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The SHAMROCK

JANUARY, 1951

ANCHOR DAM
MISSOURI BASIN PROJECT
OWL CREEK UNIT - WYOMING
SPILLWAY AND OUTLET WORKS
1 : 30 SCALE

ANCHOR DAM
MISSOURI BASIN PROJECT
OWL CREEK UNIT - WYOMING





"Dedicated to the Progress of the Great Southwest"

C. R. BOWEN, Editor

MARVIN GWINN, Associate Editor

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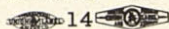


PHOTO CREDITS—The cover picture as well as all photographs illustrating the article about the Reclamation Engineering Center in Denver were provided by the Bureau of Reclamation.



In This Issue

Changing the Face of the Earth 3

Featured in this issue of The Shamrock is a description of the services and facilities of the Bureau of Reclamation's Engineering Center in Denver, Colorado. Occupying a substantial part of the Denver Federal Center, the Engineering Center is the hub of the Bureau's technical and engineering activities.

Bugbee Drawings 13

Last month, instead of a regular issue of the Shamrock magazine, Shamrock sent its readers reproductions of an exclusive pen-and-ink drawing by Artist Harold Bugbee. While they last, copies of this picture, as well as a companion picture sent to Shamrock readers last year, may be obtained by writing the Editor, The SHAMROCK, Box 631, Amarillo, Texas.

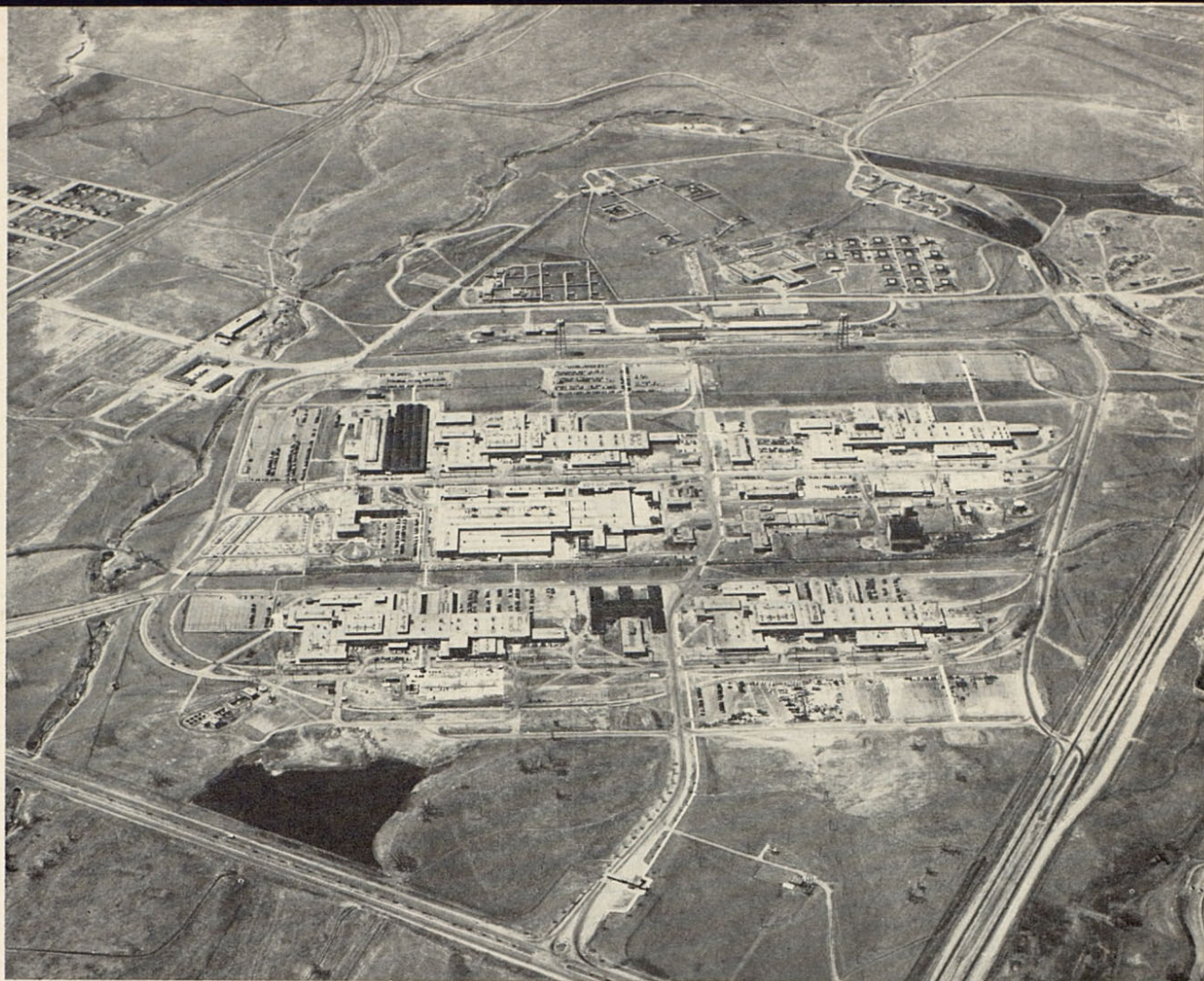
Denver Pipeline Terminal 14

Shamrock announces the opening of its new Products Pipeline Terminal in Denver, Colorado. This terminal will receive Shamrock liquid products directly from the McKee Refinery in the Panhandle of Texas.

THE COVER

The Lilliputian dam pictured on the front cover is an exact scale model of one now being designed as a feature of the Missouri Basin Reclamation Project in Wyoming. Engineers and scientists at the Bureau of Reclamation's Engineering Center in Denver, Colorado, use hydraulic models such as this in solving problems involved in the design and construction of proposed reclamation structures. Hydraulic models are an important part of the research and design studies that precede the specifications issued to contractors.

In the cover picture, W. P. Simmons, Jr., hydraulic engineer, is shown determining the depth of water on the spillway face of the Anchor Dam spillway. On the full-size structure, the water falls 91 feet from the spillway crest to the ski-jump buckets below and is then deflected 150 feet downstream before falling to the river surface.



Denver Federal Center

SOUTHWEST COLLECTION
Texas Tech University
LUBBOCK, TEXAS 79409

Changing the Face of the Earth

Reclamation Engineering Center "Dedicated to Service of Mankind"

The problems involved in designing, constructing, and operating many of the world's largest man-made structures make up a large part of the day-to-day work of the Bureau of Reclamation's Engineering Center in Denver, Colorado.

Among the massive Reclamation projects which first took form from the ideas, skills, talents, and experience of the engineers, scientists, and technicians of the Engineering Center are Hoover Dam, world's highest dam; Grand Coulee, world's largest concrete dam; Grand Coulee Power Plant, world's largest hydroelec-

tric power plant; and many other gigantic engineering achievements. Many of the problems involved in the design and construction of Grand Coulee were without parallel in the engineering experience of man. This huge structure contains 10,585,000 cubic yards of concrete. It is 500 feet in height, 500 feet wide at the base, 30 feet wide at the crest, and 4,173 feet long at the crest. Its mass is three times greater than the biggest Egyptian pyramid, and it contains enough concrete for two 16-foot highways from coast to coast.

