The Wisconsin engineer. Volume 52, Number 7 April 1948

Madison, Wisconsin: Wisconsin Engineering Journal Association, [s.d.]

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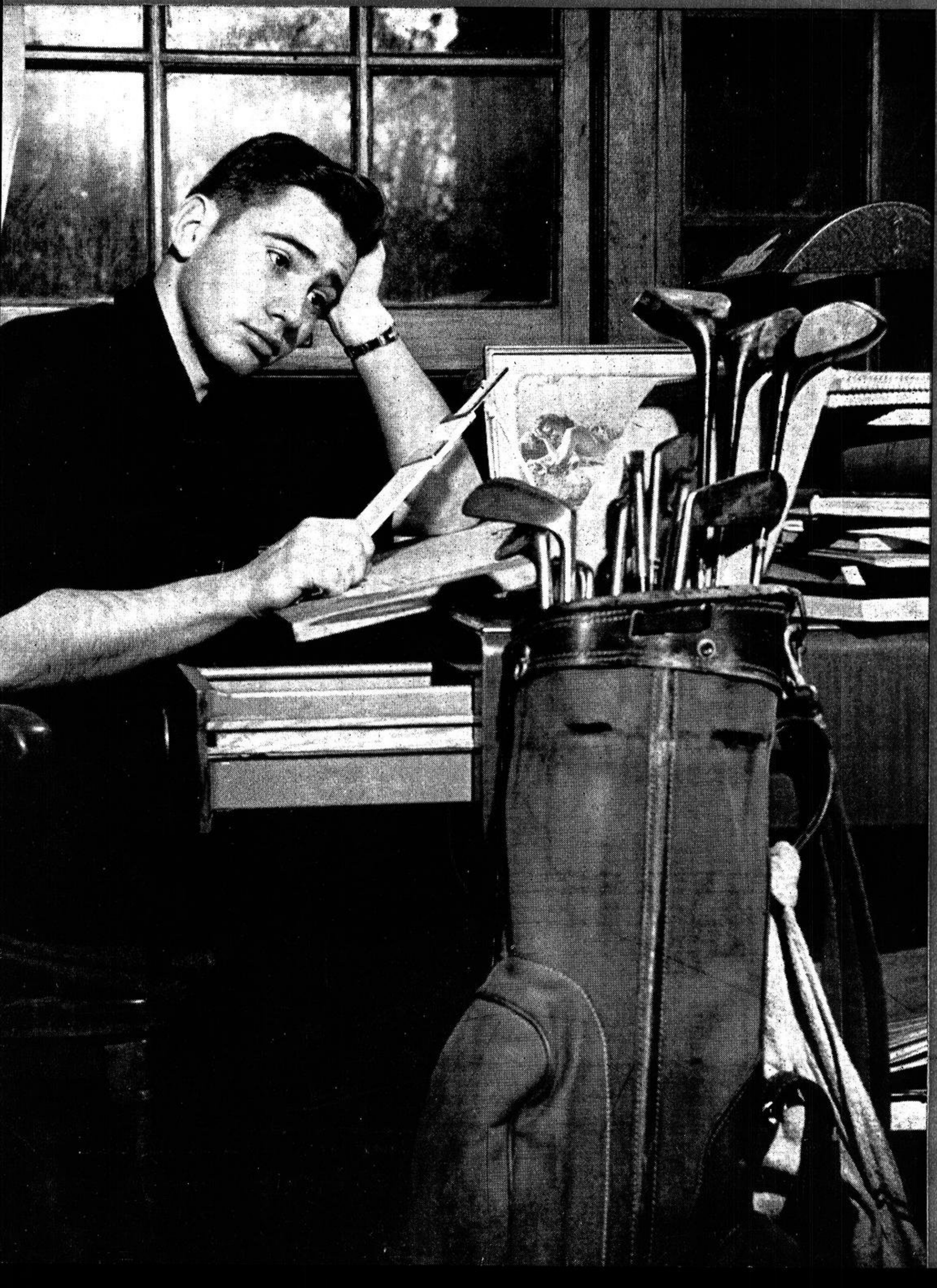
engineer



April, 1948

In This Issue:

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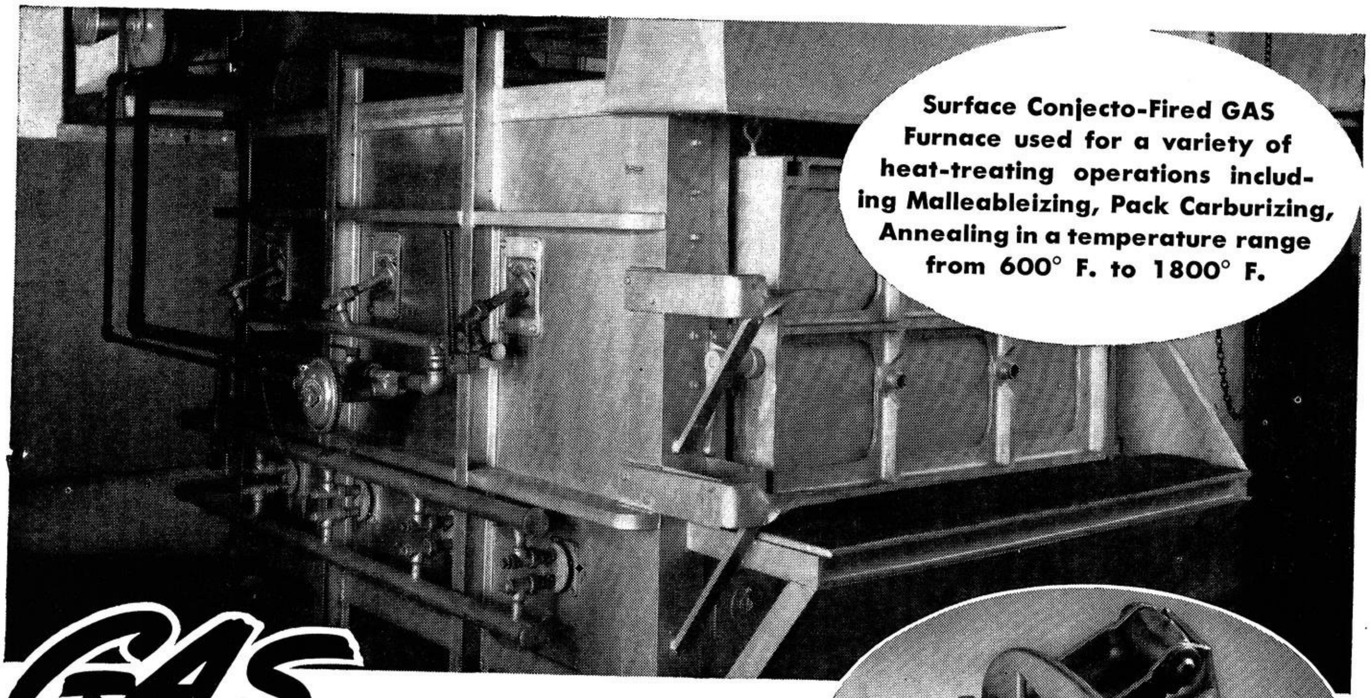

Surface Conjecto-Fired GAS Furnace used for a variety of heat-treating operations including Malleableizing, Pack Carburizing, Annealing in a temperature range from 600° F. to 1800° F.

GAS FURNACE PERFORMS MULTIPLE HEAT-TREATING FUNCTIONS UNDER VARIED CONDITIONS

In modern heat-treating, adaptability of equipment and flexibility of fuel are primary influences in any cost-per-piece analysis. As a typical example of the flexibility of the productive flames of GAS, this Conjecto-Fired GAS Furnace is used for a variety of operations without any change other than regulation of the fuel-mix and temperature controls.

Atwood Vacuum Machine Company, Rockford, Illinois, is equipped to heat-treat pieces ranging from 1 ounce to 1000 pounds, in volume up to 15,000 pounds daily. Their modern Gas-fired Equipment is adapted for annealing, carburizing, drawing, hardening, normalizing, malleableizing, stress relieving, under rigid metallurgical specifications.

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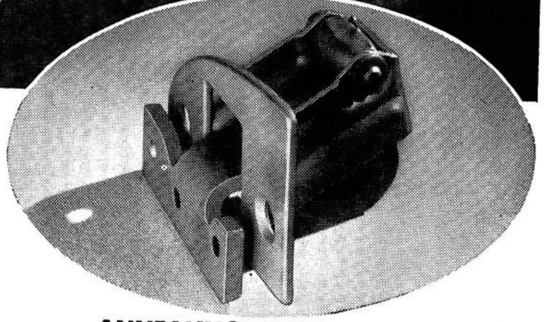
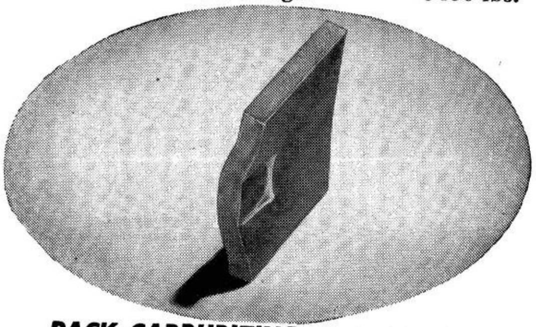


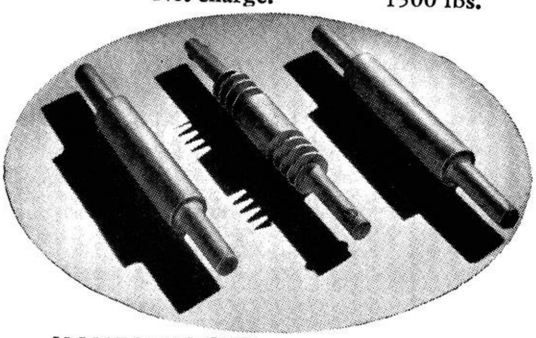
ANNEALING—Station wagon body hinge

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.



PACK CARBURIZING—Brake Trunnions

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.



MALLEABLEIZING—Trailer Jack Screws

Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

AMERICAN GAS ASSOCIATION

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Data and Photos by SURFACE COMBUSTION CORPORATION, Toledo, Ohio, Manufacturers of Gas Heat-Treating equipment

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

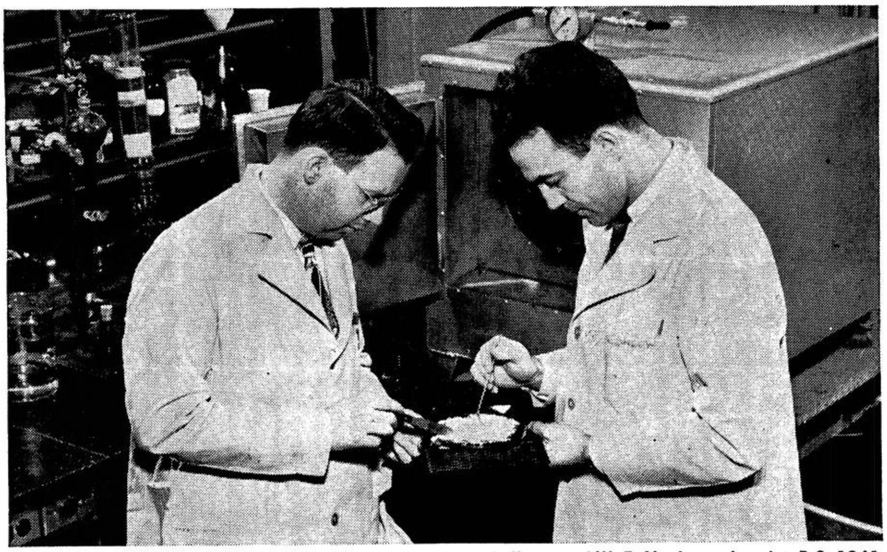
DU PONT *Digest*

For Students of Science and Engineering

Experimental research results in better Vitamin D source for poultry industry

Fifteen years of work by Du Pont chemists, biochemists, physicists, and engineers behind development of "DELSTEROL"

In 1922, it was shown that vitamin D controls the utilization of calcium and phosphorus in the body, especially in the bones of growing animals. This led to the discovery that leg weakness in chicks, poor production, low hatchability of eggs, and other disturbances were caused by a deficiency of this vitamin.



L. Fullhart, Ph.D. 1946 in organic chemistry, Iowa State College and W. F. Marlow, chemist, B.S. 1941, George Washington University, preparing to examine a sterol product for quality and yield.

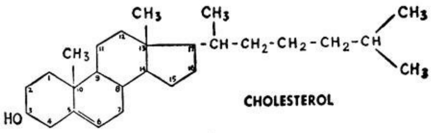
Scientists subsequently discovered that vitamin D could be made by irradiating plant or animal tissues with ultraviolet light. This reaction has since been shown to consist of transforming certain provitamins from the group known as sterols, into vitamin D. The final result of these discoveries was the present large-scale commercial production of the vitamin by a series of complex chemical and photo-chemical reactions which require careful control by chemists, biochemists, physicists, and engineers. In this development, Du Pont scientists played an important part.

Ergosterol once the only source

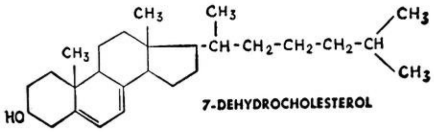
For years before 1934 it was assumed that ergosterol, a sterol first isolated from vegetable sources, was the only provitamin that yielded vitamin D. In that year, Du Pont research men—who had been studying the chemistry and biochemistry of vitamin D for almost four years—announced that the provitamin in animal cholesterol was *not* ergosterol. They showed that the activated provitamin in cholesterol gave a vitamin D much more effective for chicks than that of irradiated ergosterol. This fact was based on many comparative assays of irradiated cholesterol, irradiated ergosterol, and irradiated mixtures of these substances on rats and chicks.

Synthesis from Cholesterol developed

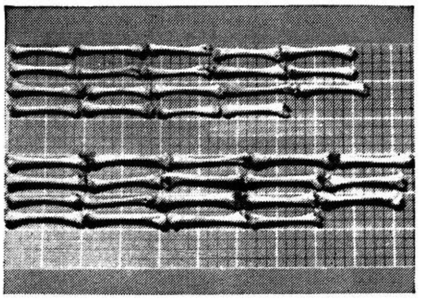
Other investigators showed that the provitamin in cholesterol was 7-dehydrocholesterol by developing its synthesis from cholesterol. The relationship between cholesterol, 7-dehydrocholesterol, and vitamin D_3 is shown by the following formulas:



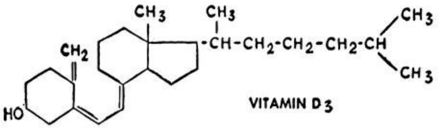
CHOLESTEROL



7-DEHYDROCHOLESTEROL



Bones at top, from birds fed no vitamin D, are shorter, poorly developed, and fragile, compared with bones at bottom from birds fed Du Pont "Delsterol."



VITAMIN D_3

Du Pont chemists and engineers carried this forward by devising a successful commercial process for making 7-dehydrocholesterol and irradiating it to vitamin D_3. Several forms of vitamin D are now manufactured by Du Pont, ranging from oil and dry powder concentrates—used by the poultry trade under the trademark "Delsterol"—to vitamin D_3 crystals of the highest purity.

Today's chickens are healthier, and the average annual egg yield over the last eight years has increased from 134 to 159 per bird. To a considerable degree, this is a result of the fifteen years of research devoted by Du Pont scientists to the development of "Delsterol" "D"-activated animal sterol.

Questions College Men ask about working with Du Pont

What are the opportunities in sales?

Separate sales staffs are maintained by each of Du Pont's ten manufacturing departments. Training in chemistry or chemical engineering is a prerequisite for some sales positions, which may be in one of three fields: technical sales, sales development, or direct selling. New employees usually acquire technical background by first working in a control laboratory or in production. Write for booklet, "The Du Pont Company and the College Graduate," 2518 Nemours Building, Wilmington 98, Delaware.

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WISCONSIN ENGINEER

Founded 1896

Volume 52 APRIL, 1948 *Number 7*

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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

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Published monthly from October to May inclusive by the Wisconsin Engineering Journal Association, 356 Mechanical Engineering Building, Madison 6.

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Subscription Price

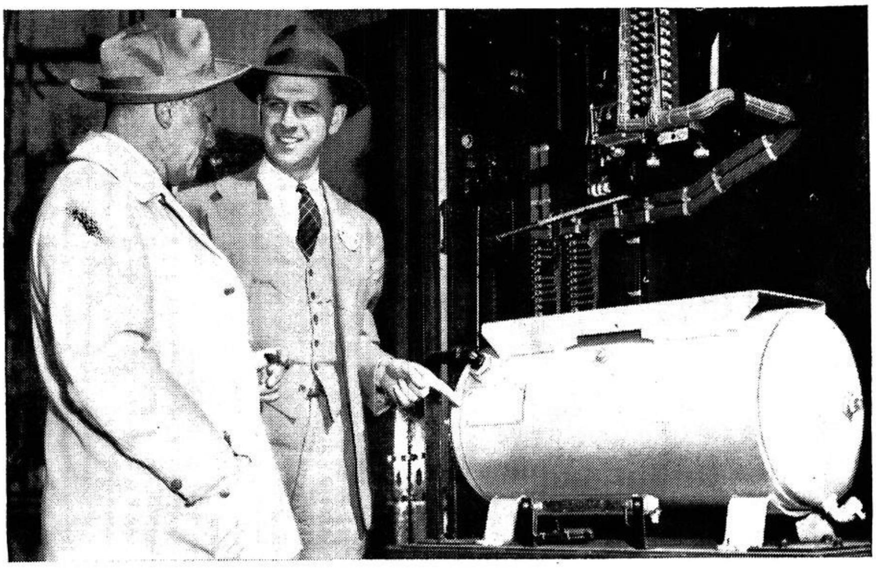
$1.00 PER YEAR . SINGLE COPY 15c

In This Issue . . .

COVER:
Allan B. Beach, m & me 2, stars in a tragic version of "Command Performance".

FRONTISPIECE:
Silhouetting the evening sky, these high power transmission towers transmit power for our vast industries and for the comfort of our homes.

