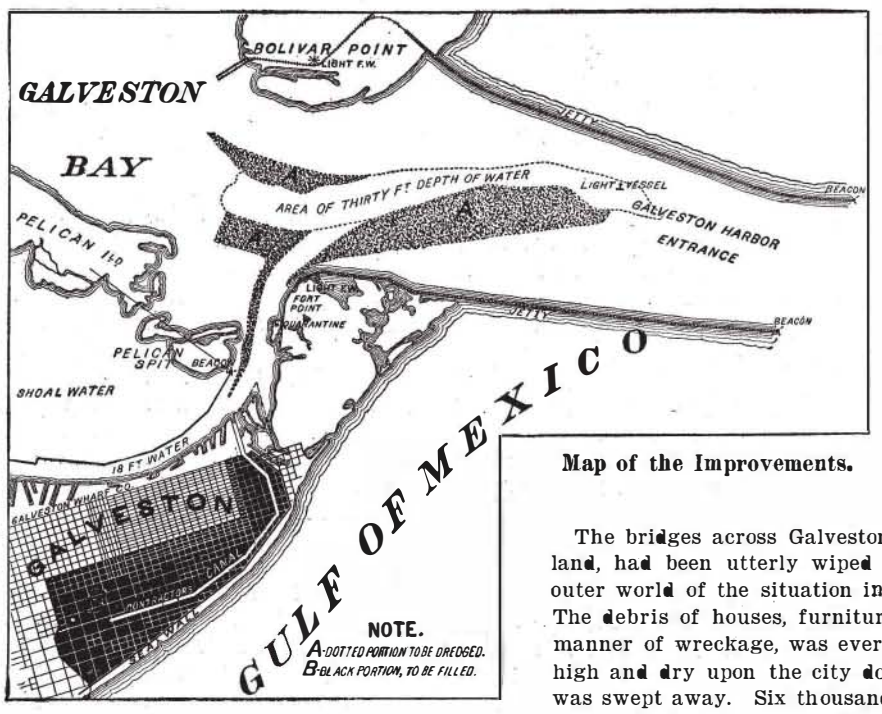
GALVESTON—A CITY BUILT UPON SAND.

BY LINDON W. BATES, JR.

The city of security has been traditionally the one whose foundations have been buried within the rock. It remained for Galveston to establish a new order, and proclaim herself the city of safety whose foundations are not sunken, but raised high, and whose trust is set not on rock, but on sand. And sand is both the material and the moral basis of this civic home, won at such cost from the sea. It is character "sand" that has armed the city against the Gulf, and set a solid rampart to shield her whole seaward face. It is this that has secured the two monster jetties reaching oceanward like two welcoming arms—jetties which dwarf those of Cherbourg and of Dover. It is the "sand" of her sons that has raised her finances from disaster prophesying bankruptcy to a place as high as any in the Union.

Of the storm that swept her in 1900 not a trace remains, save in the memories of the inhabitants; and with the backing of a concrete wall, there is being heaped in eleven million cubic yards more to raise the grade



Map of the Improvements.

hundred miles an hour. The water was steadily rising. It rose five or six feet almost in a jump at about 7 o'clock. Wave after wave rolled in, and encountered a current from the bay. The two met, turned, and in a sweep across the front carried along houses, animals, street cars, telegraph poles, everything, in utter ruin. Great beams and railway ties were lifted by the stream and driven like battering rams into dwellings and business houses. Night came on with apparently no abatement in the violence of the storm. But about 10 o'clock in the evening the wind died down suddenly, and the water fell with amazing rapidity. Within a half hour after the subsidence began, it had fallen two feet. By daylight the streets were clear. But what a scene of desolation was revealed by the dawn!

The bridges across Galveston Bay, their one connection with the mainland, had been utterly wiped out, so that no news could be sent to the outer world of the situation in the town. Drinking water and food failed. The debris of houses, furniture, bodies of men, horses and cattle, and all manner of wreckage, was everywhere. A freighter of 10,000 tons was cast high and dry upon the city docks. The residence district of the sea front was swept away. Six thousand lives, a sixth of the city's population, were lost. A broad white strip of newly-made beach, three miles long and four blocks deep, lay swept absolutely clean of a sign of a dwelling. Behind this was the bulwark of flotsam and jetsam, forty feet high in places, which piled up and saved the center of the city from the full sweep of the waves.