The equipment at Grand Coulee includes

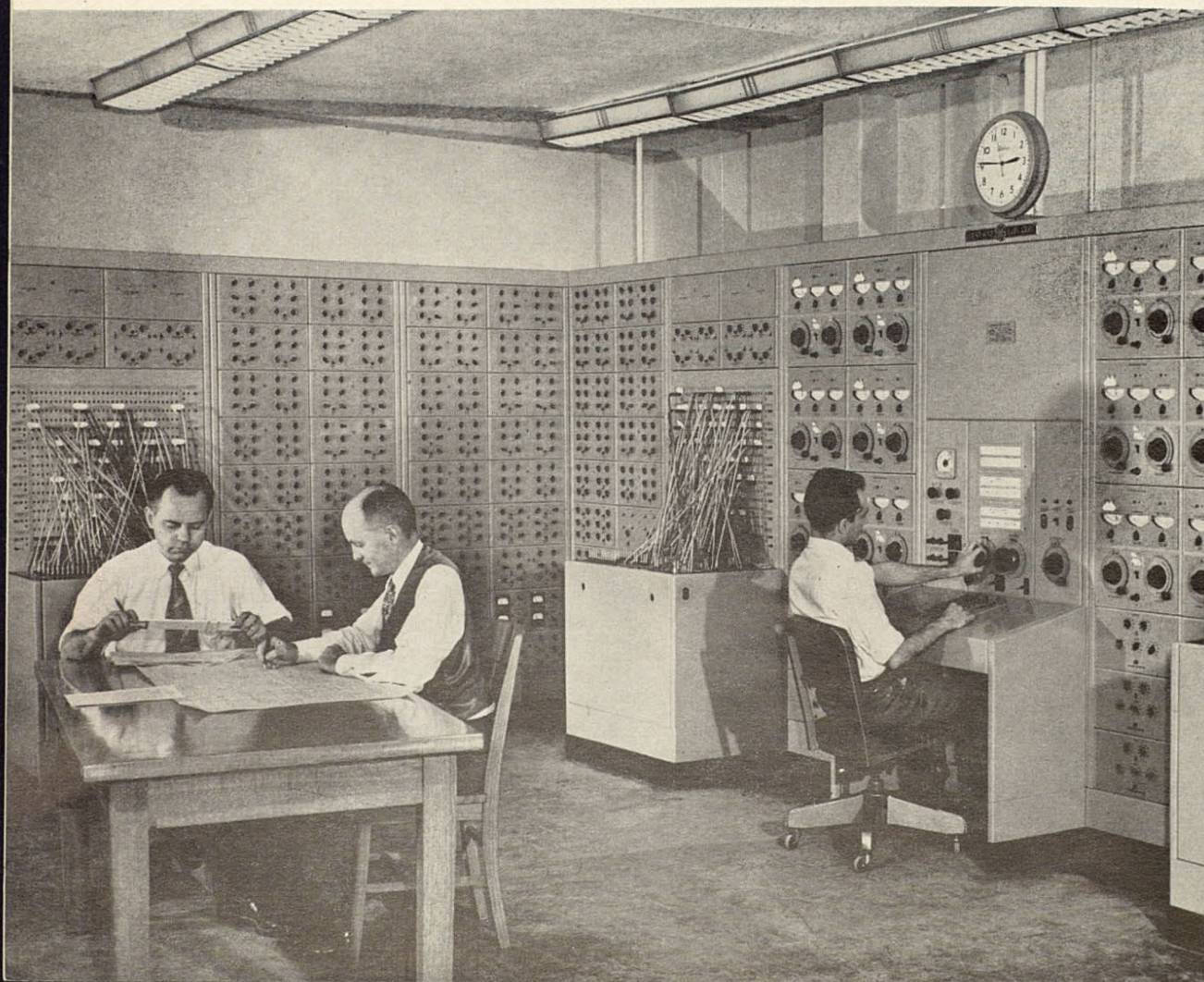
the world's largest pumping plant. This plant is capable of delivering 13,500 second-feet of water when operating at 200 rpm under a total dynamic pumping head of 310 feet—the equivalent of pushing 500 tons of water to the top of a 27-story building every second. Each of the 12 pumps in this plant is eight times larger than the largest pumps in prior use and can serve irrigation water to 100,000 acres. The pumps are operated by six 65,000 h.p. electric motors.

To solve the problems involved in the designs and construction of these and other reclamation projects, the Bureau of Reclamation operates the Engineering Center in Denver. Here, hundreds of engineers, scientists, and technicians—working with laboratories, equipment, and other facilities valued at more than \$2,500,000—are mobilized for mass attack on the complex problems of reclamation engineer-

ing. The Engineering Center occupies about 20 acres of the 800-acre Denver Federal Center and employs a personnel force of more than 2,000 persons. The Center is the Hub of the Bureau of Reclamation's technical activities, serving all of the seven Reclamation regions.

Federal reclamation originated in 1902 when Congress passed the Reclamation Act authorizing the Federal Government to construct irrigation works for the reclamation of arid lands. Subsequent legislation broadened the scope of the program to include other activities related to the construction of dams and irrigation works. Reclamation activities now include the construction of dams to regulate and control floods and to store and divert water for irrigation, construction of canals and laterals to deliver water to arid areas, the generation of hydroelectric energy, and the development of

Pictured below is the Network Analyzer in operation at the Bureau of Reclamation Engineering Center. With this ingenious device, engineers are able to study power systems in miniature.



projects for improvement of navigation facilities and domestic and municipal water supplies. The Bureau of Reclamation is also concerned with the creation of recreation opportunities, preservation of fish and wild life, and enlargement of other benefits associated with land and water resources.

