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CSF

Every mother in the land has at least one thing in common —

The Second Sunday in May



Anna M. Jarvis
Founder of Mother's Day

ONE of the newest American family holiday traditions — observance of Mother's Day on the second Sunday of May — actually is one of the world's oldest. It had its origin in the ancient Greek worship of Cybele, "great mother of the gods;" was recognized with diminishing importance during the early and middle years of Christianity; then all but disappeared until a half century ago when it

was given new vigor in Philadelphia and spread throughout the nation and to many parts of the globe.

Today, it is observed as one of the most important holidays of the year in Vienna, ranks high in importance in Australia, is commemorated throughout South America and all other Spanish-speaking areas, rates three days of special notice in England, and in the United States annually causes the year's worst traffic jams with family cars headed for Grandma's for a day-long visit.

The Greeks, and later the Romans, both celebrated the day on the Ides of March. The holiday called Hilaria was the Roman counterpart of the Greeks' Feast of Cybele. The ceremonies were marked by feasting, music and dancing, but were not conducted in honor of earthly mothers. After the dawn of Christianity, the fourth Sunday of Lent was dedicated to "Mother Church," the Christian religion. Some early Christians also venerated the Madonna on this day.

In 17th-century England, Mid-Lent Sunday became known as "Mothering Day," a day on which apprentice boys who lived within traveling distance of their homes were allowed to return to their families for a visit. When an apprentice was "going-a-mothering," it was customary for him to carry home a simnel cake as a gift. This was a plum pudding encased in a hard crust. If the trip were too long, the apprentice was expected to send home a letter of felicitation, usually a missive that had to be penned for

him by a professional letter-writer or scrivener.

Mother's Day, as it is known now, however, had its legal origin in 1908. Two years previously, Miss Anna Jarvis of Philadelphia, had suffered the loss of her mother. During memorial services in 1907, Miss Jarvis discussed with friends the possibility of having a day set aside for the remembrance of mothers and during the ensuing year succeeded in interesting several influential groups in the idea. As a result, the city of Philadelphia proclaimed the second Sunday of May 1908, Mother's Day.

By 1912, the idea had spread as far as Texas. Texas' governor instituted a custom that year of pardoning worthy prisoners as well as proclaiming the day in honor of motherhood. The next year, Texas was joined by Pennsylvania and Nebraska in memorializing Mother's Day. Nebraska also designated it a Flag Holiday.

Meanwhile, the idea had spread across the ocean to England. In addition to the Sunday observance, since 1913 schools in that country conducted special ceremonies on the preceding Friday, and business firms honored mothers on the preceding Saturday.

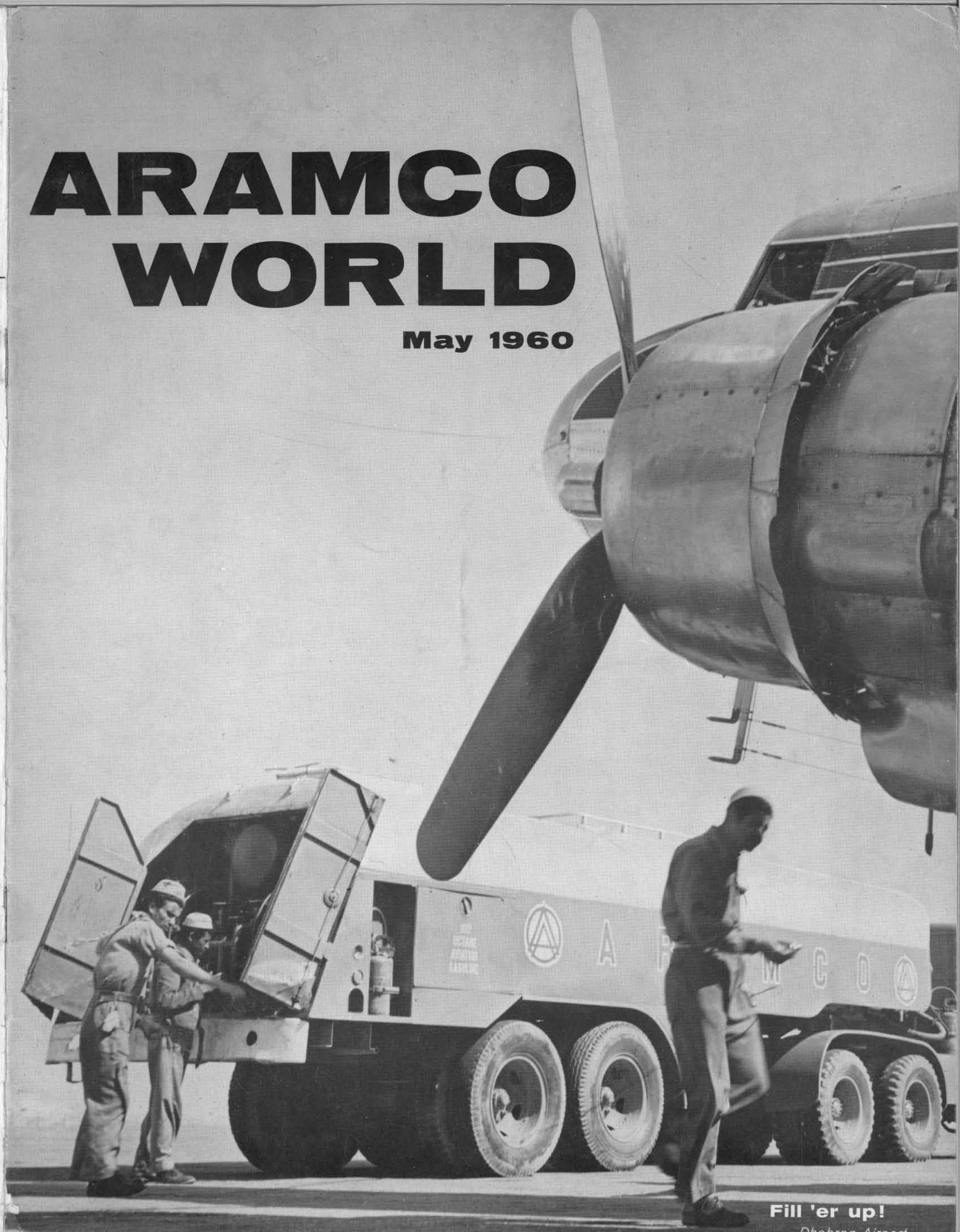
President Woodrow Wilson, in 1914, proclaimed the second Sunday in May Mother's Day in perpetuity and succeeding presidents have followed the custom of issuing special proclamations directed toward its national observance.

For many years thereafter, Miss Jarvis devoted her energies and her personal funds to efforts to dedicate Mother's Day to the lofty purposes she had envisioned. Miss Jarvis lived well into the era when Mother's Day had become a national tradition. She died in Philadelphia in 1948, penniless as the result of her life-long crusade.

On May 8th, this year, white or pink carnations appearing in buttonholes in memory of departed or living mothers will be tangible evidence to the success of Miss Jarvis' life work. Millions of families, however, reunited on this special day will signify the deeper spirit of the occasion — the heart of the hearth is Mother. ■

ARAMCO WORLD

May 1960



Fill 'er up!

Aramco World

MAY 1960

VOLUME 11 NO. 5

FRONT COVER: An Arabian American Oil Company DC-3, gases up at Dhahran Airport in eastern Saudi Arabia. With the help of its alkylation plant, a recent addition to the great refinery at Ras Tanura, Aramco manufactures enough aviation gas for its own local needs, those of the Saudi Arabian Airlines, and for commercial carriers flying into Dhahran.

MASTER FUEL-MAKER

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During a visit with Aramco experts, we find that making the "champagne" of gasolines is more than just scrambling a lot of molecules.

SEA BANDITS

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For an unparalleled 50 years—1670-1720—the most colorful bunch of cutthroats the world has ever known wrought havoc on the high seas.

THE LONG, LONELY FLIGHT

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Could an airplane carry enough fuel to drive it 3,600 miles even in ideal weather? Strange as it may now seem, in 1927 that question had not yet been answered.

WHEN NATURE BLOWS HER TOP

Nature's mountain-making activities have caused man a lot of grief during his time on earth, for somehow he's always managed to set up house close by a volcano that's itching to blow.

PASS THE PEPPER, PLEASE

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This fillip to the palate has been a hot item for 5,000 years and it's been called on for everything from ransoming Rome to killing moths.

CANALWAYS

20

Apparently, we have been busily ditching our way to trade and prosperity ever since some engineer first realized that ships could be taken where nature failed to provide for them.

THE SECOND SUNDAY IN MAY

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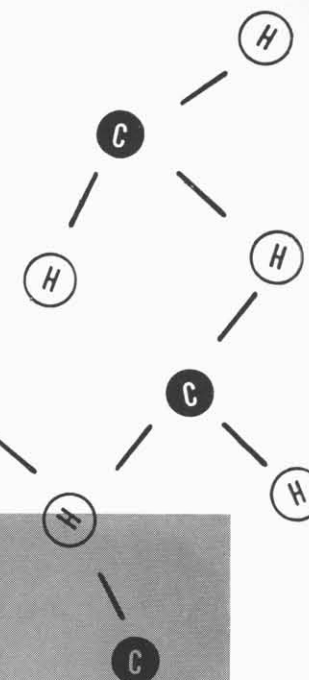
Do you know who first officially proclaimed Mother's Day? And do you have any notion of how far back into history such an idea dates?

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MASTER FUEL-MAKER

The champagne of gasolines—Aviation Gas—is turned out at Aramco's Ras Tanura Alkylation Plant



THIS is going to be a simple story of how you take one kind of gas from over here, and another kind from over there, and add a touch of this and a dash of that — and get aviation gasoline.

