INDICATING AND RECORDING THE TIDES.

BY DAY ALLEN WILLEY.

The system employed for predicting, recording and indicating the fluctuations of the tide by the United States government is acknowledged by mariners to be more thoroughly developed and more accurate than any adopted by other nations. It is the result of experiments and investigations made by the Coast and Geodetic Survey, and consists of three different kinds of mechanism, the tide indicator, the tide recorder and the tide predicting machine, the last to be described in another article. The indicators are divided into two classes—one being in use at stations directly on the harbor, and the other installed at inland points which may be some distance from the locality where the ebb and flow of the water is being noted. The inland indicator, as it may be termed, is connected with the seaboard or harbor indicator by electric wires. For example, the apparatus at the Maritime Exchange in Philadelphia is a mile distant from the Delaware River, whose changes is records; but such is the system employed that these changes could be noted in Chicago or across the continent as accurately.

The harbor indicator appears as a large semicircle painted white, and faces up the stream. The inner edge of the semicircle is divided into spaces by heavy black lines representing feet and half feet. The longer of these division lines are numbered by figures in black. A pointer, actuated by the rise and fall of the tide, turning about the center of the circle, sweeps along the inner edge of the graduations and indicates, at any moment, the number of feet of water above or below the plane of reference (mean low water) to which soundings on the chart are reduced. The minus sign, shown near the left edge of the indicator, indicates the number of feet below the plane of reference. An arrowhead, placed in the center of the disk, is made to point up while the tide is rising and down while it is falling. A glance at the indicator will enable the navigator to tell the height of the tide, whether above or below mean low water, and whether it be rising or falling. The division lines, figures, pointer, and arrowhead can readily be seen at the distance of a mile with the aid of an ordinary marine glass.

The electrical tide indicator having an inland connection consists of two parts—the apparatus shown

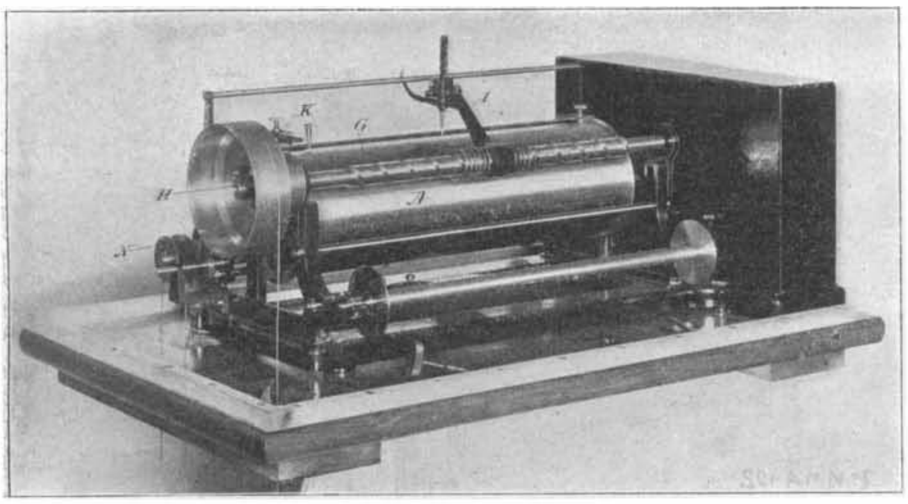

Fig. 1.—Rear View of Self-Registering Tide Gage.