Primarily, the work of the Bureau of Reclamation is located in the 17 western states which contain hundreds of thousands of acres of arid land. Reclamation activities for this vast western area is divided into seven regions whose boundaries are determined by the great western river basins. Regional offices of these seven areas are at Boise, Idaho; Sacramento, California; Boulder City, Nevada; Salt Lake City, Utah; Amarillo, Texas; Billings, Montana; and Denver, Colorado. Administration for each of the seven regions is headed by a regional direc-

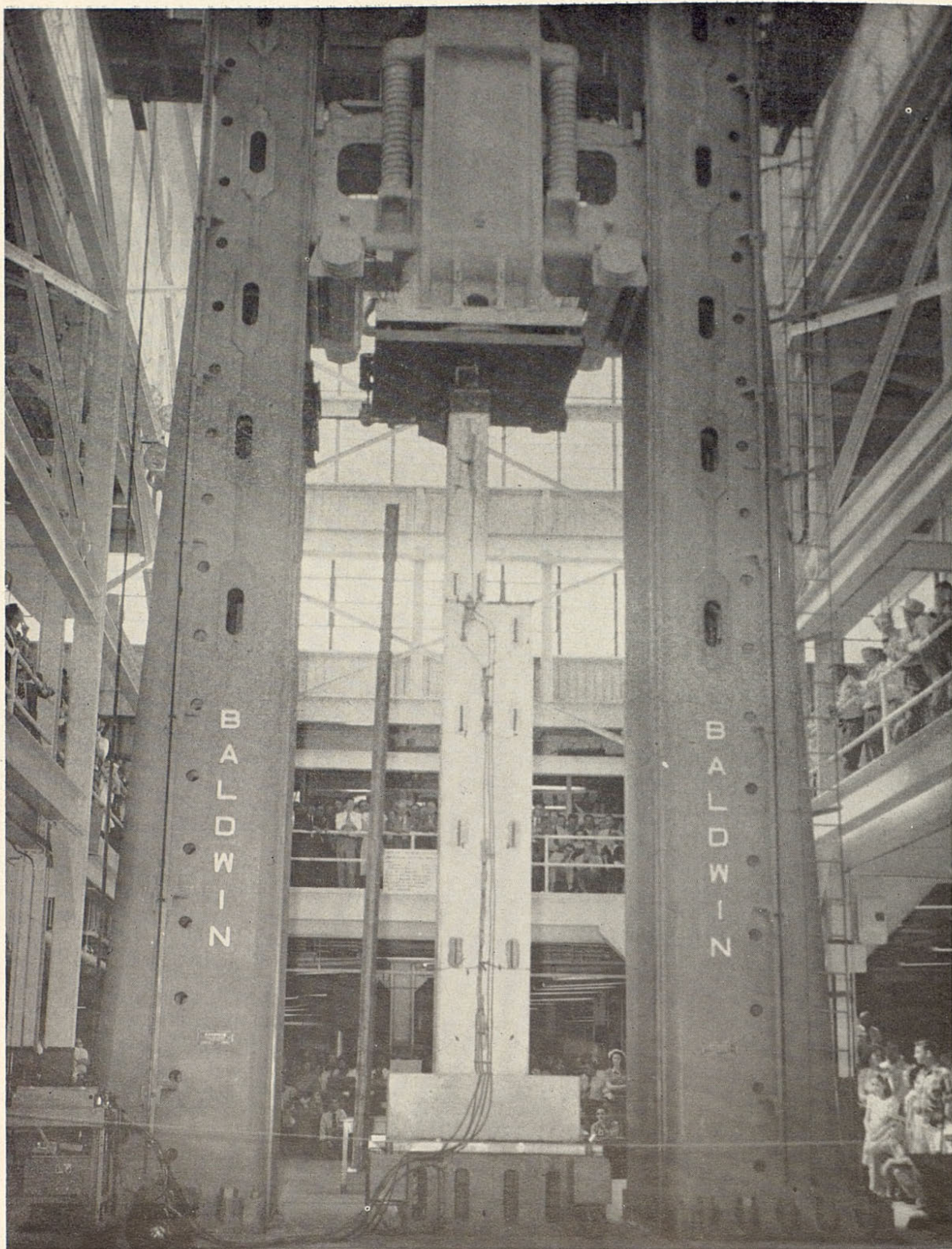
tor. The Bureau of Reclamation as a whole is headed by Commissioner Michael W. Straus.

The Engineering Center at Denver serves all seven of the great Reclamation regions and is headed by L. N. McClellan, Chief Engineer and Director of the Branch of Design and Construction. The Engineering Center dates back to 1905 when John Y. Jewett was employed as "Cement Expert at Denver, Colorado." The original cement testing laboratory under Jewett's direction was the start of the present research and geology laboratories at the Engineering Center. Today the Center, under the direction of the Chief Engineer, has the responsibility for design and construction of nearly all major projects of the Bureau of Reclamation.

For administrative purposes, the Center is organized into four main divisions. The Branch of Design and Construction is the largest of

Hours of painstaking work at the drafting board by more than 700 engineers and draftsmen performing such tasks must precede the construction of dams, power plants, and other structures.





these divisions, employing about 75 per cent of the Center's personnel. This division prepares designs and specifications for major structures and equipment; provides laboratories, engineering research, and testing facilities; and supervises construction of large, complex jobs. The Hydrology Division of the Branch of Project Planning is also located at the Center. This division conducts hydrological and sedimentation studies to determine the availability of water for irrigation, domestic use, power generation, and industrial consumption. The Hydrology Division also performs studies and analyses required to forecast future stream flow at potential storage and diversion sites. A third division of the Center is the Power Field Office of the Branch of Power Utilization. This office furnishes special technical help to the regions on major problems affecting power transmission and power system operation and maintenance. The fourth division consists of the necessary service offices, principally concerned with supply, personnel, financial and legal matters.

In planning a major Reclamation project, exhaustive studies and analyses must be made before even preliminary designing of facilities can begin. Conducting these studies and analyses is an important part of the work of many of the scientists and planning engineers at the Denver Engineering Center. Once the need for a reclamation project in a particular area has been established, engineers and hydrology experts must find a suitable source of water. This source may be in the unharnessed rivers near the area. It may be in the form of winter snows high up in the mountains; or it may be in lakes and streams on the opposite side of the mountains, susceptible to transmountain diversion. It is the job of the project planners, first, to discover a source of water and then to determine the most practical means of delivering that water to the area where it is needed.

When the source of water has been found and means of utilizing and transporting it is determined, further investigation must be made to establish the feasibility of the plan. These investigations include a variety of aspects of the

← Shown here is a view of the 5 million pound capacity testing machine during a compression test on a 22-foot model of a concrete step column. The test determined load capacity of the column. Failure occurred at 1,675,000 lbs.



