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Mrs. Clarence E. May, Sr.
45 Mechanic St.
Fitchburg, Mass.

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SCHOOLDAYS, 1780 B.C.

RECENT EXCAVATIONS in southern Iraq, at the site of the Babylonian city of Ur, have yielded a surprisingly detailed picture of school life in the Middle East 3,700 years ago. And judging from what the archaeologists found, going to school in 1780 B.C. was, in many ways, just like it is today.

A young Sumerian scholar rose early in the morning, put on his best clothes, took a packed lunch from his mother, and set off for school.

Once in his seat, the youth was confronted with whatever theological, botanical, zoological, mineralogical, geographical, mathematical, grammatical and linguistic knowledge was current in his day.

Clay tablets reveal that a Sumerian schoolboy had to learn multiplication tables, rules for extracting square and cube roots, as well as tackling problems in practical geometry such as land surveying, or perhaps the calculation of the amount of earth to be moved once the measurements of an excavation were given. One ancient tablet explains what happened when a student fell behind in such lessons. By way of punishment he was "kept in" or, made to write "a hundred lines."

The full school course lasted "from the time of childhood to maturity." But after two years "a fortunate pupil" might be named *dubsar tur* (junior scribe) and entrusted with tutoring one of the younger students. Upon completion of school, the student was given the proud title "Sumerian" and permitted to work as a junior or high temple scribe, royal scribe of the palace, schoolmaster, or notary public.

Although Sumeria and other sections of ancient Babylonia had women scribes, only boys' schools have been found at Ur. At the site of one ancient school, the archaeologists unearthed small classrooms which accommodated 25 boys of varying ages, a lavatory, and a courtyard quite similar to today's playground.

The bun-shaped students' clay tablets found in the school bear on one side the teacher's elaborate copy and on the other the pupil's attempt to reproduce it. The simplest of these start with single syllabic signs, progress to lists of words beginning with the same syllable, then go on to full sentences.

A composition on one of the tablets entitled "What Did I Do at School?" furnished insight into the education of a young Sumerian schoolboy:

"I reckoned up [recited] my tablet, ate my lunch, fashioned my new tablet, wrote and finished it. Then they assigned me my oral work, and in the afternoon they assigned me my written work. When the school was dismissed, I went home, entered the house, and found my father there. I told my father of my written work and my father was delighted."

The next day, the boy was less fortunate:

"When I awoke early in the morning, I faced my mother and said to her, 'Give me my lunch. I want to go to school.' My mother gave me two rolls and I set out. In the school the 'man on duty' said to me, 'Why are you late?' Afraid, and with my heart pounding, I entered on my teacher."

But the teacher was correcting his tablet of the day before and was not pleased with it. Then the overseer "in charge of the school regulation" punished the boy for such errors as "talking," "standing up out of turn," and "walking outside the gate."

A tablet unearthed at another school site records a father's advice to his son on the virtues of going to school. The father points out that uneducated men often have to perform the most tiring labors and can never hope to become an ambassador. "Therefore, apply your heart to learning," the ancient tablet concludes. "In truth there is nothing that can compare with it. If you have profited by a single day at school, it is a gain for eternity." Parents have been giving the the same good advice ever since. ■

This clay tablet was used for practice in writing by a student in Nippur, 1780 B.C.

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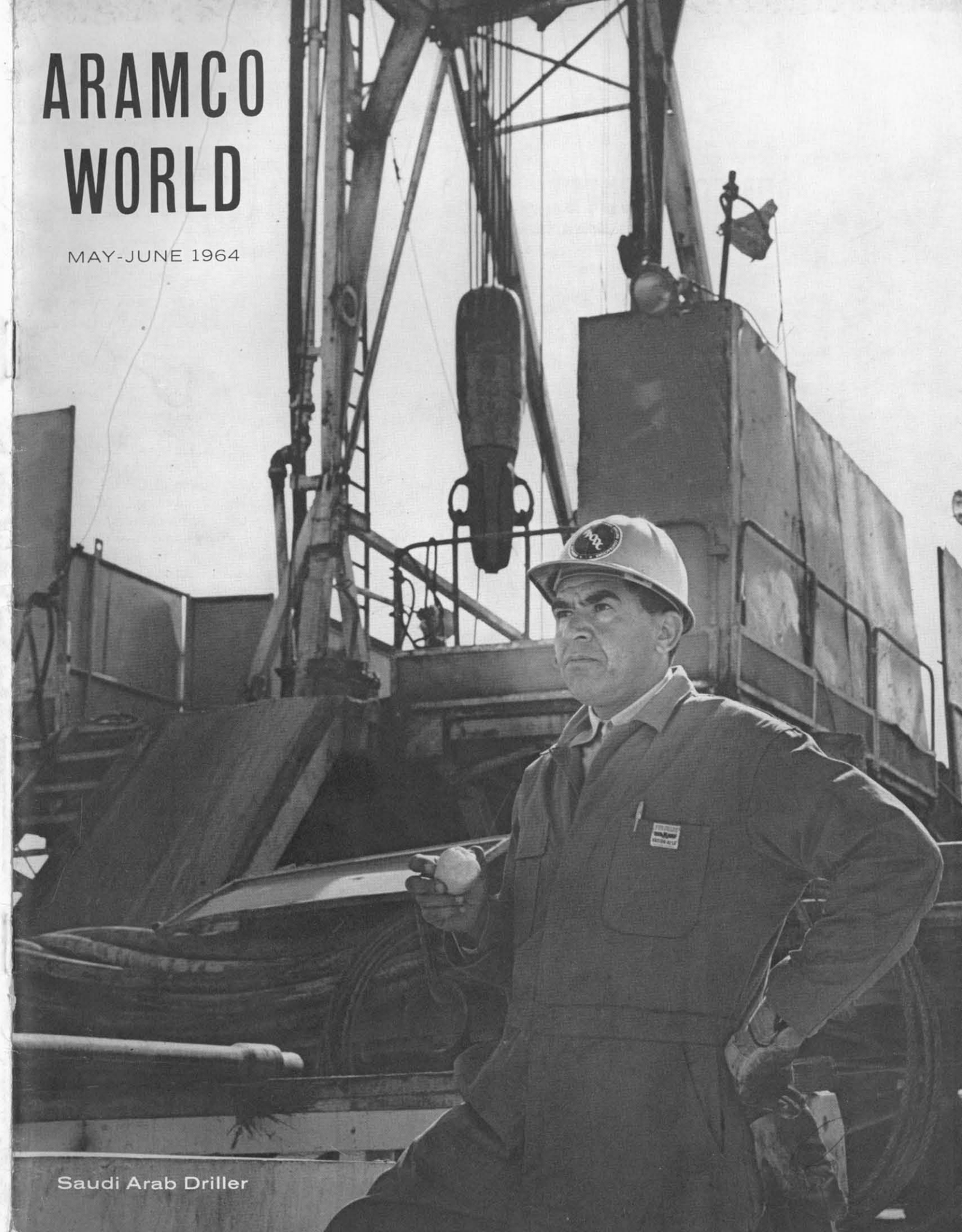

