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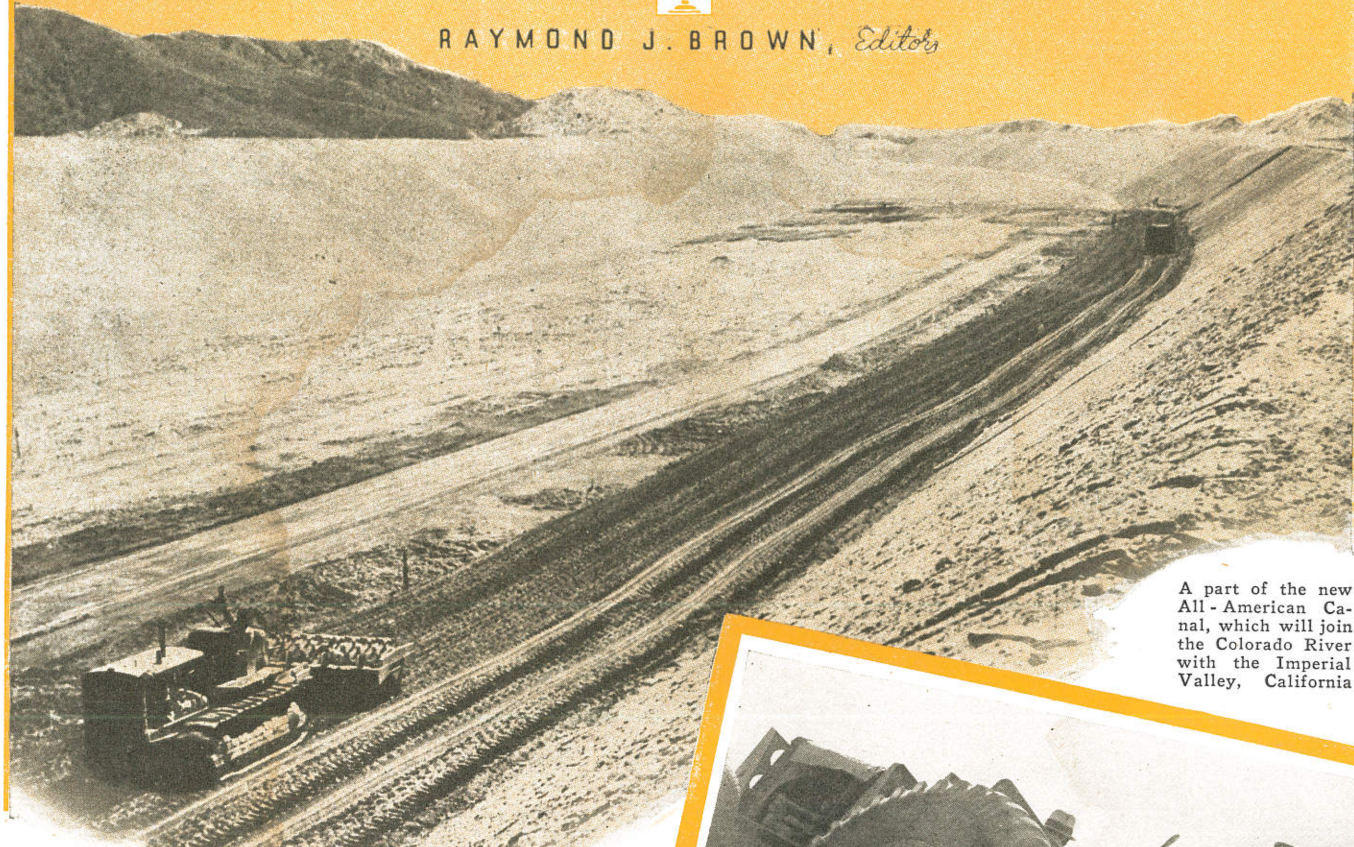
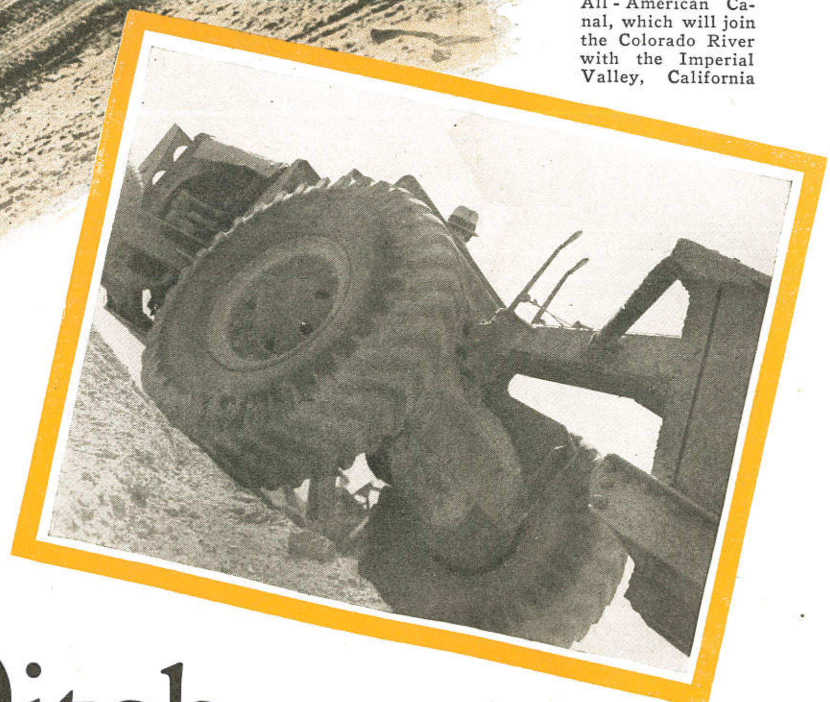


