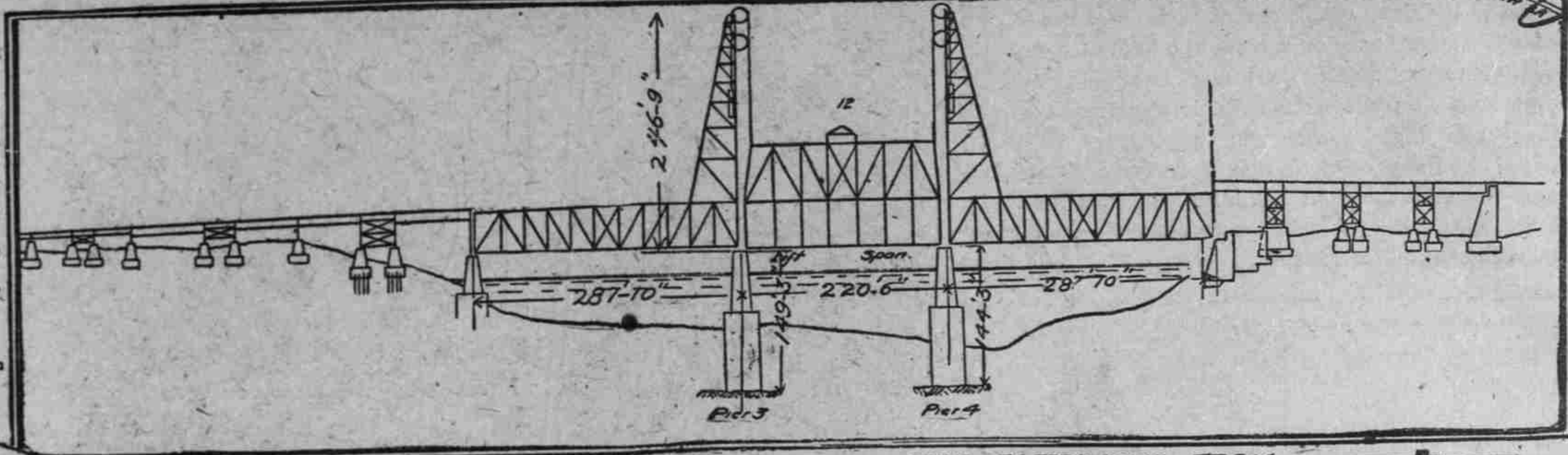
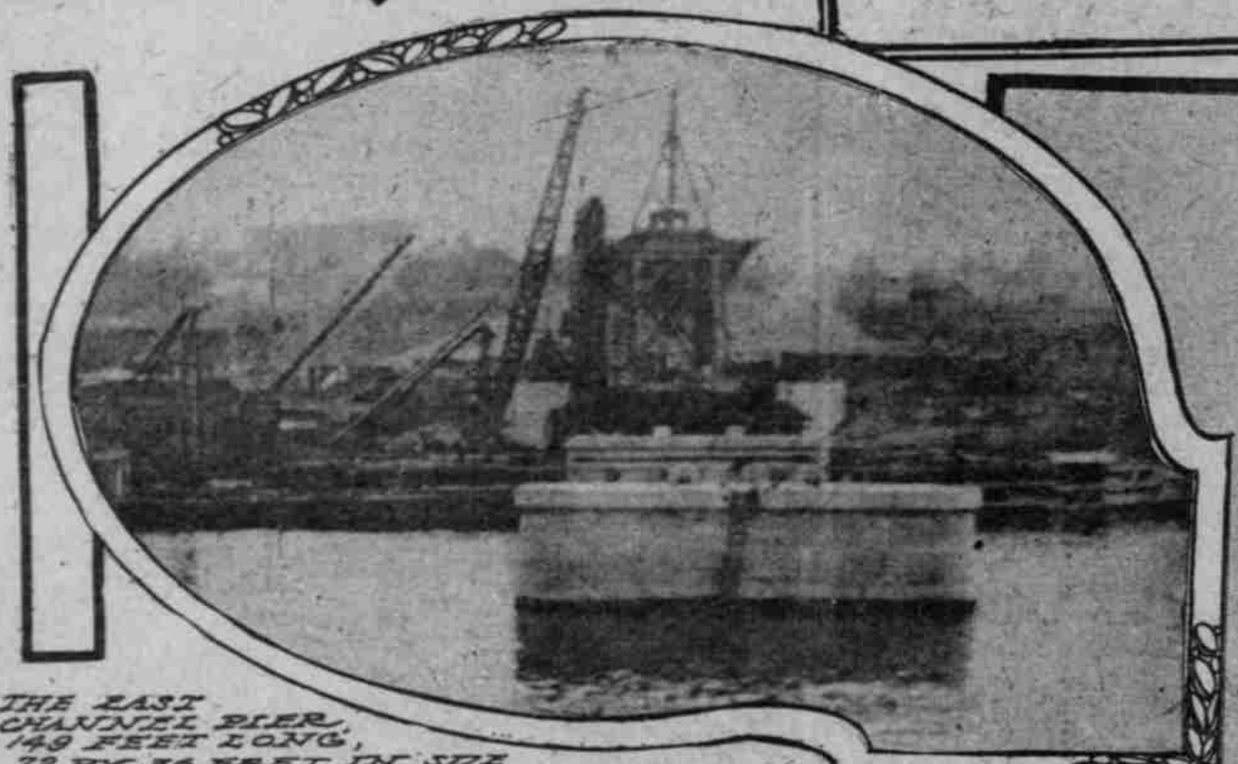
Bridging the Willamette

