THE VERSATILE KERNEL

and on. Did you know dextrin pastes are probably holding your bedroom wallpaper secure? Corn oil is part of soap manufacturing? Aluminum producers get a hand from cornstarch during the refining of bauxite ore? And that even in the manufacture of your glassine lamp shade, certain types of corn syrup are used by the paper mill to retain moisture?

In defense and medicine corn figures heavily. During World War II corn shortages caused some critical moments. "The entire military program is subject to dislocation if the supply of starch and other industrial corn products is not maintained . . ." complained the Undersecretaries of War and Navy to the War Food Administrator in 1944.

Nitrostarch, cornstarch treated with nitric acid, is used in hand grenades and other weapons. Cornstarch is in the powder used for flares and is an essential ingredient of dynamite. A G.I.'s uniform and knapsack are made of cotton cloth requiring cornstarch in its manufacture, true also of gun covers, tarpaulins, barracks bags, hammocks, camouflage cloth, air hose, stretchers, tire fabrics, surgical dressings and so forth.

Typical of the little-known corn product uses is the important role it plays in the serious business of life saving. For example, the miraculous aspects of penicillin are not alone concerned with the drug itself. Miracles have been performed in its production. Corn steepwater played an important part in raising the output of penicillin from the discouragingly small yields of early World War II to the quantity-production scale of today.

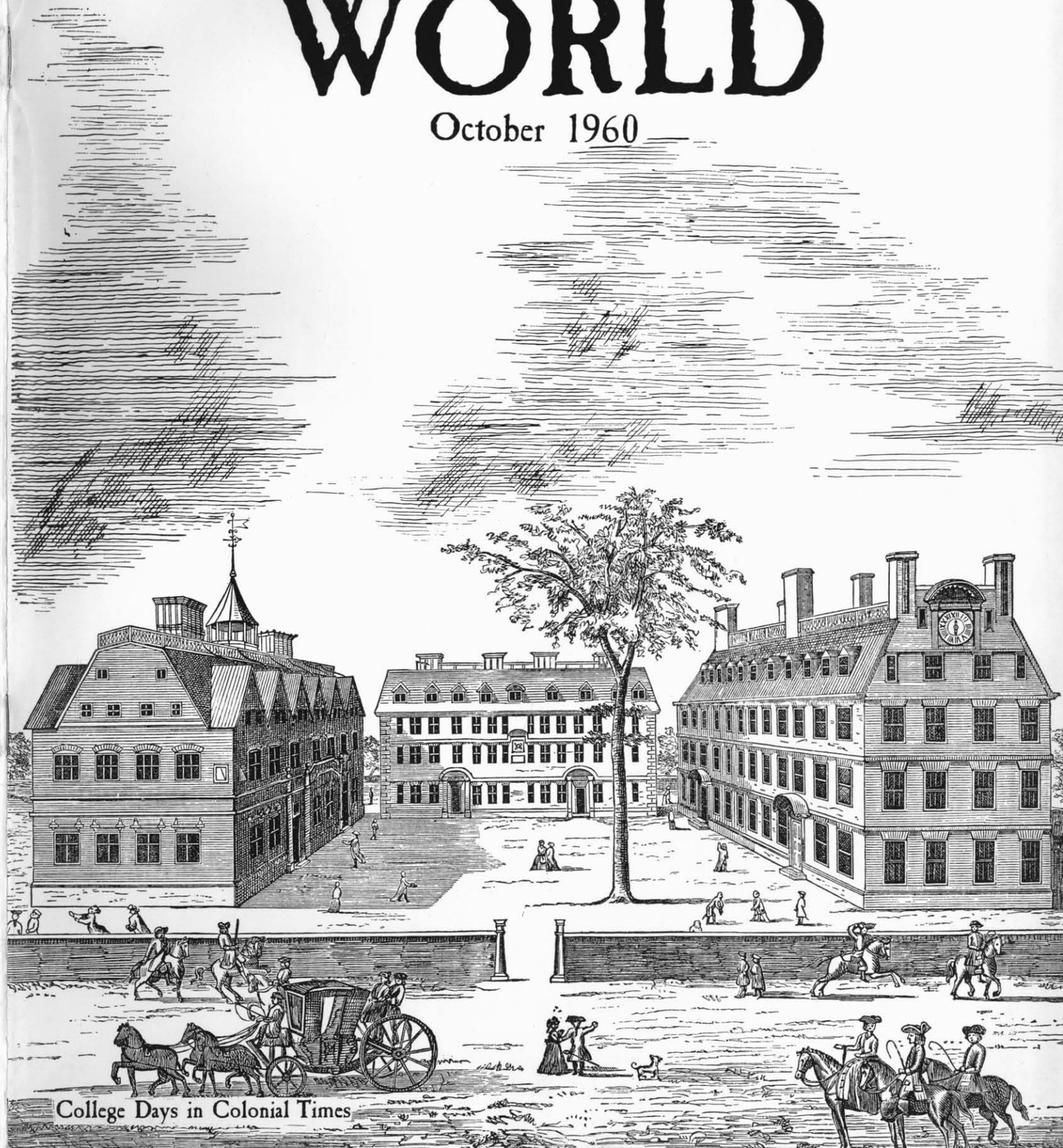
A group of men at Northern Regional Research Laboratory, Peoria, Illinois, in 1941 took on the task of increasing penicillin's yield and recovery. These men knew that corn steepwater, the water in which the whole kernels are soaked preparatory to the corn refining process, was rich in the soluble proteins and minerals of corn and that it was available in quantity. They decided to add steepwater to the medium on which the penicillin molds grew. The molds promptly responded to this change in diet by stepping up penicillin yield. The production of penicillin was eventually doubled.

Corn steepwater also helps in aureomycin production and that of other antibiotics. And less critical, but important, are aspirin and other tablet remedies in which cornstarch acts as the carrier for active ingredients.

What new jobs will be found for corn to perform in the future? The refiners seek to answer this question by some twenty research grants awarded yearly which provide incentive for top scientific minds at work to penetrate the unknowns in carbohydrate science. ■

ARAMCO WORLD

October 1960



College Days in Colonial Times

Aramco World

OCTOBER 1960 VOLUME 11 NO. 8

FRONT COVER: Grandfather of American colleges, Harvard University welcomed her first freshmen in 1636 with a president, two tutors, and one building. The cover engraving shows the university at the turn of the century, when Harvard had developed not only a campus but also a formidable set of regulations to govern life on that campus. Beginning on page 8 is a story telling just what it meant to attend college in colonial times.

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AT WAR WITH TRACHOMA

Research fighters are making Saudi Arabia a scientific battleground in their search for the diagnosis, cause and cure of the world's most damaging eye infection

Aramco trachoma battle leaders, Dr. Edward Murray, of Harvard, left, and Dr. Roger L. Nichols, head of Saudi Arabia field research, study a culture under a hood in ultra-violet lights.

TRACHOMA, one of the oldest diseases known to man, causes more blindness and impaired vision today than any other eye infection. For years doctors could describe its physical characteristics, but the cause of the disease was a mystery. It was not even possible to tell for certain whether a person had trachoma or some other eye infection which merely looked the same.

Then the Arabian American Oil Company launched the Aramco Trachoma Research Program in October 1954, with a five-year grant of $500,000. Extended in 1959 for another five years with an additional $585,000, the program was set up with a three-point objective: diagnosis, cause and cure.

Each of our eyes has a thin, transparent sheet or covering called conjunctiva which lines the back of the eyelids and covers the transparent front part of the eyeball, the cornea. Trachoma is an infection of the conjunctiva which can be passed from one person to another, and by reinfection may frequently last a lifetime and cause permanent scars of the eyeball and lids.

The name of the disease comes from the Greek word, *trachys,* meaning "rough." When untreated the disease progresses through several stages. The third of these is the one that does the harm. The cornea of the eye becomes

Dr. Nichols prepares to take a scraping from inside the upper eyelid. Dr. Nichols drives as many as 20,000 miles a year to treat patients and collect trachoma specimens.

Barbara Buckley, laboratory technician at Dhahran, injects trachoma specimen into yolk sac of a live, week-old chick embryo. Viruses will live and grow only in living tissue.

AT WAR WITH TRACHOMA

cloudy and scarred, destroying some or all of the vision.

Concentration of trachoma is greatest in the Middle East and along the borderlands of the Mediterranean. Eyes of millions of people living in Africa and the Far East, some parts of Europe and South America, also bear tragic evidence of the disease. An estimated 400 million persons, all told, are affected to some degree.

The Aramco-sponsored research project is fighting this global affliction on an international scale. Laboratories for studying the disease are located at the Dhahran Health Center in Saudi Arabia and at Boston's Harvard School of Public Health, whose dean, Dr. John C. Snyder, is director of the program. Doctors on the research team have included Americans, Lebanese, Egyptians, Chinese and Indians. Portuguese and Italian eye physicians have cooperated in various aspects of the investigation. The most intensive field studies made in connection with the program have been carried out in villages of eastern Saudi Arabia, and research in certain phases has been carried on in Egypt, Portugal, Eritrea, Hong Kong, Yugoslavia and Formosa.

Some time after the program got under way, a group of doctors working in China proved beyond a doubt what investigators had long suspected — that trachoma is caused by a virus. This opened the way to the possibility of eventual control of the disease by the same means that doctors have been using for years to control smallpox, yellow fever and, more recently, poliomyelitis.

Investigators agree that the infectious agents called viruses do not strictly qualify as either animals or plants, but nobody can say for certain whether they are living organisms or a complex of inanimate proteins. They do, however, have certain characteristics in common: They are so small that they can go through a filter too fine to pass bacteria, and they are able to multiply when—and only when — introduced into susceptible living cell "hosts."

Long before man knew anything about viruses, he observed that certain diseases such as measles and chicken pox attack only once, and if a victim recovered he almost never had the same illness again because he had become immune.

Well over a century ago doctors began asking themselves the question: If genuine, severe attacks of certain diseases could apparently make their victims immune, would not a much lighter case, given on purpose under controlled conditions, offer similar protection?

In 1794, Dr. Edward Jenner of England inoculated a volunteer with cowpox, a relatively mild disease in man, followed six weeks later with a smallpox inoculation. No evidence of the usually severe smallpox developed in the patient. Similar protection against other virus-caused diseases such as yellow fever and poliomyelitis grew out of Dr. Jenner's pioneering work with inoculations.

It is the long-range goal of the Aramco Trachoma Research Program to find a vaccine with which to inoculate people living in areas where trachoma is prevalent in order to give them just such a defense against this particular disease. But before such a substance can be produced, trachoma researchers first have to find out more about the kind or kinds of virus they are fighting.

They already know that in different geographical areas trachoma is caused by more than one type of virus. But if many types of virus are causing trachoma around the world, the production of a practical and effective vaccine will be difficult or even impossible, and control measures other than a preventive vaccine must be sought.