A part of the new All-American Canal, which will join the Colorado River with the Imperial Valley, California



The big balloon tires on this tractor keep it from sinking into the sand as it pulls a "buggy" up a hill

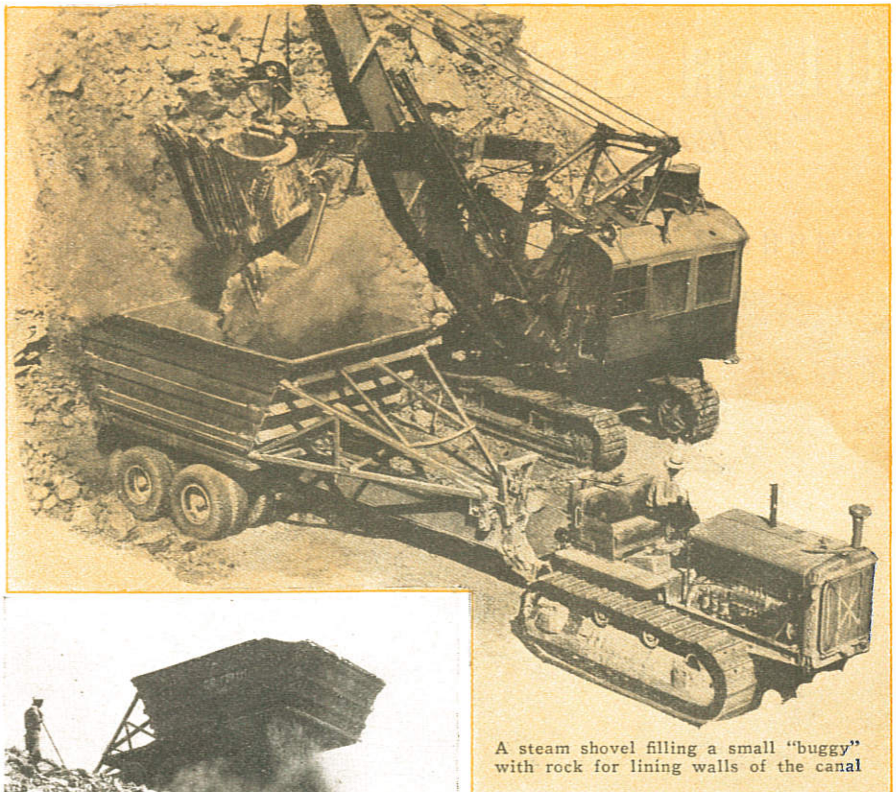
DIGGING THE World's Biggest Ditch

MONSTER MACHINES ARE SCOOPING AN ARTIFICIAL RIVER BED ACROSS EIGHTY MILES OF BLAZING DESERT IN HUGE NEW IRRIGATION PROJECT

By Sterling Gleason

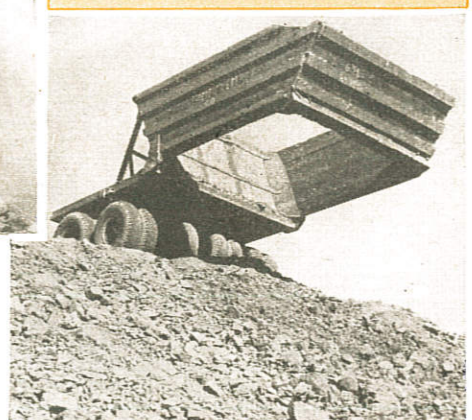
TO CREATE a brand-new river, wide, smooth-walled, and straight, stretching across eighty miles of blazing desert, is the huge project now being tackled by Uncle Sam's engineers. In the southwestern corner of the United States, a mechanized army of workmen is gashing the desert with a giant irrigation ditch, the largest ever built and last of the sensational projects designed to harness and tame the turbulent Colorado River.

Rushing through miles of sage and mesquite, plunging under natural watercourses through concrete siphons, the new All-American Canal will tap the Colorado's muddy waters about fifteen miles north of Yuma, Ariz. Laundering them clear in a giant washing machine, it will lead them due west across the



A steam shovel filling a small "buggy" with rock for lining walls of the canal

At the dumping place, the tractor driver pulls a lever and the body of the trailer slides back beyond the end of the floor



The empty "buggy" after its load has fallen through the open bottom onto the side walls of the canal

sands without crossing the Mexican border, as does the present Imperial Canal dug by farmers half a century ago. The main canal will empty into the irrigation network of Imperial Valley, where, under a broiling sun, a phenomenally rich soil puts forth amazing crops. Ultimately, a branch will snake northward to Coachella Valley, the fertile, palm-covered oasis from which come America's home-grown dates.

Nowhere has the job of moving dirt become so highly developed a science as here on this colossal project. The place swarms with strange machines that resemble gigantic bugs, waving their long, skeleton feelers, scuttling back and forth, carrying sticks or stones, or marching in antlike processions, laden with cargoes of earth. Each is designed to shorten hauling by ten feet here or fifty feet there; to cut lifting by inches; or to clip a second or two off the time required for handling.

A herd of mechanical mastodons such as never before assembled has been marshaled for this task. Huge, lumbering "buggies," rolling on balloon tires eight feet in diameter, haul and dump enormous loads. Diesel-powered bulldozers nudge wide steel blades ahead of them, leveling off the hilltops. Gigantic power shovels, with gaping maws of lightweight alloy steel, gulp tons of earth at a single bite.

