that along FG. The radius along CE being also same as that along GH. The radius along CD and FG is less than that along CE and GH. The fact that the thimbles when in use would not remain in a vertical position rendered this feature of the design necessary, so that a line joining the two extreme corners would be tangent to the curve where the line entered and left the thimbles, as

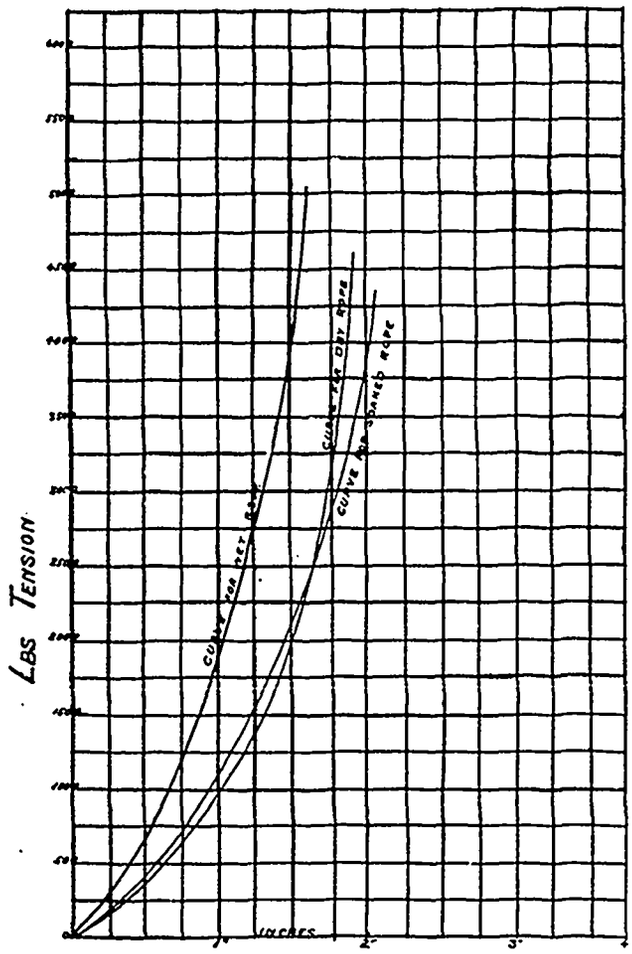


DIAGRAM SHOWING RELATION OF EXTENSION TO LOAD FOR MANILLA AND HEMP (TARRED) ROPE

AB. When this was the case a rope could not possibly be injured by the curve of the thimble, although the great pressure, even of a smooth surface against the strands of the rope, might possibly crush the fibers to some slight degree. The method of securing the rope was as follows: The free end of the rope was put up through the thimble, passed completely round the pin and brought down again through the thimble. The end was then tied with one or two knots to a short piece of piping about one inch in diameter. This piping reached across and rested against the lower end of the thimble, thus preventing the end of the rope from passing up through the thimble. It was found that, on account of the friction of the rope against the pin, one knot of the rope on the toggle was quite sufficient to hold it. In fact in some instances there was not sufficient rope to tie one knot around the toggle. When this was the case the rope was unstranded and the toggle inserted between the strands and the strands tied around it; even this method of making the fastening never failed.

The Wicksteed testing machine—a machine of the balance type—was the one used. The total range of the machine for ordinary work is about three feet. This was, however, found inadequate for our work owing to the excessive elongation of the rope, especially when wet, and we were compelled to dismantle the machine to some extent. The part C and the corresponding part together with the vertical rods D, P, E, F, (see accompanying illustration) were removed, leaving the pins B and A with their eyes surrounding them. This gave a range of about five feet six inches, which in a solitary instance was not enough. The vertical rod, G, with a corresponding one opposite to it connect the crosshead, J, to both a hydraulic and an electric motor, the former for heavy work where speed is not a desideratum, and the latter for more rapid work where power not beyond 5,000 lbs. pressure is needed. The range of the hydraulic ram was about 10 inches. This was needed whenever the power exceeded 5,000 lbs. When the test was begun the crossheads were usually about two feet apart; yet the distance between them often reached 5 feet 6 inches before rupture. The pins were about 3 inches diameter, and the rope was usually placed twice on the pin in order to increase the friction.

The method of getting the extension was as follows: Owing to the great stretch of the rope no extensometer could be employed. The unequal give at the different ends excluded the setting up a scale beside or attached to the specimen. Workings on the surface were debarred by the want of definition. Fine, smooth tacks were inserted

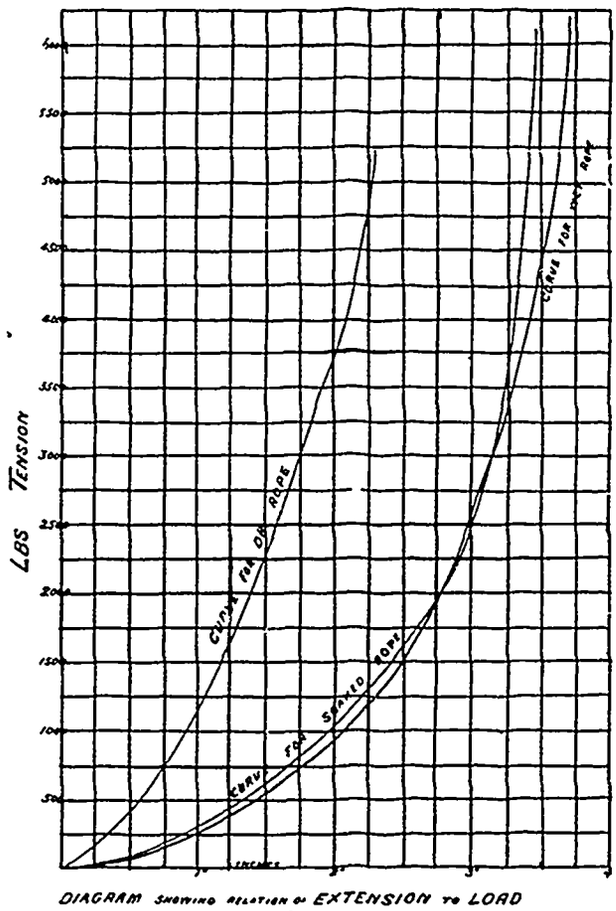


DIAGRAM SHOWING RELATION OF EXTENSION TO LOAD FOR MANILLA AND HEMP (UNTARRED) ROPE

in the rope at the required distance apart. The distance could be conveniently measured, and we hoped this was a final arrangement, but here again we were doomed to disappointment. Incredible as it may seem even these very small tacks caused the rupture to take place at the points of their insertion, as the tabulated results will show. A very convenient and easily adjusted device was finally employed. It was the adaptation of a contrivance based upon the principle of the pinch-cock to our work.

SHRINKAGE.

The percentage of shrinkage for the different kinds of