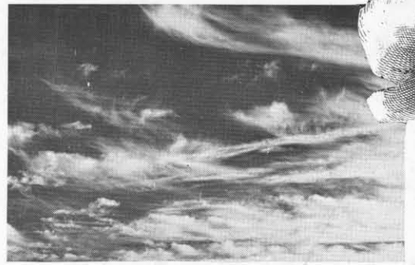
A fine Arizona day with a sky of puffy white *cumulus* clouds.

Rare *cumulonimbus* or "thunderhead" over town of Dhahran, Saudi Arabia.

Thick, layered *nimbostratus* clouds bring rain or snow.

Term "mackerel sky" refers to *cirrocumulus* formation.

Altocumulus clouds form 8,500 to 20,000 feet up.



Cirrus clouds, highest, sometimes trail snow streamers called "mares' tails."

LOOKING INTO THE CLOUDS

that it tears itself to pieces. Hours later and miles away its *fractonimbus* remains may be seen scurrying across the sky like a flock of shamefaced sheep.

Stratocumulus clouds drift at a height of about 10,000 feet. They resemble cumulus clouds but are not nearly as fluffy. More often they look like long rolls of cotton, joined together in irregular layers. They frequently take shape at sunset or after thunderstorms, when cumulus clouds run together before they disappear.

Altostratus are streaky gray or bluish clouds that build up anywhere from two-and-a-half to three-and-a-half miles high. They usually mean snow in winter, and in summer may produce a steady, but rarely a heavy rain.

Altocumulus and *cirrocumulus* look somewhat alike, but the former is larger and flies lower. They drift 18,000 to 24,000 feet high and are part ice, part water. When altocumulus take the shape of towers or castles, a cold rain may follow. A cirrocumulus formation is often called a "mackerel sky" because its pattern resembles the striped markings of this fish.

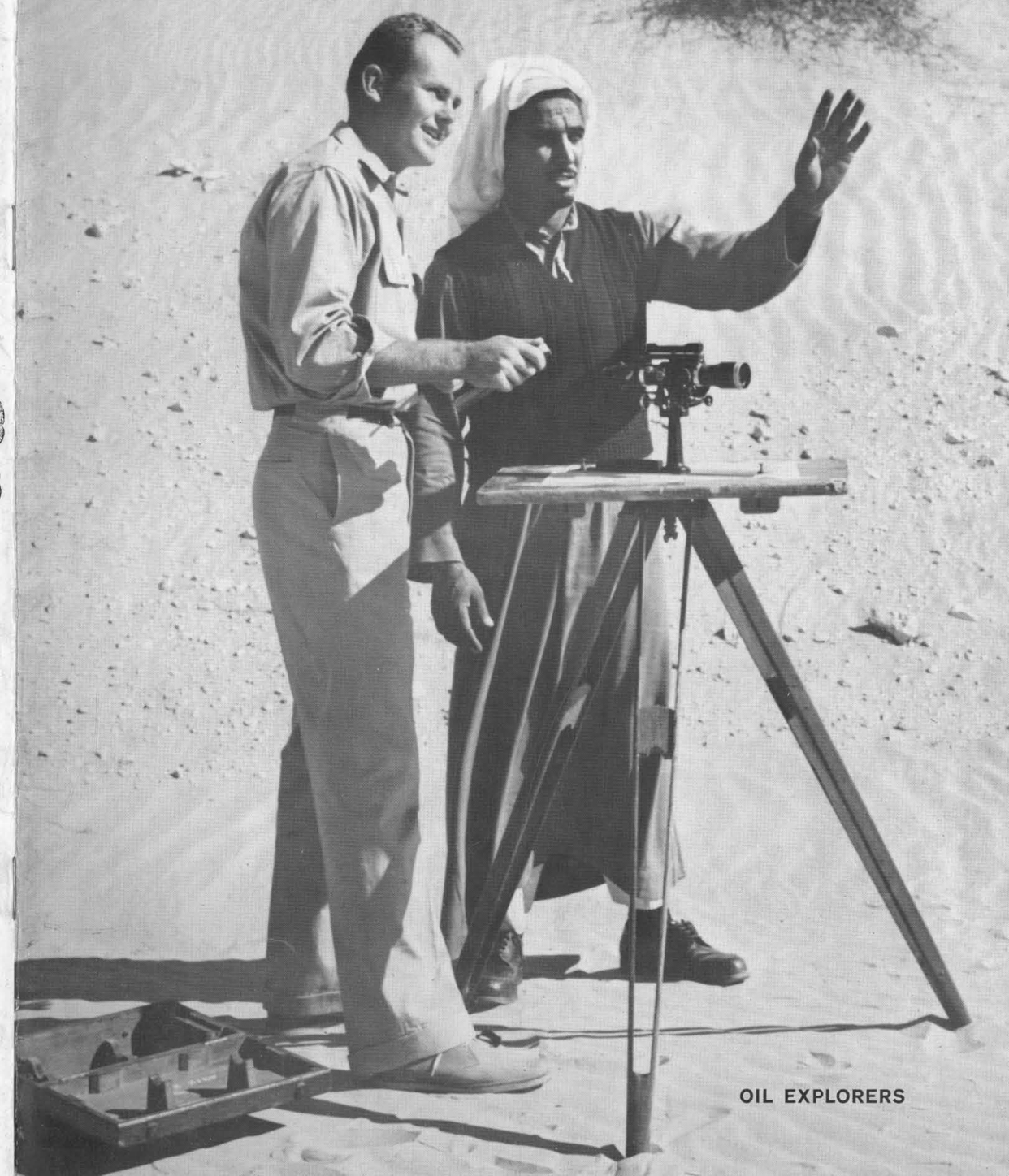
A halo around the sun or moon usually means rain or snow. This phenomenon is caused by the *cirrostratus,* a thin whitish veil of ice crystals, which is best seen at night reflecting the light of the moon. The highest of the visible clouds are the cirrus formations — windswept curls of delicate texture that brush the heavens five or six miles high. Cirrus clouds are composed entirely of ice and occasionally trail streamers of snowflakes called "mares' tails."

Wind, moisture and conflicting temperatures characterize all clouds. With the sky for their stage they make endless entrances and exits, changing their costumes to fit their roles, bringing pleasure, misery, or pain according to the script which Nature writes for them. The parts are short, but the scenes are often unforgettably dramatic.

And the play will run as long as the sun shines and the earth turns round.

Aramco World

APRIL 1960



OIL EXPLORERS

Aramco World

APRIL 1960 VOLUME 11 NO. 4

FRONT COVER: The American and the Saudi Arab in the picture are members of an Arabian American Oil Company survey team. They are doing mapping work with the aid of an instrument called an alidade. Other oil explorers will then search this section of desert for geological information that may contain clues to the oil-bearing possibilities of the area. On the opposite page, a story begins about a typical structure drill crew whose job it is to gather such information by drilling a very special hole in the ground.

PICTURE CREDITS: Front cover, pages 5 (two lower), 20 (top center)—Aramco photos by T. F. Walters. Pages 3 (right), 4 (upper left)—Aramco photos by C. E. Wilkins. Pages 3 (upper left), 5 (upper)—Aramco photos by R. L. Painter. Pages 4 (lower), 14, 15 (left)—Aramco photos by E. E. Seal. Pages 6 (letter), 8 (lower), 13 (two left)—Bettmann Archive. Pages 6 (right), 9—Ewing Galloway. Pages 7, 16, 17, 20 (lower left, center, and right)—A. Devaney, Inc. Page 8—Map by Johnson & Ward, 1860. Page 10 (left)—Karl Gullers from Pix, Inc. Pages 10 (right), 11 (lower left and upper right), 13 (lower right), 18 (engraving), 20 (engraving)—Culver Service. Page 11 (lower right)—from "Venezia" by Molmenti. Page 12—woodcut by Walter Ferro. Page 15 (right)—Aramco photo by Khalil Nasr. Pages 18 (top), 19, 20 (upper left)—Frederic Lewis. Page 20 (upper right)—U. S. Weather Bureau.

