

men by set screws, each carrying a graduated circle four inches in diameter, over the face of which moves a balanced pointer. This pointer carries a small vernier and is attached to a spindle, in which is a friction roller measuring exactly one-half inch in circumference. The roller on one spindle is operated by an arm which is attached to the other collar, these arms being mounted symmetrically on opposite sides of the specimen. The apparatus reads with exactness to the nearest one-ten-thousandth of an inch, and registers elongations beyond the elastic limit as readily as it does those below that limit. Its operation is very satisfactory.

At the regular meeting, June 1, the usual routine business was transacted and subscriptions to the leading engineering papers ordered.

Mr. Flad presented some diagrams showing loss of head for the flow of gases through pipes of varying diameters and for varying velocities. Discussion followed by Messrs. Wheeler, Colby, Flad and Love.

Mr. Ockerson exhibited blue print diagrams showing the effects of erosion on the Mississippi River banks, from Cairo to Donaldsonville, from 1877, 1883 to 1892. The diagrams showed graphically the annual amount of caving per mile of river considered in sections of 10 miles. Discussion followed by Messrs. Colby, Wheeler, Flad and Crosby.

NOTES AND NEWS.

A Large Plate Girder Bridge.—The Boston Bridge Works at Cambridge, Mass., recently shipped two heavy steel plate girders, to be placed over Southbridge Street, Worcester, for the Providence & Worcester Division of the New York, Providence & Boston Railroad.

The two girders, each 95 ft. 8½ in. long, were put together in the shop and shipped in single pieces.

Each girder is 9 ft. deep, too wide to safely lie flat on a car. They were therefore loaded on edge, each on three long flat cars. Each girder weighs 57,715 lbs.

The bridge structure will be 17.4 ft. wide, and will be supported by these two girders, resting on stone abutments.

An interesting feature in the construction of this bridge is its floor plan. The foundation is a series of steel V-shaped troughs, side by side, lying transversely to the tracks and resting in sockets riveted to the girders. The troughs are bent at right angles and are about 18 in. deep.

These are to be filled with cement or concrete, and over this will be placed the material of an ordinary roadbed. The result is a thorough protection of the bridge floor from fire or storm, the deadening of sound, and the making of a tight and solid floor.

Petroleum Burning in Russia.—A number of locomotives on the St. Petersburg-Moscow and the St. Petersburg-Warsaw lines, in Russia, are now being prepared to burn petroleum. Experience with oil-burners on the Southwestern Railroad has shown that oil can be supplied at a cheaper rate than coal to almost any of the Russian lines, except, perhaps, those in the Baltic provinces.

Lengthening a Stand-Pipe.—Owing to the steady growth of Mt. Vernon, N. Y., it became necessary, in order to obtain greater pressure for elevated points, to enlarge the stand-pipe. The old affair was originally 100 ft. high, 20 ft. in diameter, and weighed about 75 tons. It was built of 5-ft. plates, double riveted vertical seams, and had a capacity of about 235,000 gallons. To increase the pressure the stand-pipe was raised 25 ft. with handjacks and blocked. The extension of 25 ft. was made of tank iron, 12½ ft. of ⅝-in. and 12½ ft. of ⅞-in. iron, having a tensile strain of 50,000 lbs. per sq. in. of section.

The present height of the stand-pipe is 125 ft.; diameter, 20 ft., with capacity of about 300,000 gallons. The stand-pipe was raised in thirteen days. The placing of the extension and connecting force main took nearly thirty days. The cost of the entire work was about \$5000. Isaac A. Blair & Company, of Boston, did the raising, and the iron work was done by the Cunningham Iron Works of South Boston.—*Fire and Water.*