It's the story of the Arabian American Oil Company's new \$7,000,000 alkylation plant at Ras Tanura, "on stream" since June, 1959.

The new plant makes it possible to manufacture in Saudi Arabia the aviation gasoline that formerly had to be imported. It provides a local supply for Saudi Arabian Airlines, Aramco's aircraft and the several foreign carriers, like SAS, TWA, KLM and Middle East Airlines.

As an added gain, it uses, as part of its raw material, gases previously usable only as fuel for the refinery power plant or processing furnaces.

It's well worth a look-see, especially if you can find a couple of patient engineers like C. V. Copeland and John Santos, and start asking childlike questions. When you're

Before panorama of alkylation plant towers, are assistant district manager S. C. Harper, left, and district engineer of Ras Tanura, C. V. Copeland.



MASTER FUEL-MAKER

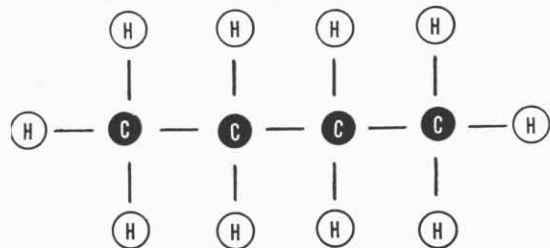
through, you still won't *really* understand, but you'll have a fair layman's idea.

Copeland, district engineer, lived with the plant from its pre-blueprint days, and helped build it. Santos operates it.

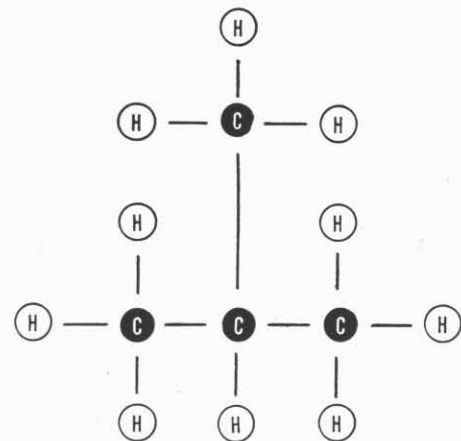
They assume you know that aviation gasoline must burn smoothly in a very high-compression engine. Ordinary gasoline would explode, or "knock." But, take a very high quality gasoline, mix with alkylate, add a touch of tetraethyl lead, and you're in business.

So . . . what's alkylate? You get the answers from first one and then the other, so let's make it a composite response:

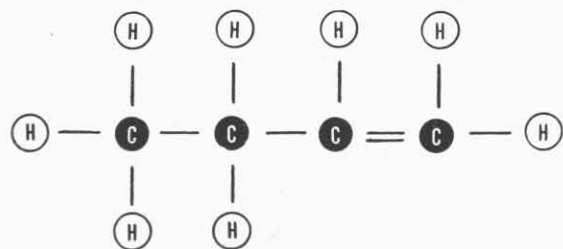
"Petroleum is a mixture of hydrocarbons — molecules consisting of hydrogen and carbon. Some molecules are called 'normal'; others, 'iso.' For example: (and Santos begins sketching a diagram) hydrogen is 'H,' carbon, 'C.'



"This is normal butane, a gas at atmospheric pressure. Liquefied, it's sold as 'bottled gas' in rural areas everywhere. But, refiners can change the molecule so it has the same number of each atom, but arranged differently. Do this to normal butane and it becomes isobutane, also a gas at atmospheric pressure." Santos sketches . . .



"O.K.? Well, there's another difference: molecules like butane and isobutane are called paraffins, and are 'saturated:' each of the four 'hands' of each carbon atom is linked with another atom. (Hydrogen atoms have only one 'hand.') Notice in the diagram? But, other molecules, called 'olefins,' are 'unsaturated,' like butylene . . .



"In olefins, one or more carbon 'hand' has nothing to hold: it's restless — never satisfied until it finds a free atom to grab."

So, now we know — in a way — what Santos means when he says:

"Alkylation is the combining of an iso-paraffin molecule and an olefin molecule. The product is called alkylate."

And, there's a ray of meaning when Copeland tells you:

"Alkylate is made here by taking butylene and isobutane, liquefying them, and bringing them together in a reaction chamber in the presence of sulfuric acid catalyst at 35° to 40° F."

The butylene comes as a by-product of the two thermal reformers, whose purpose, being very general and skipping a lot of details, is to make a higher-octane gasoline than you get by distillation.

Part of the isobutane comes from the hydroformer, which has the same purpose as the thermal reformers, except it's a newer process, using a fluid catalyst and making a very high-octane gasoline, known to the technologists as hydroformate.

The rest of the isobutane comes from the light straight-run stabilizers, which strip light gases from naphthas, the part of crude oil used in making gasoline.

So, let's wander around the plant and see how they put things together. We'll start in the control room, where they automatically control and record everything — temperatures, pressures, flow rates, etc. — from the big instrument panel.

With admirable tolerance, Santos relates what's happening, and, happily, we can look out the window and see the equipment he's talking about . . .

"When the 'feed streams' reach here, they go first to the surge drums to give us added flexibility in controlling flow rate.

"Now, at this point, the streams contain certain gases that mustn't be in the feed. So, the isobutane goes first to the depropanizer, then to the de-isobutanizer — the tallest column out there: 160 feet high. It has 60 perforated

Impressive shadow network of pumps, turbines, overhead pipes and steelwork indicates complexity of alkylation process.



trays, and isobutane is separated out at about 85 per cent concentration.

"The olefin stream is sent to the olefin splitter column that separates out the desired butylene."

Now, the streams are caustic-washed to take out hydrogen sulfide and vile-smelling mercaptans . . . cooled . . . and now:

Isobutane and acid enter at the end of the horizontal reactor drum, butylene at the top — and then there's action. Out of the turbulence comes what you were after — alkylate — plus excess isobutane, which is separated out and re-cycled through the reactor.

The alkylate, after a water wash, goes to the debutanizer, and then to its final stage: the re-run tower, where the light part is separated from the heavy. The former goes into aviation gasoline; the latter is blended into automotive fuel.

So . . . that's the story of the alkylation plant. It's designed to make 1,210 barrels daily, using the M. W. Kellogg process.

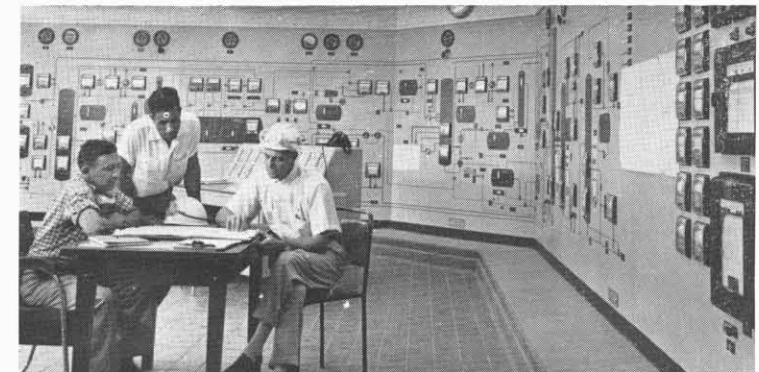
And, now we're ready to get finished aviation gasoline. Remember that very high-octane gasoline from the hydroformer: the hydroformate? Well, we take the very choicest "cut" of this, and we take the alkylate, and pump them both, in the desired proportions, to a mixing tank described by Copeland as "sort of like a Waring blender."

Here, tetraethyl lead is added — about 4.5 cubic centi-

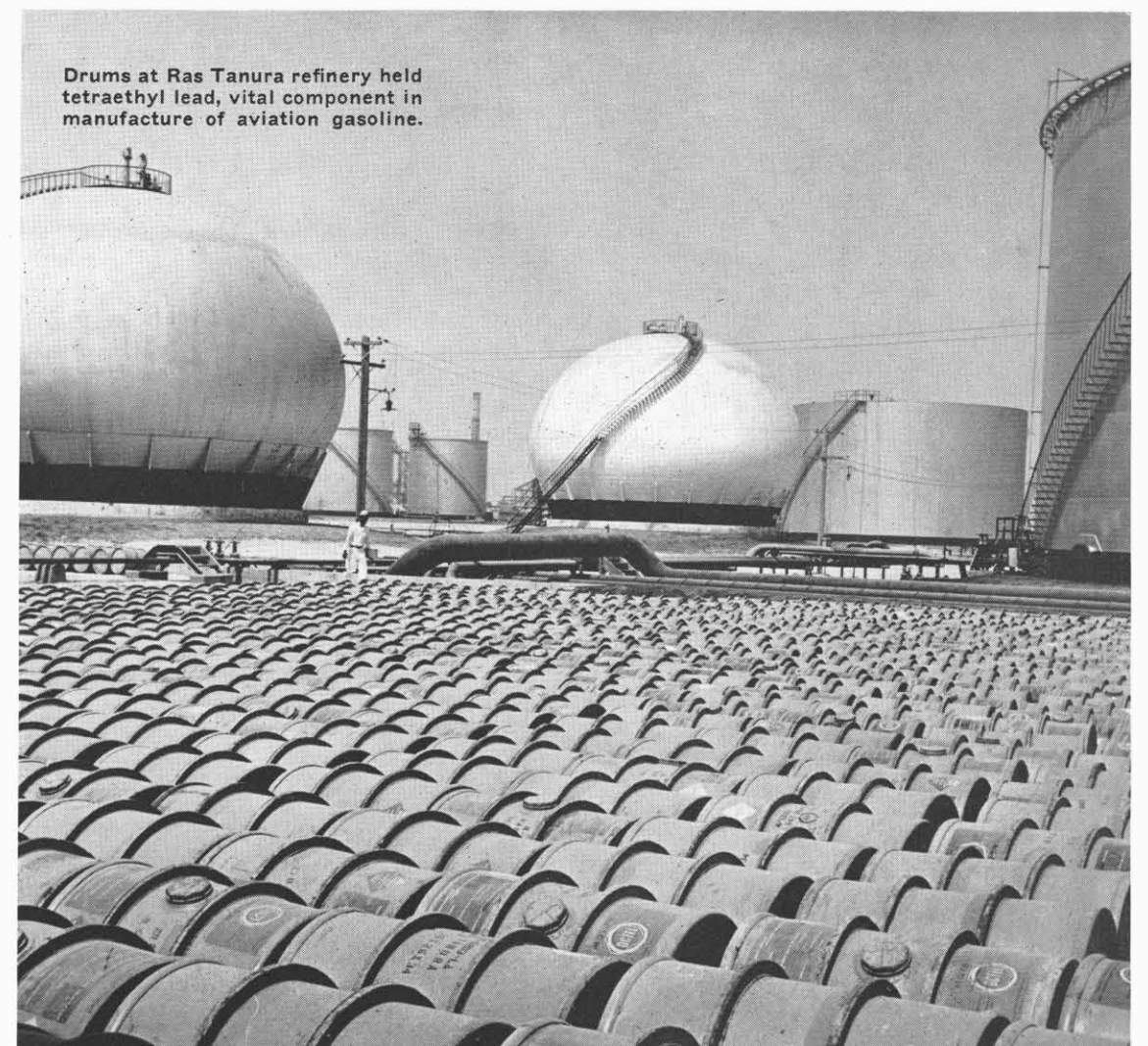
meters per gallon; and, when the mixing's over, it's aviation gasoline. Two grades are made: one for engines with high requirements; the other for those that are less demanding.