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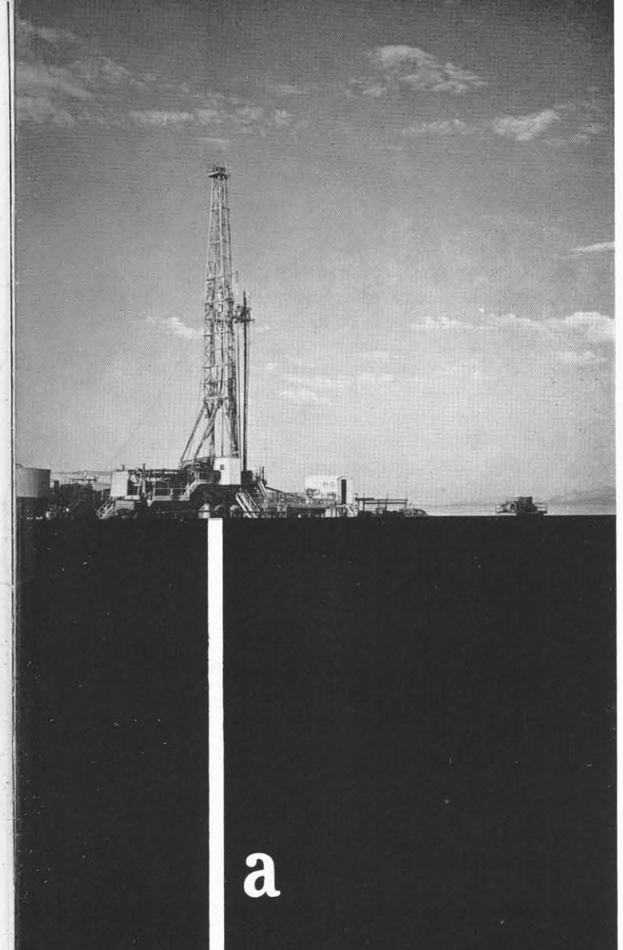
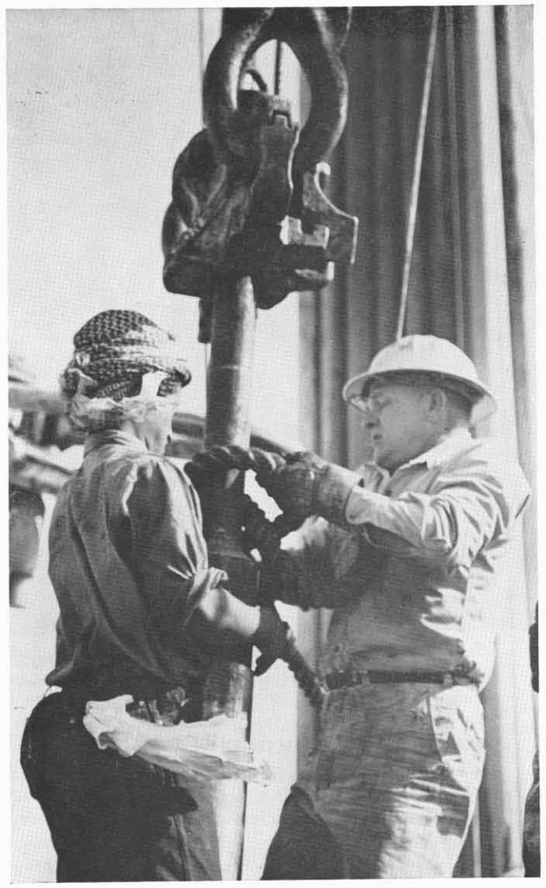


a very special hole in the ground



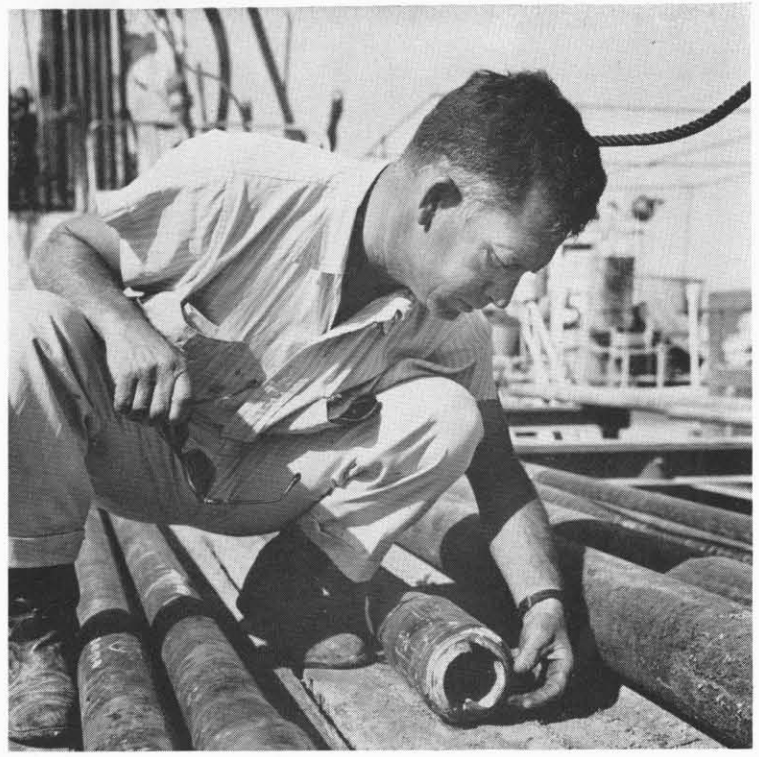
Driller Forest Cathy, right, works with Saudi Arab drilling crew on T-32 rig.

WE were standing in one of the five specially built desert trailers that comprised the Arabian American Oil Company's Structure Drill Camp 5 located in the southern part of the Rub' al-Khali, the Empty Quarter. Frank Wilmore, Aramco geologist, was sifting a teaspoonful of rock chips from a small cotton sack into a sample dish.

"Rocks, $200 a sack — cost more than gold," commented Frank as he bent over his microscope to identify the rock sample. "You see, that rig out there drills about a hundred feet a day. We get a sample of the rock cuttings drilled by the bit every five feet — twenty little sacks a day. It costs about $4,000 a day to operate the rig and this camp. Figure it out!"

A hundred yards away a mobile drilling rig with a 97-foot derrick was drilling ahead, not for oil, but for geological information — the little sacks of rock cuttings.

During the past decade, Aramco's structure drill rigs have crisscrossed vast areas of the Arabian desert drilling exploratory wells which average about a thousand feet in depth. Over a thousand structure wells have been drilled — more than a million feet of hole in the earth! As the drilling bit chips away rock fragments, they are flushed to the surface by the drilling fluid which is circulated down the drill pipe and out through the bit, then up again between the drill pipe and the side of the hole. A vibrating screen separates the rock chips from the drilling fluid which is



Drilling foreman H. B. (Red) Caudill inspects section of ruptured drill pipe. Replacement of equipment sometimes slows down normal drilling rate of 100 feet per day.

A VERY SPECIAL HOLE IN THE GROUND

pumped down the drill pipe again, continuously circulating.

Frank transcribes his microscopic identifications of the rock fragments to a 'strip log' which presents a graphic picture of the various layers of rock penetrated. Plotting a number of wells then yields a cross-sectional presentation of the rock strata below the surface of the earth. From a study of this cross section, traps which could possibly contain oil are discovered. Finally, the million-dollar gamble comes when geological conditions are so favorable that a decision is made to drill a deep "wildcat" well.