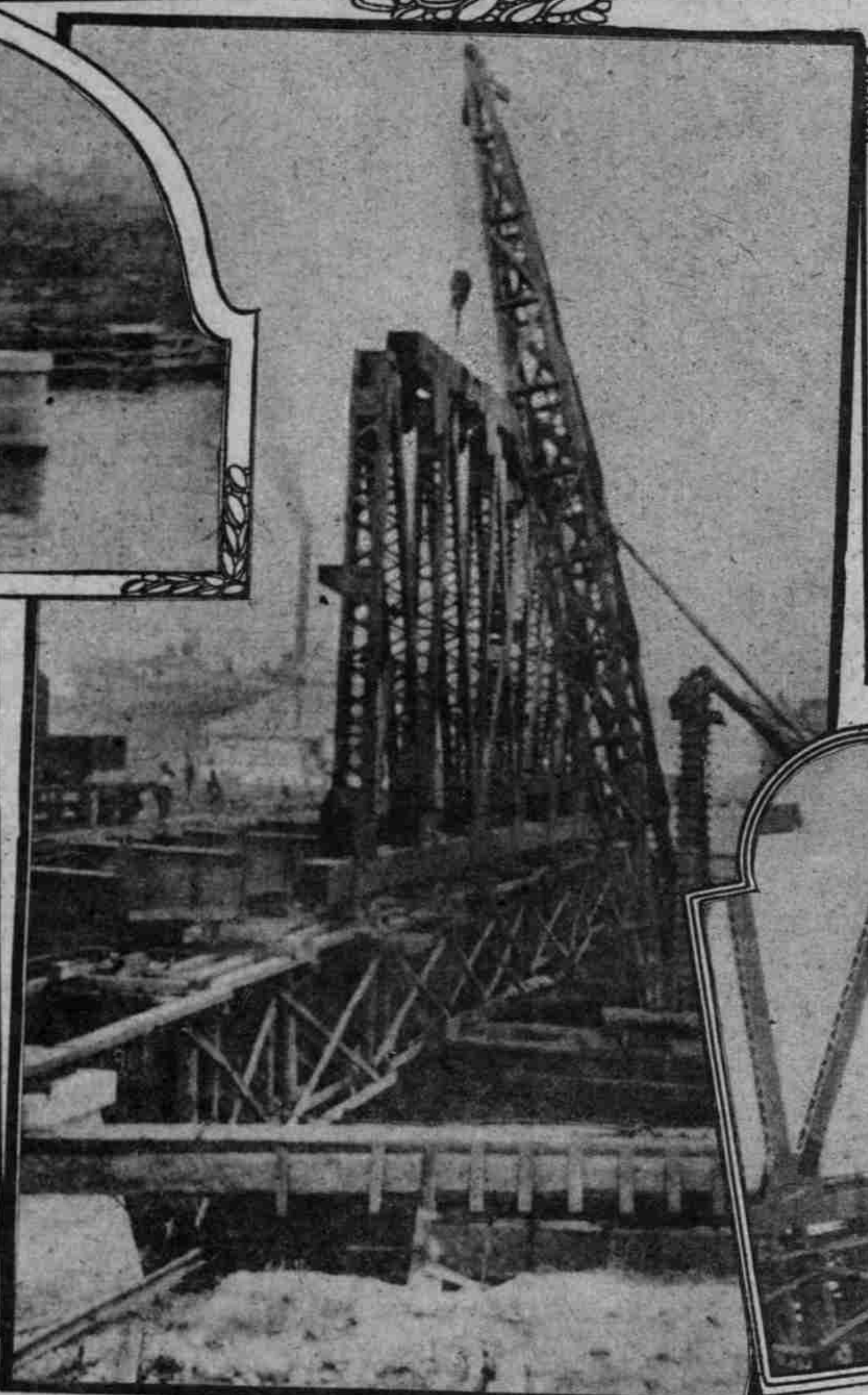
TREMENDOUS TASK IS THAT OF CONSTRUCTING NEW MODERN BRIDGE

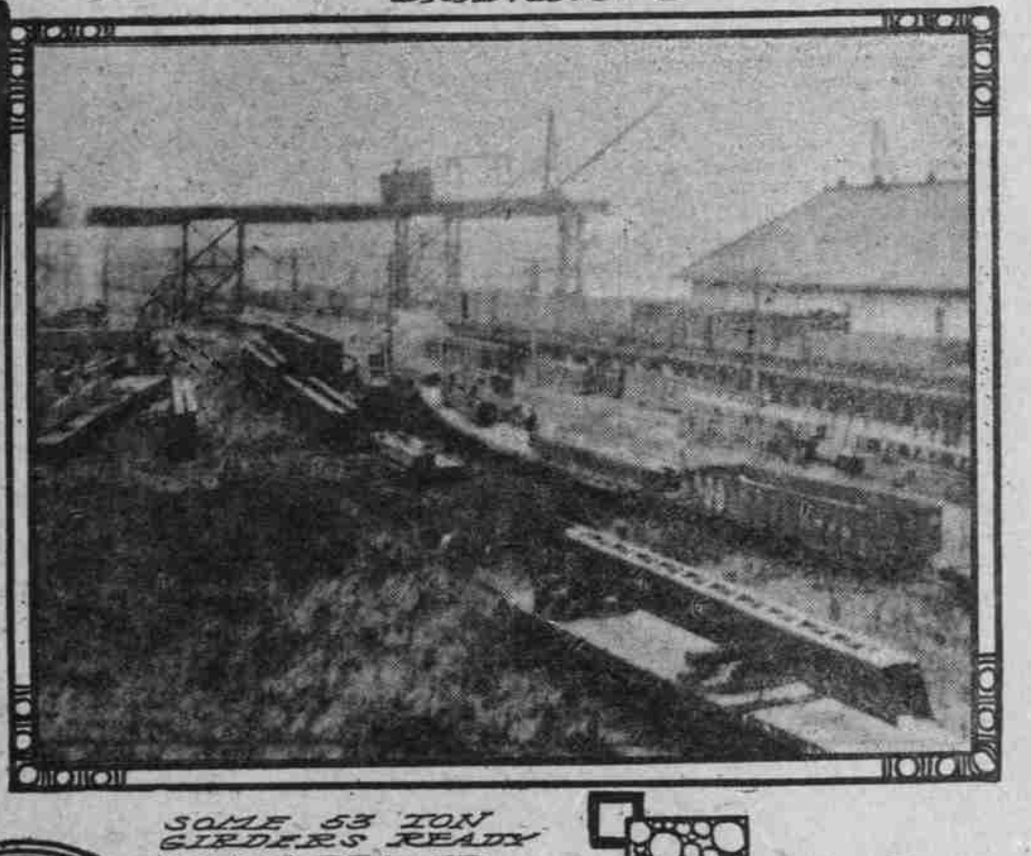
Working Force That Is Engaged With Placing New Steel Bridge, Extends From Atlantic to Pacific—Building Piers That Measure Higher Than the Average Skyscraper—How Huge Steel Frames Are Transported and Lifted Into Place—Difficulties Imposed by the River.