There's a future for you in *Sales* at Westinghouse



In the electrical manufacturing industry, it takes an *engineer* to sell. He must be prepared not only to explain the features, construction and design of his product, but must be able to apply it as well. He should foresee operating problems of his customer and be able to explain how the apparatus works *under every condition.*

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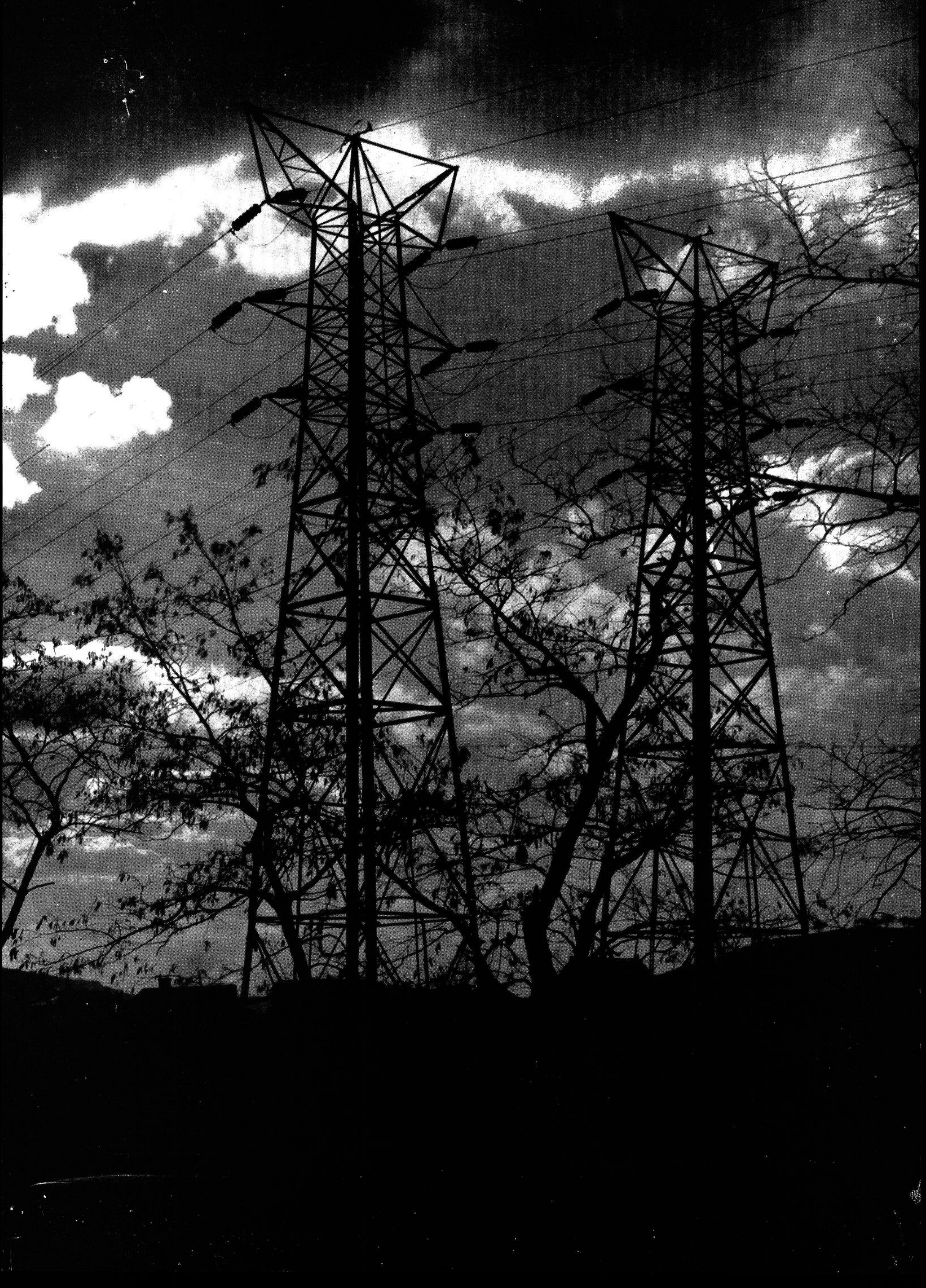


LEAD . . .

Origin of the Badger State

by W. M. Haas c'49

At the present time, lead and zinc are so closely related in the Wisconsin district that one can hardly discuss the one and exclude the other. At the present time, zinc is most important, and generally has been for several decades. Lead has almost been relegated to the status of a by-product of the zinc industry. A century and a quarter ago, however, the mining of lead had a tremendous part in the opening and development of a new territory, and the rapid advancement of that territory to statehood. It will be our primary purpose here to relate the history of lead mining and its influence upon the State of Wisconsin. The story of zinc begins in a more recent period, and will be told in the next issue of the WISCONSIN ENGINEER. This publication wishes to acknowledge the assistance of Mr. Ernest Bean, State Geologist, and Prof. Edwin Shorey of the Mining and Metallurgy Department in compiling the information for this series.

—W.M.H.

* * *

THE lead and zinc mining region of Wisconsin is located in the southwestern part of the state, and roughly embraces the three counties of Grant, Lafayette, and Iowa. A considerable portion of this area is well suited to agriculture. Dairying is of considerable importance, as well as the raising and fattening of hogs and beef cattle. There is some rough land that is best suited for timber and limited grazing. When the white man first came to stay, the tillable land did not need a great deal of clearing, as it was mostly situated on the upland prairie. Most of the present timber on the steepest slopes has grown since the white man settled the area, as the Indians used to burn the timber regularly.

Despite the fact that the region was so well suited to agricultural pursuits, the pioneer industry was mining, not farming. The tilling of the soil developed quickly too, but in the beginning lead was the great attraction that first drew settlers to Wisconsin. It was the economic cause of the organization of the new territory, and the basis of its first prosperity. The day of the plow and reaper was yet to come.

To find the underlying reasons for this interest in the heavy, gray, soft metal, let us look back into the early history of the United States. At the time of the American Revolution, very little lead was mined in the colonies. There were small diggings in various of the present eastern states, but their production was not nearly enough to satisfy the needs of the commerce and industry of the growing colonies. Most of the lead and lead products were imported from England. In fact, importation of lead continued long into the nineteenth century. During the Revolutionary War, there was not enough lead for bullets in the colonies, so it was necessary to melt down leaded window frames, pewter vessels, and even statues. It can be seen that there was a ready market for lead in America, and it follows that any substantial deposits of the metal that might be discovered would be exploited quickly.

The French had already done some mining in the Mississippi valley, in the place that later became the state of Missouri. The French government worked these deposits quite extensively (for that age) between 1720 and 1740, when it was part of the Louisiana Territory. They made explorations farther north along the great river, too.

In 1788 a French trader, Julien Dubuque, started mining lead near the present Iowa city that bears his name. Evidently a shrewd and influential person, he obtained permission from the Sauk and Fox Indians to conduct his operations there, and also got confirmation from the Spanish governor of Louisiana. He used Indian labor for his operations, and developed a substantial business. A considerable portion of the lead produced in the Upper Mississippi valley was credited to him. When Dubuque died, the Indians continued mining lead ore as their own enterprise, and profited reasonably well by selling the ore to the white men who had the smelters. It is worth noting that the squaws did most of the mining work, and that the Indians did some smelting themselves on a limited scale.

During the 1820's the general demand for lead increased, and the opportunity for developing the potential lead regions was ripe. At the time of their opening by the Americans, the lead mines in the Illinois-Wisconsin field were the greatest lead treasure known in the United States. The early miners found the hillsides pocked by the shallow diggings of the Indians, and of the French who had quit the area a few years ago. The Indians were scooping the ore from their crude "mines" with stone picks, bone spades, wooden shovels, gun barrels fashioned into crowbars, and occasionally some implement left by earlier white men. Lacking blasting powder (and probably also the knowledge of how to use it), the native miners broke up rocks by heating them with fire, then pouring cold water over them.

The Indians had crude smelters, too. Doubtless they learned about smelting from the French, as these primitive furnaces resembled those used by the French in their earlier developments in Missouri. These smelters were constructed by first digging a trench on the slope of a hill. This trench was about 3 feet wide on the top and 8 inches on the bottom. It was lined with flat stones, and suitable stones were placed across the trough to form a sort of grate. A fire pit was dug at the lower end of this trough, and a wood fire was started. The ore was placed in the stone-lined trench, and when sufficiently hot, the metal flowed out of the ore through the fire, and into a pool dug at one side of the fire. Here the metal was cast into plats or pigs, each weighing from 30 to 70 pounds.

A law passed by Congress in 1807 contemplated the plan of leasing the government lands to the miners, with the government to receive a share of the production. This was not actually carried out until 1822, however, in the Wisconsin region. In that year, the first leases were arranged. They were continued for some time, but the government later sold all its mineral lands.

The first significant production of lead began in 1824, but the Wisconsin field was not long in developing. In 1826, most of the lead produced in the United States came from the Missouri operations, but in 1827 the Upper Mississippi mines spurted ahead, producing about one and a half times as much as the older mines to the south. This increase continued rapidly through the 30's, and continued until about 1847, when lead production began to fall off. During this expansion, the Missouri fields continued to fall off in production, and for a time remained a secondary source. They were, however, to regain considerable importance at a later time.

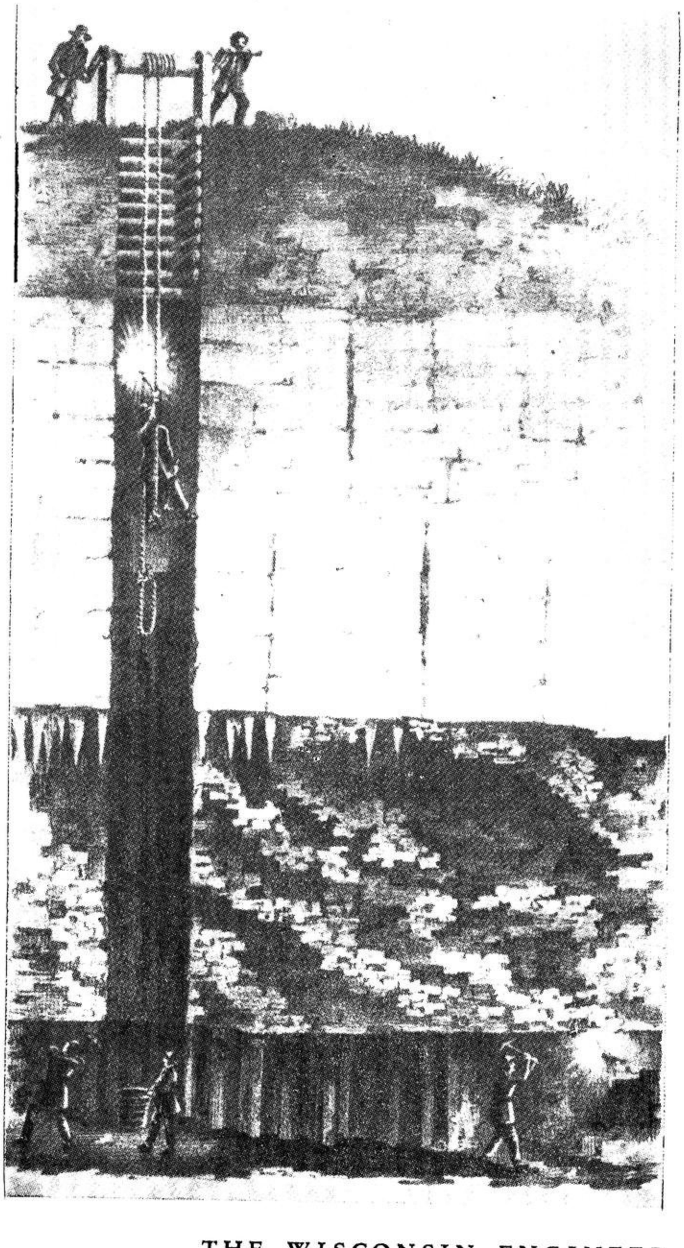
Two economic factors had a considerable effect upon this rapid gain in the Illinois-Wisconsin area. The Missouri mines were at a considerable distance from water transportation compared to the new developments to the north. The land in Wisconsin was better adapted to agricultural activity than was the mining area in Missouri, providing an opportunity for the Badger miners to raise at least a portion of their own food. The swift-flowing streams in Wisconsin provided many mill-sites, where grains could be made into flour, and sawmills could be constructed for producing lumber for housing.

The population in Wisconsin increased in a direct relation to the production of lead. In 1825, there were about 200 whites in the area; 1828 saw about 10,000. The Cornish miners, who proved to be the best, came shortly after. These men were so adept at their work that they were able to work at a profit some of the deposits that had been given up by earlier miners who were less effective in their work. So important was this region that when the Territory of Wisconsin was set up in 1836, Belmont was selected as the site of the capitol. Later, of course, Madison became the seat of the state government.

Some of these persons started farming right at the beginning, and following the farms were the mills and other industries supplemental to the development of a new territory. Many of the newcomers did not stick to one occupation, of course, and there were the "mining farmers" and the "farming miners." These people had permanent homes in the area, and were able to produce a considerable portion of their wants. Thus it was possible for them to produce lead on a smaller price margin than the miners in other areas could. When the price of lead dropped from $4.50 in 1827 to $2.00 per hundred in 1829, Wisconsin production fell off but little. On the other hand, due to costly digging, transportation, food, and numerous other handicaps, the Missouri mines were forced to cut operations sharply during this same period.

The methods of prospecting and mining were, of course, very primitive compared to modern procedures. A good bit of the early miner's success in locating a rich deposit was due to luck. He did, however, also use careful observation in deciding where to dig. Most of the miners had some previous experience in the Missouri fields that served them well in Wisconsin, even though conditions were

(please turn to page 26)



This early lead mine, primitive though it was, strongly influenced American history.

Courtesy of the State Historical Society of Wisconsin.

COMPRESSION DISTILLATION UNITS

by Russell Pipkorn m'49

FRESH, pure water is essential to human life. During World War II our armed forces occupied numerous outlying bases which had little or no pure water. Equipment had to be supplied so that the available water could be purified. It was at this time that the Cleaver Brooks Company of Milwaukee began building purification apparatus. The principle of operation used was the compression distillation process. The units built for the army were mobile or portable units of various sizes. At the present time the standard line of models has been set up with three sizes, either Diesel engine or electric motor driven.

Principle of Operation

The operation of the compression distillation unit can be divided into two cycles, the initial warm-up cycle and the running cycle. The various steps can be followed on the flow diagram. During the warm-up period, water is heated in the engine water jacket to 212 degrees Fahrenheit and flashes into steam in the engine cooling water tank or engine water boiler. This steam is drawn through the compressor, where the steam temperature is raised to 221 degrees by compression, and passed on into the evaporator where it gives up its heat to the main body of water contained in the bottom of the evaporator. After about an hour, the main body of water is heated to 212 degrees and the unit has reached its operating temperature. The warm-up cycle described is that of a Diesel operated unit. For an electrically driven unit an auxiliary boiler must be used to supply the heat for initial warm-up and later on for make-up.

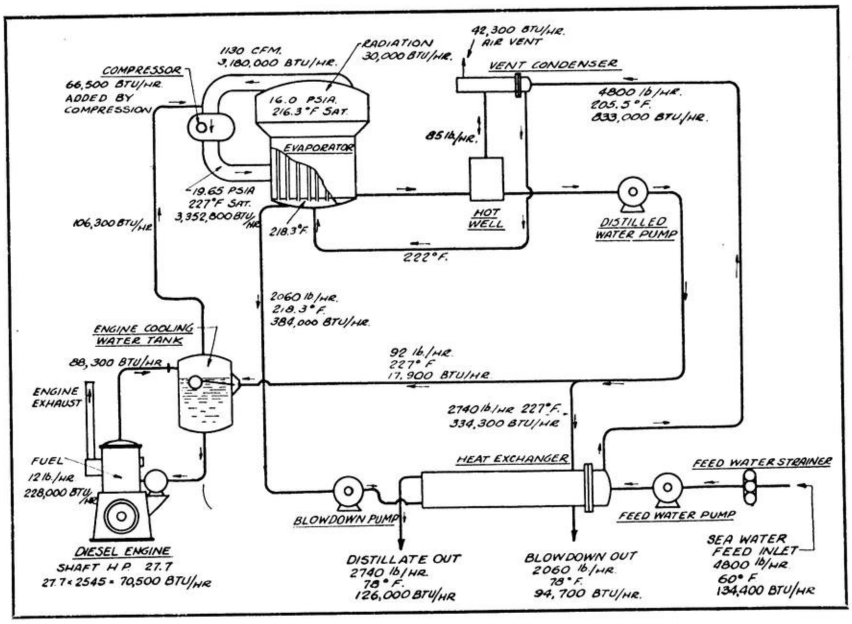
After initial warm-up, the actual operation begins. Steam is produced in the evaporator and is drawn into the compressor, where the temperature is raised from 212 degrees to 221 degrees by compression. The compressed steam is discharged into the outer shell of the evaporator. The steam, being at a higher temperature than the water, gives up its latent heat to the water and condenses, flowing into the hot well. The freed water that had picked up the latent heat from the steam, flashes into steam itself and is drawn into the compressor, completing the cycle. The steam which condensed and went into the hot well is the distilled water and is pumped through a heat exchanger, giving up its heat to the incoming feed water. To prevent excessive concentration of salts in the unit, continuous blowdown is taken from the bottom of the evaporator. This blowdown is also passed through the heat exchanger, giving up its excess heat to an equivalent amount of feed water.

Components of the Unit

The distillation unit itself is composed of a few main parts, a number of automatic controls and safety devices, and many feet of connecting piping, valves, and fittings. The components are all assembled on a base weldment which is arranged to take up the least amount of space.

The evaporator is of the shell and tube type, and consists of a vapor head, cone and vanes, central tube bundle, and bottom head. The tube bundle consists of a number of brass tubes mounted in tube sheets and enclosed in an "Everdur" metal shell. Two overflow passages are provided to convey the water from the tube bundle to the bottom head. To the vapor head, which covers the top of the evaporator, is attached a steam duct which carries the steam to the compressor. Spiral vanes and the cone inside the vapor head serve as a steam separator, so that dry, pure steam is delivered to the compressor. A by-pass connection between the vapor head and the evaporator allows for the escape of air during the warm-up period. The metals used in the unit are all non-ferrous corrosion-resistant metals. The entire evaporator is insulated to minimize the heat losses. In operation feed water circulates through the vertical tubes and steam is compressed in the area around them. As the steam loses its heat to the feed water it condenses and flows into the reservoir in the bottom of the evaporator. This is the distillate which is picked up by the pump and forced through the after-cooler and discharged.

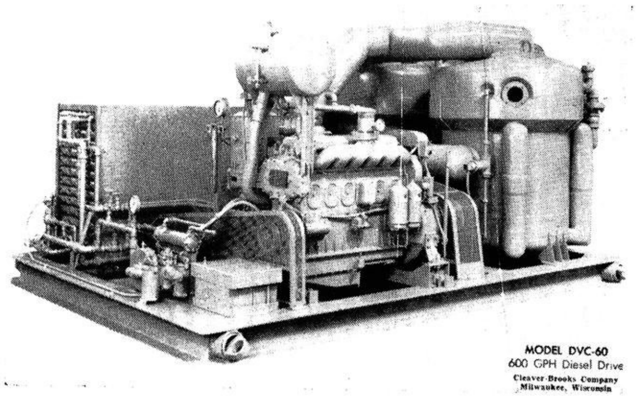
The compressor is a standard Roots type (see the January Wisconsin Engineer). Its component parts, housing,



Flow diagram for the compression distillation unit showing the path of water from entry as feed water until it leaves as distillate or blowdown. (Note: Temperatures shown are only approximate).

end plates and rotors are made of bronze since they are continually in contact with moisture. Special labyrinth seals prevent the escape of steam at the bearings. Generally the housing is insulated. The steam is drawn from the top of the evaporator, compressed, and delivered, at an increased temperature to the area around the tubes within the evaporator. The number of cubic feet of steam compressed per revolution is in direct proportion to the number of gallons of water condensed in the evaporator, therefore the output of the still is determined by the speed of the compressor.

The power for the unit may be supplied either by a standard Diesel engine or an electric motor. On the larger, electrically operated units individual motors are supplied for the compressor and each of the three main pumps, feed water, distillate, and blowdown pumps. These are



Diesel driven 600 GPH distillation unit. Engine boiler mounted above the engine uses heat from engine cooling water.

turbine type pumps. On the Diesel driven unit all the power is supplied by the engine.

