then RCA has spent over $25,000,000 to add the reality of color to black-and-white TV, including development of the tri-color tube.

The fruit of this great investment is the RCA all-electronic compatible color television system, *a system that provides for the telecasting of high-quality color pictures that can be received in full color on color receivers; and in black and white on the set you now own.*

RCA and NBC will invest an additional $15,000,000 during color TV's "Introductory Year"—1954—to establish this new service on a solid foundation.

RCA color sets are beginning to come off the production lines in small quantities. Although it will probably be another year before mass production is reached, the promise of compatible color television is being fulfilled.

RCA pioneered and developed compatible color television

INTRIGUING OPPORTUNITIES FOR GRADUATING ENGINEERS

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The Transdipper

By Joseph Verdeyen, sr., e.e.

The title of this article, "A transdipper", was chosen because the apparatus involved resembles the conventional vacuum tube grid-dipmeter in its operation. However, the transdipper is an entirely different piece of apparatus as far as circuitry is concerned.

As the name implies, the transdipper uses a transistor instead of a vacuum tube for the oscillator circuit. Because of this difference, this report will give a simplified idea of transistor action and discuss the circuitry involved in this specific transdipper.

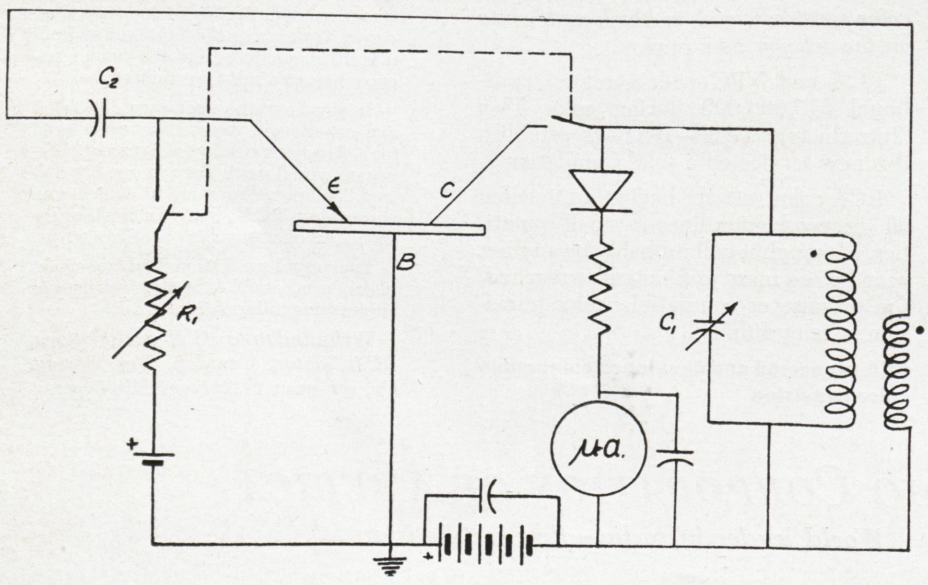
In its amplifying action, a transistor is similar in some ways to a triode vacuum tube. There is a conventional notation for a transistor. There are two types of materials involved, a p-type and an n-type. For simplicity's sake, the p-type of material may be considered to have an excess of positive charges, while the n-type material may be said to contain an excess of negative charges. Actually, there is no net charge in either material. If germanium is contaminated with an impurity element which has an excess amount of electrons when fitted into the germanium crystal, n-type material is produced. The p-type has an impurity introduced into the crystal structure such that there will be a deficiency of electrons. Thus, "holes" are produced. The electrons are free to move in the n-type, while the "holes" are free to move in the p-type.

An easy way to see how a transistor works is to apply batteries of different polarities to the emitter and collector circuits and see what happens. Essentially, this means analyzing a p-n junction to show why it rectifies.

Because the base resembles, in schematic notation, the cathode of a vacuum tube, the first inclination might be to put the emitter bias in with that in mind. In this case the plus side of the battery will attract electrons in the base material of n-type, and the negative side will attract the mobile holes in the p-type. After an infinitesimal surge of current, conduction will stop because the junction has been swept clear of mobile charges. But if the polarities are reversed some interesting things happen. The positive side of the battery will pull to itself reaching across the p-n junction. At the same time electrons will be injected into the n-type base material. The holes are attracted by the negative side of the battery and are replenished by the positive side. Therefore, conduction continues as long as the polarities are reversed.

The preceding discussion shows the effect of one of the germanium diodes. Now the transistor idea comes into play. At first, it might seem logical to apply the same line of reasoning to the collector circuit as was done for the emitter. However, if the collector were made positive with respect to the base, the transistor would be just two diodes with a common element but with no interrelation between the two. If instead, the collector is made negative with respect to the base, some of the holes injected by the emitter will diffuse into the "swept" junction of the collector region providing charge carriers under the control of the emitter.

Schematic Diagram of the Transdipper



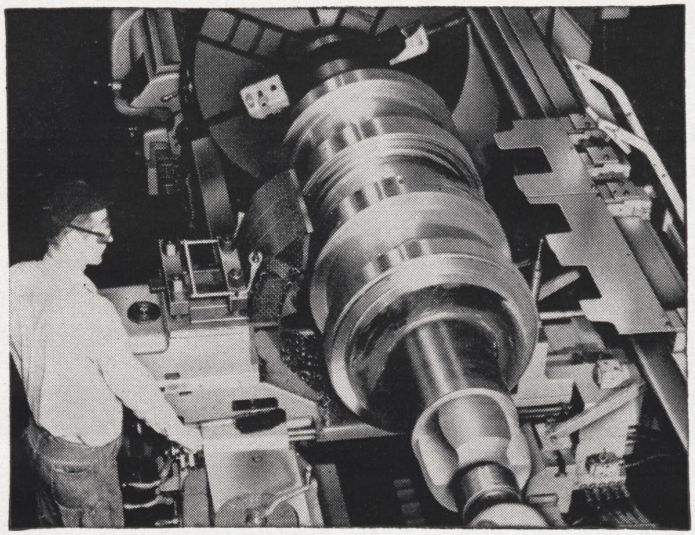
It can be seen from the characteristic curves plotted from collected data that the collector current in a typical point-contract transistor is very dependent upon the bias current applied to the emitter. It can also be seen that, for a change in emitter current, a larger change in collector current will occur, the collector voltage being held constant. For example, it turns out that:

Delta $I_e = 0.5$ ma @ $V_c = 12^v$
Delta $I_c = 1.35$ ma.