The Exploration Department's many years' experience in desert operations has evolved equipment and organization well adapted to the difficult desert conditions: extreme heat and long supply lines over roadless, sandy wastes. Structure Drill Camp 5 is typical of other camps.

The five desert trailers with their huge, low-pressure sand tires and rugged undercarriages are parked in L-formation. The "office" trailer, an ingeniously compact unit, contains Frank's geology laboratory, office space for H. B. ("Red") Caudill, drilling foreman, and for Carl Barber, camp mechanic. Although the outside temperature is well over 100 degrees, the air-conditioner keeps the trailer fresh and cool. Fluorescent lights, running water, a short-wave radio transmitter and receiver (with a radio beam for aircraft), and even office-size desks and swivel chairs could almost make one forget he was in the desert, 500 miles from Aramco's headquarters in Dhahran — until he looked out the window at the sea of sand stretching to the horizon.

Five rooms in the 45-foot-long air-conditioned sleeping trailer provide bunks for ten men and about as much living space as a Pullman roomette. The dining trailer, with seats for twelve, also has a little library of paper-back books and current magazines. The spotlessly clean stainless steel kitchen, trailer-mounted, is equipped with an electric stove, a huge refrigerator and a freezer with space for 30 days' supply of fresh frozen vegetables, fruit and meat. The forward end of this trailer is partitioned off to provide two showers and wash basins.

The fifth trailer houses two diesel-driven generators, the energy source for the many camp comforts — air-conditioning, lights, radio, movies, refrigeration. Part of this trailer contains the mechanics' shop with power and hand tools, spare parts, and a battery charger.

"Supplying this camp is a king-sized operation in itself," you're assured by Caudill, a veteran of a dozen years in the Arabian desert drilling business. "We receive about 300 tons of material a month — drill pipe, lubricants, food, drilling mud chemicals, diesel fuel — about ten truckloads; and usually a ton or so by DC-3's, dispatched from Dhahran and from the Rub' al-Khali operating base, 'Ubaila."

These rugged aircraft, which land on a level gravel area near the camp, also transport personnel, and fly in frozen foods and urgently needed supplies.

Specially designed desert trucks, with 600-gallon fuel tanks, ten driving wheels, and fat low-pressure sand tires, require up to two weeks to make the round trip between the camp and 'Ubaila, and three weeks between the camp and Dhahran.

Saudi Arab drivers of the supply trucks are directed by a Saudi Arab convoy leader-mechanic, who maintains radio contact with 'Ubaila, and who draws, also, upon his own store of knowledge of how to navigate the trackless sands.

"And," Caudill noted, "all we have to show for all of this is a hole in the ground — and those little sacks!"

The preferred desert cars are half-ton pick-up trucks with four-wheel drive. Their incongruously large wheels and tires — actually, modified DC-3 aircraft tires — enable them to "float" over soft, shifting sands.

Truck-mounted structure drill "folds" back and is ready to travel hundreds of miles across soft sand and rough gravel. Camp mechanic Carl Barber makes a last check before start.

The advice from experts on desert transportation:

"If you can't get there in these powerful babies, you'd better stay home."

The drilling foreman, drillers, mechanic and geologist comprise the camp's American personnel; the remainder, Saudi Arabs, cover a diverse range of crafts: rig men, heavy equipment operators, cooks, welders, mechanics and drivers. The friendly, cooperative spirit that characterizes the Saudi Arab-American relationship results in a smooth-running camp and operation.

Every effort is made to provide reasonably pleasant living conditions in the hot, barren area. Excellent food, 16-millimeter versions of current movies, tape recorders, and the little rotating library all help.

But, camp life can unquestionably become rather monotonous during off-duty hours. The most popular pastime is probably the old-fashioned "yak" sessions which tend to center around the well being drilled . . . progress of the week's supply convoy . . . plans for the next "time off" or the next vacation.

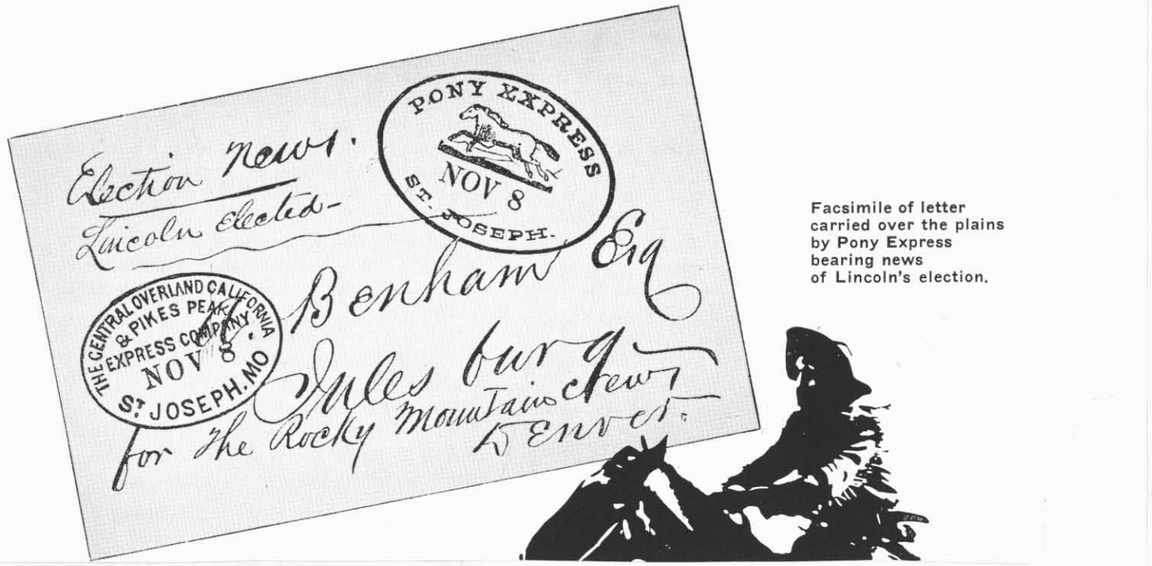
One night, the shop-talk was too much for one crewman:

"I don't mind putting in my eight hours on the rig, but do we have to re-drill the well here in the trailer every night!"

When the well is completed, the husky, ten-wheel tractors will couple on to the trailers and drilling rig, and the whole community will roll across the desert to the next location.

Matter of fact, that's what was about to happen as this was written; and, if you want an idea of the kind of terrain they must travel, consider this:

If they could go in a straight line, the distance would be only about 100 miles. But, to get around impassable sand, and dunes 400 to 500 feet high, they must travel more than 700 miles — to get where they can fill more of the little sacks.



Facsimile of letter carried over the plains by Pony Express bearing news of Lincoln's election.

who vowed by the "Living God" they would not drink or swear during their term of office.

By April 3, 1860, the line was ready and the first relay sent the mail on its historic run.

The trail was uncertain and perilous with constant danger of Indian attack over the lonely stretches. In winter, hungry wolf packs ranged the route and in the high country there was the menace of mountain lions. But records indicate only one rider ever balked at making the run, and in 650,000 miles ridden, the Pony Express lost only one mail pouch. More than once, when Indians brought down a courier, the riderless horse galloped on with the mail to the next station.

Much credit went to the dauntless little ponies. One of the couriers' favorites was Black Billy, a plucky little mount who wasn't fazed by man or beast. One day he limped into the station flecked with blood and foam. Two Indian arrows were embedded in his flank, another in his shoulder, but he had brought his rider through.

The pony express route followed the famed Oregon Trail along the Platte River in Nebraska through the South Pass, pioneer's gateway through the Rockies. From there it ran across the alkali flats by Salt Lake, Utah, to the snow-capped High Sierras, then down the western Sierra slope into California and along the final stretch into Sacramento. Finally it was taken by fast steamer to San Francisco.