But, making the aviation gasoline is only part of the job: the rest is checking it. Samples of each batch are put through an elaborate test engine to make certain it will yield the specified power.

All in all, you might say it's a bit more involved than whipping up a batch of hollandaise sauce.



Instrument panel controlling alkylation plant. John Santos, left, in charge, confers with operator Ahmed bin Rashid and refinery superintendent K. F. Maloney.



Drums at Ras Tanura refinery held tetraethyl lead, vital component in manufacture of aviation gasoline.



SEA BANDITS

Their lurid careers ran the gamut of crimes on the high seas

JUST who were these fabled buccaneers of the Spanish Main? How did they get into the "pirate business"? And why were they able to enjoy such a heyday in the Caribbean, only to fade away within a few decades?

In some ways, it was a little like the era of pioneering in the American West — incredible opportunity available in untouched wilderness. Both areas passed through a stage when what laws there were could neither protect commerce nor the man who could not protect himself, and both moments in history produced something colorful and unique while savage and cruel.

Underdogs, adventurers, sadists, dreamers, runaway slaves, fugitive seamen, juvenile delinquents, all of these and more walked the decks of outlaw vessels in the golden age of piracy, about 1670 to 1720.

A common type of pirate leader was the embittered man who could not countenance the "injustice" of being born at the "bottom of the heap," so to speak, but who had no desire to improve his conditions through the difficult though lawful up-from-the-ranks process.

Take, for example, François Lalonois. Abandoned by his parents, he developed into a savage, hate-filled child passed from one uncaring household to another in the small villages of southern France.

At sixteen, he was sold as a slave and shipped to the

Tortugas in the Caribbean to work on a sugar plantation. The day he landed François found an opportunity to escape.

He joined an ill-fated pirate crew and only he survived a raid on a Spanish settlement.

With ten slave Indians, whom he had talked into running away, he stole a fishing boat, and in the dead of night, silently boarded a large Spanish merchantman in the harbor. Forcing the captain at knifepoint to weigh anchor and steer for the Tortugas, François was now in business for himself.

By the time he was 20, he was a captain, in charge of a flotilla of five prize vessels and a gang of 500 of the toughest professional criminals in the Caribbean. With this force he stormed and captured the wealthy Venezuelan city of Maracaibo, whose forces outnumbered his by four to one.

During the sacking of one city, Lalonois entered a church and noted a golden crown among the relics. He kneeled before the altar and commanded the frightened priest to place the crown upon his head. In this strange way, an embittered waif forced the world to notice him.

There were many remarkable customs followed by the pirate gangs. Some of these customs bordered on a kind of crude democracy. These men who had renounced the orderly authority of civilization would certainly never accept the absolute rule of one of their own number.

Therefore, in almost every instance, pirate captains held office by majority vote of their crews. In battle, their authority was absolute; but at any other time they could be — and frequently were — deposed.

The ship's articles of most pirate vessels provided that

the captain would receive two shares of the booty, the officers one and a half shares each, and the men one share each. Thus, the captain never got more than twice the amount received by the lowliest deck hand. Large additional stipends and bounties were specified for men injured in battle.

The role of pirate chief was one for a strong leader. Lalonois was such a man. So was Henry Morgan, city-sacker par excellence, who was the runaway son of a poor Welsh farmer. If ever there was an indomitable, mesmerizing personality, Morgan was it.

He carried on a sustained campaign of plunder against the Spanish cities of Central America. His capture of Panama City with his fanatically loyal gang is one of the most astonishing military feats of all time.

All this was tremendously useful to England in her off-again-on-again war with Spain. Piracy? King Charles II looked the other way, knighted Morgan, and made him Lieutenant Governor of Jamaica!

In this high post, Morgan conspired in piratical enterprise. Jamaica became a haven for buccaneers, including Henry's younger brother, Charles. These pirates preyed on English and Spanish shipping alike. The King soon realized his error; Morgan was tried and removed from office. But by now he had many powerful friends. He was soon holding down another minor official post in Jamaica while planning and financing pirate expeditions. Oddly enough, he died peacefully in a four-poster bed one day.

Another famous pirate was Blackbeard, master of psychological warfare.

Born Edward Teach, he grew up an orphan ragamuffin

An old engraving shows artist's version of buccaneers in action.





SEA BANDITS

on the waterfront streets of Bristol, England; did his early pirating with a veteran captain named Ben Hornigold; and soon had his own ship and crew.

He purposely cultivated a legend of himself as the devil incarnate. His great black foliage was braided into four small pigtails, each tied with a scarlet ribbon. Across his chest he wore a string of six pistols, and his belt was cluttered with knives and cutlasses. He chose the name Blackbeard himself, and hugely enjoyed the effect that his name, appearance, and ravings produced.

He often attacked at night for maximum psychological effect. When boarding an enemy vessel he would insert long, slow-burning cannon matches into his tar-slicked hair, and laugh wildly while brandishing guns and cutlery. Many a terrified sailor threw down his weapons and fell on his knees before this hellish apparition. Blackbeard's reputation rapidly spread; his shrewdly chosen name became a synonym for high-seas terror; and many a prize fell into his hands with little or no fight.

Blackbeard was finally dispatched by a special expedition from Virginia that surprised him in his secret hideout on the South Carolina coast. But Blackbeard the actor had created an image of himself that has lingered in history, ballads, and folk memory.

Ruthless Blackbeard fought night battles, lighting slow-burning cannon matches in his tar-slicked hair to terrify his enemies.

As piracy grew and prospered, it attracted many persons who felt that the danger involved was preferable to certain intolerable conditions in their lives. Slavery and indentured servitude in the Caribbean swelled the outlaw ranks. So did the prevailing hardships and cruelties aboard legitimate warships and merchantmen.

The pirate way of life exercised a fascination over different kinds of people. Take Stede Bonnet, retired British Army major and rich Jamaica plantation owner. Tales of piracy were often related when he entertained friends on his cool verandah, and apparently an overwhelming impulse stirred Bonnet's heart.

One dark night he simply disappeared. When next heard from he was taking prizes on the high seas as a pirate captain! He had purchased, outfitted and manned an outlaw ship at his own expense — perhaps the only paid-for pirate vessel in history!

Bonnet was a tenderfoot on the quarterdeck, but he learned fast. For a time, he cruised in company with the one and only Blackbeard!

The crude democracy of pirate life also appealed to certain idealists and visionaries. Captain François Misson — a very different man from his countryman François Lalonois — flew, not the Jolly Roger, but a white banner

bearing the words "For God and Liberty." His crew constituted a "Republic of the Sea." All prizes became the common property of the Republic, which had established a permanent residence on an island.

Misson and many of his men were religious, and all were deeply committed to their "new and better way of human life." Swearing and heavy drinking were taboo. Those members of the Republic who weren't out cruising were back home on the island raising crops and cattle.

In battle, the Republic was invincible; in victory, generous. Misson was courteous and merciful; he spared life whenever possible.

Members of conquered crews could join the Republic if they wished; otherwise they were set free upon the next surplus vessel. Misson boarded slave ships, liberated the slaves and offered them full membership in his pirate Utopia.

The sheer adventure of pirate life was a powerful magnet. Bartholomew Roberts, one of the greatest buccaneers, was apparently in the game just because he loved it. This scourge of shipping roamed the Spanish Main as the golden age of piracy was drawing to a close. He fought scores of brilliant battles and took more than 400 prizes before he was finally killed in an engagement with a British frigate in 1722.

Why was he a pirate?

"In an honest service (Roberts says) there is low wages and hard labor; in this, plenty and satiety, pleasure and ease, liberty and power. Who would not balance creditor on this side, when all the hazard that is run for it, at worst, is only a short look at choking? No, a merry life and a short one shall be my motto."

