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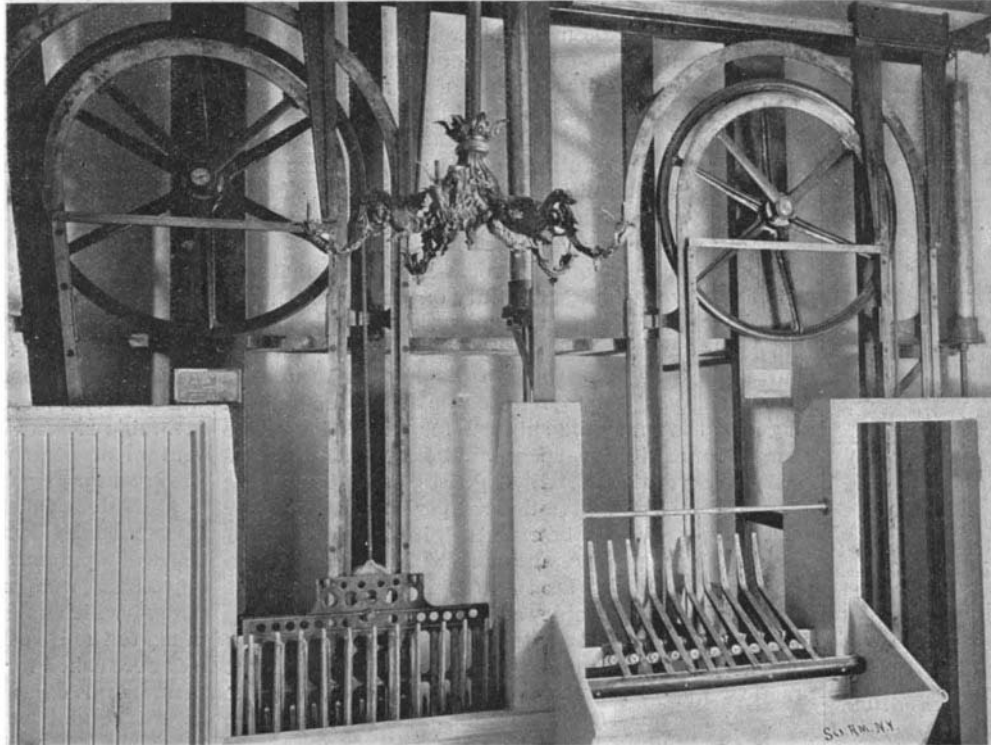
## THE BOOK CARRIERS OF THE NEW LIBRARY OF CONGRESS BUILDING.

BY E. J. PRINDLE.

The new building for the Library of Congress is, probably, in its architecture and decoration, the most perfect public building in this hemisphere. A great deal of machinery is necessary to conduct the affairs of so large a building, and the mechanical and sanitary features have been the objects of most careful and skillful attention. The lighting, heating, and ventilating systems represent the highest development in those directions; and, in designing them, as with all the other engineering work in the building, the object of the building has been kept constantly in view.

The Library of Congress contains seven hundred thousand volumes, exclusive of duplicates and pamphlets to the number of three hundred thousand. It is no small problem to provide machinery which will bring any one of this great number of books from the necessarily large and distant book stacks quickly to the reading room of this building or to the Capitol for the use of Congress.

For the latter purpose a book carrier runs from a terminal beneath the rotunda or reading room of the library building through a tunnel twelve hundred feet in length to the Capitol, where a second terminal is located between the Hall of Statuary and the library of the United States Supreme Court. The tunnel is well lighted by electricity and is large enough for easy passage erect. This book carrier was installed by Mr.



CAPITOL TERMINAL OF THE LIBRARY-CAPITOL CARRIER.

George Miles, of Boston, Mass. A double track runs from one terminal to the other, and an endless half-inch cable draws two baskets or carriers constantly around the track. The carrier consists of a solid back and sides and a bottom and front formed of a series of parallel, U-shape fingers secured to the back and having no obstruction between the fingers. Strips of felt are secured in grooves in the fingers to protect the books. The carrier is pivoted to the face of a two wheel truck that is secured to the cable, the wheels of

and the fingers are inclined upward and back. As the carrier descends, the stationary fingers of the receiving station project between those of the carrier, and the books are left by the carrier to slide into the trough. As the carrier ascends the next vertical section of the track, it passes through a series of U-shape, stationary fingers similar to those on the carrier; and any package that may have been deposited in these stationary fingers is caught up by the carrier and taken

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ROTUNDA OF LIBRARY OF CONGRESS BUILDING.

