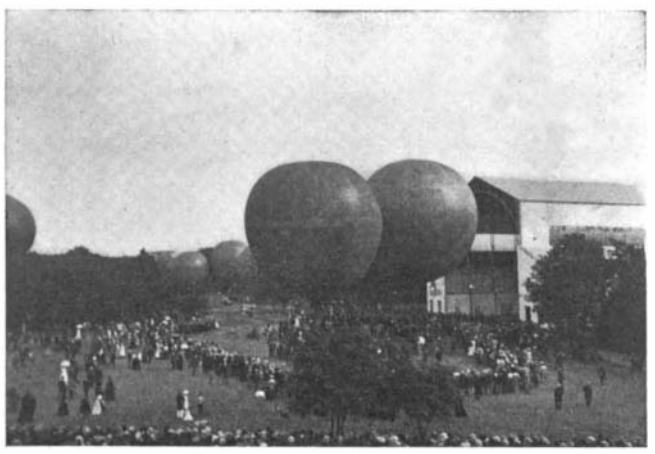
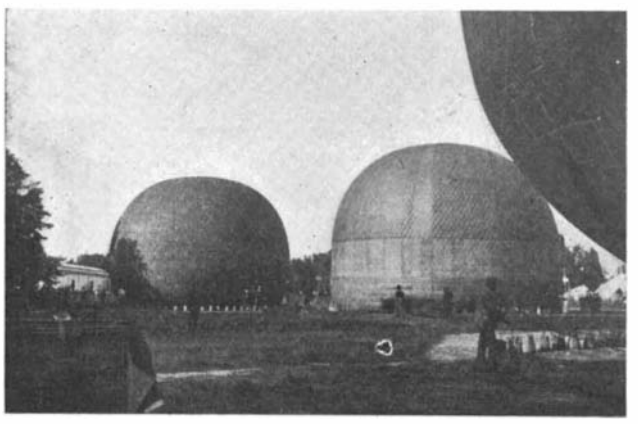
BALLOONS AT VINCENNES.

The illustrations presented herewith are reproductions of photographs taken at the first aeronautical *concours* held during the recent Paris Exposition at Vincennes. From the 17th of June to the 9th of October, 156 balloons, all of French make, varying in gas-capacity from 3,000 cubic meters (105,945 cubic feet) to 350 cubic meters (12,360 cubic feet) were exhibited at the aerostatic park of the Exposition, and made ascents with 327 passengers. Never were so many balloons collected in a single spot. To fill the numerous gas-bags 196,927 cubic meters (6,993,862 cubic feet) of gas were required. One hundred and fifty-eight ascents were made without any accident. On September 16, twenty-six balloons, inflated with 23,311 cubic meters (823,228 cubic feet) of gas, were sent up from the grounds. This was a noteworthy day at the Exposition so far as the number of balloons was concerned. The record for the longest balloon ascension is held by MM. Henry de la Vaulx and Castillon de Saint-Victor, who remained in the air for 35 hours and 47 minutes, and landed in Russia after having traveled 1,935 kilometers (1,202 miles). It has been suggested that the aerostatic park at Vincennes be preserved; but a permanent park could be maintained only by holding each year a *concours* somewhat on the order of the automobile and bicycle shows which have made Vincennes a favorite resort for sportsmen of late years. For the photographs reproduced herewith, and our information, we are indebted to M. Louis Bereau, a well-known aeronaut, who, on the ever memorable 16th of September, made a 15 hour ascent.

A BALLOON ASCENT.



THE AEROSTATIC PARK AT VINCENNES.



INFLATING THE GAS BAGS.

A NEW PILE-DRIVER.

The Chicago, Milwaukee and St. Paul Railway Company, finding it necessary to employ a pile-driver which could be utilized, not only in connection with the ordinary maintenance of bridges, but also in times of emergency, intrusted one of its engineers with the task of designing such a pile-driver. Mr. Willies E. Smith, of the Engineering and Bridge-building Department of the road, Chicago, Ill., recently patented a machine which fully answered all requirements. The improved driver can be used in renewing old piles, as well as in quickly repairing breaks in a burnt or injured bridge. In the latter emergency it is necessary that, without track-supports, the pile-driver should be able to reach far enough ahead to drive a bent to support the further end of a set of stringers, so that when rails have been laid on the newly-driven portion, the pile-driver can advance to drive the piles for the next bent. On the Chicago, Milwaukee and St. Paul Railway pile-driver, designed by Mr. Smith, this extension has been secured in a very simple and ingenious manner.

