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- Oil and Human Welfare
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PERSONAL NOTES

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(Continued from page 5)

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The Mine & Smelter Supply Co.
TOOK A DAY OFF TO CATCH UP ON MINES MAGAZINE

From Dewey D. Bowling, '49, c/o Shell Oil Company, McCamey, Texas.

I just received copies of three issues of Mines Magazine and really did have a field day reading them!

Several trade publications interested me and I would appreciate it very much if you would send them to me, as listed. Also, could you get the books for me which I have designated?

I am employed as junior exploitation engineer with Shell Oil Company, Inc., and find the work extremely interesting.

ESTABLISHES OFFICE IN SINGAPORE

From W. J. Kroeze, '40, 65, West 37th Street, Sheridan, Wyoming.

I have resigned my position with the Standard Oil and Gas Company to accept one as mining engineer with the Sheridan-Wyoming Coal Company.

REGRETS HAVING MISSED THE 75TH ANNIVERSARY CELEBRATION

From R. W. Koontz, '44, Box 512, Bowie, Texas.

I regret to have missed the 75th Anniversary for I know it would have been fun to receive old acquaintances and make new ones.

My regards to the boys for reconstructing the "M" in such short time—a job well done. I didn't, however, see any pictures of Isald and painted monkeys.

RATHER SLOW IN GIVING CHANGE OF ADDRESS!

From L. P. Morley, '45, Exploration Dept., Socony-Vacuum Oil Co. of Colombia, Aereo 4034, Bogota, Colombia.

I am employed as junior exploitation engineer with Shell Oil Company, Inc., and have changed my home address to that given above but you can continue sending your publications to my new address. I am located here.

ATTENDED MEETING OF OKLAHOMA CITY CHAPTER

From Charles R. Cross, Jr., 19, 513 W. First Street, Oklahoma City, Okla.

I am in Oklahoma City but work and attend the semi-monthly luncheon meeting of the Oklahoma City chapter of the Alumni Association. Saw some old friends and it was a real reunion. Occasionally I would like to receive Mines Magazine, if possible, at the address given above.

ENTER PRIVATE PRACTICE AS MINING ENGINEER

From John E. Motica, '48, 1226 South E. 42nd Street, Sheridan, Wyoming.

I am now in Evansville—still with Sohio Petroleum Company. Since graduating I have worked in Pennsylvania, Ohio and Texas. I enjoy my work very much and am happy with the work I am doing.

SOLAR REPRESENTATIVE IN MY DISTRICT


I am employed as junior exploitation engineer with Shell Oil Company, Inc., and have changed my home address to that given above but you can continue sending your publications to my new address. I am located here.

A GEOPHYSICIST REPORTS HIS SON'S ARRIVAL

From Albert W. Middaugh, 47, 300318th Street, Golden, Colorado.

I am enclosing a birth announcement of our baby boy who by this time is of a ripe old age... And yes, we are proud of him.

I hope this letter will not be too long in reaching you. The mails are sometimes erratic in this part of the world.

HAS NEW POSITION

From John E. Motica, '48, 5 West 37th Street, Sheridan, Wyoming.

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Continued on page 33

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THE MINES MAGAZINE • JANUARY, 1950

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Stripping overburden for the stripmining of Bentonite near Sanders, Arizona, with Caterpillar Diesel 720J Tractor and No. 10 Scraper. Courtesy Caterpillar Tractor Company.

For advertisers listings, see page 46.
Engineers of Trans-Arabian Pipeline

In early discussions of a proposed pipe line across Arabia, it was tacitly assumed that the wall of 24-inch diameter such as had been employed on the Big Inch lines from Texas to the Atlantic seaboard and was the largest in use for oil transmission up to that time. When the subject came up for reexamination in 1945, however, it became clear that a 24-inch pipe would not be small for greatest economy, and that a normal average size of 300,000 barrels per day of thin-wall pipe of approximately 30-inch diameter would be preferred and this size finally was adopted.

Specifications of Pipe

The pipe has been, and still is, being produced atpipe manufactured at Maywood, California, from plate rolled at Geneva, Utica, N.Y., of 10 inches in diameter and half 31 inches in diameter, and most of it has a nominal wall thickness of 1/2 inch. The steel is of medium carbon, medium high manganese material and is semi- killed.

In general most of the pipe actually runs about 25-30 carbons and about 1.0 manganese.

When the plate arrives at Maywood, it is planned to exact size, rolled and welded inside and out by the "Union-melt" process. As fabricated, the pipe is about 1/2 inch under size in diameter. After fabrication it is put into a heavy steel die and expanded under hydraulic pressure into its full size. This expansion stretches the steel beyond the yield point, and the cold work makes a significant increase in the tensile strength, especially in the circumferential direction. The specifications call for the pipe after expansion to have a minimum circumferential yield strength of $22,500$ psi and an ultimate of $65,000$. Both of these figures are consistently exceeded, and most of the material shows a yield strength of over $60,000$. The expansion apparently causes a gain in yield strength of between 12,000 and 20,000 psi in the circumferential direction and perhaps half as much in the axial direction. The cold work also increases the ultimate strength of the metal in the circumferential direction by as much as 3,500 to 7,000 psi; this effect may not be generally known.

After being expanded, the pipe is tested hydrostatically to 90 percent of the minimum specified yield strength of $52,000$ pounds. Very few failures result on this final test. The reason for making half the pipe 30-inch and half 31-inch was to permit it to be telescoped to save ship space. It is impossible to load a cargo ship to more than a third its deadweight carrying capacity with large, long, empty pipe. There was some consideration of telescoping three deep, but the complications seemed too great. In the beginning there were many who questioned whether a nominal difference of only an inch would be sufficient to permit easy nesting and de-nesting. It has proved to be sufficient, but another half-inch clearance would have facilitated de-nesting and have avoided some scoring of the pipe.

With pipe fabricated as outlined, the design basis for the pipe line was taken as 65 percent of the nominal yield point based on nominal thickness, stresses being computed by the conventional outside diameter or Barlow formula. Such a procedure gives an allowable working pressure of approximately 570 psi for 30-inch pipe having a nominal 1/2-inch wall thickness. When the pipe line was laid out on the basis of a minimum flow of 350,000 barrels per operating day (300,000 barrels per average day) and 1/2-inch wall thickness, it was found that at least eight pumping stations would be required, but by increasing the wall thickness of the pipe at the high-pressure part of the line to a maximum of 7/16 inches, the working pressure could be increased to 885 psi, and by this move it was possible to reduce the number of stations to six. When it is realized that each pumping station is a small building with some pumps deriving power from a utility line, as they were on the Big Inch line, it becomes evident that an addition to the community out in the desert which has slightly over 500,000 barrels if the intermediate stations are added.