Saudi Arab Driller

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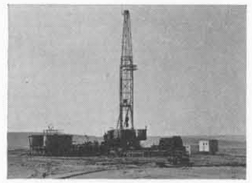
It takes hard-won know-how—

the kind A. J. Kishi has—to boss an oil rig

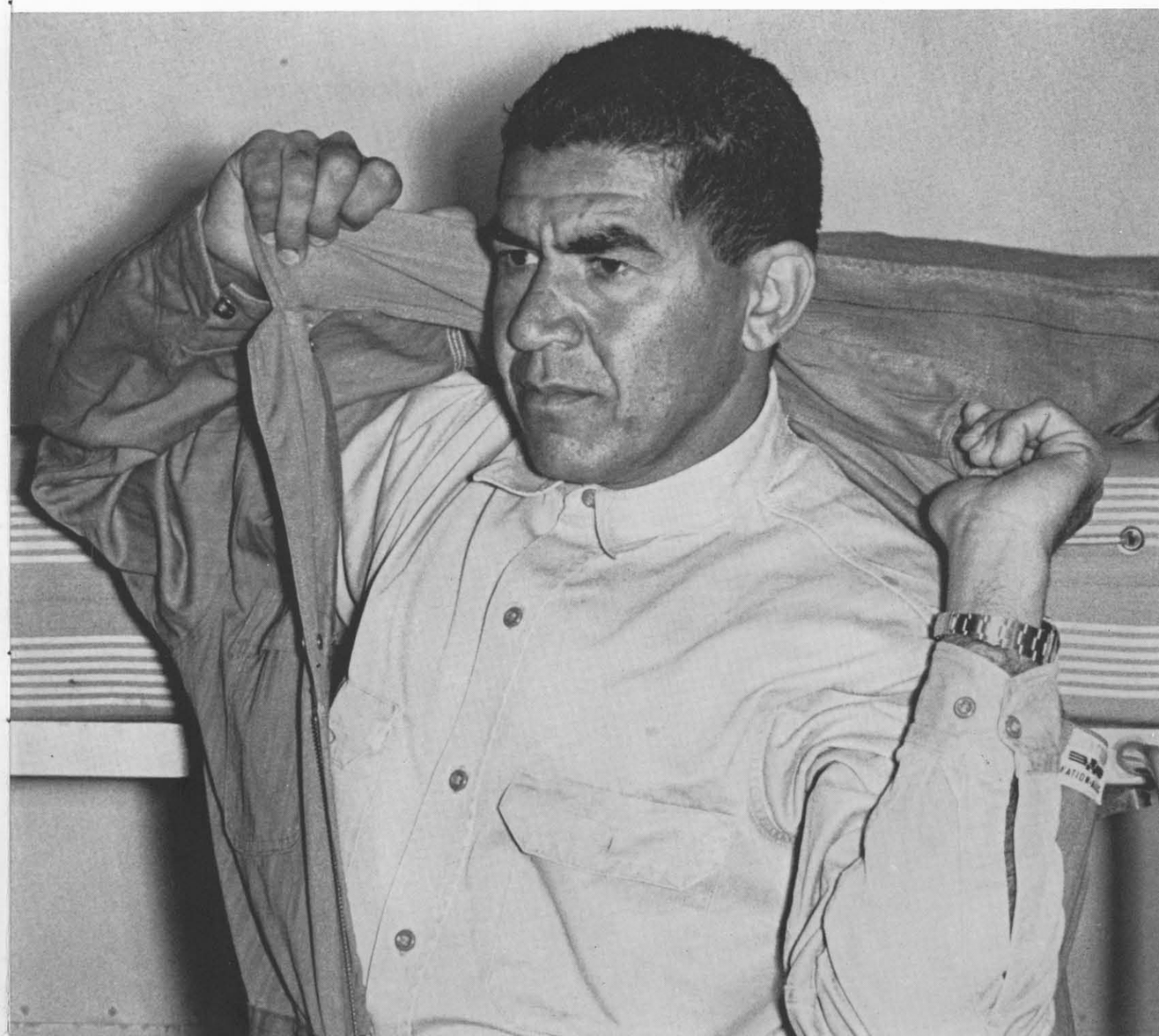
SAUDI ARAB DRILLER



ABDULLAH JAZAM KISHI is a 37-year-old resident of Hulailah in al-Hasa oasis of Saudi Arabia. He has a gilded "hard hat," a gift from the American Association of Oilwell Drilling Contractors (AAODC) that betokens an unusual accomplishment; a wallet bulging with pictures of his six children; big hands that are calloused from 16 years of handling "iron" on oil derricks; a lively mind that has generated an exhausting flow of questions about drilling and kindred matters; a diploma from the University of Texas Drilling School at Odessa, Texas; an engaging sense of humor; the paradoxically-intense nonchalance of a real "pro"— the relaxed style of a man who, in the midst of a good story can *feel* that something is wrong on a drilling rig thirty yards from his trailer office; an identity card that certifies that he is a Special Deputy Sheriff in Stephens County — and a variety of other distinctions, some small and personal, and some of a magnitude that should assure him an enduring place in the human side of his country's oil industry.

Kishi was one of the first Saudi Arabs to handle the brake, the critical control lever, on an oil well drilling rig in Saudi Arabia. He was later to become the first man in the history of his country to achieve the rank of driller, the first to join the proud but unpretentious aristocracy of men who run the drilling rigs of the world's oil fields.

A drilling rig is an extremely costly and complex tool, the central component of a family of tools designed to drill, study, record, and maintain an oil well. It incorporates generations of research and thousands of miles of slowly-drilled oil well footage. It is a sophisticated tool and yet something of a curiosity, for it has a basic conceptual flaw: the deeper the hole goes, the farther the drilling bit is separated from the engine that drives it round and round. Thus, the drill stem becomes an ever-lengthening drive shaft. Some of these "drive shafts" have been five miles in length. The driller at the brake controls the speed of rotation of the drilling bit and the weight with which it bears upon the bottom of the hole. His hand must be experienced



Before leaving air-conditioned trailer for a tour of night-shift duty, Kishi pulls on his work clothes.

and sensitive; his intelligence is the final link between the complex of tools that make up the rig, and the earth below. This is a simplification of the matter, for there is a great deal more involved in modern drilling technology. However, it serves to indicate the responsibility that rests upon the hand of the driller, the kingpin of the rig.

Abdullah Jazam Kishi became a "Rotary Driller 'A'" for the Arabian American Oil Company (Aramco) during 1954. Today he is the "Assistant Foreman" on the rig; he supervises the work of the drilling crews, including, of course, that of the drillers. He has a broad and ready smile, but he is a thoughtful and serious-minded man about his drilling rig. The overhead rigging of the draw works, the pipe racks, the drilling mud tanks and pumps, the huffing rhythms of the diesel generators, the valve complex in the rig's basement, the varying vibrations of the rig floor, the spidery derrick structure that rises perhaps more than 100 feet above his head, and the instruments that "see" what is happening a thousand feet under the ground are extensions of his own personality. In them are his hopes, ambitions, years of work, knowledge, skill, sensibilities, and pride. For men like Kishi, drilling remains an art served by science – he has an almost tactile bond to the rig.

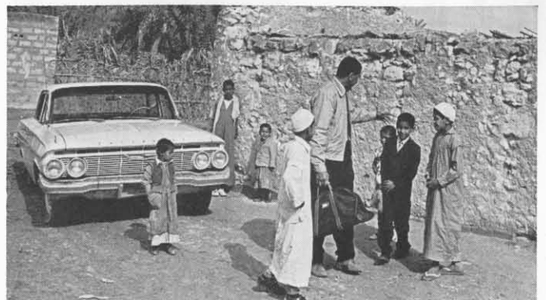
Now that he is supervising the work of several crews he is in a position to observe the attitudes of younger men, some of them just starting out. He was asked recently if there is one particular quality he looks for in younger men. Kishi looked out the open door of his trailer office, conned the T-32 work-over rig nearby, and joined his hands behind his head.

