The Petroleum Engineer: His Past, His Present and His Future

By C. E. REISTLE

There is an old saying that every man feels that he is eminently well qualified—whatever his training—to pursue three careers: to coach football, to sing baritone, and to write deathless prose. Back in the early days of the petroleum industry, you might have added a fourth career to the list: that of drilling and producing oil wells.

Now, I imagine that Bud Wilkinson, Ezio Pinza, and Ernest Hemingway would agree that success in their respective fields depends on considerably more than confidence in one's ability to do a job. And in the field of petroleum engineering, to get down to the case in point, I feel sure that Dean W. H. Carson and his colleagues will back me up when I say that there is no easy route, no royal road, no automatic entree, to success in the oil fields.

There was a time, true, when the requirements were not quite so stringent. A man could go far in the petroleum industry on little more than confidence in himself, a bit of luck, and a dash of mechanical ingenuity. Thousands of wells were drilled and millions of barrels of oil were produced in this country before the name "petroleum engineer" ever entered our vocabulary. But those days are far behind us.

As the shallow sands became harder to find, as the drilling bit began to probe deeper and deeper, as the conservation movement steadily raised the goals of ultimate recovery, the field problems of the oil industry increased in geometric proportion. Many of the new techniques, much of the new equipment, were beyond the ken of the old-time, catch-as-catch-can driller. It was then that the scientifically trained men we now call petroleum engineers moved onto the scene.

That was not too many years ago. It is quite easy, as a matter of fact, to forget just how young the now-flourishing profession of petroleum engineering really is. Back in the early Twenties, when I was a student at Norman, the University offered no course leading to the degree of petroleum engineer. I took my degree in chemical engineering. Petroleum engineers—that is, men specifically trained for work in the oil and gas industry—were few and far between.

How times have changed! Today the business of drilling for and producing oil and gas is almost entirely an engineering enterprise. No company, small or large, would think of drilling a well without competent engineers on hand to oversee the entire operation from spudding in to final completion. And the nation's universities, in answer to the mounting need, are turning out hundreds of young men each June ready, willing, and able to assume positions of responsibility in the drilling and producing phase of the petroleum industry.

These young engineers are casting their lot with a dynamic industry. Over the past thirty years, America's demand for petroleum products has increased nearly five per cent a year on the average. The nation's petroleum industry has not only met this constant challenge to its productivity, but it has also managed, at the same time, to build our known reserves to the highest level in history. The known reserves of oil alone are currently estimated at more than 29 billion barrels. Our present reserves of natural gas are approximately 205 trillion cubic feet, an amount equivalent in heat value to 34 billion barrels of crude oil.

In terms of today's prices, these oil and gas reserves comprise half of our nation's total mineral wealth.

The availability of oil and gas in steadily increasing quantities was bound to have a tremendous impact on America's employment of energy. At the turn of the century, for instance, oil and gas supplied less than one-tenth of the energy consumed in this country. Today oil and gas supply about 62 per cent. To keep pace with this expanding market, the petroleum industry has had to up its production of oil from 175,000 barrels a day in 1900 to more than six million barrels a day at the present time.

Natural gas has had an even more spectacular growth. In 1920, natural gas supplied only four per cent of the energy consumed in the United States. It now supplies more than 20 per cent. Last year, the industry produced nearly eight and a half trillion cubic feet of this clean, efficient fuel. This whopping output, if weighed, would have tipped the scales at 244 million tons. It was transmitted through 425,000 miles of gas pipelines to the burner tips of 20 million customers.

Under our "multiple effort" system of hunting for oil—a system once described as providing an opportunity to all but guaranteeing a profit to none—production of oil and gas has been established in 27 states. This production comes from more than half a million producing wells scattered across some 18 million acres of oil and/or gas fields.

As of now, however, the five states of Oklahoma, Texas, California, Louisiana, and Kansas account for more than 80 per cent of our crude oil production. But this ratio could change, of course. No one can say where the great discoveries of tomorrow will be made.

Present estimates indicate that our national demand for petroleum products will double within the next 25 years. To prepare for that contingency, an industry that already has 17.6 billion dollars invested in oil and gas production is currently anteing up two billion dollars a year in new capital expenditures for oil and gas production alone.

But capital investments, however large, are far from being the only key to this amazing success story. The American petroleum industry could never have reached the point where it produces 52 per cent of the world's crude oil had it not been for the men and women, its employees, who carry out so ably their widely diversified tasks. There are now about two million of them employed in all phases of the industry, and of this number about 265,000 work in oil and gas production.

In this latter group, of course, may be found the petroleum engineers.

Now, what about the educational requirements for the man who wants to be a petroleum engineer?

I find that there is still a considerable difference of opinion as to the exact ingredients required for a sound engineering education. The situation, I suppose, is

somewhat analogous to that in our public schools, where the traditional subjects are bumping shoulders with newer courses aimed at providing practical experience in the art of living. Some engineering schools, for instance, stress the scientific fundamentals and soft-pedal specialization on the undergraduate level. Others take a different emphasis and offer a wide range of specialized degrees.

