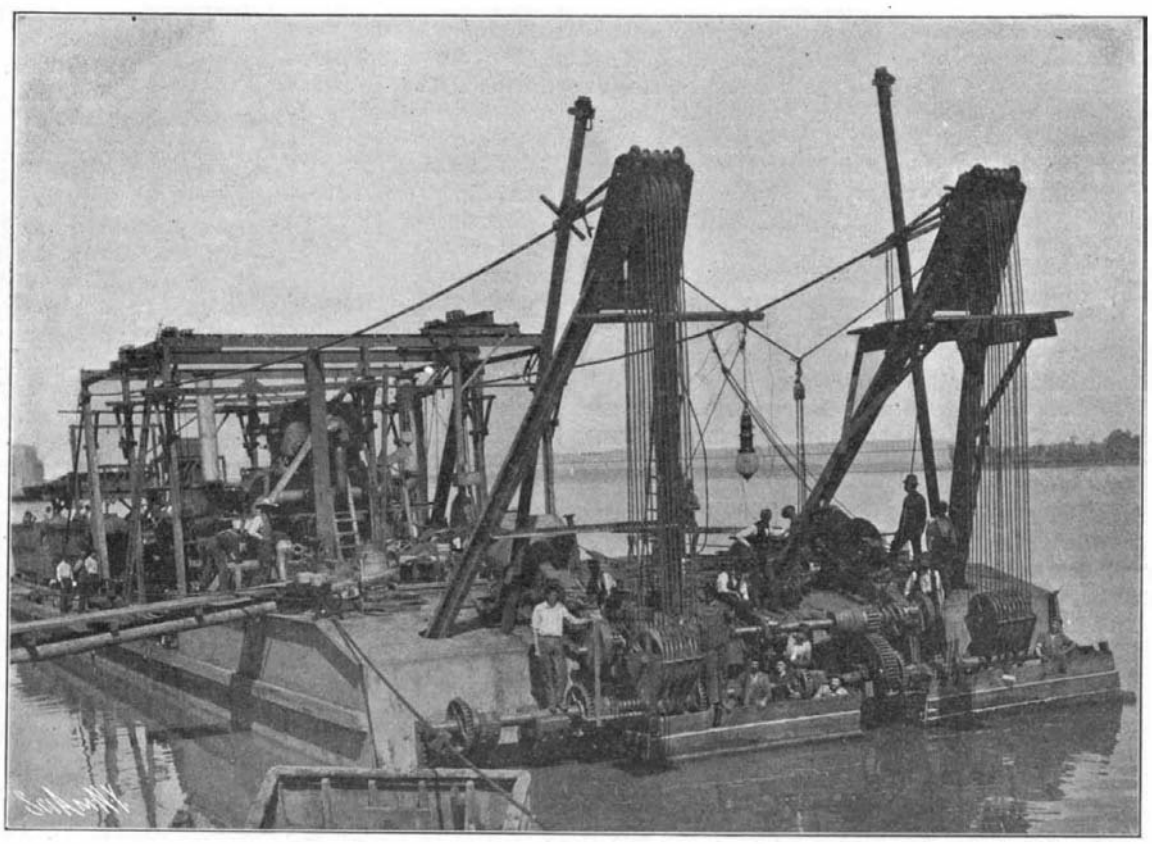
HYDRAULIC SUCTION DREDGE ON THE MISSISSIPPI.

BY DAY ALLEN WILLEY.