**THE BOOK CARRIERS OF  
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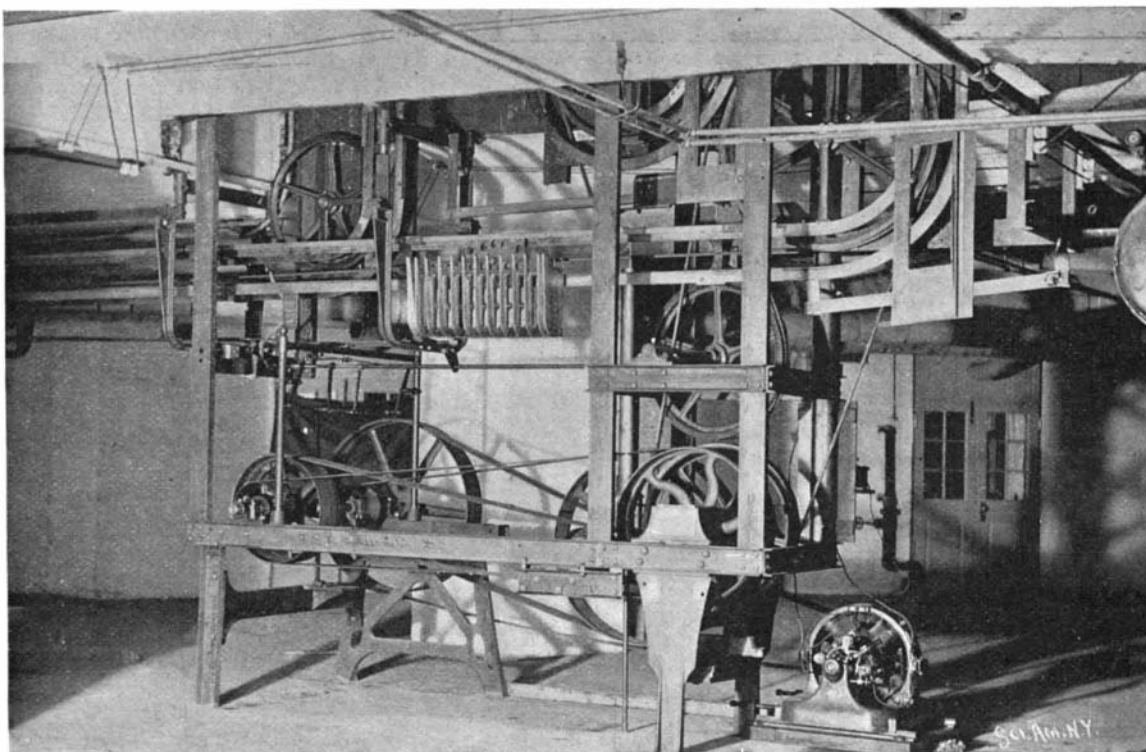
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along. The carrier, after passing the next curve, descends to the main track and travels to the opposite terminal, where it passes through the same series of operations.