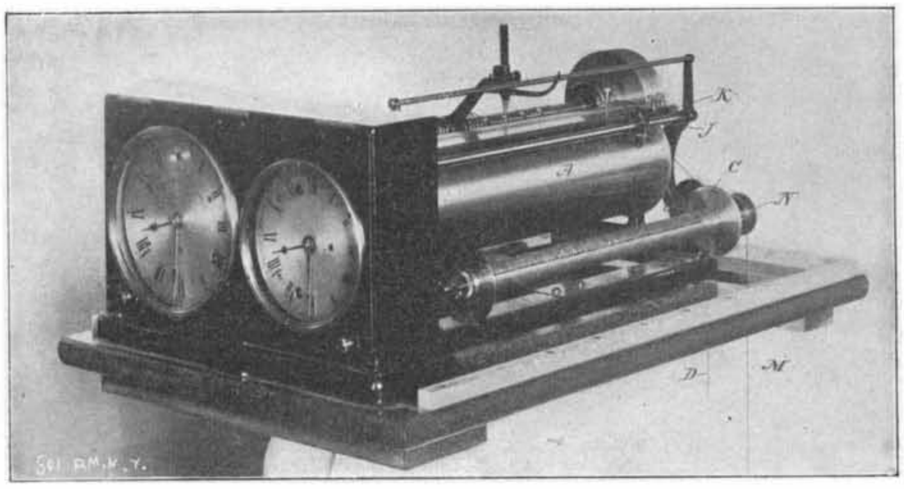

Fig. 2.—Front View of Tide Gage.

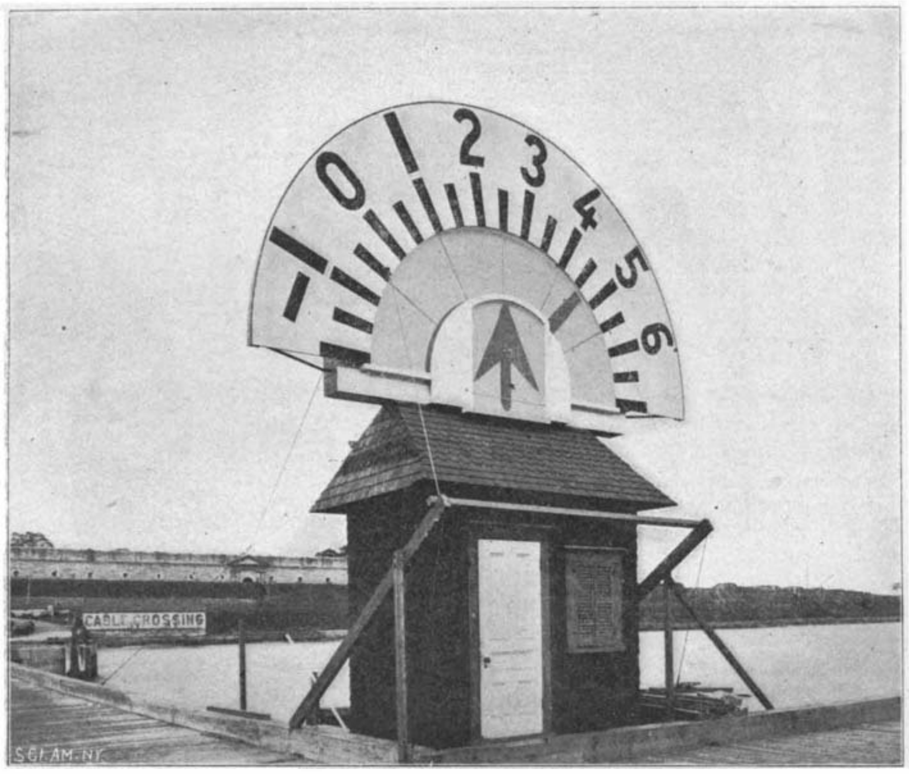

Fig. 3.—Tide Indicator at Fort Hamilton, N. Y.