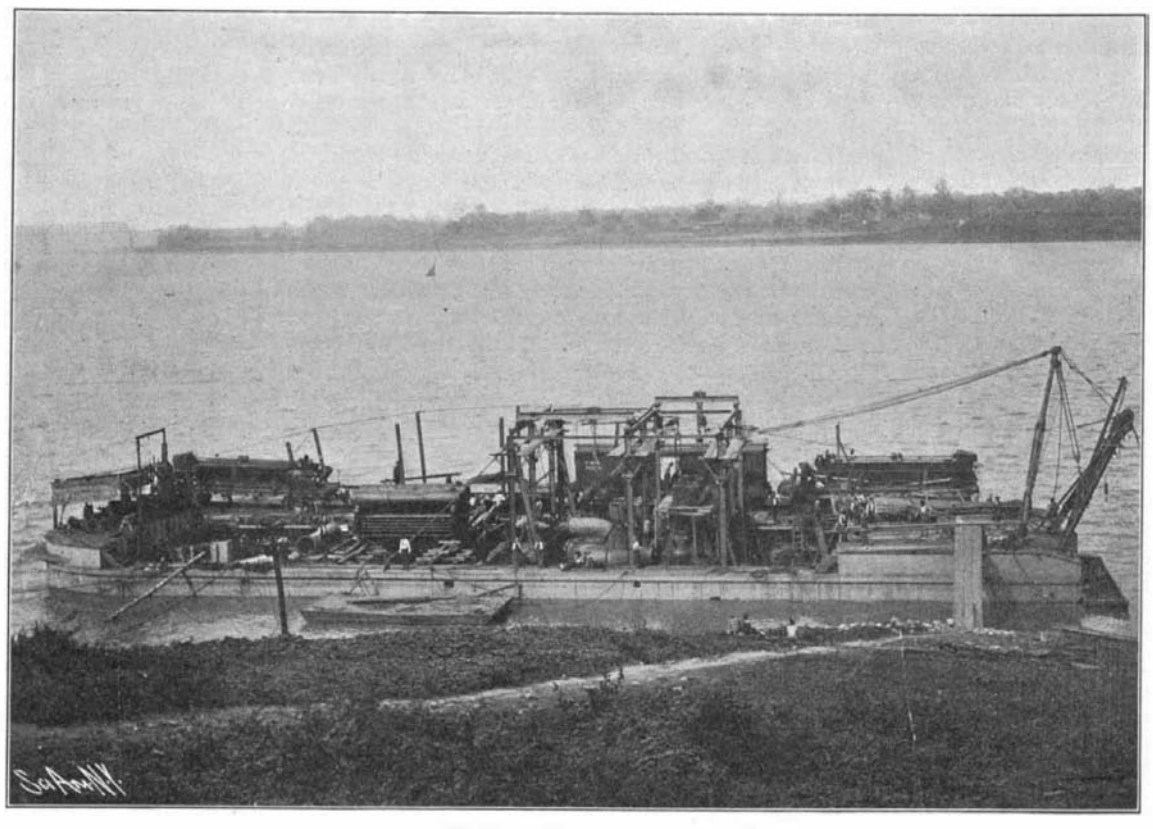
The hydraulic suction dredge in use on inland waters of the United States has been employed extensively only within the last ten years; but such has been its development, that a revolution in the methods of deepening river channels has resulted from its service. The construction of what engineers term the "Greek letter" series of dredges marked the beginning of a new era in controlling the channel of the Mississippi, and undoubtedly the work done by this type of excavating machinery is responsible for the dimensions of the present boat channel.

The problem presented to the United States engineers by the Mississippi River has been one of the incentives which has led to the designing of the modern suction machine, not only for inland waters, but for the excavating of deep-sea channels such as the entrance to New York harbor. The "Alpha," "Beta," and other dredges of this type, constructed for the Mississippi service, have a number of points in common with the excavators which are employed upon the New York improvement, but were designed for use in comparatively shallow water, and to remove a wide area of the bottom of the river.

The accompanying illustrations give an excellent idea of the arrangement of the pumping and other machinery on the Mississippi dredges, being photographs taken at the time the mechanism was installed on the "Beta," one of the largest of the Greek letter series. At the time it went into commission the "Beta" was by far the most powerful suction excavator employed anywhere on inland waters, and for several years had the greatest capacity of any of the Mississippi suction machines. The dredge really consisted of two inclosed in one hull, each being provided with its individual pump, conduits, and other connections, so that one section of the dredge could be operated independently of the other. The hull, which was built of steel, was 172 feet in length, 40 feet in width, having a depth varying from 7 1-6 to 10 5-6 feet. The apparatus, which was constructed by the Maryland Steel Company, at Sparrow's Point, and placed in the hull at Cairo, Ill., includes two triple-expansion pumping engines having cylinders of 20½, 33, and 38 inches respectively with a 24-inch stroke, the engines being provided with jet condensers. The pumps are located amidships, each having a runner of seven feet diameter with a shaft of ten inches diameter. The discharge is of the enormous size of 33 inches, and the suction 33¾ inches in diameter. Each suction pipe is provided with three heads of 19½ inches in diameter, making the combined diameter of the suction heads nearly five feet. At the ends of the suction pipes are placed cylindrical cutters five feet in diameter, which have a speed of 25 revolutions a minute, being operated by a separate engine placed on the bow of the dredge.