The high tide of piracy produced many more colorful figures. Thomas Tew, Rhode Island Yankee and specialist in Indian Ocean hijacking, became a devoted member of Misson's pirate Republic. Ben Hornigold, Blackbeard's mentor, retired to the Bahamas after a successful pirate career. He applied for and received the King's pardon, then went back to sea to help the authorities track down Charles Vane, a notorious pirate who had been one of his pals!

Henry Avery, an Englishman, probably captured the biggest prize of all time — a 62-gun East Indianman carrying an incredible fortune in gold and jewels. When he returned to England, however, he found that he had precipitated a major international incident, and had to go into hiding. He sold his share of the treasure to "fences" for a pittance, and died anonymously a few months later, so poor that he was buried at town expense without a coffin.

And what about Captain Kidd, most famous of pirates? His is perhaps the strangest story of all.

He was commissioned by the British Government to hunt pirates, and also to prey on French shipping as a privateer during a period of hostilities between the two countries.

On his return, Kidd was charged with piracy. One of his prizes, said his accusers, was neither French nor a pirate.

Kidd stoutly maintained that the vessel in question, the *Quedagh Merchant*, carried French papers and was a law-



For preying on Spanish shipping, Henry Morgan was knighted by England and made Governor of Jamaica which became a haven for buccaneers.

ful prize. But he was convicted and hanged; and soon a haze of ballads and legends enshrouded him.

A few years ago an American marine historian, Ralph D. Paine, made a remarkable discovery while doing research in the Public Record Office in London. He found the *Quedagh Merchant's papers*. They were indeed French! The British Admiralty had had the papers all the while and had suppressed them! Kidd was apparently framed in order to embarrass and discredit certain highly placed politicians who had backed his expedition. So it is probably accurate to believe most modern historians, that the world's best-known pirate was really never a pirate at all! ■



Most famous pirate of them all, Captain Kidd, subject of many tales of buried treasure, was in the pay of the British and hanged by them.

Tucked away in the crowded annals of aviation accomplishments is the one feat to top them all—

A steady, disheartening drizzle fell on Roosevelt Field, Long Island, the morning of May 20, 1927. On the runway, a little silver monoplane gleamed through the haze, its single engine purring.

Black letters spelled out *Spirit of St. Louis* on the plane's nose; in the cramped, enclosed cockpit sat a young mail pilot named Charles Lindbergh. In a few minutes, he would wave to the men at the wheelchairs, would open the throttle and take off. His destination: Paris — 3600 miles and an estimated forty hours away.

The feat was impossible, many said. Perhaps someday it would be done, but not in 1927, when the aerodynamics of long-distance flying were yet in a primitive state. They pointed to the one, pitifully small engine, the difficulties of aerial navigation over the trackless ocean, the fact that Lindbergh was alone and would get no rest. They pointed to the four men already dead, and three injured, in similar attempts, and to the fact that less than two weeks before, two Frenchmen had been lost without a trace while trying to accomplish the flight in reverse, from Paris to New York. Even Lloyd's of London refused to quote odds on the chances for success. The newspapers called the young pilot a "daring youth," and a "flyin' fool."

Daring he was, certainly, but he was no fool. His plane had been specially built under his own supervision. For two months he had practically lived at the aircraft factory, while workmen and engineers crowded four thousand man-hours of work into the *Spirit of St. Louis*. The product of

their labor was one of the best long-distance light planes then in existence. It had been tested and retested in a total of thirty short flights and then had established a new transcontinental solo record while flying from California to New York, with a stop at St. Louis.

The plane's only really unusual feature was the complete obstruction of straight-ahead vision. The oversized fuel tank had been built into the space ordinarily occupied by the pilot. Lindbergh sat behind, depending for visual observation on the side windows flanking his shoulders. He also had a small "periscope" installed that afforded him a quick glance directly forward. (Total cost of body and engine: \$12,900.)

At 7:52 the *Spirit of St. Louis* started down the mile-long runway of Roosevelt Field. The soft, rain-soaked ground clung to the wheels, robbing the hurtling plane of precious speed. Once . . . twice . . . it lifted only to come down again. Then suddenly it was in the air, missing telephone wires by a bare twenty feet, and passing over the spot where, less than a year before, another Paris-bound plane had crashed, killing two of its four-man crew.

The crowd on the field watched until the plane disappeared northward. It would follow the great circle route: up the coast of New England, over Nova Scotia, the tip of Newfoundland, 2000 miles of barren ocean, southern Ireland, then — Paris.

The dope-coated fabric wings, and the 200-horsepower, air-cooled engine had lifted a gross weight of over two-

The Long, Lonely Flight

and-a-half tons into the air — an unprecedented performance for an engine of that rating.

The little Wright "Whirlwind" J-5 in the *Spirit of St. Louis* was one of the most advanced power plants of its day. It was then in widespread use by the Army and Navy, as well as most commercial lines. The *Scientific American* magazine called it an engine of "remarkable lightness, efficiency, and endurance." That was no exaggeration: weighing only 508 pounds dry, it had already captured the world's endurance record, keeping a Bellanca plane aloft for fifty-one hours. Further, the Wright corporation had subjected it to the punishing fifty-hour ordeal at full throttle — a much more severe and demanding test than any it would receive in the air.

The lightness of the J-5 engine was a prime factor in Lindbergh's mind when he was drawing up his plans. All possible weight should be saved, he insisted, in order that more fuel might be carried. This was the problem at the back of all those early attempts at transatlantic flight: could any airplane carry enough fuel to drive it such a distance, even supposing the weather were ideal all the way? As obvious as this seems today — with huge jet-liners dashing back and forth from Europe — in 1927 the question had not yet been answered.

Lindbergh's efforts to save weight were extremely painstaking. He went so far as to have special boots made that would combine lightness with protection; he even tore out the extra pages in his log-book to avoid carrying those few

— but unnecessary — ounces! He also disdained a parachute, reasoning that if his plane did go down into the vast Atlantic, he would be safer in staying with it.

About twelve hours after take-off, the *Spirit of St. Louis* crossed Newfoundland and edged out over the ocean. Later, the weather closed in and he was compelled to fly on instruments. Although they were simple and few compared to today's intricate systems, they comprised every instrument of practical use then available, including the newly devised earth-inductor compass.

When the weather was clear, Lindbergh flew a pre-set compass course, correcting for wind-drift by observing how the wind blew the foam off the breakers. To do this, of course, he had to fly low, and once or twice the salt spray actually splashed the wheels of his plane, as if the hoary sea were reaching up to drag down its conqueror.

Twenty-seven hours after he left New York, Lindbergh sighted the lush greenness of Ireland. He knew that he had won — that the tensions, the uncertainties, and the racking fight against drowsiness were finished. Over England he flew, noting especially the small, neat farms; over the Channel, and on into France.

Although he had packed five sandwiches in a paper bag before leaving, he had not touched them. From a canteen, he had taken only a few sips of water. Now, after flying for thirty-two and a half hours, and with Paris only another hour away, he reached down under his seat, picked up one of the sandwiches and began munching happily. ■



WHEN NATURE BLOWS

HER TOP

Cone of Parícutin volcano in Mexico (left) born in 1943, grew to 1600 feet in eight months time. Ancients explained thunder in volcano depths as hammer blows of Vulcan (below), Roman god of fire and metal.



of performances rivalling the exhibition staged by far-off Ilha Nova II. At one point the Hawaiian volcano sent up a giant fountain of golden lava 1,650 feet high. A dozen fissures opened up on the slope sending rivers of lava down to form a 35-acre lake on the valley floor.

But Nova II and Kilauea-Iki were mere playful children compared to some of the monsters nature has created over the ages.

From the dawn of civilization, volcanoes have brought terror and death wherever they have thrust up through the earth's brittle crust.

The ancient Romans used to watch in dread as fire and smoke belched from the mouth of great Vesuvius near the Bay of Naples.

As Roman children looked up in wonder at the blazing mountain top, their mothers told them Vulcan, the god of fire and metal, was at his anvil forging thunderbolts for Jupiter.

And, as the thunderous roar crackled up from the mountain's depths, they likened it to Vulcan's hammer blows and thus gave all mountains of fire the name Vulcanus which in time was changed to Volcano.

Others who watched the fitful fires etched against the night sky swore the glowing mouth must be an entrance to Hades itself and fearfully turned away.

The Romans' fear was not unfounded. Vesuvius had been "dead" for centuries when it suddenly erupted in 79 A.D. Within eight days, it had buried the resort city of Pompeii beneath a blanket of rock and ash and killed nearly 20,000 people.

Nor was Vesuvius the most damaging of the mountains of fire that dot the globe. There was the titanic blast of Tambora on Sumbawa Island in the Indian Ocean east of Java in April, 1815, which ripped 4,000 feet off the top of the great peak and left a death toll estimated at from 12,000 to 30,000.

The Tambora eruption lasted a full week and spewed forth a blanket of dust and ashes which enveloped a 300-mile area in darkness for three days and three nights.

More than six decades later in August, 1883, there occurred in the same East Indian area one of the greatest explosions and one of the worst disasters of all time. It occurred on Krakatoa, a wooded island lying in Sunda Strait between Java and Sumatra.

The Krakatoa eruption began with a series of explosions that continued with mounting intensity for 14 weeks. On August 26, the island became enveloped in a mantle of black vapor through which flashed streaks of lightning.

The following day the explosions grew louder. Then, after a brief lull, came a mighty blast. The gigantic spasm blew Krakatoa mountain's main crater to bits and left a hole full of water 900 feet deep where minutes earlier a volcanic peak had risen 2,600 feet high.

A huge wave of water broke over the shore and swept far inland wiping out village after village. When the great tide finally receded it left 36,000 drowned.

