ARAMCO WORLD
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ARAMCO WORLD magazine

NOVEMBER—DECEMBER 1968

THE LONG LOOK FORWARD

This little girl does not look as if she is having an adventure. She is though—the adventure of education, which last month began again for millions of Arab children. Photo-essay on page 12.

ARAMCO WORLD magazine

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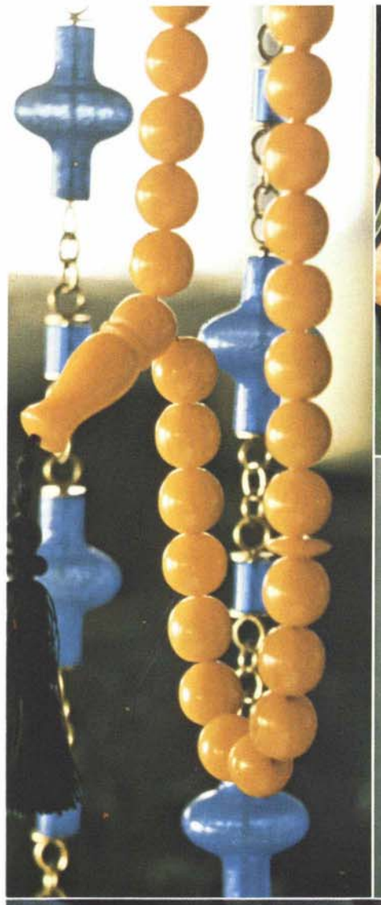
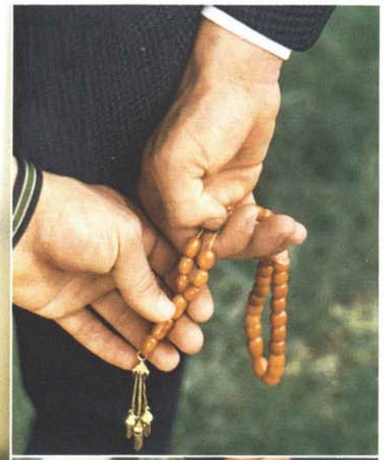
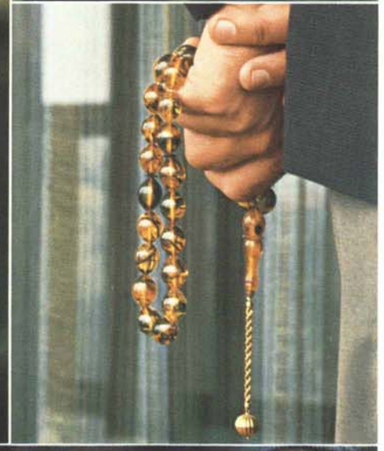
Cover: In this aerial photograph and the one on the rear cover, Burnett H. Moody, Aramco's Chief Photographer, suggests the wide range of challenges faced by the company's planners when they propose, and then design, the facilities which Aramco will need years in the future: facilities such as additions to Ras Tanura's tank farm and pier or, at left, the sea islands built to handle new giant tankers, or, rear, a new pipeline under construction in the desert. Story on page 20.

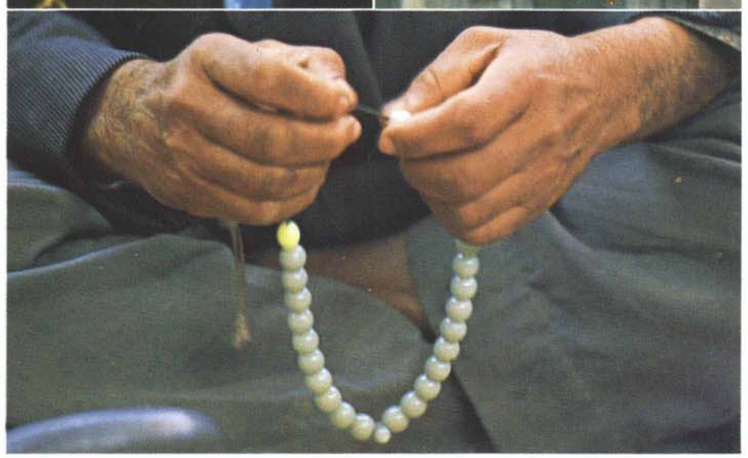
WORRY BEADS

BY DANIEL DA CRUZ / PHOTOGRAPHED BY KHALIL ABOU EL-NASR









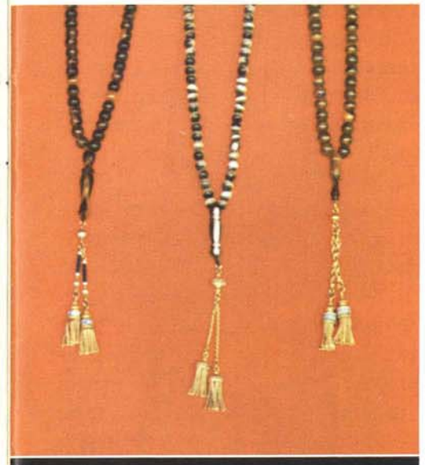
In times of stress, when men of other nations reach for aspirins or tranquilizers, the Arab is likely to reach into his pocket and come up with a string of beads.

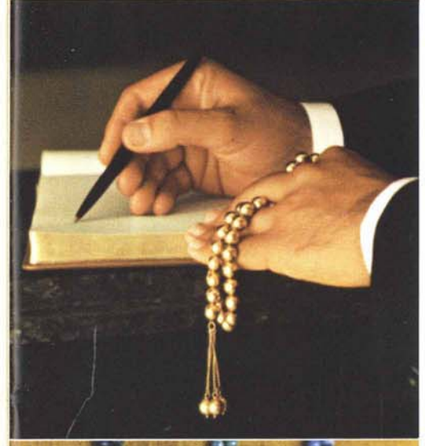
Beads?

Beads. Beads of ebony, beads of mother-of-pearl, or amber, cornelian, aloe, coral, date pits, olive wood, glass, ivory, and a thousand other rare and mundane materials, but always either 33 or 99 in number, and always with enough slack in the string so that, as each bead is released by thumb-and-index finger in its turn, it raps its brother below with an emphatic *click*! The clicks themselves are wholly without character, but their rhythm and the intervening pauses can express a vast range of meaning: placid boredom, thoughtful meditation, agitated nervousness, measured insolence, mounting impatience, burning hostility, and a full palate of shadings between, for the Arab's *misbaha*, or rosary, is a natural extension of his personality, and a most useful means of getting his point across without actually saying anything.

The *misbaha* has been performing this vital social function for the Arabs at least as far back as the 9th century, but originally it served the holy purpose of helping the devout remember the number of times a particular prayer or eulogy had been recited and help keep a man's thoughts away from intemperate thoughts. Coming to the Middle East by way of India, the *misbaha* was at first probably no more than a handful of seeds or pebbles moved from one small pile to another in the course of devotions. Eventually the counters were strung for convenience, more precious materials were substituted for the simple originals, and lo! — the *misbaha* was born.

For a device in such common use —many Middle Eastern men feel undressed without one—uncommonly little





is known about it. It is said that the 33-bead *misbaha* represents, to Christians, the 33 years of Christ's earthly existence, while those of 99 beads represent the 33 years multiplied by the three manifestations of God the Father, God the Son, and the Holy Ghost.

Islamic *waikas* observe that the use of the *misbaha* originated with the mystical Sufi sect, which employed the beads as a mnemonic device to recall the 99 most beautiful names of Allah, for to Muslims God is "the Merciful, the Compassionate, the King, the Holy, the All-Knowing, the Patient, the Wise, the Venerable, the One, the Giver of Life and Death...."

The 33- and 99-bead *misbahas* are used today by both Christians and Muslims; whatever distinctions once limited their use to one or the other religion have long since been obliterated by time and cultural diffusion, and their basic form is invariable: both have a carved handle-like piece through which the two ends of the string are threaded and knotted, frequently in an ornamental tuft, and in the 99-bead version the beads are separated into divisions of 33 by the handle and two smaller beads of different design, called imam ("religious leader" in Islam, presumably here having the connotation of that which connects the various parts of the whole). In past times a third type of *misbaha*, consisting of 1,000 egg-sized beads on a heavy cord, had a place in Egyptian funeral ceremonies, where mourners formed a large circle holding the *misbaha* and circulating its beads to record the 3,000 repetitions of the Muslim Profession of Faith: *La ilaha illa Allah*—"There is no god but God."

Available evidence suggests that the rosary of the Roman Catholic Church is a lineal descendant of the Arab *misbaha*, for it was introduced into western Europe during the 13th century after more than two centuries of contact between the Franks and Arabs during the Crusades. The Catholics' rosary has 50 beads to mark repetitions of the Hail Mary, with five larger beads to count Our Father's, preserving the enumerative function for which the *misbaha* was originally elaborated.

The fierce Janissaries, the professional soldier caste of the Ottoman Empire, though Muslims, were forbidden to use the *misbaha* by their commanders, who believed that the telling of the beads leads to softness through excessive contemplation. But the passage of years has made the former vice a present virtue. The gentle mind-lulling click of the beads smoothly bridges over long silences that otherwise might become awkward, allows one a few moments of grace to gather his thoughts, and then provides a rhythmical accompaniment to the cadenced sonorities of the Arabic language, a filigree frame for poetic expression, a delicate punctuation for profundities....

True, the captain of industry with his executive-length cigar can achieve a similar orchestration of effects by means of stacatto bursts of fragrant smoke, the twin rituals of trimming the stogie and lighting up, the grandiose gesture that threatens his audience with second-degree burns. But, the Arab might argue, ticking off his arguments as he clicks off his beads, just think of the advantages of the *misbaha:* no spilled ashes, no burns on the coffee table, no bad breath, no trading with Cuba, no stained fingers, no yellowed teeth, no tobacconists' bills, no smoker's hack, no lung cancer....

Daniel da Cruz, a frequent contributor to Aramco World Magazine, *is a free-lance writer, a correspondent and the author of several novels.*

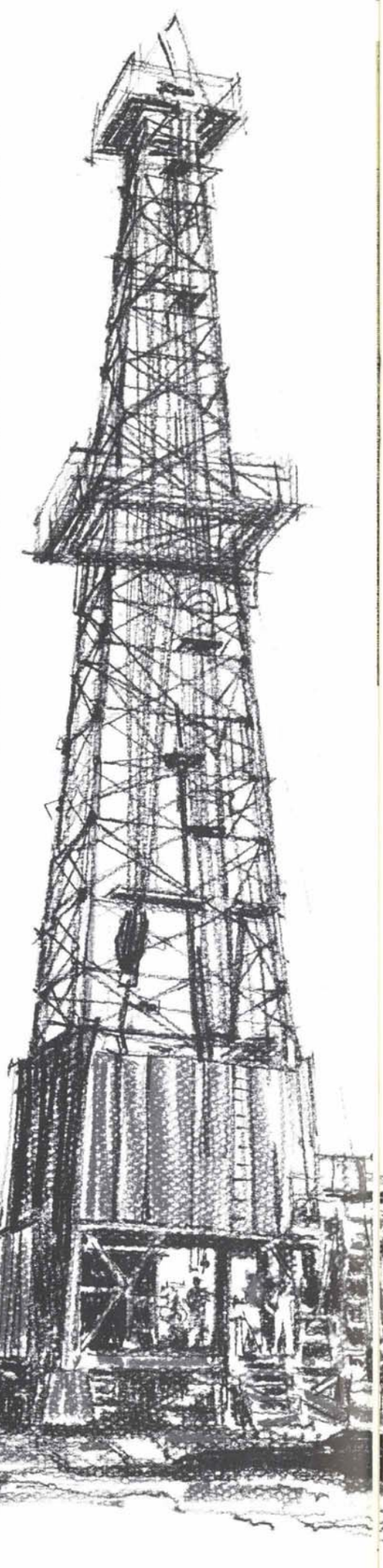
Beads from the collection of the late Emile Boustany, courtesy of Mrs. Myrna Boustany.

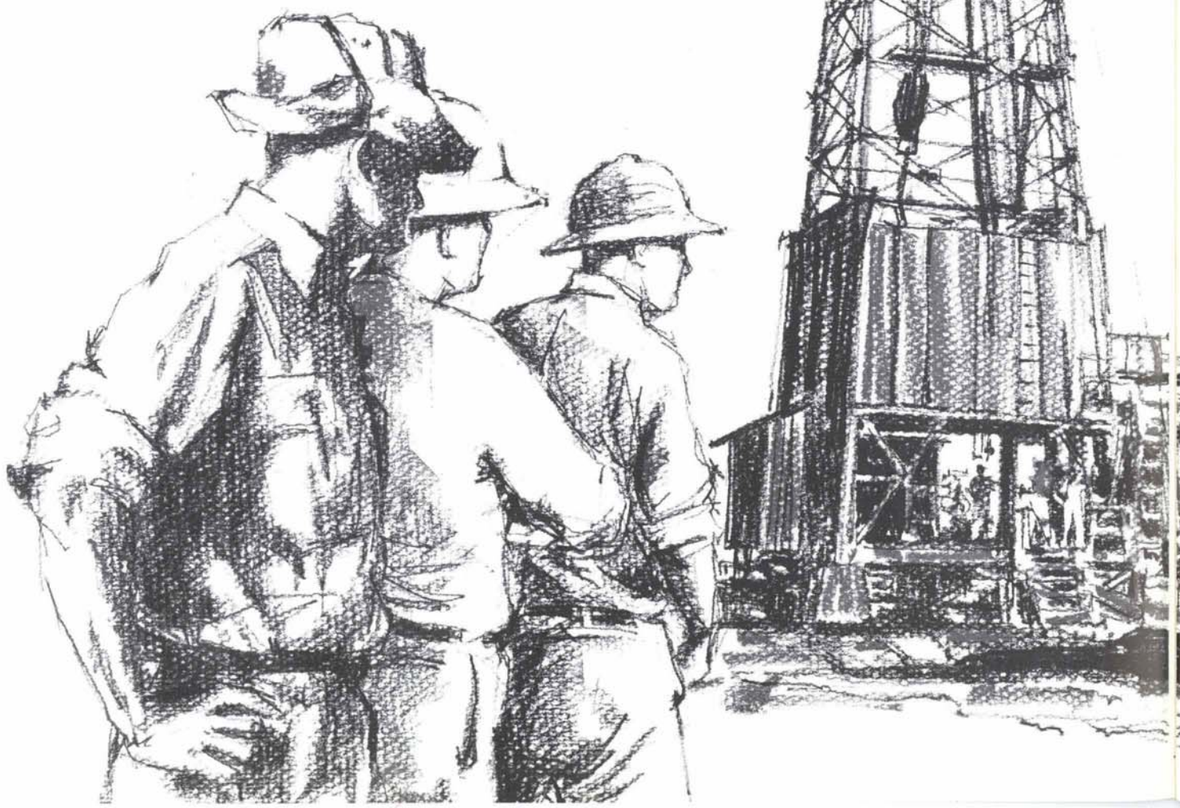
SYNOPSIS: With each year that passed the stage got more crowded. The English financiers and their New Zealand major had come and gone. An American philanthropist, a mining engineer and one of Great Britain's most famous explorers had given their views to an Arab king. An expert from San Francisco and King Ibn Sa'ud's shrewd advisers had hammered out an agreement. Now it was the turn of the geologists, the ten-man team of hard-living, able experts who would decide if and where the Company, soon to be called California Arabian Standard Oil Company, should begin to drill for oil.