For the pile-driver in question a 45-foot car is employed, two extra truss rods being placed under the car to prevent sagging, and the transoms of the truck being extended beneath the outer sill of the car-body. To the top of the transoms a heavy plate carrying a jack-screw is riveted. The screw can be turned up against the car-sill to prevent side-tipping. Only when the leaders are swung far out from the center of the track are these jacks needed. In order that the pile-driver may be coupled to any train, the leaders are so proportioned that they do not project beyond the car when lowered, and the driving deck is equal in length to the car. The highest point of the pile-driver itself is 16 feet 8 inches above the top of the rail.

By means of a capstan connected by chain gearing with a sheave at the center of the driving-deck, a vertical shaft is operated provided with a pinion which engages a rack along the side of one of the center car-sills. Thus the driving-deck is moved. In order to permit a back and forth and a swinging movement, an intermediate deck is provided, between the 5-inch channels of which are located a number of 5-inch wheels traveling on 1 inch plates secured to the top of the car-sills.

In order to raise and lower the leaders a novel construction is employed, which comprises a pair of quadrant rockers forming part of the frame work of the leaders. As the rockers pass from a horizontal to a vertical position, they roll on the deck, and elevate the leaders.

The leaders are supported at the apex of a four-cornered tower, 20 feet above the deck. Two legs of this tower consist of a pair of angles over the front corner of the deck, and an oblique ladder behind, and are matched by two members serving the same purpose. The fixed portion of this tower is the "A" bent in front, the rockers with their radial struts, the platform seven feet above the deck, and two rear braces from this platform up to the apex of the tower. That portion of the rear braces which extends from the platform down to the deck is hinged and jointed to permit the rocker to roll back when the leaders are to be lowered. Pins are used as connections. The rear brace folds up like a jack-knife, but at no time is the tie between the apex of the tower and the deck of the driver entirely broken. Hence the leaders and framework cannot clear the end of the driver if carelessly raised.

The tread for the rocker is a T-shape, with the head laid on the deck. The rocker itself consists of two plates with a filler between, one plate riding on each

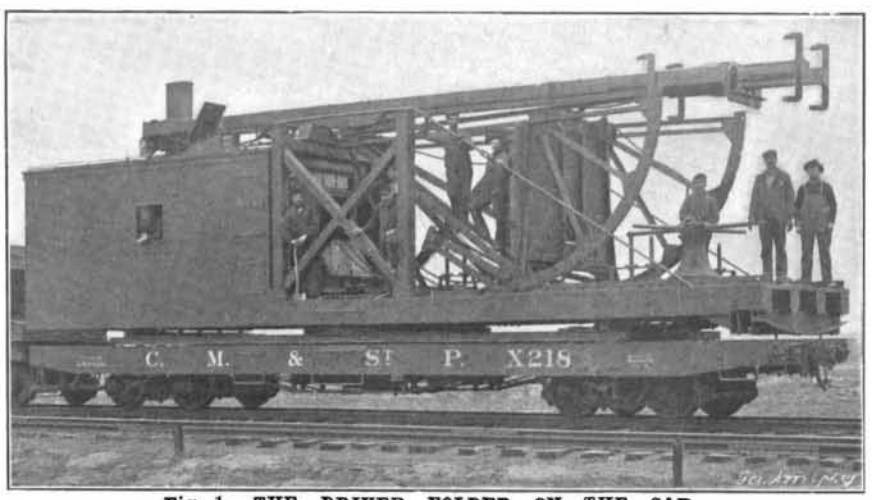


Fig. 1.—THE DRIVER FOLDED ON THE CAR.

Fig. 2.—DRIVING DECK SWUNG ACROSS THE CAR.

Fig. 3.—LEADERS BATTERED.

side of the upright leg of the "T." So nicely are the leaders balanced that with very little power they can be moved from either the horizontal or the vertical position.

For extension work the deck of the pile-driver can be moved forward until the center of the leaders is 18 feet beyond the center of the front car wheels. The deck is swung by pinions which engage circular racks attached to the intermediate deck. At each end of the intermediate deck is a segmental rack, and at the center is a complete circular rack, by which the deck can be swung clearly around. The ends, while over the intermediate deck, are partly supported and enabled to move freely by rollers; but after having swung clear, the deck is balanced by the equal distribution of the load. Fig. 2 shows the pile-driver swung at right angles across the car, in which position the center of the leaders in this position is 22 feet 6 inches from the center of the railway track. The weights on the deck are so adjusted that the center of gravity is never outside of the 9-foot circle on which the deck rests. In this position a pile can be picked up and driven with perfect safety.