The picture many people of Arabia is a wilderness of sand, with perhaps a little water hole or well here and there supporting a few date palms. This, however, applies only to a small part of the area traversed by the pipe line. Just to the north of Abqaiq where the major oil production of Arabian American Oil Co. is now located, and covering a part of the field, there are sand dunes close to 100 feet high which move southward at rates approximating 50 feet a year over a belt of cheese. These dunes are indeed a serious obstacle to construction, but they are almost entirely confined to the first 40 miles of the line between Abqaiq and Qatif. As a matter of fact, the moving dunes probably cover less than a third of even this section. The line here was not expected to be completed and its type of terrain, largely confined to the first 150 miles of the line, has been found excellent for pipe line construction and road building. Further to the west the terrain for miles consists of flat rock and gravel plains, virtually treeless except for a few spots, but supporting an intermittent and sparse growth of grass on which the Bedouins graze their small herds and camels during favorable parts of the years.

Certain portions of the plains country were extensively flooded, the surface being covered with fractured stone, gravel, and sand, making it almost impossible for road or other
construction, even though it looks fairly smooth from my airplane at an elevation of 1,000 feet. Fortunately, however, there are several factors which would nearly all the worst of this country by adjusting the route slightly.

When the line approaches Trans-Jordanian territory, the well-known Trans-Jordan line beds are regularly encountered. Roads are generally very good, and the terrain described can be classified as follows:

1. Moving dunes
2. Sabkhas
3. Stable sand with small bushes, known locally as dikes
4. Gravel plains
5. Rocky plains or plateaus with rock at least two feet below the non-existent flat surface.
6. Lava beds
7. More or less cultivated land near the Mediterranean, much of it being rocky hills.

There are several wetter terrains throughout the desert which might be anything from damp to almost absolutely flat surface, giving the impression that they are natural pools of salty water that have a high temperature. Laying the pipeline on these permanently wet and often have an active movement of some sort. Sometimes one sees along the line, and it seems that the status which is normal, is the soil is just damp enough and smooth enough to prevent more dry salt from adhering to the surface. Sometimes the surface of sabkha is covered with loose sand and leaves, like a perfectly flat surface, in which the temperature is high enough to prevent the formation of a crust.

The usual accessories for a modern power plant at Ras Tanura refinery are installed in the adjacent country where there is very little water and, in general, is under an atmosphere of more than 90°F and 75% humidity. The water results in an axial stress of approximately 340,000 barrels daily against a maximum of 840 pounds pressure. The exhaust of these turbines will be used for heating in a stabilizer which recovers the heat of condensation. Turbulent unnatural features or departures from ordinate practice. At the same time, the design of this project is a careful study was made to determine whether they should be driven by a modern steam pump or by a steam pump. As a matter of fact, the project will be decided to go ahead with the more advantageous engines. This is a very important factor. However, the initial resistance to the welding of the gas well so far applied produces a shock excitation from gusty or variable movements. Every degree change in the temperature of a completely restrained piece of steel results in an axial stress of approximately 750 kips. If the temperature in the more highly stressed portion of the line, and it appeared to be supplied by magnesium ribbon and by anodes in deep wells. The high initial resistance to the welding of the gas well so far applied produces a shock excitation from gusty or variable movements. The axial stress amounts to 30 percent of the circumferential stress instead of the circumferential tension of the pipe line. The circumferential tension is approximately 190 psi, so 70°F would result in a maximum of 140°F. This tension tends to offset the circumferential tension of the pipe line and it appears to be perfectly practicable. It was estimated that the pipe line would be perfectly practicable. It was estimated that a maximum of 70°F would be required.

The two types of failure ordinarily encountered in a pipe line are rupture or buckling. The former is relatively more likely to occur as the result of inherent defects or as the result of the line pulling up in the sand or as the result of differential welds made in the field. The latter is more likely to occur, of course, not expected when the line was in compression. The surrounding land is mountainous in part of the terrain is mountainous in the sense usually understood, and it has been designed to make the pipe at these points in some manner, and pressed-steel ring girders were selected for construction. The pipe line was made to determine whether they should be driven by a modern steam pump or by a steam pump. As a matter of fact, the project will be decided to go ahead with the more advantageous engines. This is a very important factor. However, the initial resistance to the welding of the gas well so far applied produces a shock excitation from gusty or variable movements. Every degree change in the temperature of a completely restrained piece of steel results in an axial stress of approximately 750 kips. If the temperature in the more highly stressed portion of the line, and it appeared to be perfectly practicable. It was estimated that the pipe line would be perfectly practicable. It was estimated that a maximum of 70°F would be offset by the circumferential tension of the pipe line. The circumferential tension is approximately 190 psi, so 70°F would result in a maximum of 140°F. This tension tends to offset the circumferential tension of the pipe line and it appears to be perfectly practicable. It was estimated that the pipe line would be perfectly practicable. It was estimated that a maximum of 70°F would be required.

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shaft and high peripheral velocities, and comparatively high pressure, sive will be of the conventional type, pressures and finally to a sump whence driven by 1700-hp diesel engines be five pumps in series, four normally charged by the Elliott Buchi system. The engines at 343 rpm. The engines operated suction and discharge valves. and the lubricating oil. They will auxiliaries, including the fans of the tors that will cool the jacket water necessary to draw oil from the station booster pump for putting pressure on the pipe lines so far operated between the field and the Persian Gulf terminals. It is not probable because the oil has never had variances involved, but wax has accumulated in the tanks. In the higher ele-Jordan the oil temperature may fall in the circumstances, it is understood that the temperature of oil received at the Halla terminal of the petrol is lower than the temperature of oil in the pipeline as low as 57°F in the winter, although this variance is a little over 70°F. Scapers, and hence scraper traps, are also of value to remove air during the filling of a tank, to separate the water used for testing from the oil following, as well as to assist in removing a certain amount of rubbish which always seems to get into pipe lines during construction.

Pump and engine houses at the stations are 230 feet long and 70 feet wide, the pump room being separated from the engine room by a glassight-firewall. As previously indicated, there will be three 3000-hp generators, together with a stable air condition­plant, a refrigeration plant and a laundromat. The plans are for the construction of six dwell­ships, in addition to the super­intendent's house and a four-room bunkhouse for single employees. There is a bowling alley, a playground, a tennis court, a baseball diamond and a swimming pool besides a community kitchen.

In addition to the housing for Aydin, there will quarters for about 24 Arab families and 20 Arab bachelors. The number of these Arab families is a very large one, and hence the plan of the house is quite different from the plans for the stations.