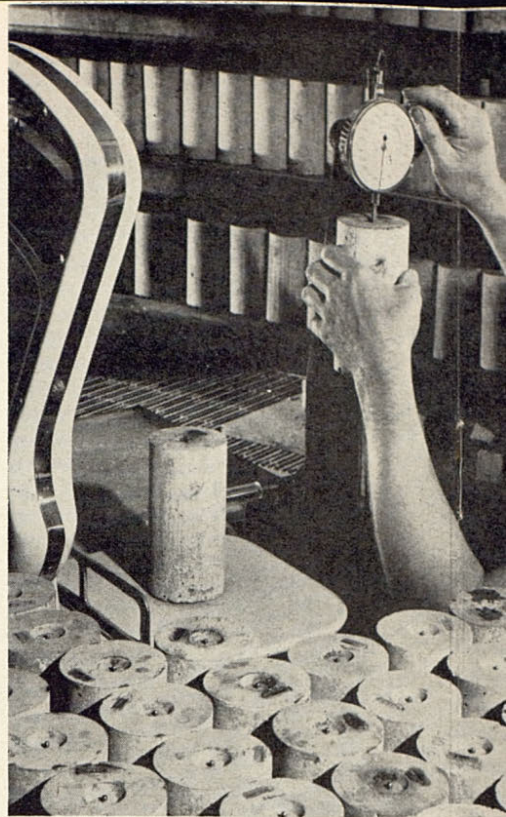
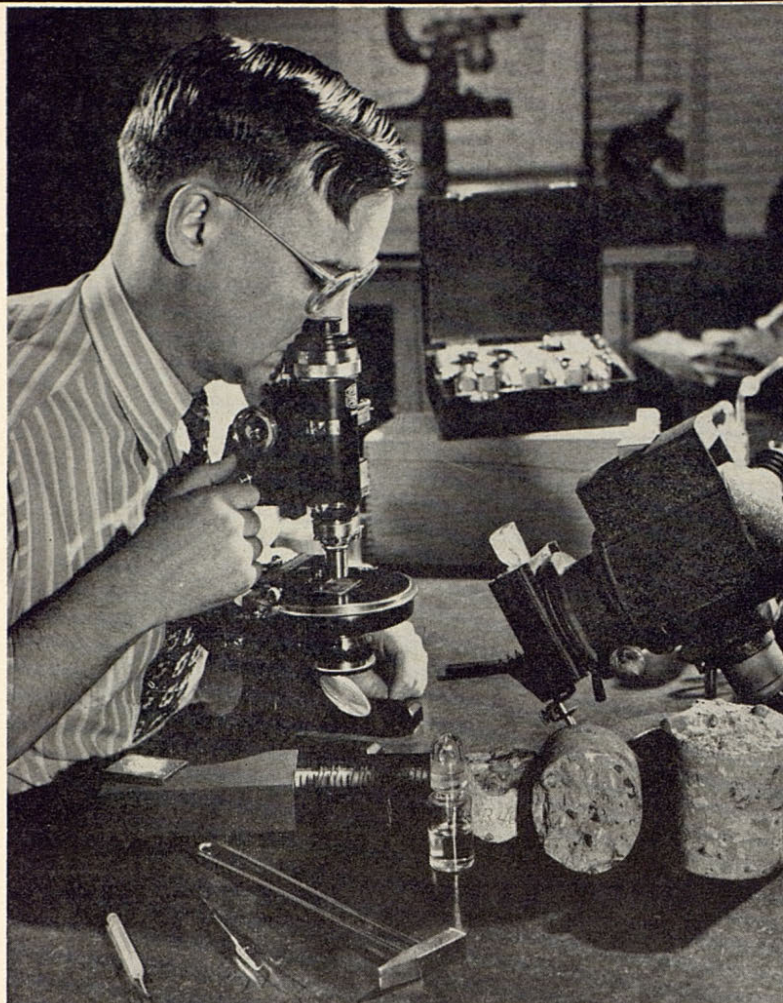
L. N. McClellan, Chief Engineer, is head of activities at the Reclamation Engineering Center.

plan—economic, engineering, agricultural—and aim at finding out if the general concept can be reduced to a specific, practical, and economically feasible plan. If so, the project plan is presented to Congress for approval and authorization.

Once a project receives authorization from Congress, the job of designing and constructing the necessary structures and other facilities can begin. This phase of the project is guided and controlled at the Engineering Center and is primarily the responsibility of the Chief Engineer.

The first step in the design and construction of a project is to draw up in final form the plans for dams, canals, powerhouses, pumping plants, and the many appurtenant structures involved in the overall plan. The objective of the designers is to provide structures that can be built and operated efficiently, economically, and to the full service of the water and power users and other beneficiaries.

After specifications for the project have been written and sent to contractors with invitations to bid, the lowest bid determined, and the contract awarded, construction can begin. Al-



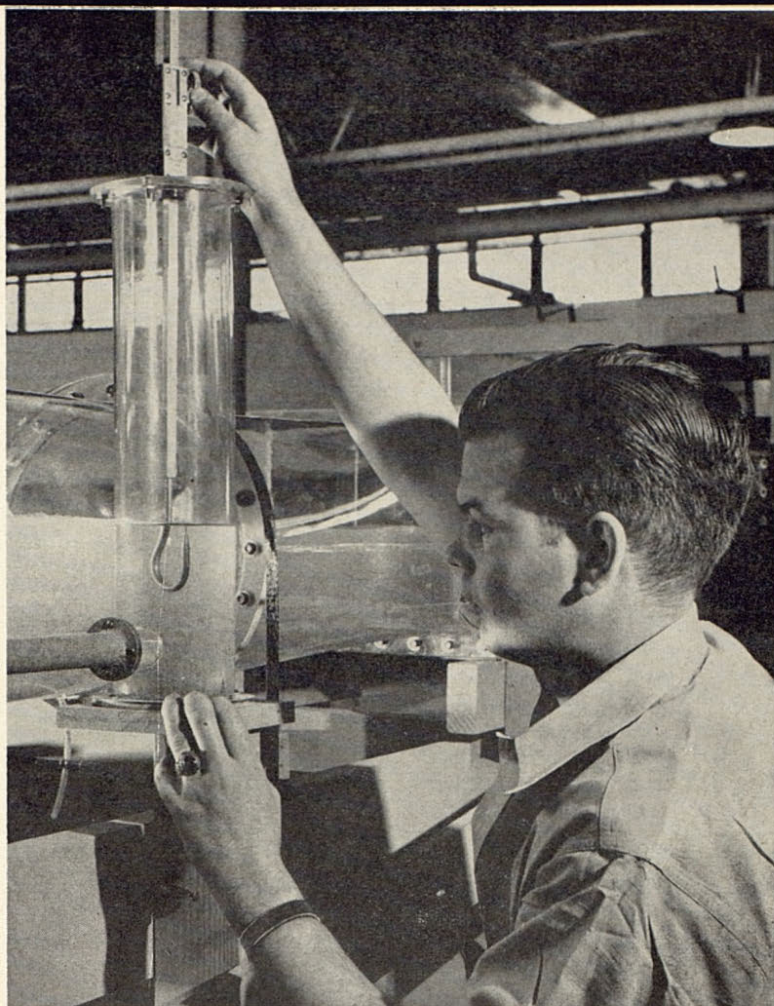
Testing and research are important activities at the Engineering Center in Denver. Left, R. B. Ray, civil engineer, examines concrete ground to a thickness of $1/1000$ of an inch. Right, R. B. Ray, civil engineer, makes length change measurements of concrete samples after thawing tests.

though the field operations are under the immediate supervision of construction engineers, the construction at large is the responsibility of the Chief Engineer and his staff at the Engineering Center, acting in coordination with the regional and field offices. The first task of the engineers and others responsible for the construction of the project is to calculate the cost of all proposed construction and equipment involved in bringing the plan to final completion. Engineers specializing in contract administration then assist and advise in negotiations with the contractors. Other engineers experienced in all phases of construction make periodic visits to regional and district offices and construction projects to advise and assist on current problems.