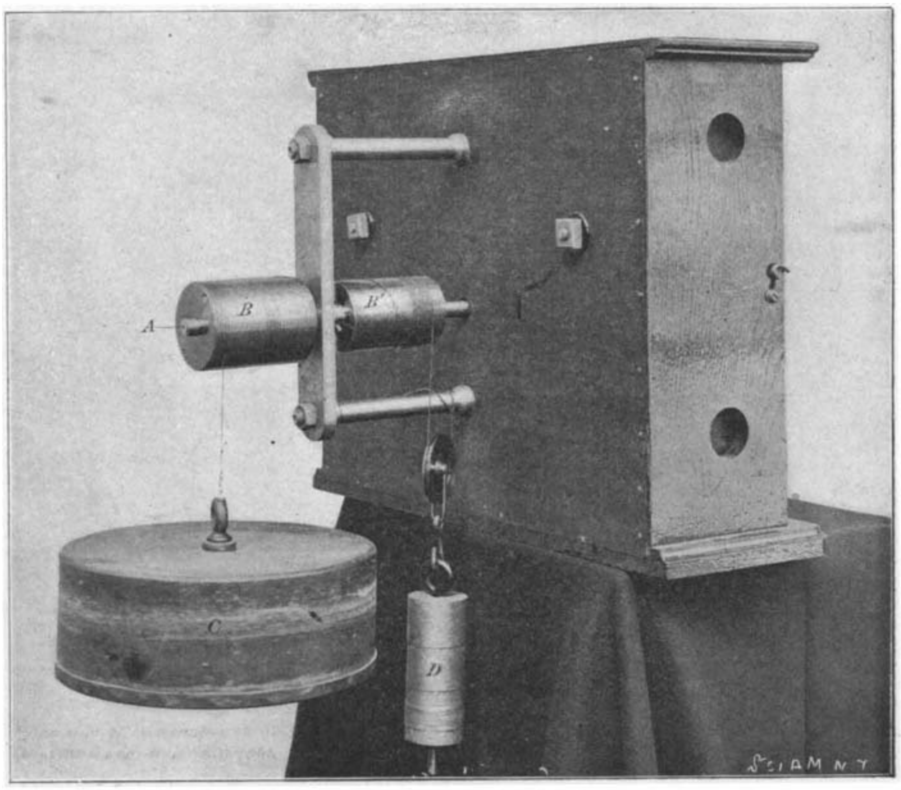

Fig. 4.—Rear View of Transmitter, Showing Float and Counterpoise Weight.

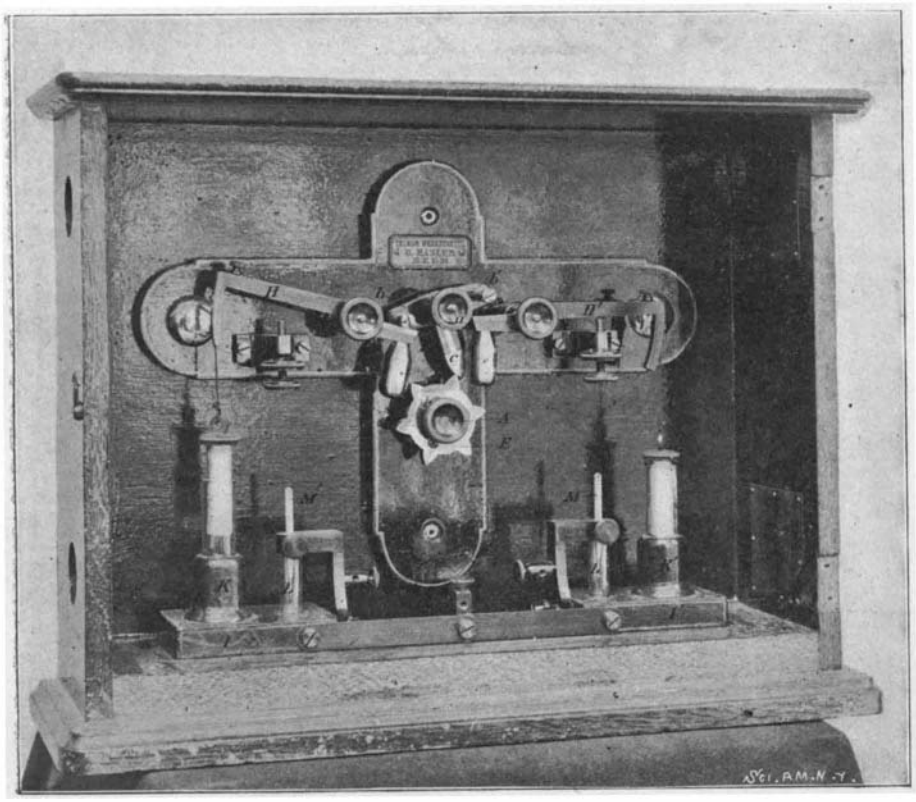

Fig. 5.—Interior of Transmitter.