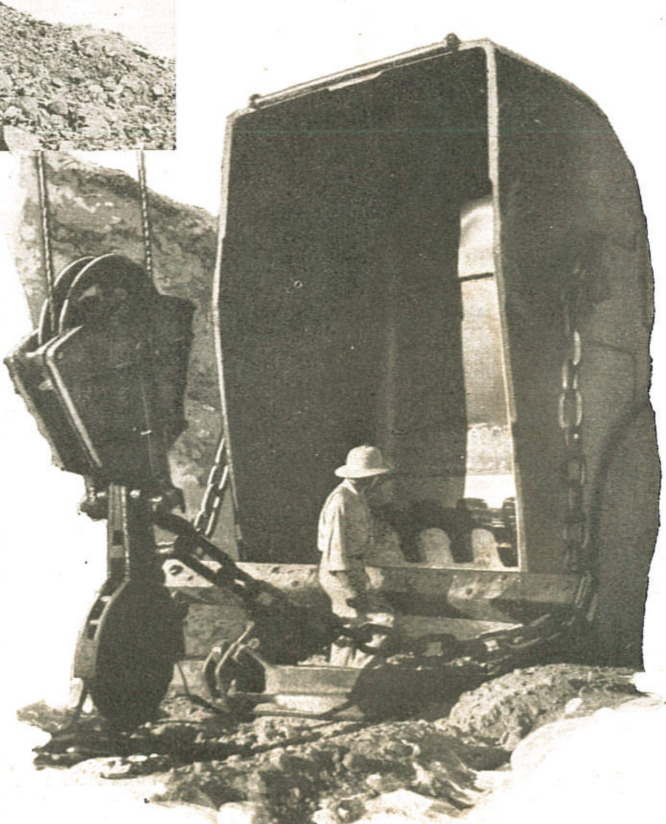
Monster drag-line machines extend their long necks half a block at a stretch, scraping up each time enough sand to fill a truck. Mechanical hens lay whole nests of octagonal concrete piles, to be picked up like match sticks by powerful cranes and driven by machines to form foundations for the structures built on the silt of the river. Skyscraper concrete-mixing towers automatically weigh, mix, and pour materials to test-tube specifications. Cylindrical samples of cured concrete are crunched between giant jaws to detect variations from formula. Miniature canals, built in the laboratory, forecast the performance of the real canal under the action of wind and water and shifting desert sands.

Long before a spadeful of earth was turned, the canal began to take form in models and drawings. Aerial photographers went aloft to sweep the country with their camera lenses. In an outdoor laboratory, experimenters made miniature canals, heaping up samples of materials, sprinkling, tamping them with rollers, and creating model embankments with varying degrees of slope. With instruments they gauged the density of the banks, measured the percolation when exposed to water, and learned exactly how steep the banks should be made.

But the most serious problem of all was that of crossing the valley of walking sand dunes—a Sahara-like waste of towering sand hills that slowly migrate under the influence of the wind. Reckless indeed seemed the engineers who dared to undertake the job, but careful observation of the dunes dispelled some of their terrors. The migration, though constant, was quite slow. A high embankment thrown up out of the material excavated from the canal would adequately guard against encroachment by the walking sand hills.

The engineers drew plans for a flat-floored ditch, half a city block wide at the water's surface, with V-shaped walls sloping back at a thirty-degree angle. Six feet above the water level is a "berm"—a flat roadway twenty feet wide. Another is located at the mesa floor on which the dunes march ceaselessly. Along these steps would move giant drag-lines, scooping out the channel below and building up the embankment above.

Ahead of the construction crews came surveyors and rodmen with transit and chain, staking out a path through the sagebrush and cactus. Behind them followed gangs of Indians, who cut away



This is the big bucket of the drag-line, largest digger ever made. Shown here in the dumping position, it will hold an automobile harsh brush with hooked, sharp instruments resembling medieval battle-axes. Tractors broke the virgin soil, loosening the earth and picking up heavy material. Where the surface was low, farmers drove four-horse teams pulling small "Fresnoes," or scrapers, to cut and fill. Nearly 1,000 horses were working at one time, and this phase of the work gave employment to hundreds of jobless men.

In their wake came the big machines. Steam shovels, Diesel tractors, and bulldozers puffed and snorted. Trucks by the hundred, piled high with excavated material, began to thunder over crude highways. Everywhere, dirt began to flow—load upon load, ton upon ton, streaming out of the steadily deepening cut being gouged out of the desert floor, and depositing itself upon the steadily growing embankments.