Throughout the entire project construction, the engineers, technicians and others involved in the work aim toward the completion of design conceptions with the maximum expedition and economy. The construction and completion of the project is the ultimate objective of the Recla-

mation Engineering Center in Denver.

An important function of the Engineering Center—and one that goes on continuously throughout all phases of Reclamation Engineering—is the vital task of testing, experimentation, and other phases of engineering research. This complex field of activity has become increasingly important during recent years as Reclamation engineering has undertaken ever greater projects. As the size of a structure increases so does the amount of waste increase if that structure is not economically planned. To make certain that the huge dams and other facilities it builds are designed with ample safety without undue waste of material, the Bureau of Reclamation employs hundreds of scientists and researchers in its extensive laboratories at the Engineering Center. Testing and experimentation are required during all phases of reclamation engineering—during investigation, design, construction, operation, and maintenance—if the most appropriate construction



ties at the Engineering Center. Left, Dr. K. T. Hughes, looking through a microscope a specimen of concrete of an inch. Above, R. I. Hughes, engineering student, reads a hook gage to measure the scale model of a water diversion tunnel.

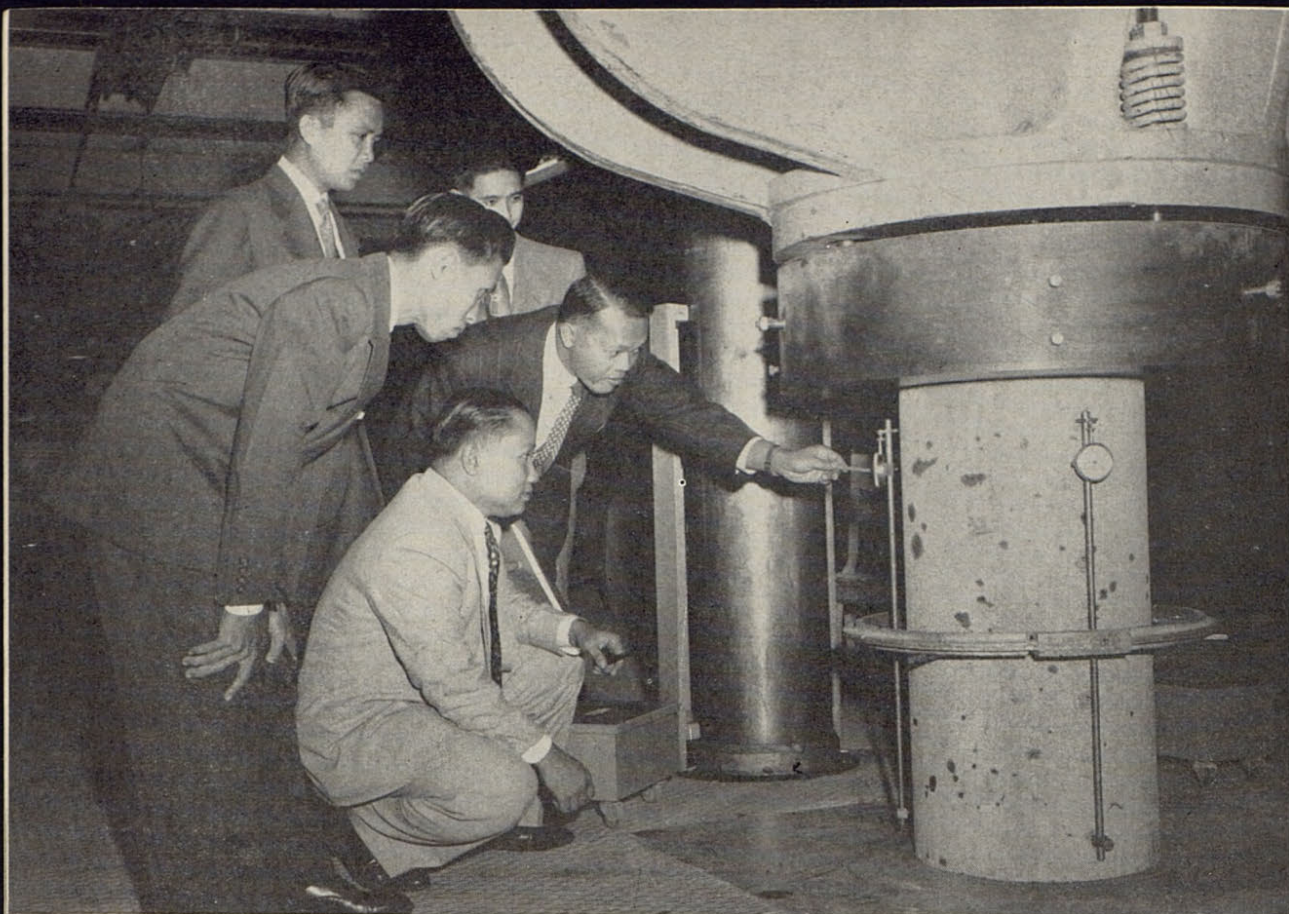
materials are to be selected, if they are to be used with greatest effectiveness, if designs are to be most efficient and economical, and the best procedures are to be applied to construction or repair.

The Denver laboratories were started in 1930 because answers to many unusual problems in design and construction of Hoover Dam could not be found in textbooks or notebooks of experience. Since then, savings in design and construction have amounted to many times the cost of the laboratories and their operation. The laboratories include such equipment as a 5-million-pound capacity testing machine, a device capable of applying tension and compression forces equal to 5 million pounds per square inch. This testing machine, largest of its kind was manufactured by Baldwin Locomotive works and is capable of crushing or pulling apart material specimens up to 32 feet long, or of breaking a watch crystal without harming the watch. The machine extends 50 feet above

floor level and 16 feet below. Its largest single part is a casting weighing 106,000 pounds.

Engineering research is not confined to the laboratory, however. Embedded in the concrete in the Shasta Dam, for example, are 1,200 electrical instruments for measuring temperature, stress, strain, and other factors which are indicative of the structural behavior of the dam. Measurements such as these not only provide the engineer with assurance that his structure is carrying the load in the way intended, but they also provide basic knowledge which is essential to improvement in quality and to greater economy in future structures.

The reputation of the Denver Engineering Center as an engineering clinic and as a repository of engineering experience in the reclamation of arid lands is recognized throughout the world. Every year, hundreds of professional men from every part of the globe—Egypt, India, Iraq, Iran, Thailand, the Philippines, and doz-



Each year, hundreds of professional men, such as these young engineers from Thailand, come to the Reclamation Engineering Center for training.

ens of other countries—have visited the Engineering Center to study irrigation and reclamation practices. Still other foreign governments have asked the Bureau of Reclamation to send experts to advise and plan with them for more and better irrigation. Foreign engineers from all over the world, requesting special forms of assistance, address as many as 300 inquiries a month to the Bureau of Reclamation and each year, thousands of copies of technical documents are sent overseas from the Engineering Center.