"I'll tell you . . . you see, many boys just come to work and go home. They learn their jobs – the things you can teach them. They do all right. But, I look for the boy who comes to work full of questions. The boy who comes and asks me everything he can think of about drilling. Why do this? What is that for? How does it work? Why don't you do it this way instead of that? When I hear those questions, then I think I have found a good boy." (Kishi, incidentally, betrays his long exposure to oil field jargon, and diction that was long ago refracted from more general usage. No one with an ear tuned to the common speech of the American Southwest could fail to note his revealing use of the oil field word *boy*.)

At the beginning of a twelve hour shift at an Abqaiq field workover rig, Kishi supervises the lifting of a string from pipe rack.

In 1961, Kishi was awarded the AAODC hard hat and diploma after taking six-week course at School of Drilling, Odessa, Texas.

At home Kishi helps his children with lessons. Left to right are Mustafa, 3; Jassim, 7; Kishi; Faiz, 8 months; Masoma, 5; Bager, 11; and Ahmed, 9. Below, children bid goodby as Kishi leaves for work.



As Kishi described his admiration for the young man who digs deeply into the craft and technology of his work, it became apparent that he was, in a sense, giving a description of himself. A few days earlier, A. C. Vick of the Abqaiq Drilling Division, and himself a veteran oil field man, remarked: "Abdullah Jazam is the kind of man who never stops asking questions. He will wear you out if he knows there is something about drilling he can learn from you." When reminded that he is a notable question-asker himself, Kishi smiled. "You know," he said, "a lot of the men helped me by talking to me. But, sometimes I asked too many questions and someone would say, 'Aw, shut up, boy. We're busy'." Kishi laughed heartily at the memory. "But I kept asking anyway," he added.

A. J. Kishi, as he prefers to sign his name, was born during September 1927, in the village where, by choice, he continues to live – Hulailah. He was only six years old when the predecessor company to Aramco signed an oil concession agreement with the Saudi Arabian Government. As World War II drew to a close and Aramco was able to swing into high gear, hundreds of young Saudis were added to the swelling payroll – Kishi among them. He worked briefly in the dining hall at Dhahran, then quit. In 1947 he rejoined the company in a job more to his liking. Shortly afterward he was transferred to Abqaiq, another of the three oil communities in Saudi Arabia's Eastern Province. There he became a rigman and began his drilling career. He advanced steadily. In seven years he was a driller. Seven years later, in 1961, Aramco sent him to the University of Texas Drilling School. Last year he was promoted to assistant foreman.

Kishi learned on the job. He has a remarkable grasp of English. Because drilling rigs are often hundreds of miles from the Aramco training centers, Kishi had little opportunity to attend the company's formal classes in English, so he taught himself with the aid of American friends and a company language book. When he entered the University of Texas Drilling School for a three-month course in 1961 he was given the usual entrance examination. He was asked, along with the other students, 257 questions. The questions were read aloud – *in English*. He scored low, partly because of the problem of comprehension. At the end of the course the exam was repeated.

"The exam was stiff," A. C. Vick, who accompanied Kishi as his training supervisor, recalls. "I took it myself, and with all my experience, I found it difficult. The second time Abdullah Jazam took the test he scored 88.7 per cent. This was an excellent grade and it revealed a very high order of comprehension and retention."

In 1948 Kishi was working on a rig in the 'Ain Dar area. "The driller was 'Goldie' Goldsmith," he remembers. "He was a tough man. One day he said to me, 'You go on the brake.' First he let me handle the brake when we were

Left, A. C. Vick jokes with Kishi as Kishi uses calipers to measure thread diameter of pipe on rack. Right, Kishi and his friends are entertained over fruit and tea in the *mejlis* (sitting room) of 'Ali Jassim, who is also a veteran employee of Aramco's drilling department.

SAUDI ARAB DRILLER

coming out of the hole. You have to bring up the drill stem and detach a section at a time. Then he let me 'go in'— it's the same thing in reverse. You add a section at a time and the bit goes back down to the bottom of the hole. You must let it go in just right. Easy, boy . . . Easy. And Goldie said to me, 'If you get nervous I'll do something to you.' I thought to myself, 'Okay, boy, this is what you want.' Connie Ridgeway was the drilling superintendent, and he wanted Saudis to learn to be drillers – and 'Goldie' Goldsmith put me on the brake."

And there were other problems – and other teachers. "When I was working in the 'Uthmaniyah field one time Jake Sims said to me: 'You know just about every job but the *tour* (pronounced *tower* and means shift or tour of duty) *report*. I'm going to teach you right now.' And he did. Every day he showed me something and every night I studied it in my room in the crew trailer. Inside a month I was making reports: time report, drilling log, and the rest.

"There was another man who pushed me – Jim Noel. Jim was a tool pusher, a boss on the rig. He told me more and more all the time. He told me, 'If you study you will have better chances.' He kept talking to me. He liked me to try something new, not just the same thing all the time.

"I appreciated these guys. They pushed me. They really helped. When I was ready to become an assistant driller and then a driller, A. C. Vick was my training advisor. He's my teacher."

Kishi talks about his trip to the United States with enthusiasm. He did not care much for New York City ("Too big!"), but when he got into the Southwest – into the heart of the "oil country"—he felt like a man sliding down the far end of a rainbow. Now he was deep in the showplace of drilling technology, the Texas-Oklahoma oil fields. He not only studied the latest methods of drilling technology, but also attended workshop classes in oil well cementing and testing, conducted by the Halliburton Company; classes in wire line pressure control, offered by Otis Engineering Company; classes in the preparation and maintenance of drilling mud, conducted by Magnet Cove Barium Company, and classes in the use and maintenance of oil well "fishing tools," offered by the Bowen Company. Classes and field trips took him to Odessa, Dallas and Houston in Texas, and Duncan, Oklahoma, as well as many oil field sites, some of them in the offshore Louisiana fields.

Kishi thrived on the opportunity to ask questions of experts versed in the latest state-of-the-art developments in oil well drilling. It was a rare opportunity; he made the most of it. He cherishes many memories he carried home to Saudi Arabia. One remains ever-present in the gilded safety hat (the oil rig "hard hat") he wears on the job. He received the hat from AAODC when he completed his three-month course at the University of Texas Drilling School and passed the repeat test.

Kishi earned his gold hat the hard way, for there was no father, nor were there uncles, older brothers, or friends of the family who were in the oil business and could offer experienced guidance to his generation about the oil business – its varieties of opportunity, and the possibilities for personal progress.