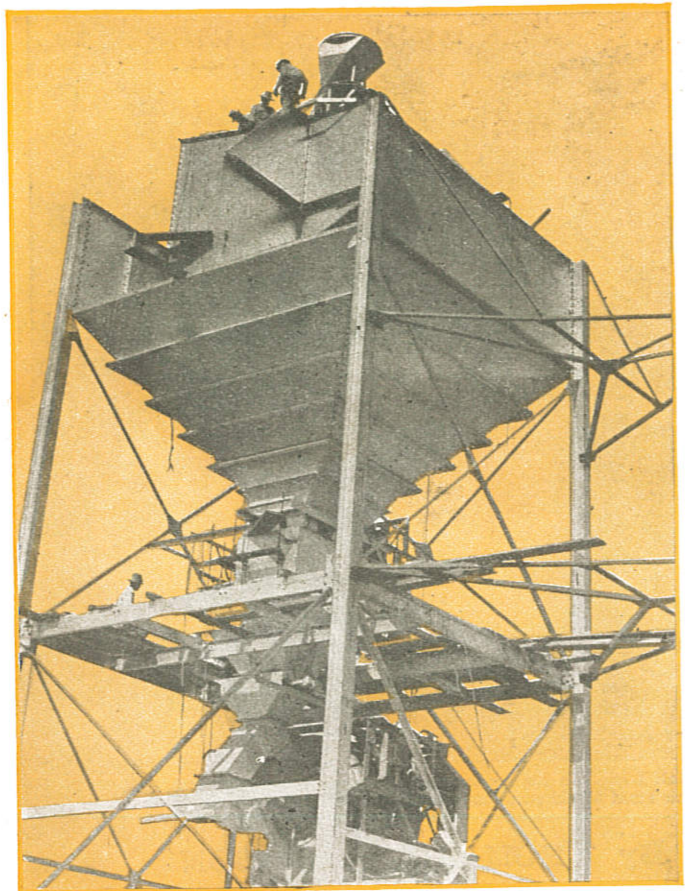
The long processions of trucks were joined by tractors pulling enormous "buggies," resembling toy wagons of the nursery but of Gargantuan size. Rolling on sixteen balloon tires taller than a man's head, these buggies carry their huge loads very near the ground, saving much lifting. When the desired spot is reached, the tractor driver pulls a lever and the side walls of the "buggy" slide backward, discharging the contents through the open bottom of the machine.

Dirt is spread by huge scrapers, attached to boxlike carts, which drop their blades and fill themselves as they move, then lift, carry, and dump, spreading their contents uniformly. One man does everything from his seat at the controls of the tractor which pulls the giant implement. Another simple but effective aid is the "tumblebug" scraper. Drawn by a tractor, it has a shoe on each side of its seven-foot blade, which enables the scraper to stand on its head, tumblebug fashion, dumping its contents instead of dragging to empty them. No helper is needed to turn the blade—it can be done by the tractor driver as he sits at his controls.