They were a colorful crew, these ten, and the work they did reshaped Saudi Arabia forever. On foot, by car and in the gallant Fairchild that Dick Kerr had flown down from Cairo—and got arrested in—they crossed and re-crossed the vast concession area, amid heat, sand, flies, illness and injury, capturing on paper the features of this featureless land.

Later, in Lebanon they savored the cool air, slept a lot, and ate and drank at a furious pace. One of them, Krug Henry, met a girl named Annette, immediately decided to marry her and did so a few weeks later. The rest worked on the reports that would send them back for a second season in Arabia and bring in others—like Max Steineke—who would also play important roles in what came later.

The second season was much like the first, except that Lloyd Hamilton came calling, and decided to drive clear across Arabia. En route he visited King Sa'ud, took the first movies ever taken of the desert King, his people and his land. It was a most interesting trip but by then attention had shifted back to the east coast. The wildcatters had arrived at last.





They did not come as settlers, or even as explorers; they were neither the kind that planned to stay nor the kind that evinced much interest in the strange places where they found themselves. One place was much like another; they took change philosophically; they imposed themselves and their own vagrant subculture on whatever spot of earth happened to contain them. They were wildcatters, used to moving on, and when they came wading onto the shores of Saudi Arabia in 1935, they were thanking their stars that they didn't have to stay on Bahrain. Discovery was their business, and they had already done that at Jabal Dukhan. It was all right to get the rig all dirty with the first producer, the one that mattered, but it was another just to drill holes where you already knew you would hit oil.

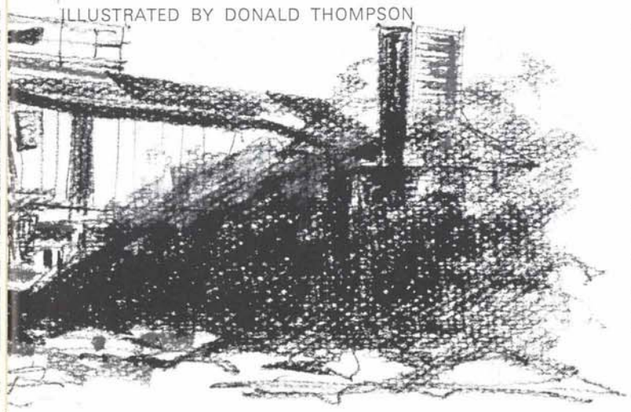
They took the far corners of the earth without excitement because they had already seen a lot of them. Of that first wildcat crew on Dammam Dome, every man had been knocking around the world for years. Guy (Slim) Williams, the slouchy and laconic tool pusher, had had a China tour; so had Jack Schloesslin, a driller, small, fat, ferociously foul-mouthed, and as soft under the crust as Camembert.

DISCOVERY!

the story of ARAMCO then

CHAPTER 6: THE WILDCATTERS

BY WALLACE STEGNER
ILLUSTRATED BY DONALD THOMPSON



Both of them had known Bill Eltiste, a general utility man in transportation, machine shop and garage in Argentina in 1922. When Eltiste pulled out in 1925 to take a leave in the States, he worked about a month at Taft, in the San Joaquin Valley, and then headed out for Maracaibo, Venezuela. After a year there he went on to Colombia, and there ran into Schloesslin, who had meantime been in Ecuador. Slim Williams had by then left South America for Montana. These were the expected and routine jumps.

When Ed Skinner, who was assistant manager at Maracaibo, was transferred to Bahrain as manager in 1931, he took with him as a crew a bunch of these rough and skillful roamers who had already touched on practically all the places where Socal had had foreign operations. This was by and large the same crew that was sent to the mainland later. The al-Hasa concession was test-drilled by men who had been around.

But they did not—quite—bring all their gods with them into Latium. Missing from the al-Hasa wildcat and from the towns around it were the beer parlors, the dance halls, the juke boxes, the slot machines, the movie theaters. Nevertheless they did manage certain things from the beginning: refrigeration, electric fans, bunkhouse radios, ice cream—and a state of mind that even without beer and movies and the company of ladies was startlingly and unmistakably American, and that involved, among other things, optimism, generosity, carelessness, roughness, high productivity, the habit of exaggeration, the knack of improvising, a family relationship to Paul Bunyan. They would have stared in incredulity at anyone who had called them missionaries. Yet if utter faith in a way of life, and an utter conviction that the rest of the world would best be served by adopting it, constitute the essential elements in missionary fervor, these men were missionaries as surely as were Dr. Harrison's Christians over on Bahrain.

The first one over, besides Slim Williams, was Walt Haenggi, a rig builder and construction man who had already done service to the Bahrain crew by demonstrating what happened if you refused to wear a hat or a *ghutra* in Arabia. Haenggi was a big, rugged oilfield roughneck, not inclined to baby himself. He scorned all head coverings for some time, until one summer day when the temperature was about 120° he suddenly took off at a dead run across the island. The Bapco manager, Ed Skinner, who had been a fullback at California, pursued him and brought him down, and they put him in the refrigerated

food locker for a while to cool his overheated skull. When Haenggi arrived at al-Khobar, he was wearing a hat.

Next came Joe Cartwright, known as Joe Khobar, the camp clerk and paymaster. He had worked in Texas where the paymaster laid a six-shooter on the table to maintain decorum among his clients. The first time Joe Khobar paid off the crew at the Dammam camp—later to be known as the Dhahran camp—there was the six-shooter. He did not last long in Arabia. It was felt that the Arabs would not understand him as the Texans had.

Just after Christmas, 1934, on the same launch that brought Lloyd Hamilton, on the first leg of his trans-Arabian tour, there came Claude Jared, a driller, Floyd Ohliger, a petroleum engineer, and Frank Dang, a Chinese cook, all wading ashore because there were no dock facilities. Jared was the orthodox foreign-department wildcatter. Ohliger was a freckle-nosed and engaging Pennsylvania Dutchman who had wildcatted in Venezuela and done a hitch on a concession in the Magdalena Valley in Colombia after getting his degree in petroleum engineering from Pitt. Subsequently he had been in California, Oklahoma and Texas, and then had gone back to school at Stanford to learn some more physics.

Frank Dang was something more unlikely. After 12 years spent cooking in a Berkeley sorority house, he went back to China on a visit, could not get back into the United States, and ended up cooking for the staff house of Socal in Maracaibo, Venezuela. Later he returned to China and opened a string of movie houses, but had to give it up. So many of Chiang Kai-shek's soldiers insisted on coming in free that they crowded out the paying guests and put Frank out of business. Now, through the Bahrain cook, Chow Lee, also an ex-Venezuelan, he was brought out here to Arabia, as erratic a wanderer as any of them.

They located a camp on the terrace near the higher jabals, dug a water well, took apart two double-walled tents that had been stored in Jubail since the previous fall and made them into four tents, which they set up near the spotted site for Well No. 1.

Until the establishment of the camp, their assault on Arabia had had no seeming of permanence; they had lived as visitors in Arab houses in Jubail and Hofuf, and in the desert they moved around more than the Bedouins. But at al-Khobar they began at once the thing they were notably good at: construction.

The first thing they had to have was a pier, and as soon as they selected a site they called an historic meeting, not thought of as historic at the time, by the fishermen's *barastis* on the shore. Its purpose was the first mass employment of Saudis as industrial labor. Ohliger enlisted every available dhow and put the crews to gathering the crusty, shell-like stone the Arabs called *faroush* which low tide exposed along the edge of the Gulf. Within a few weeks there was a long rough finger of stone poking out into the green water, and visiting firemen no longer had to come ashore on the shoulders of crewmen, new employes no longer had to wade ashore, supplies no longer had to be carried on the heads of workmen.

Then there was the problem of housing: Walt Haenggi and a crew started on a bunkhouse up near the site where the first well had been spotted the June before: it was oriented in an east-west direction so as to admit as few as possible of the sun's hottest rays. There was the problem of water: a hand-dug well in the flat below the jabals yielded sweet water of fair quality for drinking; and Eltiste boxed in one of the underwater springs exposed at low tide, and got a greater supply of brackish water than could be used for camp and drilling purposes. There was the job of supply, the job of transportation. Across the stretch of dunes between the al-Khobar camp and the site of the well they dragged lumber, cement, equipment, the old cable rig, moving things by camel or car or laboriously and slowly by Caterpillar tractor.

It is a legend in Arabia now that at some point in these early years Bill Eltiste and Dick Kerr, observing how a camel's big squishy feet spread out to the size of a manhole cover in loose sand, commandeered a cargo camel and hoisted him on an A-frame and weighed him and then sat down with a slide rule and figured out the ratio of foot-surface to body weight, and so devised the low-pressure sand tires that have since revolutionized off-road work in the desert. They were indeed pioneers in off-road transportation, but neither Eltiste nor Kerr admits to weighing any camel.

If anybody ever did, it was an engineer with the Egyptian Camel Corps who developed the idea of oversized tires with Dunlop, in England, and got them to manufacture 9.00 × 13's with about 12 pounds pressure for desert work. Miller saw these tires when he was in London in the summer of 1934, and ordered 50 of them for the touring cars, pickups and station wagons. On the way back to Jubail, when he stopped in Alexandria to meet Lenahan, he saw a demonstration of larger tires for trucks arranged by the Dunlop people with the Ford agency. Because he wasn't quite sure they would work on the Arabian sands, he bought only one set and two spares. As soon as he got back in the field he was wishing he had bought dozens.

The fact is that the earliest beginnings of low-pressure tires in Arabia go beyond Eltiste and even Kerr and Miller. The so-called "balloon" tires, as used in the United States, were recommended from the first by Twitchell and Hamilton, who had heard about them from others. The cars that Twitchell brought across from Jiddah in September, 1933, had the biggest tires he could get there, which were 7.50 × 16's. Even Kerr's Fairchild had big doughnut balloons. In spite of the attractiveness of the picture of Eltiste and Kerr hoisting a camel on an A-frame, truth compels the statement that it was later, and on heavy equipment, that these two made their notable contribution. They took what the Camel Corps engineer had first comprehended, and applied it to bigger and bigger carriers until by now a rig weighing 400,000 pounds and up goes off across the Arabian desert on rubber.

By February 19, 1935, the collar for Dammam No. 1 was completed—the hard way. Having no dynamite at the time, they broke up the rock by alternately getting it hot with a wood fire and then drenching it with cold water. Haenggi's crew began erecting the derrick, accepting the help of everybody around, including the engineers and geologists. *("What can I do to help around here?" asked Floyd Ohliger, the petroleum engineer. Eltiste handed him a ten-pound hammer and a handful of 60-penny spikes and pointed to some 3 × 12 planks on the derrick floor. "Nail down a few boards," he said.)* By the middle of April the derrick was up and they were rigging up and digging a sump hole. On April 30, 1935, they spudded in Dammam No. 1 with the old cable rig, starting a $22\frac{1}{2}$-inch hole.

This was what they had come for. No problems of expense, policy, public relations, cultural adjustment, logistics, or integration of effort concerned them. Those were office problems. No problems of terrain or location troubled them: those were the geologists' lookout. The three American drillers with their crews were here to drill a hole and see what was down there, to keep three shifts going night and day, to meet the hourly problems of teaching the Saudi and Bahraini workmen how not to get hurt, how to respect the machinery, how to do the job. The fact that most of them had only a little Arabic did not bother them. Most of them hadn't had much Spanish either: they gave orders by some combination of gesture, grunt, shouting, and an occasional indispensable word. Slim Williams, confronted by the necessity of communicating the idea "down," and knowing only the word for "up," which was *fōk*, managed to convey his meaning by raising his voice to three times its usual volume and adding "no God damn it." Thus, "FŌK, NO GOD DAMN IT!" came to be a reasonably clear, if slightly crude, version of "down."

The theory behind drilling oil wells is very simple. You drill a hole in the ground, over a place where you have reason to hope, or guess, or believe there is a humped-up dome in the strata, and try to break through into that dome. If there is any accumulation of hydrocarbons there, as gas or oil or a mixture of the two, the internal pressure will force it up the hole you have drilled, and you have an oil or gas well. It is as simple as that. Only the actual doing is complicated. And with the best geological advice in the world it is terribly easy to guess wrong about what is a half mile or a mile or two miles underground.