It should be noted at this point, that a point-contact transistor may *amplify* a current. This property is

(*Concluded on page* 32)

Another page for **YOUR BEARING NOTEBOOK**

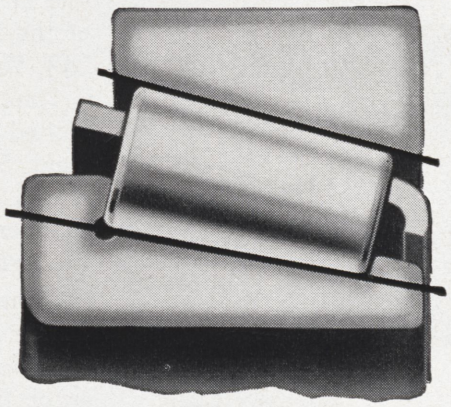


How to hold a heavily-loaded lathe spindle in accurate alignment

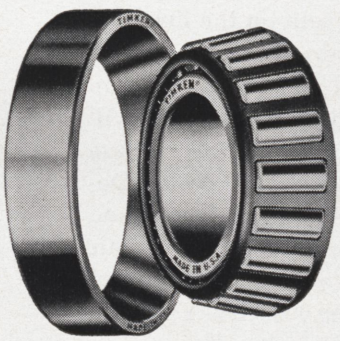
This big lathe machines rolls for steel mills. The roll is rotated by the lathe spindle and it must be machined to very accurate dimensions. So the lathe manufacturer, LeBlond Machine Tool Company, mounts the spindle on Timken® tapered roller bearings. Despite the great weight on the spindle, the Timken bearings hold it precisely in place—because they are made so accurately and have such high load capacity.

Why TIMKEN® bearings have high load capacity

This picture shows why Timken bearings have such high capacity—the load is carried on a *full line contact* between the rollers and races in the bearing. Note also the tapered construction. This permits the bearing to be tightened up (preloaded, we call it) to prevent chatter in rotating parts like the machine tool spindle above.

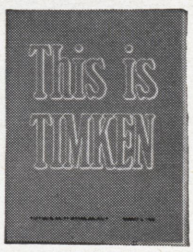


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Want to learn more about bearings or job opportunities?

Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.



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

Alumni News

By Birt Kellam, soph., e.e.

'14 Shopmeyer, George E., C.E., was recently honored by the Effingham chapter of the Illinois Association of Highway Engineers for his outstanding work in road maintenance. Mr. Schopmeyer has been District Maintenance Engineer of the Illinois State Highway Department for the past twenty years, and is now retiring.

'36 Campbell, James W., M.E., formerly an engineer with the Detroit Edison Company, has been promoted to Plant Operations Engineer at the Conners Creek Power Plant, one of the present six power plants of the Edison Company.

'43 Thomas, Charles T., M.E., formerly a 1st Lieutenant in the United States Air Force as Armament Systems Officer, is now Research Engineer with Thomas and Skinner Steel Products Company, Inc. in Indianapolis.

'43 Pipp, Joseph P., Jr., E.E., Transformer Design Engineer for the General Electric Company, is the designer of the huge mobile transformer built for the Louisville Gas and Electric Company. The transformer, which will be one of the largest ever built for highway use, will be used to replace equipment on the line during emergency periods or for general maintenance and will be mounted on a 75-ton, low-bed semi-trailer. It will be a forced oil cooled, three-phase unit rated 25,000-KVA, 60 cycles. Designed as a combined auto and straight transformer, it will have four windings with voltage ratings of 138,000 Grd Y, 69,000 Grd Y, 37,000 Grd Y and 14,000 volts. The unit is scheduled for completion in December, 1954.

'52 Barker, Wayne M., M.E., has just completed an intensive four months course in Naval indoctrination, covering the same basic material presented to NROTC students in schools throughout the nation. Successfully passing courses in Engineering, Naval Weapons, Seamanship, Navagation, Operations, and Orientation qualifies the new Ensign as a Junior Officer aboard any one of the Navy's warships or supporting command.

'53 Flesor, Chris N., M.E., is now in contract engineering department of the Bailey Meter Company, Cleveland, Ohio.

Mr. Flesor joined the company after his graduation from Rose as a member of the company's 1953 Cadet engineering training class. After completion of his training he was assigned to the contract engineering department.

While at Rose, he was a member of Blue Key honorary fraternity, president of Alpha Tau Omega social fraternity, a Rose Honor Man, secretary-treasurer of his sophomore class, vice-president of the junior class, a member of the Glee Club, and active in intramural basketball while at Rose.

Mr. Flesor, who graduated from Rose with a commission in the Army, will be called to active duty in May and will be stationed at Fort Belvoir, Virginia. Ω

Chris N. Flesor

Ever Study

TERRESTRIAL ENGINEERING?

Probably not. As far as we know, there isn't such a term. Even so, the terrain of a manufacturing plant may have a vital effect on the design and location of its engineering equipment.

It certainly did in the case of our Belle, West Virginia, plant, which is just across the road from a flat-topped hill, 750 feet high.

Perhaps you'd like to match wits with Du Pont engineers, for we feel that this problem was interesting—and its solution ingenious.

Briefly, the situation was this: Carbon dioxide was to be removed from a mixture of gases by bringing them into contact with water in "scrubbers" operating at 450 psi (gauge). The inlet gases contained about 25% CO_2 by volume. Because of its greater solubility, most of the CO_2 would leave the scrubbers dissolved in the water.

It was necessary to reduce the pressure of this water to atmospheric and recover the dissolved carbon dioxide, since CO_2 was needed for use in a chemical synthesis. The degasified water then had to be pumped back into the pressure scrubbers, to repeat the scrubbing cycle.

Still like to match wits? How would you design an economical closed system for this scrubbing water? After you've thought out your solution, you might like to compare it with the one given below.

Du Pont engineers made use of the precipitous terrain in this way: pressure on the water leaving the scrubbers was sufficient to force it up to the top of the hill for CO_2 recovery. The returning water thereby provided a pressure of approximately 325 psi (750 feet of head) at the base of the hill. This gift of pressure on the suction side of the water pumps resulted in considerable energy saving.

Do unusual problems such as this one challenge you and stir your enthusiasm? If they do, we think you'll be interested in technical work with the Du Pont Company.

Watch "Cavalcade of America" on television

DU PONT

REG. U. S. PAT. OFF.

E. I. du Pont de Nemours & Company (Inc.)

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Poppet, Rotary, etc.

(*Concluded from page* 11)

the engine as a valve. This system is presently used in 2-cycle internal-combustion engines where the intake cycle of the engine does not depend on an intake stroke but on an external pressure system. In this case, the engine ports are located at a specific height around the cylinder walls of the engine; and when the piston is below these ports, gas is forced into the cylinder and combustion chamber. When the piston rises, the ports are closed and the compression stroke is carried out. This type of operation is used quite effectively in most 2-cycle diesel engines.