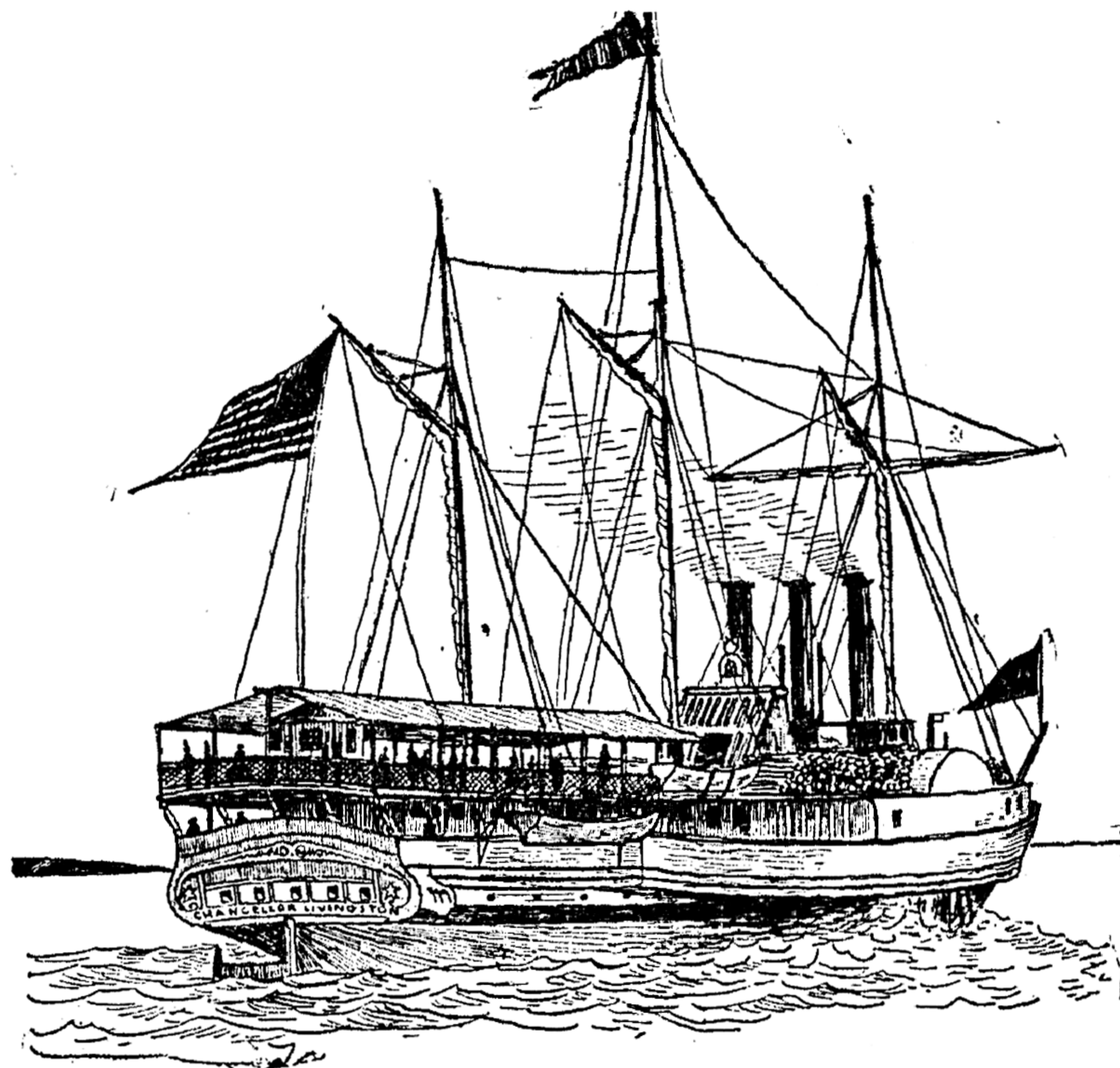
An Old-Time Sound Boat.—Our marine contemporary, *Seaboard*, is publishing a very interesting series of articles on the old-time steamboats of Long Island Sound. From one of these we take the accompanying illustration of the *Chancellor Livingston*, which was built in 1815. The history of this boat is given by *Seaboard* as follows:

"She was designed by Stouddinger, and was two years building; when finished she was the most elegant steam vessel in

the world—the *Puritan* of the steamboats of that day. Her hull was built by Henry Eckford, and the joiner-work executed under the direction of David Cook. Her engine and boiler were constructed by James P. Allaire. Her boiler was of copper, but on a new model, having a large cylindrical flue, with two small return flues and a false front. She was the first boat having a cabin on the main deck, with a promenade above. She cost, complete, \$110,000.

"The *Livingston* made her trial trip on Saturday, March 29, 1817, going to Newburg, a distance of 60 miles, which, according to those on board, 'was accomplished in a few minutes less than nine hours, of which time the tide was in her favor only three hours. In returning, the same distance was run in 8 hours and 15 minutes, the greater part of the time against a flood tide and south wind.' It was expected that she would go to Albany in about 20 hours, and she did a number of times. Her fastest run that year to Albany was on December 5, when she went up in 18 hours.

"The *Livingston* continued on the Hudson until March, 1828, when she was placed on the New York & Providence line as an opposition boat, with Captain Coggeshall in command.



THE "CHANCELLOR LIVINGSTON," 1828.

She had been rebuilt during the winter previous, and now appeared with three boilers and three smoke stacks, as is shown in the illustration. The other steamers running between the two places were the *Fulton*, *Connecticut* and *Washington*. The steamboat *Long Branch* was placed on the same route later in the season, and a new boat, the *Ben Franklin*, appeared in September that year. The latter was said to be the best boat on the Sound, but it was claimed that the *Livingston* was the fastest. The *Livingston* continued to run for a number of years. She became a great favorite, and the superb meals that were always to be had on this boat added not a little to her popularity. She ran independently during 1831-32, keeping the fare down, and the steamers *President*, *Connecticut*, *Providence*, *Franklin*, and *Boston* were on the other lines. In 1834 the *Livingston* went to Boston, where she struck a rock in the harbor and sunk. She was raised again and placed on the Boston & Portland line, where she ran for a number of years. Her hull having been condemned, it was broken up and her engine put into the new steamboat *Portland*."

The Hawarden Bridge.—A paper recently presented before the British Institution of Civil Engineers by Mr. Francis Fox gives a description of the Hawarden Bridge over the River Dee, built under his charge, which has the longest clear opening of draw span in England.

The bridge consists of two fixed spans of 120 ft. each, and of one swing portion, 287 ft. in length over all, which gives two unequal openings, the largest of which, being for the navigation, is 140 ft. clear span, while the tail end of the girder gives a clear span of 87 ft. The bridge carries a double line of railroad, with a footpath, 4 ft. in width, supported on cantilevers outside the main girders.

The piers are founded on brick wells, a system much used in India, the brick columns or wells built in iron caissons sunk in the bottom of the river, which is of soft, shifting sand.

The swing bridge consists of two main girders, constructed of mild steel, each having a total length of 284½ ft., and a total