This is how the testing of a gamble looks when transcribed as a series of cables sent halfway around the world:

May 7, 1935: To Reginald Stoner from Guy Williams: *Well No. 1 ... drilling in hard gray limestone ... 260'.*

May 14: Stoner from Williams: *Well No. 1 ... 496' ... gray limestone, encountered water 312' ... slight showing tar 385' ... casing set on shoulder 103' ... to straighten hole. All well here.*

July 15: Stoner from Williams: *Drilled ahead to 1,433' ... gray limestone ... All well here.*

August 25: Stoner from Miller: *Slight showings of oil and gas at 1,774'. Not important but encouraging.*

August 30: Stoner from Williams: *1,886' ... blue shale. Casing 1,845' ... dense limestone 1,774'-1,800'; and 1,819'-1,883'; shows oil and gas 1,779'-1,801'; and 1,840'-1,883'; flowing by heads ... possibly would make 50 bbls. per day. All well here.*

September 6: Stoner from Williams: *1,959' ... casing 1,939' ... dense limestone oil and gas 1,886'-1,906'. Streaks blue reddish brown greenish shale and dense limestone 1,906'-1,959'. Oil and gas 1,948'-1,959' A.P.I. gravity 47 ... hole caved badly ... lowered casing present*

depth hole cleaned itself ... maximum pressure 530′ in four hours ... preparing make flow test. All well here.

September 12: Stoner from Williams: ... *21 hours test at the rate of 98 bbls. in 24 hours and 700 MCF gas rate ... 30 flow pressure ¼-inch bean A.P.I. gravity above 50 ... preparing to drill deeper.*

September 18: Stoner from Williams: ... *1,977′ deep ... While shut down for changing control head, flowed by heads approximately 6,537 bbls. per day A.P.I. gravity of 50.*

That September 18 cable jarred them back home. It could just possibly be true. San Francisco cabled frantically for confirmation of the figure of 6,537 barrels a day, and to Stoner from the Los Angeles office came a telegram suggesting that the figure must be an error because the well was only flowing "by heads" or by surges. "These figures may need checking before jumping out of window," Los Angeles said a little breathlessly.

Williams steadied them with a cable on September 23. The estimated flow was around 100 barrels a day. It would have been an oil well in Pennsylvania, but not out here. And so back to work and back to the cabled reports:

November 27: Stoner from Davies: *2,271′ ... 6⅝″ casing 2,238′ ... alternating sand and shale 2,236′-2,271′; total of 19 feet sand in three members. Unloaded to test. Strong flow of gas ... showing of oil. Gauged 1,800 MCF gas with 680 lbs. back pressure. Unable to gauge further because fitting started cut out. Killing well with mud ...*

January 4, 1936: Stoner from Davies: *Plugged with cement to 2,372′ ... standing.*

They hadn't given up on No. 1, but their enthusiasm was dampened. On the same day they plugged it, they started rigging up for No. 2. The parallel with the Bahrain structure was obviously not so precise as they had hoped: the zone that was richly productive on Bahrain was disappointing here. But one of the wells on Bahrain had found oil at a deeper horizon, at 2,832 feet. To go down that deep they needed a rotary drilling rig. Charley Potter brought one over from Bahrain and they went about installing it on No. 1, using the cable rig to start No. 2 on February 8.

In mid-April, a year after they had spudded it in, they had No. 1 down below 3,200 feet, down below the deep productive zone on Bahrain. Through May and June they struggled with sticking drill pipe, cavings, cementings, broken casings, and perforations and acid treatments that had little effect. Their faith in the well was gone, and the excitement stirred up in official Saudi Arab quarters when it blew gas and oil during the tests of the previous August had faded too.

The crew went on tinkering with No. 1 for six months more, then shut it in for nearly a year before they finally completed it as a stand-by gas well in December, 1937. By then no one was paying much attention to it. The attention had long been focused on No. 2, which by May 11, 1936 (after the rotary rig was moved there), was drilled to 2,175 feet, and was giving most encouraging indications. On June 20, during a five-day test, No. 2 flowed an average of 335 barrels of 54° A.P.I. crude a day. One week later, after acid treatment, it produced steadily at the rate of 160 barrels an hour—equivalent to 3,840 barrels a day—until it was shut in because the storage was full. Obviously there were some hydrocarbons down there. Even on the meager showing of No. 1, the San Francisco office had shown strongly bullish tendencies, and No. 2 confirmed the official optimism. On May 22 William H. Berg, then a vice president and director, sent word that if Dammam No. 2 turned out to be a producer, the men in the field should be prepared to drill the al-Alat structure, first recommended by Max Steineke partly because it was the likeliest geological prospect and partly because it was only twenty miles northwest of the Dammam camp and could be serviced from there and supplied from al-Khobar. Inside of six days, on the strength of the developments at No. 2, the al-Alat well was authorized, and early in June the San Francisco office threw the book at Davies and his slim field force by authorizing Dammam Nos. 3, 4, 5 and 6 to test the extent of the structure there.

When Davies protested that even No. 2 had been pushed too fast, and that they really had no idea of the thickness of the producing strata, and that four new wells at Dammam plus one at al-Alat were beyond the capacities of the crews, San Francisco replied by authorizing Bahrain to cooperate with everything it had, and in July it authorized still another well, Dammam No. 7, designed to be a deep test of the so-called "Arab Zone" which had shown gas, but little oil, on Bahrain.

Authorization of the drilling program also meant authorization to expand the work force and the camp facilities to meet it. This meant replacing the wildcat camp with a permanent one, and a little group of less than two dozen Americans and about two hundred Saudi, Bahraini and Indian workmen with a very much larger force. It meant reserving for company use another plot of land at Dammam camp to match the reservations already made at al-Khobar, Ras Tanura and Dhulaifain, on the Gulf north of Ras Tanura. It meant new workers, most of whom would have to be recruited from abroad with inevitable arguments to prove to the Saudi Arab Government that, as yet, there were no technically skilled Saudis available. It meant better transshipping arrangements between Bahrain and the mainland. It meant water wells at al-Alat and new ones at Dammam camp; the drilling they were already doing utilized 15,000 barrels of fresh water daily, and worked the pumps on the submarine spring around the clock. It meant approval of layouts and plans for a permanent camp, approval of housing plans, building of housing for new personnel, and before that the building of housing for the men who would build the housing. It meant enlargement of al-Khobar pier, the surveying of the Gulf to find better channels for deeper draft ships. It meant laying out and oiling and keeping in repair a road between al-Khobar and the al-Alat wildcat, the last eight miles of it across bad dunes. It meant increasing the size of the camps for Saudi workers and the building of a new one at al-Alat. It meant more bunkhouses, more machine shops, a bigger power plant, bigger storehouses. And almost every new and bigger thing that expansion meant also created new and bigger problems of adjustment between Arab and American, new and bigger difficulties of negotiation, fresh differences of opinion in the interpretation of the all-important Concession Agreement.

San Francisco, convinced after the June showing of No. 2 that they had an oil field, cabled that it was sending four two-bedroom, air-conditioned, prefabricated bunkhouses to supplement the already-enlarged one that Walt Haenggi had built. Ten days later, riding a big wave of excitement and optimism, Stoner cabled that he was also sending some air-conditioned cottages suitable for family living. He advised Fred Davies to put his mind seriously on the problem of taking care of married personnel.

Davies was perfectly willing. But he as general manager, and Floyd Ohliger as petroleum engineer, and Guy Williams as drilling superintendent, and Max Steineke as chief geologist, and Bill Lenahan as official government representative, and every one in a position of responsibility in Arabia, had plenty of other problems to put his mind on. The wildcatters with their bits probing a half mile down in Arabia's crust had immensely complicated all their lives. This was no longer an adventurous exploring expedition or a picturesque outpost. The Jubail compound was still kept as a geological office, but geological headquarters had already, in October 1935, been consolidated into the Dammam camp when Davies replaced Bert Miller in charge of the whole operation. Some of the fun had gone. The Fairchild, once their pet and darling, was folded up and stuffed in a shed, no longer needed. Its motor, packed in a crate labeled A-1, was shipped off to the United States for rebuilding, the first thing ever exported from the al-Khobar pier. The old concerns—the constant equilibristic job of government relations, the steady exploration of the concession, the drilling of new test wells—would go on, but around them now would grow an increasingly complex net of other needs, other jobs, and other problems; and along the Gulf coast would grow new outposts of industrial civilization, some of them temporary, some permanent.

What had been a frontier was on the boom. But it was on the boom in a way new to their experience. In most parts of the world the discovery of oil or valuable minerals would have drawn in a crowd of fortune hunters, prospectors, floating labor, entertainers, gamblers—plus providers of supplies and services, who would have supplemented the planned expansion by the Company. In Saudi Arabia the conditions of remoteness and the exclusive concession left everything to be done by the Company, and if that gave them the advantage of greater control, it also left them with the responsibility for greater foresight.

Throughout 1936 they were always behind, always short of something, always getting something half-built and moving into it and using it as a base to build something else. While San Francisco pondered the plan and map of the permanent camp, sent in by Davies at the end of 1935, and while Bay Area laboratories tested various Arabian building materials to see if anything local would do for construction, Davies and Dreyfus visited the King, then visiting Hofuf, and found him genial, and pleased with the way they were pushing ahead, and not at all upset by what they were then calling the Haenggi affair.

The Haenggi affair had occurred the previous year. Under the pressure of 125° heat and an irritating rash, Walt Haenggi had lost his temper and manhandled one of his Saudi workers. The Saudis had demanded

that he be expelled from the country, and the wildcatters, believing him justified had said they would close down the drilling if he were. Eventually, when all the evidence was in, the King believed he was justified too, or at least not guilty of anything serious enough to warrant expulsion. But for a while there was a new reserve in the previously easy relationships.

All through the spring, as the bits ground deeper in both No. 1 and 2, the supporting operations proliferated. The men broadened and lengthened the al-Khobar pier and before it was anything but a horizontal rockslide cars and trucks were scraping their pans across it. Dark roads began to reach out from al-Khobar to Dammam camp, from Dammam camp toward al-Alat, sprayed with the crude from No. 1. In March, Davies negotiated a contract with the Mesopotamia Persia Corporation of Bahrain to bring company freight in by barge or launch or dhow, and immediately the local customs officers, the local government representative, and ultimately Lenahan and the Ministry of Finance in Jiddah were involved in a debate about anchorage fees, liability in case of accident, the proper validation of manifests.

In Jiddah there were quite different signs of growth and strain. Saudi Arabia, which for generations had used the Maria Theresa (thaler) dollar and sometimes the gold sovereign for currency, had, under Ibn Sa'ud, formally outlawed the Maria Theresa dollar and established as its own unit of exchange the silver riyal. There were never enough riyals in circulation, but what had been before Casoc a faint awkwardness now revealed itself as an acute lack. Casoc was interested because it sometimes had trouble making payrolls in the local medium of exchange, always silver because the Saudi Arabs still neither understood nor trusted paper. (Khamis ibn Rimthan, paid once in silver and a rupee note, had kept the silver and thrown the note away.) The Saudi Arab Government, to remedy this shortage, and to stabilize the fluctuating value of the riyal, had placed an order for the coinage of a million riyals early in 1936 and now wanted to coin another million. For backing it needed gold; it suggested that Casoc might lend it £15,000, and after hesitating from March to July, Casoc did so, since by that time the euphoria brought on by the production at Dammam No. 2 was loosening the purse strings in San Francisco.

This was only one of literally dozens of problems and negotiations that kept Bill Lenahan and his new assistant Bill Burleigh busy in Jiddah. Experience had taught them not to deal with local officials on policy questions, so that now any matters involving interpretation of the Concession Agreement or the supplementary Private Agreement were automatically referred to the Jiddah office by Davies or by Ohliger, who on August 1, 1936, was made assistant general manager.

They handed Lenahan all the old (and persistently renewed) debates about customs liabilities and the size of escorts for field parties and about the Company's requests to import foreign labor for specialized jobs that could not yet be handled by Saudis. He acquired likewise such new matters as the police problem brought about by the establishment of a permanent camp. Saudi Arab police assigned to the Dammam and al-Alat camps were local men, and authority did not always sit well on them, even when they thought they knew what this authority was. The precise nature of their jurisdiction within the company reservation, as well as problems of the behavior of policemen, were Lenahan's to solve, though Davies and Ohliger had to deal with specific situations as they arose.

And there was a whole series of Government requests, most of them now channeled through Najib Salha, who, always the bargainer, reopened a lot of agreements the Company had considered settled. Most of them called for additional Company contributions, such as the building of a Government house at al-Khobar pier and provision of transportation for the Saudi Arab Government representative in al-Hasa. After all, the Government argument ran, we would not be having these problems and expenses if you were not here digging for oil. Demands had to be taken up one by one, and parried or allowed as justice and public relations dictated. One thing Lenahan could be sure of; the moment he got one settled there would be another in its place.

Problems were what made Jiddah stimulating, actually. The gossip and intrigue of its foreign colony were interesting after a fashion, and Lenahan took periodic trips to Egypt or Europe to refresh himself. But it was the problems that he liked. He was a born negotiator, alert and imaginative, and when necessary immovable, and once in a while furious. Paradoxically, his temper rather endeared him to the King, to whom he sometimes went when he found the ministers intransigeant. "I like Lenahan because I know him," Ibn Sa'ud said once, "and I know him because I have fought with him so many times."

By the beginning of August, 1936, when Ohliger was taking over his new job and they were building the rig for al-Alat No. 1, the Company had made its loan to the Government, had decided not to compete with Longrigg and IPC for a concession for the Saudi-owned Farasan Islands in the Red Sea, and had obtained land reservations for al-Alat and clearances for Dammam wells Nos. 3, 4, 5 and 6 as well as a 70,000-acre reservation for the permanent camp and its necessary installations. By that same midsummer dividing line, a company engineer named Charles Herring had reported that a submarine pipeline to the Bahrain refinery was perfectly feasible, and in London Roy Lebkicher, Hamilton's assistant, had had several conferences with the British Admiralty about a hydrographic survey of the Gulf with an eye to the marking of channels and the creation of a major port.