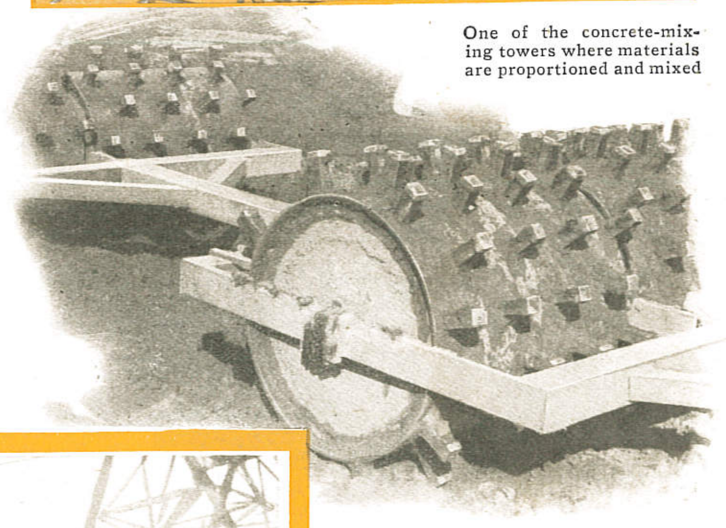
From the ancients, who built hard dirt roads by driving flocks of sheep over them to tamp them smooth and firm, the engineers learned a valuable lesson. Embankments now are compacted with a device called a "sheep's-foot tamper"—a huge roller studded with dozens of round "feet" several inches square. As it turns, each foot tramps the surface beneath it with a pressure of 250 pounds to the square inch. Tractors draw the bumpy rollers back and forth over the soft dirt until the impact of hundreds of mechanical feet has tamped it hard. Despite its spiky appearance, the tamper produces a much smoother surface than a solid roller.

No larger digging machine ever walked the earth than the monster drag-lines that scoop out the main contours of the canal. Twenty freight cars are required to carry the dismantled parts of one such machine. A 100-car train was needed to bring in the equipment used in digging a single thirty-mile stretch of canal.

A giant drag-line in action. When it moves from one location to another, it literally walks on two large eccentrically mounted shoes



One of the concrete-mixing towers where materials are proportioned and mixed



"Sheep's-foot tampers"—heavy rollers studded with iron "feet" that tramp the earth hard. They are drawn by tractors

Each drag-line controls a huge bucket traveling on cables at the end of a movable steel boom as high as a fifteen-story building. The cab itself is a veritable power house—a nest of seventeen different electric motors and generators, which operate fans, centrifuges, and pumps for keeping up the "circulation" and "breathing" of the giant organism. Heart and muscles are the two huge Diesel motors, the larger of them rated at 450 horsepower—half the strength of a crack Diesel locomotive. Lubricating oil and water both are cooled by special equipment to permit the motors to withstand the extreme desert heat. Special devices clean the *(Continued on page 124)*

DIGGING THE WORLD'S BIGGEST DITCH

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air before it is sucked into the jets of the Diesels, as a guard against sudden sand storms.

When the machine is ready to travel, it literally walks ahead on its own feet. Two gigantic shoes, each weighing some 42,000 pounds, are mounted eccentrically on an axle forty-five feet long and eighteen inches thick. As the axle turns, first one shoe and then the other moves to propel the drag-line ahead, seven feet at a step. Thus the 650-ton machine moves on its mechanical feet and walks smoothly across the desert sand without sinking in.

AN ARRAY of pneumatic controls, electric switches, throttles, and levers, makes the control room resemble the cab of a locomotive. Twenty-four men keep the big machine going day and night, eight men at a shift. In the forward part of the cab, behind glass windows, sits the man in charge. From his perch, the perspective is distorted as he looks down the barren slope of sand, so that distances cannot be accurately judged. He is peering intently before him. Far below, down the steep canal wall, the "pit man" waves his arms in a sweeping motion. He is talking in the private sign language by which the workmen communicate.

Around swings the cab on its pivoted base, rolling smoothly on the seventy dollies beneath its thirty-six-foot platform. The giant boom, a latticed steel girder, sweeps in a semicircle. It dips slightly.

The pit man is indicating a spot almost directly beneath the beam. The control man touches a lever. A steel cable, twice as thick as a man's thumb, begins to sing as it swiftly pays out. Down plunges the huge bucket, a scoop big enough to accommodate an ordinary automobile with room to spare at the sides. As it nears the designated spot, it hesitates slightly. Beam, cable, and drag-line work together to draw the bucket in and land it at the exact spot desired.

A heavy, shrieking chatter splits the air as the hoist engine goes into action. The drag cable, a steel sinew two inches in diameter, tightens, gouging the bucket into the sand bank. The scoop fills itself to overflowing, and begins its upward climb—slowly, laboriously, for with its load it weighs 50,000 pounds.