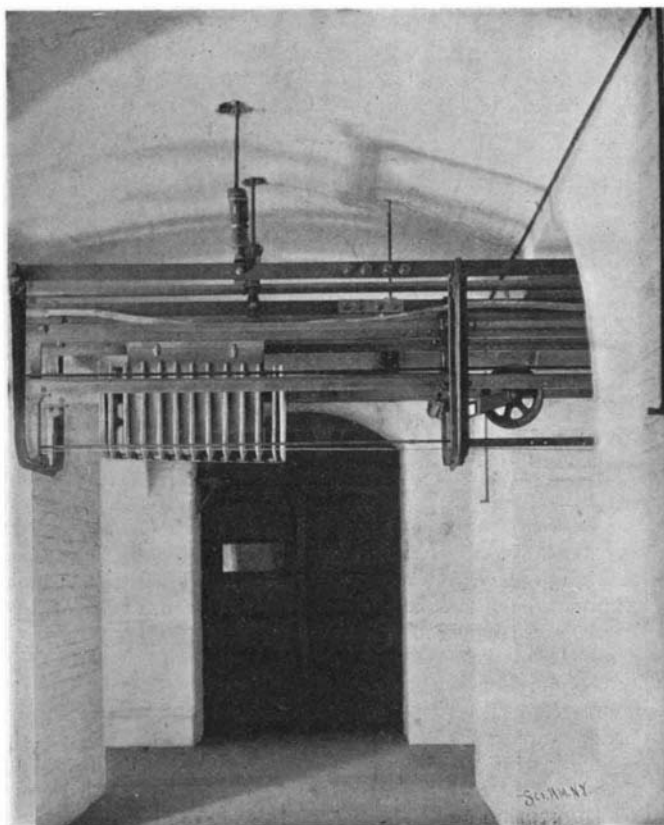
In order to keep the carrier vertical while the truck is passing the curves of the terminals, a number of sliding frames are provided at the curves; and these frames have vertical surfaces which engage the carrier and prevent its tipping. At the first curve a simple rectangular frame is mounted on slightly inclined rails, so that gravity places it in the path of the carrier; and, when the latter strikes against the frame, the frame, while bearing against the end of the carrier, travels up the inclined rails until the carrier has passed above it. At this point, two supplemental rails enter grooves in the sides of a boss on the back plate and maintain the vertical position of the carrier until the upper curve is reached. The sliding frames at this and the next two curves are the same, except that the frame for the lower curve is inverted. These frames consist of a base and two depending legs, and they slide on horizontal rails. The legs form continuations of the supplemental rails; and, as the carrier passes around the curve, the frame slides on its rail to correspond to the horizontal component of the motion of the carrier. The frame is returned to its first position by a chain which is attached to a weight in a vertical tube whose lower end is closed, and is provided with a cock to regulate the escape of the air under the weight and thus to prevent shock. At the last curve no frame is needed to steady the carrier.

The carriers necessarily move at a slow rate of speed while passing through the terminals; but, as there are twenty-seven hundred feet of cable, the speed is increased while the carriers are passing from one terminal to the other. There are two carriers on the cable and they are half the length of the cable apart, so that the carriers are in the terminals at the same time, one at the library and one at the Capitol.

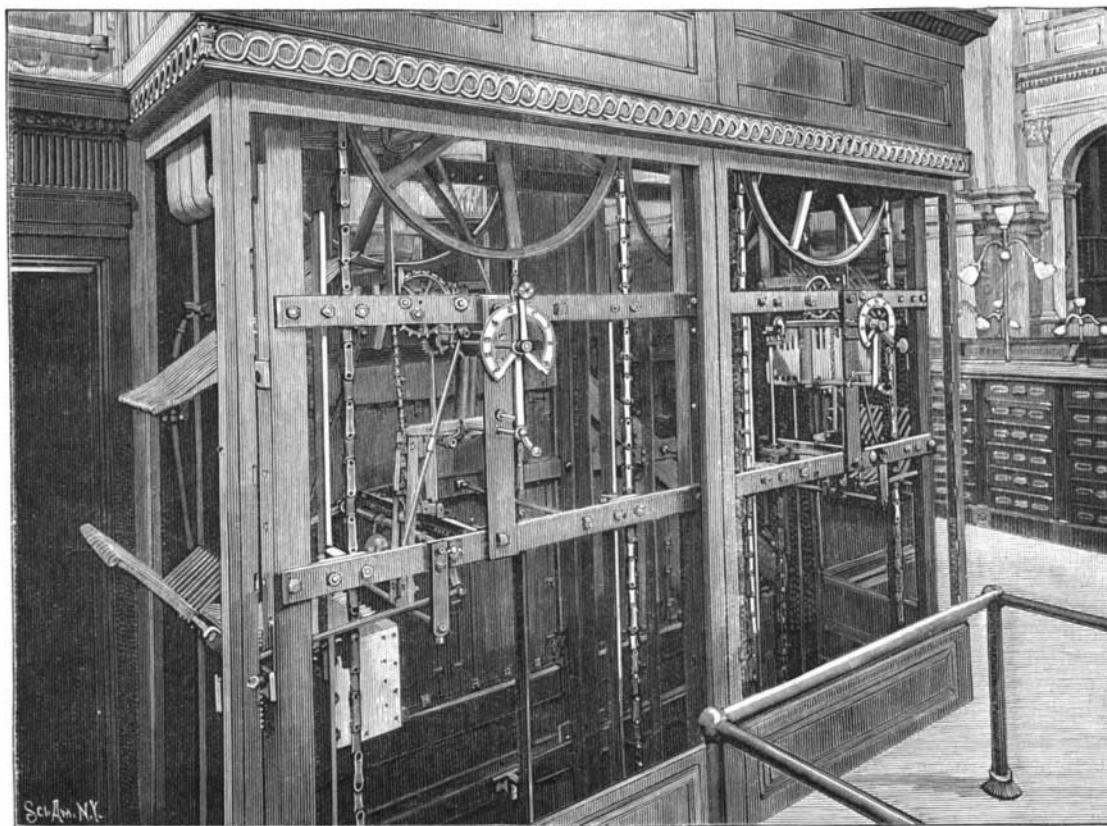
While the carriers are in the terminals, the cable is run at a speed of fifty feet per minute; but while they are in the tunnel the speed of the cable is six hundred feet per minute. Two minutes are required for the passage through the terminals and two minutes in the tunnel. By the use of ball bearings, the power required is reduced to five horse power. An electric motor is used and is belted to one of two parallel shafts in a framework below the terminal in the library. Two belts connect pulleys on these shafts, and the shaft that is belted to the motor is connected by a belt to a third shaft from which the power is taken. One pulley on each of the first two shafts is connected to its shaft by a friction clutch, and the operating levers of these clutches are connected indirectly to a long sliding rod whose farther end is pivoted to a lever in the path of the incoming carrier. The rod is also connected to a lever that is in the path of the carrier as it leaves the terminal. When the friction clutch on first shaft is in, the speed of the motor is reduced but twice; and this condition obtains when the carrier has passed through the terminal; but, when the clutch on the second shaft is in, the speed is reduced four times