To such events—events that have changed the way men live forever after. They are not by work-day people. More common than plutocrats ride in American Park. He drives it an average of one in every family for a ride, or for a trip to Yellow­stone Park. He drives it an aver­age of one in every family for a ride, or for a trip to Yellow­stone Park. He drives it an average of one in every family for a ride, or for a trip to Yellowstone Park. He drives it an average of one in every family for a ride, or for a trip to Yellowstone Park.

THE MOUNTAINS

By MAX W. BALL

The Millionaires of Human Progress

The great events of human prog­ress—those that have changed the way men live forever after—are the inven­tories books. Historians emphasize po­litical changes; in the mastery of men over demands and miles, so as from Paris to Bombay and back. For some of the engineers buy enough gasoline to drive as far as from Vienna to Rome. These things have come from the discovery that few men thought important when it happened.

THE OIL MAN'S OIL

This discovery came none too soon. The Industrial Revo­lution had started in England some sixty years before; between our War for Inde­pendence and the War of 1812. It started with the use of steam and the substitution of coal for wood. It soon spread to the Continent. The Industrial Revolution is still growing in its early stages of growth; machines take the place of men; factories replace home handi­craft; man is no longer the king of the world; the man has and the common man covets; men have something wholly beyond and apart from the statesmen.

The stations are piped in such a manner that they can be operated either through a single line or through two lines. The "double" system of 86,000-barrel tank on the line coming into the sta­tion from the field. It is then split into two main lines, through which the oil is pumped. Booster pumps were provided to raise the pressure to about 1000 pounds per square inch and to prevent cavitation.

It is not certain at this time what caused the company to install booster pumps with "closed suction." This method of operation is almost obligatory for a transmission of the crude oil in an ordinary crude line has advantages in permitting the dis­patchers to correlate receipts and de­liveries, without difficulty or inaccuracies. The advantages are, however, it has no disadvantages too. Unless precautions are taken to limit the results of surge pressure to one section, pressures in the line created by the various stations, under certain circumstances, will be ex­cessive and result in over-pressuring the line. Where the line is laid above ground, there is another necessity for using booster pumps while operating with open tankage at each station that does not appear where the line is laid below ground. Where the line is laid below ground, the advantage of booster pumps while operating with open tankage at each station that does not appear where the line is laid above ground, this phenomenon is per­haps not so generally appreciated. In a line with many stations, each station of which is exposed to sunlight, every station receives more volume of oil during the day than it pumps out, and, conversely, pumps more during the night than it receives. The accumula­tion of this effect is uncertain, since the exact distribution and quantity of unburied line is not yet established.

In order to avoid over-pressuring the pipe line in case of accident or faulty operation, especially when op­erating with closed suction, it is now contemplated that relief valves of special design will be installed on both the incoming and outgoing main lines. In addition, over-presssure traps will be installed to shut down one or more engines in case of over-pressure on the discharge of the station.

Conventional scraper traps are being installed. The Arabians who are known to be somewhat wary.

(Continued on page 36)

OIL AND HUMAN WELFARE

By MAX W. BALL, '06

The Millionaires of Human Progress

The great events of human prog­ress—those that have changed the way men live forever after—are the inven­tories books. Historians emphasize po­litical changes; in the mastery of men over demands and miles, so as from Paris to Bombay and back. For some of the engineers buy enough gasoline to drive as far as from Vienna to Rome. These things have come from the discovery that few men thought important when it happened.

THE OIL MAN'S OIL

This discovery came none too soon. The Industrial Revo­lution had started in England some sixty years before; between our War for Inde­pendence and the War of 1812. It started with the use of steam and the substitution of coal for wood. It soon spread to the Continent. The Industrial Revolution is still growing in its early stages of growth; machines take the place of men; factories replace home handi­craft; man is no longer the king of the world; the man has and the common man covets; men have something wholly beyond and apart from the statesmen.

The stations are piped in such a manner that they can be operated either through a single line or through two lines. The "double" system of 86,000-barrel tank on the line coming into the sta­tion from the field. It is then split into two main lines, through which the oil is pumped. Booster pumps were provided to raise the pressure to about 1000 pounds per square inch and to prevent cavitation.

It is not certain at this time what caused the company to install booster pumps with "closed suction." This method of operation is almost obligatory for a transmission of the crude oil in an ordinary crude line has advantages in permitting the dis­patchers to correlate receipts and de­liveries, without difficulty or inaccuracies. The advantages are, however, it has no disadvantages too. Unless precautions are taken to limit the results of surge pressure to one section, pressures in the line created by the various stations, under certain circumstances, will be ex­cessive and result in over-pressuring the line. Where the line is laid above ground, there is another necessity for using booster pumps while operating with open tankage at each station that does not appear where the line is laid below ground. Where the line is laid below ground, the advantage of booster pumps while operating with open tankage at each station that does not appear where the line is laid above ground, this phenomenon is per­haps not so generally appreciated. In a line with many stations, each station of which is exposed to sunlight, every station receives more volume of oil during the day than it pumps out, and, conversely, pumps more during the night than it receives. The accumula­tion of this effect is uncertain, since the exact distribution and quantity of unburied line is not yet established.

In order to avoid over-pressuring the pipe line in case of accident or faulty operation, especially when op­erating with closed suction, it is now contemplated that relief valves of special design will be installed on both the incoming and outgoing main lines. In addition, over-presssure traps will be installed to shut down one or more engines in case of over-pressure on the discharge of the station.

Conventional scraper traps are being installed. The Arabians who are known to be somewhat wary.

(Continued on page 36)
Still there was not enough. The cost of coal was high, but it was a lubricant. Man needed a bigger and cheaper source of oil. Without it, no wheel could roll, no machine could grow. Looking back, we see that the Industrial Revolution was in grave danger. It might have come to an end.

**The Search for More Oil**

It was a middle 50's, Great Britain had 130 miles of tubing in the ground. Whoever heard of digging for oil? But they did. They risked much, and they succeeded. They scraped together enough money to pay for a report. It was presented to the local paper, and it included a map of the underground oil deposits. It was a nuisance; it spoiled the salt. They tried to make some money, but no one was interested. They abandoned the idea. Then they organized the world's first oil company, and got busy.

**What the Report Said**

The report discovered that there was oil on the farms in the area. They studied how to meet the demand and thereby make money. They had vision; they had signposts to guide them. Men skimmed oil from springs and dug wells to get brine; they evaporated the brine and got salt. In some wells the oil and gas were mixed, and they were not a lubricant. Man needed a bigger and cheaper source of oil. Without it, no wheel can roll, no machine can grow. Looking back, we see that the Industrial Revolution was in grave danger. It might have come to an end.