A leading Galveston newspaper, the year after the storm, analyzed the financial status of the city. It reached the conclusion that the utmost which could be done for safeguarding would be to drive a double row of piles along the beach in front of the city. It even doubted if, with the great losses sustained, there could be ventured the $400,000 bond issue needed to pay for this public work. A double row of piles! $400,000 bonds to pay for them! This was the utmost that the city was deemed able to bear. Yet the men

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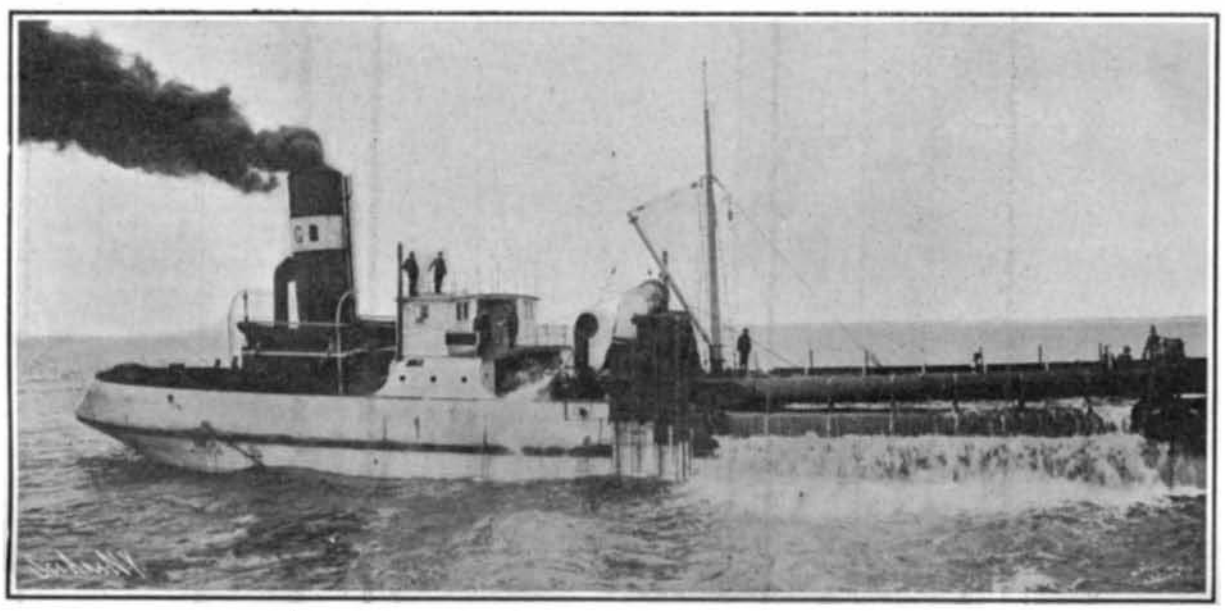
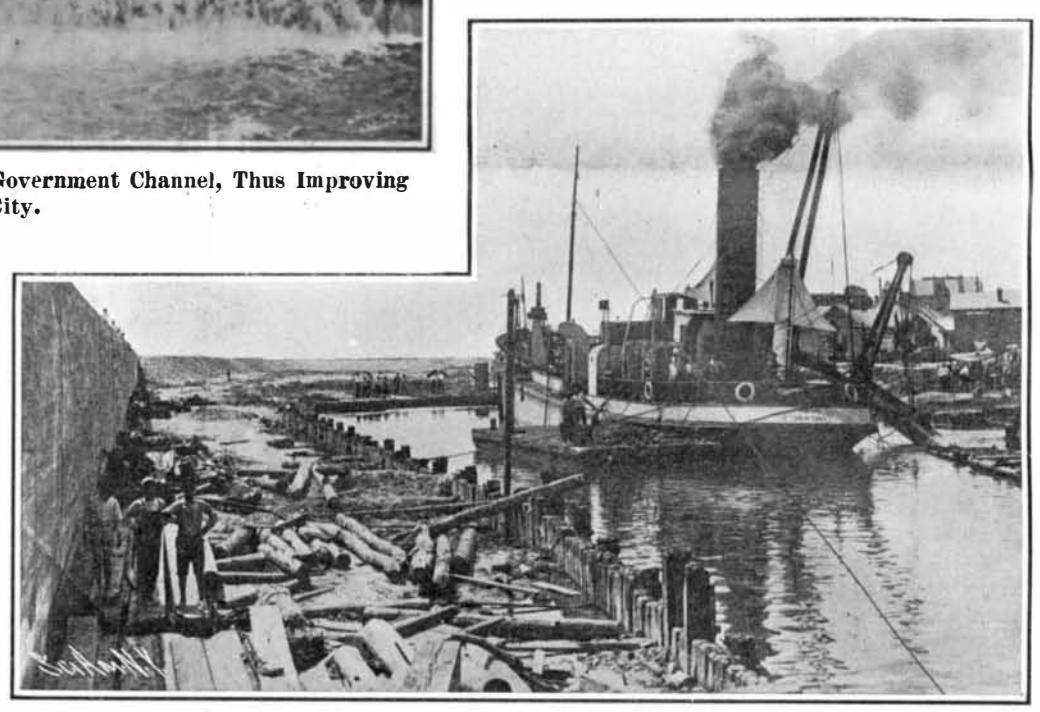