There is certainly ample evidence that trachoma is widespread. Early efforts in Saudi Arabia were concentrated on obtaining an accurate idea of just how prevalent the disease was in the Eastern Province. Material from the eyes of known victims was collected in attempts to isolate the virus, or viruses, causing the trouble.

Of the approximately 5,000 Saudi Arabs whose eyes were examined between June 1955, some months after the program started, and September 1957, over ninety per cent were found to have what doctors describe as clinical evidence of trachoma.

In order to be able to diagnose with maximum certainty, a clearer clinical picture of the disease has been sought by producing it artificially in the laboratory.

Researchers have cultured four main kinds of bacteria, including some found in normal as well as trachomatous eyes. They also isolated 67 different strains of viruses, of which all but two have been identified as infectious agents associated with respiratory disorders which frequently cause a sticky material to appear along the rims of the eyes and give the patient the appearance of having early trachoma. When such symptoms are present it is very important that the virus at the root of the trouble be identified as accurately as possible in the laboratory.

Two terms often heard around virus research laboratories are *inclusion bodies* and *elementary bodies*. Elementary bodies are individual virus particles which, when stained with a special dye, show up under high microscopic magnification as tiny clusters of dots. An inclusion body is a virus colony in a living cell in which elementary bodies are found embedded.

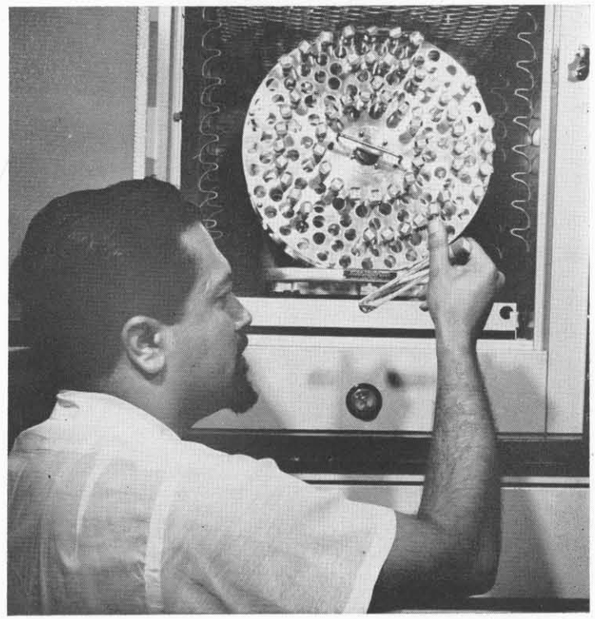
Research in virology has shown elementary bodies to be the real villains. They multiply and burst out of the inclusion body and the cell holding them, thus intensifying and spreading infection and disease.

It must be found whether there are one or many kinds of elementary bodies causing the disease before researchers can proceed to select strains of viruses in order to make vaccine to combat trachoma and evaluate the role of a vaccine in the prevention of the disease in man.

Hens' eggs containing six- to eight-day-old chick embryos are the culture media used to isolate the elementary bodies of trachoma. Viruses multiply and survive only in living cells. Trachoma specimens are injected into the yolk sacs. At least once daily the eggs are examined with a bright light placed against the shell — the candling process used by all poultrymen — to determine if the embryo is still alive.

If the embryo shows signs of life after four days, there is hope that some elementary bodies have "taken" in the yolk sac and are multiplying there. At the end of a week those eggs still alive are broken, the yolk sac is removed — or "harvested" as they say in the laboratory—and the material is then injected into another egg containing a week-old chick embyro.

The process is repeated every seven days as long as the



Dr. Azmi Tobia Hanna cultivates cells using eye scrapings he has obtained from victims of the most damaging of eye infections.

embryonated eggs being used during any given week survive and are able, at least in theory, to propagate viruses. The object of these successive "passages" is to be able to observe them under a high-powered microscope.

Research laboratories in Boston use 80 dozen eggs a week, and the Dhahran Health Center laboratories use six dozen, supplied every week by a hatchery in nearby Dammam, Saudi Arabia.

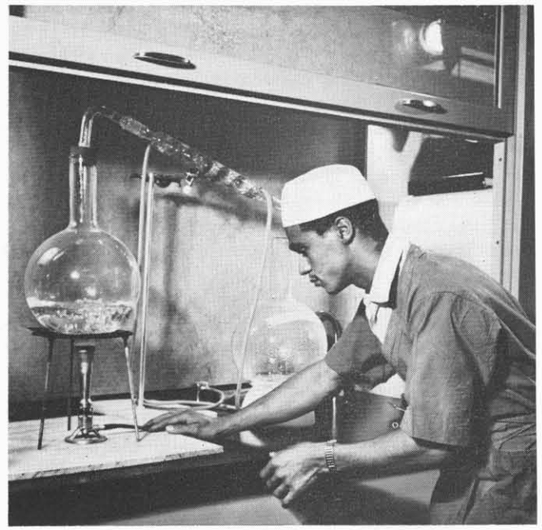
The question then is how are these infectious agents used to attain the goal of giving human beings protection against trachoma?

Over a score of strains of the elementary bodies of trachoma have been isolated. Now attempts are being made to classify these strains into distinct types. In the meantime, information was needed as to whether one particular strain would be able to protect against itself and against other recognizable strains of elementary bodies, by the principle of immunization.

Although elementary bodies can be grown in embryonated hens' eggs, it has been found impossible to immunize chick embryos against the elementary bodies they produce. An intensive search for a small laboratory animal for immunization experiments ended when it was discovered that certain types of mice died from the toxic effects of a number of strains of elementary bodies they received in concentrated form by injection. This phenomenon gave trachoma researchers a chance to see how mice reacted to the injections of various elementary body strains.

By noting the number of mice that survived, the investigators were able to tell which, if any, strains of elementary body vaccines gave protection against each strain of elementary body viruses.

These time-consuming experiments, which are still going on, showed that there are at least two distinct types of



Laboratory technician Ali bin Rahman distills water at Dhahran Health Center in test-tube war against trachoma.

elementary bodies that can be obtained from trachoma victims in the Middle East. The experiments also proved that it was possible, in some cases, to immunize mice against the toxic effect of trachoma virus! Researchers agreed it was now time to try it on human beings.

Work on this stage of the investigation moved to Portugal, Eritrea and Hong Kong, where selected groups of trachoma victims were inoculated with one of three strains of elementary bodies, and two weeks later the majority of subjects received a second injection. Blood samples were tested for evidence of virus-combatting antibodies after each injection. Results of these tests are still being analyzed.

Back in the second-floor trachoma laboratories at the Dhahran Health Center, embryonated eggs continue to be injected with elementary bodies in isolation experiments, and for this purpose fresh supplies of conjunctival scrapings are always needed.

Medical teams of Americans and Saudi Arabs sweep across eastern Saudi Arabia periodically every year collecting specimens, examining patients. Friendly doctors and technicians set up their informal outdoor clinics of camp chairs, tables and medical kits opposite some village mosque, and their patients, long familiar with the routine, line up for examination.

Such smoothly-functioning teams are taking the war against trachoma to the villages of Saudi Arabia, working in close connection with Aramco Trachoma Program doctors, laboratory technicians, collaborating specialists and other workers with a common goal. If they find what they are seeking, many people throughout the world will no longer suffer the itching and blurring in their eyes, and the world will be free for good from the ancient, stubborn curse of trachoma. ■

Healthy vision for people of all ages is the long-range aim of Aramco's program of trachoma research in Saudi Arabia.

How come the RAINBOW?

What is that pastel arc we see on the rim of the sky?

OF all the magnificent displays put on for us by nature, one of the most spectacular takes place in plain view in the sky. For sheer beauty and splendor, no artist's brush, no technicolored Hollywood production can match the brilliant rainbow. A sudden heavy shower stops; the sun emerges, glinting on the drops still falling a mile or two away, and the result is an exquisite band of color across the sky.

The ancients were more impressed. The Greeks not only sang their praises of the rainbow; they considered it a sign placed in the sky by the gods to forestall wars or damaging rains. The Norsemen believed their gods used the rainbow as a bridge to the earth from their heavenly abodes. Arab legend called it a sign from the Lord that the downpour would stop and there would be no flood.

Certain Indian tribes, while esthetically appreciative, regarded rainbows as evil things that caused droughts by sucking water up into the sky.

Modern man, more scientific, less romantic, knows that this stunning phenomenon is caused by a simple process — sunlight playing on water, usually rain. We see a rainbow when our backs are to the sun and it is raining in front of us. The lower the position of the sun, the higher the bow, and vice versa. Around midday, when the sun is higher than 42 degrees, no bow can be seen, for the refracted light cannot reach us.

A rainbow is a complete circle, but generally we see only part of it — an arc or semicircle — unless we are on a high mountain or up in a plane. The bottom portion is hidden from us, below the horizon, the "ends" of the bow seemingly planted on earth. This gave rise to the expression "pot of gold at the end of the rainbow."

As raindrops are constantly falling, each instant we see another rainbow, which is formed by a new set of drops. Individuals viewing it from different angles, see a different rainbow.

Water — in this case raindrops — acts as a prism, refracting and reflecting light, and dispersing it into its various colors. Sunlight is a combination of seven colors, each with its particular wave length, and these form the natural spectrum we see in the seven concentric arcs of the rainbow — violet, indigo, blue, green, yellow, orange and red. The colors fade into and overlap one another — because the sun is not a single luminous point of light — and rarely do we see more than four of five clearly. In a thin mist or spray, the colors are barely discernible. The larger the raindrops, the brighter the colors.

Rainbows are curved because raindrops are themselves curved. They consist of an inner or *primary* band of color and an outer or *secondary* band. The inner arc is the brighter of the two, and its colors are arranged in reverse order to those of the outer arc.

Occasionally, rainbows are formed by the light of the moon. As this is rather feeble, compared to sunlight, the colors are faint. "White rainbows" — halos around the sun or moon — are caused by light shining through tiny ice crystals. Sundogs — colored patches on either side of the sun, somewhat resembling rainbows — are formed by crystals falling through air.

Cataracts, waterfalls, fountains, even lawn sprinklers often produce rainbows — the whole circle. Some splendid bows can be observed at Niagara Falls.

Snowflakes, since they are opaque, can never produce rainbows, nor can tiny cloud particles. When rainbows are reported during a snowfall, it means that the snow is half thawed or accompanied by a drizzle.

Compared with the awe-inspiring aurora borealis, or northern lights, which, in Arctic regions, illuminate, with dazzling colors, vast stretches of sky, the rainbow may seem relatively puny. But as it is not confined to any one area or region, it is our best known and loved optical phenomenon. Artists, poets, librettists all over the world revere it and use it as a symbol of peace, hope and goodwill.

In other countries and other languages, the rainbow is known by different names. In Italian, it is "the flashing arch;" in Sanskrit, "the bow of Indra;" among North African tribes, "the bride of the sun;" in Central European countries, it is called "the arch of St. Martin," "the bridge of the Holy Spirit," "the crown of St. Bernard," and "the girdle of God." ■

College Days in Colonial Times

Every student knew why he was there: to educate himself for usefulness in a new country which needed him

ANY present-day college student may remind himself how lucky he is just by turning a few pages of the past, back to the good old days when America was young. Great men and great deeds flourished in the seventeenth and eighteenth centuries, and liberty was in the air – except at colleges.