Sleeve Valves

The sleeve valve is a hollow cylindrical sleeve which rides up and down in contact with the cylinder bore. This sleeve has appropriately spaced holes in it which match the intake and exhaust ports at the proper times during the engine cycles. The engine piston then slides inside this sleeve. Sleeve valves are noted for their silent operation and long repair-free life. They are extremely efficient in their operation since a vertical movement of only one inch is enough for the complete engine cycle.

The major limitations of any sleeve valve are oil loss and compression leakage; however, these have been overcome in modern engines employing this valve.

Single-Sleeve Valves

The single-sleeve valve consists of only one sleeve which carries openings for both the intake and exhaust strokes. It is operated by a positive-action crank mechanism and has proved quite successful in modern English aircraft engines.

Double-Sleeve Valves

The double-sleeve valves are identical in operation with their single-sleeve counterparts except that there are two separate sleeves, one inside the other, which are operated by separate crank mechanisms.

The greatest proponent of this type of valve is the Skinner engine. Oil sealing and compression leaks have effectively been eliminated in this engine. This double-sleeve application presents an engine that will outperform conventional poppet valve power-plants. It is both lighter and more economical, and produces no pre-ignition due to hot exhaust valves. This engine operates successfully at compression ratios 1½ to 2 times higher than poppet valve engines of the same displacement.

Rotary Valves

The rotary valve is merely a rotating member which contains holes that come into alignment with the engine ports for the valve action. The rotary valve is usually driven by a gear system or a chain and sprocket arrangement. This gives it a positive action at all times and makes it readily applicable to both internal-combustion and steam engines.

The major problem encountered in rotary valves is a large friction force which is due to high engine combustion pressures. Lesser problems of the rotary valve are compression leakage, heat dissipation, and oil control.

Longitudinal Cylindrical Rotary Valves

The longitudinal cylindrical rotary valve is merely a long narrow cylinder with holes bored across its longitudinal axis. These holes affect the valve action.

This cylindrical valve rotates about its longitudinal axis at one-fourth engine speed if one cylindrical valve is used in the engine, and at one-half engine speed if a separate valve is used for intake and for exhaust. These valves present no great friction, oil loss, or heat control problems since the valve area exposed to the combustion pressure is generally small. They are produced cheaply and repair costs are small.

Vertical Cylinder Valves

The vertical cylindrical rotating valve is a short cylinder with a hole bored in it angularly.

This cylindrical valve stands vertically in the cylinder head of the engine and rotates about this vertical axis. During its rotation the valve hole comes in line with the intake and exhaust ports of the engine and produces the intake and exhausting effects. Friction forces in this valve operation are a major problem since a large area of the valve is exposed to the engine's working pressure.

Conical Rotary Valve

The conical rotary valve is similar to the vertical cylindrical valve except that it is in the shape of a cone.

The valve has only one bored hole but the surface on which the valve rotates has the ports spaced angularly around it. Generally there is a separate port for intake, exhaust, and ignition. The width of these ports may be designed to give a longer intake or exhaust period for better efficiency.

This valve generally has a high friction force and considerable oil leakage. However, with proper vacuum oil scavenging and special cooling measures the valve has operated very successfully.

Spherical Rotary Valve

In most rotary valves high rubbing loads are encountered due to the high engine working-pressure. A system to eliminate these forces has been developed and takes the form of a "pressure balanced" spherical rotary valve.

Effectively the spherical rotary valve is a sphere with a stem coming from the top of it. The spherical body of the valve contains a Y shaped, bored out volume.

The "pressure balance" is accomplished by the shape of this bored out section of the valve. The bored section is so designed that the area on which the pressure is acting upward is equal to the area on which the pressure is acting downward.

This valve operates at one-fourth engine speed in the case of a 4-cycle engine, and the greater port area possible (in relation to piston area) by the use of this valve creates a higher efficiency than that of valves which restrict flow. Positive control of this valve at all times with complete mechanical silence is another major benefit of the spherical rotary valve.

Foreground: Boeing RB-47E, world's fastest day-or-night long-range reconnaissance plane. *Background:* Standard B-47E six-jet bomber.

What do you want most in an engineering career?

Is it room to grow? Then join a company that's growing. Boeing, for example, has grown continuously throughout its 37-year history of design, production and research leadership. There's always room up ahead—and Boeing promotes from within. Regular merit reviews are held to give you steady recognition.

Do you want long-range career stability? Boeing today employs more engineers than even at the peak of World War II. Here you'd work on such projects as pilotless aircraft, research on supersonic flight and nuclear power for airplanes, on America's first jet transport, and the world's outstanding jet bombers.

Do you want variety of opportunity? Aviation is unique in this respect. It offers you unmatched variety and breadth of application, from applied research to production design, all going on at once. Boeing is constantly alert to new materials and new techniques, and approaches them without limitations. In addition, Boeing's huge subcontracting program—requiring engineering co-ordination—offers you contacts with a cross section of American industry.

Boeing engineering activity is concentrated at Seattle, Washington, and Wichita, Kansas—communities with a wide range of recreational opportunities as well as schools of higher learning. The company will arrange a reduced work week to permit time for graduate study and will also reimburse tuition upon successful completion of each quarter's work.

There are openings in *all* branches of engineering (mechanical, civil, electrical, aeronautical and related fields) for DESIGN, PRODUCTION and RESEARCH. Also for physicists and mathematicians with advanced degrees.

For further information, consult your PLACEMENT OFFICE, or write

RAYMOND J. B. HOFFMAN, Admin. Engineer
Boeing Airplane Company, Wichita, Kansas

BOEING

Research and Development

(*Continued from page* 15)

means of studying the problems of space travel.

They say the extensive basic research made possible by the device may lead instead to such developments as an improved phosphor for television picture tubes, better fluorescent lamps, new electronic devices, and a better device for measuring the exposure of human beings to the damaging radiation from atomic bomb blasts.

NEW TRANSFORMER COILS

A continuous roll of thin metal foil and a sheet of insulating paper, rolled together, form the heart of a new, high-speed, automatic technique for the manufacture of transformer coils, it was revealed here today by engineers of Sylvania Electric Products, Inc.

The new development not only can substantially reduce manufacturing costs, but would eliminate a potential bottleneck in electronic equipment production during a national emergency.

For more than 60 years the production of transformer coils has been a comparatively slow process involving a great deal of meticulous hand labor. The new process was developed by Sylvania engineers in response to a request from the Air Force to seek faster production methods capable of rapid expansion in cases of national emergency.

The traditional method of producing transformer coils involves the winding of copper wire on cardboard cores. The new concept is based on stacks of wafer coils which resemble miniature life preservers. The coils are made by rolling together wide sheets of very thin metal and similarly thin sheets of insulating paper. The roll is then sliced — as bread is sliced. Each of these slices, or wafers, can form the key element of an ordinary transformer and, in some cases, — for radio and television frequencies — may actually be the complete transformer.