As it reaches the level of the embankment, the operator shifts his controls. The giant beam wheels smoothly, swings the bucket neatly above the embankment, and a seven-ton load of sandy earth cascades out of the scoop, adding its bit to the bulwark which is to check the movement of the shifting desert sands.

UNDER the scorching noonday sun, under the huge, desert moon, through summer heat and blinding sand storms, the work will go on. At night, the powerful glare of floodlights attached to the booms makes daylight where they work. Before water can flow, sixty million cubic yards of material must be excavated and hauled to its proper place—enough, loaded upon standard forty-foot gravel cars, to make a trainload 2,235 miles long, stretching from Chicago to Los Angeles.

But more than a colossal job of earth-moving, more than the biggest irrigation ditch ever built, is this huge gash engineers are cutting in the southern desert. In combination with Boulder Dam, it not only will bring life-giving water to parched desert lands, but will permanently end the menace of the millions of tons of water that thunder down the Colorado's steep-walled chasm.

For years, the Colorado has been a trouble maker in the West. From the northern plateau where sudden desert storms sweep across the barren mesas to discharge cloudbursts that race to join the river's brown torrent, to its mouth in the Gulf of California, where at times it creates some of the roughest ocean water in the world, it is a violent, powerful giant. Near its delta, where its rolling brown waters mingle with the blue of the ocean, it is sluggish but temperamental. News of rains in the mountains far to the north is brought by sudden, spectacular rises in the river's height at Yuma, where the government gauging station often records sensational jumps in the water flow within a few hours.

BUT the temptation of this precious fluid, going to waste, was too strong for dwellers in the thirsty lands near-by. At the turn of the century, farmers pierced the natural barrier separating the lower Colorado from the huge sink just to the north, in whose trough, far below sea level, lies the dead Salton Sea. The crude thirty-mile canal they dug brought the waters into a natural depression leading down into the Imperial Valley. But soon, in 1905, a flood crest suddenly swept down the river. The head gates controlling the flow of water stuck, and, before they could be released, the torrent surged madly through the newly excavated channel. For two years the runaway river, heavy with thousands of tons of silt, poured into the inland sea, raising its level seventy-three feet and swelling its area by 278,000 acres.

Though levees have since checked the flow and provided a measure of safety, the threat of flood has persisted. Even now, these embankments are in need of repair, and ordinary maintenance alone costs upward of $100,000 every year. With Boulder Dam cushioning the shocks of flood crests and the All-American Canal, with its diversion dam, as a valve to regulate the flow, the giant Colorado will be rendered as tame as a town waterworks system. Dredges no longer will be needed to remove the silt which constantly clogged the old canal, for the giant paddles of the washing machine will remove it.

ALREADY, Boulder Dam has begun its work as a good Samaritan. When, last spring, flood waters swelled the Colorado, rushing past the gauging station at Grand Canyon, Ariz., at the rate of 100,000 foot seconds, the heavy gates were lowered and its titanic bulk checked the flow, storing it for future use. The rising crest never reached Yuma to endanger the cracked levees. Soon afterwards, the floodgates were raised slightly and the impounded flood waters began to trickle down little by little as they were needed. Within a few weeks, enough water had been stored to meet the whole year's needs for irrigation, thus preventing a repetition of the 1934 drought which cost Imperial Valley farms a loss of $10,000,000.

ELECTRIC SHOCK USED TO REVIVE DYING MAN

SUCCESSFUL use of a heavy electric shock as a means of saving life was reported at a recent meeting of the American Institute of Electrical Engineers. An account of how a surgeon, sewing a gash in a man's heart, revived the patient after the heart stopped beating was given by Dr. Kowenhoven of Johns Hopkins University, Baltimore, Md. The method was developed at university's laboratory after many experiments on counter-shocking animals to revive them after they had suffered electric shocks. Experiments along this line have indicated that the method may be of assistance in reviving drowned persons.