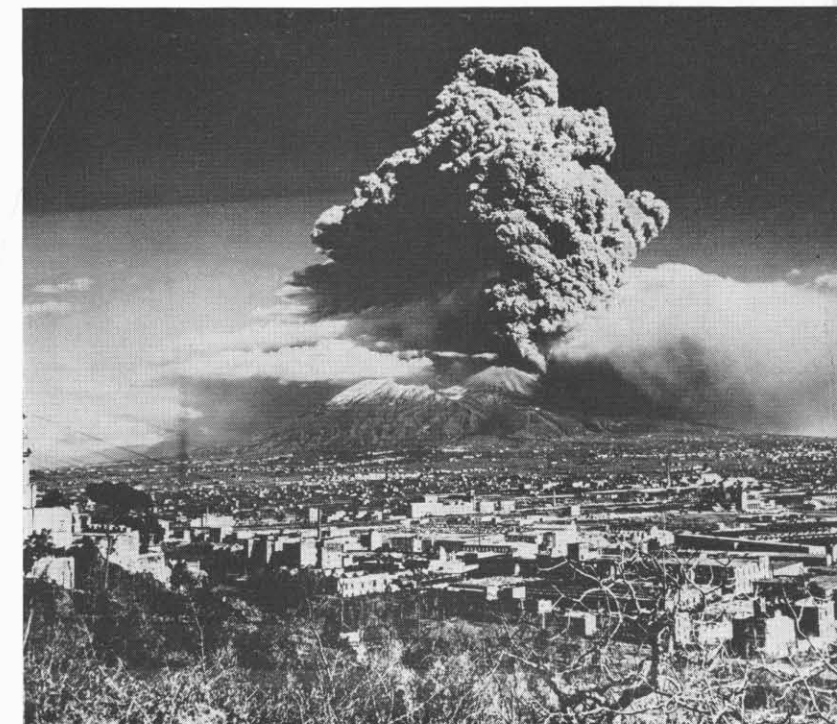
The roar of Krakatoa was heard by a coast guardsman on Rodriguez Island 3,000 miles away. The blast sent ashes and dust 17 miles up where winds swirled them around the globe. Because of the great pall of dust from Krakatoa, sunsets all over the earth gleamed blood red for weeks after.

Most ironic disaster was the eruption of Mt. Pelée in May, 1902. It caught the Island of Martinique by surprise and wiped out the entire city of St. Pierre with its more than 30,000 inhabitants.

For days the crater had been active, throwing up hot mud and rocks, but Martinique authorities assured the people the old peak was acting normally and urged them to stay where they were. After all, Mt. Pelée hadn't erupted for nearly a half century and old timers recalled that the last show had been pretty much a fizzle.

On the morning of May 8th it happened. Within min-

In worst eruption in 72 years, Mt. Vesuvius, Italy, belched forth destruction in 1944, on towns crouched against its crusty flanks.



With a heart of smouldering fire, she slumbers for years—then suddenly awakens into spectacular action bringing terror and disaster

WITH a soft swish, a plume of steam spurted from the mouth of the gray cone that stood tall and grim against the moonlit sky. Then came a thunderous roar and a stream of boulders shot through the opening. White hot, they blazed a fiery trail a half-mile high.

As orange-bright jets of lava sprayed from the inferno's maw in a brilliant cascade, the boulders, still glowing, ended their ascent and rained down on the ash-blanketed slope.

Thus — as a group of scientists and newsmen huddled in awe on a nearby cliff — Ilha Nova II, the world's young-

est volcano, put on a fireworks show that beggared anything man had ever attempted.

Nova II was spewed up from the Atlantic's depths in November, 1957, striking awe and terror among nearby Azores islanders. Just two years later, a much older volcano named Kilauea-Iki awoke from slumber and thundered into spectacular action in the Pacific dazzling more than 150,000 islanders, tourists and news photographers on the island of Hawaii.

For four weeks Kilauea-Iki put on an awesome series

Eruption of Mt. Pelée in Martinique, West Indies (left) on May 8, 1902, resulted in total destruction of city of St. Pierre (below) and the loss of over 30,000 lives.



WHEN NATURE BLOWS HER TOP

utes a great blast of fiery gas roared down the mountain-side and seared its way through St. Pierre. It left the picturesque old city a smouldering mass of rubble. Only one resident of St. Pierre survived the flaming hurricane — a prisoner in the city jail, below street level.

Racing on, the wave of fire swept over St. Pierre harbor engulfing the 18 ships at anchor and killing most of the crewmen.

Largest of Europe's volcanoes is venerable Mt. Etna which rises 10,870 feet above the western shore of Sicily. Ancient writings indicate Etna was active long before Christ's time, but the first recorded catastrophe was in 1169 when 15,000 persons were buried in the scorched ruins of Catania. Etna erupted again in 1669 with a fury that cost the lives of 20,000 people.

The most disastrous eruption in recent times occurred in New Guinea in January, 1951, when long dormant Mt. Lamington suddenly came to life and belched forth a molten mass of rock and flaming gases that claimed nearly 6,000 lives. The atmosphere was so thick with volcanic ash that rescue planes couldn't land for two days.

Just what causes a volcano to "blow" has puzzled man through the ages. In ancient times volcanoes were looked

on with suspicious awe and it was considered wicked to attempt any investigation of their actions.

The Greeks were the first to attempt a scientific explanation. Plato suggested a subterranean river of fire was the source of lava streams. Aristotle referred to "pent-up winds" forcing the molten stone through the earth's crust.

Scientists today believe underground gases force the lava upward until it bursts through a weak spot. The ensuing fountain of rocks and fire has been likened to the rush of soda pop from a bottle when the cap has been removed.

There is also evidence that after internal pressure has started lava on its upward journey, it sometimes encounters an underground river which sets off violent steam explosions and blows an opening in the earth's surface.

Once a volcanic chimney is opened, gases caused by the boiling lava keep the eruption going.

Geologists say volcanoes date back to the dim mists of time, long before man walked the earth. When the world

was young, great fountains of molten stone, hot mud and ash welled up from the ground to form many of today's great mountain chains.

The Miocene epoch of 19,000,000 or so years ago was perhaps the most active volcanic period the world has known. During this distant era volcanoes played a major role in shaping the face of the earth.

In America, the Sierra Nevadas and the Rocky Mountains were thrust up by seething masses beneath the ground. In Europe the great chain of Alps was pushed up from the shifting land mass and in Asia The Himalayas began to attain their majestic height.

Today there are about 500 active volcanoes left in the world. Only one — California's Mt. Lassen which last erupted in 1915 — is on the United States mainland. The European continent has no active peaks except Vesuvius.

Most of the live cones stretch in a belt around the Pacific, dotting many of the islands. South America has a long chain of smouldering mountaintops. Some volcanoes are near the Mediterranean. Others lie in the heart of Africa.

Disasters are few today, because craters which show intermittent activity are kept under constant watch by volcanic experts. These specialists are armed with seismographs, geophones, and recording thermometers. They also make analyses of gas content, take gravimetric measurements and keep a lookout for changes in the earth's surface.

When Sakura Jima erupted in Japan's Bay of Kagoshima in 1914, sufficient warning was given to evacuate the entire population from the area.

Sometimes, of course, volcanoes are born without warning. In Parícutin, Mexico, in February, 1943, an Indian named Dionisio was plowing his cornfield when he saw a wisp of smoke rise from the ground near where his sombrero lay. As he walked over to look, there was a sudden rumbling and Dionisio saw his hat fly into the air on the crest of a fountain of stones.

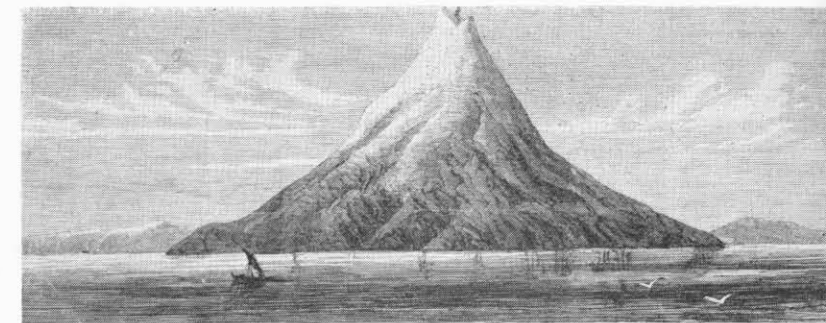
What Dionisio saw in his cornfield was the birth of a volcano. Within nine years, the little mound of spitting pebbles had grown to a vast cone 1,600 feet high and spewed 40,000,000 tons of lava that wiped out two villages and buried the surrounding farmland. Parícutin peak belched forth its last boulder in March, 1952, and went dead — for the time being, at least.

Some volcanoes are constantly active. Stromboli in the Mediterranean erupts so regularly that it has been likened to a lighthouse by sailors who see its red peak glowing through the night.

Others, like Mt. Etna, erupt in cycles fixed by the amount of time needed to generate heat for a new outburst. Still others may lie dormant for hundreds of years, then suddenly flare up.

Scientists classify volcanoes into four types (1) *Hawaiian*, which have fluid lava and erupt with little violence (2) *Strombolian*, with thicker lava which emits gaseous explosions (3) *Vulcanian*, with lava as thick as tar and (4) *Peleian*, which is the most violent of all.

Volcanic eruptions often send forth gases from the surface of lava lakes in the crater which may throw particles of molten lava in the air to be caught by the wind and blown into long glassy threads. Pacific islanders call these "Pele's Hair" after the Polynesian goddess of volcanoes.



Pall of dust blasted 17 miles high by Krakatoa eruption in 1883 caused sunsets all over globe to gleam red for weeks.