Potential benefits which may be derived from the new technique, are the certainty of greater uniformity and, hence, higher quality; more flexible design through simplicity, a broader approach to material usage, and new shape concepts; and the possibilities of use in other fields heretofore limited by standard techniques.

NEW LARGE-SCREEN COLOR TELEVISION TUBE UNDER DEVELOPMENT BY WESTINGHOUSE

A new color television picture tube that produces a 20-inch (diagonal) color picture, comparable in contour and size to the standard 21-inch black-and-white tube, is under development by the Westinghouse Electronic Tube Division. The developmental tube, first shown publicly at the Institute of Radio Engineers Show in New York, is a directly-viewed tricolor tube employing a single gun and deflection-grid color pack.

A significant advancement in the new tube is its larger screen size coupled with the use of a phosphor screen which has 20 complete color groups per inch compared to 17 previously used. This gives improved resolution and excellent color definition at normal viewing distances. The total viewing area of the screen is approximately 200 square inches.

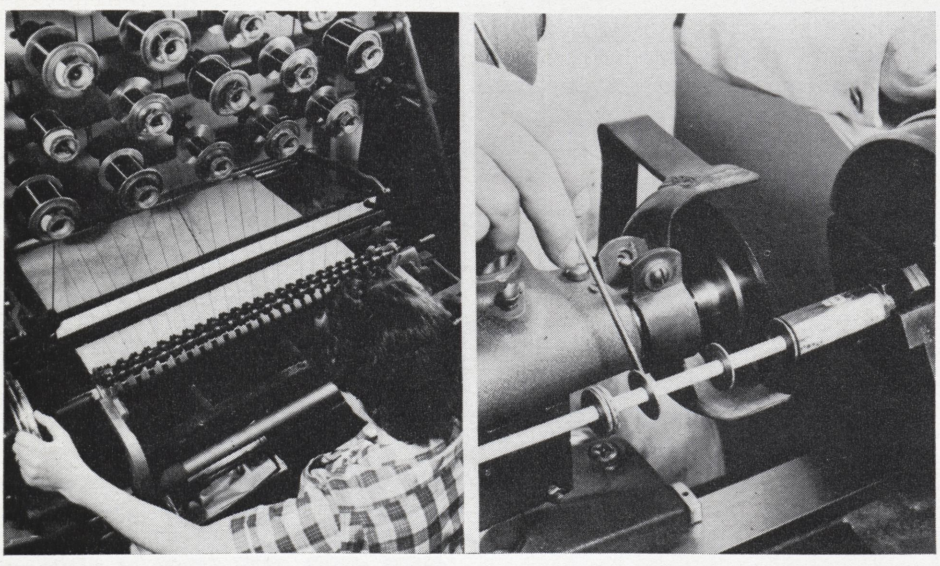
The over-all size of the tube has been held to a minimum by using a 24-inch (diagonal) rectangular metal cone and 70-degree deflection.

The screen of the tube consists of lines of three color phosphors which produce the colors red, green, and blue. The lines, 80 to the inch, are alternately deposited on a flat glass plate by either silk-screen printing, or a photographic process. The complete color-pack assembly includes the beam-deflecting wire grid, mounted parallel to the phosphor lines, so that the grid is between the screen and the gun.

A 3.58-mc sine wave signal applied to the grid deflects the beam alternately over the three color phosphors. Color information is applied sequentially to the single gun in synchronism with the 3.58-mc switching signal so that at the instant the beam is focused over one of the phosphors, it is carrying the appropriate color information.

Westinghouse engineers emphasized that the new tube, believed to be the first 24-inch rectangular color tube to be developed, is still in the laboratory stage. The tube employs but one of several technical approaches that they are exploring as a part of the Electronic Tube Division's program to develop color cathode-ray tubes, with larger picture sizes at lower cost, which will be commercially attractive to the customer.

(*Concluded on page* 30)



Making transformer coils. Conventional (left). New (right).

"Allis-Chalmers Graduate Training Course Was Just What I Needed."

says LOWELL E. ACKMANN

University of Illinois—B.S., E.E.—1944
and now manager, Peoria, Ill., Branch Office

"My experience with machinery in the Navy during the war convinced me I needed a training course. There was so much equipment on board that was a complete mystery to me that I became very 'training-course minded'.

"After investigating many training courses, the one at Allis-Chalmers looked best to me then—and still does.

"In my opinion, the variety of equipment is what makes Allis-Chalmers such a good training spot.

"No matter what industry you may be interested in, Allis-Chalmers makes important, specialized equipment for that industry. Electric power, steel, cement, paper, rock products, and flour milling industries—to name a few, are big users of A-C equipment.

"Before starting on the Allis-Chalmers Graduate Training Course, I thought I would like selling, preferably technical selling but, as is often the case, I didn't know for sure. This course, together with some personal guidance, helped me make up my mind. That, too, is an important advantage of the GTC program.

"But whether you want to be a salesman or designer, production engineer, or research engineer, Allis-Chalmers, with its wide variety of equipment and jobs, is an ideal place to get off to a good start—without wasting time."

Facts You Should Know About the Allis-Chalmers Graduate Training Course

1. It's well established, having been started in 1904. A large percentage of the management group are graduates of the course.

2. The course offers a maximum of 24 months' training. Length and type of training is individually planned.

3. The graduate engineer may choose the kind of work he wants to do: design, engineering, research, production, sales, erection, service, etc.

4. He may choose the kind of power, processing, specialized equipment or industrial apparatus with which he will work, such as: steam or hydraulic, turbo-generators, circuit breakers, unit substations, transformers, motors, control pumps, kilns, coolers, rod and ball mills, crushers, vibrating screens, rectifiers, induction and dielectric heaters, grain mills, sifters, etc.

5. He will have individual attention and guidance in working out his training program.

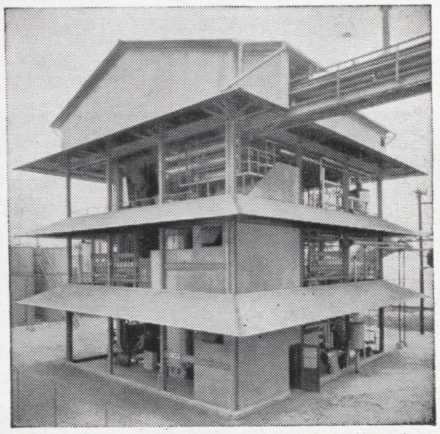
6. The program has as its objective the right job for the right man. As he gets experience in different training locations he can alter his course of training to match changing interests.

For information watch for the Allis-Chalmers representative visiting your campus, or call an Allis-Chalmers district office, or write Graduate Training Section, Allis-Chalmers, Milwaukee 1, Wisconsin.