There are impressive arguments on both sides, but my vote must go to the former type of education. No school, it seems to me, can cover adequately in an undergraduate curriculum all of the many possible specialized fields. It becomes exceedingly important, therefore, that one acquire a thorough grounding in scientific fundamentals.

The experience of our company may be cited as a case in point. It indicates that graduate engineers with an adequate background in engineering fundamentals (regardless of the type) are capable of coping with any of the possible petroleum engineering specializations. It is not at all uncommon, for example, to see a graduate "electrical engineer" become an expert in the field of secondary oil recovery.

But enough for education. Once the young engineer has a good basic understanding of the scientific fundamentals, how does he go about getting a job?

The petroleum industry usually obtains its engineers in one of two ways: (1) by accepting applications for employment from engineering graduates, or (2) by conducting recruiting campaigns designed to enlist the desired engineering talent directly from the graduating classes of the various colleges and universities.

It is then that the young engineer may very well begin thinking about specialization. He will find that so wide is the scope of drilling and production problems that several avenues of specialization are open to him. Broadly speaking, these fall into one of two categories: (1) drilling practices or (2) production practices. But there are also several other more or less special fields involving either drilling or production or both. Among these are the design, selection, and maintenance of mechanical equipment, methods of improving drilling techniques, reservoir engineering, and natural gas processing.

One could also name a score or two of sub-specialities, such as drilling fluid control, secondary recovery, artificial lift, oil treating, and formation logging. But suffice it to say that the young engineer with a desire to specialize will never be at a loss for possible choices.

But what is the outlook for progress and promotion?

In general, the petroleum engineer performs a staff service. His primary function is to act in an advisory or consulting capacity to Management and the Operating Department. In the performance of his duties, he also becomes closely associated with the various categories of service rendered by the Engineering Department.

It is possible that the young engineer's particular interests or talents may lead him into operating work. A transfer of this type can usually be made at practically any level, and many companies are constantly placing and later promoting engineers in the operating department. Those whose chief talents and abilities lie in engineering are promoted in engineering. It is possible, in short, for an engineer to advance and eventually arrive in top management by several different routes.

As an engineer myself, I would like to mention at this point one pitfall that all of us in the profession should try to avoid. Too often the engineer looks upon just the technical and factual side of a problem and, when he has worked out his answer, concludes that that is all there is to it. Too often he fails to realize that many of the people in his company—people without his background, training, and experience—do not think as he does, that their attitudes toward the solution of the problem may not be as objective as his, that emotional factors must be taken into consideration in addition to technical factors. Because he fails to consider these things, very many of the people in his organization will not often readily go along with his solution.

All in all, however, it should be borne in mind that the matter of promotion is of critical concern to management as well as to the employee. There is always room for advancement in a successful organization. But higher education, in itself, does not guarantee success nor does it entitle one to a position of favor. It is the contribution that the individual makes that governs his success.

Now, as to salaries: Since practical experience in field operations is a necessary part of a petroleum engineer's training, many of the larger companies follow the practice of initially assigning new engineering employees to a nonprofessional job in operations for a training period of from six months to two years. Beginning salaries for engineering graduates, as a result, are usually dependent upon the prevailing wage scale for the nonprofessional work to which they are assigned.

A worker's hourly wages in the production end of the petroleum industry, however, are approximately twenty per cent higher than the average for all manufacturing industries. At current wage scales, an engineering graduate who starts out as a "roustabout" can expect to receive wages in the order of from $365 to $395 a month.

But even from the bottom rung of the ladder, the future looms bright and promising. Some excellent clues as to what lies ahead for petroleum engineering may be found in the record of the past:

(1) In the last 25 years, the maximum depth of wells has increased from less than 10,000 feet to more than 20,000 feet.

(2) We now produce economically horizons that would have been classified as noncommercial a few years ago.

(3) Adoption of modern conservation practices and new insights into the behavior of fluids underground have increased considerably the amount of recoverable oil.

ABOUT THE AUTHOR

After Mr. Reistle had received the degree of Bachelor of Science in Chemical Engineering from the University in 1922, *he joined the staff of the United States Bureau of Mines at Bartlesville and at Laramie, Wyoming. He remained with the bureau until* 1933, *in which year he became chairman of the East Texas Engineering Association. In August* 1936 *he became assistant chief engineer of the Humble Oil and Refining Company. During the spring of* 1948 *he took courses in advanced management at the Harvard School of Business Administration; and in the same year he became Director and Manager of the Production Department of the Humble Company. In June* 1922 *he married Mattie Ann Muldrow, daughter of the late H. L. Muldrow, former Regent and life-long friend of the University.*

This article is based on an address which Mr. Reistle gave at the Career Conference, 1954.

(4) Wider spacing of wells has made it possible to get commercial production out of fields with small per-acre recoveries.

(5) Longer life for wells and reduced producing costs have added greatly to the recovery of oil.