The engine boiler is connected to the water jacket of the engine and serves as a cooling reservoir. It is a well insulated tank with necessary connections and is mounted on brackets above the engine. The engine water pump receives its supply from the boiler, circulates it through the water jacket and returns it to the boiler. As the water circulates, the heat from the engine causes it to boil and the steam thus produced flows from the boiler to the evaporator. During the warm-up cycle, this steam will cause the water in the evaporator to boil after a short time, while during the running cycle the heat from the engine makes up for radiation and other losses.

The vent condenser is similar in construction to the evaporator, having as its principal component, a tube bundle through which raw water is forced. This condenser is mounted above the distillate hot well in a horizontal position. Water vapor, with air and other non-condensable gases flow into the area around the tubes. The water vapor is condensed and drains back into the hot well. The air and other non-condensable gases are freed to the atmosphere through a small orifice.

The aftercooler is a heat exchanger through which the distillate, blowdown and raw water pass during the running cycle. It consists primarily of banks of tubes held in cast tube sections; each bank consisting of four brass tubes which are expanded into a brass tube sheet on each end. In the aftercooler the distillate and the blowdown are cooled by reclaiming the heat in both and transferring it to the incoming feed water. From the aftercooler, the distillate and blowdown flow to discharge outlets and the preheated water flows into the evaporator.

Beside the valves and gauges and many feet of non-ferrous piping, important automatic controls are supplied. A liquid level control and high water shut-off valve is connected to the evaporator to control the raw water level inside. The engine boiler is supplied with a liquid level control and low water shut-off valve so that the cooling system is protected against low water conditions. The evaporator is also supplied with a pressure relief valve.

Size of Units

The size of the compression distillation units is determined by the number of gallons of distilled water delivered per hour. Three standard sizes are being built in both Diesel engine and electric motor drive; they are a 90 GPH, a 375 GPH, and a 600 GPH. unit. The Diesel drive units are self-contained, but the electrically driven units require some outside source of heat supply. The 90 GPH unit is also manufactured with an electric boiler. All the units contain the same basic parts, however, with size variations in some cases. The largest unit employs two evaporators operating simultaneously.

Since the first units were built, the efficiency has been increased until at present 200 pounds of pure water can be obtained for each pound of Diesel fuel used. This is significant since more water must be handled than is actually delivered as distillate, most of the excess leaving the unit as blowdown. For example, the 375 GPH unit requires 650 gallons of feed water per hour and the efficiency now obtained is due to the cycle being used. Excluding such losses as radiation, the heat is always reused. Running the distillate and blowdown through the aftercooler makes the heat available to the new feed water. This is exemplified by the fact that the distillate leaves the unit at approximately 20 degrees above that of the feed water.

At the present time the compression distillation unit has found uses in chemical and pharmaceutical companies and also in foreign oil fields. Numerous units have been installed in Saudi Arabia by the Arabia-American Oil Company and more are to be installed. Other problems beside actual purification arise with various locations and various waters. The water of the Persian Gulf, for instance, is particularly high in salt content. This required that the units supplied were equipped with methods of cleaning salt scale which is especially hard and forms fast. Also the fact that the water is highly odorous required that a means of deaerating be supplied.

Just as numerous other developments that we know today were developed during the war because of necessity and have found even further peace time uses, so the compression distillation unit, a product of the war, has found widespread post-war use.

STELLAR RADIATION MEASUREMENTS

by R. Bartelme e'48

ONE of the problems confronting the astronomer is the detection and measurement of radiations from heavenly bodies. Ordinary methods of measurements are not sensitive enough, so through the years various schemes have been developed in order to accomplish this result.

The earliest attempts to measure small amounts of radiation employed heat devices which operate on the principle that since radiation is energy it can be measured by converting it into some other form of energy, such as heat, and then measuring the latter.

One of the first successful devices was the bolometer which was invented by Dr. Langley in the year 1880. Basically it consists of a thin metal strip, usually platinum, blackened with camphor smoke to absorb radiations and so connected with a Wheatstone bridge circuit that the absorption of the radiant energy will disturb the bridge balance. The beam of radiation impinges on the strip, or sometimes the beam is dissolved into a spectrum and the wave length of which the power is to be measured is allowed to fall on the strip, and thus raises the temperature of the material by the conversion of the radiant energy into heat. This rise of temperature produces an increase of electrical resistance and since the bolometer strip is enclosed in a sensitive Wheatstone bridge this change of resistance may be measured.

An extremely accurate mathematical expression has been developed that gives the relation between resistance and temperature for moderate ranges of temperature from 0 to 100 degrees centigrade: i. e. $R_2 = R.[1 + a.(t_2 - t.)]$, where R. is the resistance at t. and a. is the temperature coefficient at that temperature. It can be seen that it is possible to calibrate the resistance dials or deflection instrument directly into temperature readings. It is obvious that a thermometer could not be used to measure these extremely small amounts of heat, but electrical resistance measurements can be made with extreme accuracy. It is possible to measure a change of resistance of 1 in a million and with very sensitive measurements, using modified circuits, even smaller changes can be detected. The change of electrical resistance of pure metallic conductors is rather large. For platinum there is about 37 per cent change between 0 and 100 degrees centigrade. This means that 1 degree centigrade produces a resistance change of about 0.37 per cent. Thus a change of one millionth would correspond to a temperature rise of 0.00027 degrees centigrade. With maximum possible sensitivity, the instrument will measure changes in temperature as small as one millionth of a degree centigrade.

The bolometer used by Dr. Langley at the Astrophysical Observatory at Mount Wilson was used in conjunction with a galvanometer having a scale of about 1.5 meters and so calibrated that a deflection of 1 millimeter corresponded to about one millionth of a degree in average temperature rise of the bolometer strip. Ambient temperatures will affect the accuracy of the bolometer so it must be protected by enclosing it in thick walls of some insulating material and it also must be screened from the direct rays of the sun. The galvanometer used at the Washington and Mount Wilson observatories were built on foundations that extended several feet below the ground in order to reduce the effect of accidental vibrations and ground tremors. This construction proved very effective, as the average vibrations recorded were about 0.3 mm. in amplitude and accidental deflections as great as 1 mm. rarely occurred, thus the instrument could safely be considered accurate to one millionth of a degree centigrade.

The radiation thermocouple was also employed for much the same purpose as the bolometer. It works on the principle discovered by the German physicist, Thomas J. Seebeck. When a circuit is formed of two wires of different metals, and one of their junction points is raised to a higher temperature than the other, an e.m.f is produced which will cause a current to flow in the circuit. This current is measured by a sensitive current galvanometer so constructed that even without shielding the earth's magnetic field variations will have little effect. Mr. Wm. Hoover, while connected with the Smithsonian Institute, Washington, D. C., constructed such an arrangement of a thermocouple and a static galvanometer which was capable of measuring currents of **one ten millionth of an ampere.** Using this system with special filters to select the desired wave length, Mr. Hoover observed in the spectrum of Vega deflections of 20 mm. on the scale of 5 meters.

In 1928, C. G. Abbot attempted to measure the distribution of radiant energy in the spectrum of some of the brighter stars by a delicate radiometer system which he constructed himself. The total weight of the instrument was approximately 0.9 milligram. The vanes were made out of the wings of a house fly and each vane was composed of a blackened front lamina and two separated laminae in its rear. They were about 0.4 mm. wide, 1.0 mm. tall, and spaced about 1.2 mm. between centers. The entire system was suspended by a quartz fiber approximately 6 inches long. This fiber was so fine that the upper end of it could be twisted 45 times before any turning could be visibly detected at the vanes. The vanes were suspended in an optically ground quartz tube and surrounded by hydrogen gas at a pressure of 0.23 mm. of mercury. When first tested the instrument had a complete period of 24 seconds, but when Mr. Abbot cleaned the quartz tube with alcohol and a chamois skin in order to

(please turn to page 33)

Oil From Davy Jones

by Alvin Pierce c'49

SURROUNDING the land masses of the earth and beneath the marginal, shallow waters lies a sea floor which is known as the continental shelf.

This submerged plain which fringes the continents is of interest to the geologist as well as the geographer—in fact, to everyone in a world dependent upon oil. Our knowledge of the geologic character of the continental shelf makes it reasonable to believe that beneath it may be concealed the greatest petroleum resources yet to be encountered.

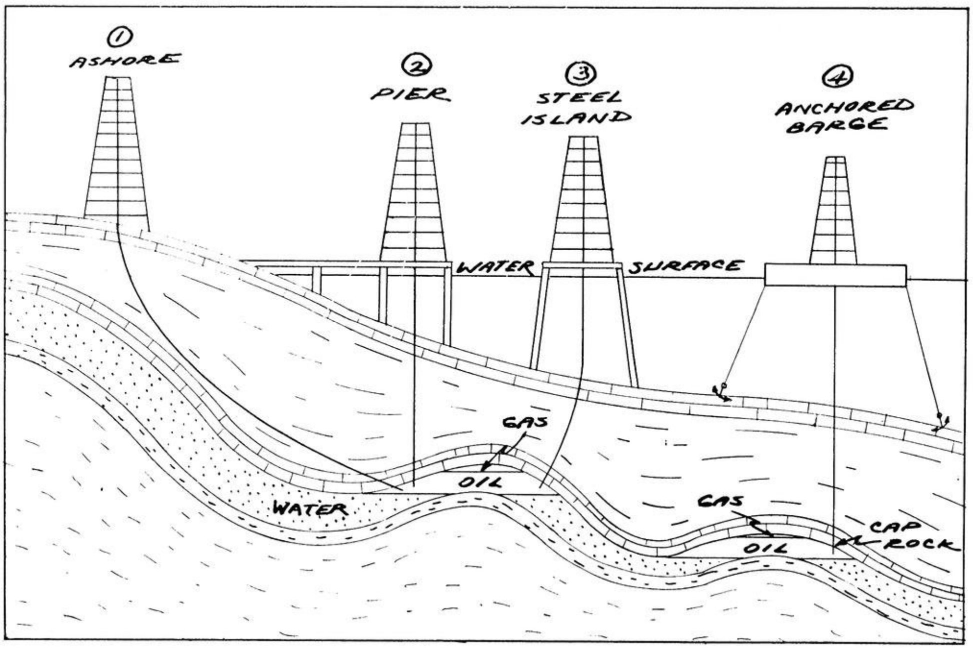
The continental shelf is really part of a larger earth feature; it is the outer, or seaward, portion of the shelving plain which forms the solid surface extending from the continental heights to the oceanic depths. The inland, upper edge of this plain, at an elevation of about 600 feet above the mean level of waters bounding the shores of the U. S., marks the mean level of the land-and-water surface of the globe; its lower edge, at an elevation of about 600 feet below sea level, marks the beginning of the steep descent along the surface designated as the continental slope, into the deep oceanic basins proper. Beneath the dry land portion of this plain are situated the natural reservoirs from which has come the bulk of all petroleum the world has consumed in the past, together with those reservoirs which contain an even larger proportion of our proved petroleum reserves. However, it is the author's intention to be concerned here with the prospects for petroleum under the adjacent submerged portion of the plain.

Preliminary exploitation of the petroleum resources of the continental shelf has already begun. Off the coasts of Texas, Louisiana, Florida and California, extensive geophysical surveys have been carried out, and numerous wells have already been drilled into continental shelf sediments.

One such survey conducted off the Gulf Coast a year ago, the largest to be undertaken to date, entailed the cooperation of several of the country's largest oil producers and cost over half a million dollars.

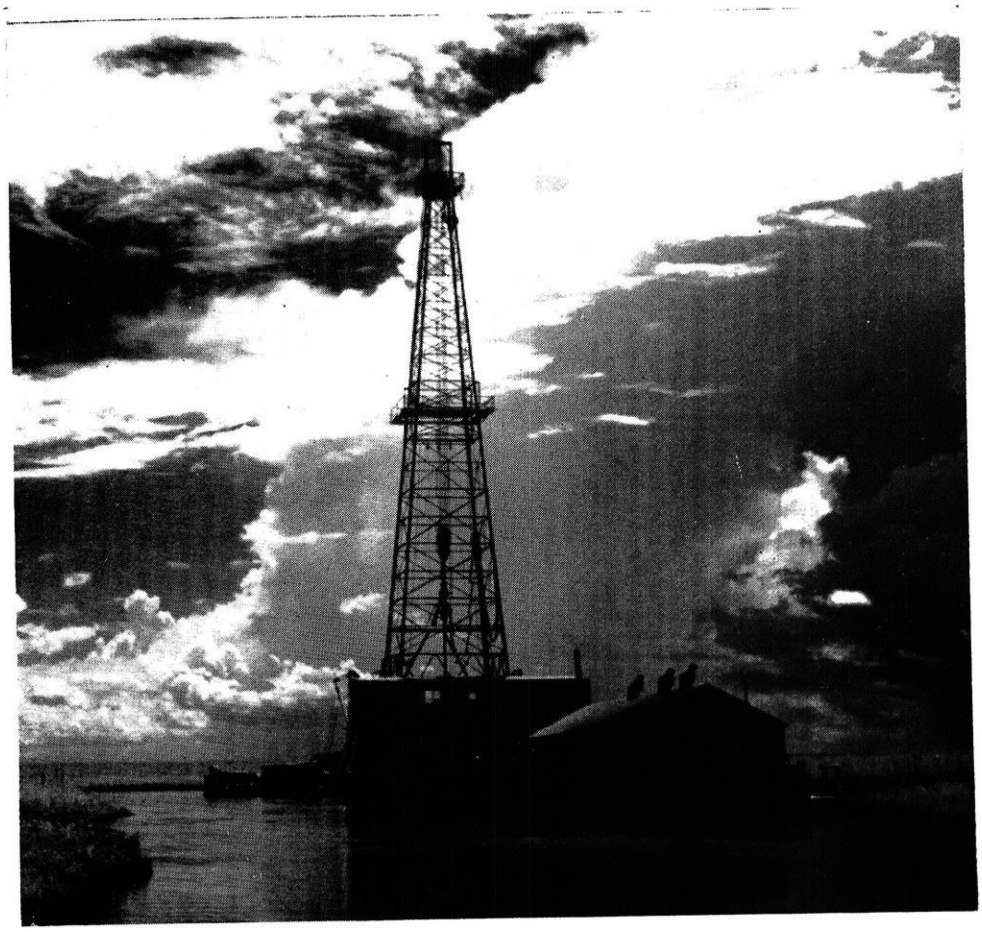
Approximately 80,000 square miles of the continental shelf are being explored in the vicinity of the Bahama Islands. Employing airplanes for the project, 8 months of flying time have been required to complete the project. A DC-3 has been employed to fly over the area in parallel courses at spacings of two miles. The latest Shoran radar equipment has been installed in the plane to enable the pilot to hold his course to within a few hundred feet of that prescribed.

Employing a magnetometer, the method of mapping the earth's surface involves plotting the variations in the earth's field. Mounted in a bomb-shaped housing, the instrument is towed by cable 60 to 100 feet below the plane. The recording instrument carried in the plane is mounted so that it is not affected by the vibrations encountered in flight. It is reported to be capable of accurately recording in any position with the exception of complete inversion, in which the ink would spill from the pen. A strip chart is employed to record variations in the earth's field.



Schematic sketch showing the four methods of obtaining oil from below the surface of the ocean.

An oil-drilling rig mounted on a barge on the Mississippi delta in Louisiana. By means of this system wells can be drilled as deep as 12,000 feet. Extensive use is made of this system in oceanic drilling. Much oil which would be ordinarily unavailable can then be pumped.



Petroleum is already being produced from the continental shelf adjacent to California, Texas and Louisiana. In search for oil on the land, operations have taken explorers from one region to another and eventually to the seacoasts. Although it is perfectly clear that petroleum resources do not stop at the water's edge, drilling has been limited to areas adjacent to the coastline.

Up to this point the geo-physicists have been able to make surveys of the strata underlying the land surfaces of the earth and to a certain extent the area lying under cover of water, but their instruments locate only the underground structure; and from their study, locations are determined where oil is likely to occur. But the ensuing phase involves actual drilling operation on a "cut and try" basis. This procedure involves a multitude of costly investments into which oil companies have put millions of dollars. By analogy, this same procedure can be applied to exploration for oil under the ocean floor. However, it is obvious; the cost of drilling operations will be far in excess of that pertaining to land operations by virtue of the inaccessibility of the potential underwater reservoirs.

Four methods of drilling under water can be used for obtaining oil from these reservoirs. The first is directional drilling (Fig. 1), in which the drilling is started on the shore with the bottom of the hole a mile or more distant under the adjacent waters. A second method widely used along the California coast is to build piers out into the water (Fig. 2). A third method is to build an artificial island in the water from which one or more wells may be drilled (Fig. 3). Another way is to anchor securely a barge of a type investigated by the War Department as a possible mid-ocean landing field so that the platform would be supported above the maximum height of waves by a group of huge caissons floating below wave action. Oil operations would be carried on from the platform (Fig. 4). Although drilling under water is increasing, particularly along the Gulf Coast, and more and more ocean drilling is expected, drilling has not so far been attempted in more than 60 feet of water. Petroleum engineers are now studying methods which will permit drilling operations at greater depths. From land positions, holes have been drilled about 2½ miles in depth.

Another method, which reminds one of the Sunday Supplement, visualizes the excavation of tunnels from the shore through the ocean floor to vicinity of oil sands. Wells drilled from the tunnels into the sands would permit the oil to flow into pipelines traversing the tunnels landward. Equally nonfeasible, it seems, is the suggestion that the aid of a type of huge diving bell, large enough to contain a derrick and drilling rig, be enlisted.

The methods suggested of producing oil from the continental shelf are so costly they would be considered on a large scale only should oil need become so imperative as to make producing cost a secondary consideration.

ON *the Campus*

by John Ashenbrucker e'49 & Don Dowling e'49

TRIANGLE

Proud as punch of the recently installed beer tap, Dick Wilson dispensed the beverages at a hard-times party held at the Triangle house on Saturday evening, March 20. The new tap has very fine cooling coils which condense the foam and allow only liquid beer to flow when the handle is pushed forward, while a throttling valve puts the head on the glass when the tap-handle is pulled back. Now if somebody would only invent a better mouse-trap.

IRE

The newly organized student Radio Engineering society has elected the following officers:

Chairman—R. K. Ausbourne
Vice-Chairman—C. E. Fordham
Secretary—Charles Cheney

A committee for handling the details of organizing the section and a membership committee have also been chosen.

AIEE

Members of AIEE met on Tuesday evening, March 2, in the Mechanical Engineering building. Mr. F. H. Roby, Assistant Sales Manager of the Square "D" Company of Milwaukee, spoke on "New Control Systems for High Speed Gun Welders."

Mr. Roby discussed the engineering considerations involved in the design of a rather intricate motor-driven timer and high-speed syncro-break contactor which makes up the control system.

Speaking to a combined Madison and Student Section of AIEE, Mr. Englehart of the Milwaukee Electric Company and writer of the Redi-Kilowatt program (WTMJ in Milwaukee), gave a lively illustrated talk entitled "What Is Hidden Under the Bushel?" Mr. Englehart brought out the lighting problems of an average individual from youth to old age.