**From a Spring to a Mine**

**The First Oil Field**

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**Oil Springs and Oil Wells**

Oil is found in the ground by drilling. It is not a mineral, but a mixture of compounds of carbon and hydrogen. The compounds are volatile, meaning that they evaporate at low temperatures. Oil is not a lubricant. Man needed a bigger and cheaper source of oil. Without it, no wheel can roll, no machine can grow. Looking back, we see that the Industrial Revolution was in grave danger. It might have come to an end.

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A real danger was presented while chewing solids or concreting the pier for reinforcement. Chuting system was used for concreting the pier where solid fortin更多

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41 ft. gallery sections of conveyor "C" leaving the hopper and gradually leveling as it approaches the tipple.

Another view of the hopper. Fourth piling was set on the down grade side of the pier and in line with the third piling to furnish a toe hold on the thrust action of the belt conveyor. A reinforced concrete mate was set over the pilings. A crane and a winch half-track were used to mount the gallery sections on the taller pier, with one piling in each pier site and the third in between the piers; the

Men working on the forms for the walls of the hopper foundation below "B" conveyor.

View of the transfer house foundation between conveyors "A" and "B". A reinforced concrete mat was set over the pilings. A crane and a winch half-track were used to mount the gallery sections on the taller pier, with one piling in each pier site and the third in between the piers; the

Tipple Construction

As the winter months approached more work was concentrated toward the construction of the coal tipple. A Caterpillar D-8 bulldozer was used to place the concrete mixer at one place while the half-track were batched and dumped into a Stalled between the bumper and the hopper-bin at the bottom in the background.

View of the layout of the belt conveyor system early in the construction

Man working on the forms for the walls of the hopper foundation below "B" conveyor. Scrap steel bars were inserted in each pier for reinforcement. Chuting system was used for concreting the foundations for the "pied-shaped" hopper above "A" conveyor, the transfer house above "B" conveyor, and the hopper above "C" conveyor. A complete network of steel rods furnished the reinforcement for concrete floor and walls. A real danger was presented while hauling material and moving equipment on the steep mountainside. An auxiliary road to the intersection of the belt

Oil and Human Welfare

(Continued from page 18)

A crane and a winch half-track (not shown) creating a 41 ft. gallery section.

View of the new tipple is the foreground and the two belt conveyor units spanning the hillside from the hopper on the kiln tip to the hopper-bin at the bottom in the background.

View of the "pied-shaped" hopper which receives the raw-off-the-mines coal from dump trucks.

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THE CORPS OF ENGINEERS' SYNTHETIC LIQUID FUELS PROGRAM

By LT. COL. IRVIN M. RICE, C.E., '39

The U. S. Potential for manufacturers of synthetic liquid fuels may prove to be considerably higher than has been the generally held opinion of leaders in the oil and coal industry. Specific information will soon be available to the public through the efforts of the Department of the Army in its synthetic fuel program, as to possible areas where such plants could be located.

A nationwide survey, to procure basic data necessary for the initial planning of the location of synthetic liquid fuel plants, has been undertaken by the Corps of Engineers, U. S. Army, at the request of the Department of Interior. The survey is not intended to explore the manufacture of synthetic liquid fuels but is intended to determine general areas where the basic requirements (such as raw materials and water supply) for one or more plants can be met. Detailed site investigations would be required before any actual plant construction can be undertaken.

The survey is being conducted by the Engineering Division, Military Construction, Department of the Army, and the National Bureau of Mines, this division being the military environmental arm of the United States Army, and the National Bureau of Mines a division of the United States Department of the Interior. The survey is primarily an inter-agency job for the Department of the Interior, the National Bureau of Mines and the Corps of Engineers to plan and carry out its work. The survey is also expected to provide a guide to industry as to where detailed site location studies can most profitably be made prior to constructing synthetic liquid fuels plants.

Since the advent of a synthetic liquid fuel industry seems inevitable, unless present conditions of fuel production and consumption change, synthetically, and since an adequate liquid fuel supply is of vital importance to the nation, this survey will be of value as a practical means of gathering and making available to interested agencies and groups the basic information for locating a synthetic liquid fuels industry. It is much more economical to prepare one comprehensive survey than to make several separate surveys to gain knowledge of individual interests which will duplicate each other in scope and content.

Need for Synthetic Liquid Fuels

The present critical situation with regard to our vital petroleum production, which, it is estimated, the result of the demand the increasing more rapidly than the domestic supplies can be developed, is, the production of the magnitudes of the jump in demand in recent years can be gauged by the experience of the petroleum_markets. We have seen a tremendous increase in the demand for petroleum in this country in the event of a national emergency or a war.

The Bureau of Mines has selected the processes of manufacture to be considered as candidates for the plant requirements, including such items as coal, water, power, and labor. Basic processes utilized in the coal industry are:

1. Hydrogenation of coal; 2. Coal tar production; 3. Manufacture of coke; 4. Fossil fuel use; 5. Natural gas; 6. Petroleum; 7. Both of the foregoing methods; 8. Petroleum and coal; 9. Coal and natural gas (the so-called Fischer-Tropsch process); and 10. The retorting of oil shale. The Bureau of Mines is currently engaged in a program to develop processes which is to culminate in the construction and operation of demonstration plants. These include a shale-oil demonstration plant at Rifle, Colorado, a coal hydrogenation plant and a gas synthesis plant, now under construction at Baton Rouge, Louisiana.

When completed, the survey will provide an accurate picture of the Nation's synthetic fuels program, as to with development of the Government's synthetic fuels program, as to planning of the location of synthetic liquid fuels plants. It will indicate where the Nation's available raw materials reserves for synthetic liquid fuels manufacture are located. It is expected to serve as a guide to industry as to where detailed site location studies can most profitably be made prior to constructing synthetic liquid fuels plants.

In 1948 and 1949 on exploration and development. Just how much new production of domestic oil and gasoline oil will result from this accelerated program of the oil companies is a subject on which differing opinions exist. The final solutions to the controversy over control of the oil-bearing coalfields in this country lies in the development of the reserves and in the development of the industry.

Mr. Ball has expressed the opinion that the oil industry can itself overcome the problem. In a recent address, Mr. Ball said that the current demand for synthetic fuels is about 600,000 barrels per day and that the synthetic fuel industry has the capacity to produce 1,000,000 barrels per day by 1950.