Kishi's was the pioneer generation of young Saudi Arabs in the oil business. They went to work for strangers in a strange venture. Now they are in a well-earned position to counsel coming generations of young Saudi Arabs on a growing number of technical aspects about their country's largest industry. ■

THEATER TRADITIONS OF THE DESERT LANDS

The stage play is almost a newcomer

to the Middle East,

but a rich "theatrical" tradition

is not

"Al-baqaa aw al-fanaa thalika howa al-su 'aal"

THAT'S HOW a famous line of English poetry – "To be or not to be" – sounds when it's spoken in Arabic. The 400th anniversary of the birth of Shakespeare will be celebrated almost as enthusiastically in Cairo, Beirut and Tehran as in Stratford-on-Avon this year. Appreciation of the Bard is a striking characteristic of modern Middle Eastern theater. Yet it's not surprising – here is yet another example of Shakespeare's universality. More surprising is the lively interest shown in the Middle East, not only for Shakespeare but for all Western theater. A theater-goer is as likely to encounter Moliere, Ibsen, Shaw – even Arthur Miller – across the proscenium as the works of local playwrights such as Ahmed Shawki, Mahmud Taimur, Ali Ahmed Bakthir or the well-known Tewfik el-Hakim.

This frank appreciation from a people with proud traditions of their own is partly explained by the fact that theater was not introduced to the Middle East until the nineteenth century. The West for centuries has acknowledged its debt to Arab scholarship in philosophy, architecture, mathematics, astronomy, geography, medicine, chemistry and literature. Yet only about 160 years ago traveling troupes from France and Italy first carried theater to the Middle East. Until then there was no true theater and no conception by Middle Easterners of what theater was.

But now, after a relatively short time, the area is producing playwrights and supporting lively theater groups with an unmistakably indigenous character. Any discussion of current theater, however, calls first for a look at the fascinating Middle East traditions that are essentially theatrical, if not true theater.

Dramatic narrators, known as *hakawat,* sat in the principal coffee houses of large towns entertaining the all-male patrons by reciting stories. Sometimes they told tales from the *Arabian Nights,* sometimes from the more popular romance of Abu Zeid. In this latter narrative poem (its length makes Homer's *Odyssey* look like a sonnet) they specialized in the tales of one particular tribe or another. Today these stories are valuable for insights they give into Bedouin life.

Most dramatic narrators chanted the poetry from memory and after each verse played a few notes on a one-stringed "poet's viol" used only for these recitations. Costume was limited to change of headgear to represent various professions, ages, or character types.

The gift of storytelling is common among Middle Easterners and a recounting of the day's events, a joke or anecdote will be told with relish, meaningful facial expressions and vigorous gestures. A spontaneous theater was a natural outcome of this characteristic. That is, a group of people get together and are given a situation as a framework for plot development and then are expected to improvise dialogue for several hours.

About five years ago improvisation was revived in Chicago theater and is popular now in the United States. Until recently, however, spontaneous theater in the Middle East was strictly private, performed only in the homes of the highly educated.

Spontaneity is characteristic of both shadow plays and puppet plays. Besides three manuscripts extant written by the fourteenth-century Egyptian doctor, Muhammad ibn Danyal, almost no manuscripts from ancient shadow plays exist for the good reason that so few were written down. The player just got behind his little movable stage and invented the story as he went along.

In shadow theater the player is concealed from the audience by sitting in back of a screen that is lighted from behind. With a long stick or two, one in each hand, he presses against the screen figures made of brightly colored transparent leather. The player is supported by his troupe, who help him with the manipulation of the figures and with different roles.

While shadow theater is revived only on occasion in the Middle East, puppet theater, which began with simple hand puppets, continues to be popular. Just recently, the beautifully carved figures of the Cairo Puppet Theater won an international prize for originality and sophistication.

All forms of early Middle Eastern theatrics employed the dialects and accents of regional groups as an integral element of playing. The existence of so many dialects stimulated mimicry and troupes of mimics toured the area. Women especially were fond of imitations of birds and beasts and scenes of village and harem life. Quirks and human foibles were common sources of humor, just as they have been all over the world in all ages.

The nearest relative to Western theater in the Middle East, though it is strictly religious in intent, is the Passion Play performed annually by members of the Shi'ite sect of Muslims during the month of Muharram. Essentially, passion plays are dramatized dogmatics; theological sayings of the heroes of the faith are constantly quoted. More important to the play is the idea of salvation through the sacrificial death of Husain.

The play itself, *ta'zaya,* takes only a few hours but is preceded by a ten-day period of mourning and purification. On the tenth of Muharram, the Muslim New Year, the whole town gathers at the camel market. After a prologue foretelling the entire action, the "actors" (townspeople who are thespians for the day) arrive. There is a camel caravan carrying women and children; a manacled prisoner in black robe and green turban; several horses covered by red-spotted sheets affixed with darts; two horsemen, their heads surmounted by helmets fixed to symbolize decapitation; last, a litter with a figure under a "blood-stained" sheet. The whole caravan disembarks at tents representing Husain's camp in the desert. The stage is set. Action: Husain's "Ring of Steel" wearing helmets and chain mail rush out, scimitars gleaming, and protectively surround the camp. From the opposite end of the field rides El-Hurr with a handful of soldiers sent to persuade Husain to return to Mecca. But Husain presents his cause so movingly that El-Hurr is won over to his camp. After many lengthy predictions of the terrible event to happen, the forces of Omar ibn Sad, clad in pink, with a clatter of hooves charge out and then the red-robed horsemen of Beni Ummaya urge straining horses toward the tents to clash with the Ring of Steel. Warriors grapple and fall. Riders are thrown by their excited mounts. To a loud roll of drums Husain's slayer, Shimr, clad in scarlet, appears and slays Husain to the accompaniment of the crowd's groans and curses. The caravan then makes its way to the mosque and other shrines, ending a bloody and reverent commemoration of an event that changed the history of the Muslim world.

Early theatrical attempts, after the introduction of Western traditions, were criticized for being static and imitative. But with Tewfik el-Hakim (b. 1898) theater in the Middle East received a great push. His play called *The Deal (As-Safka)* revitalized the ancient Arabic language, the only acceptable, polite language for literature, but the language was so remote from the spoken language that the play lacked spontaneity. An untutored audience found its nice distinctions laughable, while the educated were left uninspired. (Picture a play about factory workers and unions presented in the English of King James.) Plays in the vernacular received some popular favor among those who understood the regional dialect used. Rather than legitimate plays, a kind of vaudeville was much more successful and the great vaudeville actor Najib al-Rihini, called the Oriental Moliere, was a national hero.

Though loved by all, al-Rihini was "popular," not "classic" and audiences then divided themselves sharply into the educated and the less educated, crippling the theater. The playwright el-Hakim tried to close the rift by selecting for his dialogue (written in classical Arabic) terms used also in the colloquial idiom; at the same time he simplified the syntax of the ancient tongue. When delivered, his lines sound spontaneous, as though written in the colloquial, but an inspection of the writing shows that it complies with the rules of the literary language. El-Hakim's "third language," as it has come to be called, has received wide acceptance on and off the stage.

But even with the development of true local theater, the theater-goer is as likely to encounter Ibsen as el-Hakim on the boards. Two months is a long run for any play, and there is nothing comparable in the Middle East to the Broadway pilgrimage that keeps plays in America running for years. Thus repertory troupes seek out audiences by touring extensively. Female parts are now played by women, though it is not yet common practice everywhere. The famous playwright of Saudi Arabia, Ali Ahmed Bakthir, had his first play, calling for the general education of Arab women, produced in Egypt, where contemporary theater and cinema are popular. Serious dramatists, including many from Syria and Egypt, fret over the public's demand for musicals. Still, "the play's the thing," or, as they say it in Arabic: *"Al-masrahya hya bait al-qassid."* ■

THE CHEMIST OF HIT

A look into a Middle Eastern lab
3,500 years ago
reveals apparatus and techniques
still not out of date

ON THE WEST BANK of the Euphrates, almost one hundred miles due west of the fabled Baghdad, stands the equally eternal city of Hit.