DRIVING MECHANISM OF LIBRARY-CAPITOL CARRIER AT BASE OF LIBRARY TERMINAL.



MAIN TRACK OF THE LIBRARY-CAPITOL CARRIER.



THE TERMINAL IN THE READING ROOM OF THE BOOK STACK CARRIER.

to allow the carrier to traverse the terminal safely.

This book carrier, like that for the book stacks, is the result of much experiment during its construction, and they are the first carriers of their kinds.

The book stacks in the Library of Congress are placed in two wings, situated north and south respectively of the rotunda. There are nine floors in each stack. Two independent book carriers are provided to bring the rotunda into communication with the two stacks, and they are duplicates. They were constructed by the Miles Pneumatic Tube Company, of Boston, Mass. These carriers run from within the circular desk in the center of the rotunda, down to the second floor below, where they pass to the centers of the book stacks and up vertical shafts to the top of the book stacks.

These carrier systems employ pairs of sprocket chains four hundred and fifty feet long, each system having eighteen carriers pivoted at equal distances apart on the pairs of sprocket chains.

Each carrier has a system of keys pivoted in its back, by which it may be made to take a book to any particular floor of the book stack and there deposit it automatically. Any carrier leaving the reading room empty will pick up the first book that is placed in the delivery tray of one of the stations in its course; but it will not take up books similarly placed at any subsequent station on the line. A carrier may be made to take a book to the central station and carry one back on the same round trip; but it cannot take a book to the stack and carry one back on its return trip. The carriers travel at a uniform speed of one hundred feet per minute by sprocket wheels that engage the chains at the foot of the vertical shaft in the stacks, and the power is derived from a  $2\frac{1}{4}$  horse power electric motor. The sprocket chains pass over large pulleys at the top of the shaft through the book stacks, and the bearing blocks of these pulleys are adjustable vertically on screws to tighten the chains.

The carriers are in principle like those of the Library-Capitol carrier system, and they consist of a solid back and sides and a bottom and front formed by parallel, separated fingers attached to the back. In the vertical portions of the carrier's travel it is kept upright by rails which occupy grooves in the sides of the carrier, and the carrier is steadied by vertical strips as it approaches the rails, to insure the rails' entering the grooves.