Those are all impressive achievements. Yet the unasked and unanswered problems in petroleum engineering still remain legion. And the solution of many of these problems may very well become a matter of economic necessity. It is estimated, for instance, that out of all the oil found in the United States from 1859 to date, some 40 to 60 billion barrels cannot be recovered by any method or process now in use. This fact alone should spur us to technical efforts several times greater than the efforts we have been able to muster in the past.

As for working conditions, the young engineer will find that reasonable work schedules are usually the rule. Because of the nature of the service he renders, however, the engineer is not inclined to be clock-conscious.

The physical demands on a petroleum engineer are certainly not extreme. Extremely aggressive and effective safety programs prevail throughout most of the major oil-producing organizations. Many oil companies also have relatively liberal benefit programs covering such items as vacations, savings plans, retirement, sickness and accident benefits, and so on.

Much has been written and said about what industry expects of the engineer. Most of the desirable qualities in an engineer are traits that make for success in any field of endeavor, and they are neither unreasonable nor difficult to acquire. To mention a few:

The engineer should have a fundamental interest in the work he is doing. He should have a sound educational background. He should have vision, which entails the ability to anticipate problems and solutions. He should have character and integrity. He should be skilled in human relations, which is just another way of saying he should be able to work as a member of the team. He should have tenacity—the ability to take defeat and still stay in there and pitch. And he should have drive—the will to get things done.

If he has those qualities, he will make his mark not only as an engineer but also as a leader. General George Patton once remarked that an army is like a piece of cooked spaghetti. You'll never move it very far, he said, by standing behind and pushing. You have to get out front and pull it. In many ways, that same principle holds true in the business world.

I should like to repeat, in conclusion, something I have told young engineers before:

For the engineer who can meet the requirements of modern industry, for the man who can accept and carry responsibility, there will always be great rewards—rewards both in the material things of life and in the spiritual satisfaction that comes from creative endeavor. And there will be no dead-ends to his career. He can move as far as his abilities and his personal qualities will carry him—and this often means into the ranks of top management.

But whether he accepts the responsibility of management or elects to remain an engineer must depend on the person himself. There are men—Kettering is an example—whose basic challenge is to continue as an engineer. Somewhere down the line each engineer must analyze his own ability and decide whether he wants to work through people as a manager or stick to reducing theories to practical use.

The important thing is for the engineer to find his own place in society—to find the place where his peculiar talents can accomplish the greatest good. His recompense will be not only in monetary returns but also in the more soul-satisfying rewards of universal respect and admiration.

A Sooner's Impressions

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of English in a series of sketches on American poets, which I developed in co-operation with a bi-lingual colleague of the state library, Miss Theresa de Amorim. English and Portuguese interpretations of representative works of American poets were recorded at these meetings and later broadcast.

Assignments to collaborate in a foreign cultural project, although particularly enjoyable to the recipient of such an invitation, must be justified on a high plane of technical need and as a contribution to international good will. The need for technical assistance in the Latin-American nations in certain fields is high. Their strong local support of projects involving technical assistance leaves no doubt as to their friendly receptivity. Thorough intelligent co-operation, when it is requested and when our country can provide it in an atmosphere of mutual give and take, can greatly strengthen other ties with the sister republics of the Western Hemisphere.

Brazil, our biggest neighbor and most constant ally, is currently buying about 34% of her imports from us. The United States is taking about 54% of Brazil's exports. We have been taking over 60% of Brazil's total coffee export. Some 53% of the foreign investments in Brazil represents United States capital. Brazil has twice allied herself with us in world wars. Her people are friendly. This friendship is vital to us. It was a personal pleasure and privilege to have had, for a few brief months, the opportunity of contributing to the cause of good relations through the library-science program at Curitiba in Brazil's newest state. It was a pleasant surprise to discover that Paraná in 1953 bore such striking resemblance to Oklahoma and the Sooner spirit.

Greater Role for States

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evolving social and economic problems. They have at times, perhaps, impeded the convenient and prompt execution of national policy. But these limitations, obvious because of their nature and the immediacy of their impact, ought to be weighed carefully against the less dramatic, long term advantages of our federal system. It could be shown, I believe, that this system has served as an important restraint upon impulsive, opportunistic, or violent leadership in Washington. And it is highly probable that, in this manner, it will serve us again.

Thomas Jefferson, after citing other defenses, concluded that " . . . the true barriers of our liberties are our state governments . . . " There may be many, in view of our experiences, who will question the soundness of this early observation. But to others, it would seem a grave misfortune should the time ever come when we may look to but one capital for a redress of our grievances, or an expression of our political convictions. The test of our federal system lies not altogether in the prestige, the power and glory, of the central government but in the vitality and effectiveness of the States and their local units.

HISTORY REPEATS ITSELF

From the regulations concerning the behavior of audiences at the theatre in Cincinnati, May 1, 1830:

> III. The practice of cracking nuts, now abandoned in all well regulated Theatres, should be entirely avoided during the time the curtain is up; as it must necessarily interfere with the pleasure of those who feel disposed to attend to the performance.

Frances Trollope, *The Domestic Manners of the Americans* (1832); ed. by Donald Smalley. New York, 1949. Page 133, note 5.

Ever crunched popcorn or goobers at the cinema?