With all the havoc they have wrought, volcanoes also have done much good. Besides spewing up mountain chains, they are responsible for land masses, like the great Deccan plateau in India and our own Columbia River plateau. Volcanoes built the Aleutian Islands, Hawaii and Iceland, *not* to mention numberless small isles dotting the seven seas.

One of the volcano's greatest benefits is the rich fertilizing effect of lava. With modern warning systems to reassure them, farmers have settled around volcanic peaks in many parts of the world. The slopes of Etna and Vesuvius are famed for their vineyards and orchards. Many of Central America's volcanic slopes are covered with rich plantations. Java would be hard put to provide enough food for its teeming millions, were it *not* for the potash-rich soil brought down from its volcanic slopes.

Sulphur derived from volcanic gas is mined from craters in South America, New Zealand and Japan. Tin, tungsten and gold are forced near the earth's surface by the force of lava.

The most valuable product of volcanoes is the diamond. Made of carbon in its purest form, diamonds are found mainly in the necks of old cones that have been weathered out of existence. Scientists believe the precious stones were formed when the lava was cooling and great pressure was exerted on the carbon.

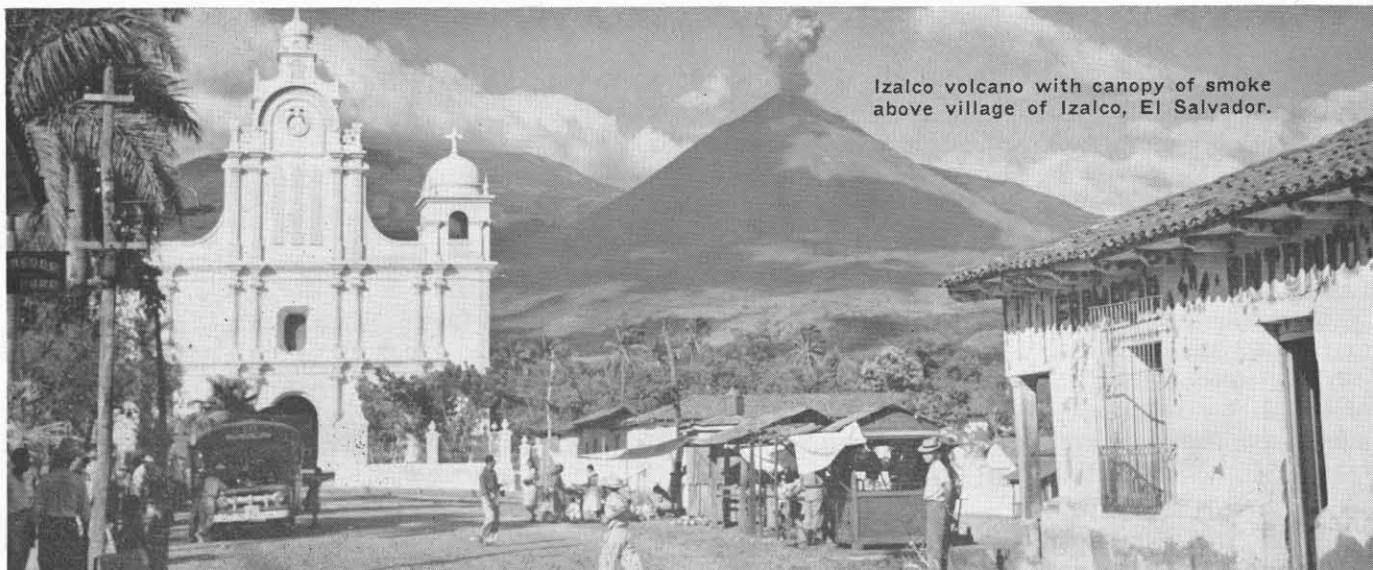
The natural steam given off by volcanoes has been used in Iceland to supply houses with hot water. Nearly 3,500 homes in Reykjavik are heated with volcanic steam. Public bathhouses there also are supplied with natural hot water.

The craters of extinct volcanoes have been put to varied uses. The gradual accumulation of rain water has turned many into picturesque lakes. Those which form natural enclosures, as in Aden, on the Arabian peninsula, are used as reservoirs.

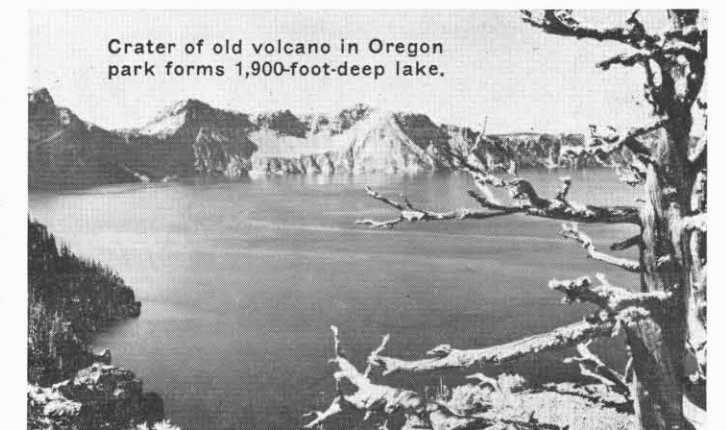
Many mildly active volcanoes have become tourist attractions and people come from thousands of mile to see the fireworks display or peer down into the glowing crater.

Mt. Pelée put on such a show just before it blew and wiped out the city of St. Pierre.

Izalco volcano with canopy of smoke above village of Izalco, El Salvador.



Crater of old volcano in Oregon park forms 1,900-foot-deep lake.



PEPPER has been a hot item for at least 5,000 years. The ancient Egyptians buried peppercorns with their dead. Alaric the Goth demanded 3,000 pounds of pepper as partial payment for sparing the city of Rome in 408 A.D. The pungent spice was even involved, although indirectly, in the discovery of America, and pepper trade with the Orient brought prosperity to our forefathers.

Captain Jonathan Carnes sailed his schooner *Rajah* to Sumatra just after the Revolutionary War and brought back 150,000 pounds of pepper, which netted him a 700 per cent profit. Soon more than 250 ships were sailing from Salem in search of the precious black berries. Pepper enthusiasts claim that it is responsible for the formation of the American merchant marine, which played such an important part in this country's early history. Still bolder claims say that if it were not for the import taxes on pepper America would never have survived her infancy. At one point, duties from Salem alone amounted to about five per

cent of the federal government's total annual budget. It is not far-fetched, according to others, to claim that if Columbus had not set out to find an all-sea route to the spice lands of the Indies in 1492, he would never have stumbled across America. Six years before Columbus set sail, Portuguese traders were searching for pepper, and in 1498 Vasco da Gama found the home of pepper when he reached the Malabar coast of India. The Venetians and Genoese, who had monopolized the pepper trade for centuries, watched Portugal run away with it and control it until the 17th century.

Pepper is never destroyed by insects, never deteriorates or shrinks, and can be stored almost indefinitely. Ancient peppercorns found in excavated Egyptian tombs were still somewhat pungent. In the past, pepper was recognized as a form of wealth and had the same value as gold or silver. Tenants paid rent in pepper (the term "peppercorn rent" still survives); pepper was included in a bride's dowry, and inheritances were considered meager if some pepper was not included. Oliver Goldsmith wrote in one of his plays, "Who pepper'd the highest was surest to please." Guards on the docks in Elizabethan England were required to sew up their pockets to forestall pepper pilfering from incoming ships. Indeed, it might be said that they were dealing literally in "hot" pepper! And the most important English guild at the time was the "Worshipful Gild of the Pepperers."

The pepper trade so flourished that in 1595 the Dutch founded the East Indies Company, with France and Denmark soon setting up similar enterprises. The most famous of these trading companies was the English East Indies Company, chartered by Queen Elizabeth in 1600. This historic company sent many ships laden with cloth, mirrors, guns, and metal goods to the Indies in exchange for spices, particularly pepper. Officials sometimes issued foolish commands in their eagerness to get all the pepper they could. Ships were lost rounding the Cape of Good Hope because all the ballast had been removed to make room for more pepper.

Although salt and pepper have been keeping company for years, they have nothing in common. Salt is a mineral and essential to most diets; pepper, a vegetable and merely

a fillip to one's palate. Salt has a solid and respectable history; pepper's past is as exciting and romantic as the *Arabian Nights*.

Pepper, the dried fruit of *Piper nigrum*, is a climbing vine native to the Travancore and Malabar areas of India, from whence it was introduced to Java, Sumatra, Borneo, the Malay Peninsula, Siam, the Philippines, the West Indies, and recently, Brazil. The plant thrives on plantations even when removed from its native habitat in the moist jungle shade. Pepper vines climb on trees or poles by roots as ivy does and require five to seven years of careful cultivation. At harvest time the berries are red, resembling clusters of currants. Green peppers, chili peppers, pimento and cayenne are no relation whatsoever to the genuine *Piper nigrum*.

Pepper derives its pungency from resin, its flavor from a volatile oil. In the U.S. pepper is sold in four forms — whole and ground black, and whole and ground white pepper. In 1958, the United States imported about 38,000,000 pounds of pepper, of which 34,000,000 were black pepper. The average American housewife uses only about seven ounces of pepper annually, but it is the most popular spice on the table. In the last five years, pepper has soared to new heights on the "spice" parade, increasing 30 per cent over the 28,000,000 pounds imported in the first half of the past decade. That's quite a jump, considering the population rose only 19 per cent in the same period.