Arrangements for aid to foreign governments are usually made through the State Department, the United Nations, or the ECA, and the costs are not paid from Reclamation appropriations. As a result of this technical help to other nations, foreign agencies each year place orders with American manufacturers for millions of dollars worth of construction equipment.

Today, through the use of modern machinery and the utilization of the increased stores of knowledge about reclamation work, the Bureau of Reclamation can accomplish as much in

twenty years or less as once would have required a century. The engineering achievements which the Bureau has completed in recent years would have been beyond the scope of the wildest dreams of engineers a century ago. Such gigantic structures as Grand Coulee, mightiest concrete structure ever built by man—a dam four-fifths of a mile long whose spillway is twice as high as Niagara Falls—was conceived in the drafting rooms and laboratories of the Reclamation Engineering Center. The original plans for the mighty Ichang Gorge Dam on the Yangtze River—intended to produce twice as much power as Grand Coulee and to help industrialize a free China—were drawn at the Denver Center. Also in Denver were drawn the plans for Hoover—highest dam in the world, holding back enough of the Colorado River flow to put New York State under a foot of water. Denver engineers are now checking the plans for Kosi Dam in India which will rise still higher.

Another major achievement of the Bureau of Reclamation is located just above Denver

where the world's longest irrigation tunnel carries water from the Pacific watershed directly through the Continental Divide to the Atlantic watershed.

But grander than any of the mighty works which the Bureau has already performed is the scope of the proposed Missouri River Basin Project. The greatest reclamation development ever attempted, plans for this project aims toward the ultimate goal of bringing irrigation water to some six million acres of arid and semi-arid land in the Missouri watershed.

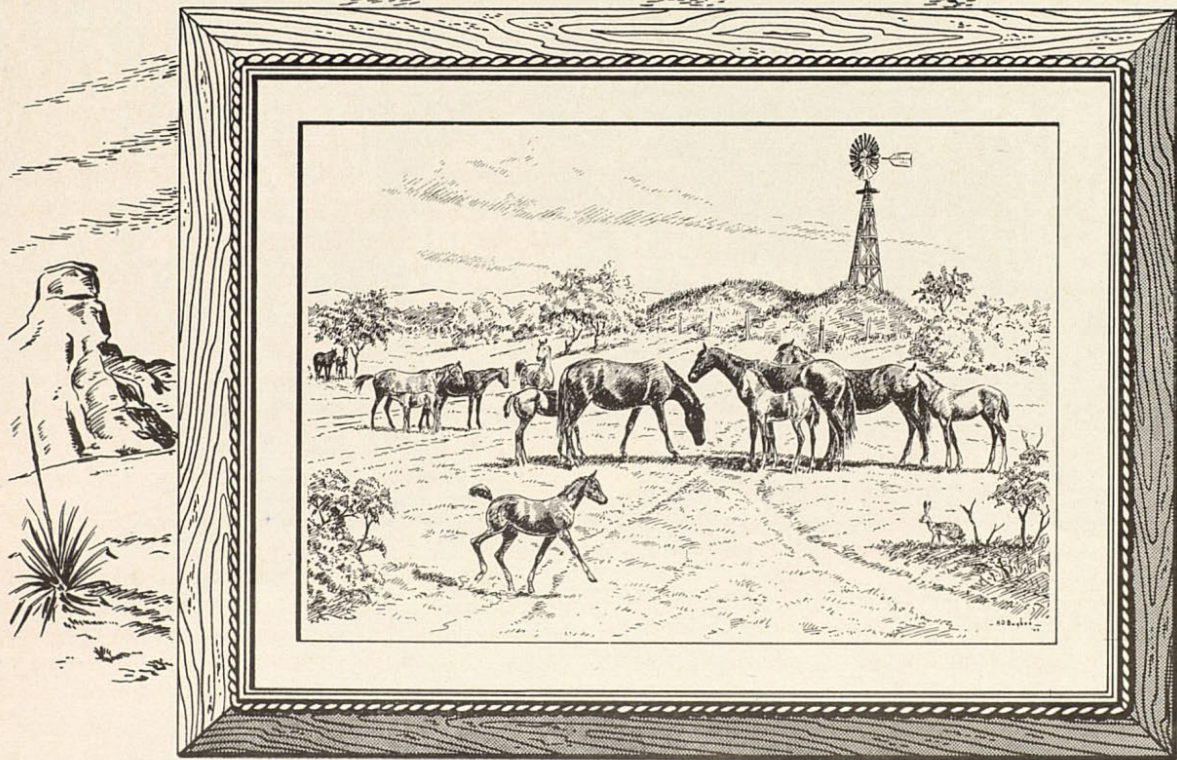
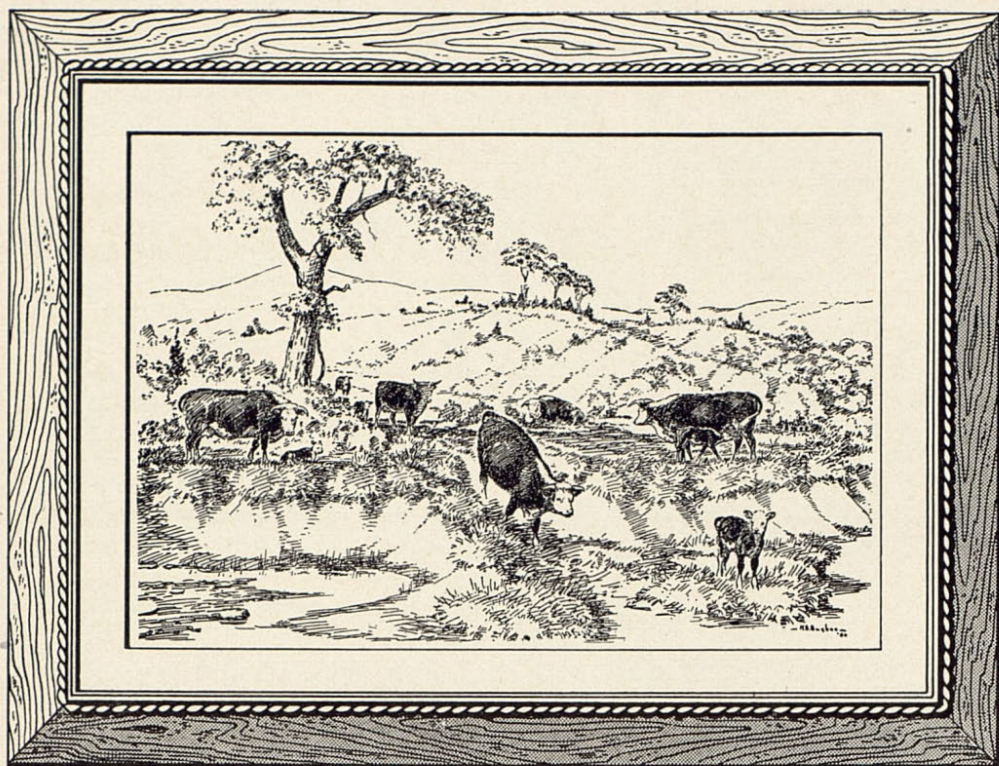
Since the Federal Government began Reclamation activities in 1902, more than five million acres of land have received irrigation water from reclamation projects. Altogether, more than six billion dollars worth of crops—nearly four times the total Federal investment of \$1½ billion—have been raised on these ir-

rigated lands since 1902. Last year, crops produced on land under Bureau projects amounted to more than \$500 million. Cumulative crop values on some of the older projects have amounted to more than 40 times the Federal investment in them.