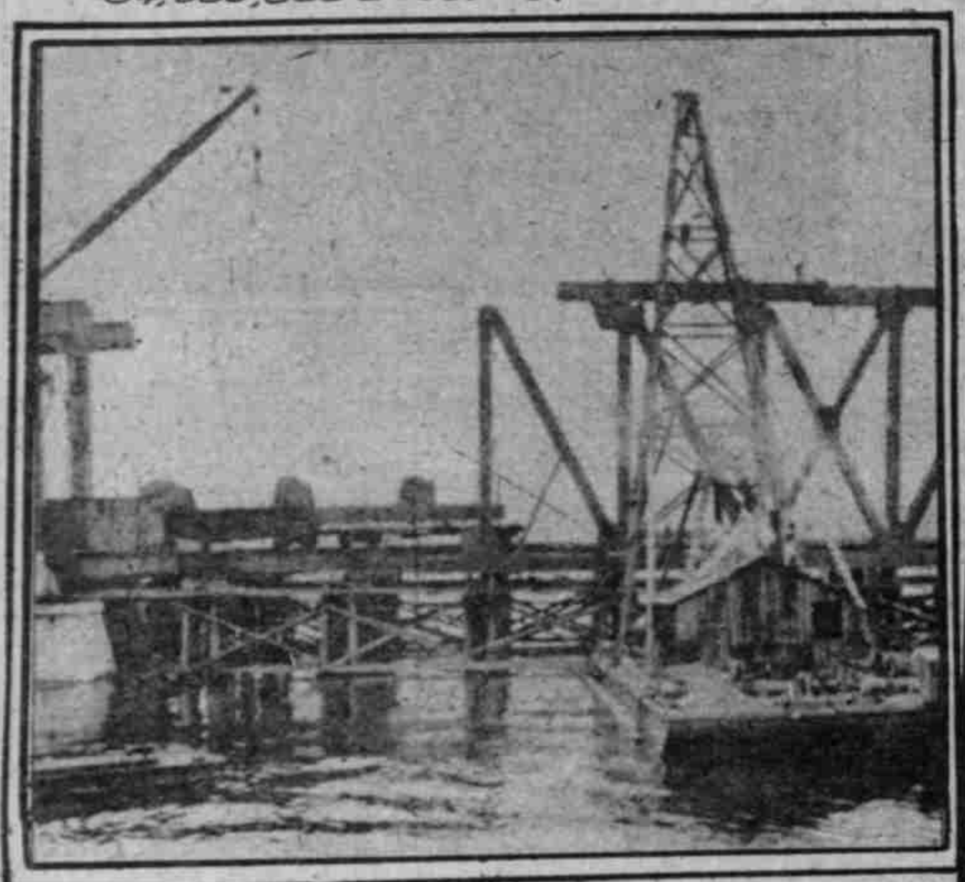


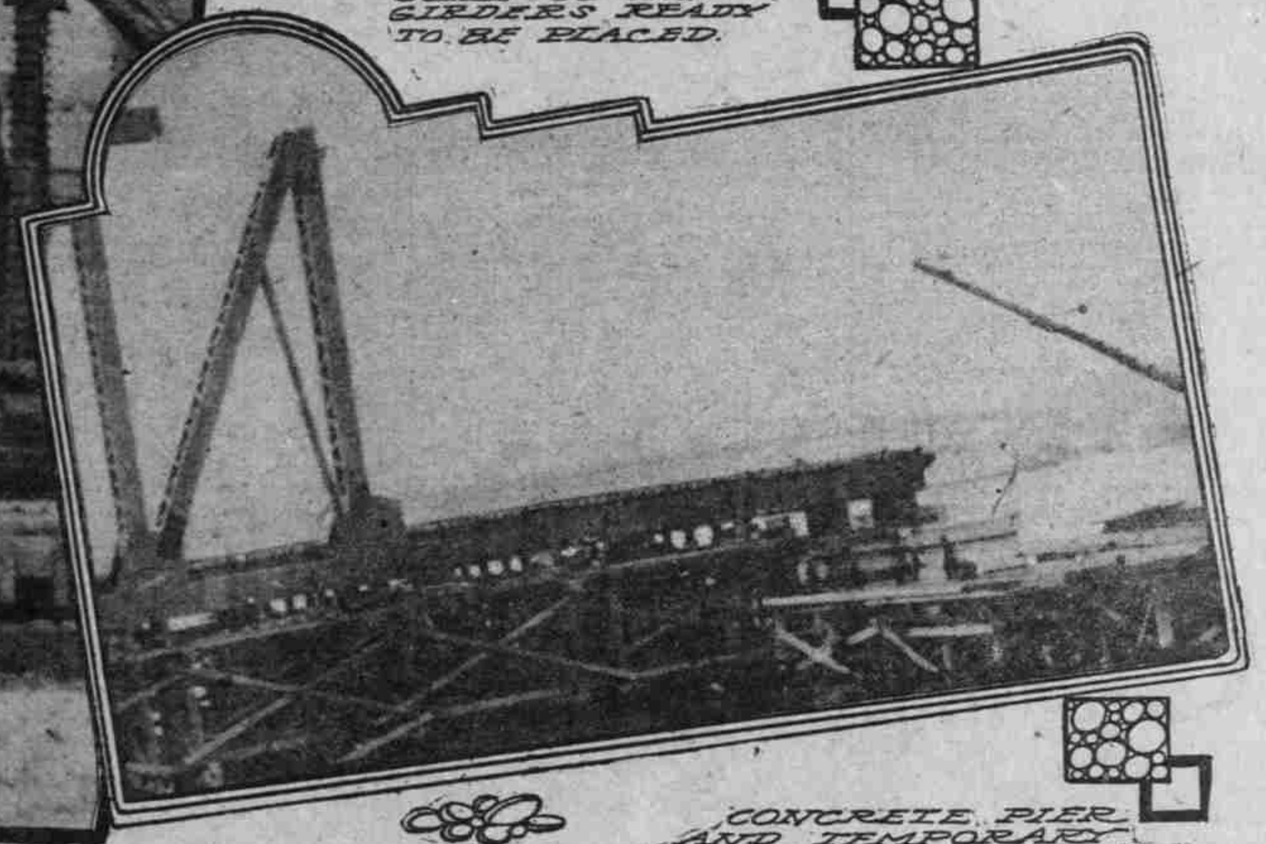
SIDE ELEVATION FROM ENGINEERS DRAWING.


THE EAST CHANNEL PIER, 149 FEET LONG, 72 BY 36 FEET IN SIZE AND WEIGHING 34,000,000 POUNDS.


PLACING HEAVY GIRDERS.


SOME 53 TON GIRDERS READY TO BE PLACED.


BEGINNING WORK ON THE STEEL SUPERSTRUCTURE


CONCRETE PIER AND TEMPORARY DOCKS FOR GUARDING THE SINKS.