Over much of the route the rider had little or no guide marks. Snow lay deep much of the year in the higher passes of the Sierra Nevadas. With frequent new blizzards, the rider and his sure-footed steed had to feel their way through treacherous drifts trying to find the road.

From St. Joseph to Salt Lake City there was some semblance of a route when the snows melted, but from there on, the riders had to blaze their own trail from station to station through vast desert stretches and sagebrush-covered valleys.

The waterproof leather pouch never weighed more than 20 pounds and it cost $5 a half ounce to send mail by the Pony line – a sizable sum in those days. Compare this with the 25¢ a half ounce it costs these days to send mail by air to such distant places as Saudi Arabia, 7,000 miles from New York!

The pony riders stayed on the trail from 50 to 70 miles normally and changed mounts every 10 to 15 miles, continuing at top speed to the next relay station. At each depot the keeper ran out with a fresh mount as the rider neared with a warning blast of the little horn he carried. The courier jumped from his horse, swung the pouch over to the new steed and was on his way again in two minutes.

Horse and rider averaged better than 10 miles an hour over hill and dale. On flat stretches they were reported to have made up to 25 miles an hour. The great racehorse Man O' War was once clocked at 43 miles per hour over a quarter-mile course. But then, Man O' War wasn't reeling off mile after mile through bramble and brush.

Often the rider pulled up at a station to find the keeper slain and the horses stolen by Indian raiders. Then he dug in the stirrups and pressed on to the next stop, nervously patting the revolver hanging at his hip.

One historian tells how a youthful rider named William F. Cody remained on the run for nearly two days and more than 300 miles, stopping only once to change horses. He later became famous under the name "Buffalo Bill."

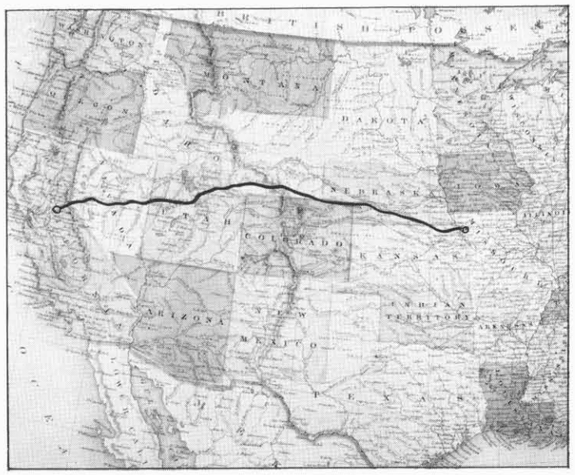
Other riders also became legends of the frontier. Writers say that "Wild Bill" Hickok rode briefly with the line. So did "Pony" Bob Haslam who once galloped 380 miles warning settlers of a Paiute Indian uprising.

The pony riders earned from $100 to $150 a month -- excellent wages then – plus a solid ration of bacon, beans and occasional buffalo steaks. They cut a colorful figure with their uniform of buckskin jacket, red shirt, bright blue jeans and fancy boots.

Since every extra ounce was a drag on the straining horse, the riders had to weigh less than 125 pounds. They carried only what they needed – signal horn, revolver and knife to defend themselves against attack. The specially designed saddle weighed a third as much as the usual variety and not even a water canteen was allowed to add to the load. But each man carried at all times a little leather-bound Bible given him personally by Alexander Majors, a deeply religious man who exacted the pledge of no drinking or swearing. Those caught breaking this simple rule were summarily fired.

The average rider's age was 18, but some like Bill Cody were hired as young as 15. Up to 18 hours a day these youths stayed on the job, riding in rain, snow or blistering

Original Pony Express barns in St. Joseph, Missouri, from which riders started 1,966 mile journey westward in 1860.



Pony Express' record time was seven days, 17 hours from St. Jo railhead across grueling route to Sacramento, California.

THE PONY EXPRESS

desert sun, catching a brief nap, then riding on again.

The ponies they rode cost several times the price of an ordinary horse. Chosen for speed, courage and endurance, they were the finest in the West.

The line ran mail both East and West, but the bulk went westward including most of the important messages from Washington.

The line's record run for the 1,966-mile route from St. Jo to Sacramento was a breath-taking seven days, 17 hours. The riders were carrying word of Lincoln's vital first message to Congress, and there was grave concern over what side California and other parts of the West would take in the looming Civil War. The line had orders to get that mail delivery through pronto — come flood or Indian war.

The Pony Express carried other important news during its brief life span. Word of Lincoln's election, the firing on Fort Sumter and secession of the Southern States were all sped westward by the swift couriers.

There was some grumbling over the five dollars to transport a half ounce of mail to San Francisco or St. Jo — a job a four-cent stamp will do today. But the demand was so great, service had to be increased from once a week to twice weekly.

To save weight when posting letters by this costly route, most writers used a special thin tissue. Many employed the skeletonized style used in a telegram.

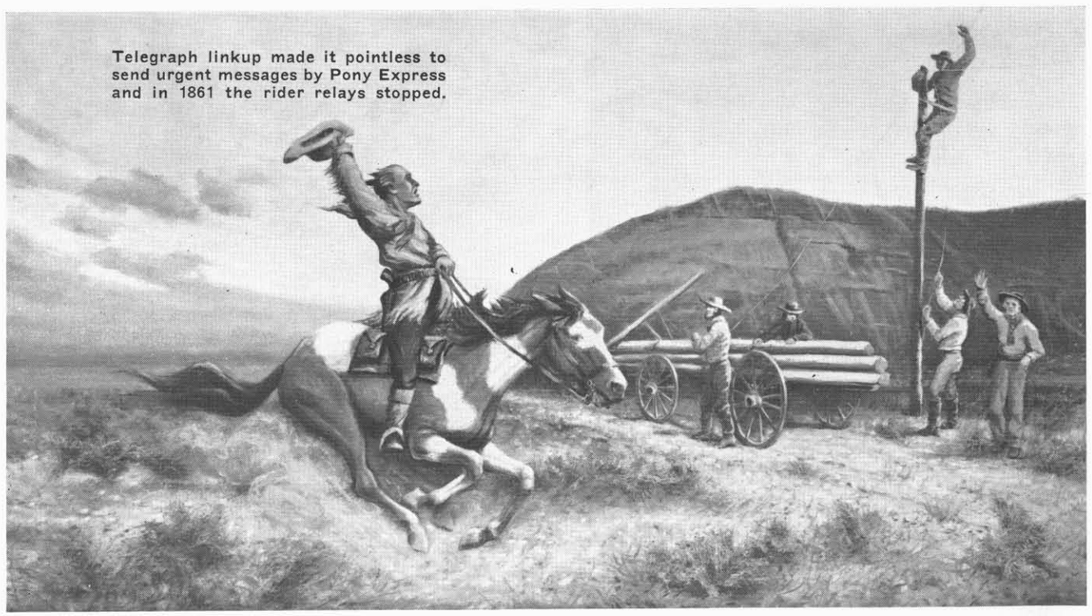
Then, at the peak of its career, the Pony Express ran into sudden reverses. With the threat of Civil War growing daily, telegraph lines had been pushing rapidly toward each other — from California eastward and through Nebraska westward. In 1861, the wire system was completed.

The telegraph linkup made it pointless to send urgent messages by the Pony Express and people could not afford to post regular mail at such a costly rate. The line dropped its charge from $5 to $1 a half ounce, but still there were few takers.

Costs of the service were also becoming prohibitive. To keep the riders on the move day and night and to care for hundreds of horses cost a great deal. And to buy a new mount ran at least $200. After dropping some $200,000 into the ill-fated venture, Messrs. Russell, Majors and Waddell went bankrupt.