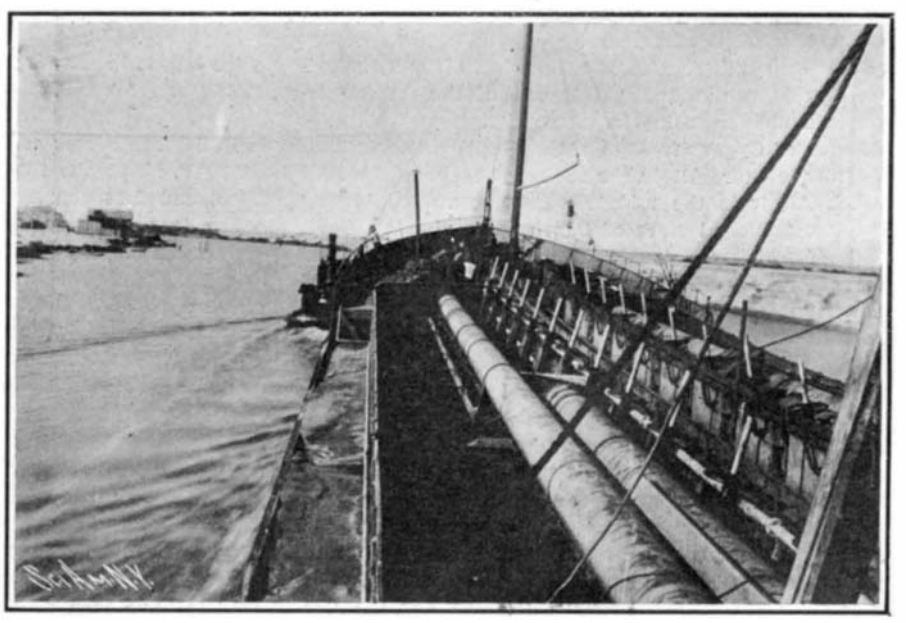
One of the Dredgers Filling Its Hoppers with Sand Taken from the Government Channel, Thus Improving It and Simultaneously Raising the City.

beyond all fear of future flood. On the 6th of September, 1900, the weather report from the Gulf Islands signaled a storm advancing upon the coast of Texas. Then the storm center drifted out of observation into the great Gulf of Mexico. Two days passed, during which the people of Galveston went about their ordinary duties with scarcely a thought of an impending danger. There had heretofore been periodic storms, some of them doing considerable damage in the lower wards of the city. The older inhabitants bore in mind the one of 1875, in which a large part of the oceanward side of Galveston had been submerged, and the water had reached nine and one-half feet above sea-level. The milder affair of 1886 was also recalled, with its high-water mark of nine feet. Many who realized the unprotected nature of the town had sounded unwelcome warnings. It was shown how absolutely undefended was the residential section of Galveston, in many places at an elevation of only three and one-half feet above the sea, while the highest part of the city was elevated only nine feet. At 2 A. M. Saturday a strong wind started from the north, accompanied by a heavy fall of rain and a rising tide. By 5 o'clock in the afternoon the storm had swept in and had burst with all its fury. Before the recording apparatus had been carried away, it registered the velocity of the wind as one



The "Holm" Commencing to Dig the Distributing Canal. The Sea Wall is on the Left. The Canal Pierces the Heart of the Town. The Dredgers Steam up It and Discharge Their Loads under the Houses.