Whiskers!! Apparently Uncle Ezra just cracked a funny.

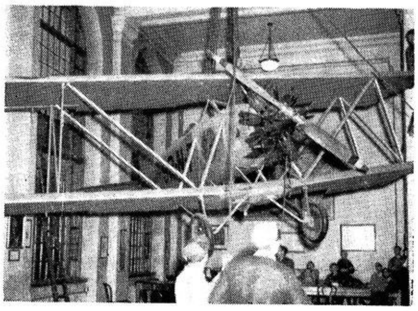


Photo by Dick McKeon c'51

This famous relic of who-knows-what was recently removed from the lobby of the M.E. building. It has been somewhat irreverently referred to as the "Damocles Dirt-Dobbler."

CLEAN-UP

Tradition took another kick in the slats when the old Navy biplane that hung for so many years in the lobby of the M.E. building was "Cut down and hauled away to the mill." Hanging precariously overhead as it did for so many years, one can safely say that half the engineers who graduated in the last decade received their first impression of the power of mechanics as they meditated over the two thin cables holding the plane to the ceiling. In line with streamlining the building and creating more space for new equipment, both the radial-engine Navy relic and the P-51 airplane in the Heat Power lab were dismantled and removed.

MINING CLUB

The Mining Club held its last meeting on March 3, 1948, in the M&M Building. The main event of the evening was a talk by Mr. T. F. Plimpton, Superintendent of the Blast Furnace Operation at Inland Steel Corporation, Chicago. He spoke on various phases in the operation of the blast furnace. The meeting was concluded with doughnuts and coffee. (*please turn to page 38*)

Alumni Notes

by J. J. Kunes e'48

Of all the engineering graduates who have left these halls of learning, a few have returned to pass on to other students the benefits of their experience and knowledge. Some of these names are familiar to every Wisconsin engineering alumnus; others are comparatively new here. Starting this month, we are presenting thumbnail sketches of some of Ye Olde Badgers who have returned to their olde stamping grounds and now preside as professors.

— EE —

James W. Watson ('02) is the grand old man of the EE department. He has been on the staff since his graduation.

John R. Price ('05) worked with General Electric for a year following his graduation, then returned to the campus to teach. He is now professor of Electrical Engineering, and is the representative from the EE department on the "New Engineering Building" committee.

Ralph R. Benedict ('25, M'26), now Associate Professor, did two years of research on fellowships after he received his degree, also some work at General Electric and at the Allen Bradley Co. He is co-author with H. A. Maxfield of a book, "Theory of Gaseous Conduction," published in 1941.

John Weber (30, M'39) worked for General Electric upon graduation, then did graduate work at MIT. He worked for Square D in the Industrial Controller Division, Commonwealth and Southern, and the Bureau of Ships of the Navy Department. During the war, while teaching at West Virginia University, he had charge of the ground school training for the Naval and Army Air Cadets enrolled there. In March, 1946, he returned to Wisconsin and now holds the rank of Assistant Professor.

J. R. Hafstrom ('37) returned to the campus last fall as Assistant Professor of Electrical Engineering. After receiving his degree here he worked with General Electric for three years, becoming a manufacturing engineer in the lamp division. From 1940 to 1942 he was an instructor at Iowa College while working for his master's degree. Since 1942 he had been working for the government.

C. B. Bradish ('12) was recently named manager of engineering for the General Electric Co., Schenectady. He joined G. E. upon graduation in 1912 and had attained the position of designing engineer in the industrial control department.

Philip S. Biegler ('05), professor emeritus of electrical engineering at the University of Southern California, died recently. He received the degree of Electrical Engineer from here in 1915 and in 1916 his M.S. from the University of Illinois. He has held many positions since then, including teaching posts at Iowa State, Purdue, Montana State, Illinois, Washington State, and Southern California. He was named acting dean of the College of Engineering of the University of Southern California in 1928, and dean in 1930. In 1947 he retired. He was very active in and a member of numerous honorary and professional societies. From 1929 to 1936 and also 1940 to 1941 he served on the AIEE education committee.

New Badger graduates have scattered far and wide in the engineering field. According to available statistics, here are the spots where some of the February grads have landed:

Emil Kasum (editor of the "Engineer" last semester) and **Robert Flugum** are with Westinghouse in Pittsburgh. **Harris A. Childs** is with the General Electric Co. in Schenectady. **Arthur W. Baebler** has accepted a position with Illinois Northern Utilities Co. **G. O. Gerth,** also interested in utilities, joined the Otter Tail Power Co. of Fergus Falls, Minn. Those casting their lot with the big oil companies include **Morton G. Spooner,** Standard Oil of Indiana, Whiting, and **W. F. Netzel,** Carter Oil Co., Tulsa. **George P. Yount** has settled in Cincinnati, with Procter and Gamble Co.

Some still like the blissful state of Wisconsin, however, and have lodged in Milwaukee. They include **Henry F. Blank,** Louis Allis Co., **Dean Morril,** Line Material Co., and **Ralph H. Wey,** with Oil Gear Co.

— ME —

Mechanical Badger Alumni who graduated in February and their places of employment are listed herein. Old Alumni, for the latest inside dope on conditions in the old Alma Mater, contact these new alumni who may be working in the next office:

R. J. Gains and **S. E. Weidler** are working for General Electric—Gains at Erie, Pa., and Weidler at Schenectady. **D. W. Widmer** has moved to Akron and the Firestone Tire and Rubber Co.

Two of the fellows like Madison so well they have decided to stay here. **Leo Reynolds** is at the Gisholt Machine Co., and **R. P. Scovill** is working for Oscar Mayer & Co.

O. Lee Wakeman is with Procter and Gamble in Cincinnati, and **William K. De Haven** is in Barberton, Ohio, working for Babcock and Wilcox.

Milwaukee claims the largest

(please turn to page 25)

Research in Miniature

by James E. Wille che '50

FRACTIONAL distillation has been used as a tool of research for the last century, but the problem of sample size has long been hindering its more extensive use. Investigations of various reactions carried out in laboratory sized reactors quite often require distillation of small quantities of samples before the results of the tests can be evaluated. The usual volume available is generally in the range of two to ten milliliters. Until recently, there was no still on the market capable of handling this size sample with any efficiency. A large hold-up and a low boil-up tolerance were the results of any attempts to work in this range.

However, the Piros-Glover Micro-Still has at last offered a solution to this problem. This still is capable of providing precise fractionation of samples as small as two milliliters with plate values of better than one hundred. This is accomplished by using a "wetted wall" effect produced by an element rotating inside the fractionating column. The rotating element in the micro-still is a long, flattened helical coil made of nichrome wire. The coil is attached to a tungsten rod which runs to the chuck of a variable - speed motor. A gasket constructed of teflon, a fluorinated hydrocarbon, is used as a rotary seal to preserve the vacuum in the still.

CONTROLLED CONDENSATION

A straight - tube primary condenser provides the required reflux and offers a means of control of the rate of vapor condensation. Compressed air is used as a cooling medium in this condenser, and by regulating the rate of flow of this air, the amount of vapors allowed to pass through the condenser to the cold-finger condenser above is controlled. Since the pressure in the laboratory air system usually fluctuates somewhat, it is decreased to twenty-one pounds per square inch before passing to a small needle valve by which the air supply to the condenser is regulated.

Two thermocouples are placed in the primary condenser to measure the overhead vapor temperature. One couple is placed near the end of the wall to measure true vapor temperature, while the other is placed a little above the air jacket around the primary condenser. This couple serves to indicate when vapor starts to pass through the primary condenser and thus serves as a guide in the regulation of the air flow.

The vapors which pass by the primary condenser are precipitated on a water cooled total condenser at the top of the column. This condenser is of the cold-finger type and has a sloping seal which directs the condensed material to a dripper in contact with the take-off tube. The opening for the rotating shaft is made large enough so that the condensed material will not return down the rotating shaft to the column.

When cuts of the overhead material need not be saved, a small pipette, sealed at its bottom graduation, is used as a receiver. A method has also been devised for changing the receivers while preserving the vacuum. A vacuum cup with a movable internal section is employed. The receivers are placed in the cup, and as the cut is to be changed, the receivers are rotated beneath the take-off tube. This arrangement allows as many as fourteen samples to be taken without breaking the seal.

CONTROLLED RADIATION

The fractionating tube, condensing sections, and take-off line are enclosed in a vacuum jacket. This column is silvered to minimize radiation losses. To compensate for losses through the jacket, an external heating system is provided. This consists of a nichrome ribbon wound around the jacket, wrapped with a thin layer of glass wool.

The still-pot is a pea shaped container having a ten milliliter capacity. Heat for the pot is supplied by a small radiant heater made of nichrome wire. The glass form which holds the heater coil is held against the bottom of the pot by a spring. This spring rests on the bottom of a strip-silvered vacuum jacket which encloses the entire still-pot assembly.

A constant heat input to the column is a necessity in micro-distillation, and to provide this, a regulated voltage supply is used. The input voltage to the pot heater is reduced to thirty volts by a Variac. This voltage is further controlled by a second Variac which ranges the supply from one to thirty volts.

One of these micro-stills has recently been granted to the Chemical Engineering department by the Sinclair Refining Company, where the still was originally developed. It is being used for purification of small samples from laboratory reactors and analysis of the products. Working at very slight vacuum and under comparatively low temperature conditions, this still produces amazingly quick and precise results. The efficiency tests show that it has efficiency as high as the larger stills, while enabling the chemist to work with the small amount of material available to him for analysis.

ABC's of Patent Law

by Michael Maier MS'49

THIS ARTICLE is presented to give the engineering student an understanding of some of the basic principles of patent law. It should be realized that a brief treatment such as this must necessarily be limited to generalities in but a few phases of the patent field. It is the earnest conviction of the writer that an understanding of these basic principles will be an asset of great value to the engineer, the man who, in most instances, is employed to do the type of thinking which results in patentable inventions.

The foundation for our patent system is the Constitution of the United States which directs Congress:

> **"To promote the Progress of Science and useful Arts, by securing for limited Time to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."**

Congress has accordingly passed legislation from time to time which empowers the Commissioner of Patents to issue to the original and first inventor of some new and useful invention a patent which is good for seventeen years from the date of issuance.

WHAT IS A PATENT?

The objects of the patent system are to encourage invention and to build up the body of public knowledge. The inducement is a patent, which is the grant of a limited monopoly by the government to the inventor in return for disclosure of his invention. It is not a grant of a right to manufacture the invention, it is the grant of a right to exclude others from using, making or selling the invention claimed. For example, the inventor of a device can prevent the inventor of an improvement which can be used only on the original inventor's device from using, selling or making the original invention. The value of the patent on the improvement is that the inventor of the improvement can prevent anyone, even the inventor of the original device, from **using, selling** or **making** the improvement. So that an inventor may exclude others from using, selling or making his invention, the patent laws provide for suit again infringers in the Federal Courts.

A patent is also considered a contract between the government and the inventor. The consideration on the part of the inventor is disclosure of his invention; the consideration on the part of the government is the grant of a monopoly in the invention for seventeen years.

Physically, a patent consists of the grant from the government, drawings of the invention, the specification or description of the invention, which explains the drawings, and a set of claims which describe the limits of the invention.

WHAT IS PATENTABLE?

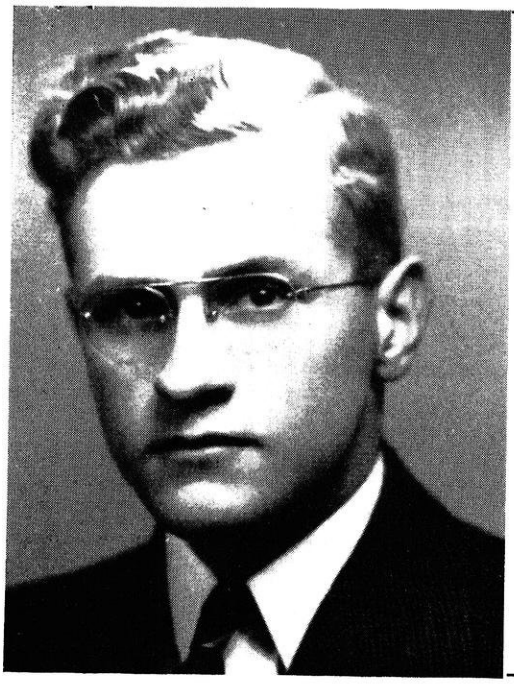
The patent laws provide that any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, or any new and useful and ornamental design for articles of manufacture or who has invented or discovered and asexually reproduced any distinct and new variety of plant, other than a tuber propagated plant may obtain a patent therefor. This statement is a general answer to the question; however, a consideration of the terms in that statement as defined and applied by the patent tribunals will serve to clarify that answer.

The word "machine" needs little explanation; suffice it to say that a machine is an association of elements **which have an inherent law of operation.** An article of manufacture differs from a machine in that it possesses no inherent law of operation; it can be said to be any tangible, man-made object which is not a machine, design or composition of matter. Early decisions indicated that an article of manufacture had to be made in a factory; however, it is interesting to note that the courts have since sustained patents on buildings and bridges as articles of manufacture.

The term "composition of matter" is said to be a chemical or physical union of two or more ingredients **which produce a new and homogeneous mass.** Thus it includes both chemical compounds and mechanical mixtures whether they be fluids, powders or solids. Accordingly, the court sustained a patent on a mixture of a certain percentage of soft uncured cheese with another percentage of hard cured cheese. It has also been held that a change of purity which produces a new result makes a substance patentable as a new composition of matter.

An improvement necessarily requires the existence of something to be improved; it is an addition to or an alteration of some existing means which increases its efficiency without destroying its identity.

As stated in the law, a design must pertain to an article of manufacture and must be ornamental to be patentable. A design patent is based on appearance and not utility. This does not mean a design patent cannot be obtained on an article which possesses utility if the design appeals to the esthetic taste. A small change in design is not sufficient to avoid infringement of a design patent. The test of infringement is whether or not, in the eye of an ordinary



Michael W. Maier, B.S. '44, now a senior in the School of Law, also expects to receive his master's from the School of Mechanical Engineering in June, 1949. While an undergraduate, "Mike" was one of the first three to receive the John Morse scholarship. This was in 1943. Since then he has served in the Navy in the Naval Research Laboratory in Washington, D. C., where his specific interest was in anti-vibration equipment for naval aircraft. After his discharge in 1946, Mike waited until the fall of 1947 to re-enter school in pursuit of his advanced degrees.

observer giving such attention as a purchaser usually does, two designs are substantially the same.

Though not specifically mentioned in the law, mechanical and chemical processes are held to be patentable. The courts have achieved this result by saying that a process is an "art" in the patent law. A process has been defined as a mode of treatment of certain materials to produce a given result. For example, patents have been granted for a new process employed to purify flour. The machine elements used to perform the process need not be new or patentable; the process of itself is patentable if it produces a new and useful result.

With the exception of the design patent, **utility is a requisite of patentability.** The word "useful" as used in the law means that the invention must be useful to society; it must not be injurious to the morals, health or good order of society. Accordingly, a gambling machine has been held not useful; but a new game similar to shuffleboard has been held patentable as possessing the necessary utility. In general, it can be said that all that is necessary is that the invention possess some utility.

INVENTION AND DISCOVERY

Invention or discovery is a requisite of patentability. Invention requires mental effort, the recognition of a problem or need and solution of the problem or satisfaction of the need. Discovery requires similar mental effort; however, those discoveries which are the result of accident or chance are judged for patentability only from the standpoint of novelty and value.

There is no statute which provides a test of invention. It is up to the courts and the patent office in each particular case to decide the question of invention. The courts and patent office have applied the general rule that an invention is a new display of ingenuity beyond the skill of the average man skilled in the art. This is but the expression of a standard of invention, and it should be emphasized that there is no fixed test but that the decision of the presence or absence of invention is a matter of judgment in any given case. Of recent years, the "flash of genius" test has been brought forth. This is but another expression of a standard of invention and has been held to be no different from the "man skilled in the art" test. It is interesting to note that the standard of invention has been raised by the courts in recent years by stricter application of the "man skilled in the art" test. It has been estimated that between 80 and 90 per cent of the patents litigated in recent years have been invalidated for lack of invention.

The following negative tests of invention have been stated by the courts: Mere change in size or degree, a mere omission of elements, a mere substitution of equivalents, a mere change of location of a part, and a mere new use have been held to be **non-patentable.** Merely making a device portable or adjustable has also been held to be non-patentable. A mere aggregation of old elements is not patentable. An aggregation is distinguished from a combination which is patentable. An **aggregation** consists of old elements working together to produce an old result, while a **combination** may consist of old elements working together to produce a **new** result.

There are factors which the courts consider as persuasive evidence of invention. This is especially true when the question of invention is in doubt. Thus the failure of many others in the field to produce the invention, and the failure of others over a long period of time to produce the invention, often swing the balance in favor of patentability. General adoption of an invention by an industry or replacement of something previously employed are also weighty evidence of patentability. The achievement of a substantial increase in speed and volume of production or of substantial economy are also deciding factors in favor of patentability.

(please turn to page 40)

Modern Heating Practices

Edited by R. W. Hucker e'49 from a paper by E. Allen Smart M.S.'48

HAVE you been day dreaming with your best girl friend lately? If you have, chances are these dreams have included that little cottage that most of us hope to build some day. Perhaps they were low, sleek buildings with large window areas—the so-called solar type homes. The popularity of these homes has increased many fold within the last few years, consequently many new types of heating systems have been evolved especially adapted to this type home.

Many of these heating systems are designed as complements to the heating effect of the sun. Four of these systems will be discussed here. They are forced hot water with convectors, radiant heating panels in the ceiling, reversed refrigeration cycle (heat pump), and forced hot air using electricity for heating.

The solar type building uses large window areas exposed to the sun on southern exposures to take advantage of the solar radiation of the sun during the winter months. The sun's infra-red rays or heat carriers pass through the glass on a short wave length, strike objects within the room and are deflected at a longer wave length that will not pass out through the glass.

At the present time no data is available to calculate the amount of heat that may be expected to be useful for heating homes in winter. Results of actual experiments do show, however, that solar heating is practical and architects are designing homes with large window areas and have no fear of excessive heat losses.

It is true that the total heat loss of any particular building will be proportionately higher than the same structure without the large windows, but several design techniques are practiced to offset to some degree this difference.

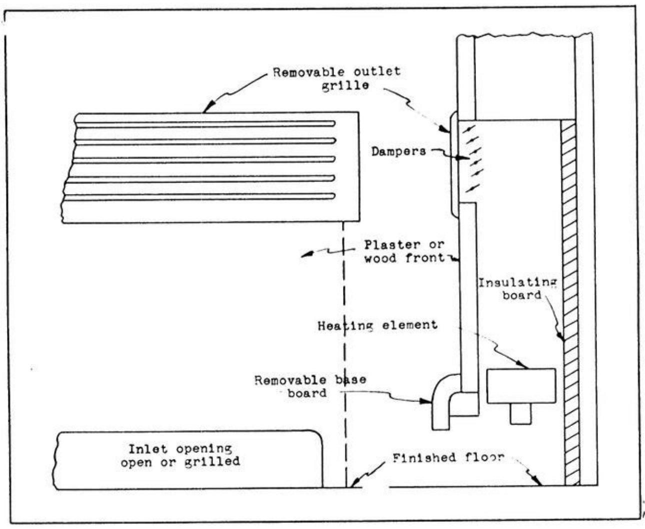
One of these techniques is the use of double-paned glass areas which has little effect on the amount of radiation that enters the room but does greatly reduce the heat transfer out of the room. A second technique is to offset the extra window area added on the southern exposure by having a somewhat small window area on the exposures where rooms that need little light are placed. Also, curtains are supplied for the large window areas that may be drawn across the window during night-time when all heat transfer is out of the room.