Once committed, there was practically no limit to how far the Company might be extended in its effort to develop and market a major oil deposit. It was very willing, even eager, in spite of its uncertain status as a purely commercial stranger in a foreign country. All it needed, actually, was the oil, and that in mid-summer 1936 did not look difficult. In the process of finding it the field was pressing several programs vigorously. A lean and drawling paleontologist, Dick Bramkamp, came out at the end of August and set up an Arabian foraminiferal laboratory so that they would not have the delay and awkwardness of relying on the lab on Bahrain. From October on, Jerry Harriss and Walt Hoag, a pair of geologists who cordially disliked each other and went for days without speaking, were off in the desert west of Jubail sourly mapping an area of nearly 4,000 square miles as a preliminary to geophysical work there. In November the first structure drilling program, with Krug Henry in charge, began a series of holes at al-Alat, Qatif and Dammam. Careful study of the cores from those holes, and their coordination with cores from other districts and with the results of surface geological work, would eventually give them a more positive idea of the continuity, depth, and flexure of strata, and make drilling less of a gamble and more of a science.

This was the beginning of the geologists' fourth season in the field, and the findings had been, on the whole, meager. They had discovered at once what they had seen from a distance: the Dammam Dome. They had by surface investigations and Max Steineke's intuitions detected signs of closure at Abqaiq and Qatif, and the an-Nala area west of Hofuf was known to be regionally high and worth further study. The al-Alat structure had been plane-tabled and was now being test-drilled and structure-drilled. But they still did not know the Miocene stratigraphy clearly enough to see the underground organization of the region, and they did not know clearly its relation to the Eocene. They had a great deal of hunting still to do, and by means more productive than surface geology.

Through 1936 that program went on. The camp spread out across the crusty rock and shallow sand southwest of the jabals and the flock of test wells that San Francisco had ordered went down—all by rotary. As reported by cable on April 15, No. 1 had gone down below 3,200 feet without real result. More alarming, No. 2, after its spectacular test at a rate of 3,840 barrels per day, "went wet," and settled down in the later months of 1936 to a production of 225 barrels a day of oil and 1,965 barrels of water; it was obviously going to need some rehabilitation. And what of wildcats Nos. 3, 4, 5 and 6, all hopefully aimed at the Bahrain Zone which had gushed out the June flow of No. 2?

No. 3 was spudded in on July 14 and completed to the Bahrain Zone on November 20. Production was never more than a hundred barrels a day of 28° A.P.I. oil, 15% water. It was never flowed except for use as road oil.

No. 4, spudded in August 20, was suspended in the Bahrain Zone at 2,318 feet on November 18. There was not even a showing on this one: a dry hole, a duster.

No. 5, spudded in September 8, was down to 2,067 feet by the end of the year without producing anything.

No. 6, whose derrick was erected in September, suffered from the overload of rush work and from the sagging of spirits when 3, 4 and 5 went to no purpose and No. 2 dwindled. It sat there, a derrick on a cellar, until after the turn of the year before anything was done with it.

In the meantime, preparations had been made for the first deep test hole. It was called Dammam No. 7, and it was spudded in on December 7. What it would find was, by then, anyone's guess, but they all knew it had better show something. Time was running out.

TO BE CONTINUED

THE ARAB CHILD IN SCHOOL

PHOTOGRAPHY BY BRIAN SMITH
Additional photos by Sa'id Al-Ghamidi and Ali M. Khalifa (Saudi Arabia) and Tor Eigeland (Jordan and Kuwait).

Education, according to one writer, is a window opening onto the world.

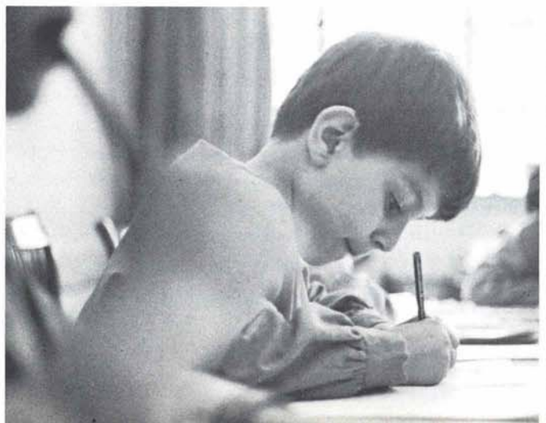
To older students, and to parents, teachers and governments, it may sometimes seem that the window is clouded with the problems of curricula, examinations, administration and financing. But to the child in elementary school, education is wondrously free of such complications. To the child—whether in England or Jordan, Australia or Saudi Arabia—education is simply the adventure of learning. To a child the window opens on a world of flowers, butterflies and bunny rabbits, of finger painting and flutes, of new-found friends and school-yard quarrels, a game of ball or a snack at recess.

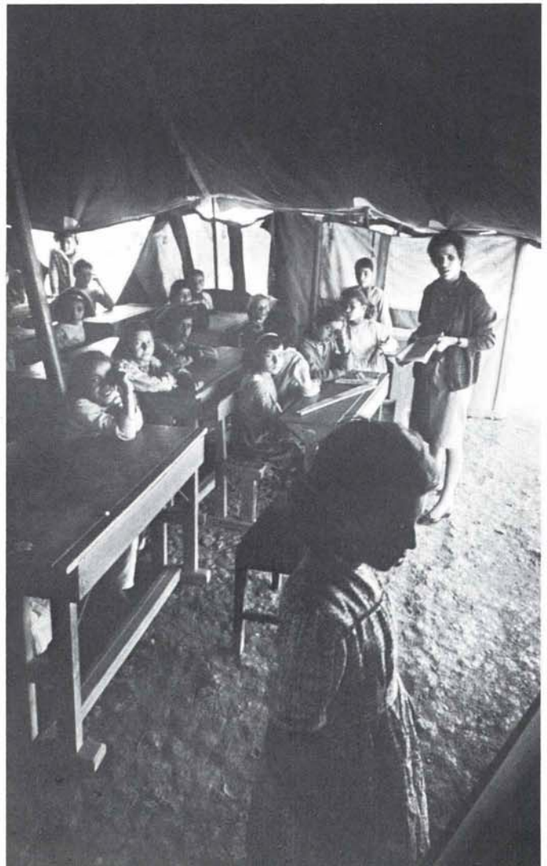
In the Arab world as elsewhere this fall, the children down their breakfasts, collect their books and rush to catch the school bus. And if the food they dawdle over is not the same as that of a child in Finland or Florida, and if they wear colorful smocks over their clothes and carry small briefcases, the wonder in their eyes as they head to school is still much the same. Through their own private windows they are about to set forth on another adventure in learning.

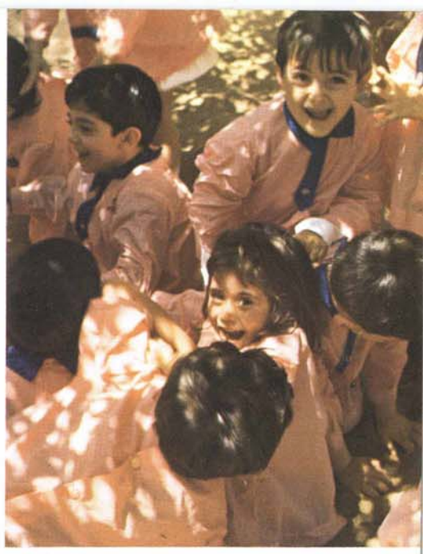
In Lebanon, where there is a strong tradition of private schools, some supported by religious institutions, others by foreign-language communities, the adventure might be waiting in a quiet garden courtyard in bustling Beirut or in a cool stone house high in the green mountains. In Jordan, it might be waiting in teeming Amman or in an UNRWA tent pitched at the edge of one of the refugee camps. In Saudi Arabia it will probably take place in a spanking new building no older than the children themselves—one of dozens either completed or now being built by the Saudi Arab Government (some in cooperation with Aramco) as part of a nationwide effort to extend free public education to every child.

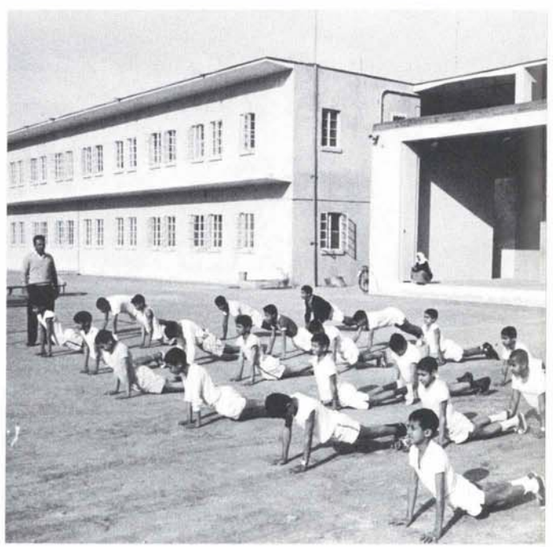
But for children all over the Middle East this morning the adventure is waiting and the big window onto the world of knowledge is opening.

No matter where a classroom is, it is made up of desks, blackboards, pencils, books—and children ... and when a word is hard, whether it's in English or Arabic, it helps if a child can scratch his nose ... or press so hard on his pencil that the point breaks and then he can't erase the line... And in any classroom teachers try to get the children to close their eyes and sit quietly for a while or try to interest them in drawing the world outside the window with crayons and colored pencils ... Even in a refugee camp a little girl must go to the blackboard in front of the class while the teacher watches sternly and her classmates giggle ... although reciting can be fun if you know the answer—or if you're a mischievous little boy ... And after the reading and writing and learning facts and figures there are always stories to listen to, or songs to sing or maybe even musical instruments to practice on ...



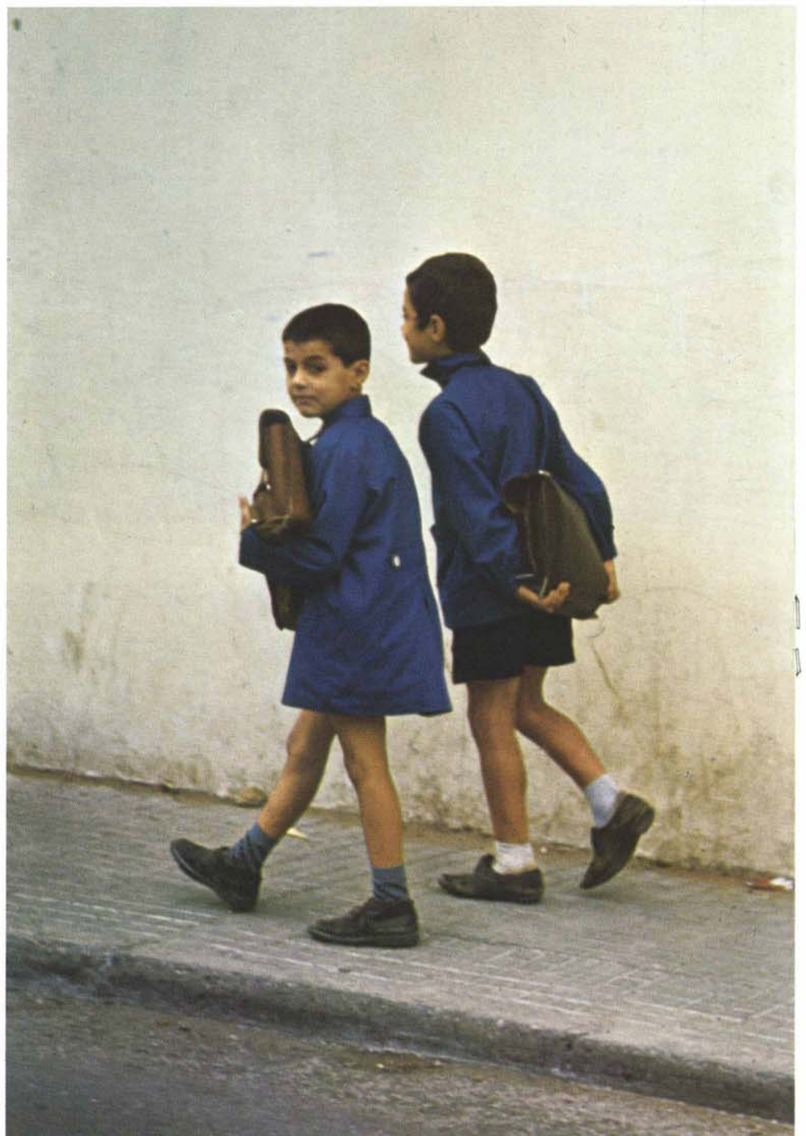






Then it's time to run outside ... to use up all that restless energy that children always have ... to play in the sun or—in some schools—run past a fountain and try to keep from getting wet ... Some boys just walk around and swing their bags or hit someone on top of the head with one ... or get down on the ground on their hands and shake all over while the teacher counts soooo ... slooooowly... Girls love baby animals—maybe because they're smaller than themselves—and they like "Show and Tell" and "Keep Away" and playing in a crowded sandbox ... They like to stretch and climb too, and hang on jungle gyms and creep up on a butterfly, holding their breaths ... They learn to wait their turns and go one at a time ... learn to share their ice cream on a stick—the ice cream they need to restore their energy so they can fidget when they get back to class ...

Going home is as exciting an adventure for children as going to school was in the morning; there's so much to tell about what they did and what the teacher said and what they learned today ... They try to remember the books they'll need at home; there are poems to learn, some arithmetic to do ... When the last bell rings the teacher helps the youngest ones to put their coats on and leads them to their bus like a row of fluffy yellow chicks ... Some children feel very grown up when they're walking home from school—even if they still wear short pants ... They poke along the sidewalk instead of running to tell their day to mother ... They might not even believe that learning is an adventure any more ... But one thing about open windows; once children start looking through them, they find them everywhere.



FOR THE NEEDS OF THE FUTURE ARAMCO'S PLANNERS MUST TAKE...

THE LONG LOOK FORWARD

BY BRAINERD S. BATES

PHOTOGRAPHY BY BURNETT H. MOODY, ALSO S. M. AMIN AND ALI M. KHALIFA

During the first half of 1968 the Arabian American Oil Company (Aramco) produced an average of about 2,800,000 barrels of oil a day. By measures of past performance and future projections, Aramco anticipates that its crude oil production could double by 1975. If so, half of its future output will be flowing through and processed in facilities that do not exist today. It may be less obvious that planning for the myriad installations needed to handled the majority of Aramco's total production and processing in the distant future must be started years before these facilities ever see a drop of petroleum.