In Raising the City All the Houses Are Elevated on Stilts and the Dredgers Fill under Them. The White Mark on the Telegraph Pole Shows the Final Grade.

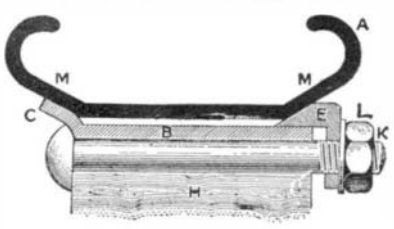


The Dredger "Leviathan" in the Canal, Showing the Undecked Hopper Space.

advantage. On the other hand, no one knew before the race just how the detachable rim would bear up during a severe race, so that those who had pinned their faith to the new system were running not a little risk. That the new rim has come to stay, there can be no doubt. But whether there is an actual saving of time in renewing the tire, is as yet a moot point. Those who did not win claim that it was because their more successful competitors employed the new system, while the winners, on the other hand, maintain that the invention effected merely a saving of work, but not of time. During a visit to the Renault factory, I had the good fortune to meet Szisz, who gave me his opinion of the detachable rim. "It is certain," he said, "that the new rim is a great improvement, and that we may henceforth expect to find it in all races. In the Grand Prix it did not save as much time as some claim. Its chief merit lies in the readiness with which it can be removed and applied. There is nothing of the hard work which the old method entails. When working in the hot sun and without assistance, as was required by this year's rules, it is evident that the detachable rim is a boon. But so far as actual time is concerned, I believe that an ordinary tire can be renewed in five minutes by experienced men. It took me just four minutes to renew the removable rim. There is no justification, therefore, in claiming a great saving of time."

In the accompanying views, which were taken on the rear wheels of Szisz's Renault car, which was the winner, the principle of the detachable rim is clearly shown. Two systems were used—the M. L. and the Vinet.

According to the system of the Société des Jantes Amovibles M. L., on the outer edge of the road wheel are imbedded six bolts projecting about three-quarters of an inch. The detachable steel rim has the flanged edges of an ordinary rim. Six projecting ears are riveted within the circumference of the rim and near its outer edge. Each of these ears is drilled to fit the bolts projecting from the face of the wheel. The tire is fixed on this rim, the air tube inserted, and inflated exactly as in an ordinary wheel. The rim is then slid on the road wheel, the bolts on the wheel



CROSS SECTION OF VINET RIM.

passing through the ears on the rim and held in position by nuts. Provision is made for the projecting valve by a notch cut in the wooden rim. As a further security against creeping the ears are countersunk into the wooden and metal rims of the wheel. The surface of the rim coming in contact with the felloe consists of two steel rails machine finished, with a groove between them, in which are imbedded the nuts holding the valve on its seating and the bolts of the leather cover on which the air chamber rests. Being flush with the level of the rails, it is impossible for the bolts to work loose.

The Vinet consists of a double rim, one part being fixed on the wheel and the other bearing the tire being detachable. As shown in the accompanying diagram, the flat steel rim, *B*, encircling the road wheel, *H*, carries on its interior edge a ridge, *C*, against which is pressed one edge of the detachable rim, *M M*. This latter has only to be slid onto the wheel, the diameter of the wheel being about four millimeters less than that of the rim in order to make the operation easy. Five or six projections on the detachable rim fit into indentations on the fixed rim, preventing one rim from revolving on the other. The rim placed in position, a steel ring, *E*, split to facilitate mounting and having one of its faces beveled to fit against the face of *M M*, is placed over the six projecting bolts on the wooden rim and held in position by nuts, *L*. To dismount a tire it is only necessary to unscrew the nuts, *L*, take off the split ring, *E*, and withdraw the rim and tire, *M M*. A special short valve has to be employed, not projecting beyond the false rim, *M M*. To inflate the tire it is necessary to dismount it. An improved model is now being made in which the fixed rim of wood and metal is pierced to allow of the passage of a prolongation of the valve, screwing into the valve imbedded within the false rim. By this means it would not be necessary to dismount the rim to inflate the tires.