"In the good old colony times,
When we lived under the king,"

Harvard students used to sing merrily, but they were safely in the 1860's. The times they sang about were, for college students, a nightmare of stern laws, rules, study, prayers, punishments and poor food.

Colonial boys, however, not being able to look into the future and make comparisons, thought themselves fortunate to be going to the colleges they had: small, struggling institutions making the best of very little. Times were hard, money was scarce during the seventeenth century in America, and though college planners went fund-raising in England and Scotland, only three colleges managed to get a foothold during the first hundred years: Harvard (founded 1636), William and Mary (1693), and Yale (1701). Theirs was the responsibility and duty of training ministers and leaders for the future.

Beginning in 1740, higher education took a spurt. Seven colleges were founded during the next thirty years: the present University of Pennsylvania, Princeton, Washington and Lee, Columbia, Brown, Rutgers and Dartmouth.

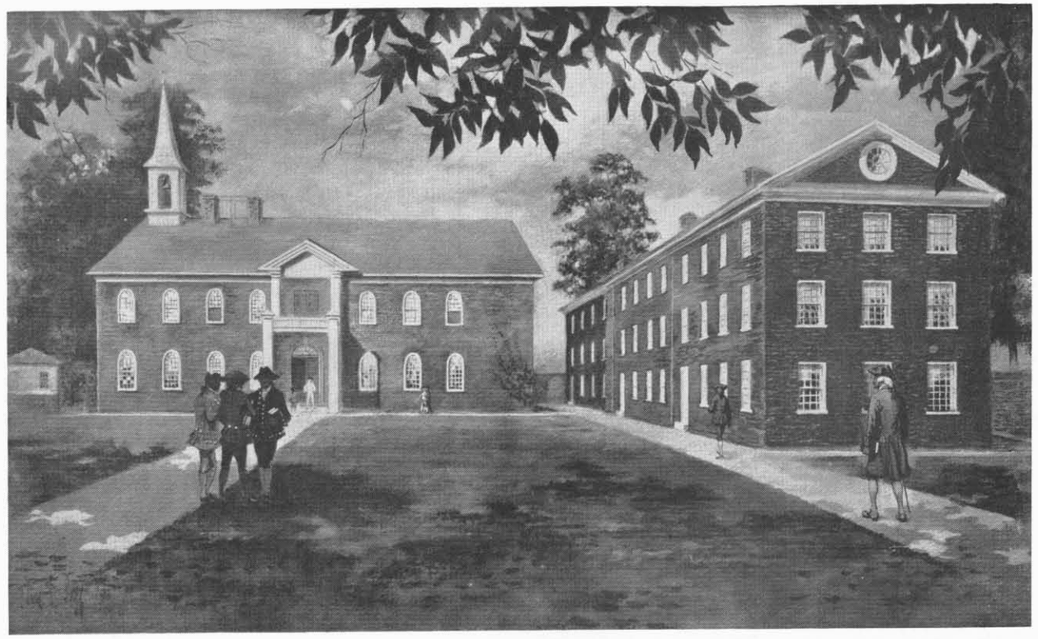
Colleges were so few that the name of state or town easily identified them. Harvard, for its first four years, was simply "the college at Cambridge." In their early years, Princeton was known as the College of New Jersey; Brown, as the College in Rhode Island; Yale, as "the Collegiate School," and the College of Connecticut. The University of Pennsylvania began as the College of Pennsylvania. Washington and Lee grew out of a school founded in 1749. William and Mary was named at its beginning for the rulers who granted its charter, and kept the name, but King's College changed its name to Columbia, and Queen's College later took the name of a benefactor, Rutgers.

College education for women was undreamed of until the nineteenth century. Oberlin College, founded in 1833 as Oberlin Collegiate Institute, was the first coeducational college; Mount Holyoke, opened as a seminary in 1837, was the first women's college.

Reading this roster of historic colleges, we think of them as they are now, with beautiful campuses, modern buildings and dormitories, distinguished faculties. Yet they all began with more ideals than money. It was a great day for a colonial college when it acquired one building for all purposes: chapel, offices, classes, dining hall and student rooms. Harvard's first building was a Master's frame house; her first president had only two young tutors for teaching, and his first graduation class numbered nine. This was the pattern for colonial colleges; even Dartmouth, founded as late as 1769, held early classes in log buildings, after students had helped to build them.

Nor did counterparts of our poised young men of 18 or so enter as college freshmen. The average seventeenth-century freshman was 14, often younger. But in spite of his tender years, he was sturdy – he had to be, to run the many gantlets of college life.

"Freshman are obliged to perform all reasonable Errands for any superior, always returning an Account of the same to the Person who sent them. . . ."
(From Freshman Laws, Yale College, about 1700)



The University of Pennsylvania, founded in Philadelphia in 1740, started with a handful of students and two buildings, the Academy (left) and the Dormitory. Today, more than 16,000 students are on campus.

First, he must appear alone before president and tutors for oral examinations. If he proved that he could write and speak Latin and read Greek, he wrote out a copy of the college laws, the president signed it as permission to enter, and the young freshman proceeded to his next ordeal: meeting the two or three strange students who would be his roommates or "chums."

That first year was one of bondage to upperclassmen. At Harvard and Yale, the freshman class listened to the reading of some two-score laws made especially for them – and designed, apparently, to keep every newcomer forever humble and fearful (or perhaps furious).

A freshman must never wear his hat in the Yard (campus), unless in snow, hail or rain, or when both hands were full. If a freshman's hands were full, it was probably with food and drink for some upperclassman, for he was obliged to serve as errand boy to any sophomore, junior, senior, graduate student or tutor who might choose to give him an order. At their command, he hurried from the buttery with breakfasts of bread and beer (eaten in student rooms); he carried notes, fetched tobacco, took wigs to be curled, and clothes to be pressed. And every errand must be done with great respect – no saucy backtalk, no laughter. Any rebellious lad could expect quick punishment.

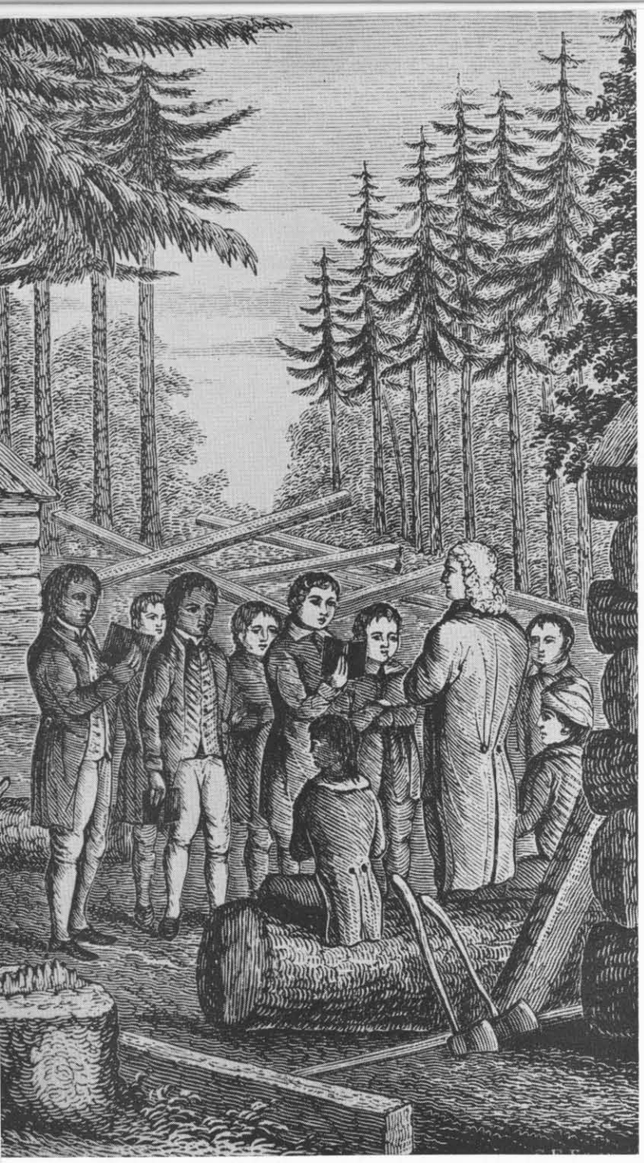
This "freshman servitude" was not just a custom, it was college law; a freshman who refused to serve must leave college. Harvard copied the practice from English universities and public schools; other American colleges followed suit. As a recent Yale president remarked, it was hard to believe that such freshman slavery flourished in the same century in which the Declaration of Independence was written!

When a freshman managed to score on his persecutors, it became part of college legend, like the Yale freshman sent on a long journey to buy a dollar's worth of pipes and tobacco. The young man returned to his upperclassman with 99 cents worth of pipes and a penny's worth of tobacco! But most freshmen could only dream of their sophomore year, when they would give orders to a new incoming class.

Six or nine months after the beginning of freshman year, the faculty wrote the class names on a bulletin board which hung in the buttery (in modern terms, snack counter) throughout their college life. A boy's "place" in the list was decided by his father's prominence. It was not based on wealth or social status in the modern sense, the order being: sons of governors, of lieutenant governors, of members of the governors' councils, of Justices (in the order of the date of the father's commission), of college graduates (in roughly the order of their graduation.) The remaining half or two thirds of the class was placed according to the individual's promise. A judge's son, for instance, was usually sure of a place at or near the top of his class. A Harvard legend tells of the shoemaker's son who achieved a high place for himself by saying that his father was "on the bench."

Holding a top place meant a choice room, being served first at meals, and taking lordly precedence over lower members of the class. One of the most effective official punishments was "degradation": reducing a youth's rank several notches, or even placing him at the bottom of the list. Most displaced students who had so disgraced themselves and their family hastened to mend their ways and so be reinstated to their proper places.

"Placing" ended just before the Revolution, not because the Colonies became more democratic, but because increas-



Eleazar Wheelock, first president of Dartmouth College, holds open-air chapel. Classes, to train missionaries for work with Indians, were held in log cabins, which students helped build.

COLLEGE DAYS IN COLONIAL TIMES

ing numbers of students entered college, and it was harder to rank them. Many complaints, by irate fathers who thought their sons placed too low, helped to end the system. It was replaced by the alphabetical list.

For freshman, upperclassman or president, the college day was a long one. It began at 5 a.m. with morning prayers. Princeton roused its sleeping students with the blast of a horn. A brief breakfast was followed by day-long hours of lectures, recitations and study, broken by dinner at noon and a short recreation period. Afternoon labors ended with evening prayers, supper of bread and milk, and the 9 o'clock bell for bed.