As a city-site, Hit was already old that summer's afternoon 3,500 years ago, when a strange thing happened in the laboratory of Tiglaser, the most respected chemist between Nineveh and Babylon.

Tiglaser was in the yard outside the laboratory building, supervising the first stages of the manufacture of lead acetate. The concentrated solution of vinegar had just begun its brisk and bubbling attack upon the beaten sheets of lead when an explosion from somewhere inside the laboratory cracked against the scientist's eardrums and threw a blast of hot air across his face.

His first thought was of Telrid, his laboratory assistant and apprentice. He hurried into the laboratory and into a mist of acrid fumes of burning sulphur and pitch. His eyes smarted as he saw the boy near the window, pouring water on to a lump of flaming bitumen the size of a man's fist.

"Sand!" shouted the scientist. "Use sand. Water will only spread the fire!"

When the apprentice had brought sand from the yard and quenched the blaze, the chemist asked him what had happened. "Sir," said the boy, "it was this thick piece of clear glass. I thought to experiment with it and held it between the sun and this lump of bitumen. The sunlight came through the glass and pierced the pitch with a single point of blinding brilliance, melting a spot on it till it bubbled, hissed and ran. A moment later—the explosion!"

The boy's eyes shone with excitement. He was neither afraid of his recent danger nor apologetic to his master. The elation of discovery filled him. He asked what had caused the explosion.

Tiglaser told him of the gas that issued from heated bitumen. "It is called 'naptu' and means 'to blaze up'. It is very dangerous and must be distilled out of all bitumen in the open air, so that it will blow away. Naptu is difficult for us to control, but we shall master it one day."

The apprentice was far away in the visions of his mind. "Such power," he said. "Such great power!"

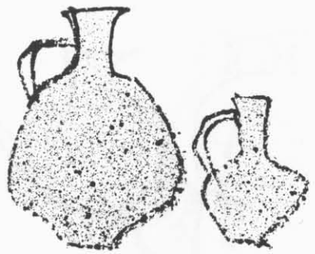
"You have not been with me long, young man," said the scientist, "and so I must warn you in laboratory matters. It is well to experiment, to inquire of nature's mysteries. But one must seek with care and respect—approach nature aright and you will be well rewarded with sweet knowledge. Search with haste and clumsiness, and you will loose a tiger upon your head."

Tiglaser was a wise man, revered in all that land for his wisdom and respected for his great learning. He saw that the boy was full of wonder, and he decided that now was the time to show the apprentice the full range of chemistry in the laboratory's activities.

The scientist began with showing the boy the blast furnaces in which glass was made and colored brilliantly. Mesopotamia was certainly one of the first countries to make glass and the first to develop the means of heating the sand and natron mixture from an open hearth-type fire to the early equivalent of a blast furnace. The hearth-type had used mainly animal waste as fuel, but it was discovered that the addition of common salt raised the temperature greatly by a process of catalysis (to about 830 Centigrade degrees). Keen observers had at first increased this heat again by the use of reed blowpipes to blow air into the glowing fuel, and this was advanced by a few stages to the kiln type of furnace, built of stone and fired from an external chamber, the heat being blown into the kiln by hand-operated bellows. The bellows consisted of clay tubes fitted with fine animal skin blowers, and were the prototype of those in use today.

The chemist laid his hand paternally on the boy's shoulder. "In the sciences, of which chemistry is only one," he said, "we can do nothing unless we first design and make equipment in order to change nature's substances to our wishes." He then began to show the apprentice certain objects which had originated in Mesopotamia.

There were the pestle and mortar, of which six sets



THE CHEMIST OF HIT

rested on a wooden bench in the laboratory. Two sets were made of flinty quartzite for crushing the hardest substances, two of bronze, one of soft limestone, and a delicately-made set of fired clay. The bowl-shaped mortar and the club-shaped pestle were of almost exactly the same design as those to be used by Western countries many centuries later, when the alchemists searched for the magic stone.

On the far left of the same bench, which was used mainly as a storing place for apparatus, were a number of clay and glass beakers and crucibles, clean, dry, and ready for use. The beakers, tall, broad-based, and each with a lip for pouring; and the crucibles, shallow and wide, and also with pouring lips, were of designs which were to spread later along the whole length of the Mediterranean to Europe and America without any significant change, because the originals could not be improved upon. The beakers were marked with graduated levels for exact measurement of fluids.

Tiglaser took up one of the graduated beakers and pointed out the marks which indicated steps of from ⅛ of a *log* up to 1 *log* (about one pint). He then showed Telrid a set of standard weights made of highly polished stone so that they would resist wear. These weights were made in the form of ducks asleep and lay along the foot of a delicately made balance with beam and pans of wood.

"In chemistry," said the scientist, "it is of the greatest importance to know exactly how much of the chemicals you use in any operation. This is so that you may repeat the same operation any number of times should you wish to do so. This step is indispensable in applied chemistry such as in our chemical manufacturing activities here."

Standing on the floor in one corner of the laboratory were a number of large, wide-mouthed jars, each containing crystals of different shapes and angles of diffraction.

These chemicals were mainly sodium chloride, alum, sodium carbonate or natron, potassium carbonate, ammonium chloride and potassium nitrate. They were found in a variety of ways, from evaporated brine, soil efflorescence, distillation of burning fuels and subsequent condensation of the fumes on cold metal plates, and sometimes they were found in the state of a natural stone, like alum.

Since most of these chemicals looked alike, being white crystalline powders in the pure condition, it was a great problem to the early Middle East scientists to find out how to purify and separate one chemical from another. The problem was solved a thousand years even before Tiglaser's time, and the method—fractional crystallization—is still in full use today in advanced laboratories. As an example of the process, the alumstone rock was crushed and boiled in water after being roasted to make it more frangible.

The solution was then concentrated by further boiling and allowed to cool, whereupon crystals of alum formed in clusters in the beakers. Any other chemical in the stone, potassium nitrate for example, also formed crystals, but these were quite different in shape from the alum and thus were easily separated. Further boiling and cooling produced more and more pure chemicals, and this refining was carried out especially in the case of substances to be used in making medicines. The others, used mainly in the manufacture of different grades of glass, did not need nearly as much purification.

There were many other wonders for the apprentice Telrid to study.

In bronze or fired clay vessels that had sieved bottoms, lumps of heavy bitumen were heated and the purified drips collected in drip trays and run into storage containers. Rock sulphur was also treated in this way, and so was history's first "flowers of sulphur" produced. In the case of the more volatile sulphur, the upward-rising fumes condensed on a tray above the material and yielded fine sulphur powder. These methods of early distillation undoubtedly gave rise, later, to modern distillation apparatus.

The apprentice saw the making of many grades of soaps by boiling alkaline plant ashes with various fats and oils. The processes are essentially the same as those used today, and even the name "alkali" is derived from the ancient name of the plant ashes, "kalati."