The southernmost oil installations being presently operated by Aramco in eastern Saudi Arabia are an aluminum-painted gas-oil separator plant and an expansion turbine pump station at Haradh, deep in the desert on the edge of the great Empty Quarter. Lonely well platforms standing out of the water at Safaniya, world's largest offshore oil field, are the most visible signs of Aramco oil activity near the northern perimeter of its concession area. The distance between these two points is something like 400 miles. In this day of turbojet helicopter transportation, which the company takes advantage of, it is possible to cover the entire distance in a morning. Viewed from the Plexiglas bubble in the nose of the chopper, evidence of an integrated oil-producing, refining and shipping operation stands out sharply against the stark desert terrain. Like a simple country road that leads gradually into a network of freeways, cloverleaf interchanges and increasingly dense urban settlements, a single slender pipe, flanked by occasional pumphouses and spheroids, thickens and multiplies into a series of pipelines converging toward ever more elaborate complexes of towers, columns and vessels where crude oil is turned by various steps into salable commodities.

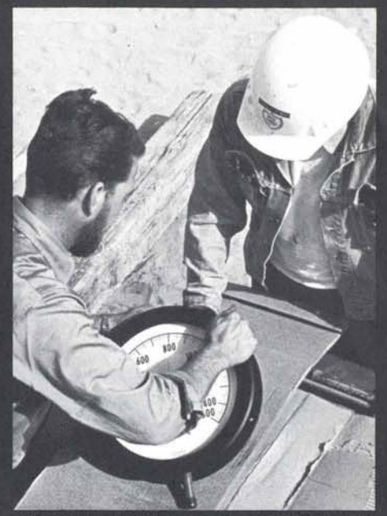
The look of horizontal and vertical steel, perfectly maintained and coldly impersonal, dominates the view from the slowly-cruising aircraft. Modern oil facilities, once installed, do not need many people to keep them running. But as he flies over Aramco's widespread oil installations the helicopter passenger who looks hard enough sees every so often unmistakable evidence of sweaty human effort.

Heavy trucks carrying heavy loads wear smooth a ribbon of sand alongside and endless stretch of pipeline. A huge square hole in the ground at the industrial area in Abqaiq, Aramco's producing center, awaits one more addition to the stack-flanked power plant there, and in the crowded tank farm area at Ras Tanura bulldozers prepare a large round hole for foundations of yet another giant crude storage tank. Spasmodic flashes of blue flame, intense even in brilliant sunlight, point to welders joining lengths of pipe or fabricating heating tubes or the metallic skeleton of a brand-new control house. Half-completed columns and scaffold-encased towers rise out of the steel jungle that is the Ras Tanura refinery, their newness accented by the yellow-orange primer coat which covers every surface. Out off the loading piers of the Ras Tanura marine terminal a barge which looks and is all business dredges the bottom of the Gulf to deepen a ship's channel for ever-larger tankers.

Another kind of human activity which goes on continuously at Aramco is not visible to any observer traveling low across the sky, nor are its results so immediately apparent to the inquiring eye. In various offices throughout the company men in shirtsleeves sit around tables either in deep discussion among themselves or listening to a colleague presenting oral arguments with the aid of flip-charts, graphs and statistics spelled out on blackboards. These are meetings held among all levels of company engineers, financial men and members of management out of which will come decisions to transport, weld, hoist, paint, and dredge on a massive scale years hence. While large segments of employes are kept busy meeting past commitments for current Aramco production, many others are hard at work preparing the company to fulfill demands for its output way down the road.

Experience shows that on a normal, non-crash basis it requires at least a year from the day a new pipeline project is formally approved, and funds for its implementation provided, to the time the line goes on stream and begins to contribute to Aramco's total production effort. In the case of a gas-oil separator plant (GOSP), to take another example,

At Abqaiq's power plant, machinists install a new compressor.



In Abqaiq, instrument fitters unpack a new pressure gauge.

the average lead time is 18 months. It is only too evident that the kind of in-depth planning which goes into the creation or expansion of a major oil installation must get underway long before that project comes up to the high-level group authorized to give it the final nod.

If petroleum production, refining and shipping is a business—and a highly competitive one at that—it is just as evident that facilities needed to produce, gather, process and transport oil represent enormous capital investments. No petroleum company can afford to own facilities much more extensive than those required to meet current demands for its output, but at the same time international oil firms must always be prepared to satisfy their customers' expanded requirements in terms of volume and variety if they expect to remain in business. Aramco's efforts to anticipate what it has good reason to believe will be rising demands for its output are carried on, as nearly all such future planning is, through the mediums of much paper and many conferences among men who are qualified to deal with the complex issues involved.

The paper on which the company does its thinking about expanding oil operations facilities—when, what kind, and by how much—has printed on it graphs showing future production curves drawn according to customers' total anticipated requirements; engineering specifications of particular projects under consideration; budgeted costs and completion dates broken down into specified time increments; approval signatures in ascending order of executive responsibility of company people who have reviewed the projects in the light of their engineering and financial expertise.

Iron workers in the Abqaiq industrial area prepare to install a shroud around an air cooler fan for a new stabilizer.

The normal sequence of the paper routine leading up to the increased production of an Aramco oil field, the construction of a new GOSP, or an addition to the Ras Tanura marine terminal's berthing capacity may, of course, overlap or be switched around, depending on the nature, size, complexity and urgency of the project in question. But no matter what procedure is followed, every major undertaking planned to answer anticipated demands for oil receives a thorough examination from all sides. Before the first topographic survey is made on the site of one more GOSP, or a desolate stretch of sand staked out to locate a new pipeline, many a meeting has been held in one of Aramco's outlying operating areas, at Dhahran headquarters, and with representatives of Aramco's owner companies to examine each project for its technical and economic feasibility and to see that all the planned undertakings together will assure the company of its share in the steadily growing oil market.

The recommendations which come out of these gatherings are not arrived at lightly. Over a period of only a week or so their participants may be talking about expenditures adding up to many millions of dollars. As the discussions move up into the higher echelons their outcome, it should go without saying, affects nothing less than the future health of the company. By the time issues relating to the expansion of Aramco's oil operations have reached the summit, however, the crucial issues of *what*, *how* and *where* would have been resolved by engineers down the line whose job it is to discover and propose the most appropriate technical responses to shifts in the general oil market picture. It is the number of choices facing these engineering specialists, who like everyone else involved must bear in mind the all-important financial implications of the schemes they put forward, that makes their assignments so constantly challenging.

Gigantic new boiler is added to Abqaiq power plant.

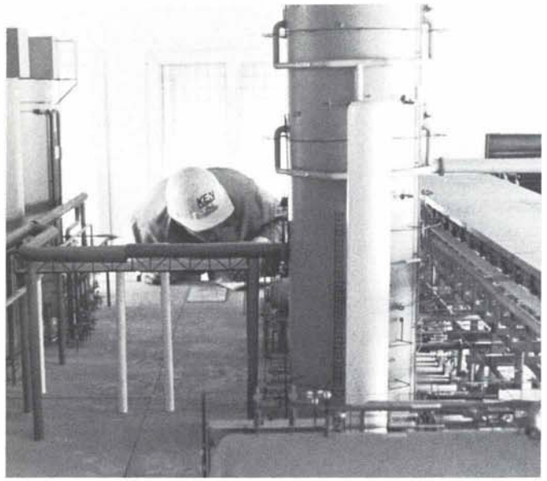
As an example, take *pipelines*. Decisions relating to these most essential adjuncts to any oil operation ought to be fairly clear cut; they are, after all, simple in form and concept and have no moving parts. But even pipelines offer construction planners a formidable array of options, each linked in one way or another to relevant economic considerations. In every instance engineers must first of all decide whether to install a powerful driver behind a relatively small-diameter pipeline or to go the other way around. Pipeliners have to choose from among a range of diameters, wall thicknesses and grades of steel to go into the pipe itself. They must look carefully for the best route along which to lay their pipe and decide, after having considered all the factors, which sections of it should be buried and which supported above the surface by trusses.

When equipping new pump stations with *prime movers*, engineers have to select both the type of driver to be installed and the amount of horsepower the driver must come with to carry the load. There are in all five basic types of drivers—diesel, electric motor, combustion gas turbine, expansion gas turbine, and steam turbine—being used by Aramco to move oil from areas near its source to central locations for processing. Much weighing of options, often finally ending in compromises, has gone into decisions as to which driver would be most suitable for each position in the company's pump station system.

A look at expansion possibilities for *storage tanks* uncovers an entirely different range of choices as to which way to go. First question is, just how much capacity to add. Inadequate tankage can mean not only excessive tanker waiting time at a marine terminal and the possibility of lost crude and product sales but also costly shutdowns and startups of producing and processing facilities down the line. Overcapacity, on the other hand, obviously wastes investment capital.

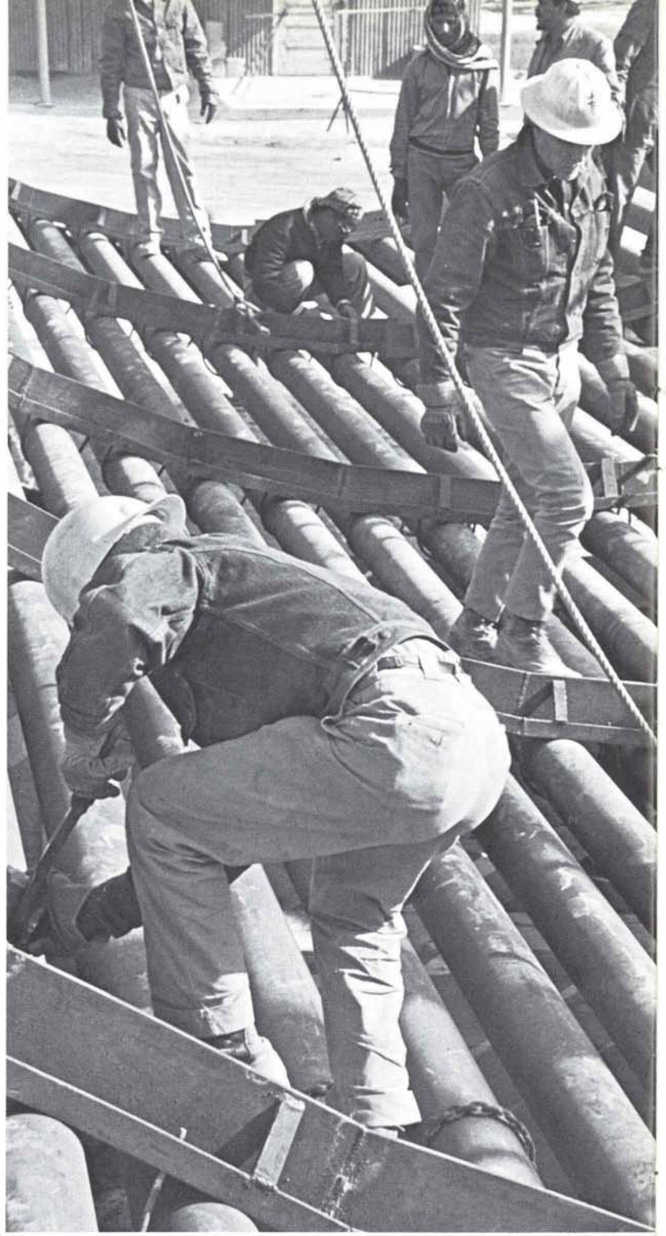
The next logical variable would be tank size. Aramco has worked out elaborate formulas, with cost factors built in, to help planners determine the optimum size of storage tanks under a given set of conditions. While planning engineers are thinking about how large their next storage vessels should be they are also considering types, choosing for their particular requirements, depending on the relative volatility of the petroleum to be stored, either cone roof or floating roof, or ordering special-design spheroid tanks for storing products under pressure. One final related factor which cannot be ignored is the weight-bearing strength of the land on which the tank is to be built. As the size of such tanks continues to grow (Aramco recently completed one which can hold 650,000 barrels of crude), the shells plus their contents become extremely heavy. The foundations for these modern monsters must rest on ground which has to be carefully selected and tested for its stability.

Those involved in the continuing study on the future of Aramco's *marine terminal facilities* work with factors even more complex and are faced with options many times more numerous than any mentioned so far. Planning engineers know from recorded port statistics that the number of tankers calling at Ras Tanura has been increasing



An engineer checks the scale model of Ras Tanura refinery's new crude topping unit.

pipefitter adjusts a process pipe going into the new crude topping unit at Ras Tanura refinery.



Steel template frame on heater tubes of new topping unit comes off before the tubes are installed.

for some time, and the size of the ships themselves keeps on growing. Already added to the port's two piers, which together can accommodate 10 tankers at a time, is a new sea island about two miles offshore designed to handle mammoth tankers too large for the piers.

The berthing spaces at the Ras Tanura marine terminal can be considered customer contact points in the same way that supermarket checkout counters and theater box offices are. Customers who must wait in line too long, too often to buy, whether they're in the market for food, or entertainment, or oil, will soon be taking their business elsewhere. But marine terminal operators cannot afford to build so many units of the real thing to find out how many loading berths, and storage facilities to feed them, will strike the correct balance between optimum customer service and economic good sense in the years to come. Aramco has gone to the computer for the answer.

In setting up a computer "model" for Aramco's marine terminal as the initial step in this quest, engineers and systems analysts worked with recent historical data on all aspects of Ras Tanura port operations. The number and size of tankers calling at the port, the quantities, kinds and grades of oil cargoes these ships lifted, waiting times for berths and tug service, time periods required for mooring and deballasting, even the number of days the port was shut down because of bad weather were all taken into account.

These statistics were arranged in a logical sequence as they affect port operations in actual practice and then translated into a language which the computer could understand. After the computer's "output" was checked against actual port operations to ascertain its validity, those associated with the study were ready to put the General Purpose Simulator to work on problems of future port planning.