Latin was the language of the classroom and texts and was supposed to be spoken anywhere within college walls. Philosophy, Greek, Oriental languages, and rhetoric led the usual program of studies, with a small amount of mathematics and some history. In the eighteenth century, physics and science became more important. Debates and "disputes" took the place of written themes. Study ended at dark, since rooms were lighted only with tallow dips.

If this 14-hour day seems more than mortal teen-aged man could stand, it often was. Every college tried to keep its students on the grounds, away from any nearby town, and inside college buildings, preferably the students' own rooms. But there were rebels who grew noisy, "hollowed," scuffled, and even jumped through windows or otherwise left college walls — sometimes, as was reported of one Columbia student, returning "thro' a Hole in the College fence at 12 o'clock at night."

These wanderers were usually fined or reprimanded, but for more serious offenses, such as blasphemous words, punishment could be a flogging in front of the entire college. This barbarous custom, based on English practice, lasted almost a hundred years. It was followed by "boxing," with the culprit kneeling to a tutor or officer so that his ears could be slapped. Any punishment meted out was made as public as possible; a student to be expelled was called before a college assembly, his offense read out with great solemnity, and his name cut off his class board.

Food caused more student naughtiness and uprisings than anything else. Most college stewards were penny-pinchers, if not worse, bringing to "commons," or dining hall, food which was poorly cooked, sometimes spoiled, and menus so monotonous that students were driven to desperation. If lamb or veal was cheap, a steward might serve it for days in a row, even weeks. Dartmouth boys complained of unending pork and greens; Yale students hated breakfast "slum" — leftovers made into hash and fried.

Bad butter was almost the rule. Harvard's first student rebellion was caused by rancid butter. Yale students once took the bad butter, used it to make an effigy of the steward, and hung it in the dining hall. Harvard students, sick of daily lamb dinners, gathered bleating and blatting around the steward's house as a gentle hint. Yale boys tried the same method, bleating in chorus in the dining hall. When the next days' dinners were still lamb, students entered commons early, before watchful tutors had arrived at their raised tables, and threw the lamb, platters and all, out the windows.

Harvard students, since fowl was never served in commons, developed a deplorable tradition: they stole turkeys or geese from town poultry yards and roasted the birds over room fires.

In the earliest days, stewards did have some excuse for sameness in menus. Before money became common, many fathers paid their sons' college bills in commodities. Instead of silver or notes, a farm wagon would drive up with payment for John or Samuel: it might be wheat, corn, rye, barley, flour, meal, malt, beef, mutton, eggs, butter, cheese, apples, turnips — or even cattle on the hoof, lumber or shoes. Whatever it was, the steward had to cook it or sell it.

In all the academic records of studies, examinations and punishments, there is no word of planned recreation. It did not occur to a college to sponsor sports or amusements for its students (though Harvard did set aside a small piece of land for a "play-place" in 1712). Still, colonial college boys were like college boys in any century: they managed to find ways to amuse themselves.

One clue to what those ways were is the record of fines. At one time in the eighteenth century, Harvard listed 52 offenses which called for student fines. Breaking these rules, Harvard boys played cards, climbed college roofs, visited town friends and taverns, made rum punch, kept guns, went skating. For some years after 1764, when the General Court presented the college with a "water-engine," Harvard student firemen raced to fires in Cambridge, even into Boston, competing with town crews in being first and most efficient. These "engine-heroes" quenched their thirst with rum-and-molasses and returned to the Yard in such high spirits, still pouring water from the long hose (often through open college windows) that the fire engine finally had to go.

At William and Mary, wealthiest of early American colleges, students erred in gentlemanly Southern ways: kept race horses, backed horses in races, kept fighting cocks, played billiards or sauntered the time away on college steps.

At Princeton, a few convivial students enjoyed such pranks as placing a calf in the Prayer Hall pulpit, but in the decade before the Revolution, the college found more suitable outlets. Students went to cheer the stirring debates of the newly formed and rival Cliosophic and American Whig Societies. They enjoyed these formal arguments as much as later generations enjoyed football. Most of the subjects were public or political issues, though at times the debaters would take up such urgent questions as "Which tends more to relieve a female of celibacy, wealth or a beautiful face?"

At Dartmouth, a-building in the wilderness of New Hampshire, every student was required to spend time in

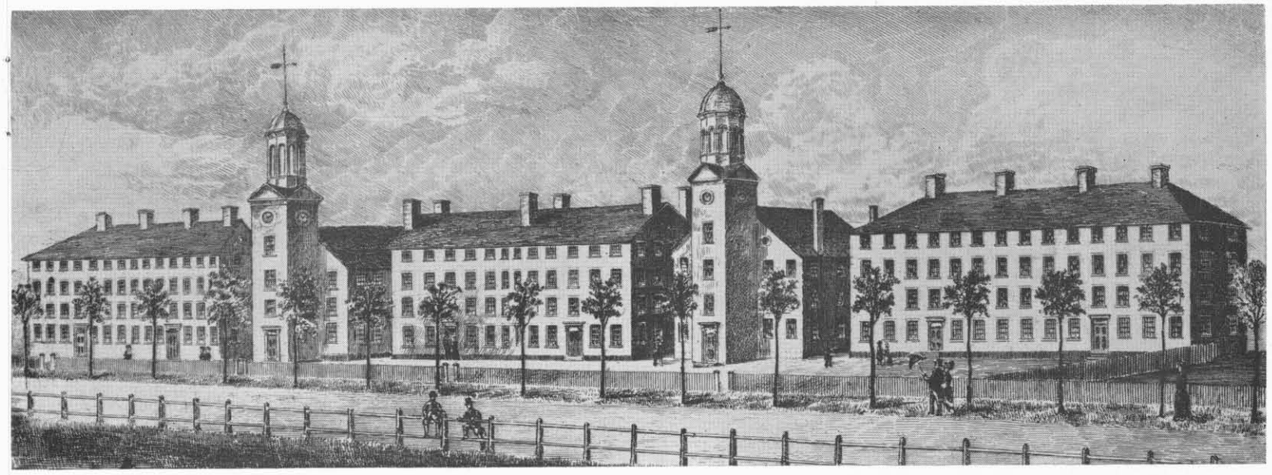
In July 1754, Samuel Johnson delivered a lecture to the first class at King's College, forerunner of New York City's Columbia University. Johnson was entire faculty in one-room school.

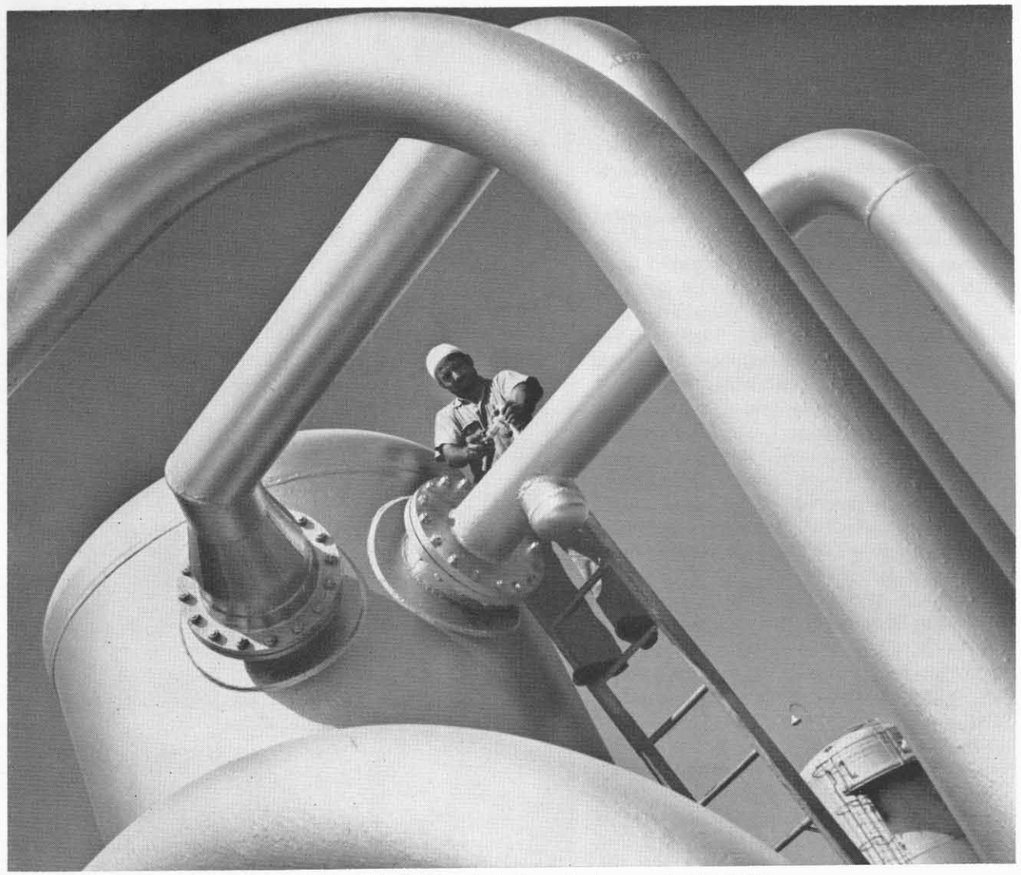
manual labor as well as study. Yet despite this double load, Dartmouth boys found time for fun, and the freshman and sophomore classes of 1772 petitioned to be allowed to spend part of their leisure "stepping the minuet and learning the sword."

For all the endless rules, limited facilities and Spartan living, colonial colleges achieved their aim. Every student knew why he was there: to educate himself for usefulness in a new country which needed him. College graduates went out into the Colonies to found schools and universities, to teach, to serve as ministers, governors, statesmen, lawyers, doctors.

And from colonial classrooms came leaders of the Revolution, men who signed the Declaration of Independence, men who guided their country out of "the good old colony times" into a new era: the United States of America. ■

Yale University, in 1807, reflects growth of colonial colleges from one-building era to time of greatly expanded campuses.