Synthetic Liquid Fuel Processes

Modern petroleum production is limited to about 20% of the world's fuel use. The availability of synthetic fuels is essential to the United States, as it is to other countries where there is a large demand for fuel. The Stanolind Company and the Standard Oil Development Company have jointly built an experimental coal gasification plant at Carthage, Texas. However, there is a general feeling in this country amongst those most familiar with synthetic fuels production that considerably more work must be done to perfect flow sheets and process requirements in the laboratory and pilot plant stages before any commercial size plants are built. The oil industry generally believes that the synthetic fuel process offers the most promise from an economic viewpoint according to testimony before a Congressional Committee. The Bureau of Mines has reportedly stated that the hydrogenation process (also known as the Bergius Process) cannot be ignored because of the flexibility of the process in making products ranging from fuel oil to gasoline; the gas synthesis process is more restricted in its products, being chiefly assembled to the production of gasoline and diesel fuel.

The hydrogenation process, first reported by Bergius in Germany in 1921, depends on the fact that the essential chemical differences between bituminous coal and petroleum are the ratio of carbon atoms to hydrogen atoms in coal is double that for petroleum (1.2 for bituminous coal and 0.6 for petroleum); that petroleum contains less oxygen, nitrogen and sulfur; and that petroleum constituents have a lower molecular weight. The hydrogenation process essentially consists then of cracking the larger coal molecules in the presence of hydrogen at relatively pressures and pressures and suitable catalysts. These processes of hydrogenation are like substances to be formed which have a higher hydrogen content than the original hydrocarbons and removes the oxygen, nitrogen and sulfur in the forms of

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Figure 1: The Bureau of Mines is currently engaged in a program to develop processes which is to culminate in the construction and operation of demonstration plants. These include a shale-oil demonstration plant at Rifle, Colorado, a coal hydrogenation plant and a gas synthesis plant, now under construction at Baton Rouge, Louisiana.
water, ammonia and hydrogen sulfide, respectively. In practice, pulverized coal is mixed with an equal amount of heavy oil (the latter a product of the process). The mixture is subjected to a hydrogen atmosphere in the presence of a catalyst to form hydrocarbons of various chain lengths and degrees of saturation. Using coals with a high grade fuel density, for a given degree of gasification, the production of a fluidized catalyst bed and an iron grade motor gasoline and correspondingly poorer Diesel fuel.

The gasification process evolved from experimental work carried on in Germany by F. Fischer and H. Tropsch and others in the 1920s, essentially consists of the reaction of carbon in the presence of a catalyst to form hydrocarbons from coal, but with the use of a iron catalyst, thus giving a heavy grade motor gasoline and correspondingly poorer Diesel fuel.

The process has been used in Germany on a commercial scale, using a coal-catalyst and equipment of a grade motor gasoline and correspondingly poorer Diesel fuel. The process has also been used in the United States, where the use of coal gasification has been made possible by the use of fluidized catalyst beds and iron catalysts, the latter for the purpose of producing a higher grade motor gasoline. A considerable amount of by-products have been produced, including alcohols, acids, and ketones, which are used for the production of a fluidized catalyst bed and an iron catalyst, the latter for the purpose of producing a higher grade motor gasoline.

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The emphasis on the new school will be supply as well as teaching, to find out how the students are being taught.

several companies are experimenting with this new method, and one of them is Union Carbide. This company is one of the most important tools in nuclear re-

Status of Accelerator Program, Particles beams of all energies and types are among the most important tools in nuclear re-

At Brookhaven National Labora-

tory, we have set up a building program (the Concourse), which will impact examples of from 2 to 5 million electron

This year, a still greater emphasis was made in the Berkeley Radiation Laboratory.

A new plutonium metal fabrication plant was opened in November July, 1949.

The contract research program for physical sciences in non-

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Oil and Human Welfare

(Continued from page 27)

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The evidence is clear: Oil is the great promoter of industrial progress; oil is the great contributor to a high standard of living. Country by country the more oil you use, the better you live.

Great Risks and Great Results

The first oil wells were in Pennsylvania. The first oil ever picked up the bottle of oil from Dr. Crawford’s desk was $1.80. In 1851, eight years later, Union Oil Company sold its first oil to Union Oil Company sold its first oil for $800 a barrel. In 1860, the United Kingdom sold its first oil for $170, in Sweden, $350, in Italy, $350, in France.

Then that: the use of oil per person in those countries followed the same order. In the United States it was $900 a barrel. In the United Kingdom 150,000, in France 55,000, in Italy.

Consistently, without exception the more oil per person the people of a country used, the greater its value of its industrial output per person.

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Oil and National Income

The next step toward judging the standard of living is to study the national income per person. It has a broader base than value of industrial output; it includes agriculture and domestic service as well as industry.

On this scale the five countries again come in the same order. The 1948 national income per person in the United States was $681, in Sweden $413, in the United Kingdom $400, in France $228, in Italy $105.

The more oil per person the country used, the greater its national income per person.

Oil Use and the Standard of Living

That brings us to the final question: How much of the oil used goes into productive activity, how much into non-productive?

An answer can be had by dividing the national income per person by the national income per person. The result is the national income per person for each gallon of oil used. It is, of course, a measure not of how much of the value of oil has gone into production.

It shows that about 90% of the productive activities are met a large amount is used in living for the home and land and sea; a world in which we live better than men have ever lived before.

We live in a new world, because a living up of men were spared the horror of unemployment; because they raised their money and their standard of living; because men have got on a little stream called Oil Creek.

The new, Link-Belt Thru-Clean Bar Screen announced (673)

LINK-BELT COMPANY The development and manufacture of a new series of Link-Belt Thru-Clean Bar Screens— traffic increasingly is making our industrial progress impossible. As a result, the great promoter of industrial progress.

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Twin roll crushers are available in sizes 34x28, 40x32, 19x21, and 36x24. Two of the triple roll models available: 42x24x32 and 30x18, the latter having just recently been added to the line.

Full facts and information are available in the catalog of this company. Write to The Pioneer Engineering Works, Inc., Minneapolis 13, Minnesota, for free copy.

New Model 80 Treadmolen (677)

Latest addition to the Parsons Line of Treadmolen is the new Model 80 Treadmolen, as described in detail in an 8-page catalog recently published by the Parsons Company of Newton, Iowa, Parsons is a subsidiary of the Rubber Company of Milwaukee. The new Treadmolen is designed for fast and even女神 for small drawing machines. It is more than just a brilliant color that can be applied to any fabric, cotton, linen, and wool in work or travel.

World's Largest Single Unit

Conveyor Belt 946 feet long.

Akron, Ohio — The world's largest single conveyor belt, for use in transporting coal at the Wright Mine of the Warren Mining Com-pany, Warren, W. Va., has just been installed by The Ohio Tire & Rubber Co.'s Mechanical Goods division. This Conveyor-belt is 946 feet long and will haul coal from the washery located near the mine, to a waiting barge on the Ohio river. The conveyor belt itself is 30 inches wide and 5 or 8 inches deep and up to 4 feet thick, and is capable of handling up to 1500 tons of coal per hour.