For some time the planners have been at a stage where they can change around "input" cards with programmed data punched into them to represent hypothetical shifts in random tanker arrivals, sizes of tankers calling, types of cargoes desired, loading rates, number of tugs available, etc. to see how these alterations would affect Ras Tanura port operations in the future. As consideration is given to modifications and enlargements of Aramco's shipping facilities the computerized "model" of the terminal can be refined to take these proposals into account. Very quickly the computer is able to inform management of the extent to which these proposals would affect costs and operating efficiency at the customer contact point to which Aramco delivers so much of its oil.

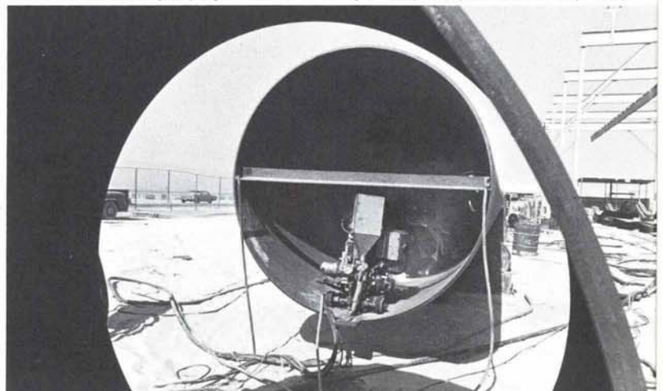
Decisions revolving around the expansion of basic oil production call for planning and financial analysis of the widest magnitude. It stands to reason that any substantial addition to the volume of oil a company decides to produce to meet future demands has a corresponding effect on every facility, from the producing fields all the way to the oil export piers, which will be handling that increase.

The question of whether additional increments of oil come from a new, undeveloped field or one presently on stream involves, like every other evaluation this article discusses, consideration of economics. Proximity of the production source to the customer contact point obviously saves money in constructing the necessary links between them. Providing that both types of sources are roughly equidistant from the ultimate shipping point, it may be best to obtain increased volume of oil from fields currently in business by simply enlarging the facilities which already pump, transport and treat their production. The choice of *which* existing fields will provide the new increments of production depends upon which grade of crude—in Aramco's case, Arabian Light, Arabian Medium, or Arabian Heavy—is expected to be in greatest demand, and which fields holding the desired grade and qualities of crude oil have sufficient reservoir potential to yield added increments of production with fewest expensive pressure maintenance provisions.

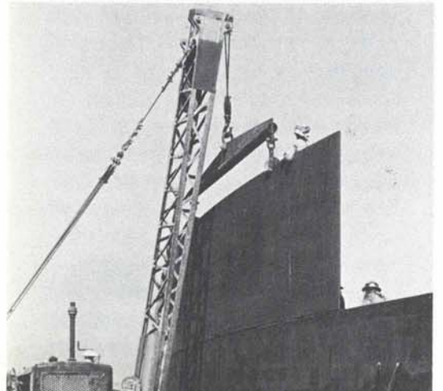
No matter which oil field is selected to supply the next increment of production, however, every single type of installation in a sequence running from wellhead to pierhead comes under consideration. In Aramco's fields oil from widely-spaced wells runs through flowlines and trunklines, known collectively as gathering systems, to more or less centrally located GOSPs, where most of the gas produced in association with the crude is separated in various stages in spheroids. The resulting oil, now at almost atmospheric pressure, must be pumped through pipelines to the next processing point.

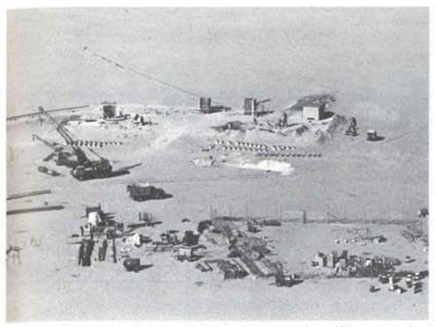
What happens here depends upon whether the crude is "sweet" or "sour" and whether it is destined for direct offshore sale or for the Ras Tanura refinery to be manufactured into prod-

A workman backwelds a jackup leg for the new offshore gas-oil separator plant in the Safaniya field.



Crane places steel for 630,000-barrel storage tank at Ras Tanura.





Aramco's new KAD line, left, will serve the Khurais field, where two gas-oil separator plants are under construction. When completed, Khurais GOSP-3, center, will look like 'Uthmaniyah GOSP-3, right.

This unusual barge was towed into Safaniya waters from Japan, later cut in two and stood on legs to make Aramco's first offshore GOSP.

ucts—gasoline, kerosene, asphalt and the like—for export and domestic consumption. "Sweet" crude oil can be pumped without further treatment directly to tank storage for ultimate delivery to the customer. "Sour" crude oil contains dissolved hydrogen sulfide, a toxic compound which must be removed by a process known as stabilization before it goes aboard tankers.

Oil wells . . . gathering systems . . . GOSPs . . . pump stations . . . pipelines . . . stabilizers . . . refinery process plants . . . quantities . . . capacities . . . diameters . . . power sources . . . calendars . . . costs. When Aramco's engineers and financial men sit around paper-cluttered tables considering new oil production targets they must fit all these individual elements together so that their company can come through on the date and at the cost stipulated with increased amounts of petroleum promised their customers long before. It is no game for children.

In this age of constantly growing demands for energy, while keeping abreast of growing requirements for its basic raw material, crude oil, Aramco cannot afford to ignore market trends which compel technological improvements in other areas of its business. Sometimes, as in the vital matter of petroleum deliveries, the challenge tends to be merely mechanical. A typical example:

Tankers calling at Ras Tanura frequently have orders for blends of different grades of crude or of crudes and refined products. Formerly, these varying types of petroleum were loaded singly into ship's tanks, where the blending was not always uniform. In 1961, Aramco installed on the shore near its Ras Tanura loading piers a so-called inline blender able to supply to customers completely blended petroleum combinations in the proportions called for. The facility, originally designed to blend 20,000 barrels of mixes an hour, was later modified to handle 30,000 barrels an hour. In the mid-1960's calls for blends had risen so sharply that a second inline blender was placed on stream, this one capable of handling up to 60,000 barrels per hour. Now, with constantly growing cargo sizes of tankers, Aramco is again investigating means of increasing its shore-based inline blender capacity to speed loading rates and cut expensive in-port time of these new giants. The company presently favors raising the hourly throughput capability of its larger blender by 30,000 barrels, which would require adding piping, meters, motor-operated valves and booster pumps to this facility.

The other end of the scale in complexity is epitomized by the company's continuing effort to meet growing requirements abroad for liquefied petroleum gas. A clean, practical and cheap fuel for industry and home cooking and heating, LPG manufactured by Aramco is refrigerated in a plant near its Ras Tanura marine terminal for storage and compact transportation in specially insulated tanks aboard ships and then vaporized into a gaseous state near its point of sale.

In the beginning, the program called for facilities to refrigerate, store and deliver for export 4,000 barrels of LPG a day. The first bulk shipment in December, 1961 of the propane and butane product came from gases separated at Ras Tanura from crude oil or produced in manufacturing processes at the company's refinery there. As requirements soared, with no letup in sight, and as Aramco laid plans to expand its LPG production facilities to meet them, it soon became apparent that gas from such conveniently close-by sources would not be sufficient. For the supply of raw feed stock for the greatly enlarged LPG refrigeration and storage facilities in Ras Tanura the company had to go 61 pipeline miles inland to Abqaiq.

At Abqaiq Aramco can gather large quantities of rich, low-pressure gases produced in association with crude oil into one operating center. As much of these gases as possible had been injected deep into oil reservoirs for pressure-maintenance purposes; the rest was flared. In 1963 the company began recovering LPG from raw natural gas liquids (NGL), processed from these same low-pressure solution gases, which also yield as a by-product natural gasoline. Last year, to meet the steadily expanding market for refrigerated LPG from Ras Tanura, a second NGL recovery plant was installed in Abqaiq, and in the same industrial area two large spheroids have gone up which together are able to separate gas from 1,200,000 barrels a day of crude flowing from six different outlying GOSPs.

The NGL stream flows from Abqaiq to Ras Tanura in two separate pipelines, one each for natural gasoline and raw LPG. The former product needs no further processing on the shores of the Arabian Gulf, but raw LPG must have volatile sulfur compounds removed in Ras Tanura. The LPG is then handled as it always has been since Aramco began to produce it: first fractionated into propane and butane, then dried, refrigerated and stored, awaiting delivery, in cone-roofed insulated tanks. To the first six 80,000-barrel storage tanks the company has added two giants capable of holding 200,000 and 400,000 barrels apiece. Incremental enlargements of installations in Abqaiq over the years have increased the capacity of Aramco's refrigerated LPG production facilities from the original 4,000 to 37,500 barrels a day.

All the foregoing notwithstanding, it takes much more than expansion of oil facilities themselves to increase substantially the output of crude and products of petroleum. Any sustained effort along these lines eventually calls for more of everything which supports the undertakings. Provisions must be built into overall expansion plans for added utilities and communications, storage for spare parts, shops where equipment required for the new facilities can be repaired.

Adequate cars and trucks, many of special types and equipped with two-way radios, must be available for assignment to construction, operating and maintenance tasks. If job sites are a long way from headquarters, housing, even of a temporary nature, must be provided and aircraft furnished to span the distance with personnel and supplies. Offshore work calls for support of another kind: mobile drilling platforms, work barges, personnel launches and helicopter transportation. As more and bigger tankers come into Ras Tanura Port, these too must be taken into account when long-range plans are laid. After all the work has been done to enlarge facilities between oil fields and loading piers to meet increased demands for petroleum abroad, it would not look good for someone in Aramco to neglect to order the proper number and size of tugs to escort these paying customers to the docks to pick up their consignments.

Brainerd S. Bates writes regularly on oil and the Middle East for Aramco World Magazine.

Of onions and orchids: lentils and lotus blossoms... BY THEIR GARDENS YE WOULD KNOW THEM

BY WILLIAM A. WARD / DRAWINGS BY DONALD THOMPSON

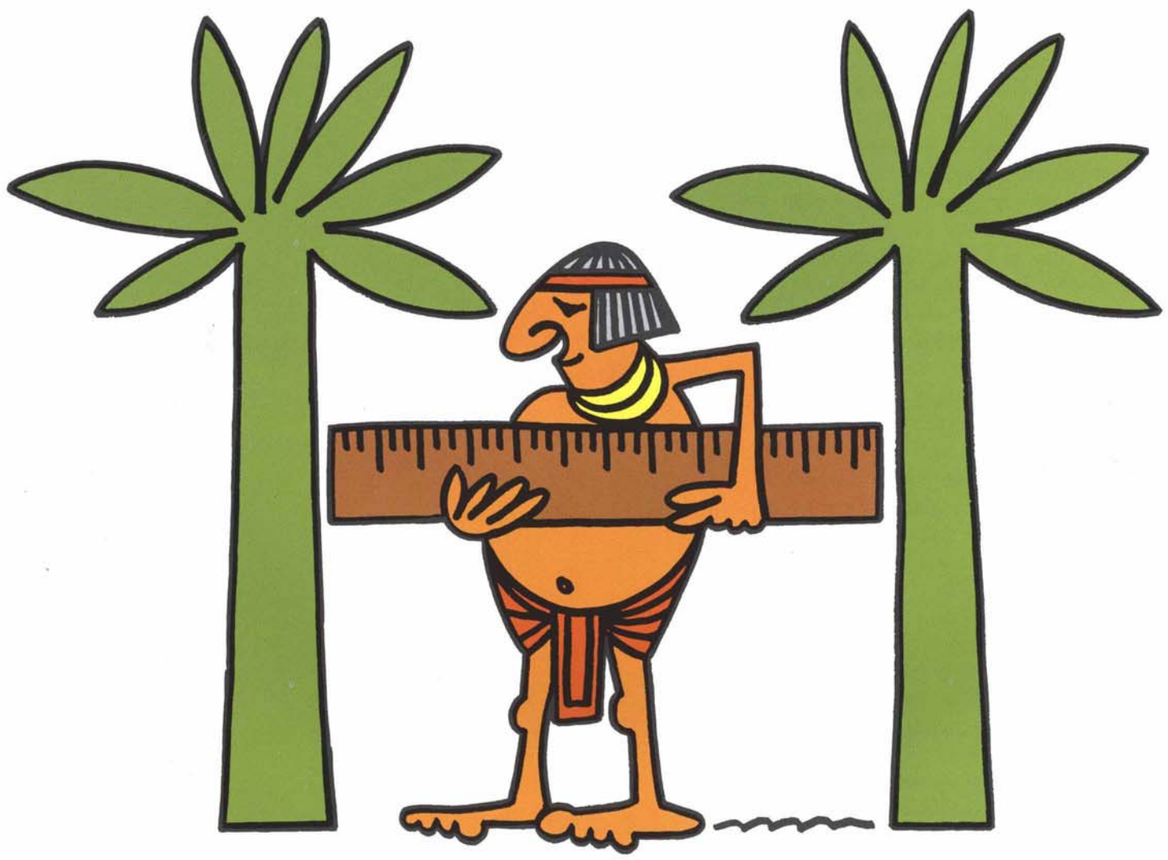
Everyone has heard of the Hanging Gardens of Babylon. They were one of the seven wonders of the ancient world. Some wonder! They didn't hang, they were full of onions and cucumbers and there was rarely a flower to be seen.

This is not to suggest that the gardens were unattractive. Sprawling irregularly around the old walled city in a profusion of palm leaves and grape vines, rich with the fragrance of fruit trees and the sharp scent of herbs underfoot, they were much more than mere vegetable patches. But neither were they the fabulous collections of botanical marvels that Victorian painters and popular historians were so fond of creating. In the ancient world gardens had to pay their way.

As gardens do to this day, the gardens of the ancient world, now usually preserved only as paintings on a wall, offer important clues to the character of the people who planted them, tended them and enjoyed them. As the rigid formality of the French garden suggests the French mind and the exquisite arrangements of the Japanese gardens reflect the delicacy of Japanese thinking, so did the private gardens of Egypt and the palace gardens of Mesopotamia tell us about the ancient societies in which they flourished.