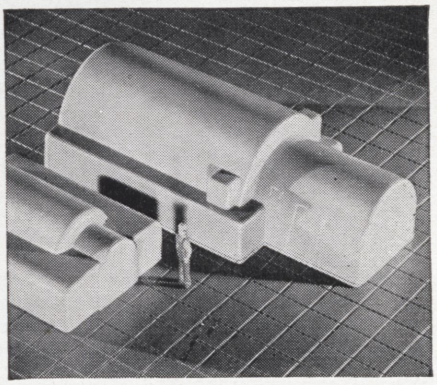
ALLIS-CHALMERS

A-C ALLIS-CHALMERS

C-5676



PROCESSING—Allis-Chalmers built solvent extraction plant processes one hundred tons of rice bran per day at oil processing plant in Texas.



POWER—Models show comparative size of generators having the same rating with and without super-charged hydrogen cooling. Allis-Chalmers is first to supply super-charged hydrogen cooling.

Research and Development

(*Concluded from page* 28)

QUIET MOTOR

One of the oldest and most annoying headaches in industry—machinery noise — will be greatly alleviated as the result of a new electric motor design.

General Electric Company engineers, after five years of extensive research into the causes of noise in electric motors, have developed what they call a "sonant" motor.

Special electronic tests prove the success of this latest concept of engineering: The new 10-horsepower motor was shown to have about the same over-all noise level as the old 2-horsepower motor.

By isolating the three main causes of motor noise — bearing rattle, magnetic hum, and windage (the rush of air through the motor) — the scientists were able to decrease the noise and, perhaps more important, make the sound frequency more pleasing to the human ear.

Since electric motors are the most widely used form of machinery in the modern world, attacking the noise problem at this level is a major technical advance for all industry, the engineers explained.

Called the Tri-Clad "55," the motor is about half as large and as much as 40 per cent lighter, horsepower per horsepower, than its predecessor.

WATER-COOLED GERMANIUM RECTIFIER

In a new experimental water-cooled rectifier developed by Westinghouse Electric Corporation, a wafer of germanium only 7/8 inch in diameter and 0.015-inch thick delivers 200 amperes (average) direct current at 100 volts. The rectifier is still in the developmental stage. While ratings are not yet exactly known, the peak back voltage is expected to be about 110 volts and the forward voltage drop at 200 amperes average (600 amperes peak) about 0.8 volt. Ω

Directional Drilling

(*Concluded from page* 13)

surface, and the people who own the mineral rights in that area receive royalties. The city of Long Beach receives a minimum of thirty per cent from the production of the wells until the cost of the drilling has been reimbursed. The city then receives eighty-five and one-half per cent, less the actual cost of production of the wells. Long Beach has received a total of $219,375,000 from the five companies who drill in the city limits. This money has been used to the advantage of the residents of Long Beach.

The improvements in directional drilling are due mostly to the experience on the part of the engineers who have so successfully overcome the hazards. It is true that tools and instruments have been improved, but the men who handle them have learned how best to operate and adapt them to the optimum advantages. They have developed and brought to the attention of those who build equipment the requirements and how best they should be constructed.

With the added new advantages furnished by controlled directional drilling, it is now a requirement of operators to increase their ultimate production of properties without leaving oil in the ground. With an improved understanding of volumes of fluid in a known sand, the proof of these figures can be determined against the cost of such ventures. Deflection tools and survey instruments have been improved to successfully contribute a service to the oil business. Wells can be drilled deeper, drift to greater distances at higher angles, and the drilling costs have been reduced in all areas. Slant holes have proved that very slight or no difficulties are added to the many problems of production. Most directionally drilled wells are in low pressure areas and are opened without added difficulties. Ω

The metal that thrives on punishment

Steel serves you better when manganese is added —because the harder it works, the tougher it gets

EVER WATCH a power shovel bite into earth and rock? And wonder how the teeth of the steel bucket can endure such punishment? The amazing answer is that the teeth not only endure such treatment—they actually get harder because of it!

MANGANESE HOLDS THE SECRET—The story behind this remarkable steel is the unusual metal called *manganese*. The hundreds of thousands of tons of manganese required each year by steel and other metal-making industries are obtained by refining huge quantities of ore that come from mines in widely scattered points across the face of the globe.

ADDED TO STEEL—All steel contains manganese. A small amount "cleanses" molten steel and removes impurities. A larger amount of manganese makes the steel tougher and stronger.

FROM ORE TO ALLOY—Transforming raw ores into a variety of manganese alloys for the metal-producing industries is one of the many important jobs of the people of Union Carbide.

STUDENTS AND STUDENT ADVISERS: *Learn more about career opportunities with Union Carbide in* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Write for booklet C-2.*

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EVEREADY Flashlights and Batteries
BAKELITE, VINYLITE, and KRENE Plastics
SYNTHETIC ORGANIC CHEMICALS
DYNEL Textile Fibers
LINDE Oxygen

The Transdipper

(*Concluded from page 22*)

peculiar to only the point-contact type. Amplification is not dependent upon current amplification but upon impedance amplification. Since the emitter is biased in a way such that conduction is readily obtained, it will be a relatively low impedance of about 100 ohms. Because the collector is biased in a non-conducting way, its impedance will be very high. For impedance matching purposes, it might be well to put a very high impedance, or tuned circuit, in the collector circuit. If this were the case, even though the collector current would be lower than the emitter current, the smaller current could produce a greater output voltage across its load than the emitter current could across the emitter circuit. In this way, the transistor amplifies a signal.

There were many reasons for making changes. The most prominent one was that the type transistor used was not available. The only transistors that were available for the author's use were ones which were originally designed for switching purposes and were the rejects of this design. For this reason, it was finally decided to use a slightly modified circuit.

This circuit presents many fundamental principles of feedback and oscillations. In the first place, the dot polarities of the coils are very important. Since there is no 180° phase shift in a transistor, at the instant the top side of the tank is positive, the feedback signal into the emitter must go positive, Therefore, the coils must have the polarities expected.

Since the emitter circuit has a relatively low impedance, there is a possibility of making the emitter feedback loop series resonant. This is the purpose of the capacity C_2. By varying this capacitor, X_{c2} can be made equal to the reactance of the secondary, allowing maximum signal current to be fed back into the emitter.

A Grid Dip Meter Using a Transistor

Basically, a grid dip oscillator is a variable frequency oscillator which can be coupled into another resonant circuit. In the convential vacuum tube grid dipper, a D-C milliammeter read the value of grid current which is a measure of the strength of oscillation. If a tuned circuit is coupled into the oscillator's tank, it will tend to load down the oscillator and to reduce the grid current. The tuning condenser's dial can then be graduated directly in frequency and the meter can be used to tell the resonant frequency of any L-C circuit. The conventional grid dip meter has one serious limitation, however. It needs a 60 cycle supply for the heater of the vacuum tube. Because of this power requirement, it is not too practical to build-in a power supply. For this reason, a circuit using a transistor is convenient, for it requires only a minute amount of power to operate.