The conveyor belt is built and powered by a 150 h.p. 4 cylinder gasoline engine. The conveyor belt is equipped to an eight-foot wide platform, 8 feet long, and is capable of handling up to 1500 tons of coal per hour.

Tires avoid damage to sidewalks, lawns

Goodyear Tire & Rubber Co.'s Mechanical Engineering Works avoid damage to sidewalks, lawns and other landscape areas by using the new Treadmolen, a new development in conveyor belts. The Treadmolen is designed to carry coal,沙石, and other materials with a minimum of damage to the surrounding area. It is capable of carrying as much as 1000 tons of coal per hour, and is designed to be used in the mining of coal, sand, and gravel.

Promotions in Goodyear Sales Management

Management officials of the Goodyear Tire & Rubber Co. have announced that Victor Holt, Jr., as of Nov. 28, will become vice president, in charge of the company's district sales managers in Akron, Ohio. Thompson will succeed John Jenson, who recently retired from the company. These changes were the advancement of the company's district sales managers, and the promotion of Victor Holt, Jr., to the vice presidency of the company.

The new Treadmolen is available at the company's main office in New York, and can be seen by appointment. The Treadmolen is manufactured by the company, and can be obtained through the company's main office in New York.

T. J. Jenson Appointed Sales Manager for the Rocky Mountain States.

T. J. Jenson has been appointed sales manager for the Rocky Mountain States for the Goodyear Tire & Rubber Co. Jenson has been associated with the company for 30 years, and has served in various capacities.

Colorado Iron Works

The commission of Colorado Iron Works Company has recently announced the appointment of Mr. J. J. Jones as manager of the company. Mr. Jones has been associated with the company for 10 years, and has served in various capacities.

The new Treadmolen is available at the company's main office in New York, and can be seen by appointment. The Treadmolen is manufactured by the company, and can be obtained through the company's main office in New York.

Sturdily built and powered by a 150 h.p.

4 cylinder gasoline engine. The Treadmolen is equipped to an eight-foot wide platform, 8 feet long, and is capable of handling up to 1500 tons of coal per hour.

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Alumni Business

EXECUTIVE COMMITTEE MEETINGS

The regular meeting of the Executive Committee, Colorado Branch of Mines Alumni Association, was held in the Alumni office, Wednesday evening, November 3, 1949. The meeting was called to order by President Kingman at 7:00 P. M. The minutes of the meeting, November 17, 1949, were read and approved.

Roll Call

There were present: Edward F. Kingman, President; Malcolm E. Collier, Treasurer; Irwin T. Vaughan; Assistant Secretary; Harvey E. Mathews, Chairman; Robert F. Barney, Vice President; Robert J. McGlone, '27, Committeemen; Robert F. White, Dart Wantland, C. E. McWhorter, A. George Setzer, Michael; passed.

Admission

No new members present. Mr. Mathews moved the report including the roll call, seconded by Mr. Mathews; passed.

Adjournment

Mr. Mathews moved that the meeting be adjourned; seconded by Mr. Collier; carried. Meeting adjourned 9:10 P. M.

PERSOnal nOTES

R. H. Bradley, also of the class of 1943, has a change of address. Address is 509, 5601 West 34th Ave., Downey, Calif.

ETTIN C. BALANCED, 205 Mount View Ave., Bluefield, West Va.; and Edward J. Collet, 11 Broadway, New York 3, N. Y.

C. A. M. Members present:

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WEDDING

Riddle - Desilets

Mr. and Mrs. Paul J. DeJails have an
dughter, Pamela, born in March. Mrs. DeJails is the former Pauline Marie, to John Aiden Riddle on September 15, 1949. The couple had been having their first child. They are now living at

Mr. Riddle, who received his degree from Mines this year is associated with the Engineering Department at

The bride was graduated from the Un-

(Conginued on page 34)

THE MINES MAGAZINE • JANUARY, 1950
THE MINES MAGAZINE ® JANUARY, 1950

WEDDINGS

Professor Clark B. Carpenter

head of the metallurgy department at Mines was elected national president of Sigma Gamma Epsilon, earth science fraternity, at a convention held in Denver recently.

Prof. Carpenter, who succeeded William A. Brown of Morgantown, West Virginia, was chief executive of Sigma Gamma Epsilon, had served as treasurer of the fraternity for the past 25 years. He is one of the charter members of Alpha chapter, the first chapter of Sigma Gamma Epsilon, when he attended the university in 1915. Since its organization in 1915, the society has grown until now it includes chapters throughout the colleges and universities of the United States and Canada.

The national meeting, held in Denver, was attended by representatives from all but two of the chapters of this honorary fraternity. Several groups had more than one man attending. In all 78 individuals registered for the convention.

A Bronze Plaque
dedicated to the memory of John H. Merryman, who was killed last spring while working for the Blue Key in the hall of the Mining Building. The plaque was presented to the Blue Key chapter by R. T. McGlone, president of the fraternity in the hall of the Mining Building. The plaque was presented to the Blue Key chapter by R. T. McGlone, president of the fraternity, in recognition of the organization's many activities while it was in Denver.

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(Continued from page 33)
wagons, occurred on Cemetery Hill around 5:00 P.M.

Miss Bowen for many years served as director in numerous colleges, hospitals, and other institutions in Arizona. Under the 1929 edition of "Who's Who Among Students in American Colleges and Universities," The annual publication is compiled from brief biographies of outstanding seniors in good standing in American colleges and universities.

Mines whose biographies appear in the forthcoming edition of "Who's Who Among Students in American Colleges and Universities" are:

Hubert E. Berghausen, president of Blue Key and a member of the "M" club.

Tylor Bisker, business manager of the Prospect and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, and "M" club.

David L. Caldwell, president of the Bar association and a member of Sigma Gamma Epsilon, Kappa Sigma, and the "M" club.

Arthur S. Dickinson, president of Blue Key and a member of Sigma Gamma Epsilon, "M" club, and Alpha Tau Omega.

Martin S. French, president of Tau Beta Pi, chairman of the Engineers' Day committee, and a member of Blue Key, Sigma Gamma Epsilon, and the "M" club.

Dennis E. Gregg, president of the glee club, secretary of the Board of Publications; and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, and Alpha Tau Omega.

Charles W. Irish, editor of The Orange, and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, and the "M" club.

Paul R. Nelson, a member of Blue Key, Theta Tau, "M" club, and Alpha Tau Omega.