What is responsible for this tremendous rise in the demand for pepper? The American Spice Trade Association believes that it is due to a more lively attitude toward food. Wartime experiences and wider travel have brought people in contact with foreign foods and flavors. The current gourmet trend has whetted people's appetites for better seasonings. Restaurants featuring especially interesting Continental cuisine now often package their specialties for sale in food stores and encourage people to experiment on their own. More salads are eaten today, and the preparation of salad dressing has become a real *tour de force*. More people are employed, which means that more lunches are carried, and the popular sandwich fillings such as bologna and liverwurst are chock-full of pepper.

Pepper was, for many years, man's first means of refrigeration; during the Crusades it was used to preserve sausages. In 1956, some 20 per cent of the pepper imported was sold to meatpackers in this country. Peppermills are now common household items, but restaurants which went along with the trend and put peppermills on their tables, found they had to retrieve them after the entree — too many customers were "collecting" peppermills.

Pepper has also been considered as a medicine. One medieval book of cures recommends that to cure aches and pains "the patient is to take nine peppercorns." Pepper was used by the ancient Aryans for dyspepsia, malaria, and delirium tremens. The Egyptians used it for embalming, and Indians use it today to cure toothaches. French and Dutch housewives use it to kill moths and as an insect repellent.

But what about the peppercorn itself, whose chronicle covers 5,000 years? The peppercorn consists of a wrinkled black outer shell and a lighter kernel. Aging alone is responsible for the difference in black and white pepper. To obtain black pepper, the berries are picked from the vine when still green and allowed to dry until the skin becomes black and shriveled. The grain inside is still white.

Black pepper production is four times that of white, which is milder. Housewives prefer white pepper for use in cream soups, white sauces and salad dressings of mayonnaise where the black specks are too conspicuous. To produce white pepper, berries are left to ripen on the vine late into the growing season. When ripe, they are soaked in pools of water until the husk becomes soft and can be peeled off easily, exposing the white kernels, a process known as decortication.

Speculators have always eyed pepper as a long-term investment. The price rises and falls with the weather, the size of the crop, and is sensitive to almost any change in



Pass the **PEPPER**, *please*

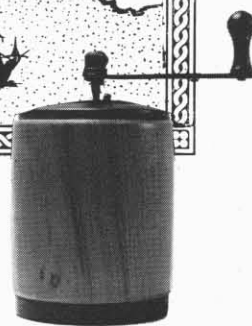
*Pepper has been a hot item for at least 5,000 years
from ransoming Rome to*

*and it's been called on for everything
killing moths and curing aches and pains*





The major sources of the world's pepper, as shown by the dark areas on the map, are India, Ceylon, Indonesia, Borneo and Brazil.



PASS THE PEPPER, PLEASE

the world situation. During the recent Suez crisis, pepper doubled in price because it took longer to transport it around the Cape. The average wholesale price rose from 3.8 cents a pound before Pearl Harbor to 10 cents a pound in 1945 under price controls, but it reached an all-time high of \$2.66 in August, 1950, during the Korean conflict.

About 20 years ago, a group of London investors — acting on a tip that the year's pepper crop would be small — attempted to corner the world market. Their strategy was simple: A small crop would be exhausted early in the season as the growers struggled to fill orders for black pepper; there would be very little pepper left on the vines later in the season when the demands for white pepper began to come in. The plot was to buy up as much of the existing supply of white pepper as possible — about 50,000,000 pounds — and then put the squeeze on the market.

The pepper crop that year promised to be larger than they had originally expected, so they decided to make their move early. The buyers were jittery and uncertain, and the investors knew they could still get a good price. But on the eve of the day the plot was to be sprung, 13,000,000 pounds of white pepper were unexpectedly dumped on the London

market from the Orient. Merchants bought eagerly, and the plotters were ruined. Several old commodity houses collapsed, stockholders lost almost \$10,000,000, and the would-be pepper kings went to jail. The scandal put London's pepper business in chaos and helped to establish New York as the new, world pepper market.

The London investors were bewildered. What had they done wrong? Where had all that white pepper come from so early in the season? The answer was as simple as it was devastating. Oriental pepper growers had gotten wind of the plot and had done some fast thinking. White pepper is black pepper decorticated. Nature does most of the job if the corns are allowed to over-ripen on the vine; decortivating pepper early in the season is an expensive process, and the difference in price between black and white pepper does not usually justify it. But when a shortage — or the suspicion of a shortage — exists, the market price of white pepper jumps completely out of proportion. The London investors created the suspicion — the cannv growers proceeded to take advantage of the situation. They converted most of their early crop of black pepper to white by hand and shipped it to London as fast as they could. By beating



Black pepper is the fruit of a vine whose leaves resemble philodendron. During harvest time, the entire spike of pepper is broken off the vine.



Black pepper production is four times that of white, which is milder. Housewives prefer white pepper for use in light soups and sauces where the black specks would be too conspicuous.



After drying, berries become hard, shrivelled peppercorns. Spice is brought to U.S. in this form and ground here.

the London investors to the buyers, they had exposed a plot, destroyed a market, and made tidy fortunes for themselves.

During World War II, an attempt to capitalize on world shortages by stockpiling 60,000,000 of pepper was uncovered by the United States government, and the pepper world was thrown into confusion. After all, 60,000,000 pounds of pepper is something to sneeze at. ■



*The world
has seen
a lot of smooth sailing
over its
man-made water routes*

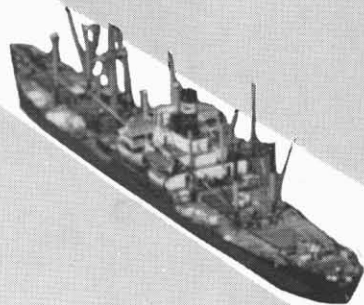
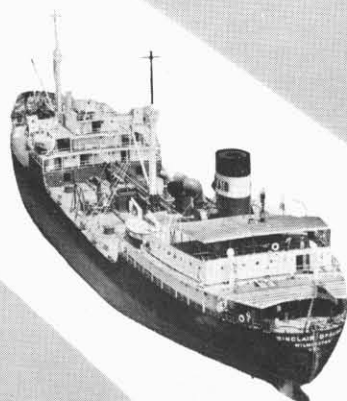
CANALWAYS

VISITORS to the new St. Lawrence Seaway are impressed by the sight of a great ocean ship *crossing a bridge* over a highway. If you are in an automobile, you can drive right under the moving vessel.

This is the latest of a multitude of strange sights that have startled the world since engineers first built canals and took ships where nature failed to provide passage for them. Egyptians, watching canal boats that seemed to sail right across the sands centuries ago, must have been just as impressed. Roman travelers in 400 A.D. brought home tales of boats that disappeared under hills in tunnels: these were canal boats taking fresh produce into Rome. And a century ago, visitors to New York State gazed in awe at boats — sometimes trains of them — crossing the Mohawk on an aqueduct high above the road that paralleled the river bank.

If you had journeyed west across Pennsylvania in 1834 you would have seen boats leaving, like trains, from a downtown railroad station. At one such station in Philadelphia, you would have boarded the Pittsburgh car — which wasn't a railway coach at all, even though it ran on rails. It was, actually, a boat cut in half.

For 90 miles this half-boat, pulled by mules, ran on the railroad and you heard the click and clatter of wheels. Some hours later the tracks ran downhill into water — and you found your half-boat afloat on the Pennsylvania State



The Grand Canal, nearly 2½ miles long and winding through the city like an inverted "S", is the high road of Venice.

Canal. There it was bolted to another half-boat and you proceeded by water. Presently, the boat stopped and again was cut in half. Your section was hauled up a steep inclined railway, to cross the Alleghenies a half mile above sea level — then to be lowered into another canal for Pittsburgh.

All these are some of the interesting oddities of canaling. But it is important to know what *service* canals have performed for the world we live in.

Early in history men discovered that where canals were built, prosperity often followed. Trade increased, industries developed, ideas were exchanged, cities and nations grew.

It was one small English canal, in fact, cut from the coal fields near Worsley to the factory town of Manchester, that helped spark the world's great Industrial Revolution nearly 200 years ago. The English merely applied a principle discovered by Egyptian farmers centuries earlier: a horse can haul 50 times more freight in a boat than in a cart. When the Worsley-Manchester canal opened, coal barges replaced the small coal carts. And for the first time Manchester factories, now beginning to use steam machinery, were able to rely on large, steady, inexpensive supplies of coal. The "mass production" spark lighted in Manchester has spread, since then, to the entire world.

In America, 135 years ago it was another "ditch" — the shallow Erie Canal — that opened the rich Middle West to industrial prosperity. Then the modern Suez Canal, in 1869, began mingling the goods (and people) of Orient and Occident. The Panama Canal, in 1914, was a further great link between the peoples — and business — of East and West. Today astronomical freight moves over these

two waterways: enough every ten years to fill 150,000 good-sized ships.