Finally, on October 24, 1861, the Pony Express came to an end 18 months after it had begun. But in those 18 months, its riders chalked up a record of courage and endurance unmatched in the annals of the old West. Their feats were immortalized by Mark Twain who depicted the express rider in these terms:

"swift phantom of the desert . . . winging away like the belated fragment of a storm."



Telegraph linkup made it pointless to send urgent messages by Pony Express and in 1861 the rider relays stopped.

Here's to those beautifully unbalanced wonders that daily defy the laws of structural stress and strain—

Long May They Lean!

THE crazy tilt of the Leaning Tower of Pisa has fascinated observers for six hundred years. Annually, thousands of tourists trudge up the winding stairs inside the 179-foot shaft to stare dizzily over the city. It is a fact, however, that the tower — already an incredible 16½ feet out of line — sinks a fraction of an inch more each year, and scientists predict that, unless something is done, it will soon come crashing down.

If the Pisa oddity does fall, it will not be the first leaning tower to topple over in recent times. The ancient and beautiful bell tower of St. Mark's Cathedral in Venice earned that doubtful distinction 58 years ago when it collapsed in an awesome shower of stone, bricks, statuary, and dust.

For over a thousand years the great tower had kept its vigil in a corner of world-famed St. Mark's Square, and by 1902 it had developed a slight lean, probably no more than three or four feet. At its top it housed a magnificent set of church bells, and its 325-foot height was surmounted by an heroic golden statue of an angel. To the Venetians, those bells were the voice of the city and Venice without its campanile was unthinkable.

But on the morning of July 14th with the usual crowds milling about the Square, a large crack suddenly spread across the eastern face of the tower, clouds of red dust puffing from the ugly gash. Terrified shouts of "The tower is falling!" raced through the area; the frantic police no sooner cleared away the crowds than the tower began to give way.

Two marble columns from the top came crashing down, followed a moment later by the golden angel from the pinnacle. This statue was later found smashed on the steps of the cathedral, causing the awed Venetians to remark that the angel had "come home."

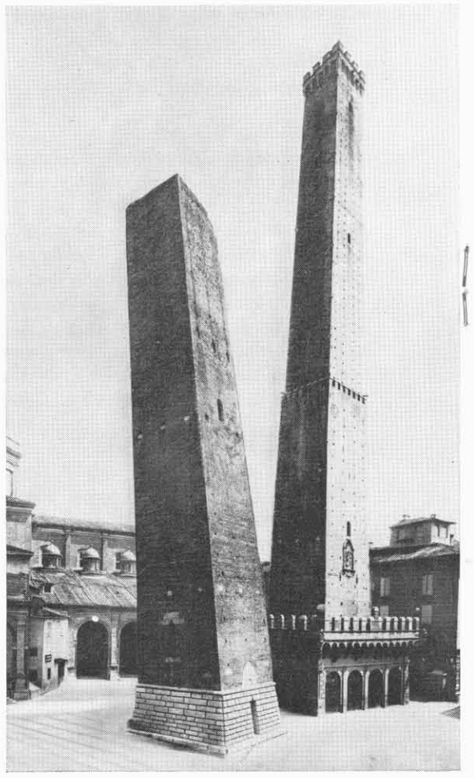
As the people in the square watched with amazement, the whole section that contained the bells broke loose and plummeted into the Square. Then, almost gently, as if it had been standing too long and was exhausted, the entire structure slumped to earth. It didn't "tip over," but simply broke apart and crumpled on its foundation, spewing bricks and masonry in all directions. A nearby building had part of its front torn away, but, amazingly, no other serious damage resulted. When the dramatic fall was over, the lofty tower had become a pile of rubble 100 feet high.

The people drifted back through the choking dust, many with tears in their eyes, to view the remains of their beloved landmark. One spectator mournfully remarked that it was as if Venice itself had died.

The sorrow soon turned to energetic plans for rebuilding.

The marble Pisa tower is a lovely example of Romanesque architecture. Completed in 1350, it began to lean before third floor was completed. It is now 16½ feet out of line.

Bologna, Italy, has two unbalanced wonders 20 feet from each other. Torre Asinelli, right, is 320 feet tall and leans four feet from perpendicular, while Torre Garisenda tilts 10 feet and rises 163 feet above the ground.



LONG MAY THEY LEAN!

and within ten years the campanile again rose majestically —and perpendicularly—over the city. Venice still has, however, at least two other, smaller towers that bend giddily toward the ground, inviting disaster.

The city of Bologna, Italy, has two unbalanced wonders of its own which, while not as famous as St. Mark's tower or Pisa's pride, may succumb to the laws of structural stress and strain. Standing within 20 feet of each other, the Torre Asinelli and the Torre Garisenda are a dizzying sight. Asinelli, 320 feet tall and extremely narrow, leans four feet from the perpendicular. The deviation is not immediately noticeable, though, because Garisenda, right next to it, has an eye-popping ten-foot lean in a height of only 163 feet. Viewed from one particular vantage point, the scene has a lurching, nightmarish quality.

Both of these towers have acquired their off-center stances gradually since the 12th century, but there have been no official predictions as to their eventual demise. Authorities are inclined to think that when one goes, the other will follow it.

There is always the possibility that Bologna will eventually have to emulate the people of Zaragoza, Spain, who were confronted with the same problem nearly 70 years ago.

Zaragoza once possessed a bell tower of exceedingly beautiful design, dating back to the 16th century. It was known throughout the world for its architectural perfection. Soaring almost 300 feet into the air and faced with delicate stone tracery, it stood in a populated part of the city and was surrounded by small shops and homes. But it had begun to decline slowly ever since its completion. By 1847, it had reached a menacing nine-foot lean. The people who lived and worked under its looming threat petitioned the city to have it taken down. But so proud were the Zaragozans of the Torre Nueva and its link with the city's long history, that opposition quickly arose. The controversy dragged on for almost 50 years.

In 1893, the decision was reluctantly made for safety's sake, the ancient shaft would have to be demolished. Stone by stone, the Torre Nueva disappeared, until no physical trace of it remained. Today, it exists only in the memories of the people, who still regret that some way could not have been found to preserve it.

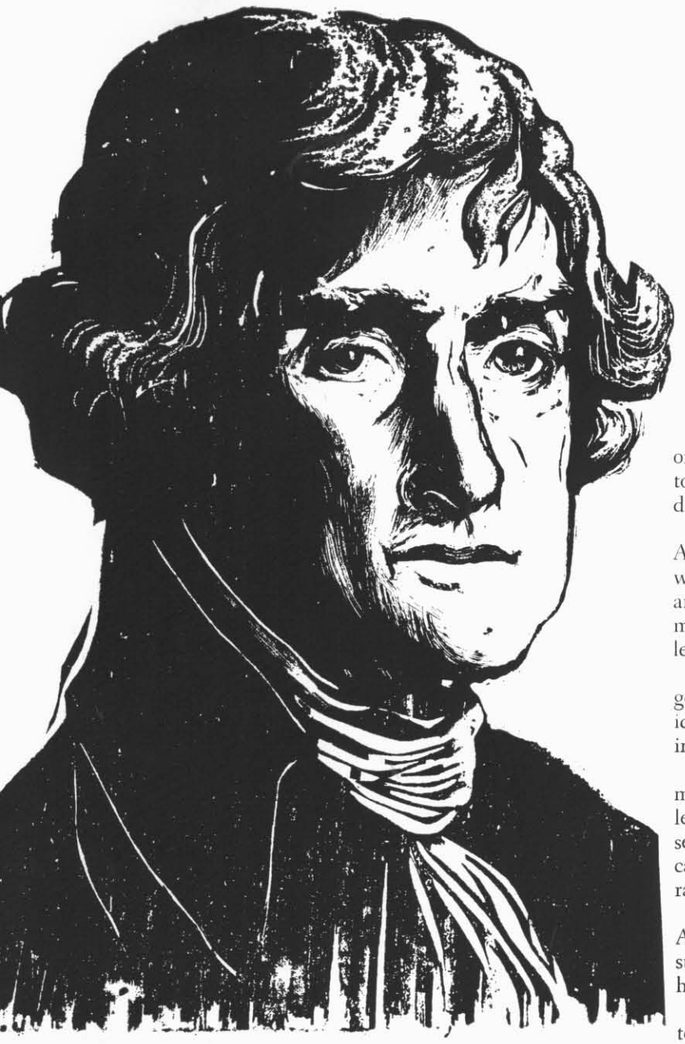
The authorities at Pisa are taking more positive steps to arrest the tilt of their famous attraction. They have tried pouring concrete under the foundation, but there is no assurance this will do the trick — the concrete buttress may sink along with the tower. Another plan, still under consideration, is to construct a pillar of concrete up the hollow center shaft, with its base sunk deep in the earth, to provide a sturdy shoulder for the aged edifice to do its leaning on.