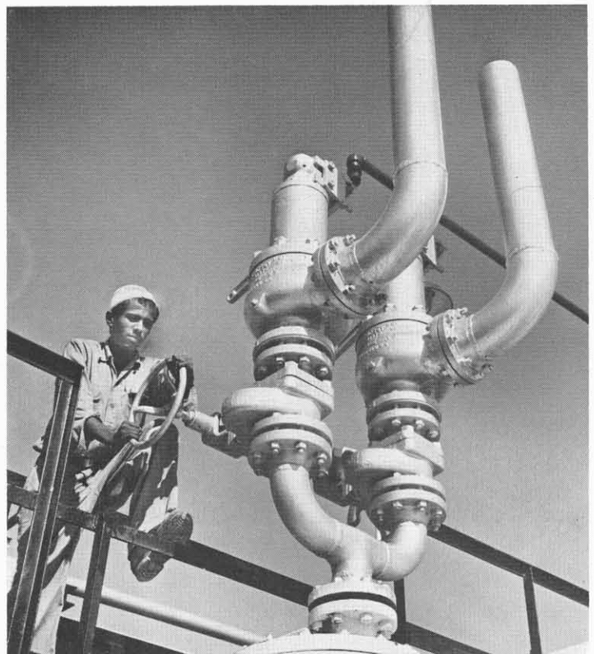


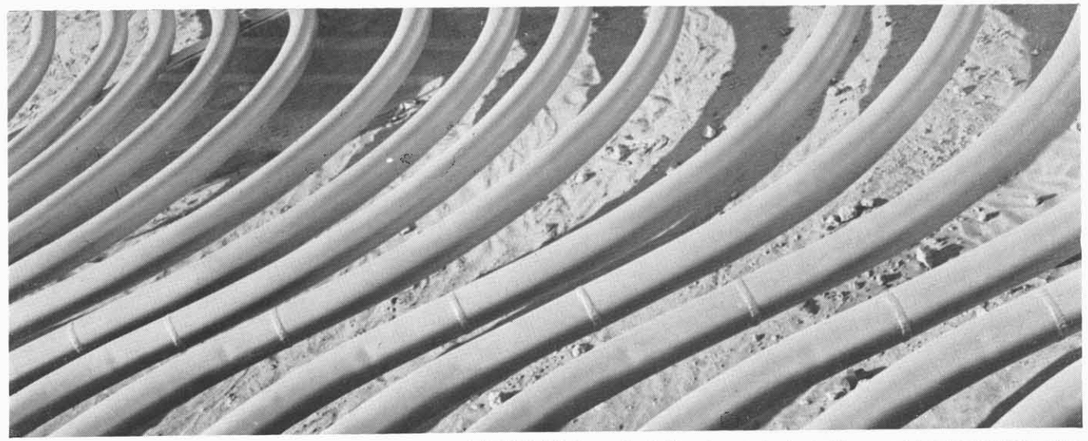


SCULPTURED BY SUNLIGHT and shadow, stout arms of pipe frame an Aramco employee in their graceful sweep at the Dhahran stabilizer.

STAGGERED OPEN ENDS of drilling pipe — big guns of the oil industry — point dramatically at the sky.

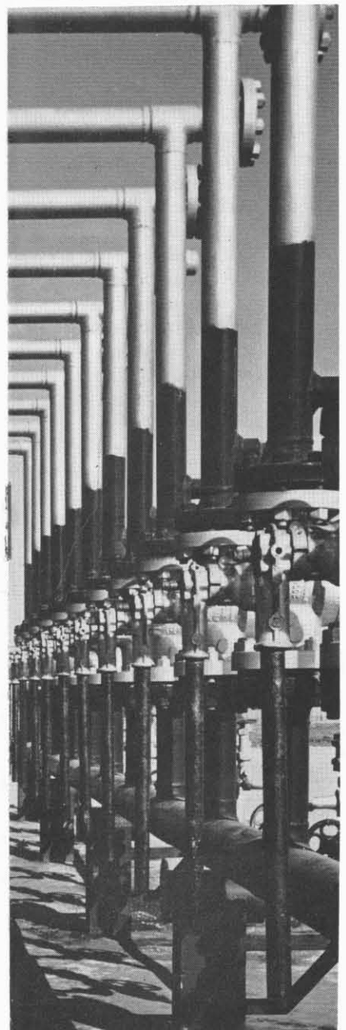
A GIANT CACTUS, wrought in steel, seems to have grown at the Ras Tanura oil refinery.





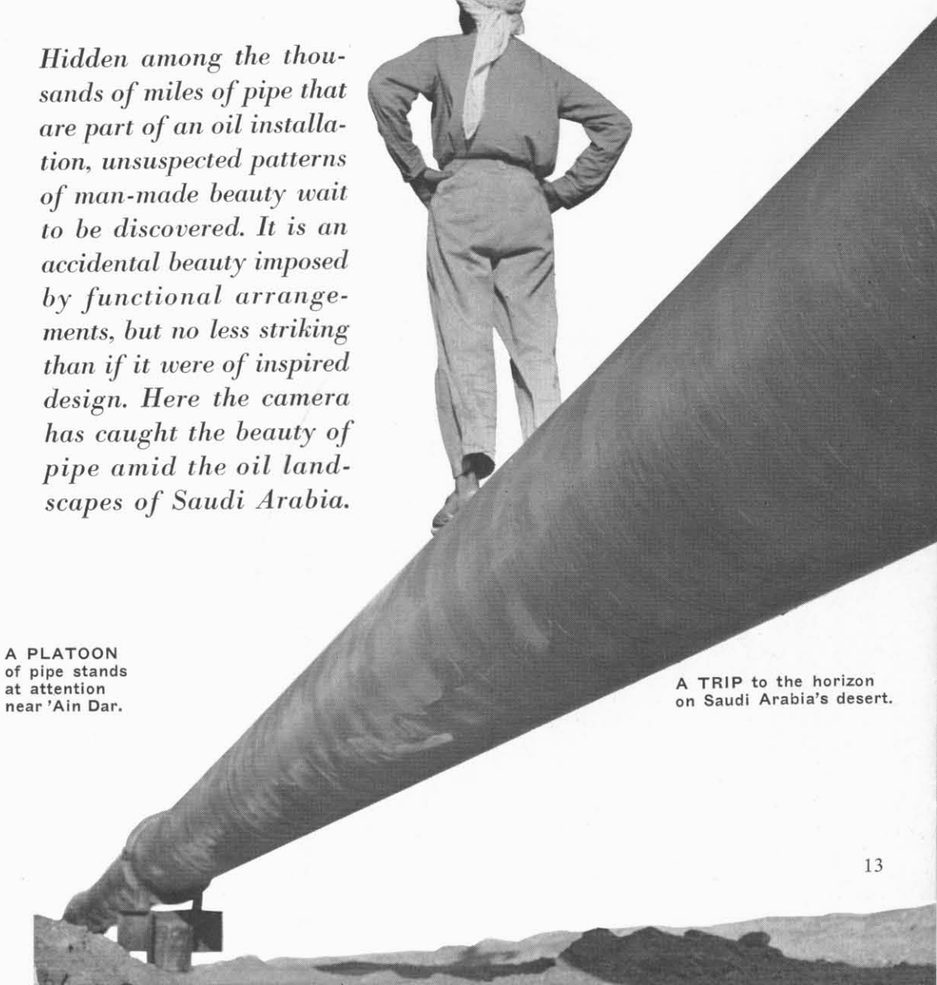
FLOWLINES against Abqaiq sands look like sun-bleached whale ribs.

pipe art



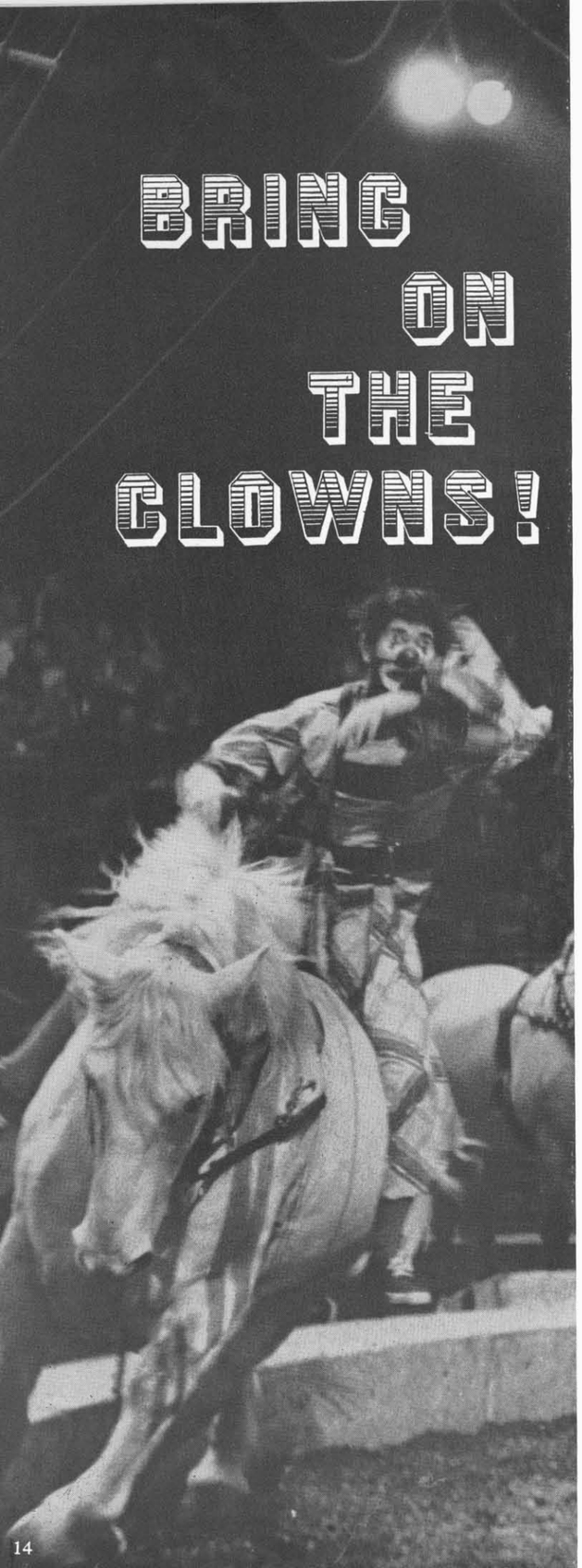
Hidden among the thousands of miles of pipe that are part of an oil installation, unsuspected patterns of man-made beauty wait to be discovered. It is an accidental beauty imposed by functional arrangements, but no less striking than if it were of inspired design. Here the camera has caught the beauty of pipe amid the oil landscapes of Saudi Arabia.

A PLATOON of pipe stands at attention near 'Ain Dar.



A TRIP to the horizon on Saudi Arabia's desert.

BRING ON THE CLOWNS!



There's a little of the clown in each of us, but it takes the genuine minister of merriment to be funny on demand

IF man's history is ever written in terms of his sense of humor, the story will certainly center around the figure of the clown.

So long ago that nobody knows quite when it happened, human beings created a comic character, as a symbol of their urge to laugh at the other fellow and their need to laugh at themselves. Though that character has often changed his dress, makeup and antics, his contribution has always been essentially the same: to show the folly and danger of taking oneself too seriously.

Fortunately, there's a little of the clown in each of us, though it may be hidden under layers of convention, frustration or fear. But to be funny on demand requires either an inborn genius for buffoonery or professional training in how to put over a bit of pantomime or a wisecrack.

The amateur clown has probably been around since men

A jester in Middle Ages was expected to tumble and juggle, as well as possess a witty tongue.

Today's circus clowns, like their acrobatic ancestors, work hard to provide laughs.

lived in caves, and the professional comic certainly was going strong when civilization was exceedingly young. Ancient Egyptian records tell of bands of gaily dressed entertainers, romping through the now-vanished streets of Memphis and Karnak to the accompaniment of drums. Undoubtedly all the Near East had such buffoons. And history tells us that, as early as 800 B.C., there were comics among the tumblers, jugglers and ropedancers who ranged the countryside of Greece.