The three main benefits of solar orientation (the placing of the home on a site with respect to compass direction, so that the various rooms are correctly related to sun position, wind directions, views, or other desirable surroundings) are additional warmth in winter, increased daylight during all seasons without excessive heat gain during summer months, and increased enjoyment to the occupants of the building.

The enjoyment of living for the occupants is increased by better light, and the psychological and health factors of being able to see the seasonal colors and growing things out-of-doors during all seasons.

HEATING WITH CONVECTORS

Steam heating systems using convectors, either concealed or cabinet type, are becoming more prevalent in modern home heating systems for several reasons. Their main advantage over radiators is the large difference in weight between convectors and radiators for the same heat output. Furthermore, the convectors can be of the "hidden" type that can be recessed in walls and be invisible to the occupants.



Diagrammed is a typical wall convector.

The air enters the convector at the floor level, passes through the heating element and then is discharged into the room at the top of the cabinet. The heat output of the convector may be controlled by dampers at the outlet. Since the air can only enter the convector at the floor level, the colder air of the room that is always at the lower level is being constantly withdrawn from the room and heated. The output of the convector is dependent on the height of the space above the heating element—this space acting as a chimney produces a larger air flow with an increase in height.

RADIANT HEATING

As more and more practical experience and better design procedures are developed in the field of radiant heating, this system of home heating is becoming more popular. Radiant heating involves use of hot water running through pipes that are imbedded in the floors, walls or ceilings of the rooms being heated.

(*please turn to page* 32)

Badger FOREIGN STUDENTS

by C. Leyse m'48

TALAAT YOUSSEF

Talaat Youssef was born in Cairo, Egypt, 25 years ago. After his preliminary education he entered Fouad I University in Cairo to study engineering. In 1944 he graduated from Fouad I with a Bachelor of Science degree in Mechanical Engineering and went to work for the Egyptian Civil Aeronautics Board. Talaat was stationed at Almaza Airport near Cairo and worked in conjunction with the Misr Airlines (Egyptian Airlines) and the British Overseas Airways. His specific duties were the inspection of aircraft and the giving of certificates of air-worthiness.

After a year or so the Egyptian government offered Talaat the opportunity for further schooling at their expense. He accepted and came to the United States in February, 1946. In March, 1946, Talaat entered the University of Michigan to resume his studies. While at Michigan he wrote a thesis on "Preliminary Designs in Automobile Chassis" and received his M.S. in Mechanical Engineering in January, 1947. From Michigan Talaat went to the Ford Motor Company in Detroit where he entered a training program. Although he did not do much actual work here, Talaat says he moved about to all the various departments of the Company and acquired valuable knowledge regarding automobile manufacturing techniques.

While on vacation in the summer of 1947, Talaat made a stopover in Madison and contacted some of his Egyptian friends who were studying here. After talking to them and to some of the engineering faculty, he decided to come to the University of Wisconsin to do some more advanced work. He left Ford in September, 1947, and came here. Talaat has particularly enjoyed the courses he has had in

(*please turn to page 36, col. 1*)

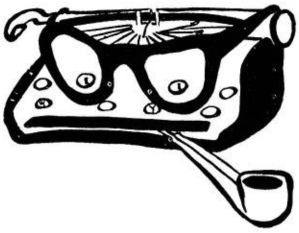
KNUT LOFSTAD

From Norway, land of skiers, Knut Lofstad has come to the University of Wisconsin to study engineering. In addition to his studies he has become a star member of the Hoofer Ski Team. Knut was born in Oslo and after completing high school attended commerce school for one year. He then became interested in receiving an engineering education and since the Norwegian Engineering Colleges were too crowded he decided to come to the United States. Knut arrived in the United States in September, 1946, and entered the University of Wisconsin to study mechanical engineering. He is interested in aeronautics and internal combustion engines and plans to take several courses in these fields before graduation in February, 1949.

After graduation Knut will attempt to get permission to stay in the United States at least another six months during which time he would like to obtain employment in some training program. Following this he intends to return to Norway. While he is not sure just what type of work he will do, an interest in automobiles will probably attract him to that industry.

Since Knut has been one of the mainstays of the Hoofers' Ski Team, a short resume of his activity in this sport seems appropriate. Knut says he started skiing when he was about four years old, which is not unusual since almost everyone skis in Norway. On coming to Wisconsin he immediately joined the Hoofers and has competed in three intercollegiate events as a member of their ski team. Last year the Hoofers' team placed third at a meet at Aspen, Colorado, in competition with many of the western college teams. This past winter the team won a meet at

(*please turn to page 36, col. 2*)



The Way We See It

PLEA TO POLYGON

UNDOUBTEDLY many people are wondering just what happened during the last St. Pat contest. Frankly, we are wondering ourselves. Campus politics is a subject that doesn't interest most student engineers, but unfortunately, it does affect them. The unsportsmanlike attitudes that were displayed in the recent St. Pat's campaign were quite evident. When a situation reaches the point where it is no longer cause for praise, the only thing left to do is offer suggestive criticism. Just where the blame lies is hard to say; but a few simple precautions in the future could prevent a recurrence of such bad feelings as existed during this year's contest: 1) Have a complete set of rules for the events published before the contests start, and not wait until the selling campaigns are half completed. 2) Have additional tickets and buttons equally accessible to all candidates so that each contestant has the opportunity to replenish his supply when he sells out.

However fundamental these rules may appear to be, they were nevertheless practices that were not followed this year.

The program and dance on March 13 went off with a measured amount of success. The intermission would have moved along more smoothly had the program been better organized, but the receptive mood of the audience overlooked any shortcomings on that score. Tom Smith, E.E. candidate, took a close race with Bill Meyer, Miner, for the St. Pat cup. Fifteen slipstick-toters with courage enough to defy custom vied with each other for the dubious honor of having the best beard. Jerome Marquardt, Ch.E. 1, with a beautiful crop of whiskers, caught the eyes of the Badger beauties judging this event. Glen Wesenberg, Ch.E. 3, took second place. Some silly stoop named John Ashenbrucker won a consolation prize by adding hair to his beard, thus giving him the appearance of a horse walking around backwards, and an unknown Irishman with green eyebrows also placed for a $5.00 gift certificate from the Co-op.

J.A.

CONTEMPORARY TEXTS

Engineering students upon graduation are usually well acquainted with the recent developments in their fields. This is a specific advantage which the "new" engineer has to pit against the years of experience which the established, practicing engineer can boast. It is only logical to assume that the advantage will disappear after the student has been out of touch with school for a number of years. That is, it would be logical if it were not for the large number of technical publications now available.

Technical publications are sponsored by progressive manufacturing and development companies, as well as by engineering societies and research institutes. Their purpose — in most cases — is to keep the practicing engineer "in touch" with progress. Technical publications are actually accomplishing the task which they have set for themselves.

One must use a certain measure of caution, however, in consuming the frequently optimistic literature released by industrial concerns. The purpose here is to create sales. It is a reasonable practice, and much information is to be found therein which is highly reliable. Further, it is a way for the company to announce that some new product or a refinement of a product is now on the market.

This is all very valuable to the design engineer and the product planners, but the same information from another source will be given more weight. This, too, is open to question unless presented by an entirely unprejudiced group. The most admirable examples of the latter are the engineering society monthly magazines. Here, then, is another major advantage of membership in such groups as AIEE, AIChE, ASME, ASCE, etc. Each month the member is presented with his contemporary textbook of recent advances in his field. This is an aspect which should not be overlooked when deciding—"Should I join?"

R.J.M.

S-T-A-T-I-C

by Chuck Strasse e'49

Hang onto your hats, here we go again. Due to the fact that spring is here, you will notice a few more poems.

* * *

She laid a pale and still white form
Beside the others there,
And then her anguished, piercing shrieks
Rang through the silent air.
With still another mournful wail
She turned upon one leg.
Tomorrow she'll be back again
And lay another egg.

* * *

Spring is the time when a young man's fancy turns, and so does his head.

* * *

Prof.: "So you finally came back to class. What was the trouble?"

Flatbush Engineer: "I had a cold in de-troit."

Prof.: "Well, what were you doing in Michigan anyway?"

* * *

A slide rule is an instrument for getting answers correct to the first three places, such as 2 X 44 is 8.80.

* * *

"Why do you call your girl pork chop?"

" 'Cause she costs more every time I see her."

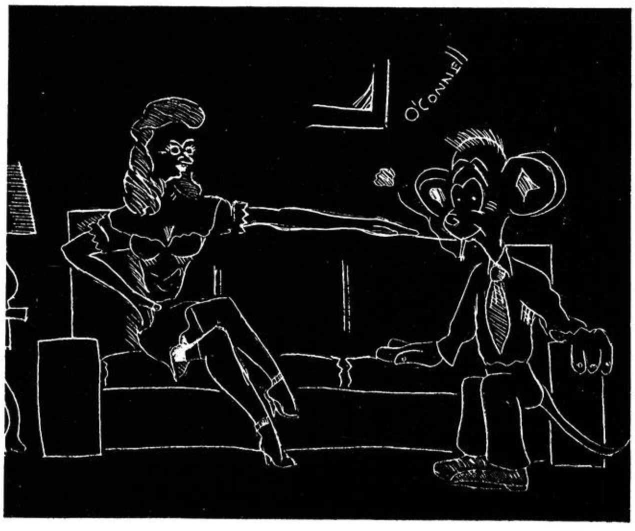
* * *

"Why is insulation put on wires?"

"To keep the birds from picking off the currents."

* * *

Said the Ohm to the Amp.: "Wire you so revolting?"



Er, uh, Myrtle. Maybe if we tried a penny in the fuse . . .

Mech. 53 quiz:
What are the different types of plaster?
Plaster of Paris.
Wall plaster.
Hard finish plaster.
Mustard plaster.
Corn plaster.

* * *

Watch for a new writer in this column. Her name is Yo-Yo, tele. no. G. 3.14159, address 32.2 E. Langdon. The following is a taste of what you can expect.

* * *

As the Indian said when his third wife died, "This is the last squaw "

* * *

If all the sleepers in physics 55 lecture were put end to end——they would be more comfortable.

* * *

Prof.: "You missed class yesterday, didn't you?"

Stu.: "No, not in the least."

* * *

A half breed is some one with a code in one nostril.

* * *

Under the mellow April moon the pretty co-ed sat,
And sat and sat and sat and sat,
While her boy friend fixed the flat.

* * *

Slam on the brakes, head for the ditch, the man of distinction is driving.

* * *

Mech. problem:

A 21-year-old, blonde, blue-eyed co-ed is walking down State street at 2.5 mph at 7:30 PM. How long will it take her to go from the square to Park street?

Ans.: 3 hrs. (There are five bars on the way and it's a 10:30 night.)

* * *

Spring is here,
The grass has riz.
Wonder what
My six weeks' average is?

* * *

Alcoholics Anonymous are expecting 20,000 new members in 1948. Remarkably close to our enrollment.

* * *

An engineer was late arriving at a tennis match. After a few minutes he said to the fellow next to him, "Whose game?" The voice belonging to the sweet young thing behind him answered, "I am."

(please turn to page 35)


100,000,000,000,000,000,
Is that "HER" voice?
Yes, indeed. That figure 1 up there, with hundreds of zeros trailing after it, represents the number of times "her" voice is amplified when she telephones you from across the country. Even on shorter calls, the total is tremendous.
The reason is that circuit resistance reduces the current which carries the voice. So every few miles vacuum tube repeaters refresh it by boosting its power as much as a million times.
The task of preparing new pathways for the voice occupies many qualified engineers. Tubes and amplifiers must be designed. Cable and intricate mechanisms must be produced. The lines themselves must be extended—over mountains and prairies, under rivers and through city streets—wherever the voice must travel.
Engineers who have a part in this job know there's a future in telephony.
BELL TELEPHONE SYSTEM
AMERICAN TELEPHONE & TELEGRAPH CO.
BELL SYSTEM
AND ASSOCIATED COMPANIES
000,000,000,000,000,000,

Science Highlights

by Robert Johnson e'50

IDEAL STANDARD OF LENGTH

The most precise standard of length yet devised by man is a light wave produced by mercury made by neutron bombardment of gold. The unit is a single wave of green light issued from an isotope of mercury with an atomic weight of 198. The present legal standard is a meter bar kept in the vaults of the National Bureau of Standards.

The process was developed at the University of California and Dr. William F. Meggers of the Bureau of Standards perfected the measurements. Dr. E. U. Condon, director of the Bureau, announced that the measurements based on the mercury green light wave, which is 21 millionths of an inch long, will make possible length determinations precise to one part of 100 million.

The advantage of a light wave standard over a physical standard is that it is indestructible and exactly reproducible. Cadmium red radiation had been provisionally adopted in 1927 as a wave length standard, but the new mercury radiation is a more nearly perfect monochromatic light. Because the mercury does not need the special heating equipment that cadmium does, it may be possible in the near future for any laboratory to have this easily reproducible basic standard of length.

ALLIGATOR "SNIFFLES" CORRECTED

Even alligators, crocodiles, and land tortoises are subject to the common cold. Director Robert Bean of the Chicago Zoological Park used to have plenty of sniffling reptiles on his hands every winter. Investigating, he found that his "swamp" was too cold for them. The result was the reptiles spent too much time in the water and they caught bad colds.

To keep his charges healthy, Director Bean decided to heat the sand in his swamp to an 80° F. temperature with a soil-heating cable. The cable was laid in sinuous loops in the area surrounding the pool and covered with sand and rocks to create the proper atmosphere. The cable is made of Nichrome wire, insulated with asbestos, varnished cambric, and coated with a lead covering.

Thermostatically controlled, the long heating cable maintains a cozy temperature of 80° F. Judging from all reports, Dr. Bean's reptiles now bask contentedly in their electrically heated swamp, suffer little sickness, and pass the long winters in much the same fashion they did in the old country.

PORCELAIN FOR TURBINE BLADES

The use of refractory porcelain as a material for the blades of the turbines in turbo-jet power-plants is a promising possibility. **Science News Letter** reports that R. F. Geller of the National Bureau of Standards has pointed out that porcelains have been found which can replace metallic alloys at temperatures above 1,500° F.

He explained that at high temperatures a porcelain blade with a tensile strength of 17,000 psi. would be the equivalent of a metal having a strength of 47,000 psi. The new porcelains suggest ways and means of increasing the net efficiency of turbine power-plants by permitting operation at temperatures of 1,800° F. and higher.

ROBOT CHEMIST

A "robot chemist" which uses electronics to determine the chemical content of gases quickly and accurately has been developed for industrial and research applications. The instrument, known as the "analytical mass spectrometer," is so sensitive that it can detect traces of one gas so minute that they represent only 1 part in 100,000 parts of another gas.

Formerly confined to laboratory research work, it has been designed for commercial use by General Electric. C. M. Foust reports that the analytical mass spectrometer requires but one-tenth the time needed by ordinary methods of chemical analysis.

The compound to be analyzed is introduced into an ionization chamber where its molecular components are given electric charges. The molecules are then accelerated through a magnetic field; and because the heavier molecules are deflected less than the lighter ones, the particles are spread across the collector plate in a molecular spectrum according to their weights.

SUNSPOTS AND RADIO

With sunspots staging what is probably their greatest activity for three centuries, radio communications are experiencing abnormal transmission conditions. Frequencies in the 50 megacycle band have been crossing continents and oceans with unheard of clarity. All this comes about with the increase in ionizing radiation from the sun concomitant with a peak of solar activity which has been unrivaled since 1778.

It is common knowledge that the ultraviolet radiation from the sun augments the electron densities in the upper layers of the ionosphere from which dx transmission is reflected. The prediction of communication requencies depends upon the time of day, the season of the year, and the sunspot cycle of 10 to 11 years' duration.

(please turn to page 44)

Alumni Notes . .

(continued from page 15)

number of new alumni. It must be the climate. The Johnson Service Co. has hired **Richard F. Bruning, N. J. Janisse, Russel Kliest,** and **J. V. Rudy.** To the American Appraisal Co. has gone **Harold P. Hertzog,** while **Forrest D. Gunderson** accepted a position with Le Roi. **Ralph C. Geigner** is working for Geo. J. Meyers and **Theodore E. Crawford** is with Oil Gear Co. **John W. Mann** is at the University of Wisconsin Milwaukee Extension Division.

— CE —

Leslie F. Van Hagan graduated in 1904 with a B.S. degree in Civil Engineering, and was conferred in 1919 with the title of Civil Engineer. At present he is Chairman of the Department of Civil Engineering, and Professor of Railway Engineering.

William S. Kinne graduated in 1904 with a B.S. degree in Civil Engineering, and is now Professor of Structural Engineering.

Ray S. Owen graduated in 1904 with a B.S. degree in Civil Engineering, and is Associate Professor of Topographic and Highway Engineering. He is an alumnus of Sigma Nu Fraternity.

Arno T. Lenz graduated in 1928 with a B.S. degree in Civil Engineering, and received his M.S. degree in 1930. The title of Civil Engineer was conferred upon him in 1937, and he was awarded the degree of Doctor of Philosophy in 1940. Professor Lenz teaches Advanced Hydraulics in the Civil Engineering Department.

Gerard A. Rohlich graduated in 1936 with a B.S. degree in Civil Engineering. He received his M.S. degree in 1937, and the degree of Doctor of Philosophy in 1940. He was conferred the title of Civil Engineer on September 28, 1940. Professor Rohlich is a member of Phi Kappa, Tau Beta Pi, Chi Epsilon, Theta Tau, and Sigma Xi fraternities. He is Professor of Sanitary Engineering in the Civil Engineering Department.

Eldon C. Wagner graduated in 1937 with a B.S. degree in Civil Engineering, and was awarded his M.S. degree in Civil Engineering in 1940. He is Professor of Surveying in the Civil Engineering Department.