IF YOU were asked if you could successfully place a solid block of reinforced concrete weighing 34,000,000 pounds, 72 feet long, 36 feet wide and standing perpendicularly higher than any 11-story building in Portland, down into the hard rock at the bottom of the middle of the Willamette so that it would stand absolutely straight and support many millions of pounds of steel above without moving the slightest fraction of an inch, what would be the answer?

This question was put to a party of engineers about two years ago by the Harriman railway system heads and without hesitancy they answered that they could accomplish it. They were given the opportunity and the two huge concrete piers projecting from the river just south of the Steel bridge are the results. They are ordinary-looking piers as they stand above the water but below the surface is hidden the story of one of the greatest engineering struggles of recent years.

Down in the watery depths rests a pile of shattered and fissured rock, which stands a monument marking the place where all nature revolted against the intrusion of the bridge piers and where modern inventions showed their superiority over nature by winning in the six months' struggle which followed nature's protest.

The laying of the piers was the main engineering feat undertaken in the erection of the big new steel bridge, and with that work completed the rest of the way is easy, according to the engineers in charge. It is comparatively a simple matter to swing 53-ton girders out over the water and fasten them to the concrete piers, because the procedure is according to rules established by precedent. It will be easy, for the same reason, to hoist two sheave wheels 14 feet in diameter 160 feet into the air and adjust them to the top of steel beams.

Difficulty of Submarine Work.

It was in the laying of the concrete piers that real engineering was required, because work had to be done along new lines, with no set rules to follow. The work as it progressed was all under water and fate had to be depended upon to make the mathematical figurings of the engineers result as planned. The slip of a detail in construction would have wrecked the whole huge arrangement, at a cost of hundreds of thousands of dollars.

The gigantic piers were put into the bottom of the river by means of cutting edge sinks, which are nothing particularly new in modern bridge-building, but which in the case of the Harriman bridge piers became decidedly new when they failed to operate properly because of the uneven and hard bottom of the Willamette. The troubles experienced could not be foreseen.

The first operation in the building of the bridge piers was the manufacture of the cutting edge sink bases, which are used in scientifically sinking the concrete. This work was started at docks near the Hawthorne bridge, where launching boats were specially constructed. The base, which is the most important part of the whole arrangement, had to be constructed with the greatest care and required many months. The base when finished was rectangular in shape, 72 by 36 feet in size at the top and 24 by 18 feet at the bottom or cutting point. It was built of heavy timbers bolted in every direction with 30-inch bolts and strands of steel and shod on the bottom with thick steel plates. Extending up through the center were a series of six wells, each three feet square. These were arranged at the bottom with cutting edges so set that when the base rested on the bottom of the river the edges would cut into the gravel and continue to sink lower and lower as weight was added to the arrangement from the surface above, forcing the gravel up through the wells. The sand was removed from these wells by means of grappling dredge buckets which, by digging out the gravel, assisted the cutting edges in their lowering process.

When the base was finished the sides extended up a distance of eight feet. The outer edges were of heavy timbers bolted in every direction and dovetailed at the corners. Between the outer walls and the walls of the wells were large compartments in which the concrete was to be placed.

Sinking the Great Bases.

The cutting base was floated down the river to temporary docks, which were built of timbers, extending 100 feet down to the sand on the river bottom and were for the purpose of holding the base in place and breaking the force of the river's current which, without the docks, would have played against the broad side of the sinking base and moved it from place. The sinking base was moored into the docks and anchored up stream and then concrete put in the compartments around the dredge wells. As concrete was added the arrangement began slowly to sink. Great care was necessary in not adding the concrete very rapidly, as that operation would have sunk the arrangement faster than the force of carpenters could build the sides up as the base went down. Slowly the concrete was added and the arrangement sunk until it reached the bottom of the river and the cutting edges rested in the sand.

Derricks were then erected at both sides of the affair and dredge buckets were lowered down through the dredge wells to remove the sand. Gradually the cutting edges sunk down as the buckets removed the sand and as concrete was added to the arrangement above the surface.