The latest and most intriguing idea, however, has come from a Polish scientist. He suggests shooting a plastic-like chemical (silica gel) into the loose, volcanic soil, spreading it evenly by means of electronics, and then leaving it to harden. The method has worked with "sinking lawns" and some statues, and is receiving serious study.

Actually, there is no way of determing exactly how long the leaning towers will stand; even a fraction of an inch added sinkage could bring them past the point of no return. If no way is found to correct the conditions that tilted them — a complicated maze of slipping soil, poor foundations and earth tremors — the present century may go down in history as the "Time of the Falling Towers."

This engraving shows Torre Nueva, a magnificent bell tower in the Spanish town of Zaragoza, 70 years ago. A menacing nine-foot lean caused the citizens to vote to demolish it.

Venice's 325-foot St. Mark's bell tower, left, had developed a slight list by 1902. That same year it collapsed, right, in a tremendous shower of bricks and statuary.



Thomas Jefferson:

RELUCTANT REBEL

Begrudgingly, he gave up thoughts of declared freedom to his countrymen and the world of peace to become the burning symbol

HE was never a satisfied man. Late in his life, when history was behind him, he sat down to make a list of all his earthly accomplishments, prompted by a doubt which he expressed in these words: "I have sometimes asked myself whether my country is better for my having lived at all . . . "

Years later, when it came time to write his epitaph, he summed up his life in a simple statement of three acts by which he wished to be remembered:

Here Was Buried
Thomas Jefferson
Author of the
Declaration of American Independence
of
The Statute of Virginia for Religious Freedom
and
Father of the University of Virginia

He neglected to mention that he had also been the third President of the United States.

Why did this man who could claim credit for such memorable deeds ever doubt his own great worth? It is difficult to say since the spirit of contradiction was a prime ingredient in the personality of Thomas Jefferson.

Reasonably and impassionately, he helped sever the American colonies from England. He authored a document which led to war and revolution; yet he always avoided argument and heated controversy. He championed the common man against aristocratic forces; yet he was nevertheless reserved and impersonal in his dealings with others.

While arguing forcibly against the Federalists' type of government (strong centralized federal power), he, as President, immeasurably strengthened their cause by purchasing the Louisiana Territory from France.

He shocked many of his friends when, while serving as minister to France, he applauded Shay's Rebellion, a violent attempt to overthrow the government of Massachusetts. And he once astounded his political supporters by calling the tribal society of the American Indian an admirable form of government.

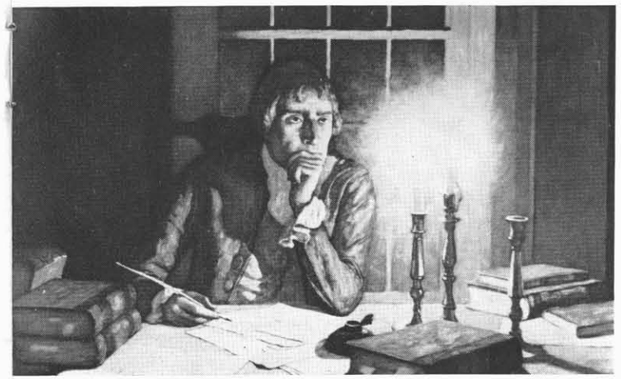
Jefferson was born in Albermarle County, Virginia, on April 13, 1743. His father was a successful planter and surveyor, and Thomas, as the first-born son, became sole heir to a large and prosperous estate.

He began his schooling at the age of five and grew up to be a serious and strong-willed young man. He boasted that the sun never caught him in bed. His classmates at the College of William and Mary at Williamsburg recalled in later years that he studied a minimum of 15 hours a day.

Jefferson was well disciplined in his personal habits. He raised tobacco but never smoked. He kept a fine stable of thoroughbred horses but never gambled. He was famous as a generous host in days when good eating and hard drinking were customary, yet he drank little and ate sparingly. He was, in fact, a vegetarian.

Williamsburg in the mid-18th century was a hotbed of political and revolutionary activity. Although Jefferson was exposed to this climate during his college years, he was reluctant to join the independence movement hoping that if the colonies could win some measure of economic freedom, a war for independence would be unnecessary.

He practiced law after graduation, was elected to the House of Burgesses at the age of 25, and became county lieutenant at 27. Once he was convinced that political independence was the only way to eliminate injustice, he stepped forward to help lead the attack. In 1774, he wrote



Jefferson's command of words marked him as the logical choice to draft the Declaration of Independence in 1776.
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A Summary View of the Rights of British America, which was a bold and damning indictment of British misrule.

As a revolutionist, Jefferson preferred cool reason and logic to patriotic fervor. He was a brilliant writer, so clear and forceful in his command of words that he was the logical choice of the Continental Congress to draft the Declaration of Independence in 1776.

Although Jefferson had great respect for fiery oratorical talents like those of Patrick Henry, he himself refused to use such methods or be swayed toward any course of action of a strictly emotional nature. He recognized Henry's wizardry for what it was: "I have frequently shut my eyes while he spoke, and when he was done asked myself what he had said, without being able to recollect a word of it."

Ironically, Jefferson was not present for the framing of the Constitution for he was serving the new United States in France from 1784 to 1789. However, he was influential in amending the great framework of law with the more specific document, the Bill of Rights which interpreted the intentions of the Constitution in terms of human rights.

Jefferson decided to retire from public life in 1793 but returned three years later to serve as Vice President under John Adams. In 1800 he ran for President himself and became involved in one of the strangest elections the country has ever seen. Because of the type of electoral system used at that time, he found himself tied for the Presidency with his running-mate, Aaron Burr. It was none other than Alexander Hamilton, a political enemy, who finally broke the deadlock in Jefferson's favor. Much as Hamilton disliked Jefferson, he hated Burr.

President Jefferson served two terms, to 1808. During his administration, the new nation had to once again steel itself for a conflict — the War of 1812 — which even the peace-loving Jefferson considered inevitable. These years saw the political beliefs of the Federalists gradually overshadow Jefferson's own philosophy of a government in which states' rights were foremost.

He retired from the national scene in 1809 and spent his remaining years at his Virginia home called Monticello. These were by no means idle years for him. His interests were encyclopedic and he now had the time to devote himself to them. He studied at least four languages and immersed himself in agriculture, architecture, physics, music, philosophy, mathematics, economics, engineering, and science. And at least one of his many inventions has an immeasurable effect on business and bureaucratic life today — the swivel chair.

Thomas Jefferson, like Benjamin Franklin and Thomas Paine, was one of the true revolutionaries. He stood as a symbol of declared freedom to his countrymen. Even his death underscored the cause he had labored for so long. He died on July 4, 1826.

It was the 50th anniversary of the signing of his Declaration of Independence.

Monticello has the appearance of an Italian villa with a Greek portico and many features of Colonial architecture. At left, as it was pictured in 1803, and above, as it looks today. It is two miles from Charlottesville, Va.