With them (as later in the more formal comedies of Rome), the farce was very broad indeed, with much falling down and hitting at each other with sticks or inflated bladders. In our time, we have seen the lineal descendants of the perpetrators of such slapstick in teams like Weber and Fields, and Laurel and Hardy. The circus clown is even closer to type, with the bladder become a balloon, and the stick, the policeman's billy. Moreover, even today, the best of our comics, wherever we see them, are likely to be admirable acrobats.

Some of the types found in the ring nowadays are at least as old as Greece and have never lost their appeal; but for the strolling entertainer to develop into the true circus clown took may hundreds of years.

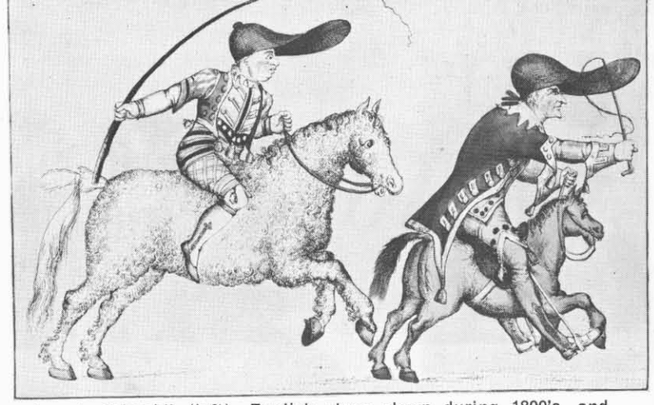
During the Middle Ages, bands of itinerant mountebanks crossed and recrossed Europe, setting up their benches along the highways, on village greens and in castle courtyards. Though there is not too much exact information about those mountebanks, we know that among them there must always have been some sort of funny man, who exchanged witticisms with the bystanders while he tumbled and juggled.

In Italy in the sixteenth century came the first of the improvised comedies of the *commedia dell' arte,* which was the rage all over Europe for 150 years. Audiences laughed uproariously at characters who have been familiar ever since — the sly Harlequin, the silly servant, the braggart soldier, the sloppy old man, the fellow who was forever getting his face slapped. At that time, too, they saw the ancestor of the classic Whiteface.

Nowadays, clowns range themselves in two broad categories — the Whiteface and the August — who often come in pairs. Traditionally, the Whiteface — or as he is sometimes called, Pierrot—is nimble, graceful, elegant, with a touch of sadness in his gaiety. Typically, the August is some version of the wild-haired, wild-eyed, grotesquely-dressed bumbler, whose foot always gets stuck in the bucket, and whose pants are always falling down. He's on the wrong end of the stick, but he almost always turns the tables in the end.

According to legend, the August came into being by a fluke 100 years ago. In the Zirkus Renz in Berlin, so the story goes, a stableboy, trying on clothes too big for him, got into the ring by mistake. The truth is that someone very like August was known to the Greeks and the Romans.

During the past century, there have been numerous famous Whiteface-August couples, who were much funnier together than apart. Circus fans still recall the shenanigans of the Pierrot, Footit, and his dark-skinned August, Chocolat, in Paris in the early 1900's. And of course the straight man and stooge of vaudeville and burlesque are really ver-



Joseph Grimaldi (left), English stage clown during 1800's, and partner, Mr. Norman, in scene from popular pantomime of that time.

sions of the Whiteface and the August.

Perhaps something of Emmett Kelly's longtime popularity comes from the fact that he combines the characteristics of the two basic types. Though his dirty clown face, with the preposterously large mouth, his bedraggled coat, oversized trousers and battered derby are characteristic of the August, his unutterable sadness and slow, thoughtful drollery are closer to the spirit of the gentle and mysterious Pierrot.

We are likely to think of the clown as belonging entirely to the circus ring, but that is too great a simplification. Kelly himself has entertained baseball crowds and been in the movies. In medieval and Renaissance Europe, the court

From sixteenth-century commedia dell' arte came the sly Harlequin.

Dan Rice, Mississippi talking clown, was last of the rovers.

Charlie Chaplin, the clown of the twentieth century, invented famous baggy-trousered tramp. As first movie clown, Chaplin's tramp excited both mirth and sympathy. Red Skelton, (above) brought clowning up to date with repertoire that includes such comic characters as Cookie the Sailor, Deadeye, and Cauliflower McPugg.

BRING ON THE CLOWNS

jester in his motley was a sort of private clown, who could say whatever he pleased, even to the King, so long as he was witty. And some of the most hilarious clowns of all time have appeared on the theater stage.

One of them was Joseph Grimaldi, master of miming, vocal drolleries, makeup and the use of ridiculous accessories. He appeared in the early 1800's in the English Pantomime, which itself began as a Harlequinade, recalling the *commedia dell' arte*. For twenty years, Grimaldi was the idol of London audiences, and it is from him that circus comics get their nickname, "Joeys," though Grimaldi never appeared in a circus.

In Europe especially, clowns of any kind have always used accessories with extraordinary adroitness – especially musical ones. The incomparable Fratellini brothers, noted for their hilarious parodies, could drive Parisian audiences into hysterics by bringing on a saw or a safety-pin as big as a man, a minute umbrella, or an enormous bass fiddle that strolled around by itself.

When the true circus first began in London toward the end of the eighteenth century, the ring comic was always a rider. His first appearance caricatured a current figure of fun, the military tailor, who supposedly couldn't even get onto a horse, let alone stay on one. And thereafter, for almost a century, any circus clown in any country had to be an expert horseman as well as an acrobat. For many years now, most buffoons have depended on their own two feet, but such comic riders as Poodles Hanneford and Lucio Cristiani still follow the original tradition.

In the ring, as on the stage, the early comic had to have a ready tongue, for the snappy comeback soon became part of his stock in trade. The European circus clown still talks a blue streak, because the typical European circus still has only one ring, and he's close to the audience. Americans used to do the same thing, until the grandiose Barnum put three rings into the tent, instead of one.

The most famous of American talking clowns was Dan Rice. Got up as Uncle Sam, with striped trousers and a jaunty top hat, Dan plied his trade in towns on the Mississippi, in the era of the sidewheeler. He used to exchange repartee with the audience, spout topical doggerel, and put several animals through their paces – a "learned" pig he called Lord Byron, a tightrope-walking elephant, a performing rhinoceros, and a trained blind horse, Excelsior. The audience ate it up.

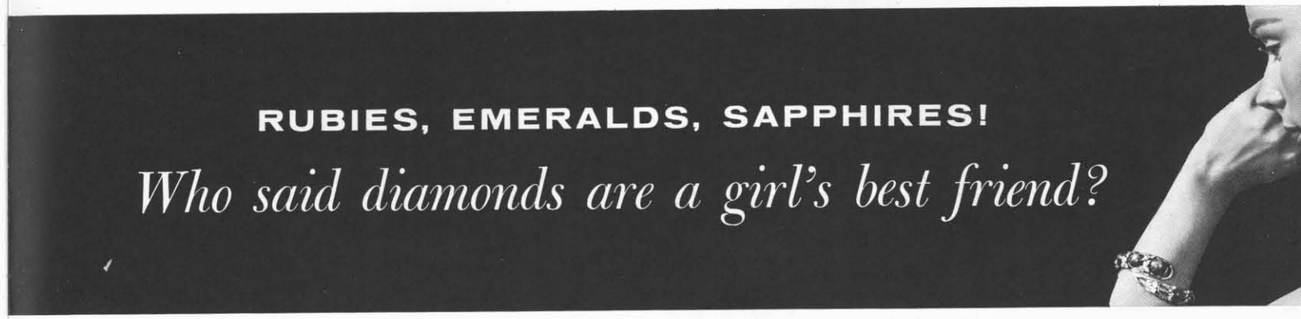
By the time Rice died, the only talking clowns in America were on the stage. That was inevitable. You can't make yourself heard in an arena so large that a person needs a telescope to see the other end; and you can't put over subtleties when everybody is trying to watch a half dozen things at once, with all the attendant hullabaloo. The three-ring comic has to get his effects by grimaces and broad gestures, enhanced by ridiculous accessories. He seldom appears alone, and only now and then does an individual – like Emmett Kelly, Poodles Hanneford, the late Felix Adler or Otto Griebling – acquire a reputation as a solo artist.

Nowadays, with the greater intimacy made possible by the movies and TV, the pendulum is swinging back and the American clown talks again. The funniest men (and women) are likely to be what we call comedians, who use all the old tricks, and invent new ones besides.

Charlie Chaplin acquired deathless fame as the first and greatest of motion picture clowns. The Marx Brothers took over almost every comedy trick ever invented. Red Skelton, who many persons think is the most skillful of contemporary comedians, gets his effects in innumerable ways. He can echo the farce of ancient Greece by falling flat on his face. As a Rube, he is brother to the circus August. And he can enrapture an audience by such a bit of inspired miming as the scene in which, with no accessory except an imagined one, he pretends to thread a needle.

In the circus, clowning may be at low ebb. But the funny man will surely be around somewhere as long as the world endures. ■

THOSE *other* PRECIOUS STONES



A GEM expert might well counsel a smart girl to yearn wistfully for a pigeon-blood ruby from Burma. Or a few carats of true emerald from Colombia. Or a Ceylonese sapphire.

He would tell her that these rarer jewels are often worth more than the finest diamonds of the same size.

The value of a gem is determined generally by four factors: its beauty; its rarity; its hardness and toughness; and the skill with which it has been cut and polished.

Only four gems have the distinction of being called precious stones: the diamond, the ruby and sapphire—both of which are varieties of the same mineral, corundum – and the emerald.

Most important in the appraisal of a stone's beauty is the dispersion of light within and the resulting refraction of color – in short, its "fire."

All green crystals are not emeralds, although some may pass as such. Oriental emeralds, also valued highly, are in fact green sapphires, a variety of corundum, even as the ruby and the sapphire.

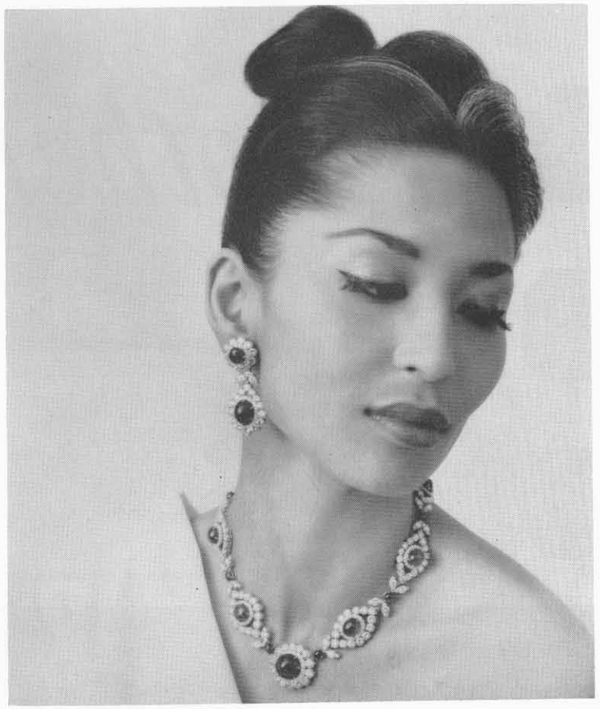
True emeralds belong to the mineral beryl family and are kissin' cousins of the semi-precious aquamarine. Mines in the Colombian Andes supply almost all the true emeralds today. The rich green color is the result of a minute ingredient of chromium in the beryl. This richness of hue makes the emerald an aristocrat of gems, worth a fortune more than its pale relative, the aquamarine.