In Egypt, for example, there is no better example of Egyptian precision and optimism than the symmetry that was the most striking feature of Egyptian gardens. Trees and plants were always in rows, equally spaced, forming perfect rectangles or squares. No plant was allowed to violate this absolute balance and it is tempting to imagine the aristocrats on their evening strolls uprooting, with mild Egyptian curses, the hapless plants that dared to grow outside the carefully measured rows.

Some gardens contained hundreds of trees in large variety (a painting of one Egyptian garden shows 90 sycamores, 170 date palms, 120 dum palms and 17 other species such as pomegranate, olive, carob, apple, tamarisk, acacia, almond and peach). But whatever the size of the garden or the number of trees, the fig, palm and sycamore formed the core and they were always planted in perfect symmetry.



In the exact center, usually, there would be a rectangular pool filled with fish and ducks and fringed with plants that needed lots of water. Then there would be a rectangle or square of fig trees in neat rows. These in turn would be enclosed on four sides by straight rows of dum palms and date palms, with the outer border formed by rows of large sycamore trees, the whole complex surrounded by a wall—rectangular, naturally.

The form of the gardens was dictated by two factors: the demand for symmetry, and the almost exclusive use of vertical and horizontal planes.

Classical Egyptian buildings, it should be remembered, did not have arches or vaulted roofs. With the exception of the pyramids, all architectural forms consisted primarily of vertical walls and columns and horizontal floors and roofs. Even Egyptian sculptors followed such principles—with the result that there is a kind of cubism in statuary and an almost unvarying stiffness and inflexibility in reliefs and paintings.

In the Egyptian villa and its garden, these canons were followed explicitly. The private house, just like the temple or palace, was built in vertical and horizontal planes. The ground plan of the estate was rectangular or square, as was the plan of the house and all its rooms. The estate was divided by straight walls into areas of the same shape, one of which was the garden. Following the horizontal-vertical principle, the trees and plants formed the vertical planes; the flat ground and even rows formed the horizontal planes. It would have been unthinkable to have a round pool in the center, a rock garden at one end, or a single tree or bush growing anywhere but in the designated rows.

In spite of this quality of rigid discipline, the Egyptian garden was still a cool and shaded area which offered a welcome respite from the heat of the sun. It even inspired love-poetry with themes that are traditional in the world's literature. One poem tells of a young girl who wanders through a garden in the cool evening breeze. She stops at each flowering tree or plant and speaks to it, for each reminds her of some quality of her beloved. In another poem, a young man and woman wander about a garden while the trees speak softly to them through the rustling of their leaves. They speak of the shade they offer, of the good fruit which is ripe for eating. "One is drunk without drinking," say the trees, "from the aroma of countless blossoms."

Not so drunk, please note, that they ever forgot that the primary purpose of their gardens was economic. If gardens were beautiful and inspired poetry, fine, but whether they belonged to villas, temples or even palaces, they still had to produce more than cool shade and pleasant fragrances. Grape vines produced wine, trees produced fruit, oil, timber—and every plant had its use, from a wide variety of herbs (prac-

tically every kind of herb used in the Middle East today was grown then in Egyptian gardens) to vegetables like lettuce, cucumbers, onions, leeks and radishes.

This didn't leave much space for flowers. This does not mean that when young men wanted to present bouquets to their beloved that they had to settle for a bunch of onions garnished with lettuce leaves. For if there were only a few specimens available—fruit blossoms, water lilies and papyrus—they were very lovely.

There were other, more specialized gardens too. In the 15th century B. C. the Egyptians marched as conquerors into Palestine, Syria and up the Nile to the Sudan, and the fruits of these conquests were enormous—land, gold, slaves and power. But there were literal fruits as well: botanical specimens that Thutmosis III planted in the temple of Amon at Karnak. The garden itself has long since disappeared, but it is reproduced on the temple walls, along with inscriptions suggesting that Thutmosis was more interested in boasting than in botanical research. Even the reproductions in stone, the inscriptions say, were put there as an "eternal remembrance" of the king's glories. Far from being an amateur botanist, Thutmosis was simply reminding the gods that he was really quite a fellow.

Imperial botanical gardens of this kind were not restricted to Egypt. Assyrian kings also built them, and on a far grander scale. In the seventh century B. C., King Sennacherib rebuilt the city of Nineveh, the crowning glory of which was the palace and its gardens. He imported trees and plants from all his conquered territories, which then stretched from Persia to the Mediterranean. This garden was devoted exclusively to showing off his international conquests. Yet the Assyrians seem to have been scientific-minded as well. Assyrian relief carvings often portray tribute-bearers bringing gifts to the king from the far corners of the empire. Among these gifts are small trees and plants, certainly not the kind of thing we expect in the midst of tribute and taxes, suggesting that the scientific value of foreign trees and plants in some ways outweighed their commercial value.

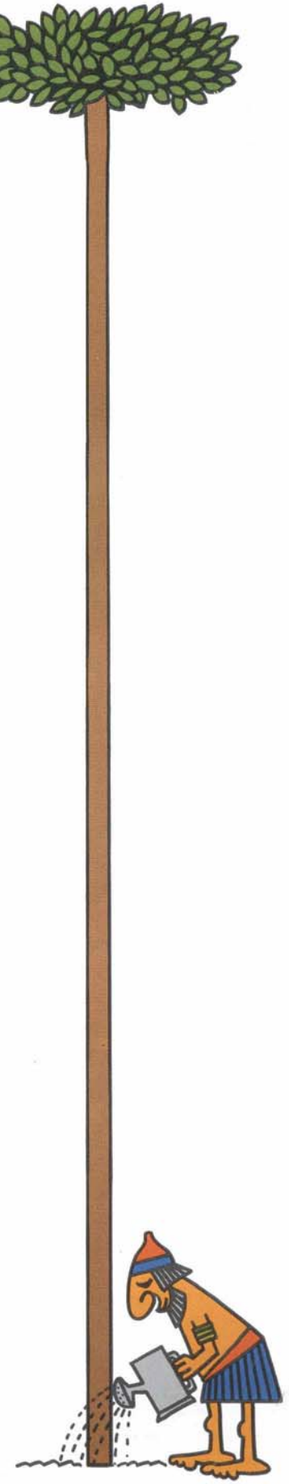
Because of the Assyrians' general tendency toward cruelty, it is perhaps difficult to see them as collectors of flowers and rare birds. Yet they were precisely that. Part of the royal gardens were turned into a zoological park in which were kept animals from all over the known world. One Assyrian king

even built a library in which he collected all the literature his agents could find. It seems that to stay on the good side of these kings one had only to give them a rare plant, a strange animal or a new book.

The royal gardens of Mesopotamia were huge by any standard. Sennacherib, for example, had to build almost six miles of major irrigation canals to water the royal gardens of Nineveh. Unlike Egypt, space was not a problem in Assyria and Babylonia, which might account for one major difference in their gardens: the lack of extreme orderliness. In Mesopotamia, the land was used as it was found, with hillsides, depressions, streams, paths and canals incorporated into the garden's plan. The Hanging Gardens of Babylon was just such a garden. Built on what were probably man-made terraces on the slopes surrounding the city, the gardens caught the eye of an ancient poet who, seeing the greenery spilling down the hill, described them as "hanging." The description has stuck ever since.

In most of these palace gardens the palm was probably the most prominent tree, though imported trees like fig, olive and peach and others like pomegranate, pistachio, pear, carob and almond were unquestionably popular too. As in Egypt, the gardens also included many varieties of herbs used for spices and medicines. The vegetables included onions, lettuce, watercress, turnips, beets and cucumbers.

It is difficult to go into much detail about gardens in Mesopotamia since reliefs portraying gardens there are quite rare. In their art as in their lives, Babylonians and Assyrians much preferred the entertainments of the battlefield to the peace and quiet of a garden. Yet what little we have in the way of pictorial representation suggests that gardens were actually what we would call parks—wooded areas with streams and paths, often filled with animals. One of the rare relief-carvings shows a king in his garden, comfortably relaxed on a couch while servants give him food and drink. In this scene the absence of flowers is noticeable, and the severed head of an enemy king dangles from a nearby tree.



There are also some clues in Mesopotamian literature. A popular type of story in Babylonia was the fable, one of which is called "The Tamarisk and the Palm," in which two trees carry on an animated discussion, each listing its own attributes and the other's failings. It is an interesting fable less for its story value than for the long list it offers of the uses to which these two trees were put in ancient times. But it also illustrates again that the value of gardens was inevitably economic and not esthetic.

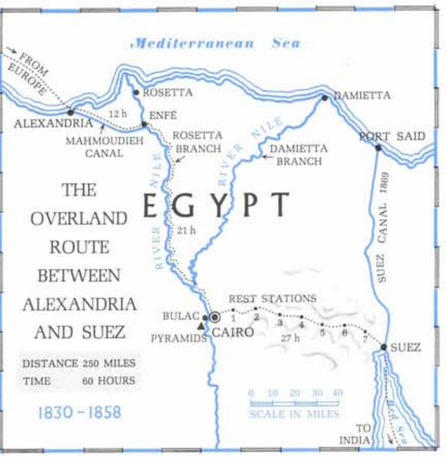
The same theme appears again and again. When references to gardens appear, they are mostly in economic texts in connection with orchards or vegetable gardens. Even an informative private letter of the 18th century B. C., stating the writer's pious intention of planting a garden of juniper trees at a temple, turns out to be economic, since other texts tell us juniper oil was a valuable ingredient in medicines.

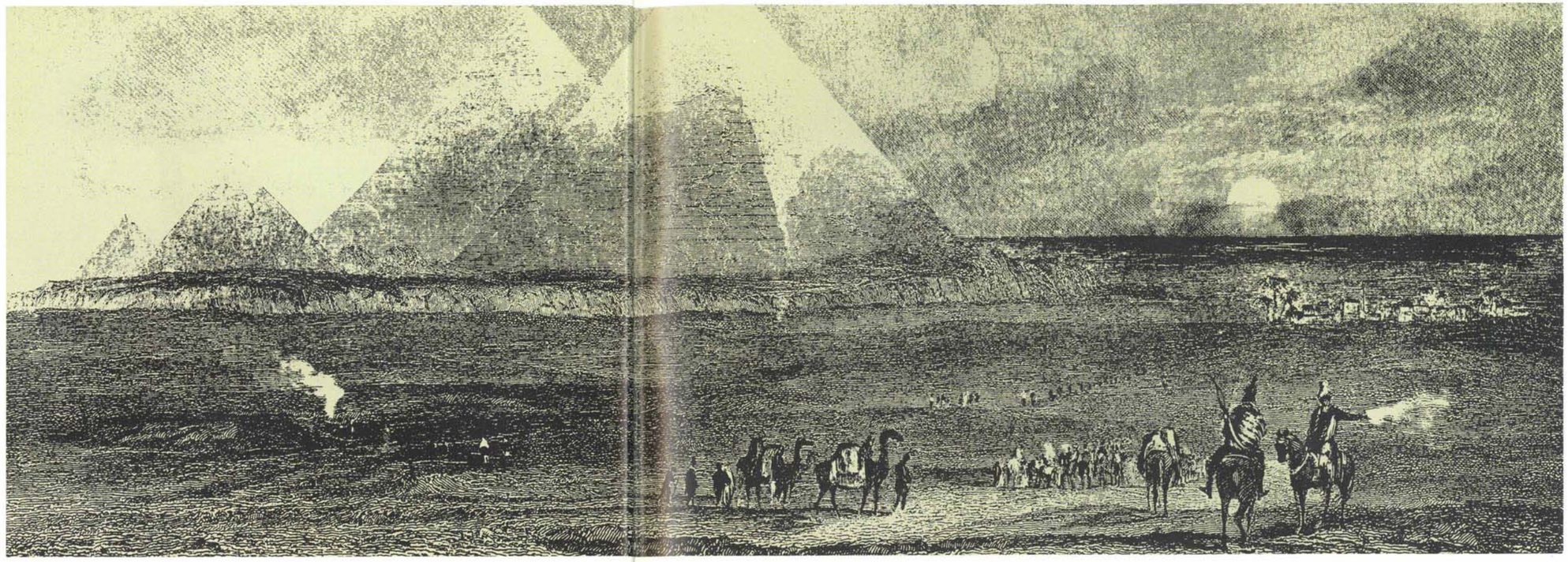
In general terms, then, the gardens of the ancient Near East expressed the needs of the societies in which they grew. But in addition they expressed the values of those societies: the Egyptians' optimistic view of an orderly universe, for example, with eternal balance as the measuring rod of existence, as contrasted with the haphazard Assyrians and Babylonians, much less sure about eternity. It is the difference between the Egyptian noble quietly uprooting a plant which grew outside the designated row and the Assyrian king lunching beneath the head of an enemy chief. Neither would have enjoyed the other's garden.

William A. Ward, a teacher of ancient history at the American University of Beirut, contributes regularly to Aramco World Magazine.

Mr. WAGHORN'S ROUTE TO INDIA

BY JOHN BRINTON





On November 4, 1838, a young lady in New York wrote exciting news to her sister in India. There was a new service that promised to deliver letters from London to India in 90 days, she wrote. "I believe it is called the Overland Route. A man named Waghorn is running it."

The young lady was quite right. Not long after, a letter stamped "Overland Route c/o Mr. Waghorn" sped out to India in the promised three months' time. For the sisters, who had previously had to wait up to two years for mail, it was almost as if they were holding hands. For the man named Waghorn it was the climax of a struggle that would eventually break his heart.

Thomas Fletcher Waghorn was one of those tough, tenacious Victorians who put the indelible stamp of Great Britain on so much of the 19th-century world. Born on the Chatham Naval Base in 1800, the son of a butcher who sold good English beef to the Royal Navy for good English prices, he went into the navy as a child and was commissioned a lieutenant at 17. By then he had grown to an enormous size—so big he once played a giant in a circus. He had also begun to develop the qualities that he was going to need in later years: tremendous energy, courage, a stubborn honesty of purpose, a handsome appearance and a forceful personality that commanded attention. His only flaws —the lack of formal education and a disjointed, somewhat exaggerated way of arguing his case—he waved away with the explanation, "I am a plain blunt fellow."