Dhahran pupils show safety posters to Chief Fire Prevention Engineer R. A. Hattrup, right, and to Dhahran's Fire Chief Norman Armstrong.

Doctor of Fire Prevention

Aramco's Dick Hattrup writes his prescriptions *beforehand*— to keep fires from happening

WHEN R. A. Hattrup went to college, the last thing that would have occurred to him was that he'd wind up being a fireman. Of course, he isn't *really* a fireman.

Maybe the best way to describe his functions is to point out that Aramco has several hundred million dollars' worth of oil processing plants, pipelines, buildings, houses — structures of all kinds: plus motor vehicles, aircraft and lots of costly materials, instruments and supplies. And, the management says to Hattrup:

"We'd like you to keep these from catching fire."

His official title is Chief Fire Protection Engineer, and his responsibility falls in three categories:

Keeping fires from happening.

Being *ready* to fight and contain them.

Putting them out.

And, if any one of these specialties were in Dick Hattrup's curriculum at Stanford University, they were not his majors, because he was getting his degree in structural engineering.

But, then, he's quite used to getting off the beaten path, both figuratively and literally. His very first assignment, when he came to the Middle East 21 years ago, was in an area where there were no paths whatever — except those made over the centuries by camel caravans. His job: to work on a joint survey to determine the Saudi Arabia-Iraq border.

Well, at least he didn't have to worry about fires away out there in the desert, someone suggests.

"No? There was one evening," smiles Hattrup, "when a workman came over to fill his kerosene lamp. Trouble was that what he filled it with was *gasoline* — while the lamp was burning!

"But, relax. Someone noticed, and quick-like doused the flame."

To get back to the present, however, it's sort of difficult to tell, briefly and simply, just what a chief fire prevention engineer does.

He doesn't build fire walls, or train firemen, or wear a helmet and handle hose lines. Rather, he's the man — you might say — who "writes the prescription." Administering the medicine — preventive or curative — is up to the supervisors of each unit or activity, and the men who work with them — plus the fire department.

Basically, the problem is much the same as in any large industrial installation in the States, except that Hattrup also must concern himself with residential areas, dining and recreation facilities — whole communities.

Take the first category: keeping fires from happening. As Hattrup points out:

"Obviously, the first thing you do is make certain that everybody understands what *causes* them. Here, the principal causes are open flames, electricity, matches and smoking, and cutting and welding. And, the main element in prevention is education."

To this end, every supervisor is thoroughly instructed, and he, in turn, is responsible for seeing to it that his men understand these dangers and avoid them. On top of this, everybody is kept continually reminded and currently informed by bulletins, posters and informational material, liberally illustrated.

But, beyond these continuing efforts, there are special problems: a major new installation, for example. Let's say that a new processing plant is to be built at the Ras Tanura refinery.

Well . . . when you're refining petroleum, you have furnaces with roaring flames, and you have gases that are highly flammable, or explosive, or both. Naturally, the plant is designed to keep these gases within the pipes and vessels, except for those that may be flared. *But,* leaks *could* happen. So. . .

The engineer who will design the plant, and the one who will build it, and the one who will operate it will not only be sure that it will serve its function, but also that it will be *safe.*

Bear in mind, though, that these men have their own specialties: they can't be expected to be fire protection experts, too. They'll look to the fire protection engineer of the company that's doing the design, and, also — to deal with special problems or differences of opinion — to Hattrup.

Does the plant embrace the fire prevention elements that Aramco has found to be advisable? Is the proper material specified for all component parts? Will the plant be located so that, *if* a fire occurred, it could be kept from spreading? (There's a lot of wind in Saudi Arabia). Are there sound plans for storing combustibles? Considerations like this. As Hattrup explains:

"There are two things that we must watch for: those that could contribute to a serious situation, and those that are minor, but could lead to frequent fires."

So . . . having tried to *prevent* fires, what do you do, Mr. Hattrup, to be ready when one occurs, anyhow?

"Well, every operating unit has some kind of 'first aid' fire-fighting equipment, and at least some of the people there are trained in inspecting and using this equipment."

Does this help? Records of a recent period show that 54 per cent of all fires were handled in this way.

The Company maintains professional fire-fighting crews and equipment in each of its three operating districts: Abqaiq, Dhahran and Ras Tanura. There's a chief in each district, and the crews comprise over a hundred men.

Backing up these regulars is a volunteer brigade of about 30 members in each district. Outlying communities generally operate with smaller volunteer brigades.

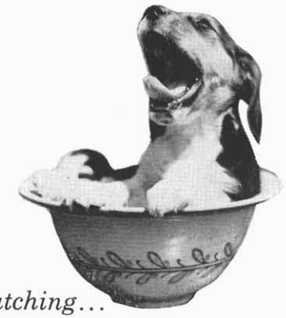
Summing it all up, a major goal in Aramco's fire protection program is to keep people remembering that fires are *everybody's* concern. Most people think of fire protection as something that's up to the fire department. They seldom give it a thought until there's a fire in their own home — or one at their neighbors' that might spread.

There's a payoff for all of this effort: for four consecutive years, the number of fires has declined every year.

So . . . the man who went to college to learn to be a builder is now spending his time protecting what others have built.

Three aspiring fire-fighters pick up pointers on proper hose handling. Firemen trainees, right, extinguish a practice oil blaze near Dhahran.

that most enjoyable YAWN



It's a relaxing prelude to sleep, an invigorating eye-opener, and very, very catching...

NOT very many have stopped to analyze or define that irresistible and overpowering impulse called the yawn. And that in itself is somewhat strange for what is more rewarding than the experience of scrunching back the neck and letting go like a miniature Metro-Goldwyn-Mayer lion?

Some purists say a yawn does not involve a stretch. On the other hand, the dictionaries and encyclopedias argue that the whole idea of a yawn is to stretch. A yawn is not a yawn without a stretch – body, throat, everything!

Sometime ago, someone, now forgotten, put a new word to work to describe yawning – *pandiculation*. Unfortunately neither Stedman's medical dictionary nor Webster's unabridged dictionary can seem to get together on just what this word means either. Mr. Stedman says yawning and stretching; Mr. Webster firmly asserts pandiculation means stretching, period.

As if to settle things once and for all, by the power of usage, *The New York Times* of October 22, 1944, ran a picture spread of babies, dogs and a man in its magazine – all with their mouths wide open – and called the whole thing "Pandiculation." But there's little doubt that there was present in the article, no matter how slight, the hint that indeed stretching could not be divorced from a good yawn. *The Times* had this to say: "Boredom, hunger, overeating, drowsiness and bad ventilation all have been blamed for yawns, but the specific stimulus that starts the reflex is still obscure. The power of suggestion has a lot to do with it. Yawns are catching as everybody knows, and they can even be self-induced . . . A yawn has all the beneficial effects of a deep breath of air. It is relaxing and refreshing. It tones up the muscles of the mouth, the chest, the back and even the arms. Whether it has any other psychological or physical effects science doesn't say."

Not that science has very much to say on the subject, all told. Any number of physiology texts slide right by the subject. Some stop only a cautious moment or so as *Physiology in Health and Disease* (3rd edition, 1939):

"Various psychic or emotional reactions manifest themselves not only by facial expressions, but also by objective changes in respiratory acts . . . Yawning is associated with a prolonged inspiration during which the mouth is stretched wide open, followed by a short expiration." Or as in *Handbuch der Physiologie des Menschen* (1905):

"The yawn is a deep inspiration carried out with widely opened glottis and usually with opened mouth; it is frequently accompanied by movement of the arms, etc. It is caused by certain psychic influences, fatigue, etc."