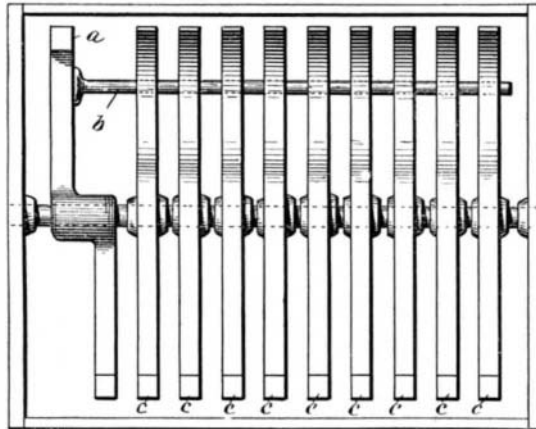
In a compartment in the back of the carrier are mounted, on a horizontal shaft, nine key levers, c, which operate the receivers of the stations, and one "pick up" lever, a, which operates the delivery trays of the stations. The key levers are duplicates and are formed with a projecting lug below and a slightly dishd upper end. The lugs, when projected out, operate the mechanism that throws a receiver, consisting of a series of parallel, separated fingers, on a pivoted frame into position under the carrier to take the book from the latter as its fingers pass down between those of the receiver. A rock shaft above the receiving station is connected by links and levers to the pivoted frame of the receiver, and this shaft is turned by a sprocket chain passing over a sprocket wheel on the shaft and connected at one end to a block that slides in a fixed, vertical guide. This block has a

lug that is engaged by the lug on the proper key lever for that station when the latter lug is projected from the carrier. This engagement pulls on the chain and swings the receiver into operative position. A counterweight on the other end of the chain gradually falls in a closed tube and throws the receiver and its book out of the path of the carriers. As the sliding block descends, a weighted lever carried thereby passes a shaft and is thus forced against the key lever lug and disengages it from the lug on the block. The key levers are set for the proper station at the central station in the rotunda. The carrier comes to the central station on the part of the sprocket chains that is at the rear, and, after passing over the large wheels at the top, descends through a fixed inclined series of fingers down which the book slides to a desk. As all incoming books are left here, it is not necessary to make the receiving fingers movable. Below these fingers are a series of similar fingers that are inclined in the opposite direction, on which fingers the book to be sent to the stack is placed. The book is held from sliding down by a series of short fingers that are placed between the fixed fingers and that are mounted on a rock shaft. This rock shaft is linked to another rock shaft on which is splined a sleeve having an arm that carries a roller which sets the proper key lever by bearing against its upper end, this end being projected out in the act of releasing the receiver. These rock shafts are operated from another rock shaft above them that is turned by a lug on the pick up lever in the same manner as the key lever operates the receivers in the stacks. Thus, the roller is thrown out and sets the key lever at the same time as the book is delivered to the carrier. The position of the roller is determined by a finger which engages a groove in the sleeve and that is carried by a horizontal rack. The rack is shifted by a gear on a vertical shaft that is geared with a horizontal shaft carrying a handle over a dial with nine digits upon its face. In order not to set a key lever except when a book is to be sent to the stack, the vertical guide for the sliding block is hinged below and is allowed to tip back above, to be out of the way of the pick up. A movement of a handle throws the guide to the vertical position, where it is held by a gravity catch which is released on the upward movement of the sliding block.

The pick up is a lever having a lug at each end,

the lugs being out of vertical alignment with each other. A long horizontal arm on the pick up passes behind the upper end of the key levers, so that, when any of the latter are set, the upper lug of the pick up is withdrawn, and the lower lug is projected.

The depositing in the stack is performed by a horizontally sliding tray composed of parallel, separated fingers and operated by a block sliding in a pivoted pair of guides like those used at central station for the same purpose. The carrier rises through these fingers and takes up the book, after which the counterweight carries the tray out of the path of the carriers. This



KEY MECHANISM OF BOOK STACK CARRIER.

throws in the upper pick up lug; and a fixed cam at central station, operating on the lower pick up lug, throws the upper lug again into operative position.

Pneumatic tubes similar to those used by cash carriers convey orders for this system and also for the system running to the Capitol.