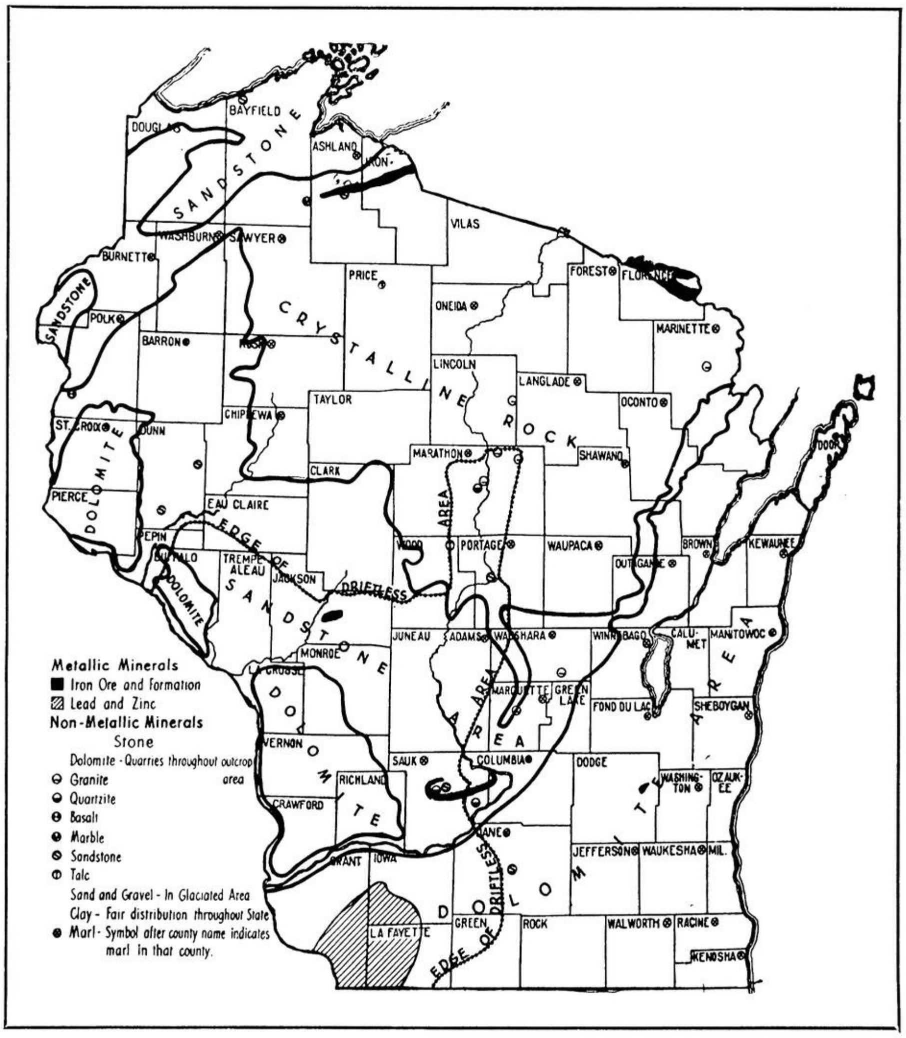
Thomas E. Fieweger ('18), construction engineer with the Central Engineering Company of Davenport, Iowa, has been elected director of Associated General Contractors of Illinois.

Frank S. King ('40) is track supervisor for the Pennsylvania Railroad, living at Sunbury, Pa.

(please turn to page 42)

LEAD . . .

(continued from page 8)



Map showing mineral distribution throughout the state of Wisconsin.

Courtesy of the Wisconsin Geological and Natural History Survey.

somewhat different here. These pioneers knew that the ore they were looking for, sulphide of lead, occurred in veins, and that these veins were in the strata that they named the "cliff limestone." The veins often occurred in groups, the veins running parallel to themselves, generally in an east-west direction. The signs that they looked for included evidence of previous digging by the Indians, old Indian furnaces, and an extraordinary presence of the "masonic weed," which was supposed to send its roots down to the lead in the veins below.

When the miner started his shaft, he hoped that when he got down to the proper level, he would come right into the vein. Then he had only to drift out along the vein in either direction to remove the ore. If he did not strike the vein with his shaft, he would then drift north and south, thus hoping to cross a vein after a short distance. When the vein had been located, the miner would start removing the ore to the surface. He used a windlass at the top of his shaft to lift out the buckets of material. (In fact, his shaft very closely resembled a well from outward appearances.) As the drift extended away from the foot of the shaft, a wheelbarrow was used to move the ore from the working face to the shaft, where it was placed in the bucket to be hoisted to the surface. For light, the miner used candles, stuck in a gob of clay. When this clay was placed against any surface, it would adhere. Thus he had a light that was adaptable to any situation. Besides pick, shovel, and crowbar, these miners brought in the hand drill and blasting powder to facilitate removing the ore.

With the ore out of the mine, the next step was to concentrate the lead, making it pure. The first furnaces used were those similar to those of the Indians. But these furnaces left most of the lead in the refuse, and thus were not very efficient. Indeed, in the future, some of these waste materials were resmelted at a considerable profit. The log furnace was next, an improvement over the original type. This furnace was built of limestone, or sometimes of fire brick. Built against a slope, it consisted of three enclosing walls, with a trough formed in the sloping bottom. At the lower end of this trough or channel was an arched opening, called the "eye," which permitted a draft to enter the furnace, and also allowed the lead to flow out into a receptacle at the outside of the furnace, where it was ladled into molds. The furnace was charged by laying logs across the channel, filling the spaces with smaller pieces of wood, then covering this with ore. Wood was piled around the ore, and also on top of it, so that before the fire was kindled, the ore was completely covered by the fuel. The heat would usually take about 24 hours, and would recover from 50 to 60 per cent of the lead content of the ore.

Because the log furnace was inefficient and not very durable (the high temperatures reduced the limestone to lime), it was natural that attempts would be made to develop superior processes. The Drummond furnace allowed the heat from the fire to pass over the top of the charge as well as underneath it. Using a water-wheel to drive the bellows, these blast-type furnaces soon came into general use. They recovered much more of the lead from the ore, and consumed considerably less fuel than the older types. Even more efficient smelters were developed somewhat later, but new problems were to cause a decline in the lead industry.

After 1847, lead mining in Wisconsin began to fall off. As the mines became deeper, the cost of working them increased. Furthermore, the water table was reached and indicated revolutionary changes in mining methods. It became necessary to install pumping machinery, or to excavate some drifts at lower levels for the sole purpose of draining the mines. Sometimes cooperative effort was required to meet this problem. In any circumstance, considerable capital was required, and as the deeper ores contained less lead, mining activity slowly dwindled. Another factor that contributed to this decline was the fact that as the mines went deeper, the ores contained progressively more zinc sulphide. This was considered worthless at the time, and was thrown away. Zinc was first marketed from this area in 1860, and gradually became the predominant product. The mining of zinc was done under more modern conditions than we have described here, so it seems well to conclude the story of lead mining in Wisconsin at this point. When the zinc was mined, it was done by a relatively few corporations, with no mining done by the small organizations that were typical of the pioneer lead days. Thus the old shafts were gradually filled up to make way for the plow, and both the mining farmers and the farming miners became simply farmers.

OPPORTUNITIES IN FINLAND

LEGATION OF FINLAND
2144 Wyoming Avenue, N.W.
Washington 8, D. C.

Gentlemen:

With reference to your letter of the 22nd of August 1947 and my reply thereto dated the 12th of September last, I am pleased to give you below the information which I have just received from Finland in answer to your inquiries concerning opportunities for American engineers in Finland, as set forth in your letter mentioned above.

1) There are possibilities for employment for engineers of all the classes listed, since for the time being there is a shortage of engineers in a number of fields in Finland. A lack of knowledge of the Finnish language, however, would restrict the duties to which foreign engineers might be assigned.

2) Employment is available in research in the field of Chemistry and possibly Metallurgy.

3) a) College graduation is a minimum requirement.
   b) Yes, engineers just obtaining their bachelor's or master's degree are eligible. In the field of research, however, wider experience of course is desirable.
   c) The beginning salary of a young engineer graduate is approximately $120 to $140 per month; for older, experienced engineers, $220 to $250 per month.
   d) The best understanding of the cost of living may be gotten from the fact that a single person can manage well on the beginning salary of a young engineer in accordance with Finland's modest standard of living.
   e) No arrangements are made for the families.
   f) No difficulties are encountered in obtaining work visas. At present there is lack of man-power.
   g) Generally travel costs are not covered by the Finnish Government or other possible employers.

I trust the foregoing fully answers your questions and reaches you in sufficient time to meet your requirements.

Sincerely yours,
Olavi Munkki
Charge d'Affaires a. i.

EDITORIAL COMMENTS

from E.C.M.A.*

** Engineering College Magazines Associated*

"... Your prospective employer takes a decided interest in the list of activities on your personal record. . . . Employers regard a man's personality as one of the most important factors in considering his employability. . . . The term 'personality' is difficult to define, but specific personal characteristics can be mentioned that are regarded as most important . . . ability to cooperate and get along with others, ability to meet and talk easily with people, a neat well groomed appearance, alertness, dependability, and enthusiasm. Other contributing factors are initiative, a sense of humor, confidence, and courtesy . . ."

Purdue Engineer, December, 1947.

"... The ideas concerning student activities have been rather interesting to watch. . . . There is one group of students who say they can't spare time from studies to put out a magazine, others who feel that they would rather spend their free time in athletics or with dates, and still others who feel that the training, contacts, and pleasure derived from the work required is worthwhile . . ."

Oklahoma State Engineer, December, 1947.

"... It is the duty of the engineering students of today to study and learn and practice better human relations. Only then can the engineer of tomorrow be qualified to aid in attaining not only industrial peace, but peace among the nations of the world. . . ."

Iowa Engineer, December, 1947.

"... The object of going to college, we are told, is to obtain an education that cannot be obtained elsewhere. In the pursuit of an education, however, many students so diligently concentrate on 'booklearning' that they entirely overlook another aspect of education: that of associating with and learning to know and appreciate their fellow students. . . ."

The Michigan Technic, November, 1947.

"... There is nothing that will degrade a school standing faster than a poor spirit and a poor scholastic standing. . . . Don't think for one minute that your spirit and cooperation will not be missed because of the large number of students. . . ."

Missouri Shamrock, October, 1947.

"... Participation in college activities, especially engineering activities, was disgustingly low . . . Perhaps if the 'glamour boys' . . . would break away from their country-club lives for a while, the situation would be remedied. Perhaps if the 'moaners' of Pollack Circle would come out of their shells and meet the college half-way, the situation would be remedied. Perhaps if the incoming sophomores possess a willingness to cooperate, now a rarity on campus, the situation would be remedied. . . ."

Penn State Engineer, October, 1947.

"... It seems clear that within a few years when the present large freshman and sophomore classes graduate, the strictly professional openings in engineering as well as in other occupations will be limited. Hence thought must be given to careers in general for which an engineering education provides a superior background, for every engineering graduate cannot expect to find the precise technical job which may appeal most to him. There will always be adequate opportunities to utilize one's engineering education effectively for a successful career, but many of us should begin now to condition our outlook to recognize that design and construction are the **sin qua non** of an engineering education. . . ."

N. Y. U. Quadrangle, November, 1947.

"... We must abandon the notion that an engineer may be 'broadened' simply by exposing him to some professor in a liberal arts college for four or five hours a term. This cannot be depended upon to work because, first, the engineering courses tend to narrow the student into the same groove for thirteen or fourteen hours each semester, while only one arts course counteracts the tendency, and, second, we have no assurance that this arts professor is not just as narrow and restricted in his field as we are in ours. . . ."

Nebraska Blue Print, November, 1947.

"... Hard work will probably bring you no business success unless it is seen by the boss . . . prejudiced personal contacts are more determinant of ability than the ability itself. All of which makes us wonder at the callous hypocrisy that represents 'maturity' in man, who is supposedly far above the animals. . . ."

The Tech Engineering News, November, 1947.

The man who cooled a million hotheads

Some women can fix anything with a bent hairpin. But it took a man to solve a problem that had stumped the hairpin experts for generations.

He solved the irritating problem of opening and shutting stubborn windows without benefit of crowbars, by means of an ingenious, automatic sash-balance, which enables you to perform that operation with one finger.

The principal member of this new temper-saver is a length of high carbon, sash-balance spring steel made by Roebling. The manufacturers have such confidence in this Roebling product that they guarantee their sash balance for the entire life of the building in which it is installed.

Roebling flat spring steel is one of the most widely used of the hundreds of Roebling products, yet it is the least known. Few men think of umbrella stays, clock springs, feeler gauges, measuring rules and tapes, and thousands of other articles, in terms of flat spring steel.

On the other hand, when enterprising inventors create knotty design problems, when competition dictates re-design of a product in order to lower costs, engineers invariably look to these Roebling products for at least part of the solution.

Born of free enterprise . . . the system that creates demands for thousands of articles that are unknown to the citizens of other countries . . . flat wire and flat spring steel point the way to other undreamt of developments and markets.

Roebling flat wire and spring steel have earned the confidence of designers and engineers throughout industry . . . the world over.

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Freshman Engineer HONOR LIST

1st Semester 1947-48

Rate: High Honor Rate, 2¾ points per credit
Honor Rate, 2½ points per credit

HIGH HONOR RATE

Lange, J. R.	3.000
Miller, D. F.	3.000
O'Connor, R. D.	3.000
Root, D. F.	2.941
Bell, H., Jr.	2.882
Munson, J. F.	2.882
Engel, C. W.	2.824
Fieve, R. R.	2.824
Kaneshige, H. M.	2.824
Koenecke, M. M.	2.824
Lenz, J. R.	2.824
Raabe, R. E.	2.824
Zimmerman, D. L.	2.824
Schowalter, W. R.	2.765

HONOR RATE

Marquardt, J. C.	2.706
Wright, H. J.	2.706
Grochowski, J. E.	2.647
Van Norton, R. N.	2.600
Ambrose, E. A.	2.588
Eichelkraut, A. A.	2.588
Wichman, R. H.	2.588
Anderson, J. E.	2.579
Anderson, W. S.	2.529
Crump, J. K.	2.529
Kopp, R. W.	2.529
Faulks, J. T.	2.471
Petzrick, P. A.	2.471
Rossi, E. F.	2.471
Bolender, J. W.	2.412
Borcherding, L. J.	2.412
Debbink, J. P.	2.412
Gerschke, F. R.	2.412
Hergenrother, E. L.	2.412
Jerome, R. H.	2.412
Trowbridge, J. J.	2.412
Zrmsek, P. J.	2.412
Engeldinger, K. J.	2.398
Sauer, W. F.	2.353
Wibbens, R. L.	2.353
Mutimer, M. B.	2.353
Wood, R. E.	2.333
Anderson, T. J.	2.294
Crump, J. M.	2.294
Priem, R. J.	2.294
Wallesz, M. A.	2.294
Punko, E. M.	2.286
Shay, R. W.	2.278

The following students, although not working at the honor rate, are in the high fifteen per cent of the class.

Bodenstein, N. F.	2.235
Gruetzmacher, L. H.	2.235
Jennings, J. L.	2.235
Kast, H. B.	2.235
Kraina, J. H.	2.235
Kronholm, H. O.	2.235
Stanley, W. A.	2.235
Rogers, R. E.	2.222
Young, G.	2.214
Anderholm, F. R.	2.200
Fischer, H. G.	2.176
Karas, H. R.	2.176
Lange, H. R.	2.176
Montgomery, D. C.	2.176
Pickup, L. I.	2.176
Pope, K. A.	2.176
Rea, R. D.	2.176
Wundrow, W. J.	2.176
Shillinglaw, H. M.	2.167
Litterst, R. S.	2.158
Connell, R. D.	2.133
Case, J. C.	2.118
Champion, M. M.	2.118
Johnson, S. C.	2.118
Pitt, C. H.	2.118
Safford, R. D.	2.118
Slotten, E. K.	2.118
Torphy, T. E.	2.118
Whalen, R. W.	2.118

Modern Heating . . .

(*continued from page* 19)

The main advantages that are now claimed for radiant heating by its various advocates are as follows:

1. The radiators are out of sight and do not occupy floor space which can be used for other purposes.

2. When the structural frame of a building has been completed the heating system has also been completed, and heating can be begun immediately to facilitate the completion of the interior work.

3. When used in prisons and asylums, the system cannot be tampered with by the inmates.

4. The system can be used for cooling as well as heating in those localities where the humidity is not too high.

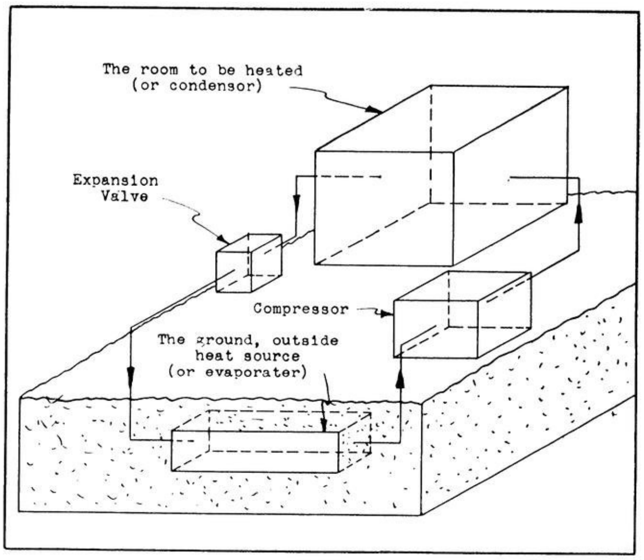
5. The floors are warmer (for floor panels) than in buildings heated by more ordinary systems and cold air currents along the floor are less intense.

6. Air currents within the room are materially reduced so that dust particles can settle out.

7. The first cost of the system depends largely on labor costs and will not vary much from that of the ordinary systems.

8. The cost of operating the system is somewhat lower than that of the ordinary system for the following reasons: (a) for equal comfort, the temperature of the air within the room is slightly lower and hence the cost of heating the air which passes through the room is lower; (b) the heat loss through outside walls is somewhat lower, especially when the windows have double glazing; (c) when either water or air is used as the heating medium, lower temperatures are used than in ordinary systems and therefore an economy in fuel combustion can be effected.

It is the author's contention that some of these advantages are "commercialized" to advance the use of radiant heating systems. At the present time the installation cost is still excessively higher than that of steam radiation or hot air installations, but perhaps the time will come when design procedures become practical enough to warrant radiant heating on an extensive basis.



Flow diagram shows the reverse refrigerating cycle of the heat pump.

The "heat pump" is the name commonly applied in present commercial practice to a year-round air conditioning system that employs the standard refrigeration cycle but has as its main objective adding heat to a given space instead of removing heat.

The cycle operates as follows: The gaseous refrigerant leaves the evaporator, enters the compressor, and is compressed to a pressure high enough to be condensed in the condenser by a comparatively low temperature. On leaving the condenser it passes through an expansion valve where in changing from a high pressure to a low pressure it drops in temperature. This low pressure, low temperature liquid is then introduced into the evaporator where it absorbs heat from the evaporator medium and is volatilized or "boiled" into gas. In the refrigeration cycle the main objective is the removing of heat from the evaporator medium.

The heat pump cycle used for heating is the same as that of refrigeration but the room or space to be heated acts as the condenser and an outside heat source acts as the evaporator. The outside heat source can be either air, ground, or well water. The system would run on the following cycle: The refrigerant on leaving the evaporator as a low temperature, low pressure liquid would enter the outside heat source which would be higher in temperature than the refrigerant. Here the refrigerant would absorb heat from the heat source, be volatilized, and then pass to the compressor. After being compressed to a high temperature and pressure, the refrigerant would pass to the room to be heated which would be at a temperature lower than the refrigerant and the refrigerant would condense, giving off its heat to the room. Both the heat and condensation and the heat added during compression would be available for heating of the room.

Secondary fluids can also be incorporated into the system: for example, the refrigerant need not pass directly to the room to be heated but it could be used to heat water or air which could then be sent to the room for heating purposes.

ELECTRIC HEATING

Up to the present time electricity has been used in heating designs only for auxiliary uses or for reheat coils on some air conditioning systems. The high cost of electricity in comparison to coal, gas, or oil furnace operating costs prohibits its use as a main heating system. However, with the birth of atomic power, it is no longer unimaginable that some day the cost of electricity will no longer be prohibitive in main system use. Because of its cleanliness, ease of operation, and no storage problem, electricity will probably come into wide use if this comes about.