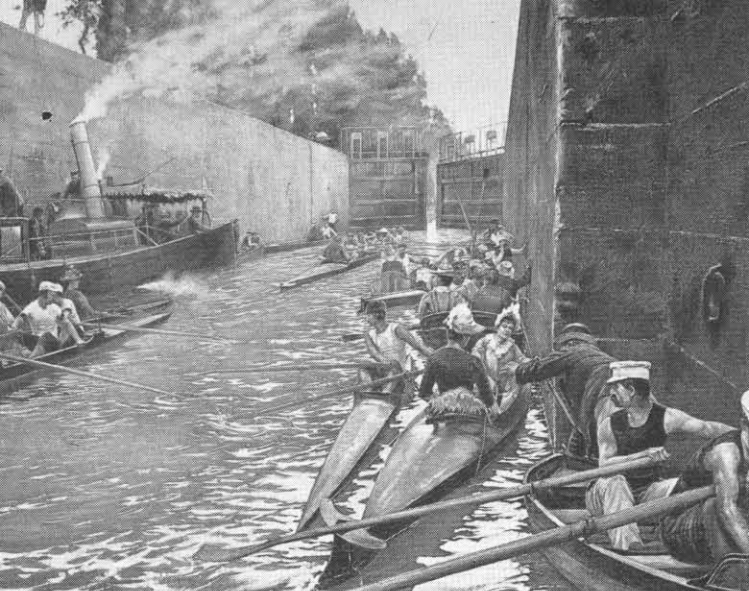
Even as you read this, other major canals are bustling with trade: the Kiel, linking the Baltic and North Seas; the American Soo, busy with ore cargoes from the Great Lakes region; the Cape Cod, a short cut from Boston to New York; the Delaware-Chesapeake, connecting two great bays and industrial regions; Russia's Baltic-White Sea canal, and others. Little barges, often with the crews' wooden shoes neatly lined up on deck outside the cabins, move endlessly on the small canals of France, Holland and Belgium. And other barges still use sections of China's 1,000-year-old Grand Canal. This famous waterway once was so crowded with boats, early writers reported, that it was impossible to see the water.

Where did canals first appear? So far as is known, the answer is: in Egypt. When? As early as 6,000 years ago, when man was just emerging from a primitive to a civilized state. Thus canals are one of our oldest inventions. Some of these early canals were built as military moats, others to please the pride of kings. But Egyptians soon learned to use boats on them and, over 4,000 years ago, one governor was writing quite casually that he had built "three cargo boats and four tow-boats." The great irrigation canals did not begin to be dug until about this time.

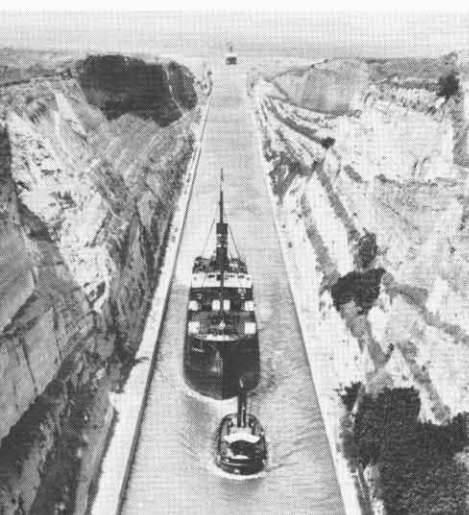
Egypt once was so crisscrossed by canals that horsecarts, the Greek historian Herodotus tells us, completely disappeared. The horses were busy towing boats! One of these early canals was a predecessor of the Suez Canal: it ran east from the Nile (near today's Zagazig) to the Red Sea (where today's Great Bitter Lake lies). But drifting sands



Aircraft carrier heading for the Atlantic after passing through Miraflores lock of Panama Canal.



Fun on a French canal at the turn of the century before the days of heavy traffic.



though Corinth Canal in Greece is only four miles long, it shortens route between city of Athens and Adriatic Sea by about 200 miles.



Erie Canal in New York State, linking Albany on Hudson River with Buffalo on Lake Erie, helped open west to settlement and commerce.



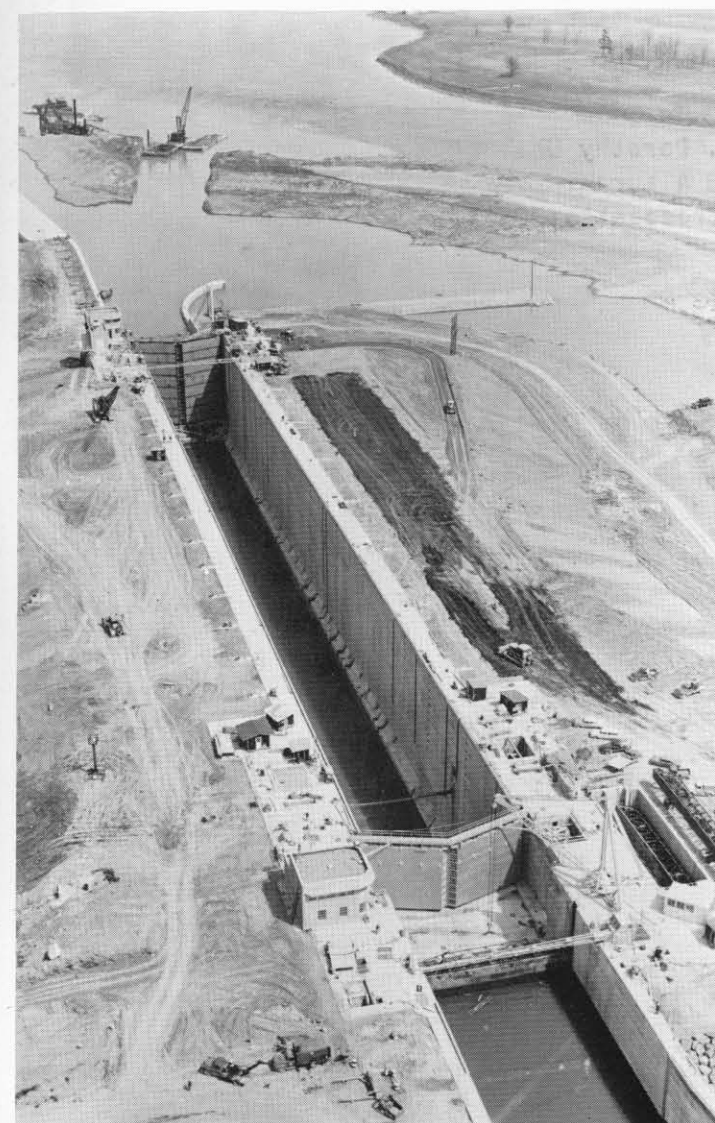
The 103-mile-long Suez Canal knifes through from Mediterranean to Red Sea making possible a short route between Europe and the East.



Germany's 61-mile Kiel Canal connects Baltic Sea with North Sea. Completed in 1895 and deepened in 1914, it handles biggest ships.



Brewer's Canal in Amsterdam, Holland, is typical of scenes in this land of picturesque canalways.



Recently opened St. Lawrence Waterway, 2 342 miles from Atlantic to Lake Superior port of Duluth, Minn., makes available to ocean carriers, ports in the Canadian interior and American midwest.

CANALWAYS

folded across the upper end of the Red Sea, closing the route for centuries. It was re-opened in 486 B.C. — only after many years of labor and the staggering loss of 120,000 lives.

Farther east in Babylonia the Tigris-Euphrates plain was cut by so many canals that a map of them, one historian declares, would have looked like a drawing of twigs on a tree. Today some of these canals are being reopened. There, as in North Africa, passengers in airplanes today sometimes can detect feathery shadows in the sands — traces of the ancient canal networks.

What is a canal? It is a highly engineered, living thing — often born of tragedy. Loss of life on early canals in Europe and Asia Minor was terrific. Even the modern Panama Canal cost 50,000 lives — victims to tropical diseases. Thousands of shovelers died building New York State's Erie Canal. The cause, again, was disease.

A canal is a ditch; but it is also far more than that. Any man can dig a ditch, but he may not be able to get water to fill it. If he gets the water, he may not be able to keep his canal filled. Water seeps down into the ground, leaks out through holes, evaporates in huge volumes. Or floods may come along and wash the whole thing away.

Sea-level canals, which don't have to rise over hills, are fairly easy to fill. As soon as the canals are dug, the sea water merely pours in. But hill-climbing canals must be able to get water from diverted rivers, or from lakes, or special rain reservoirs. Sometimes this is easily done. Other times it is difficult. The Babylonians used to have to fill some canals by hand, lifting water in buckets from the Tigris or Euphrates.

Modern canals that have locks must have large sources of water — in order to replace the great volume lost each time a lock gate is opened for a ship.

To keep water from leaking out once the lock is filled, canals have been lined, for centuries, with bitumen, rock, bricks and bundles of reeds. Today's engineers also employ concrete and a kind of material called "puddled clay" which turns a canal into a sort of watertight dish.

Besides natural leaks, floods and evaporation, canals at times have known other enemies: earthquakes, landslides — and even men and animals. Disgruntled farmers, finding their lands bisected, used to chop holes in canal banks. When one canal was opened across Connecticut in 1835, with great fanfare, the first boat found itself stranded at a lock because someone had cut a hole and let the water out. To add to the embarrassment, the stranded boat was carrying two governors and 200 other dignitaries. Looking ahead, all they saw was a muddy ditch.

In 1809 the Middlesex Canal near Boston was plagued by burrowing animals that caused the water to leak out. The worried owners began offering to pay trappers: five cents for any muskrat or mink caught within a mile of the canal, and 50 cents for any caught within 12 feet of it.

Several times the world has gone through great "canal eras." Will we ever have another?

It is not impossible. Today, canals are easier to build — and the only deaths are due to occasional accidents to workmen. Instead of the armies of hand-shovelers, canals today are built by huge machines that can dig them almost overnight. Some of these can lift 20 tons of dirt at a single bite and return in 48 seconds for another load.

It was such machinery that helped build the 183-mile St. Lawrence Seaway in four years, turning Chicago into an ocean port. Such machines, too, may soon be widening Ontario's busy Welland Canal and the bustling American Soo Locks between Michigan and Ontario. In Asia there is talk of a 3,000-mile canal to link Moscow and Peiping, letting ships make the long voyage from Europe to the Orient without once entering the great oceans. In Central America, it is not impossible that another "Panama Canal" may, some day, be cut from Atlantic to Pacific.

Canals, since history began, have been removing nature's barriers to prosperity and trade. So long as ships ply our seas, more and more canals certainly will be built. ■