This procedure was kept up until the hard cement rock under the sand was struck. Blasting then became necessary. By means of a pile driver, holes four inches in diameter and about 15 feet deep were dug in the rock. A dynamite cartridge was inserted in the hole by means of a long tube and the charge exploded by a battery. The blasting was carried on in this manner until the cutting edge or base of the pier had sunk far down into the rock and was absolutely solid.

This system worked well with the pier which rests on the west side of the channel, but with the east channel pier nature revolted against the insertion of the big mass of concrete into the rock.

When the huge cutting edges reached the bottom of the sand it was found that the rock below was not level. The river bottom of cement rock was fifteen feet higher on one side of the cutting edge than on the other, and it was necessary to cut this down by blasting.

Bucking Flinty Rock.

This work delayed the bridge several months, as the blasting operation was extremely difficult. The rock was 100 feet below the surface of the water. The derricks were raised and used for drilling again. The work was so slow that it took the heavy drills from 10 to 12 hours to sink a hole a few feet in length. As the holes were completed the tubing three inches in diameter and six feet long filled with dynamite was lowered and exploded by the use of a battery on the surface.

For weeks this operation was kept up until the pier rested in the rock deep enough to be absolutely solid. In this pier are 8275 cubic yards of concrete and over 1,000,000 square feet of timber.

The piers are much larger below the surface of the water than above. On the top of the main shafts are the smaller concrete tops which are seen above the water and which will form the base upon which the steel will rest.

The plans for the new bridge are contained on 700 large sheets of blue print paper, filling a fair-sized room. The plans required many months of steady work on the part of dozens of engineers.

The work as seen on the bridge here is only a small amount of the work which is actually being done. The engineers say there are men working on the bridge from the Atlantic to the Pacific in hundreds of cities and towns. Their efforts are seen in the storeyards on the east side of the river, where are thousands of tons of steel and other supplies to be used in the bridge construction.

Besides the two main piers there are others which are of huge dimensions. On the dock, between Front street and the west harbor line, are thousands of piles inserted deep into the ground to hold the piers. If all these were placed end to end they would extend for six and three-quarters miles. Between Front and Third streets are enough piles to cover a mile and a half if placed end to end.

Cost of Great Bridge.

The foundations of the bridge cost $540,000, which is about $30,000 more than the entire cost of the Hawthorne bridge. The total cost of the Harriman bridge will be $1,800,000. The main river piers are 127 feet down from the extreme low water line of the river, and 22 feet 3 inches above, making a total length of 149 feet 3 inches. The towers will be 246 feet 9 inches from the top of the piers to the top of the sheave wheel. The total height from the base to the top of the sheave is 396 feet. The steamboat clearance when the lower deck is up will be 72 feet above low water. When both decks are up to the top there will be a clearance of 161 feet. The width of the channel between piers is 205 feet.

An interesting feature of the bridge is the fact that it is to have two moving decks. To allow steamboats to pass the lower deck, which will support the trains, can be raised and boats allowed to pass under without interfering with the road traffic on the upper deck of the bridge. Only in case of boats with long masts will the upper deck have to be raised. The engines to raise the lift span will not be large because of the huge counterbalance which will weigh the same as the lift span. The only power needed to raise the span will be that necessary to overcome the necessary friction.

The engineers for the bridge are Waddell & Harrington. They are represented on the job by C. K. Allen, resident engineer. John D. Isaacs is consulting engineer; George W. Boschke, assistant general-manager, and George T. Forsythe, bridge engineer of the O.-W. R. & N.

UNCLE SAM'S DAREDEVIL EXPLORERS

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that a rescue party from camp appeared with canteens of water, the violation of the scientific principle of exploration would have meant death to this Government party.