Here, then, are four of the most modern and up-to-date heating methods. Before planning a home, all of them should be investigated to see which, if any, can be applied. Through continued advances in design, through changes in installation techniques, and through the lowering of costs by mass production, more and more of these systems will find their way into the home of tomorrow.

RADIATION . . .

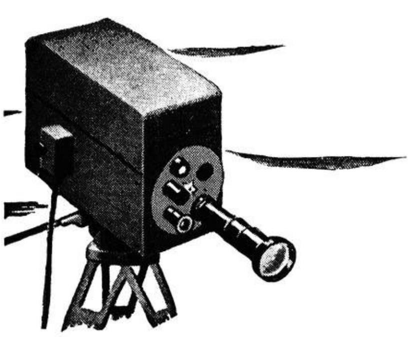
(*continued from page 11*)

remove the finger prints, it became electrified and the complete period of swing fell to less than a second. After several days the period returned to about 3 seconds and the instrument was used in this condition for stellar observation. The sensitiveness was only one fiftieth as great, yet a candle at 2.4 meters with one silver reflection and 3 plates of quartz between it and the radiometer gave a deflection of about 80 mm. on a scale at 0.4 meters. This method was discarded in favor of the radiation themocouple and the bolometer, and has not been used extensively for this purpose since that time.

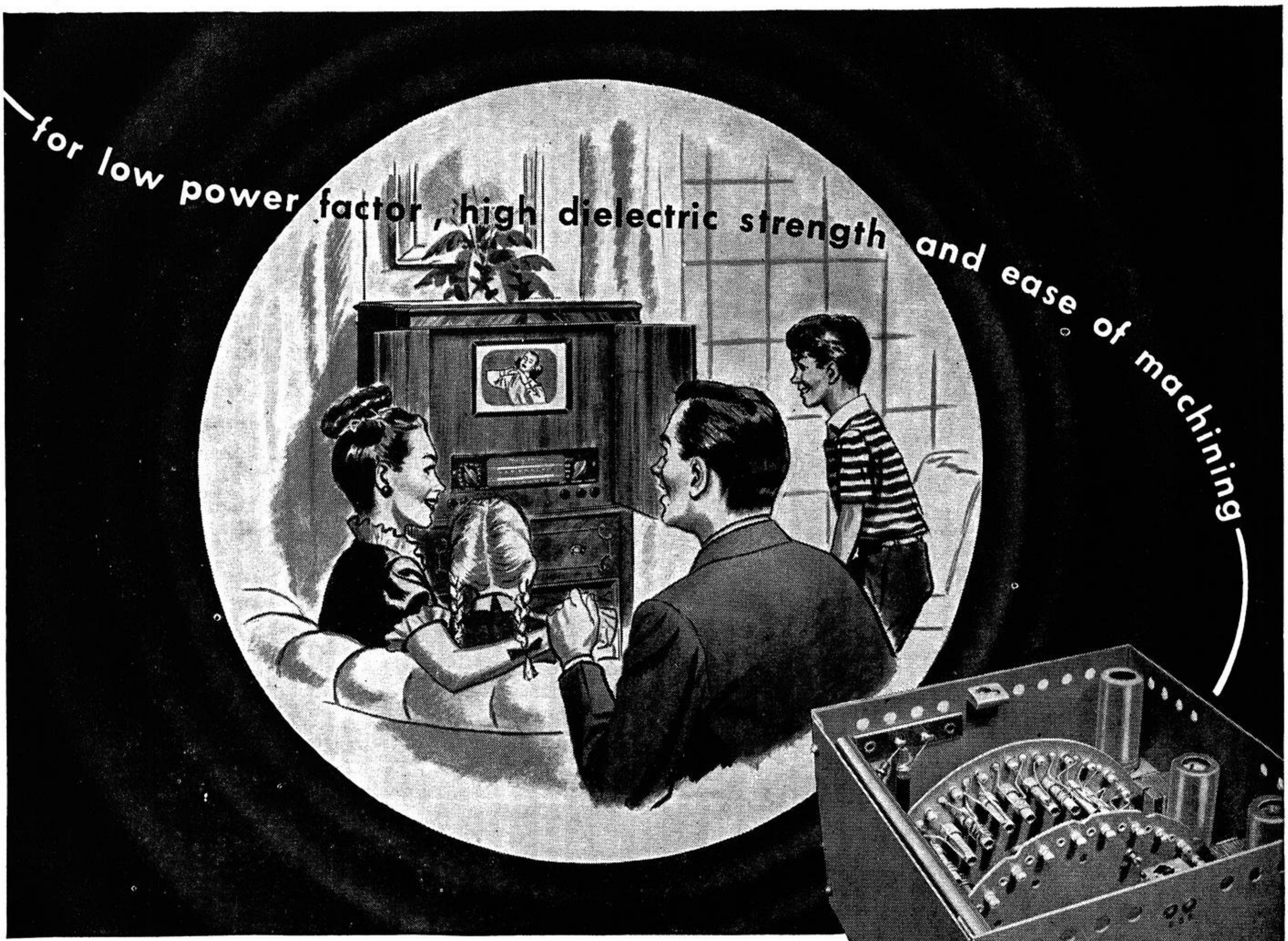
The two major disadvantages of all these instruments are that they are not sensitive enough for most stellar radiations and that they are not sensitive to any particular color of the spectrum.

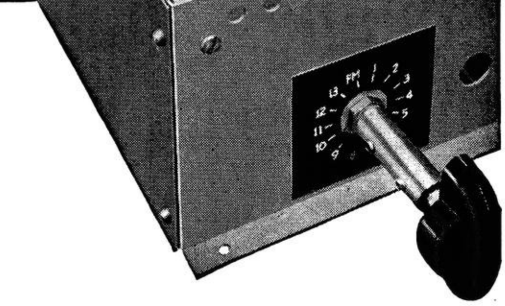
In recent years the photo-electric cell has been perfected to a point where it answers these two problems most satisfactorily. Aside from the fact that the cathode of a photo-electric cell can be made sensitive to a certain wave length or band of the spectrum, they can be used in conjunction with an amplifier system and have thus given a sensitivity of 100,000 times that of the bolometer or such similar heat devices.

In the next issue the photoelectric cell as a stellar radiation device will be discussed in detail, as well as the various applications of the photoelectric radiation detector.



Plastics where plastics belong





Synthane where Synthane belongs

HERE'S Synthane at work in a channel selector turret . . . the nerve-center of any television receiver. Synthane is employed for a number of the intricate parts to insure extreme electrical and mechanical precision and rugged operation. It's an appropriate job for useful, hard-working Synthane . . . a timely example of plastics where plastics belong.

In addition, Synthane is moisture and corrosion resistant, hard, dense, easy to machine, and has unusual electrical insulating qualities. Synthane is also structurally strong, light in weight and stable over wide variations in temperature.

These and many other properties—combined—make Synthane adaptable to countless chemical, electrical and mechanical applications. Synthane Corporation, 14 River Road, Oaks, Pa.

SYNTHANE
S

SYNTHANE TECHNICAL PLASTICS • DESIGN • MATERIALS • FABRICATION • SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-MACERATED • MOLDED-LAMINATED

S-T-A-T-I-C . . . *(continued from page 22)*

First Lawyer: "As soon as I realized it was a crooked business I got out of it."
Second Lawyer: "How much?"

* * *

They call him buck teeth, because that's what he paid for them.

* * *

Mary had a little lamb;
Her father shot it dead,
And now it goes to school with her
Between two hunks of bread.

* * *

We always say that a cow on a curve isn't nearly as dangerous as a curve on a calf.

* * *

"Join me in a cup of coffee?"
"Sure, you get in first."

* * *

Cave men used to knock girls senseless, but that is no longer necessary.

* * *

Thanks for the hug.
The pressure was all mine.

* * *

I think that I shall never see
A girl refuse a meal that's free
A girl whose hungry eyes aren't fixed
Upon a malt that's being mixed
A girl who doesn't like to wear
A lot of doo-dads in her hair
Girls like that aren't liked by me
But who the heck would kiss a tree . . .

Foreign Students . . .

(*continued from page 20*)

Talaat Youssef

design, or to be more specific, analytical design. He has not definitely decided on his thesis subject yet, but at present he has narrowed it down to a research on "Mechanical Vibrations in Crankshafts" or "V-Belts." Talaat is working under the direction of Professor R. J. Harker, and expects to complete the work for his Doctorate by June, 1949.

Before returning to Egypt Talaat plans to spend a short time in the United States getting some practical experience. On returning to Egypt he must work seven years for the Egyptian government to fulfill his part of the agreement whereby they financed his advanced schooling.

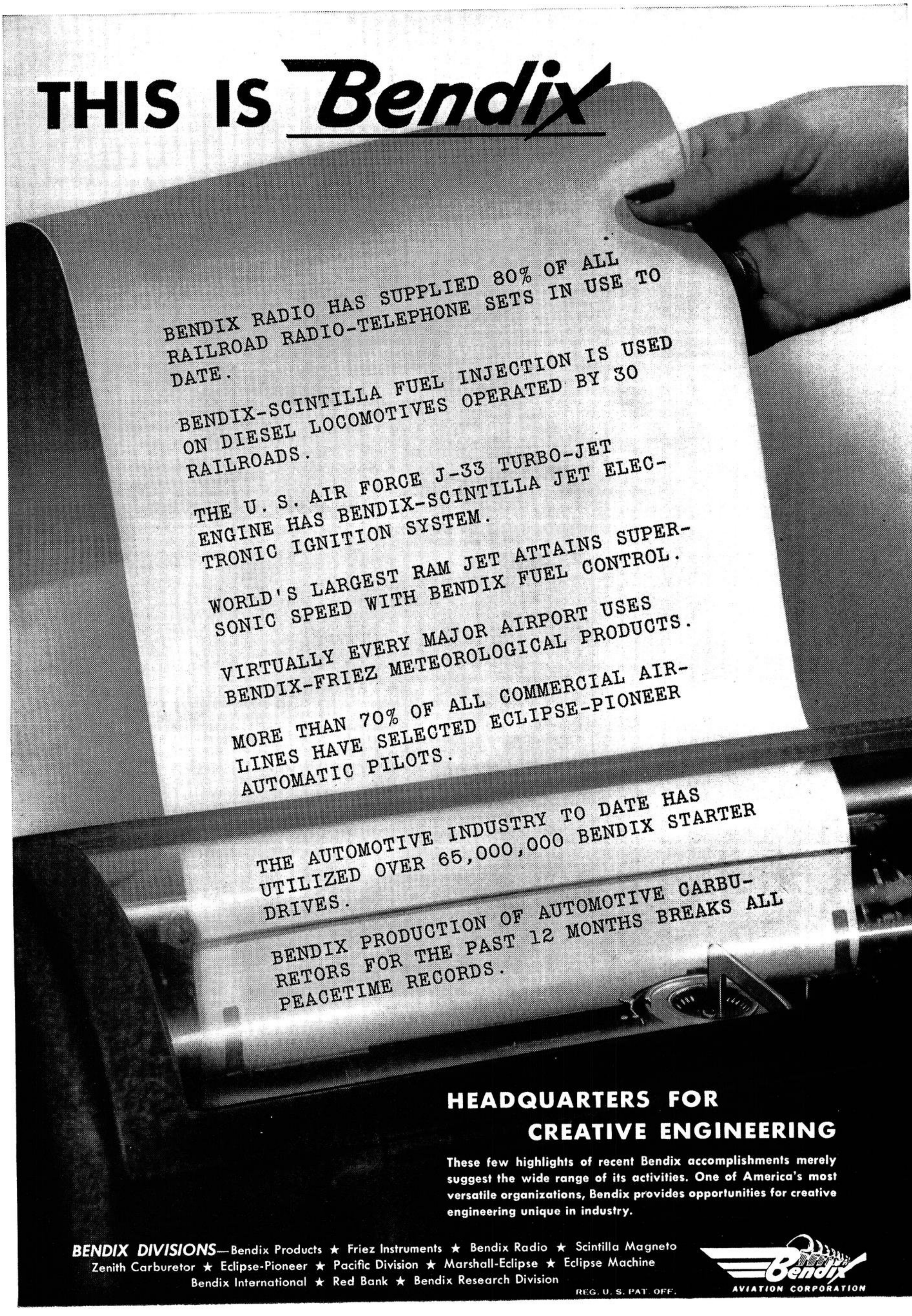
Talaat is an Assistant Fellow of the Royal Aeronautical Society in London, Egyptian Branch, and is a Junior Member of the Society of Automotive Engineers. His favorite sports are swimming, rowing and tennis. While at Fouad I University in Cairo he was a member of the varsity crew team of the School of Engineering. The various schools of the University competed in a tournament and Talaat was a member of the winning Engineering School crew.

Knut Lofstad

Houghton, Michigan, in which teams from the University of Minnesota, Michigan Tech., and the University of Minnesota at Duluth competed. This competition was for four-event teams, where each man must do all events, jumping, cross-country, slalom-downhill and downhill running. Knut's specialty is slalom-downhill. At Leland, Michigan, last year, Knut won the General Midwest Slalam-downhill, while this year at Houghton he placed second. Knut is also a sailing enthusiast and is a member of the Hoofer Sailing Club.

Although his first interest is in skiing, his hobby of sailing is by no means a small one. In Norway Knut has sailed on pleasure craft that ranged in size from 15 up to 55 feet. Most of his experiences are in day sailing and cruising, and such stories of adventure and his analysis of the engineering principles involved in the use of a boat might be of particular interest to sailing enthusiasts.

Knut feels that the free enterprise in the United States offers better opportunities than are to be had in Norway. He likes the University of Wisconsin campus and the nice friendly atmosphere here, but has also found some inexperienced instructors in the teaching staff. He is a member of the Society of Automotive Engineers and, of course, the Wisconsin Hoofers.


THIS IS Bendix
BENDIX RADIO HAS SUPPLIED 80% OF ALL RAILROAD RADIO-TELEPHONE SETS IN USE TO DATE.
BENDIX-SCINTILLA FUEL INJECTION IS USED ON DIESEL LOCOMOTIVES OPERATED BY 30 RAILROADS.
THE U. S. AIR FORCE J-33 TURBO-JET ENGINE HAS BENDIX-SCINTILLA JET ELECTRONIC IGNITION SYSTEM.
WORLD'S LARGEST RAM JET ATTAINS SUPERSONIC SPEED WITH BENDIX FUEL CONTROL.
VIRTUALLY EVERY MAJOR AIRPORT USES BENDIX-FRIEZ METEOROLOGICAL PRODUCTS.
MORE THAN 70% OF ALL COMMERCIAL AIRLINES HAVE SELECTED ECLIPSE-PIONEER AUTOMATIC PILOTS.
THE AUTOMOTIVE INDUSTRY TO DATE HAS UTILIZED OVER 65,000,000 BENDIX STARTER DRIVES.
BENDIX PRODUCTION OF AUTOMOTIVE CARBURETORS FOR THE PAST 12 MONTHS BREAKS ALL PEACETIME RECORDS.
HEADQUARTERS FOR CREATIVE ENGINEERING
These few highlights of recent Bendix accomplishments merely suggest the wide range of its activities. One of America's most versatile organizations, Bendix provides opportunities for creative engineering unique in industry.
BENDIX DIVISIONS—Bendix Products ★ Friez Instruments ★ Bendix Radio ★ Scintilla Magneto Zenith Carburetor ★ Eclipse-Pioneer ★ Pacific Division ★ Marshall-Eclipse ★ Eclipse Machine Bendix International ★ Red Bank ★ Bendix Research Division
REG. U. S. PAT. OFF.
Bendix AVIATION CORPORATION

Campus . . .

(continued from page 14)

ENGINEERING RESEARCH TALK

On the evening of March 3 Mr. A. T. Waidelich, Assistant Director of Research for the Austin Company, discussed the coordination of civil, mechanical, electrical, and architectural designers in the planning of modern industrial plants.

Mr. Waidelich's talk, "Industrial Plants—Who Designs Them?" was supplemented by slides showing examples of research and new developments. Special topics touched by Mr. Waidelich included: Industrial Architecture, Plant Designs for Maximum Efficiency, and Controlled Conditions involving windowless plants.

Sponsors for the talk were the student chapters of the engineering societies on Campus.

WHAT A MAN, THIS PAT

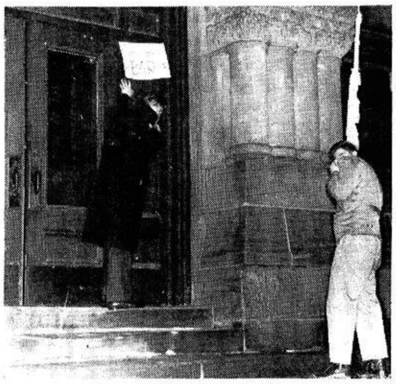
Reeling off Celtic songs with a bit of an authentic accent, Roger M'Hugh, a true Irishman from Dublin and guest lecturer in English on the Hill, revealed to the members of Triangle Fraternity that St. Patrick was really two men. It seems that the Association for Advanced Studies in Dublin has reached this conclusion in a book published on the subject. M'Hugh made this startling revelation on St. Patrick's day just before kissing the Blarney Stone over the bookcase while waiting for dinner to be served. The Irishman suggested that perhaps St. Pat was both a lawyer **and** an Engineer, but his explanation doesn't seem plausible.

THETA TAU

A Western theme prevailed at the party held by Theta Tau, engineering fraternity, on Friday evening, February 27, at Turner Hall. John Pike acted as master of ceremonies for the evening's entertainment of dancing, games, and refreshments. Professor and Mrs. G. A. Rohlich were chaperons for the party.

ASME

Mr. Harry W. Highrighter of the Vascoloy-Ramet Corporation spoke to the student chapter of American Society of Mechanical Engineers in the Old Madison room of the Union on March 9. He spoke on "Powder Metallurgy," a fairly new process involving the building up of small parts by compressing finely powdered metals under extreme pressures. Sandwiches and beer were served after the talk.



Dirty Work at the Law Building. The solicitous photographer who left this shot of Comrade 'X' and Comrade 'Y' (of the notorious X-Y axis) in the 'ENGINEER' box may now have the print back.

ETA KAPPA NU

Eta Kappa Nu, honorary electrical engineering fraternity, met on March 2 in the Memorial Union for a short business meeting with a social gathering afterwards. Keys and shingles were distributed to new members.

ATOMIC ENERGY

"Will Atomic Energy Serve or Destroy Mankind?" was the topic discussed in the Union on Tuesday evening, March 2. Dr. Farrington Daniels, Chemistry; Prof. W. W. Beeman, Physics; and Prof. David F. **Ellman**, Political Science, couldn't seem to agree on the answer. It appears that no one else can agree either; and it does present a problem as answerable at present as the question of which came first—the chicken, or the egg?

A page for YOUR BEARING NOTEBOOK

A FACT WORTH REMEMBERING! Yes, and we're saying it good and loud because it explains one of the basic reasons why 9 out of 10 bearing applications can be handled more efficiently with Timken tapered roller bearings.

As an engineer you'll run into many important problems involving bearing applications. If you'd like to learn more about this phase of engineering we'll be glad to help. Don't forget to clip this page for future reference—and, for additional information write today to The Timken Roller Bearing Company, Canton 6, Ohio.