Most famous of the world's great emeralds is the one set in the papal ring, handed down through more than four centuries to the successors of Pope Clement VII (1523-1534). Francisco Pizarro and his crew in their conquest of the Incas in 1533, looted this, among many fine emeralds, from the temples and royal treasury of the Incan empire. The Incan belief that the emerald possessed great spiritual power may have been Pizarro's reason for presenting the stone to the Vatican.

Incan legend tells of the Emerald Mother, an enormous emerald, on an altar in the Temple of the Sun in Cuzco, capital of the Incan empire. Believing it to be the abode of a sun goddess, worshippers made offerings of other emeralds as the Emerald Mother's "children."

The plundering conquistadores were denied not only this sacred jewel but also the fabulous necklace of the last Incan Emperor, Atahualpa. The necklace is described as having 52 emeralds, each the size of a pigeon egg and each engraved with a symbol of a phase of the moon, alternating with 52 magnificent topazes.

When Pizarro deceived the hospitable Atahualpa and his court at Cajamarca and made them captives, one of the Incan nobles ripped the priceless necklace off his Emperor



The icy brilliance of diamond settings accent the deep red of Burma rubies.

THOSE OTHER PRECIOUS STONES

and passed it to another Incan minister. By group sleight-of-hand it was saved from the conquerors and eventually hidden in a far Andean cave, where it remains to this day, says the legend.

Emeralds found on Egyptian mummies and archaeological discoveries prove there were emerald mines in upper Egypt nearly 2,000 years B.C., but the South American mines, say the scientists, were being worked thousands of years before the earliest Egyptian record — no one knows how long ago. Like the Egyptians, the ancient Incas buried emeralds with their owners, but anthropologists think that the beauty of the emerald had fascinated their aboriginal predecessors many unknown centuries before.

Notable among the historic emeralds of the world is the one that was worn by Alexander the Great, engraved with his portrait. Napoleon, fond of their green fire, gave many emeralds to Josephine. Fine emeralds sparkle in the Iron Crown of Lombardy and many other European royal baubles. The treasuries of Indian potentates are rich in magnificent green gems, but most of these, while valued as emeralds, are actually fine specimens of green sapphire.

Old superstitions about the emerald were amusing and sometimes therapeutic. An unmarried person, it was said, could render himself invisible by possessing one, and a snake would be blinded by gazing at one. On the other hand, the emerald was a sight for sore eyes, even restoring eyesight. It was the custom of gem cutters and engravers to keep an emerald handy to look at when their eyes got tired.

Medieval sorcerers practiced their art with an emerald suspended above a plate whose rim was decorated with the alphabet. As the stone swayed toward the letters, it spelled out messages, omens and predictions, forsooth, for the wizards of the black arts.

In Hindustan the ruby is esteemed superior to all gems, because of its legendary powers to protect its wearer. Ancients believed its glowing red beauty was the eternal flame of life.

Perfect rubies are so rare and precious that few persons can afford them. In hardness, rubies and sapphires are second only to diamonds.

Since the nineteenth century, synthetic rubies and sapphires have been made successfully by the knowledgeable heirs of the alchemists. These synthetic gems are not imitations — like a ruby-red garnet — but chemically identical with the gems formed by nature. They cannot be identified by the naked eye as synthetic. In fact, only gem experts can determine that they are man-made.

Most rubies are found in Burma, in an area once monopolized by a ruler who became distinguished as Lord of Rubies. His secret mines were so efficiently guarded by his successors that nothing was revealed about them until 1885, when Britain annexed Upper Burma.

Ruby mines exist in nearby China, and rubies have been discovered in Ceylon. These, however, lack the rich transparent color of the Burmese gems. A few perfect rubies have been reported from Montana's sapphire mines, and several have been discovered in North Carolina, a state which seems to possess samples of all the great minerals.

Long, long centuries ago, the Oriental looked with awe, even reverence, on the ruby. He called it "the lampstone" and "the glowing coal," because he believed it contained its own eternal source of light. One enduring legend tells of a fabulous hall of an Emperor of Cathay, which had pillars of solid gold and was illuminated by a ruby, six inches in diameter, set into a central column. The grandpas of the period avowed to the small fry that the ruby glow was as bright as day.

A Syrian myth relates of a goddess image with a ruby on her head that lighted the whole temple like a blazing torch, and in the East Indies it was believed that the home of the gods was decorated with enormous rubies to shed light on the divine goings and comings.

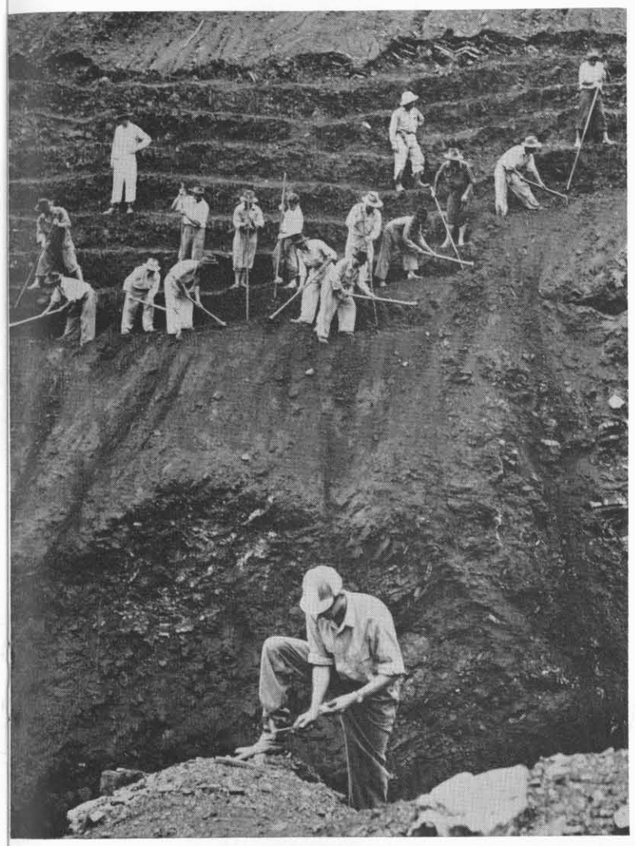
Sapphires occur in more different colors than any other precious stone, although the diamond has many disguises, too. To us, generally, a sapphire means the lovely crystal of velvety strawflower blue or perhaps a translucent Ceylon gem whose inner luminescence forms a star-shaped glow on its cabochon (smooth rounded) surface — a "star" sapphire.

It is ironic that sapphires in various colors — blue, red or green — are cherished so highly for their rarity, since they are all crystallized alumina, identical with the dull corundum that is abundant in common clay found everywhere.

Considering the sapphire's hardness, it is puzzling that the primitive lapidaries were able not only to cut and polish them, but actually to carve and engrave them.

Mounted in the cross of the British crown is one of the most famous sapphires, carved in the form of a rose, once the property of Edward the Confessor. Among the world's most prized carved sapphires are a Medusa head in the

These hands hold a king's ransom in uncut emeralds—worth $11,500,000 a pound. Workers at Muzo, Colombia mine sift rock and dirt on terraced mountain-side in search of gems.



Marlborough jewel collection and the celebrated signet ring of Constantius II, showing the emperor spearing a wild boar. A sapphire with the head of Jupiter carved in classic Greek style was found in the hilt of a Turkish dagger, but it was mounted upside down with the exquisite carving completely hidden. Queen Mary of the Scots owned another famous sapphire engraved with England's royal arms.

An ancient Iranian folk belief was that the earth reposed on a super-colossal sapphire, and the blue sky was its reflection. A Greek myth held the sapphire sacred to Apollo, and worshippers at the god's temples curried favor by wearing the stone, which the Greeks called hyacinth, named for its color resemblance to the flower.

Hebraic legend relates that the angel Raphael engraved a book on a sapphire given to the first man on his expulsion from Eden. Another folk tale relates that Moses had engraved the Ten Commandments on a sapphire.

Like all precious stones, the sapphire was credited with strange supernatural powers. A thirteenth-century monk wrote that a sapphire deposited near a venomous creature would make it expire.

Star sapphires, a pleasant old belief held, were most ingratiating love charms. It is said that Helen of Troy was irresistible because she wore them.

In the Cathedral of Aachen is preserved an extraordinary sapphire ring, which, they say, belonged to Charlemagne. Its setting is two cabochon sapphires, one square, the other oval, mounted back to back. Sandwiched between the stones is a miniature cross, visible against the light.

While sapphires occur in many places, connoisseurs agree that those from Kashmir are the most desirable. Burma, however, produces the greatest number of gem sapphires. Bengal and Ceylon also market many of them.

And yet the largest sapphire mine in the world is in Montana, near Helena. These stones, however, are so small that they do not measure up competitively.

And what of the romance, superstitions and beauty to be found in the semi-precious category — the opal, topaz, amethyst, garnet, turquoise, aquamarine and the many varieties of quartz? The terms "precious" and "semi-precious" seem arbitrary indeed when the variance of qualities in each category is considered. Is it fair to call "precious" a commercial diamond or colorless sapphire ground up to make an abrasive wheel and then classify as "semi-precious" "The Flame Queen," whose breathless opal beauty, 253 carats' worth, is legendary in Australia?

Fair or not, in the mineral hierarchy only the diamond, ruby, emerald, and sapphire claim royal blood. ■

Britain's Imperial State Crown has five rubies, 11 emeralds, 17 sapphires, 277 pearls and 2,783 diamonds.

THE FIRST 4 OUT OF 7

Overflow fans form a home run fence as Giants and Athletics meet in second game of 1905 Series at New York's Polo Grounds. Horses, as well as fans, had to scatter on long fly balls.

1905 marked the first official clash of the two leagues in what was to become a classic of the sporting world

THE World Series — has been a frantic fixture in the life of the country for over fifty years. Annually, during early October, baseball fans all somehow manage to remain close to radio and television sets. And while the Series is on, it almost seems as if *everybody* is a fan. It should hardly come as a surprise, then, to discover that the frenzied interest and high excitement were features of the classic right from the start.

It was in 1905 that the American and National League pennant winners first met to determine world supremacy. ("World" is a euphemism, of course, since it refers only to the United States.) The American had not yet gained full recognition as a major league, being then only five years old to the National's thirty. But it had provided exciting baseball and had developed great players in its short life.