A Transistor Oscillator

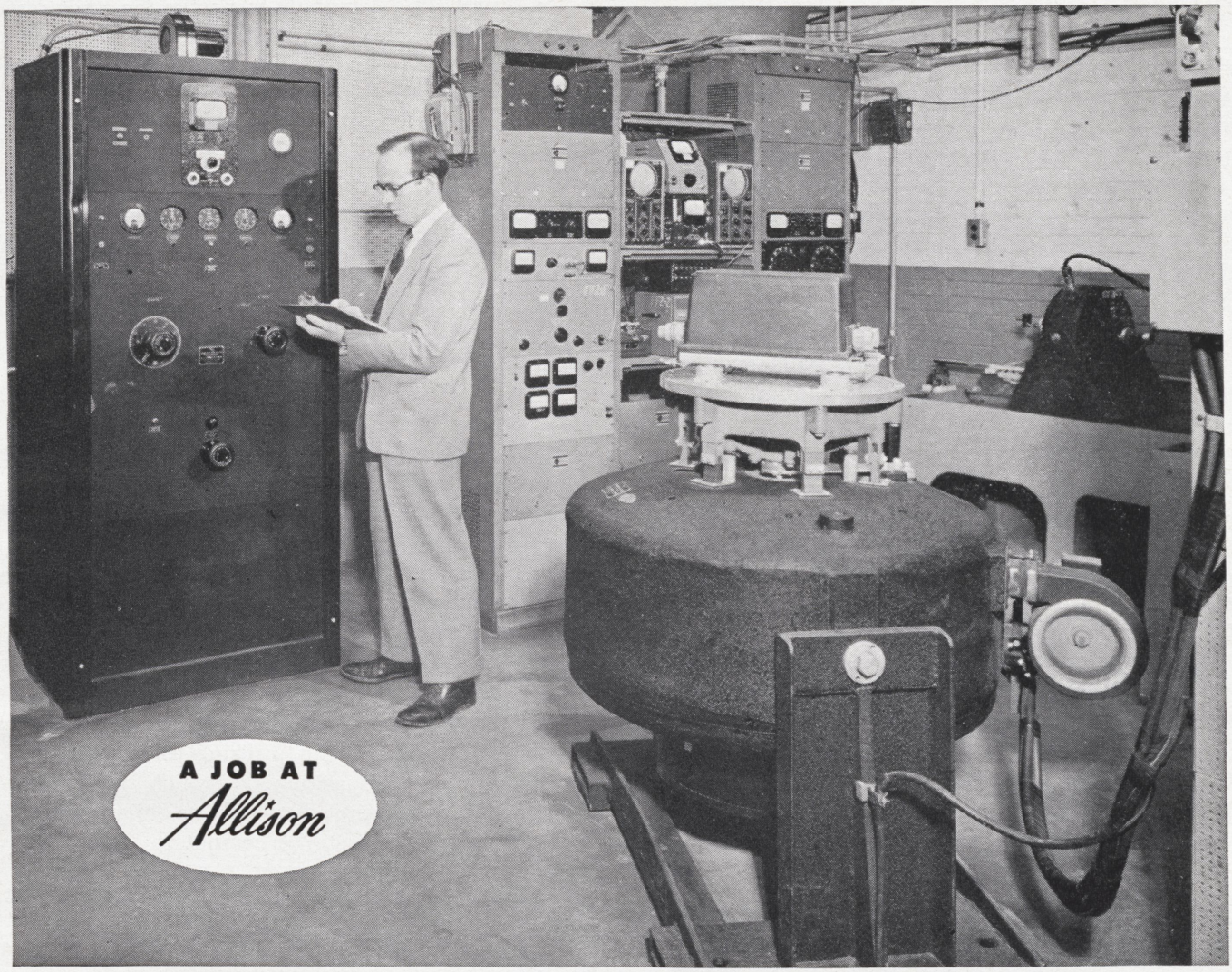
The idea for this type of grid dip meter was an article in the October, 1953 issue of *Radio and Television News* entitled "The Transdipper". However, the circuit described in the article is quite different in detail.

Condenser C_1 is the tuning condenser, which is graduated in frequency. Resistance R_1 is an important part of the circuit. It limits the bias current of the emitter and thus controls the strength of oscillations.

An interesting aspect of a transistor oscillator is that the noise characteristics show up very clearly. If a radio receiver is brought close enough to the probe coil and if the resistance, R_1, is varied, just before it breaks into oscillation, a pronounced noise peak will occur. As R_1 is adjusted so as to allow enough emitter current to produce oscillations, the noise will disappear and a nice clear beat frequency can be heard. This illustrates why a feedback oscillator always breaks into oscillation. The noise spectrum contains all kinds of frequencies for the circuit to amplify. The tank picks the right one.

Conclusions

Although this particular grid dip meter is not too practical for radio frequency work, it does suggest the possibility of grid dip meters using transistors as components. Ω



● Cort Kegley received his Masters Degree in Physics from Connecticut Wesleyan in 1951.

When the above picture was taken he had been on the job less than a month, and was one of a group of young graduates then in training at Allison.

Much of the experimental and test equipment at Allison is entirely different from any other. And, Cort—like other new engineers on the job—must first learn about these various facilities which he will be using in instrumentation and testing.

He is pictured here getting acquainted, so to speak, with some of the equipment used in vibration and shock qualification testing. One of the many electronic accessory units used with the Allison jet engines is here undergoing a "shake test" on the large MB vibration exciter shown in the foreground.

A turbo-propeller governor is bolted to the shake table of the exciter, which is controlled from the panel at the left, to determine if simulated engine vibration will cause the unit to malfunction. The large MB exciter has the capacity to exert a vibratory force of 2500 pounds, with a frequency range up to 500 CPS. A smaller MB exciter, shown on the bench in the background, is rated at 50 pounds peak force available to 2000 CPS.

• • •

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Binary Counters

(*Concluded from page* 18)

ing circuit must recognize each appearance of the information-bearing input condition and it must establish a unique state for each successive appearance of the input condition. The number of appearances can be determined at any time by an examination of the state of the elements in the circuit."

Thus far, we have determined what kind of device we need, and we have investigated a plausible kind of arithmetic for it, and so now we must put the two together to get the actual device. The key to the situation is the base of our arithmetic system, two. If we have a device which has two states and which alternately assumes one of these states and then the other whenever two successive input events are put in, we then would have what we have defined as a counter. It will divide two successive like inputs into two unlike outputs. Then, if we choose to recognize only one kind of output, we have successfully divided the input by two. Such a device is the electronic "flip-flop" circuit. A device utilizing relays to do this job also can be built. Any device built with transistors for counting in this manner would be similar to the "flip-flop" circuit.