Patent Law . . .

(*continued from page* 18)

NOVELTY

There are a number of statutory rules which determine whether or not a patent can be anticipated or invalidated on the basis of lack of novelty. In general, the patent laws require that the invention or discovery be new and that the invention shall not have been patented or described in any printed publication in this or any foreign country **more than one year before** the filing of the patent application. A "printed publication" means that the work must have been printed and published. Publication requires either a sale or offering of the printed matter for sale, or deposit of the printed matter in a public library where it is indexed, or otherwise making the work available to the public.

The laws also provide that the invention must not have been in public use or on public sale more than one year before filing the patent application. This requirement applies only within the United States. An inventor who had no knowledge of a foreign public use or sale is not barred from obtaining a patent in the United States.

A public use must be distinguished from experimental, accidental and secret uses. If an invention was used experimentally and the primary purpose was experimental, even though some incidental profit was made, the courts have held this use no bar to a patent; however, if the primary purpose was for profit and experiment was only incidental, the courts have held it to be a public use and a bar to a patent. An accidental or unintentional production of a process or device will not invalidate a patent. Such cases usually involve rejection of the accidental result because it was considered faulty or because its value was not recognized by the accidental user.

A secret use is not a bar to a patent. Frequently corporations use an invention in secret and prefer to maintain a trade secret over a period of years by requiring employees to take an oath of secrecy and by other extensive security measures. It is interesting to note that in such cases somebody else, entirely independent of the secret user, may invent the trade secret and obtain a patent, which the courts will not allow the prior, secret user to invalidate.

PRIORITY OF INVENTION

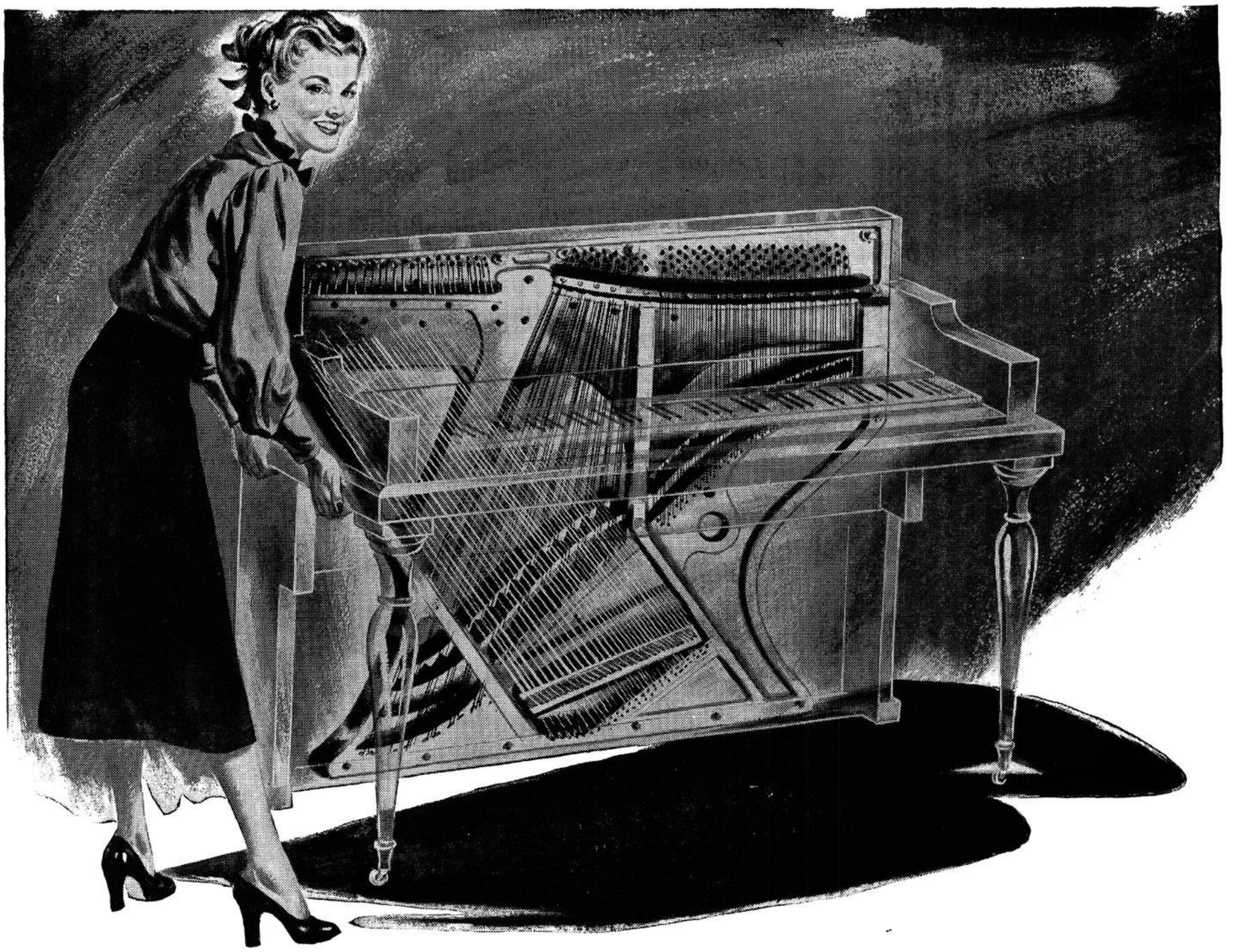
In general, only the first inventor who has given the knowledge to the public is entitled to a patent in the United States. He, and he alone, is entitled to the patent. If he does not choose to obtain a patent on the device, but dedicates it to the public instead—no one else can. There are cases, however, in which patents are actually granted to the second inventor. Such cases involve the revival of a lost art, patenting of a device which some other inventor has abandoned and never made public and patenting a device which some other inventor has used in secrecy. These cases are not an exception to the rule since the second inventor gives the knowledge to the public.

Frequently, two inventors working independently of each other, apply for patents within a short time so that their patent applications are pending at the same time. The patent office must then decide who is the first inventor. To facilitate explanation, let us say A and B have patent applications pending on the same device. The party who first reduced his invention to practice, B, is considered to be the first inventor unless the other party, A, can show that he conceived the idea prior to the time B conceived the idea, and that he, A, proceeded to reduce his invention to practice with due diligence. Reduction to practice is the making of a full sized operative model of the invention. An inventor need not necessarily make a model of his invention since the filing of a patent application is considered constructive reduction to practice and serves in lieu of actual reduction to practice. The courts are strict in requiring diligence in reduction to practice. If A proved that he was the first to conceive the idea but had stopped working on the invention for a considerable length of time after B had conceived the idea, he would not have used due diligence and B would be considered the inventor; however, if A proved that he was the first to conceive the idea and had begun to work on the invention again slightly before B entered the field, A will be considered the inventor providing he used due diligence from that time on.

OWNERSHIP OF PATENTS

As stated before a patent is granted to **the** inventor—it can only be granted to the true inventor. Ownership of the patent belongs exclusively to the inventor; however, he can sell or assign his patent. In general, ownership of a patent can only be transferred by an oral or written agreement to do so; the courts are reluctant to enforce an **implied** contract of transfer. Such contracts can be entered into before an invention is made. Employers frequently require that their employees enter into agreements which provide that any invention made by the employee during the term of employment will be assigned to the employer. Such agreements must be reasonably limited or the courts hold them non-enforceable as contrary to public policy. For example, an employee entered into an agreement which required assignment of any inventions which the employee has made or conceived or may at any time hereafter make or conceive and extended to any business in which the company or its successor is or may be concerned. The court held those provisions of the contract contrary to public policy and non-enforceable since they were not **limited in time or subject matter.**

(*please turn to page* 48)



The Piano Business Gets a LIFT... when Alcoa Aluminum Castings Replace Heavy Metal

Even a well-trained husband who'll rearrange the living room every Spring balks at piano-moving. You can see the main reason above. It's the big metal plate that holds the strings—and it has always tipped the scales at around 125 pounds.

No wonder it gave the piano business a *lift* when a progressive piano builder replaced the heavy iron plate with one weighing 45 pounds—made of Alcoa Aluminum. As perfected, this big casting from our foundries is strong to resist the 18-ton pull of the taut strings. It is stabilized to provide tonal quality and stay in tune. And its cost today is competitive with the old-fashioned cast-iron plate.

With other advantages, in other industries Alcoa Castings are effecting similar changes. In one plant, their corrosion resistance means no painting, simple finishing. In another, they are liked for their superior machinability. In still another, they are preferred for the ease with which they swing through production, where iron castings had to be hauled by truck or hoisted on heavy cranes.

The change from heavy metal castings to Alcoa Aluminum Castings is a revolutionary switch in product engineering. Old, old habits are being questioned as engineers re-evaluate metals—with a sharper eye than ever before focused on Alcoa Aluminum. ALUMINUM COMPANY OF AMERICA, Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

Just 60 years ago six young men started a tiny business in a little shed in Pittsburgh. They began to make aluminum by a new process. That was the beginning of what is now Alcoa. Alcoa's aim, then and now, was to make aluminum cheaper and more useful. How successfully that has been done is shown by the fact that America today has the greatest aluminum industry in the world, employing around 1,000,000 people in the manufacture of aluminum in its many shapes and forms or in making many useful products in which aluminum plays an essential part.

Alumni Notes . . .

(continued from page 25)

George A. Williams ('43) was married to Dorothy Rose Winters on October 30 at Kobe, Japan.

Raymond J. McVeigh ('46) is now with the W. S. Lozier Co., engineers, at Rochester, N. Y.

The February graduates have scattered quickly to take their places in the professional field. Those for whom information is now at hand include:

Lester E. Christensen will work with his father, who is a mason contractor in Racine.

Donald Gmeiner will be with the Sundstrand Machine and Tool Co. of Rockford, Ill., where he expects to take training in sales.

Lauren K. Hanson will be with the Chicago and North Western Ry. at Chicago.

John W. Kelley has entered the Law School here at Wisconsin.

Donald L. Nord is a graduate student at Wisconsin.

James P. Schmitt will be with his father in private engineering practice in Milwaukee.

Tor Skogstad will be with Sverdrup and Parcell, a firm of consulting engineers, in St. Louis.

Constantine N. Tragakes is with the firm of Atkinson-Drake-Park, which is doing some engineering work at Athens, Greece.

Curtis Warren is an instructor in Mechanics at Wisconsin.

Walter J. Scott is with Swift & Co. in Chicago.

Arthur J. Langenberg is working for the American Bridge Co. in Gary.

— M & M —

Dean Withey of the College of Engineering was the opening speaker at the Wisconsin Annual Regional Conference of the American Founrymen's Association at Milwaukee, February 12 and 13. Mr. George K. Dreher, one of the principal speakers, is director of the Foundry Educational Foundation, which awards five scholarships to the University of Wisconsin.

Badger Engineering alumni present at the conference included **Larry H. Hahn** ('21, '22), **David C. Zuege** ('20, '29), **Norman F. Koch** ('24, '29), **Arthur K. Higgins** ('28, '32), **Edward A. Erdman** ('35, '36), **Walter W. Edens** ('37), **John L. Yarne** and **Edward J. Wellauer** ('38), **Frederick R. Mueller** ('39), **Roy W. McIntosh** ('42), **Robert M. Ramage** and **Richard C. Juergens** ('43), **Walter J. Gotstein** ('44), **Donald M. Gerlinger** ('45), **John A. Jefferys** and **James M. Jude** ('46).

Science Highlights . . .

(continued from page 24)

Ultraviolet radiation from the sun, resulting from solar explosions similar to an atomic bomb, cause ultraviolet flares on the solar surface which may result in a momentary blackout of radio communications on all frequencies. The interruptions may last from 15 minutes to an hour or more.

Another effect of longer duration is attributed to electrified particles emitted from the sun in the region of sunspots. Gigantic solar whirlwinds shoot these particles earthward, and upon reaching the atmosphere so heavily ionize it as to disrupt the radio ceilings over the entire earth.

It may not be said that under all circumstances do sunspots make for poor radio reception and a clear sun for good; it depends on the length and frequency of the radio waves employed and whether or not the receiver is beyond the radius of the ground wave. The important result of the anticipation of the number of sunspots in any future year is the possibility of estimating the best long - distance communication frequencies. **(Radio Craft.)**

DIAMONDS AMPLIFY ELECTRIC CURRENT

By having an electron gun shoot a beam at a small diamond chip, it is possible to amplify the current by as much as 500 times. Dr. K. G. McKay of the Bell Telephone Laboratories described the discovery as a radically new method of controlling the flow and amplification of an electric current.

The experiments reported by him stemmed directly from previous Bell Laboratory research in which current was induced in diamonds by bombarding them with alpha particles. The development is expected to have far-reaching influence on the future of electronics by supplementing the existing electronic techniques. It promises a new and improved laboratory tool for detecting and counting alpha particles. According to the National Bureau of Standards, the diamonds might be used to replace the Geiger counter, the standard instrument for detecting radioactivity discharges. **(Science News Letter.)**

NEW TELESCOPE GUIDER

A new guiding device developed at Mount Wilson Observatory will automatically follow the stars on which the telescopes are trained. A description of the instrument appeared in the **Review of Scientific Instruments** (Nov.).

A photocell activated by a small part of the starlight which is reflected from within the telescope controls the mechanism to keep the telescope directed on the star. In photographic work with large telescopes, constant manual control is generally required to keep the image of the star accurately on the spectrographic slit in the instrument. In spectrographic work a part of the star's light is reflected from the knife edge jaws of the slit. This new device uses a fraction of the reflected light. Any deviation of the star results in modulation of the reflected light which is transmitted through a small guiding telescope into a multiplier-type phototube. The output of the tube therefore varies and is used after amplification to operate the mechanism to adjust the pointing direction of the telescope.

TEN TOP SCIENCE ADVANCES

The ten most important developments made in science during 1947 as picked by Watson Davis, the director of Science Service, are:

1. The discovery that smell is detected by infrared radiation absorbed by odor material reaching the nose.
2. Synthesis of protein in long

(please turn to page 46)

AFTER April 16, Standard Oil's great new research laboratory at Whiting, Indiana, will be open to the public. Technical men will be especially interested in these splendid new buildings and their equipment. Most interested of all will probably be young men like yourselves, for here at Whiting you can see facilities so modern in every respect that they are likely to serve as a model for similar industrial developments for many years to come.

It may well be that you will spend part of your professional career in surroundings patterned after these well-planned new buildings at Whiting. In any case, you cannot fail to find the new Standard Oil laboratory a present accomplishment and a promise for the future. Here is one of the places where the world of tomorrow will be shaped by the skill of men trained, as you are, to the exacting, rewarding tasks of scientific research.

Standard Oil Company

(INDIANA)

910 South Michigan Avenue, Chicago, Illinois

STANDARD

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Science . . .

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chain molecules, promising new plastics of medical and industrial importance.

3. Artificial rain-making by spinkling dry ice or water on clouds.
4. Interconversion of proton and neutron fundamental particles and smashing of many more elements yielding new isotopes and transmutations in the world's highest voltage synchro-cyclotron.
5. Largest display of sunspots in over three centuries.
6. Pilotless plane that crossed the Atlantic without a human hand at the controls.
7. Discovery of 10,000-year-old Tepexpan man in Mexico.
8. Use of streptomycin in tuberculosis treatment.
9. Development of jet bombers and higher speed jet planes.
10. Camera that makes a finished photoprint in a one-step process. **(Science News Letter.)**

TINY, LOW-PRESSURE WIND TUNNEL

A tiny wind tunnel at the University of California is said to be the world's first low-pressure type to duplicate actual pressure conditions up to an altitude of over 45 miles.

The principal object of the tunnel is to develop precise information on the fluid mechanics of supersonic speeds in the extreme altitudes. Present supersonic wind tunnels blow air over models of rockets and airplanes at high pressures and do not necessarily give a true picture of what happens to a missile traveling at supersonic speeds in the rarified upper atmosphere.

INDUCTION HEATING

General Electric has announced the use of high frequency induction heating combined with a water quench to treat the bed surfaces of lathes to surface harden them to prevent accidental blows from prematurely rendering the surface improper for close work.

Patent Law . . .

(continued from page 40)

The employer-employee relationship frequently gives rise to a right called a "shopright." A "shopright" is a form or license which is non-transferable. In general, if the invention of an ordinary employee is made and used or if it was perfected by the employee in the employer's shop, the employer has a license to use the invention. It has been held that if the invention is related to something which the employer usually sells, the employer has a license to make and sell it. When an employee is hired to make improvements, the invention belongs to the employee, but the employer has a shopright. This hardly seems fair since the employee is being paid for his inventive skill, but it is recognized as the law. There is an exception to this rule. When an employee is employed to make a specific improvement, the invention belongs to the employer.

If a man, A, merely suggests an idea to his assistant, B, with no suggestion as to how it is to be carried out, B is the sole inventor if he develops the idea and works out the details. If A had suggested the general idea together with ideas as to how it should be reduced to practice, those who work out the details are given no recognition as inventors. The assistant may be a joint inventor if his contribution is real and substantial. It is hard to draw the line in many cases, but the distinction is important since a patent is invalid if granted to someone other than the true inventor. In deciding these cases the courts consider the relative skill and background of the people involved. If the problem involved required the detailed theoretical knowledge of an engineer, it is quite improbable an unskilled assistant contributed materially to the invention.

PRELIMINARY PROTECTION OF AN INVENTION

When an invention has been conceived, the inventor should draw the invention in ink, explain it to two reliable witnesses and have them sign the drawing with their name and date. This is not a strict requirement, but it facilitates proof of the date of conception and should be done if possible. There is no requirement that ink be used. A pencil drawing will do as will the oral testimony of a competent witness; however, it is best to have **the most convincing evidence available.**

Another device often resorted to is the use of stationery which folds into an envelope. The inventor sketches the invention on the sheet, has a notary seal it and then mails it to himself by registered mail. An envelope type sheet of stationery should be used so that there is no doubt about substitution of the sketch as there would be if an ordinary envelope were used.

As stated before, an inventor may have to prove that he was diligent in reducing his invention to practice. For this reason it is a good idea to keep a file of dated data sheets if at all possible.

SERVICES OF THE PATENT ATTORNEY

This article has merely scratched the surface of a tremendous field of law. The drafting of patent applications and the prosecution of lawsuits involving patents requires specialists. In fact, many attorneys who draft patents refer their court work to men who confine their activities to patent litigation.

Any invention which is worthy of the time and effort of an inventor is worthy of the attention of an expert patent attorney. Drafting a patent is an art, and skillful drafting may greatly enhance the value of the patent. The patent attorney will also have a search made which will disclose similar inventions in the same field and enable him to decide the relative chances of obtaining a patent on a given invention.

The patent office merely passes judgment on patentable difference. **They do not make a decision on the question of infringement.**

As stated before, a patent is merely a right to exclude others from using, selling or making an invention. The holder of a generic patent can prevent the holder of an improvement on the device covered by the generic patent from making, using or selling the original invention. The holder of the improvement patent may suffer serious loss if he practices his invention without the consent of the holder of the basic patent. The question of infringement should be decided by a competent patent attorney to avoid the possibility of this loss or to arrange for licensing agreements in which the inventor's interests are fully protected.