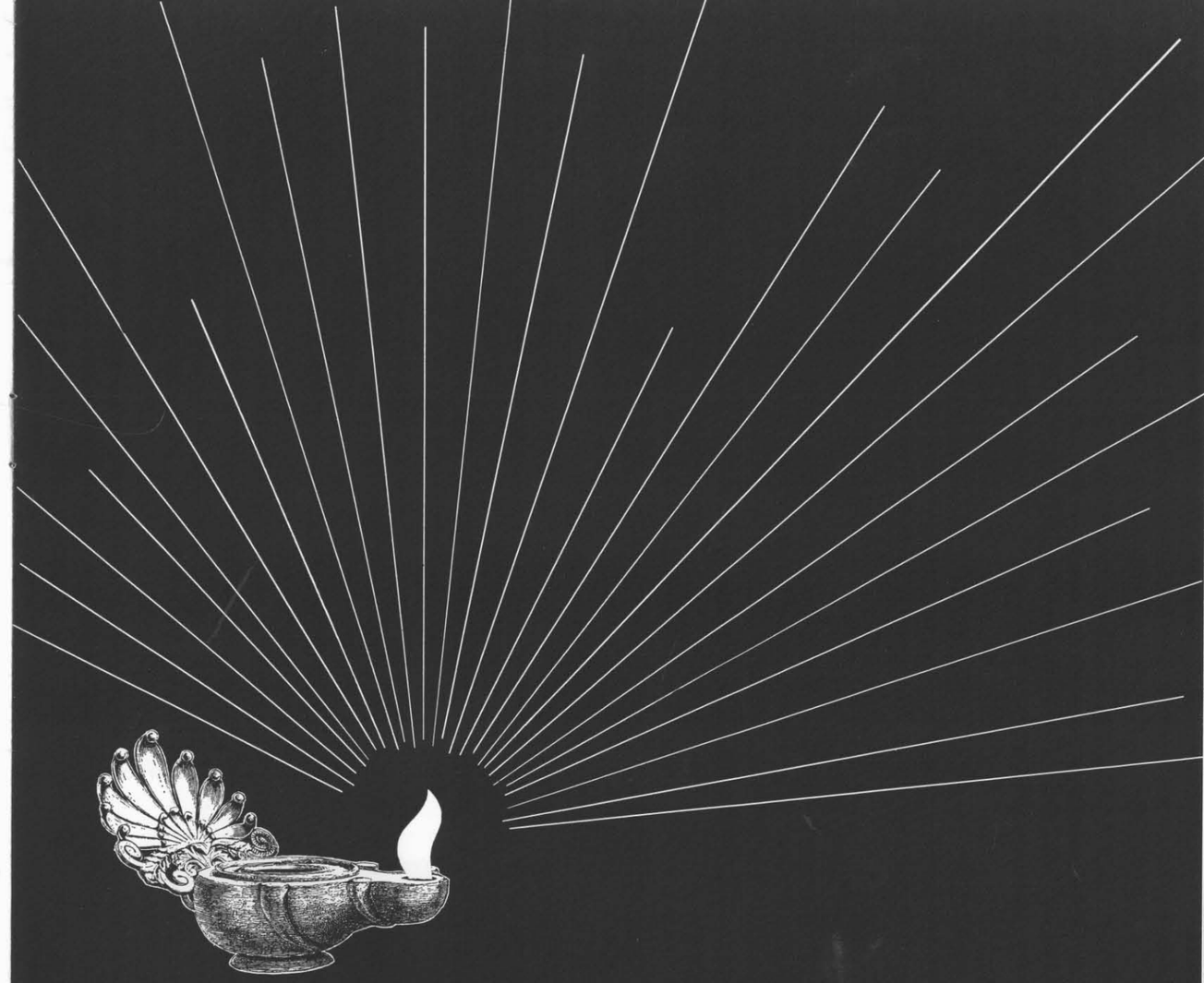
During the rest of the tour, Telrid watched the production of red lead, made by roasting the vinegar-metallic lead product, lead acetate. This red substance was used for coloring glass and making paints, as was also a green color from malachite; a special blue from oven-roasting copper carbonate and limestone; light ibis-red and vermilion through crimson to the deep black-red of old blood from iron oxides, and, among others, a rich and truly royal purple produced by melting sand with alkali and secret copper salts.

The day waned before all the processes could be shown to the boy.

As Tiglaser was preparing for bed that night, the stars were great in the clear sky. What was it the apprentice had said about the explosion—ah, yes—"Such power! Such great power!"

There was awe in the heart of the Mesopotamian chemist as he looked again at the distant planets, then remembered the many mysteries of his own planet, mysteries he himself tried to sort out in his laboratory. There was so much more to learn.

But this much is sure—the foundations of the chemistry of the twentieth century were laid in the thoughts, the apparatus, and the fundamental techniques of that early day, for Tiglaser and his fellow scientists were true chemists—they pursued honest knowledge and used it for the practical benefit of mankind. ■



Civilization took a giant step forward when men in the ancient Middle East found a better way to

LIGHT UP THE NIGHT

In all man's legends and folklore, as well as in his religions, a connection was made between darkness and danger, between light and well-being. Crouching in his cave, surrounded by the cries of nocturnal beasts, primitive man waited for the reassuring light of day. His first light came from the sun and moon, but eventually fire was tamed and used for its warmth, then for its light.

In caves, a flaming branch lighted the night's darkness, permitting the artist to work, women to sew, the craftsman to hew and carve, and cultural progress to begin its upward climb. No one knows the precise moment

when man first chanced upon portable and producible light, but a parallel line of development may be traced between human achievement and the production of light. Nowhere is this better to be seen than in the Middle East, the cradle and ancient nursery of man.

By comparing the portable devices used to produce light through the ages, it's possible to see successive stages in human progress. In some of the earliest levels of excavated antiquity in the Middle East, small crude bowls, blackened on one side, are evidence that man had moved from his hearth fire and flaming torch and was able to light the rest of his home more efficiently and safely. The introduction of the fiber wick, probably a piece of twisted bark at first, permitted a revolution in lighting, for now oil could be burned, the fuel could be stored and replenished easily, and the danger of fire was reduced. The crude bowl lamp was used for many centuries, becoming refined in its shape only when the potter's wheel brought symmetry. The wick evolved into a cord of twisted flax or cotton, floating in the bowl, with one end drooping over the edge to support the yellow flame.

But as early as the great Pyramid Age, lamps in the Middle East grew sophisticated. The bowl became shallower, a lip was pinched into one side, better to hold up the wick, and the lamp began to move from sheer usefulness in design to beauty as well.

Improvement of the oil lamp continued during the Early Bronze Age to the extent that the typical Syro-Palestinian lamp, by about 2000 B.C., was a four-lipped lamp with a small foot. Pottery refinement permitted an even better outward appearance of the lamp, even without any great improvement in the light which it produced. With the coming of the Late Bronze Age, the Western world began to make overtures to the more ancient civilizations of the Middle East, and ornateness in decoration characterized ceramic efforts. By the flickering light of the lamp, Cypriote swans could be seen preening themselves on the plates and bowls the proud housewife placed upon her low table for "company" meals.