Some nine years ago Mr. Smith found that he could dispense with the special drivers used for emergency repairs in driving the piles for the temporary support of through truss bridges by attaching an additional swinging set of leaders to the head block of his regular driver. Thus he was enabled to drive a pile close to the lower chord of a through truss bridge without swinging the deck of the driver out far enough to interfere. The swinging leaders proved so serviceable that he has incorporated them in the driver under discussion. Swinging leaders, besides dispensing with special drivers, are of great value in giving the outside piles of bents a good batter and the bents wide bases.

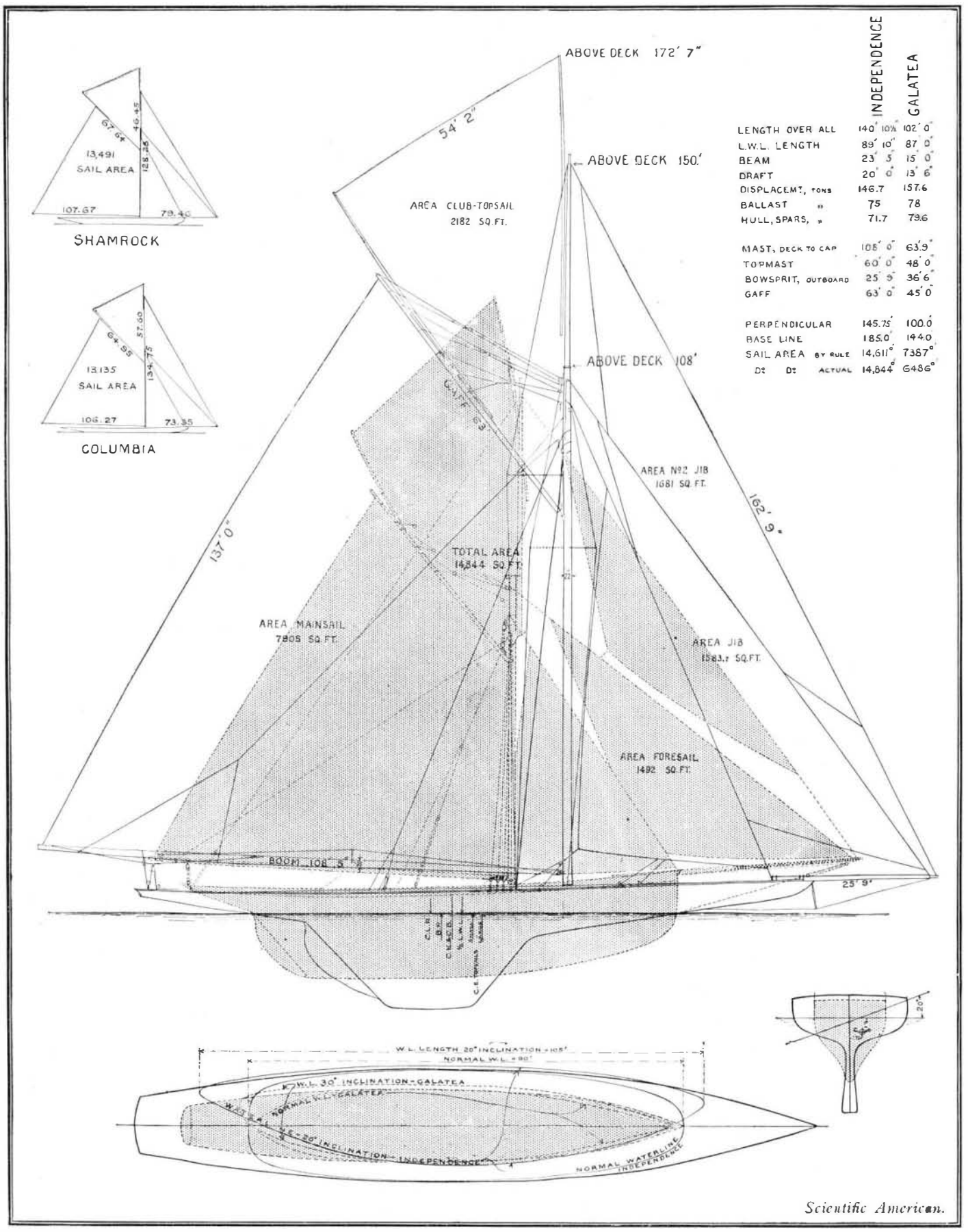
The Smith pile-driver is compact, easily coupled by the usual means with a train and is self-contained in every respect. The leaders can be raised and lowered by men on the car. The driver will drive piles in all places and under all the conditions encountered in railway service.