As the focal point from which have come the plans for great reclamation projects all over the world, the Reclamation Engineering Center in Denver is an instrument of American leadership throughout the free world. Each year, reclamation projects which have had their beginning at the Center add to America's domestic prosperity and contribute to the preservation of America's valuable natural resources for the benefit of generations to come. Dedicated to the service of mankind, the Reclamation Engineering Center is one of the constructive forces in our civilization today.

Laboratories aid in fighting canal-clogging weeds. Below, Chemical Engineer J. M. Shaw collects specimens to be used in weed killer tests.





Bugbee Drawings

Popular With Shamrock Readers

The western scenes pictured on the opposite page are the work of Harold Bugbee, Cowboy-Artist of the Southwest. These two pictures were drawn exclusively for Shamrock by Artist Bugbee. They portray scenes which the artist sketched on the fabulous J-A Ranch in the Texas Panhandle. The upper picture is a sketch of cattle grazing along Spring Creek. Copies of this drawing were mailed to Shamrock readers last month as a Christmas greeting from Shamrock. Reproductions of the lower picture were sent to our readers a year ago.

Shamrock readers have, for a number of years, been familiar with the work of this popular southwestern artist. Many of his fine pen-and-ink drawings have illustrated stories and articles in *The Shamrock*. An expert on the lore and customs of the great Southwest, Bugbee has made it his life's work to depict the life of the West on canvas and paper. His reputation as an artist has made his works well-known to art collectors and critics throughout the United States. His services as an illustrator for magazines and books are in constant demand, and many of his paintings and drawings hang in well-known art collections. He has illustrated a number of the popular books by J. Evetts Haley, noted Southwest historian and a frequent contributor to the *Shamrock*.

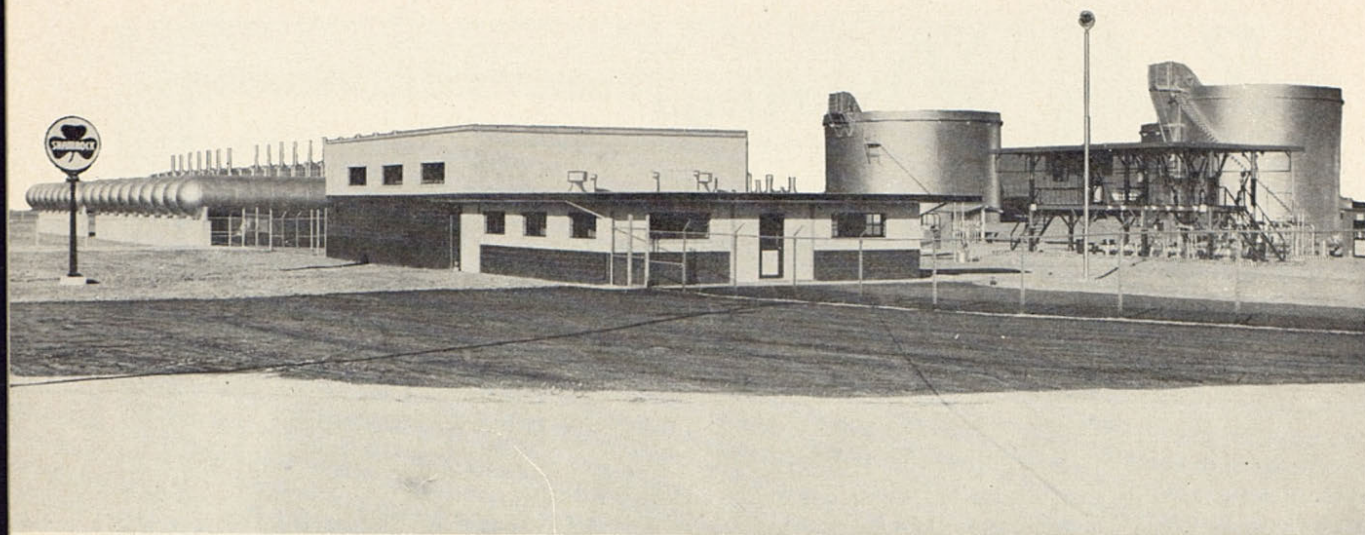
The versatile artist was born in New England near Lexington, Massachusetts. He moved to the Texas Panhandle at the age of 12 when his family acquired a farm near Clarendon, Texas. Even as a child in New England, how-

ever, he was fascinated by stories of the West and looked forward to the periodic visits of his uncle, T. S. Bugbee, a pioneer Panhandle rancher.

After coming to Texas, Bugbee quickly made himself at home in his new surroundings. Impelled by a tremendous curiosity, he immediately set himself to the task of learning as much of the ways of the West as possible. Today, still driven by that same curiosity and still seeking additional knowledge, he is recognized as an authority on western culture and tradition.

Early in his youth, Bugbee decided to become an artist. After finishing high school at Clarendon, he attended Texas A & M College and later enrolled in the Cummings School of Art at Des Moines, Iowa. Since completing his formal art training in 1921, he has devoted most of his time to studying, painting and sketching. Most of the time, his studio is the great outdoors. After making preliminary sketches of subjects where he finds them, he prepares finished drawings and paintings in his basement workshop. The workshop contains such items as deer and elk antlers, guns of every description, a Sioux Indian headdress, branding irons, saddles, harness, horseshoes, spurs, and many other articles illustrating phases of western life and culture.

Shamrock still has a limited supply of both of the Bugbee prints appearing on the opposite page. Anyone desiring additional copies of either or both can obtain them as long as the supply lasts by writing to : Editor, *The Shamrock*, Box 631, Amarillo, Texas.



Shamrock's new Denver Pipeline Terminal

Denver Pipeline Terminal

*La Junta-Denver Extension of Colorado Products Pipeline
Ready to Deliver Shamrock Products to Denver Area*

Shamrock completed its new Denver Pipeline terminal last month and products will begin going through the 310 mile Panhandle-to-Denver pipeline some time in January.