All the cars employing these rims in the Grand Prix race carried two spare tires completely inflated. The weight limit of 1,000 kilos, however, prevented several competitors from adopting them, and the private objections of drivers may have been a determining factor in other cases.

Clément Bayard and Vulpes cars were fitted with either Vinet or M. L. rims, while other firms having given them extensive trials were Darracq, Renault, and Brasier. The Itala, driven by Baron de Caters, stuck to fixed rims.

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of Galveston have built a solid concrete sea wall, four and a half miles long, at a cost of $1,500,000, and have paid for it in cash. They have backed the wall up with 100 feet of solid filling; they have issued and floated bonds eagerly seized in every market to the value of $450,000, as an incident to the work, and are now raising the greater portion of the city to an average height of 14½ feet above sea level at a cost of $2,200,000 further.

The sea wall was advertised, was contracted for, and was started. It required faith and courage, the type of courage that characterized the men of Valley Forge. But each day the solid wall crept farther along the Gulf front, until at length it stretched four and a half miles, guarding the whole corporate length to its outer limits. And on top of this the city has undertaken a task unknown in history, but which is now one-third completed—to lift itself bodily above the flood line. A district as large as all that part of Manhattan below Houston Street is being raised to a height in places fifteen feet above its present level. It was not an open country or a tract of waste land which was to be lifted; it was the major part of an active, vigorous town, the most important business center of the Southwest. Street-car lines, gas pipes, water mains, houses, churches, all the complex mechanism of a metropolis, had to be elevated an average of seven feet above the old grade. No less than eleven million cubic yards are needed to complete this work.

Eleven million cubic yards! The quantity conveys no definite idea to most. What it really meant for the Gulf City to undertake this work may be realized from comparisons. Galveston is the second export city of the United States. During the last fiscal year, 1905, there cleared here for both United States and foreign ports, vessels of a total of 1,762,478 net registered tons. This tonnage is an equivalent of 1,828,000 cubic yards. If every vessel clearing from the port of Galveston last year had been loaded with sand to her full net tonnage capacity, the amount carried away would be less than one-sixth of what is being used in raising the grade. The material required would make five pyramids as large as that of Cheops. If every vessel flying the American flag were required to bring one full cargo of sand, it would take three trips of this great fleet to meet Galveston's need. This is the magnitude of the public work that the city of less than 40,000 souls has undertaken with no outside aid, save the retention of its own State taxes for seventeen years.

The solution of the problem of raising Galveston was an engineering feat. No tool in America could accomplish the work within the city's resources, and hauling material by rail cost $500,000 more than the municipal tax limit would allow. Suction dredges could not pump the three miles into the heart of the town. The solution lay in the radical proposal of driving a canal into the heart of the city and using self-propelled dredges but recently introduced in Europe, which could take their loads from the ship channel, steam up this canal, and discharge the material under the houses and through the streets.

The operation of these engineering Titans possesses a certain interest. They steam over or alongside a sandbank. The main engines actuate a large centrifugal pump, whose function it is to take up material and discharge it into the hoppers. "Kriesel pompe," or whirlpool pump, was the name given it by the old Prussian pioneer who first applied this principle to hydraulic dredging. The pump forms a small maelstrom, sucking up into the interior of the dredge sand, mud, etc., with eighty to ninety per cent of sea water. Then with a full load of hundreds of tons the dredge steams across the navigable channel, up the temporary canal, and pipes the mixture onto the lots and appointed streets.

Two years more will see the accomplishment of this great undertaking. The sea wall will withstand the fury of the wildest storms. The raising of its grade will lift the city above the danger point of the highest floods. The incubus which has for so long overshadowed this *entrepot* of the Southwest will vanish. Galveston's legitimate future will have to its realization no vital barrier.