Adopts Baggage Check System.

The Great Eastern Railway, of England, will introduce the baggage check system on its lines on June 1. A small fee will be charged, but the adoption of the system by the passengers is optional with them. The Caledonian Railway is having thirty large steel cars built at Leeds and twenty in America with the object of comparing results.

FIFTEEN YEARS' DEVELOPMENT OF THE 90-FOOT RACING YACHT.

In pursuance of their commendable policy of satisfying the very natural and perfectly proper public curiosity as to what manner of yachts are being put afloat for the defense of the "America" cup this year, Messrs. Lawson and Crowninshield, the owner and the designer of "Independence," have furnished the SCIENTIFIC AMERICAN with the sail plan of "Independence" which is herewith reproduced from the original blue-prints. At the same time, by the courtesy of J. Beavor Webb, the designer of the famous old "Genesta" and "Galatea," we are enabled to present the sail, sheer and deck plans and midship section of the latter yacht, these plans being also reproduced from the original working drawings.



FIFTEEN YEARS DEVELOPMENT OF THE 90 FOOT RACING YACHT.

As shown by a comparison of "Galatea" (cutter, 1886) and "Independence" (cutter-sloop, 1901).

(Reproduced by the courtesy of the designers, J Beavor Webb and B. B. Crowninshield, from the original working drawings.)

It will be fifteen years ago this summer since the 90-foot cutter "Galatea" (her actual water-line length was 87 feet, but she classes with the 90-foot "Independence") came across the Atlantic to make the second attempt on the part of the typical English cutter to secure the "America" cup. She and her sister the "Genesta" may be said to have opened the latest period of the cup contests, a period which has been far the most brilliant in the history of this memorable and long-drawn-out struggle. Although her genial owner, Lieutenant Henn, one of the most thorough English yachtsmen that ever crossed the water, sailed "Galatea," not merely in the cup races, but throughout the yachting season of the following year, she did little to add to the prestige of her predecessor, "Genesta," whose performance stands to day as the most creditable among the many English yachts that have competed for the cup. We have chosen the "Galatea," however, for this comparison, because on the basis of water-line length, by which the modern racing yacht is classed, she lends herself admirably to comparison with the 90-foot "Independence" of 1901. In our drawing, the cutter of 1886 is thrown in shadow upon the cutter-sloop of 1901, and the two drawings being exactly to the same scale, they tell the story of the development which has been taking place during the past decade and a half better than would a whole volume of verbal description.

Speaking in a general way, it may be said that among the many conditions surrounding the cup contests, there is only one, at least as regards the dimensions of the yachts, that is strictly negative, and this is the rule that neither yacht must exceed 90 feet in length on the water-line. They may be as deep, as broad, as long on deck, as their respective designers may care to make them, but in length, while they may be many feet less than they must not be a fraction of an inch over, 90 feet. Subject to this restriction, then, the problem is to design a yacht which shall carry a maximum amount of sail upon a hull that shall have the smallest possible displacement and wetted surface, and shall present the easiest form to drive through the water. At the time of the "Galatea" - "Mayflower" races, the American and English yachts were widely different in form, the English cutter being of narrow beam and considerable depth of body, the American sloop being of shallow draught and great beam, and depending upon the movable centerboard to give her the proper lateral plane when sailing by the wind. The initial stability of the sloop was large, the center of buoyancy moving out rapidly to leeward as the vessel heeled, and thus automatically, as it were, maintaining the margin of stability. In the narrow cutter, the initial stability was small, the center of buoyancy moving to leeward but little as she listed, although the righting moment increased rapidly with every increase in the angle of heel. On equal displacements, the greater initial stability of the sloop enabled her to carry a considerably larger sail plan, and hence in light winds she was invariably faster than the cutter. At higher speeds, however, the finer form of the cutter showed to advantage against the bluffer lines of the sloop; there was less wave-making resistance and, hence, in the second race