Detail View of Bow Section of Dredge, Showing Elevators for Raising and Lowering the Pipe.



General View of the Dredge Machinery.

The pumps, which are driven at the rate of 125 to 130 revolutions per minute, discharge the material through a steel conduit ranging from 1,000 to 1,200 feet in length, according to the location of the dump from the vessel. This conduit is made in 50-foot sections, with flexible connections of rubber hose. It is supported on a series of steel pontoons, and is extended forward on the craft, and is usually placed up-stream from the dredge, advantage being taken of the current in controlling the movements of the latter when in service. The upper portion of the suction apparatus is also buoyed on a pontoon attached to the bow, in order to partly relieve the strain caused by the weight of the pipes when carrying material. The suction conduits are raised and lowered by arms projecting obliquely from the hull, each arm supporting a block through which are passed cables attached to each conduit. By this method the suction apparatus can be immediately lifted from the water, when it is necessary to change the position of the dredge or to perform some other service.

Steam is generated on the "Beta" by a battery of four boilers, each representing nominally 375 horse-power. Steam is not only employed for driving the pumps, but for operating an electric-light plant for working at night and for several other auxiliary purposes. When in operation the dredge is held in position by two vertical spuds set astern, which are controlled by a three-drum hoisting engine.

Considering the dimensions of the suction and discharge pipes, and the high power of the pumping engines, it was expected that the dredge would be capable of removing a much greater quantity of material than any other type of river excavator that has yet been employed in this country. But a test of the service showed that the capacity had been underestimated rather than overestimated; for on ordinary work the "Beta" has removed 5,000 cubic yards of sand in a single hour, discharging it at a distance of at least 1,000 feet from the excavation. While many of the shoals on the Mississippi consist principally of sand, at times clay and formations are encountered so hard that the use of the cutter is necessary. It has been found with this attachment, however, that a dredge of the "Beta" type can work on practically any portion of the stream, except where snags or some other unusual obstacle exists.

One of these suction dredges and its auxiliary craft represent a small fleet of boats. The "Beta" usually requires two towboats to move it from shoal to shoal, as well as a pile driver, two river barges for carrying the discharge pipe and other material, as well as a barge which has been fitted up for a combined blacksmith and machine shop. To operate the dredge proper and the discharge pipe requires a crew of about sixty men; but estimates made of the cost of excavation by this method compared with other plans which have been employed upon the Mississippi, show that it is far more economical, owing to the much larger quantity of material which can be removed in a given time.

THE NEW SOLAR OBSERVATORY AT MOUNT WILSON.

BY M. BENEDICT MAYE.

In 1903 Dr. Hale went up to Mount Wilson, and began his new solar observatory. The following spring an expedition for solar research was organized under the joint auspices of the University of Chicago and the Carnegie Institution for the Promotion of Science with the understanding that the Carnegie Institution furnish the funds for the construction of piers and buildings and other expenses incidental to the work, while the University of Chicago furnished equipment and paid the salaries of some of the members of the party.

The Carnegie Institution has granted the sum of $150,000 for use during 1905, which will cover about one-half the cost of the first equipment, with the understanding that should the Carnegie Institution decide to establish a solar observatory of its own, this should take the place of the Mount Wilson station of the Yerkes Observatory and the work be continued under the sole auspices of the Carnegie Institution.

Dr. Hale, who is now president of the Society for International Co-operation in Solar Research, which numbers its members from every civilized country on the globe, has already outlined the plan of research and determined the equipment of two other observatories, the Kenwood—subsequently merged with the Yerkes—and the Yerkes Observatory of Chicago, and he regards the instrument shop of great importance, since it renders possible the construction and frequent improvement of instruments of new type and special design. The operation of the shop is not confined to the construction of the mechanical parts of the instruments; provision is also made for optical work on a large scale.

This shop is located at Pasadena, and is 50 by 100 feet, with an optical testing room 150 feet long extending 68 feet beyond it in the rear. It is fireproof, as the optical and mechanical parts of the instruments under construction are very valuable. It contains offices and drafting rooms, machine shop, instrument shop, pattern shop, lacquer room, constant temperature room, room for 5-foot grinding machine, room for 40-inch grinding machine, long optical testing room, photographic dark rooms, enlarging rooms, etc. The equipment includes milling machines, planes, lathes, grinding machines, drill presses, various saws, trimmers, and all other tools needed. The optical laboratory will contain all necessary machinery for grinding, polishing, and testing mirrors with apertures as great as 5