The range of this device which we have developed is not in itself very useful; it will handle only two inputs before it repeats itself. The range can be extended if we use the output of this device to act as the input to another similar device. We would then have expanded the range of our device by a factor of two, giving a total range of four unique states. Likewise we could add more and more of these devices, each time expanding the range of our counter by a factor of two. This can be seen to correspond exactly to the binary arithmetic table in the chart. Each device adds another column or power of two, and if we call one kind of output equal to one, and the other kind equal to zero, the pattern of ones and zeros that each device follows with respect to the other devices is just the same as the ones and zeros in our binary arithmetic table. So, we developed a binary counter.

As discussed earlier, these counters may be used in two ways; one for high speed counting of large numbers, the other for computers. It can be seen that our computer does this; for instance, if we had a six stage device, sixty-four (64) inputs would be represented by one output and the actual counting would be much easier. As noticed earlier, our counter repeats a definite pattern (seen in the binary table), and so if we put in a definite number of inputs starting from zero, the counter will indicate (within its range) how many there were. If then more inputs were applied, the counter would indicate the sum of these two inputs. Thus, in this simple instance, the counter has been used as a computer. And so, we have seen that a counter can be built utilizing the binary system of arithmetic which will function very adequately as either a very fast counter or computer. Ω

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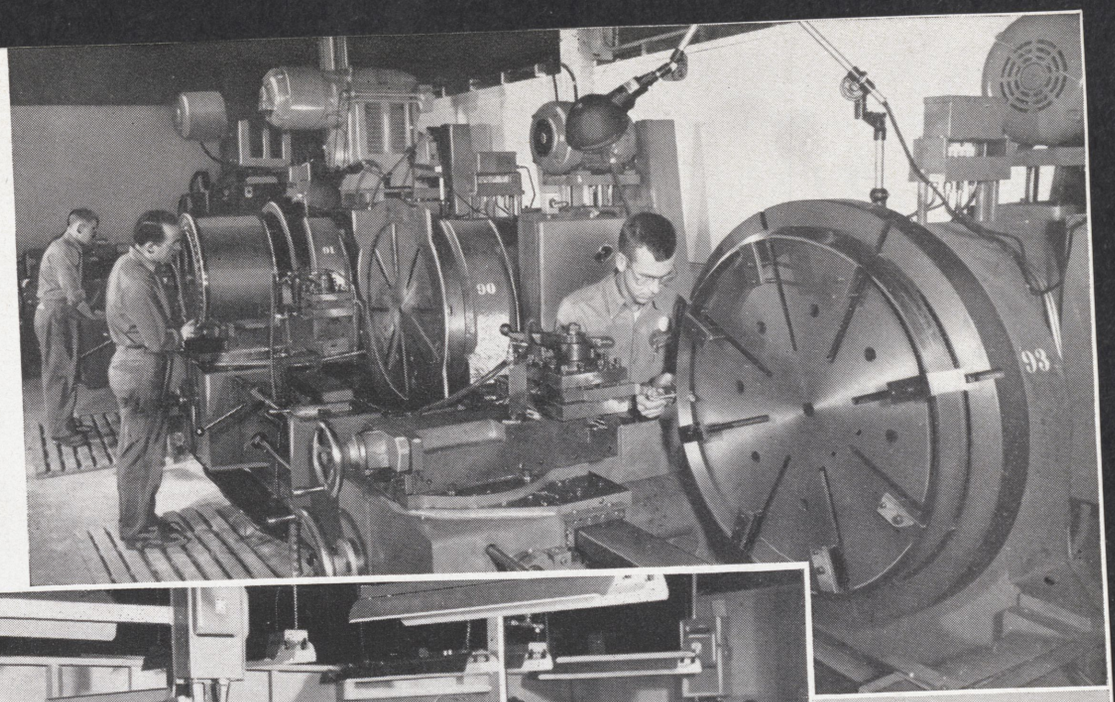

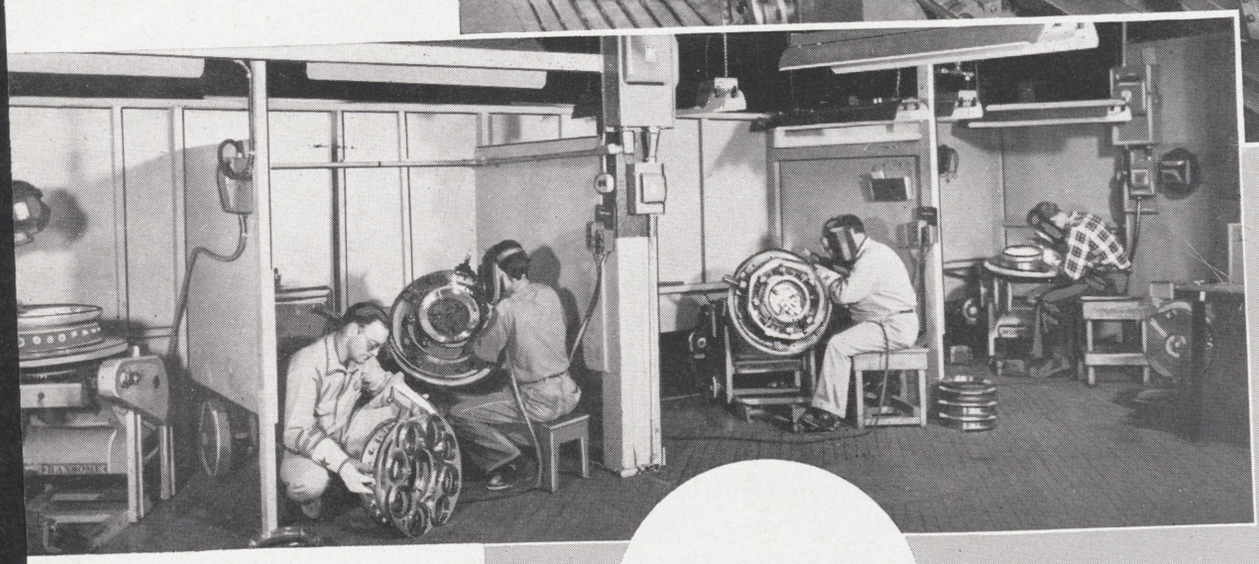

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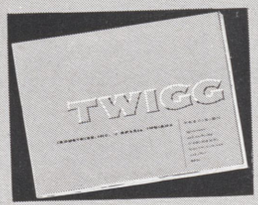

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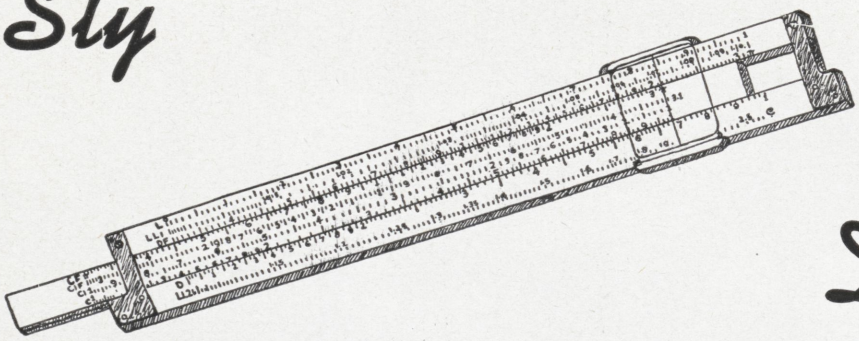

Stolen by Ralph Branson, jr., m.e., and Frank Potts, soph., m.e.