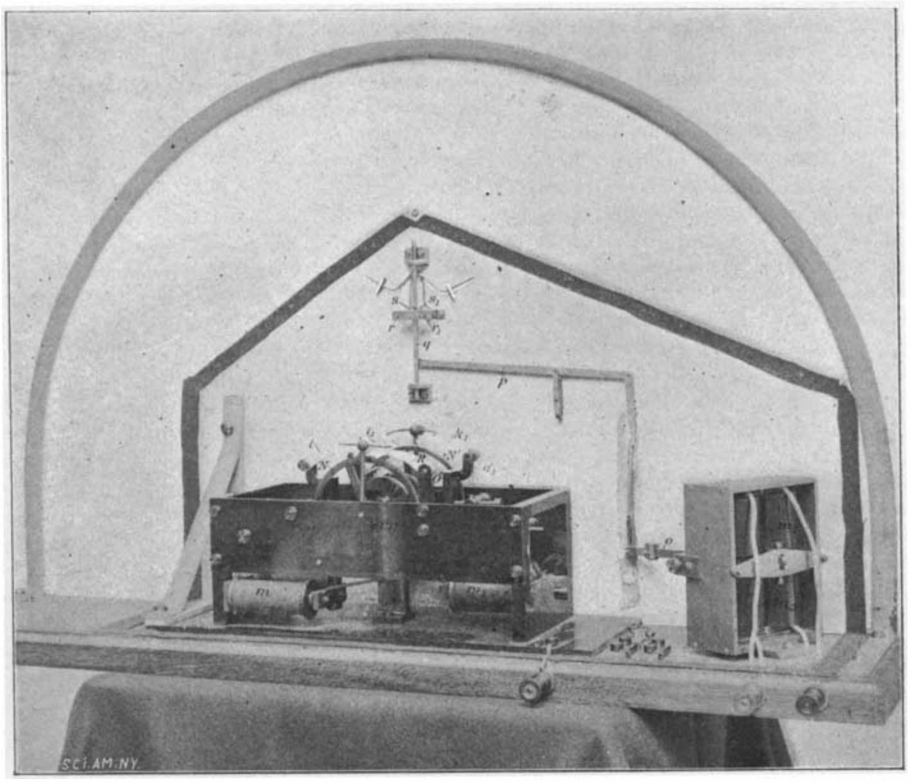

Fig. 6.—Receiving Instrument.

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in Figs. 4 and 5, whereby the rise and fall of the water level is utilized to complete electrical circuits, which, in the second part (Fig. 6), through the intervention of electric magnets, communicate the motion to the indicator arm and device, by which the required information concerning the height and character of the tide is displayed to the public.

An arbor, *A*, behind the apparatus case, carries two brass drums, *B* and *B*'. From *B* the float, *C*, is suspended, and from *B*' the counterpoise, *D*. The same arbor in the interior of the case carries the six-toothed wheel, *E*. Above the ratchet wheel is placed a three-armed lever, movable about the center, *a;* the two horizontal arms carry the pins, *b b ;* the vertical arm, *c*, engages the teeth of the ratchet wheel. The pins, *b b*, rest on the short arms of the levers, *H H'*. Resting on the bottom of the apparatus case are two cast-iron reservoirs, *I I'*, containing mercury, which are equipped with the tubes, *K K'* and *L L'*. In the larger tubes, *K K'*, two cylinders plunge, which are suspended from the outer ends of the arms of the levers, *H H';* from the smaller tubes protrude the ends of the contact ends, *M M'*.

If the level of the water is lowered, the float, descending, causes the wheel, *E*, to turn to the right, the lever, *H*, raising the cylinder slowly until the arm, *c*, trips, when the cylinder falls, compressing the air in the large tube, *K*, raising the surface of the mercury in the tube, *L*, and producing a brief contact with the rod, *M*, thereby completing for a short time the electric circuit which brings the second apparatus into action. If the water level rises, the counterpoise, *D*. makes the wheel, *E*, turn to the left, and the mechanism on the right of Fig. 5, operating in a similar manner through a second circuit and set of electro-magnets, produces opposite indications on the dial.