A post-season playoff in 1903 had been a privately arranged affair. Again in 1904 the "upstart" American League had challenged the Nationals, but crusty little "Muggsy" McGraw, whose Giants had captured the pennant, haughtily refused the invitation, saying he would not "demean" his Giants by allowing them to meet a "minor league" aggregation. However, his action led to definite arrangements between the rival leagues, and in 1905 McGraw found himself forced to take the field against Connie Mack's Philadelphia Athletics for the big prize.

They clashed in the first game — of a best-four-out-of-seven series — in Philadelphia, with the Giants parading proudly through the streets, from hotel to ball park, behind a blaring brass band. The Giants, attired in traditional gray, found themselves facing a strikingly uniformed Philadelphia team; "Mr. Mack" had clothed his men in dramatic fashion: black shirts, black pants, white socks, belts, and caps.

The game of baseball itself was somewhat different in those days, too. The home run, for instance was not exactly the big offensive weapon it is today. Home Run King for 1905 was Fred Odwell who blasted a grand total of nine round-trippers. The ball had just about the same outward appearance, but did not have the same resiliency that was afterwards built into it by such means as tighter winding of the yarn and cork-rubber centers. The large, thick-handled bats looked more like war-clubs than the slimmer, shorter, thinner-handled versions of today. Playing techniques, such as the hook slide, were the proud know-how of only a few and not taught systematically to all players as they now are. Much, however, was the same: basic rules, dimensions of the playing field (60 feet, 5 inches from home plate to the pitcher's mound and 90 feet between bases), and the inalienable right of fans to shout, boo, heckle, and cheer, at their pleasure.

On the mound for the Giants in that first game was the immortal Christy Mathewson, then generally regarded as the best pitcher in baseball; only a few months before, he had pitched the second no-hit game of his career. Mathewson won that opening game, giving up only four scratch hits, and went on to dominate the Series. By the time the smoke of battle had cleared, Mathewson had pitched the Giants to the championship and established himself as a Series hero for all time. In the space of six days he won three games, all shutouts, struck out 16 men, gave up 15 hits and walked only one batter.

In describing Mathewson's feat, one newspaper reporter had to get some help from Shakespeare; he paraphrased a speech from *Julius Caesar*: "He bestrode the field like a mighty Colossus, and the Athletics peeped about the diamond like pygmies who were struggling gallantly for their lives, but in vain." Afterwards, Matty enjoyed a popularity unequaled — except for the phenomenon of Babe Ruth — by any other player in history.

A satisfying crowd of 100,000 paid to watch the five games, and each winning player's share was $1,141.14 — no small amount at the turn of the century, before television, radio and movie rights swelled the total, as in the last five Series, to about $9,600 a share. Although today's attendance figures and total receipts are very much higher, the difference does not indicate greater present day interest in the Series. The difference is accounted for by growing population, greater prosperity, more leisure time, bigger stadiums and the vastly changed news-outlet setup.

One small incident shows nicely, though, that the business side of the Series was not neglected in those days. When the third game was postponed at the last possible moment, supposedly because of wet grounds, the small crowd of 4,000 guessed the real reason was the sparseness of paid admissions and not the negligible drizzle. Philadelphia outfielder Bill Strang, at least, was candid about it. He winked at the nearby fans, who were booing the decision to wait for fairer skies and larger crowds, and said good-humoredly, "We need the money."

Those were the days when overflow crowds were permitted on the playing field, and each of the five games had its ring of noisy spectators standing in the outfield. The police lines had difficulty in preserving the rules for overflow spectators set up by the National Commission: "No spectator will be allowed nearer than 235 feet from the home base in right and left fields, nor within less than 25 feet of the foul lines in any portion of the field." This meant that often during a game it was necessary for the fans to scramble hastily out of the way, as a fielder raced back after a high fly or a pop foul. Today, of course, any fan who puts his foot on the grass of the playing field finds himself being chased by a uniformed guard or escorted out of the park.

For the first game, 500 New York fans had followed the Giants to Philadelphia, most prominent among them being Heavyweight Champion James J. Corbett, who rooted long and loud for his favorites. It was another Gothamite, however, who stole the spotlight from Corbett with a unique method for cheering his heroes. The man, whose name is unfortunately lost to posterity, brought to the ballpark with him an incredibly large pad of yellow writing paper, fully six feet by four. On it he wrote his judicious comments in charcoal for all to see.

When New York's Roger Bresnahan succeeded in stealing from first to second, the enterprising fan complimented the player with: "Roger, thou artful dodger, they catch thee not!" After the Giants' Mike Donlin had swung at a third strike and missed, the fan with the literary turn promptly scribbled an anguished, "What, a strike on our Mike? It cannot be!"

Somehow, they don't seem to make fans like that anymore. Pads, either. ■

Three men who appeared in 1905 World Series won baseball immortality in Hall of Fame. John J. McGraw (left) managed Giants for 30 years, won 10 pennants, three Series.

Pitcher Christy Mathewson (center) won three games in 1905 Series, 94 games in three years. Connie Mack led Athletics for 49 years, won nine pennants and five Series.

the versatile kernel

TO most of us the familiar ear of corn suggests fritters, corn flakes, hot muffins. Probably no one would be too surprised to learn that corn products are also involved in such supermarket staples as puddings, soups, sauces, candy, salad dressings, dessert powders, ice cream and even beer. But when the list begins to include carpets, coal, charcoal briquettes, doll heads, rock wool, molded toys, soaps, metal furniture, dynamite, aluminum, oil wells, it seems past the time for raised eyebrows.

While an oil well may be a peculiar place to find corn, oil well "mud," using gelatinized cornstarch as one of its ingredients, is vital to today's deep oil well drilling. It performs a number of chores as it is circulated from surface to drilling bit, such as bringing up rock cuttings, caking the side of the hole and lubricating the bit. And if mentioning an oil well can conjure up visions of a corn field gently swaying in summer breezes, so should cigarettes, paper, textiles and many other everyday products.

Perhaps the first "hidden" industrial use of the golden kernel occurred in 1804 when corn-fed cattle were transported from Ohio to Baltimore over 300 miles of rugged terrain, there to be sold at fantastic prices.

Approximately 85 per cent of this country's corn crop still provides food for animals. This is not the sweet variety we relish at the table, but "dent" corn – easily identified by the dent in the broad end of the kernels. It grows as high as a small house and in its hybrid and open-pollinated varieties is the kind, more than any other, that the U.S. Department of Agriculture refers to in the crop reports published annually. (Last year's crop was 4,361,170,000 bushels).

It is what happens to the other 15 per cent not used for fodder, that reads like a "who-dun-it" authored by industry.

Some of this goes to the "dry milling" industry for corn meal, hominy, breakfast foods. Distillers turn their share into alcohol. Feed manufacturers absorb a portion. Corn refiners and wet-millers take the rest.

The refiners are responsible for the most interesting nonfood uses of corn. They take more than 150 million bushels in an average year and in 13 plants around the Corn Belt of the United States, they turn their corn into starch, syrup, sugar and oil, which are then used by manufacturers whose nonfood products reflect neither hide nor hair of anything vaguely resembling a corn product.

It is the eminently adhesive quality of corn products, especially starch and syrup, that make them ideal as a binding agent. Just as the cement holds the sand and gravel mixture together, a corn binder is used with sand, water and other additives in the forming of molds and cores for the manufacture of metal castings.

Dextrin is a prime example. A roasted form of starch, it is a key ingredient in the mass production of molded metal products, all the way from kitchen furniture and TV sets to engine blocks and armaments. Acting as a "core binder," dextrin is used along with other ingredients to hold the mold's sand lining to the required shape.

Cylinder heads and other automotive cast metal parts are usually made in molds having a sand core, which is also bound together by cornstarch and dextrin.

To go a step further in the automotive industry, such small but vital items as spark plugs use cornstarch or corn syrup to bind the ceramic material of the insulator. And the "cold" rubber which makes some tires wear as much as 30 per cent longer was formerly produced so slowly that it was uneconomical. Chemists and engineers hit upon certain ingredients that speeded up this process that makes synthetic rubber at the temperature of ice water. One of these ingredients is dextrose, or corn sugar.

Metal "starchates," chemical compounds of starch and certain metals, are used in electroplating to provide smooth, bright finishes. Therefore, to some degree, corn starch is responsible for the very gleam of today's car.

Finally, this grain, which scientists estimate is 60,000 years old, is relied on in the tanning of leather upholstery, and if that leather has then been dyed red or green or blue, very likely cornstarch can also be thanked for fixing the color.

If the auto upholstery happens to be fabric, then corn products were involved there, too, for they have some important chores in textile work.

Syrup is used by textile finishers for both "weighting" and "feel." In other words, it gives "body" to the treated cloth. *Zein*, the versatile protein of corn and another by-product of the corn refiners, is an excellent carrier for textile colors. (It is also used in the manufacture of lacquers and as a basic plastic material.)

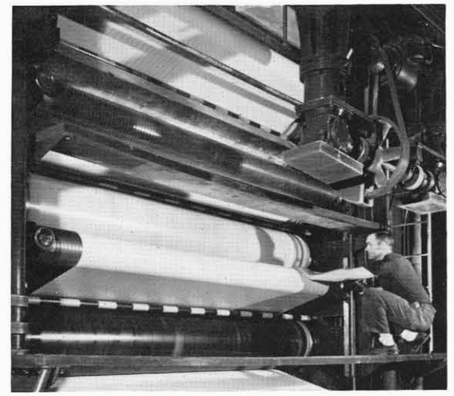
The most important use of corn in the textile industry, however, appears in the sizing of raw cotton yarn to give it sufficient strength to withstand the back and forth abrasive action of shuttles during weaving. This sizing requires giving the yarn a hot bath in what is chiefly cooked cornstarch. The backs of carpets are very often treated in this same way to keep them flat and give longer wear.

The did-you-know game about corn products can go on

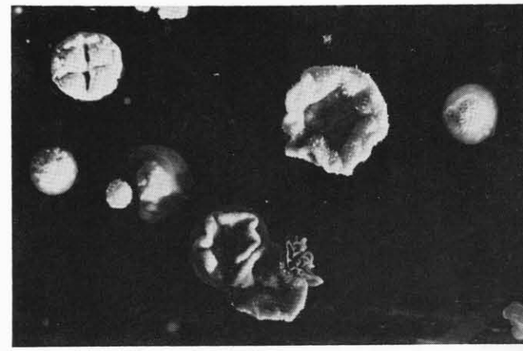
Corn does an amazing job on the industrial scene,

contributing to everything

from paper



Fine printing surfaces on paper are obtained with aid of starch.



Corn steepwater provides a rich feeding ground for cultivating antibiotic molds.

and penicillin

to tires

Corn Sugar speeds up the synthetic rubber process.

A hot cornstarch bath strengthens cotton yarn for rigors of weaving.

and textiles