Arriving at a strange hotel, a fussy woman thought she'd better know where the fire escape was. So she started exploring. During her tour, she opened a door and found herself in a bathroom occupied by an elderly gentleman.

"Oh, I'm sorry!" she twittered. "I was looking for the fire escape."

Continuing her search, she presently heard the pad of bare feet behind her and a shout made her turn. It was the elderly man, clad in a bath towel.

"Wait a minute!" he gasped. "Where's the fire?"

* * * * *

Wife (to drunken husband): Let's go to bed, dear."

Hubby: "Might as well. I'll catch hell when I get home anyway."

* * * * *

E.E. "How did you like the bridge party last night?"

M.E. "Fine, until the cops looked under the bridge."

* * * * *

Lady: "Is your husband broad-minded?"

Wife: "Yes, the cad! That's all he seems to think about."

* * * * *

Have you heard about the two engaged nudists who decided to break up because they'd been seeing too much of each other?

* * * * *

The difference between amnesia and magnesia is that the fellow with amnesia can't remember where he is going.

"Now," said the professor cheerfully, "please pass all your test papers to the side of the room and kindly insert a carbon sheet under each paper so I can correct all the errors at once.

* * * * *

We have read so much about the bad effects of drinking that we have decided to give up reading.

* * * * *

Legs are appendages that are extremely necessary to baseball players and to girls who are trying to get to first base.

* * * * *

Conscience doesn't keep you from doing anything wrong — it just keeps you from enjoying it.

* * * * *

A young and attractive girl entered the door of a crowded bus and asked the handsome driver, "Can you squeeze me in there?"

"It will be a pleasure, Miss," he grinned, "if I can get somebody to drive this bus."

* * * * *

Lou: I heard that you were out golfing with Eddie. How does he use the woods?

Lil: I wouldn't know, we played golf all the time.

* * * * *

The scene is a train compartment in Romania. The characters: A Russian officer, a Romanian, an old lady and an attractive girl.

The train enters a tunnel. The passengers hear first a kiss, then a vigorous slap.

The old lady thinks: "What a good girl she is, such good manners, such fine moral character!"

The girl thinks: "Isn't it odd that the Russian tried to kiss the old lady and not me."

The Russian thinks: "That Romanian is a smart fellow! He steals a kiss and I get slapped!"

The Romanian thinks: "Am I a smart fellow! I kiss the back of my hand, hit a Russian officer, and get away with it."

* * * * *

Two English cockney broom vendors met on a London street and started to talk business at once.

" 'Ang it all," said one, "I don't see 'ow you can sell these 'ere bloomin' brooms for a shillin'. I steals the brush, an' I steals the wire, an' I steals the 'andles an' I can't sell 'em for a shillin' an' make any money on 'em."

And the other replied: "Why, I steals them ready made."

* * * * *

A motorist, at a roadside market stand, chose a piece of one of those rare old pungent cheeses.

As the proprietor wrapped his purchase, his customer asked anxiously, "Do you think that cheese will keep all right until I get home tomorrow night?"

With a wry smile, the proprietor answered, "Mister, there ain't nothing more **ever** going to happen to that cheese."

* * * * *

Then there was the chemical engineer who died from drinking shellac. The boys all said he had a good finish.

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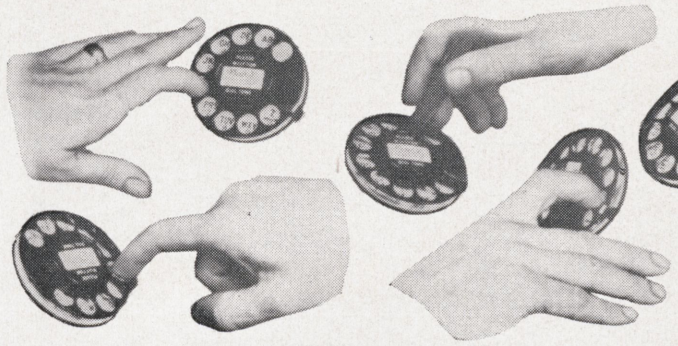

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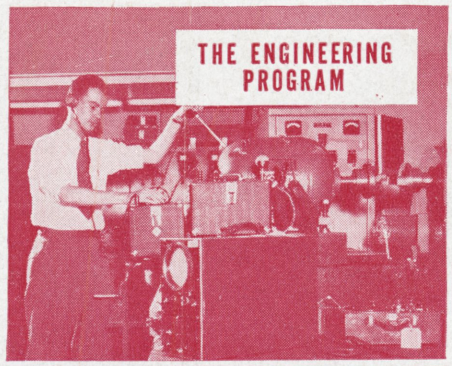

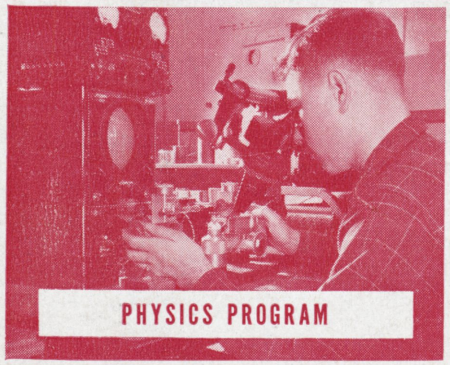

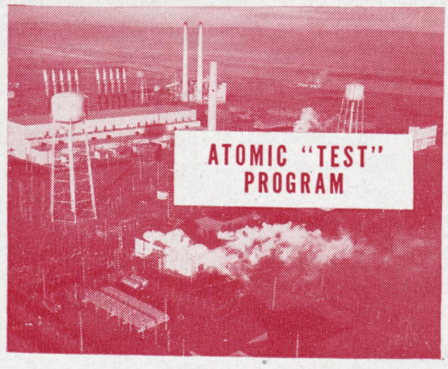

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