The mechanism on the inland apparatus is shown by Figs. 3, 4 and 5. On an arbor, *U U* (Fig. 6), which carries the indicator arm, two pairs of wheels, *N O* and *N' O'*, turn. Each pair is riveted on a common barrel. A rod, fixed in the middle of the arbor, *U U*, carries at one end a wheel, *R*, which engages the wheels, *N N'*, and at the other end a counterpoise. On the completion of the circuit in the apparatus at the tidal station, if the current of the battery passes through the electro-magnet, *m*', the latter attracts the armature, *a*'. With the interruption of the current, a coil spring draws back the armature lever and the pawl, *k*', makes the wheel, *N*', advance one tooth. If the current passes through the electro-magnet, *m*, it is the wheel, *N*, which turns one tooth. The wheels, *N* and *N'*, are equipped with safety pawls, *t t'*, which permit of revolution only in one direction. When the wheel, *N'*, advances one tooth, the wheel, *R*, and the arbor, *U U*, with the indicator arm, *T*, turn in the same direction, while the wheels, *N* and *O*, are held in repose by the pawl, *t*. If the current passes through the electro-magnet, *m*. the wheel, *N*, turns backward one tooth and the indicator arm a space indicating a change of water level of one-tenth of a foot, while the wheels, *N' O'*, remain unmoved. The direction of the arrow in the center of the dial shows whether the water level is rising or falling. This indication is secured by the use of two electro-magnets in series with *m m'* and a system of levers which control the position of the vanes which make the head of the arrow.

The tide gage or recorder is the design of Mr. A. Stierle, of the Engineer Corps. With an eight-day marine clock is connected, by a clutch, a light brass drum or cylinder, *A*, around which the recording sheets are laid, or over which the continuous paper passes, as one or the other respectively is used. This cylinder revolves twice in twenty-four hours, or only once, if so ordered, and is provided upon its surface with two rows of needle points, each row (of twelve points) being near one end of the cylinder, which puncture the paper and thus mark the time abscissas, either of two or four hours' duration. The cylinder can be lifted out of the frame after the clutch connecting it with the clock has been moved back.

The variations of the water level are transmitted directly by a copper float at the end of a fine wire, *E*, fastened to the periphery of a grooved float wheel, *F*. This wheel is exactly one foot in circumference, and has a projecting double flange in which are three cycloidal notches that extend to the bottom of the grooved rim. The rectilinear distance between these notches is four inches, and corresponds with the distance between small cross bars riveted upon the float band, *E*. The wheel, *F*, fits loosely upon the end of the screw, *G*, made of phosphor-bronze, but can be jammed with the nut, *H*. The screw, *G*, itself sets loosely between the framework, and together with the wheel, *F*, revolves as the float rises or falls, and thereby causes the pencil holder, *I*. which with its threaded core embraces the screw, to move right or left at the rate of one inch for every foot the float ascends or descends with the rise or fall of the water level.

On the rear of the frame a graduated rod, *J*, is placed, upon which is clamped the pencil holder, *K*. for the so-called stationary pencil. This pencil traces upon the recording sheet any assumed or established reference or base lines, usually the zero of a tide staff, from which the ordinates of a curve representing the water level can be readily measured. The copper float rises and falls with the water level in a square box, the interior clear area of which is about 1½ inches larger in width than the diameter of the float, its length being such as to reach about a foot below the lowest known water level of the locality and about six inches above the floor of the house in which the gage is set. The box is closed on the lower end, a small opening not over one-half inch in area being left in the center. One of the interior corners of the box is divided from the rest by a thin strip of wood extending the full length of the box, forming thus a separate compartment, in which the counterweight attached to the band, *D*, moves up and down.

The paper moves in the same direction as the hands of the driving clock and is drawn along, as it were, by the needle points upon the cylinder, *A*. This movement is materially assisted, but not accelerated, by a light counterweight at the end of the cord, *M*, which is suspended from a sheave or pulley, *N*, fitted upon the axle of the wooden roller, *C*. The cord is fastened with one end to the hub of the sheave, *N*, and is coiled or wound upon the latter in such a manner that it must unwind as the paper rolls upon the roller, *C*. The weight, *M*, causes a slight tension in the paper between the roller and the cylinder, *A*. and thereby assists in laying the paper evenly and smoothly upon the roller, *C*.