By the time he had won his commission, Europe had defeated Napoleon, the Royal Navy was going into dry dock and ambitious officers were looking elsewhere for employment. Waghorn chose the navy of the British East India Company, then having problems in Bengal. He did well, was decorated for bravery and as a reward was posted to the Bengal Pilot Service where he encountered his first steamship and learned for the first time what an important question steamship service to England had become.

Until the Industrial Revolution the leisurely sea route from England to India had been quite sufficient for the needs of the empire. But now England's mills needed India's raw materials, and fast transport was urgent. The means were at hand—in 1817, the United States steamship *Savannah* had made the first steam-propelled crossing of the Atlantic—but independent senior officials in India were not at all eager to employ them. By the long Cape route, two years could elapse before communications from their executive board in London could reach them and an answer be returned. The idea that their superiors could get orders to them within three months was terrifying. And even when events had made steamship service inevitable, the businessmen themselves could not agree on the route. Which would be fastest? Around Africa via the Cape of Good Hope? Up the Persian Gulf? Or the overland route across Egypt?

The challenge of solving the problem of the new routes to India was tailor-made for Waghorn. He soon presented a plan for the use of steamships on the Cape route to an organization called the Bengal Steam Fund, one of a number of societies set up by merchants to promote steamship service between England and India. Waghorn simply proposed that certain postage rates be increased to a point where steam service would pay. The Bengal Steam Fund members, who had raised £10,000, asked him to go to London and try to persuade the government to accept the idea. Waghorn obtained leave from the Bengal government and departed.

When he reached England in April, 1825, his hopes high, he learned that his scheme had been doomed from the start. Postal rates to India, the Post Office informed him coldly, had been set by an Act of Parliament and could not be changed. Since higher rates for better and quicker service were the key to profitable service, the Cape route plan was as good as dead.

Instead of giving up, however, Waghorn decided to return to India by way of Egypt's overland route. An ancient trade route, it connected Mediterranean and Red Sea ports and until 1498, when Vasco da Gama found a sea route to India, it had been very important. After 1498, it was virtually abandoned, and by the end of the 18th century was largely forgotten. With the Cape route eliminated for steamships, however, the overland route—to Waghorn at least—suddenly seemed more interesting. He decided to explore it, but before leaving England arranged for an interview with Lord Ellenborough, Chairman of the East India Company, to give his views. Waghorn assured Ellenborough that he could set up a passenger and mail service to India which would take only 90 days.

Ellenborough immediately responded. He told Waghorn that the steamship *Enterprise* was about to make her first trial run from India to Suez via the Red Sea. The ship would arrive at Suez about the 8th of December and then return immediately to India. Would Waghorn like to try to get to India in 90 days if he had a courrier's passport and orders to survey the route? Waghorn would indeed. He packed 20 pounds of luggage, collected some dispatches for the Governor of Bombay and set out.

What Ellenborough did not tell Waghorn was that a certain Mr. Taylor would also be catching the *Enterprise* at Suez. Mr. Taylor was the agent of a rival syndicate which was financing the *Enterprise* on her trial run. Although Waghorn didn't know it, the race to Suez was on.

Waghorn left London by coach on the 20th of October, 1829, and despite

"Give me your mail," he told England, "and I'll deliver it to India in 90 days."

Engravings reproduced from the author's library.

bad roads, washed-out bridges and even an avalanche, delivered a copy of the *London Times* to the British Consul in Trieste just nine days later. It was a record and the impact was immediate. Since letters coming via the regular London service took a minimum of 14 days the Foreign Office was soon inquiring why the mail took so long.

From Trieste, Waghorn started out for Alexandria on an Austrian ship. When the ship was forced to turn back he embarked again on a Spanish ship and after bucking strong head winds for 16 days arrived in Alexandria. Learning that Mr. Barker, the British Consul, (and agent for the East India Company) was at his country house at Rosetta at the mouth of the Nile, 12 miles away, Waghorn, after a stop of only five hours, plodded off to Rosetta on the back of a donkey. Two days later he climbed down stiffly to shake hands with Mr. Barker. The consul greeted him warmly enough and agreed to give Waghorn an introduction to the Viceroy of Egypt. He did not tell Waghorn, however, that he was also helping Mr. Taylor and that Mr. Taylor had already come and gone.

From Rosetta, Waghorn took a boat up the Nile to Cairo. Halfway there the boat went aground and the impatient Waghorn left his luggage on the boat and finished the trip on another donkey.

In Cairo, things took a turn for the better. The Viceroy of Egypt then was Muhammad Ali, the wily Albanian army captain who boldly assumed the governorship of Egypt shortly after Napoleon's return to France and had since become the strongest ruler in the Ottoman Empire, not excluding the Sultan. Muhammad Ali immediately saw the value in the restoration of the overland route and was pleased to issue a "firman" (a permit and safe conduct) through Egypt. Waghorn thanked him, climbed aboard a camel and hurried on to Suez. He arrived three days later, December 5, to find that the *Enterprise* had not arrived and that Mr. Taylor had.

Shocked at finding an unknown rival already ahead of him and impatient at this new delay, Waghorn commandeered an open boat and set off down the Red Sea in hopes of intercepting the *Enterprise* and leaving Taylor behind. To attempt such a trip in an open boat was dangerous enough, but so impatient was Waghorn that he insisted that the boat sail at night too. When the local seamen objected, Waghorn drew his revolver on the captain and "persuaded" him to sail on. For six days, they sailed south without maps or compass, guided entirely by the sun and the North Star. At Corsseir, 620 miles down the Egyptian coast, they took on supplies and made for Jiddah and the final blow: a meeting with the officers of an East India Company ship at which he learned that the *Enterprise* had broken down. It was not coming. The heroic trip had been for nothing. Waghorn, exhausted and weak from his dash south, collapsed.

For the next six weeks Waghorn lay in bed a sick man. Then he went on to Bombay. By the time he limped into the office of Sir John Malcolm in Bombay with Lord Ellenborough's dispatches, the journey from London had taken four months and 21 days. It was a record actually, but it was still a lot longer than the 90 days he had said was possible, and no one seemed impressed.

Waghorn, however, was undaunted. He began to buttonhole every influential person he could find. He lectured in Bombay and Calcutta. He petitioned the authorities for help in organizing steamship routes and an official overland route across Egypt. But he got nowhere. He had no backing in high places, no money of his own and—unknown to him—strong competition. At last even the East India Company lost patience with him and ordered him back to the Bengal Pilot Service.

By that time, Waghorn was too firmly committed to give up. He resigned, went to Egypt and set himself up as an independent agent for transporting mails, goods and passengers from England, via Alexandria, Cairo and Suez to India. "Without," as he wrote, "official recommendation, and with a sort of official stigma on my sanity."

For the next eight years ex-Lieutenant Waghorn traveled constantly from England to India and back, inspecting steamships and rest stations, experimenting here, improving there and constantly urging important people to support the work. His drive, enthusiasm and energy were boundless, and the

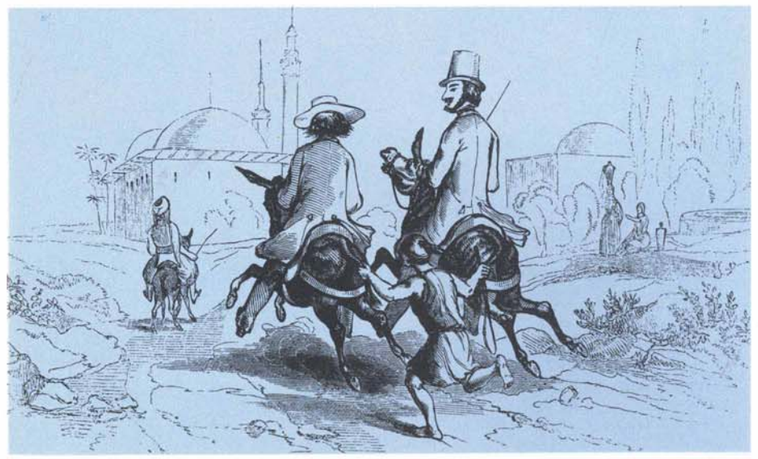
results were soon seen in the efficiency of his service. By 1835, the 90-day trip to England, for either mail or passengers, was commonplace, thanks largely to the speed of the vital overland link between ships.

It was not an easy trip by any stretch of the imagination. Passengers disembarked at Alexandria and proceeded by barge down the Mahmoudieh Canal to Enfé, where the canal joined the Rosetta branch of the Nile. From there they sailed up the Nile to Bulac, the port of Cairo, first by ordinary Nile falucca, later on a small paddle steamer bought by Waghorn. To get into Cairo from Bulac they rode donkeys.

It wasn't until the third stage that the real fun began: the trip across 80-odd miles of sandy, desolate desert. It was made on camels or sand carts, primitive affairs designed for speed. The Overland Route had to maintain schedules between the arrival of mail ships at Alexandria and Indian naval ships at Suez.

And those were the early days. By the middle of the 19th century it took less than 40 days to get to India and the trip across the overland route was down to just three days, including a night in Cairo. By then it was also one of the most picturesque and romantic trips in the world.

At Alexandria passengers boarded large houseboats which were fully equipped with lounges and bars. At Enfé they transferred to swift Nile steamers which did the 120-mile run to Cairo in 10 hours, and which offered cabins, good food and wine. Donkeys and carriages awaited the Nile boat to take the travelers to one of Cairo's new hotels for a bath—European or Turkish—and a night's rest. At dawn, in specially-built carriages drawn by four Arab horses, they set out across the desert. It took 20 hours but there were no hardships, thanks to seven small rest houses where they could get rooms, meals and drinks ranging from European mineral waters to iced champagne. It was even possible to have a haircut. In Suez they went directly aboard ship to find that their heavy luggage, the great trunks of our grandmothers' day, was already stored in their cabins.



In 1835 the number of passengers Waghorn had handled totaled 275. By 1845 the number reached 2,100, and ten years later more than 3,000. The number grew year after year. The cost, per-person, London-Calcutta, First Class, all inclusive, was £230 for a lady's single cabin and £250 for a gentleman. Why there was a difference in rates was never explained. Perhaps the gentlemen ate and drank more.

The guidebooks—Waghorn wrote the first one—make quaint reading. Ladies were instructed, for example, to provide themselves with baskets having a cross handle and two flaps, to hold their toilet requirements. Another, *Captain Barber's Guide Book*, had good advice to travelers about their luggage:

"One trunk, or section of the drawers should contain three weeks' linen and be arranged for use between Southampton and Alexandria. On the day previous to the steamer's arrival at Alexandria, the trunk should be re-packed with foul linen, and at the same time such articles

as are required during the journey through Egypt should be placed in the carpetbag. On embarkation at Suez the other trunk will come into use."

For 30 years the route pioneered by Waghorn provided a regular service for mail and passengers and the impact on Egypt was enormous. The luxurious new hotel of Samuel Shepheard was opened in Cairo and others were opened in Alexandria and Suez to cater to the new trade. Sight-seeing tours in Egypt were organized by a Mr. Thomas Cook. Muhammad Ali's international reputation was enhanced. Egypt again became an important factor in world politics.

All that, however, came much too late to benefit Thomas Waghorn. For Waghorn's success had also been his undoing.

By 1835 Waghorn's service had become so efficient that the English Post Office was obliged to officially recognize it as the fastest and safest way to send mail to India. On the 7th of March, 1835, the Overland Route was authorized to handle the English mails. Even more significantly, perhaps, businessmen were beginning to grumble that it was too efficient; they could no longer blame slow communications for their failure to pay bills.

In the meantime, rivals had begun to contest Waghorn's monopoly, the strongest being two Englishmen named Hill and Raven. With backing from India, Hill and Raven opened a hotel in Cairo and a competing service and soon were cutting into Waghorn's business. Waghorn fought back but in 1841 had to merge his company with his rivals under the name of J. R. Hill and Co.

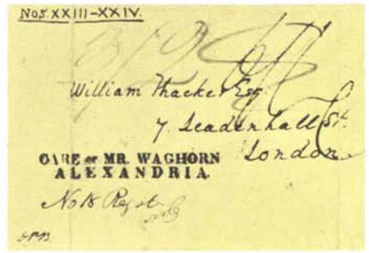
The next blow came when the East India Company stepped in and helped form the Peninsular and Oriental Steamship Co., better known today as 'P. & O.' Steamships were soon running on regular schedules. Finally, Muhammad Ali, quick to realize that the time of small interests was over, bought out J. R. Hill and Co. and put the future development of the Overland Route into the hands of a government department called the Egyptian Transit Company.

For Waghorn, then, success meant defeat. From 1831 to 1842 he had single-handedly fought for and developed the Overland Route into what Palmerston later called "the world's most important trade route." He had also rendered incalculable service to Muhammad Ali. Yet at the moment of triumph the system he created was taken from him.

Years later, to be sure, Waghorn would receive the homage due him. The citizens of Chatham, his birthplace, put up a bronze statue. A fine portrait hangs in the National Portrait Gallery in London. For the opening of the Suez Canal in 1869 Ferdinand de Lesseps erected a statue to Waghorn with an inscription giving him full credit for having pioneered the route that eventually led to the canal. And in his book, '*From Cornhill to Grand Cairo*,' William Thackeray gave him the honor he deserved:

"But what are his (Napoleon's) wonders compared to Waghorn? Napoleon massacred the Mamelukes at the Pyramids; Waghorn has conquered the Pyramids themselves; dragged the unwieldy structures a month nearer England than they were and brought the country along with them ... Be ours the trophies of peace! Oh my country! O Waghorn!"

But by then it was too late. In 1851, in London, lonely, sick and bitter, Waghorn had died. His only legacy was a few thousand letters stamped "The Overland Route c/o Mr. Waghorn," of which a mere 121 have survived—to become, ironically, rare treasures sought after by stamp collectors around the world.



John Brinton, a Beirut bibliophile, spends his spare time searching for—and reading—rare books having to do with the Middle East.