The Aegean Sea peoples ushered in the Iron Age in the Middle East, about 1200 B.C., establishing themselves along the coastal plains north of Egypt and extending to Anatolia. They introduced new decorative motifs to the whole area. Although the basic oil lamp continued in use, its shape began to change. Still characteristic of this period was the old "saucer lamp," but its tip began to be pinched closer together and it gradually developed a larger foot to stand on. Dating can even be done on the basis of the height of the foot of such a lamp. From the days of David through the Assyrian and Neo-Babylonian conquests in the early sixth century B.C., scribes and priests continued their toil, probably pausing to praise each refinement in the simple oil lamp as an aid to literary development. The palaces of kings and the simple dwellings of the common man all depended on the oil lamp to brighten the dark hours of the night. Steadier now, on its flat disc foot, the "saucer lamp" still gave its flickering light, and the wide saucer-like oil bowl offered a potential threat to the housewife's floors.

By the time Alexander the Great arrived in the Middle East to avenge the slight given the Greeks by Darius and Xerxes, he found the local peoples using "folded lamps"—a new and spectacular achievement in household lighting fixtures! The opposite sides of the rim of the saucer had now been brought together on each side of the wick spout and overlapped, like an envelope. Now the wick was held in place, protruding from a small hole on one side and the oil was kept from spilling by the overlapped sides of the bowl. These lamps were filled through another hole, opposite the wick. Both grace and utilitarian demands were met by this simple device. This lamp type was the forerunner of a fully closed lamp, which soon appeared all over the ancient world.

Commonly called "Graeco-Roman," the fully closed lamps were cast from molds in two separate parts—a base and a top—and then joined together when the two parts were partially dry. The completed lamp was then fired in the kiln and decorated with colored glazes and paints. A small nozzle, with a hole for the wick, extended from the front of the base. Another hole in the top of the lamp permitted the lamp to be filled. These lamps set the pattern for succeeding generations in the Middle East, as they had already done in the Hellenistic and Roman worlds—in pottery for the poor and in metal for the rich.

An infinite variety of styles developed in terms of shape, number of wick nozzles, handles, and, particularly, in decoration. The artists of the age used lamps as a new "canvas" upon which to fashion pictures illustrating history, mythology, architecture, current events, and similar scenes. Such lamps even became the first real "greeting cards"—serving to convey greetings, with set messages, to friends, business acquaintances, and neighbors, on the Roman New Year Day throughout the Empire.

Because they were produced from molds, these lamps could be mass produced, using semi-skilled labor. By standardizing parts, as well, a single base shape could be fitted with a great variety of tops, as the market and whims of high fashion dictated.

Local peoples soon copied the new and more expensive "imported" models. First by styling their own molds directly from the foreign types, and then by designing styles of their own. The Middle Easterners ignored representations of Roman deities and turned to the classical grape-and-leaf, rosette, or other designs more truly at home in the Middle East. Handles also became more exotic, in size and shape, providing a new surface to decorate with leaves, human and divine faces, animal heads, and similar details.

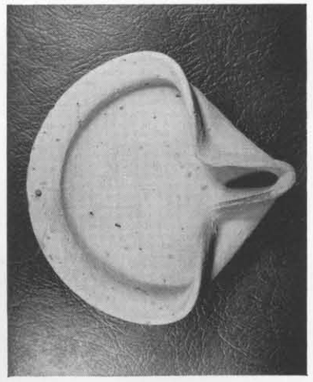
The excavated sites of the entire ancient world have provided thousands of molds and complete lamps and with them the index to chronology. Probably the best known groups were those found at ancient Corinth. Other sites, farther to the east, have also produced potters' workshops and salesrooms literally piled high with the ubiquitous molded lamp. These finds, in company with the reports of ancient travelers, attest to the demand for light in this period of history. Temples were crowded with votive lamps, housewives kept them on stands or shelves, and tombs even had small niches carved into their walls to accommodate lamps placed there by mourning relatives and friends.

With the rise and spread of Islam, the molded lamp underwent new changes, sometimes appearing in an elongated shape like a pointed slipper, and, more and more, with colorful glazes applied over the whole lamp. As glass came into prominence in the decorative techniques of Islamic art in general, masterpieces of metal and glass began to grace both mosques and private residences. Motifs reflected the opulence, and the piety, of the days of the Arabian Nights, with enamels and precious metals worked into the glass chimneys and oil reservoirs. Hanging lamps, in particular, came into vogue, and many splendid examples may still be seen in the Middle East today.

Although the candle was invented—substituting a solid fat for the liquid fuel of the oil lamp—the lamp remained the most common form of lighting device for the world at large until the 1700's, with very little change in basic design. Modifications of bowl and wick, with the addition of mechanical devices for controlling the flame, and the use of new fuels, gradually took place in the eighteenth century. But it was not until 1879 that the oil lamp—and its gas-operated cousin—was really displaced. With the invention of the incandescent electric light bulb, the lamp began to wane in its importance. But it has only been in the last few decades of the present century that the lamp has fallen into second place as a lighting device. Even today, lamps brighten the homes of countless thousands, as well as providing illumination for campers, hunters, and others. ■

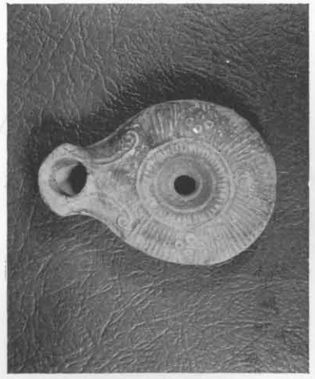
Cave-dwellers shaped stones to hold animal oil, bark wick.

Roman lamp was molded in two halves, then decorated and assembled.



Saucer lamp dating to the Iron Age (about 1000 B.C.), had curled lip for wick.

Molded lamp with handle from the Arabian Peninsula.



First century B.C. molded Nabatean lamp from Petra.

Craftsmen in Mesopotamia developed lamps with a pedestal-like foot.

In The Wake of Sindbad

Comes the weekend,

many an oilman turns skipper, ready to test

sea legs on the Persian Gulf

PICTURESQUE, lateen-rigged Arab dhows are still around, but nowadays it is frequently mains, jibs and spinnakers of Dacron that propel boats across certain bays and inlets along Saudi Arabia's east coast. Arab sailors discovered long ago that teakwood caulked with sheep's wool and rubbed with fish oil stands up best against the salt, sun and sandstorms of the Persian Gulf. Today fiberglass hulls punched out of molds in American, Dutch and British boatyards are challenging the elements on water where Sindbad once sailed.