An attachment designed by Mr. F. M. Little is used for more accurately keeping and marking the time. This "hour-break" attachment, as it is called, consists of an additional and independent clock. On the back of the clock and attached to its minute shaft is an arm which at the end or beginning of each hour trips the trigger projecting from the break mechanism. This permits the crank, working in the slotted arm, to make one revolution. This slotted arm is fastened to the end of the lower rod, which is the axis of the frame. Over the upper rod the hook from the pencil carrier hangs, but not in contact, and the pencil holder is pivoted in the pencil carrier so that the pencil can be rocked. The pencil is held in its normal position by a small spiral spring, one end being attached to the pencil holder and the other to the pencil carrier. At the end of every hour the time clock releases the trigger, and thus the break mechanism rocks the frame over which the pencil-holder hook hangs, causing the pencil to move back and forth, thereby recording the hour exactly, regardless of what the rate or time of the driving clock may be.

Automobile Racing.

Racing has proved itself to be of inestimable benefit to the development of the automobile industry. At various stages and in different ways the racing chauffeur has been able to show the maker exactly what a certain construction will, and will not, stand under a strain of varying speeds. Sometimes the scientifically deduced theories of the maker would work out in good shape, and sometimes they would not work at all.

The chauffeur, ever ready to risk his neck on the new design, would try out with reckless zeal experimental vehicles which ordinary riders would not dare to push to full speed. Mishaps occurred, of course, but they only seemed to sharpen his appetite for testing new machines and identifying himself with the latest type.

The debt owed by maker and tourist to the racing chauffeur is similar in proportion to the credit due bicycle racing men for bringing the bicycle to its present marvelous basis of mechanical perfection.

No speed performance in which man ever partook compares with that of the automobile. It is much more fascinating than railroad locomotive speeding, and, as far as road racing is concerned, useful in calling public attention to the scandalous state of our roads and highways.

In order to give a correct idea of what has been accomplished in this country in automobile racing of various kinds we append the following tables, which present the carefully-revised authentic times of accepted road, track and straightaway automobile records. Many of them are world records.

TRACK RECORDS.

Gasoline Vehicles.

Best Mile Performances.

1:06 2-5—Winton, Detroit, October 24, 1901.
1:06 4-5—Fournier, Yonkers, October 10, 1901.
1:12—Keene, Yonkers, November 1, 1901.
1:13 2-5—Bostwick, Yonkers, October 10, 1901.
1:16¾—Vanderbilt, Providence, October 9, 1901.

From 1 to 24 Miles.

1 mile, 1:06 4-5—Winton, Detroit, October 24, 1901; 2 miles, 2:13 4-5; 3 miles, 3:20 1-5; 4 miles, 4:27 1-5; 5 miles, 5:33 4-5; 6 miles, 6:40 4-5; 7 miles, 7:47 1-5; 8 miles, 8:54 3-5; 9 miles, 10:01 2-5; 10 miles, 11:09.

11 miles, 14:02 2-5—Bostwick, Yonkers, October 8, 1901; 12 miles, 15:21; 13 miles, 16:38 4-5.

14 miles, 17:55 3-5—Fournier, Fort Erie, September 26, 1901; 15 miles, 19:10 4-5; 16 miles, 20:24 4-5; 17 miles, 21:40 4-5; 18 miles, 22:56 4-5; 19 miles, 24:12 2-5; 20 miles, 25:25 2-5; 21 miles, 26:42; 22 miles, 27:57; 23 miles, 29:12; 24 miles, 30:28 4-5; 25 miles, 31:44 1-5.

50 miles, 1:17:50—Winton, Chicago, September, 1900.

Steam Vehicles.

1 mile, 1:22 1-5—H. L. Hibbard, Joliet, Ill., October 19, 1901.

2 miles, 4:16 2-5—W. L. Hibbard, Guttenburg, September 18, 1900.

3 miles, 6:20—J. W. Howard, Newport, August 19, 1900.