F. Terrence Quiert, student council chairman of the University of Denver; and a member of Blue Key, Tau Beta Pi, Sigma Gamma Epsilon, and "M" club.

John R. Weyler, president of the Student Council and a member of Blue Key and Sigma Gamma Epsilon.

The Standard Oil Company of New York has established a graduate fellowship in geological engineering at the University of Denver. This provides $1,200 a year until the holder plus an additional amount for expenses incident to the period of study. The fellowship has as its objective the encouraging of young men desiring graduate study in the field of petroleum exploration by geophysics.


Other Colorado are Tyler Bisker, Richard M. Sradyszewski, Francis P. Consuegra, and John K., "M" club, and Alpha Tau Omega.

The second-year Vacuum Oil Company graduate fellowship in geophysics has been given to Norman Dometico of Denver. The fellowships are awarded for the present year, is $1,500, and has as its purpose research in the general field of elastic waves and solids.

The fellowship has been received by Francis P. Consuegra, a member of Blue Key, Sigma Gamma Epsilon, and "M" club.

Nanette Copper Corporation has awarded the Neel fellowship in geophysics to John W. Lumley, Denver.

The Neel fellowship is awarded annually, and is for $750, and is made on the basis of academic record and promise in the mining engineering field.

Sigma Nu and Blues were found to be the average grade of Mines' freshman class in the fall semester of the 1948-49 school year. Sigma Nu led the first semester and Sigma Alpha Epsilon the second semester.

At the 1949 commencement exercises, Sigma Nu presented a gift to the mining engineering field.

The Damage to Stratton Hall resulted in the loss of many of the student's personal belongings. The cause of the fire was found to be an electrical failure in the control room. It caused an estimated damage of $250,000.

The Mining Engineering Society of Mines was pleased to present one in the future.

A meeting of the Great Lakes Section of Mines Alumni Association was held on the evening of November 21 at Phoenix, Ariz.

The members convened at 7:00 P.M. and dined with appropriate beverages supplied by independent restaurants. The entertainment was furnished by some old friends who were having their representatives at an adjoining dining room. As the ladies took the Powder Room floor led by our host, several flooring arrangements were made by the members of the group. As far as can be determined, there were no lasting relationships developed. The height of the evening's excitement was reached when there was an exchange of toasts, the more conventional songs being supplied by the ladies. After the ladies took their departure, they bade some farewell before going on their way.

The following members were present:

Mr. and Mrs. Blackwell, B. Wagner, of South Dakota; Mr. and Mrs. E. A. Sawitzke, of Phoenix, Ariz.; Mr. and Mrs. J. E. McCall, of Chicago, Ill.; and Mrs. E. A. Sawitzke, of Phoenix, Ariz.

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Lester L. Puller
who received his metallurgical degree from Mines in 1910, died in Los Angeles, October 22, 1949.

Lester L. Puller's first experience was gained in Mexico where he spent a year with two mining companies, after which he went to the Philippines as shift boss for the Syndicate Mining Company, Baguio, Philippines. He was later promoted to superintendent of the mill.

Returning to the States he accepted a position in the Research Department of the Aluminum Company of America at Marysville,陕西, where he was promoted to production superintendent and was responsible for his entire year, before his health forced him to retire in 1937. During this time he was an active member of the American Society of Civil Engineers, and was largely concerned with the design and construction of a new smelting plant for the American Smelting & Refining Company.

Mr. Puller was a member of the Mines Club of Missouri, N.Y., the Philippine Society of Southern California, an organization of former residents of the islands, and of Mines Alumni Association.

His immediate survivors are his wife, Rae, and two sons, Charles R. and Edward A., both of Utah State University.

Mr. Puller's accomplishments were recognized in various offices and on committees.

Mr. Puller was an active member of the Alumni Association, serving on various boards and committees.

Mr. Puller was born in Colorado in 1904, and received his Bachelor of Science degree from Mines in 1926.

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CONTRIBUTORS TO PLACEMENT FUND FOR PART OF 1949

BY HERB WATERMAN

Thirty-five men received a variety of positions for the 1949 football season. Dick Bench was selected to an end position by the Ottawa University squad members on their 1949 all-outstanding team. The players placed their names in the hands of the many pa­payers who bought "Miner" subscriptions. Lettermen

Don Adam
Wallace Arnold
Dorrell Ballou
Ronald Bemeth
David Brown
John Earl
Roy Esary
Robert Gardner
Edgar Goule
Paul Hamilton
Joe Hill
Clarence Jenkins
Robert Johnson
William Johnston
Howard Kaylor
John Keating
George King
Harvey Knigie
Denzel Low
Francois Merier
John Macmillan
Jack Macruth
Tom Massett
John Madonna
Bobby McQuay
Jack McShane

Miners Take First Two Games of Basketball Season

The Miners opened their 1949-50 basketball schedule with a couple of liquid fuels program

(Continued from page 24)

were brought up to date in 1936 by the estimates made by Mr.
Mr. Hendricks.

Buffs Whip Grapplers 28-8

Showing plenty of spirit, but lack­ing the ability to score points, the Buffs fell to a 28-8 defeat in the hands of the State Western State in two games the previous weekend, however, the state basketball supper in Denver was improved greatly over last season. Coach Karamigios took a twelve man squad plus himself, Joe Davies, and the team manager, John Hudson.

Miners Split with Adams State

The Miners took the first and last games of the Colorado university schedule with a couple of Buffs Whipped 12-5.

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Atomic Energy and the Life Sciences

If one is willing to overlook the occasional lapses of the author's logic, the treatment of the various aspects of this subject is lucid and clear. The AEC has gotten out an extremely fine pamphlet on a subject which should be high in the interest of all Americans, and, indeed, of all human beings.

In the foreword the description is given of one which "sums up briefly the major developments in atomic energy program and further gives a comprehensive review of its major phases—the biological and medical applications of atomic energy in the treatment of disease and in the production of energy."

The material in the report is considered under the following headings:

1. Major Developments in Atomic Energy Projects
2. Biology and Medicine
3. Obtaining a Nuclear Reaction
4. Research in Metals
5. Accounting for Materials
6. Control of Experiments

In the opening section, it is described that the recent developments in the field of atomic energy are burgeoning, which it points out the importance of the services rendered by the Atomic Energy Commission, Los Alamos Scientific Laboratory at Los Ranchos, N. M., and Oak Ridge National Laboratory. The report outlines the more important aspects of the field of medical and biological applications of the atomic energy projects.

For a straightforward, complete and impartial study of the subject, this report is to be recommended. The report covers the different aspects of modern medicine which can be translated for an English term varies with locality, all the varieties are given and identified as the areas in which they are used.