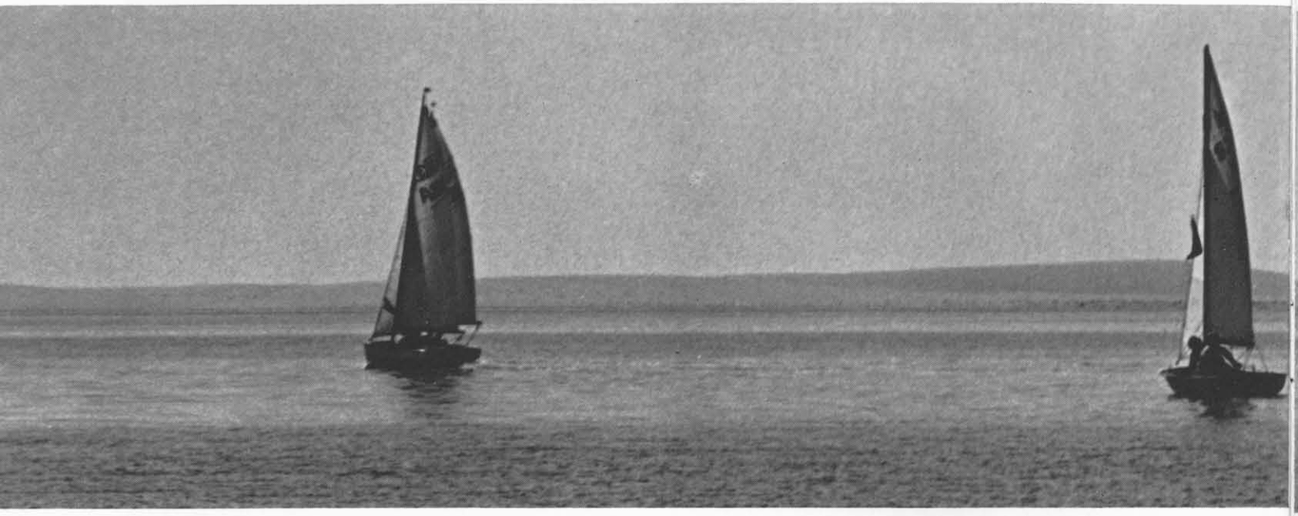
To the Arabs, sailing is a business, not a sport. Their shallow-draft dhows are used exclusively for coast-wise trade. It was Westerners, usually living near the coast as oil company employees, who introduced pleasure boating to the Persian Gulf. Recently a number of young Saudi Arabs have themselves joined the keel-and-trailer set.

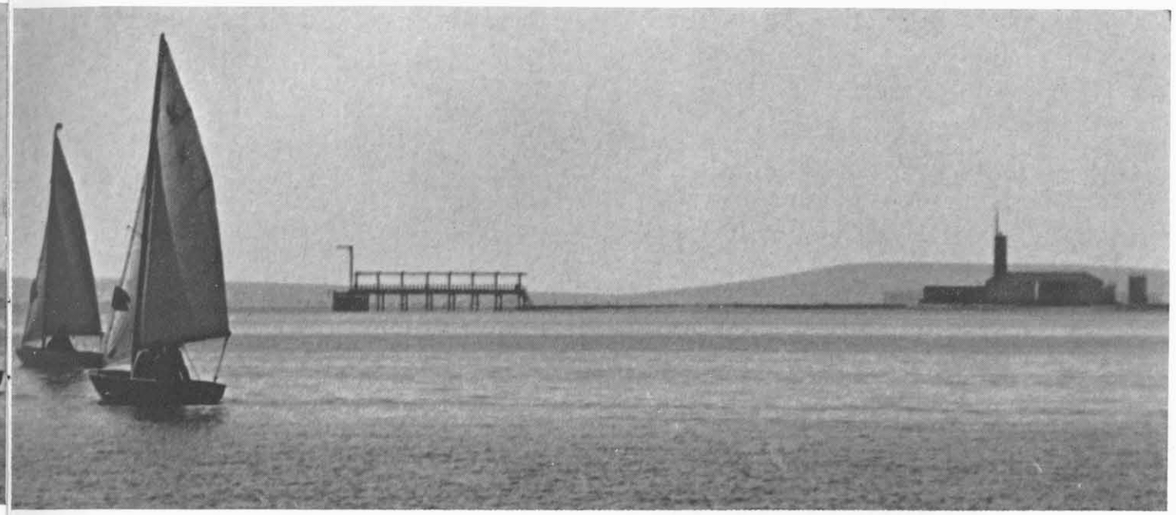
Arab, American or Britisher, the sailor who casts off into the Gulf, with all its tricky shoals, must be of a special breed. On that body of briny water sailing comes fairly close to being a year-'round activity. Over a given 12-month span skippers can expect every sort of weather condition from bitingly cold gusts to steamy calms, both often shifting to sand-carrying *shamals* that can obscure a shoreline quicker than you can say "hard a' lee."

The first sailing craft to be imported into Saudi Arabia by an Aramco man was a Lightning, built in the Finger Lakes region of western New York State and delivered to Ras Tanura, where the company's refinery and marine terminal are. That was back in 1947, and for some seasons following, Lightnings held the day. As more small craft, both sail and power, began to appear on the scene, water sport enthusiasts organized boating groups and built their own docks and clubhouses. Ras Tanura, where local pleasure-boating got its start, has long since been served by the Sandy Hook Yacht Association. Nautically-minded residents of Dhahran and Abqaiq use boating facilities of the Half Moon Yacht Association, situated at the head of a big salt-water inlet between these two communities.

Some week-end sailors earned their sea legs on American waters before joining Aramco. Sloops at home off Ras Tanura or in Half Moon Bay are helmed by skippers who are,

Qatar Petroleum Company employees launch their "Fireflies" against a strong onshore wind at Dukhan.





Two Albacores (in lead, at left) and three Terns try to catch elusive puffs of breeze while sailing close-hauled on Half Moon Bay.

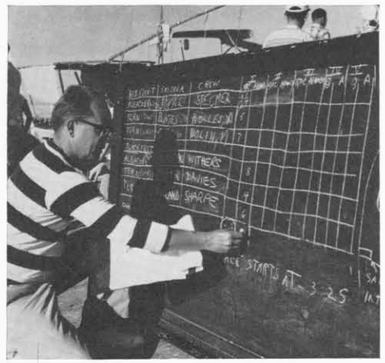
In The Wake of Sindbad

Fast catamarans with their streamlined double hulls run away from conventional boats in races off Ras Tanura and in Half Moon Bay.

as individuals, equally familiar with Massachusetts, Narragansett or Chesapeake Bays, Long Island Sound, the coast of Florida, Newport Beach, Catalina, or the Golden Gate. But large numbers of the active boating contingent, including a majority of cup-winners, first felt the sting of salt on their faces by water splashed up from the Persian Gulf. While their colleagues were getting experience aboard Cape Cod cats or ocean-going schooners, these erstwhile sailing neophytes were spending younger days far from blue salt water sports, typically in the dry oil country of Texas and Oklahoma.

Aramco's amateur boatmen hold three seasonal sailing contests a year, formally designated as the Spring Regatta, the Fall Regatta, and, borrowing a term from northeastern American yachting circles, a wintertime "frostbite" series. Small-craft events in Half Moon Bay put heavy arithmetical responsibilities on race committeemen who must handicap on the Portsmouth System a fleet often made up of one Jollyboat, two Lightnings, one Tern, two Albacores, one Tech Dinghy and one Gull.

Periodic sports exchanges with oil company employees from Qatar and Kuwait are both a welcome change and a severe test of sailing skills. Aramco's competitors in these events are all Britishers, who take their yachting very seriously, indeed. As guests in unfamiliar waters of such places as Umm Sa'id and Dukhan, sailors from Dhahran and Ras Tanura enjoy the rare experience of true one-class competition. At the helm of craft belonging to their hosts, they can feel the exultation or chagrin of knowing exactly where they stand while the race is in progress, instead, as in home ports, of waiting for the corrected times to be worked out on the beach. ■



At Half Moon Yacht Assoc. Race Committeeman Stan Bolin records results in invitational series between Qatar Petroleum and Aramco.

Eight-thirty on most spring or fall Thursday mornings finds Aramco sailors rigging for races run from Half Moon Bay Yacht Association piers. Company weekends follow Muslim Thursday and Friday days off.

At Sandy Hook Yacht Association,
snub-nosed El Toro-class sailing prams
help get Ras Tanura
youngsters off to an early sailing career.