5 miles, 9:40 3-5—G. C. Cannon, Providence, October 7, 1901.

10 miles, 20:49—S. T. Davis, Trenton, September 24, 1900.

Electric Vehicles.

1 mile, 1:46—A. L. Riker, Guttenburg, August 18, 1900.

5 miles, 10:44—A. L. Riker, Newport, September 6, 1900.

ROAD RECORDS.

Gasoline Vehicles.

25 miles, 1:06:42—Alexander Fisher, Long Island, April 14, 1900.

40 miles, 1:33:32—E. B. Shaw, Chicago-Joliet, October 18, 1901.

50 miles, 2:30:01—Alexander Fisher, Long Island, April 14, 1900.

700 miles, 3 days 20 min.—A. T. Winton, Cleveland to New York, November 1 to 4, 1900. Actual running time, 38½ hours.

Steam Vehicles.

25 miles, 58:13—S. T. Davis, Jr., Long Island, April 14, 1900; 50 miles, 2:18:27.

Electric Vehicles.

25 miles, 1:00:36—A. L. Riker, Long Island, April 14, 1900; 50 miles, 2:03:30.

MOTOCYCLE TRACK RECORDS.

Motor Bicycle.

1 mile, 1:12 2-5—A. Champion, Vailsburg, N. J., October 27, 1901; 2 miles, 2:31 1-5; 3 miles, 3:47 2-5; 4 miles, 5:05 1-5; 5 miles, 6:22 1-5; 10 miles, 12:47 1-5.

Motor Tandem.

1 mile, 1:18 1-5—Henshaw and Hedstrom, Buffalo, August 13, 1901; 2 miles, 2:36 4-5; 3 miles, 3:58 1-5.

4 miles, 5:20 3-5—Crookes-Scherer, Philadelphia, September 1, 1900.

5 miles, 6:44—Henshaw and Hedstrom, Buffalo, August 13, 1901; 6 miles, 8:04 4-5; 7 miles, 9:25; 8 miles, 10:45; 9 miles, 12:05; 10 miles, 13:22.

11 miles, 16:23 2-5—Miller-Judge, Cleveland, May 30, 1900; 12 miles, 17:56; 13 miles, 19:27 2-25; 14 miles, 20:27; 15 miles, 22:22 2-5.

16 miles, 24:59 3-5—Miller-Judge, Baltimore, Md., September 7, 1899; 17 miles, 26:35 2-5; 18 miles, 27:08 2-5; 19 miles, 29:40; 20 miles, 31:10 3-5.

21 miles, 33:25 1-5—Miller-Judge, Manhattan Beach, N. Y., September 4, 1899; 22 miles, 34:56 2-5; 23 miles, 36:36.

24 miles, 38:11 2-5—Miller-Judge, Baltimore, Md., September 22, 1899; 25 miles, 39:46 1-5.

Motor Tricycle.

1 mile, 1:18 3-5—A. Champion, Chicago, September 25, 1900; 5 miles, 6:49 1-5.

10 miles, 13:37½—Kenneth Skinner, Providence, R. I., October 18, 1901.

44⅝ miles, 1 hour—Kenneth Skinner, Providence, R. I., September 4, 1901; 50 miles, 1:07:10½.

ONE MILE STRAIGHTAWAY WORLD'S RECORD.

Special road record made on the Ocean Boulevard, Brooklyn, New York city, November 16, 1901.

Gasoline.

Henri Fournier 0:51 4-5

Electric.

A. L. Riker.......................... 1:03

Steam.

S. T. Davis, Jr...................... 1:15

H. W.

New Poems by Sappho.

Dr. Schubert, of the Egyptian Section of the Royal Museum, Berlin, claims to have discovered in the papyri recently added to the collection of the museum several entirely unknown poems from the Fifth Book of Sappho. According to the German authority from which our information is obtained the manuscript dates from the sixth or seventh century, and is not in very good condition. The discoverer has been able to decipher two of the poems, one of which describes the poetess of Mytilene comforting a departing pupil. Another is addressed to a former pupil who had removed to Lydia. The poems are said to show new metrical combinations.