This book, which is a comprehensive coverage of oil in Venezuela, its history, and importance, and provides a detailed study of the various types of synthetic fuels plants in operation or under construction. The book concludes with some discussion on the future development of synthetic fuels. It is accepted and will present no difficulty.

The Corps of Engineers has undertaken the task of estimating the recoverable reserves of coal in the United States, is interested in this question to a degree since reserves of bituminous coal are being depleted. The Corps of Engineers is undertaking this investigation primarily because the synthetic liquid fuels survey must be based on data. The Corps of Engineers has made in the survey to estimate total reserves, an estimate of reserves available in the near future, and an estimate of reserves which have been developed. Information is wanted in these categories for from the use of synthetic fuels. Therefore, a set of rules for computing these data is needed. An outline of this is the following:

LIFE LIQUID PROGRAM

(Continued from page 43)

Estimates of crude oil reserves have also been made by individual states through their own governmental agencies. These estimates have differed in some instances from those of the U.S. Geological Survey. Some states consider the United States as a whole. The U.S. Geological Survey, on the other hand, considers the United States as a whole. In 1945, the American Institute of Mining and Metallurgical Engineers recommended for the regulations governing the production of crude oil. Other features of this report include a graph showing the relationship of the various types of synthetic fuels plants in operation or under construction, the definitions of the various categories of synthetic fuels plants in operation or under construction, and the requirements for consideration for synthetic fuels such as, for example, availability of the raw materials and distribution.
The possiblity of supplying water requirements for synthetic fuel plants may be an important limiting factor in determining the number of plants which can be located in an area as the reserves of raw materials. Areas which are found to have insufficient water supply for even one plant are dropped from further consideration even though the raw materials may be present.

Order CONYERYS

For areas found to meet requirements for raw materials and water supply, further and detailed investigations are made to include: (1) cost of production of raw materials; (2) amount of construction required for on-site mining and cost of developing a suitable water supply; (3) estimates of cost of development of additional facilities if necessary; (4) availability of labor and need for housing and community facilities; (5) potential markets for the synthetic fuels produced; (6) availability of electric power for synthetic fuels plants and (7) waste disposal.

Areas are classified as to general order of desirability. Sufficient detail is included to indicate the reasons for selecting or rejecting an area from further consideration.

Indication of Sample Survey Results

In the few areas already examined, the magnitude of the raw materials reserves and the availability of water indicate a very large potential for various parts of the country as a whole for synthetic liquid fuels manufacture. Existence of a wide choice of locations for plants is indicated. Apparently there is a large amount of coal mineable from existing mines by increasing the number of working days per year to provide steady year-round employment.

Nationwide survey to determine general areas suitable for location of synthetic liquid fuels plants, for which funds were appropriated by the 80th Congress, will get under way early in 1949. It will include the continental United States and part of Alaska. The previous survey covering parts of Kentucky, Colorado, Texas and Montana will be incorporated into the new study.

COMMENDATIONS FROM PACIFIC NORTHWEST SECTION

For areas found to meet the requirements of the nationwide survey, the results will be the same for the coming year and will, therefore, require no change in the Yearbook....

COMMUNICATIONS FROM PACIFIC NORTHWEST SECTION

From: W. L. Smokey, 405 W. Windom, Seattle, Wash.

Replied the smiles of the last meeting of the Pacific Northwest Section, which was held on December 8, 1949.

With reference to those minutes it can be noted that the officers of the section will be the same for the coming year and will, therefore, require no change in the Yearbook.

We would like to extend our congratulations to the Alumni Association for its part in the program of the Seventy-Fifth Anniversary celebration of the Anderson School which was one of the recipients of the Distinguished Achievements Medal. Anderson was out of town during the last meeting so we were unable to extend our congratulations to him at that time.

We were also impressed with the past successful football season and hope that the good work will continue.

We are also pleased to see that the Systematic Survey will be completed in from one to two years.

Bibliography


"Marines and Coal Fields of the U. K. by M. R. Campbell.


TRANS-BORDEN PIPELINE

(Continued from page 26)

normal time, and the change-over is manual. Communication with the 50 and 300-barrel line automatic conveyors is also excellent, and at times even the 15-watt automobile transmitters have been able to communicate three-quarters of the way across the area. The latter situation is unusual and not to be depended on, but the automobile transmitters have apparently been able to get in communication with the nearest construction camps without difficulty.

It is contemplated that the permanent installation will consist of two more or less separate systems, one being a through system from Sidon to Khallat, and the other a dispatcher system for the pipe line, feeding into all the intermediate stations as well as the terminals. The through system will utilize transmitters of 1000-watt output power feeding to rhombic antennas on the top of the storage tanks for the purpose of obtaining single-hop transmission.

Three rhombic-antennas will be used for reception in conjunction with the diversity receiving arrangement which automatically selects the strongest signal and virtually eliminates fading. The dispatching system will utilize three frequencies simultaneously to provide dependable communication to any station or stations at distances varying from 125 to 1000 miles. The frequency for these distances will be in the vicinity of five, 10 and 16 megacycles.

Storage Tanks

The Mediterranean terminus of the Trans-Arabian Pipeline Line, which will a few miles south of Sidon at a point where the Mediterranean comes into the Mediterranean, is planned to be the larger of 180,000-barrel capacity each at elevations 285 to 378 feet above the water. The tanks will be about 2500 to 7,200 feet from the shore. Four submarine loading lines will extend some 2,700 feet from the beach to a point where the water is 50 to 55 feet deep, and in addition there will be separate ballast lines. The initial installation will be the simplest necessary for loading tankers by gravity with crude oil under a high rate, although the possibility of a refinery at this point at some later date has always been in mind. Industrial facilities required for a submarine loading terminal are a separator for handling oil ballast, a communications system from ship to shore and from shore to tankage for controlling flow of oil, and a small pier for the hatches that are necessary for handling ships' mooring lines, hose and other personnel and moving minor supplies.

The permanent radio transmitting station will be located at Sidon rather than at Beirut where the present station is now located.

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The Mines Magazine ® January, 1950
Wherever iron or steel meets abrasive minerals, how to specify the best wear-resisting materials?
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Reprints of an informative and authoritative paper (published by the American Institute of Mining and Metallurgical Engineers), giving the statistical results of extensive wear tests on a wide range of grinding ball materials, are now available.
Copies of this paper are available to interested engineers and metallurgists. Although the data apply specifically to wear tests on grinding balls, there is a wealth of comparative information listed in the form of "abrasion factors" for forged and cast steels, chill cast iron, white iron, etc., which can be applied to many other abrasive conditions encountered in the mineral industry.

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