As to what that future holds, it is hard to place a limit. The natural potentialities of the location loom up prominently, and entail consequences which are unavoidable. A marked similarity to New York harbor impresses one entering Galveston Bay from the Gulf. Twist Galveston Island around so that its length points out between the jetties, and the similarity is very strong. The long, narrow peninsula, Bolivar Point corresponds roughly to Brooklyn. Texas City answers to Jersey City. Each place is the nucleus of a larger growth and of future extensions.

But New York is only one of several ports on the Atlantic coast tapping the Northern States and the West by the lake route. Galveston may be fairly ranked as the one really good seaport west of New Orleans. This means that there can be accurately classed as directly tributary, virtually all the territory beyond the belt of the Mississippi steamboat competition. It includes practically all of Texas, Oklahoma, Indian Territory, Kansas, Colorado, Arizona, and New Mexico. In the natural course of events, all foreign commerce to and from this district, and most of that with the Atlantic Eastern States, will go *via* Galveston. Now, Texas alone has an area greater than that of New York, Pennsylvania, Ohio, Illinois, and Iowa combined. It includes 170,000,000 acres, ranking in fertility well up with that of these older States. Its population is only 3,500,000. It is as inevitable as the law of gravitation that this area will be filled sooner or later with a population many times greater than it now has, and this means so much more commerce to pass through Galveston's port.

The Action of Radium on Gems.

A. Miethe, the author of a paper on the coloration of gems by radium rays, published in Ann. d. Physik, studied the action of these rays on a large number of gems, and found that many of them are influenced by the rays.

No general principles can be indicated, except that the more transparent gems show a greater tendency toward coloration than the opaque or highly-colored ones. Miethe used a preparation of 60 milligrammes of radium bromide. A colorless diamond from Borneo was colored a light yellow after eight days, and a decided lemon-yellow after another eight days. On heating the diamond to 250 deg. C. the yellow color was diminished, but it could not be entirely got rid of even at a red heat. A colorless Brazil diamond showed no coloration. A peculiar behavior was shown by a pale blue sapphire from Ceylon. After only two hours' exposure to radium bromide it showed a coloration, green at first, then light yellow, and after a few more hours, reddish yellow. After a fortnight it was a dark yellow approaching chestnut. The color could be got rid of by heating, but the light yellow color always returned on cooling. Rubies show no change, and tinted tourmalines very little. Brazil tourmalines slightly colored green and pink respectively at one end acquired the same color at the colorless ends on exposure to radium. This coloration took a day or two to appear.

The Search for Diamonds.

Never before in the history of the United States has there been such a demand for diamonds as there was in 1905. Large quantities were imported, but the country produced none. In 1903 it produced diamonds to the value of $50, in 1901 it had an output worth $100, in 1900 its production was valued at $150, and in 1899 the country boasted native diamonds to the value of $300. Diamonds have been discovered in the United States in four different regions, but their actual place of origin is in every case unknown. All have been found in loose and superficial deposits, and all accidentally. It is not at all improbable, however, that some day the original sources of this queen of gems may be discovered.

The high price of diamonds has made the recent search for these precious stones in the United States and Canada keener then ever before. A careful watch for diamonds was kept during the examination by the United States Geological Survey of many samples of gold and platinum sands at the Lewis and Clark Exposition in Portland, Ore. A lookout for diamonds has also been kept by a number of people who have been dredging for gold on an extensive scale in the rivers of California. In neither case have any finds been reported.

Paper from Cotton Stalks.

The manufacture of paper from the fiber of the cotton stalk is one of the latest inventions which are said to have passed the experimental stage. It is asserted that all grades of paper, from the best form of linen to the lowest grade, can be manufactured from cotton stalks. In addition to this, a variety of by-products, such as alcohol, nitrogen, material for gun cotton and smokeless powder can also be secured in paying quantities. Mills for the use of cotton stalks in that way may become general in the cotton-growing States. It is estimated that on an area of land producing a bale of cotton at least one ton of stalks can be gathered. Upon this basis, from 10,000,000 to 12,000,000 tons of raw material could be secured for the production of paper, which would increase the value of the South's cotton crop nearly $10,000,000.

According to a letter in the Manufacturer's Record, of Baltimore, a company has been organized under the laws of Maine, with a capital stock of $15,000,000, preferred and common, for the purpose of manufacturing pulp and paper from cotton stalks. Mr. Harvie Jordan, president of the Southern Cotton Association, has been elected president.