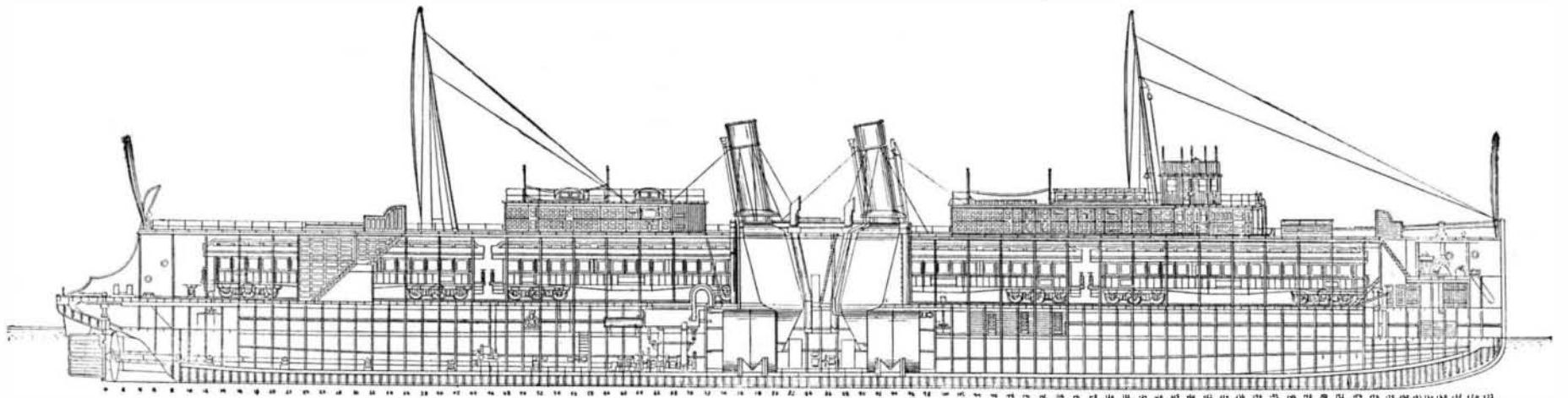
The beautiful mahogany casing of the carrier at the reading room terminal is lined with asbestos so that no sound of the machinery may disturb the readers.

**THE SEAGOING FERRY "PERE MARQUETTE."**

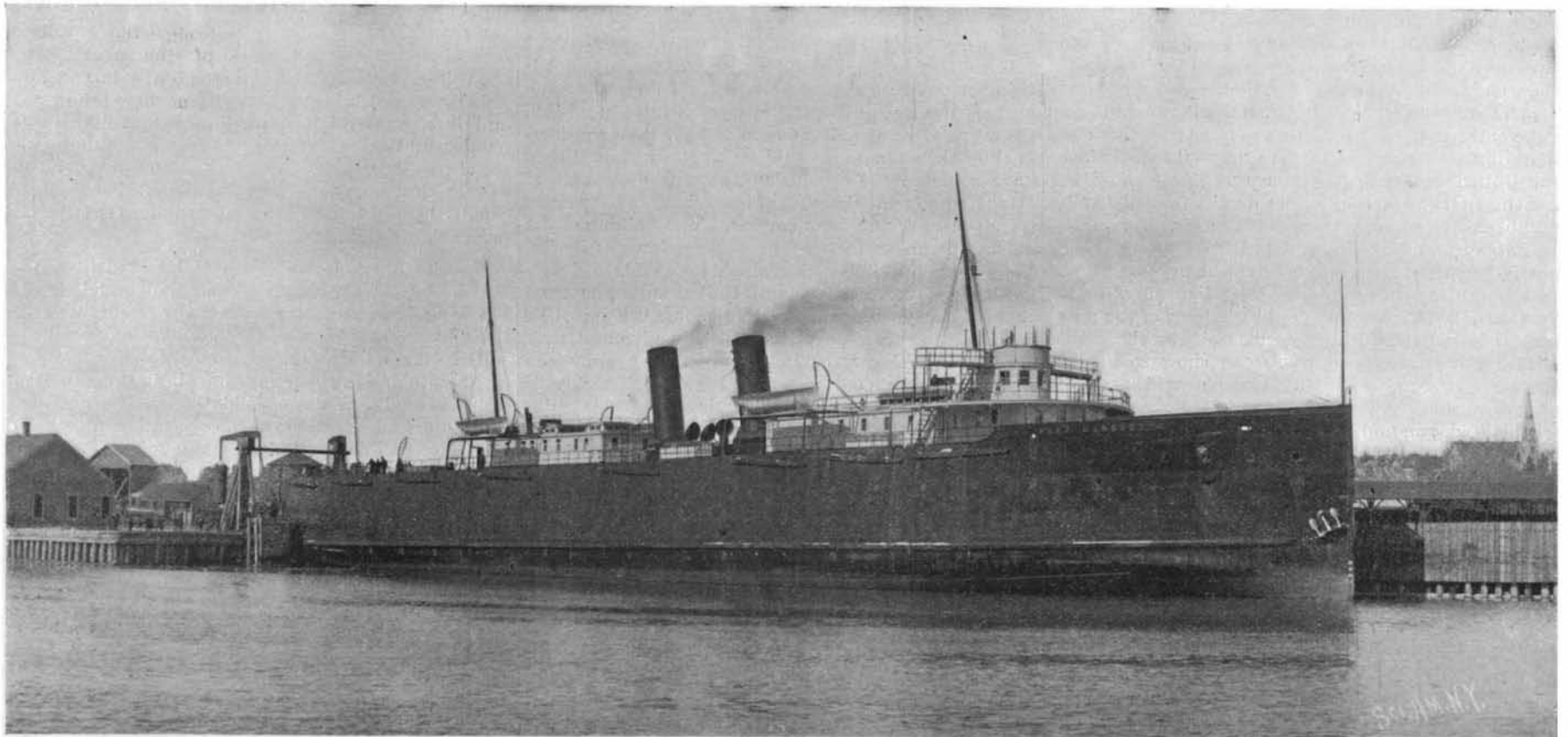
We present illustrations of the twin screw car ferry "Pere Marquette," which has been built for the Flint