Completion of the Denver terminal and the extension of the Colorado Products Pipeline from La Junta, Colorado, to Denver is the second big step in Shamrock's current program for expanding facilities and services in Colorado. The first phase of this program, construction of the Colorado Products line to La Junta and the installation of the terminal there, was completed in November of 1947. Shamrock owns a joint interest in the Colorado Products Pipeline and the La Junta Terminal, but owns and operates its own terminal facilities in Denver.

When the Colorado line is put into complete operation it will connect refining facilities in the Panhandle, including Shamrock's McKee Refinery, 12 miles northeast of Dumas, Texas, with terminal facilities in La Junta and Denver. Products transported through the line will include propane, butane, several grades of gaso-

line, diesel fuel, distillate, and kerosene. These products will be boosted along on their journey to Colorado by pump station located at the McKee Refinery, Boise City, Oklahoma, and La Junta. If it becomes necessary in the future to increase the daily volumes of products delivered through the line, additional pump stations can be added.

Through the operation of the Colorado pipeline and the terminal facilities at La Junta and Denver, Shamrock will be able to serve its dealers and customers in the Colorado Territory more efficiently than ever.

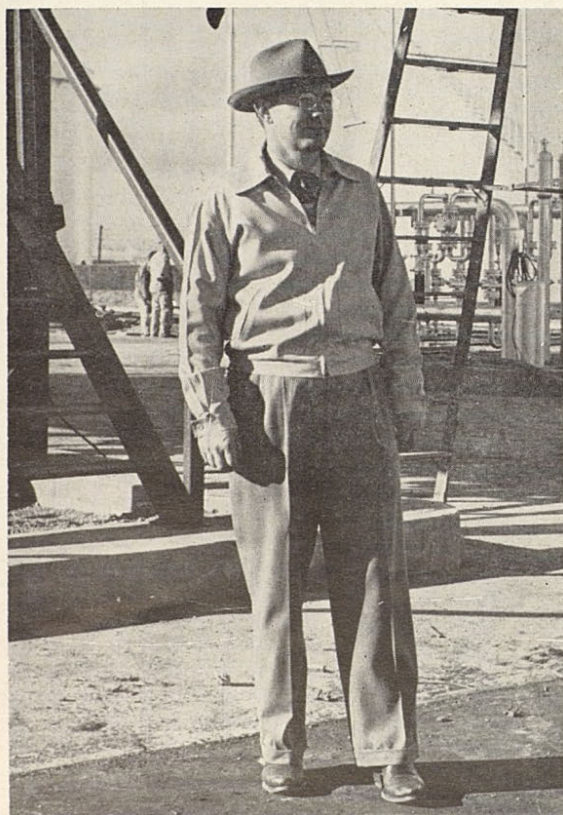
In anticipation of the improved transportation facilities to the Denver market, Shamrock has also expanded distribution facilities. Last June the Company purchased the Banner Oil Company of Denver, a petroleum products distribution firm. The Banner Company consisted of a bulk plant and a number of owned and leased service stations in Denver and vicinity. L. E. Clarida, former owner and manager of the firm, now operates the facilities as Shamrock Consignee.

Another comparatively recent addition to

the northeastern Colorado marketing facilities is the Longmont Bulk Plant. This new station was formally opened October 20-21 and is operated by Clyde Harrison. The Longmont installation, located on Highway 87 at Longmont, Colorado, about 30 miles north of Denver, will serve as a retail outlet and will also provide bulk sales facilities for the extensive farming operations in the area.

The marketing program in the Denver area is headed by Joe Corbin, District Sales Manager in charge of the Denver District Sales Office. He is assisted by Bill Carpenter, Denver City Salesman. Howard Taft, Shamrock Salesman in charge of LP-Gas sales in Colorado and parts of adjacent states, also makes his headquarters in Denver. Q. Mills, formerly Foreman at Shamrock's McKee Refinery Bulk Plant, is in charge of operations at the new Denver terminal.

Q. Mills, Foreman at the Denver Terminal, was formerly Foreman at the McKee Refinery Bulk Plant. He is shown here during construction of terminal.



Shamrock Dealers

In Denver and Vicinity

DENVER

- MAC'S ECONOMY OIL NO. 1
Davis L. McQueen 1176 South Santa Fe
- GLENN'S SERVICE
Glenn McQueen 2560 Federal Blvd.
- SHADY NOOK SERVICE
Archie Blakeshaw 4331 Morrison Road
- PIFIE'S SHAMROCK SERVICE
Pifie Ortis 1879 West Colfax
- RANDY'S SERVICE
L. B. Randleman 2245 Washington
- J. A. NEELY SERVICE
J. A. Neely 2800 South Federal
- SANTA FE FUEL CO.
William A. May 1001 South Santa Fe
- HARRY'S SHAMROCK SERVICE
Harry M. Beeler, Jr. 1899 South Broadway
- SHAMROCK SERVICE
Melvin L. Hendricks 1251 Federal Blvd.
- AL'S SHAMROCK AUTO SERVICE
Elmer Quist 501 Kalamath
- A & B SHAMROCK SERVICE
Otis Ames 2650 West Alameda
- MILLER'S SHAMROCK SERVICE
Kenneth Miller 2758 North Speer
- ZEPHER GAS & OIL CO.
Robert E. Clarida 350 South Federal

ENGLEWOOD

- JOHN'S SERVICE
John Sanders 2700 South Logan
- HARTLEY'S SERVICE
Ray Hartley 4600 South Broadway
- KNOEDLER SERVICE
C. M. Knoedler 3901 South Santa Fe

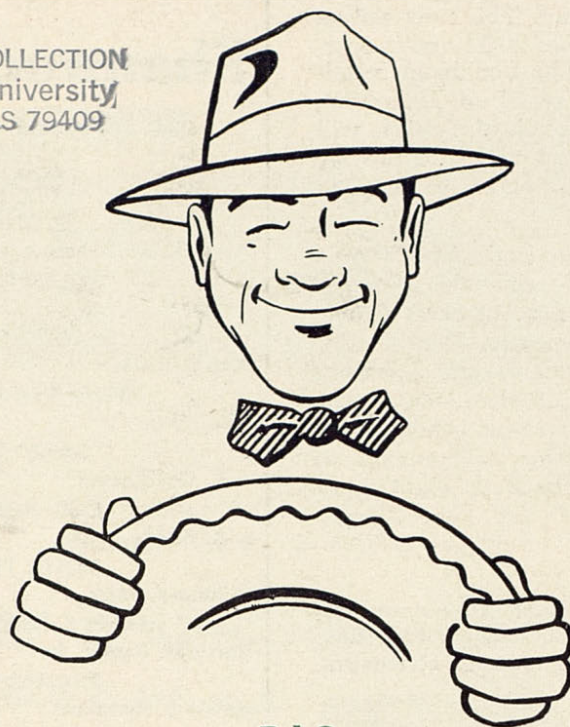
LITTLETON

- RIBER'S SERVICE
Wesley Riber 5695 South Broadway

SULLIVAN

- DALE'S SERVICE
Dale Brooks, Operator Route 2, Denver

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