Quite different from this experience was one which Mr. Chapman passed through in the exploration of what is now the Glacier National Park, in Montana. He was far up on the Swan range following a goat trail, which was rough and dangerous. He had dismounted and was leading his horse when the animal stumbled, knocked him down and fell upon him in the narrow trail, which skirts the edge of the cliff. The surveyor realized the great danger which faced him as he lay under his fallen horse. Were that horse to flounder and fall over the cliff there was danger of the man being carried with him. Were he in any way to disable the rider the solitude afforded no hope of rescue. But, fortunately, as the horse attempted to rise the man struggled free from him. Then the horse slid over the cliff and fell a precipitous 500 feet before striking the earth. The surveyor states as the animal fell he uttered a shriek that was almost human in his tragic fright.

Surveying the Bad Lands.

Nowhere in the United States does the primal condition of lawlessness exist as it does in the Big Bend of the Rio Grande River, in Texas. Here is a stretch of land of such an extent and of such scattered population that an Eastern state might be dropped into it without the knowledge of any of its inhabitants. There is a cattle ranch once in a hundred miles, a quicksilver mine at Terlingun, an occasional visit of rangers in pursuit of a cattle thief and a well-covered trail or two over which smugglers occasionally introduce tobacco and Chinamen from Mexico. Otherwise the country is left alone with its great solitude and the mournful howl of the benighted coyote.

It was into this region that Arthur Stiles, representing the Geological Survey, went for the purpose of making maps. His experiences were novel from the standpoint of the roll-top desk or the morris chair. For instance, in the spirit of the explorer seeking knowledge, he once allowed himself to be let down on a rope into a cave he had discovered. Such caves had been known to yield the mummified remains of prehistoric dwellers in this region, and Stiles was in search of mummies. Before reaching the bottom he, by chance, dislodged a rock, which fell into the cave. The result of its fall was the hissing of a veritable multitude of rattlesnakes which inhabited the chamber below. Stiles signaled to his assistants above to haul him up, and escaped the fate that would have been his but for the accidental falling of the stone.

One of the best examples of the superiority of the scientific explorer over the mere adventurer is to be found in the case of Dr. W. J. McGee, Government geologist, ethnologist and soil expert, in his trip to Tiburon Island, in the Gulf of California. Upon this island dwell the Seri Indians, the most isolated and primitive people in the world today. These Indians are of gigantic stature and fanatically believe that the touch of any man from the outside world is damnation to them. They, therefore, resist to the death any expedition that is sent into their country. Sixty miles of desert and a stretch of exceedingly rough water separate them from inhabited Mexico, of which they are supposed to be a part. Any invader of their island is forced to surmount these difficulties which nature places in the way before they can be intruded upon. For 300 years they have successfully resisted all attempts on the part of the Mexican Government to subdue them. Scores of parties of adventurers and prospectors, led on by the tales of a wealth of precious metals in Seriland, have attempted to explore Tiburon, and in practically every case up to the time of the McGee expedition the attempt had resulted in tragedy, and often in the extermination of the members of the party.

But Dr. McGee arranged his trip upon the principles of the scientific explorer. He knew the amount of supplies necessary to take his party across a 60-mile desert and guarante their return. He knew the necessary materials with which to build a craft that would make it possible for his party to cross to Tiburon. He knew the strength of a party equipped with modern firearms that would be required to beat off any attack of the natives. He met every one of these requirements on the scientific basis the occasion demanded. As a result the trip was made without any especial risk. When Tiburon was reached Dr. McGee kept his fighting men together in such force as to discourage any attack from the natives, who knew the danger of firearms. The entire expedition, which had proved death to many adventurers, was in this way made entirely safe through the man of science.

So are the men of the test tube and the spectacles robbing the adventurers of the glory of their many accomplishments in the face of danger and death. So is it being demonstrated that adventure is a thing that comes only to the amateur, and is due to a lack of knowledge and precaution. So are the great feats in exploration and discovery now being made by the men of science rather than the lover of adventure. The season is now on when the stunts are being done, and the coming of Autumn this year, as in other years, promises additions to the store of knowledge, because these men of science have gone afield in the Summer months.