and Pere Marquette Railroad for transporting freight or passenger cars across Lake Michigan. She is considerably the largest ship of her kind afloat, and in respect of her seagoing qualities she is quite unique among the large ferries of the United States. Her dimensions are 350 feet long on deck, 56 feet in beam, with a depth from keel to upper deck of 36¼ feet. She has four tracks, with accommodation for thirty freight cars or sixteen full sized passenger cars.

The Flint and Pere Marquette Railroad runs from Toledo, Detroit, Flint, Saginaw, Bay City, through Michigan and up through the lower peninsula to Ludington. From the latter place a line of steamers runs across Lake Michigan to Milwaukee, Chicago, and Manitowoc. The new ferry has been built for service between Ludington and Manitowoc, a distance of about sixty miles. As she is intended to run continuously throughout the whole year, she has been given great strength and a special shape of hull to enable her to withstand the heavy weather and the crushing strains of the ice during the winter months. Accordingly the framing from below the turn of the bilge to the upper deck is built of 12 inch channels weighing 25 pounds to the foot; the frames are spaced 24 inches center to center; the keel is 48 inches in width and weighs 32½ pounds per square foot; the center plate keelson is 42 inches wide and weighs 25 pounds per square foot, and the floor plates are 30 inches deep at the center, weighing 20 pounds to the foot, and they are connected to the center girder by double angles. On each side of the center girder, and spaced 6¼ feet from center to center, are two continuous keelsons flanged to the shell plating and extending above the top of the floor. The whole of the material worked into the bottom construction of the vessel beneath the engine and boiler spaces is made specially heavy. The shell plating from the keel to the bilge weighs 25½ pounds to the square foot. There are two water line strakes above the bilge and the main sheer strake, the last being double; all of these weigh 30 pounds to the square foot. The plating between main and upper decks weighs 10 and 12½ pounds, and upper deck sheer strake weighs 15 pounds to the square foot. From the stem to about 35 feet aft, and from the keel to about 3 feet above the water line, the shell plating is double, and it is needless to add that the interior of



LONGITUDINAL SECTION OF THE "PERE MARQUETTE."



**THE "PERE MARQUETTE" THE LARGEST SEAGOING FERRY STEAMER AFLOAT.**

Deck length, 350 feet; beam, 56 feet; depth, 36¼ feet; capacity, 30 loaded freight cars or 16 passenger cars; speed, 16 knots.