Some men of science observed along the way that certain of the lower forms of life – birds, fish, snakes – merely opened their mouths wide. Darwin discovered what is probably the most dramatic yawn in existence. He found that there could be either a threat or thrill in the yawn of the baboon:

"Baboons," he wrote "often show their passion and threaten their enemies in a very odd manner – namely, by opening their mouths widely as in the act of yawning."

Study of other primates led observers to the conclusion that yawning is widespread throughout the animal kingdom, particularly among primate meat eaters. Primate herbivores stretch but do not yawn. While this may bring kudos from the etiquette experts (who frown fiercely on even the most muffled yawn) it is only fair to add that these vegetarian animals refrain from yawning, not out of politeness, but only because they can't. They breathe exclusively through the nose, even under conditions of severe stress.

Dr. A. Price Heusner of the Harvard Medical School looked into this whole matter in 1946 and reported his findings in an article in the *Physiological Review* of that year, an article entitled "Yawning and Associated Phenomena." Excluding from consideration "morbid" yawning, that is, yawning connected with illness, Heusner reviewed all the foregoing authorities on the subject and added some of his own clinical observations.

He found that the pulse rate quickens with a yawn, there is a vasoconstriction -- contraction of the blood vessels – in the fingers and toes of the person yawning and that there is evidence to indicate the yawn can be occasioned by voluntary or involuntary motor control centers.

Dr. Heusner pointed out that although there is some lack of unanimity in deciding which phenomena often accompanying the yawn should be included in the definition of the word – stretching of the arms, legs; arching of the back; vocal sound, etc. – the various actions associated with yawning have been delineated rather completely on an individual basis.

He noted, however, that much work remains to be done to establish a clear understanding of why a yawn occurs and what, if anything, the individual can do to induce or prevent it.

In the years since Dr. Heusner's report, medical people seem to have hardly opened their mouths on the topic of yawning, except only to say "o-h-h-h" – with or without a stretch.

The sparkling, billowy clouds that accumulate in heaps and mounds on fair-weather days are *cumulus* clouds.

Nimbus – also called *nimbostratus* is the rain cloud, a thick, shapeless gray layer which settles above the earth at about 3,000 feet. The wisps of cloud which often hang down from its undersides are called "scud." Three-fourths of all nimbus clouds bring rain or snow within four or five hours.

The sparkling, billowy clouds that grace the skies on fair-weather days are called *cumulus* clouds. They begin to take shape in the air at the condensation level, and so their bases are more or less flat. Great columns of overheated air often push cumulus clouds to a height of a mile or more, and they may be several miles wide. Heavy cumulus clouds may bring showers or snow flurries if conditions are right.

When nimbus and cumulus clouds get together, Nature stages one of her most masterful melodramas – starring the *cumulonimbus* or "thunderhead." This is the prima-donna of all the rain clouds, a turbulent, anvil-shaped mass of wind and water vapor often five or six miles tall. Blue, green, black, and purple towers rise and fall within it, illuminated by streaks of lightning. At its base, dark grape-like clusters of cloud boil and bubble, and in certain sections of the world, particularly the midwestern United States, these clusters foreshadow the birth of the most villainous of all clouds: the *tornado*.

A furious battle between columns of warm and cold air inside a thunderhead precedes the birth of a twister. Rotating winds – 300 to 500 miles per hour – create a low pressure area which reduces air temperature and condenses water vapor. Giant hail stones, formed by the up-and-down

LOOKING INTO THE CLOUDS

I am the daughter of Earth and Water,

And nursling of the Sky;

I pass through the pores of the ocean and shores;

I change, but I cannot die.

from *The Cloud*, Percy Bysshe Shelley

A THIN mist had hung over the countryside all morning, but by noon the earth had warmed and the air had cleared. The remainder of the day was bright and sunny, with hardly a breeze to ruffle the fields of wheat or the leaves on the trees. Just an ordinary April afternoon in central Kansas.

Then, just before sundown, it happened.

A farmer who had been reading on his front porch suddenly found himself lying, dazed, in an orchard 300 yards away. His house had exploded.

A row of trees on the road to town were stripped of their bark and leaves. A chicken lost all its feathers. A small duck pond disappeared. A straw was driven through a one-inch pinewood board.

Eight buildings in town were totally demolished; cars were overturned; shrubbery was uprooted. It looked as if a gigantic combine had cut an uneven swath through town. The truth was far more simple:

The town had been attacked by a cloud.

"Cloud" is a gentle sort of a word. It calls to mind mounds of cotton and fleece in the sky. We might not readily connect it with a violent word like "tornado." Nevertheless, they belong together. For that black, destructive funnel of wind and water vapor – known variously as a "twister," a "whirlwind," a "waterspout," and a "tornado" –is a member of the cloud family: the cousin of mist, the brother of fog, the son of the thunderhead.

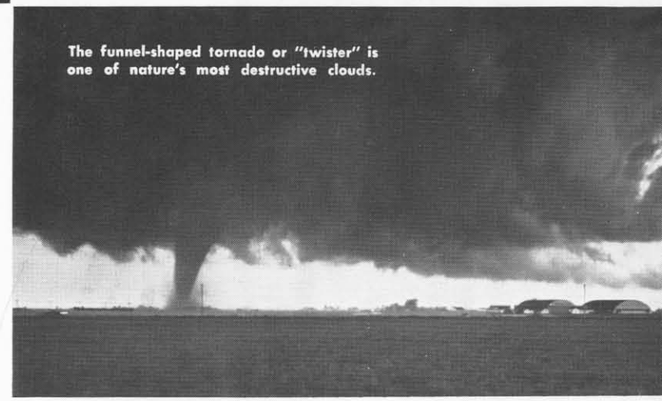
All clouds – the lazy, the kind, the brutal – share a common origin. Light rays from the sun strike the earth and are converted into heat. The heat warms the air, and the warmth changes water into vapor, which rises above the earth. When this air cools below the point where it can hold the vapor in invisible form, clouds appear.

The mysterious comings and goings of clouds fascinated our imaginative ancestors: Zeus hurled his thunderbolts from them to punish those who had offended him. But, strangely enough, no one thought of cataloguing clouds until the beginning of the 19th century. In 1801 the French naturalist, Jean de Lamarck, gave them their first French names; in 1803 an English scientist, Luke Howard, devised the Latin names which we use today.

The two basic types of clouds are: *stratus,* which form in layers or sheets; and *cumulus,* which "accumulate" in heaps or mounds. To these we can add *cirrus,* high thin clouds, and *nimbus,* any layer cloud from which rain or snow is falling. These four terms, in combination with each other and with the roots "fracto" and "alto," are used to describe all clouds.

Let's examine the possibilities, from the ground up.

The commonest type of cloud is the *stratus* cloud – an old, worn-out mass of vapor that is gradually sinking to earth to be re-evaporated. During the day, stratus clouds reduce sunlight to a milky luminescence; at sunset, they look like bars stretched out across the horizon. A stratus cloud may cover hundreds of square miles and be anywhere from 50 to 1,000 feet thick. It may bring a light drizzle, but rarely rain. Fog is a ground-level stratus cloud which forms when warm and cool air mix under conditions that prevent air from rising. If you've ever walked through a thick fog, you've seen the inside of a stratus cloud.



The funnel-shaped tornado or "twister" is one of nature's most destructive clouds.

motion of water in the freezing funnel, often lash out at earth before the tornado strikes.

As the funnel moves up and down, it occasionally dips below the mother cloud. If it touches the earth, havoc results. The low air pressure causes the twister to act like a giant vacuum cleaner, sucking up dust, dirt and debris in its travels. Buildings literally explode, cars are plucked right off the ground.

A tornado eventually destroys itself. As it rages farther and farther from its birthplace, it grows lean and long, develops loops, and finally snaps and disappears.

Cloud formations that have been destroyed by high winds are known as *fracto* types. A nimbus cloud, drowning a picnic, may become so enthusiastic about the sport