MAXIMUM LOAD DUE TO A CROWD OF PEOPLE.

The accompanying illustration does not represent the descent of a crowd of people down the shaft of a mine, nor an overloaded elevator. It is a photograph of a careful attempt to determine exactly how great a load of people may be crowded within any given space—a subject of the most vital importance which ought to have been investigated in this careful manner long ago. The experiments were carried out at Harvard University by Mr. L. J. Johnson, professor of engineering, who recently published the results at a meeting of the American Society of Civil Engineers.

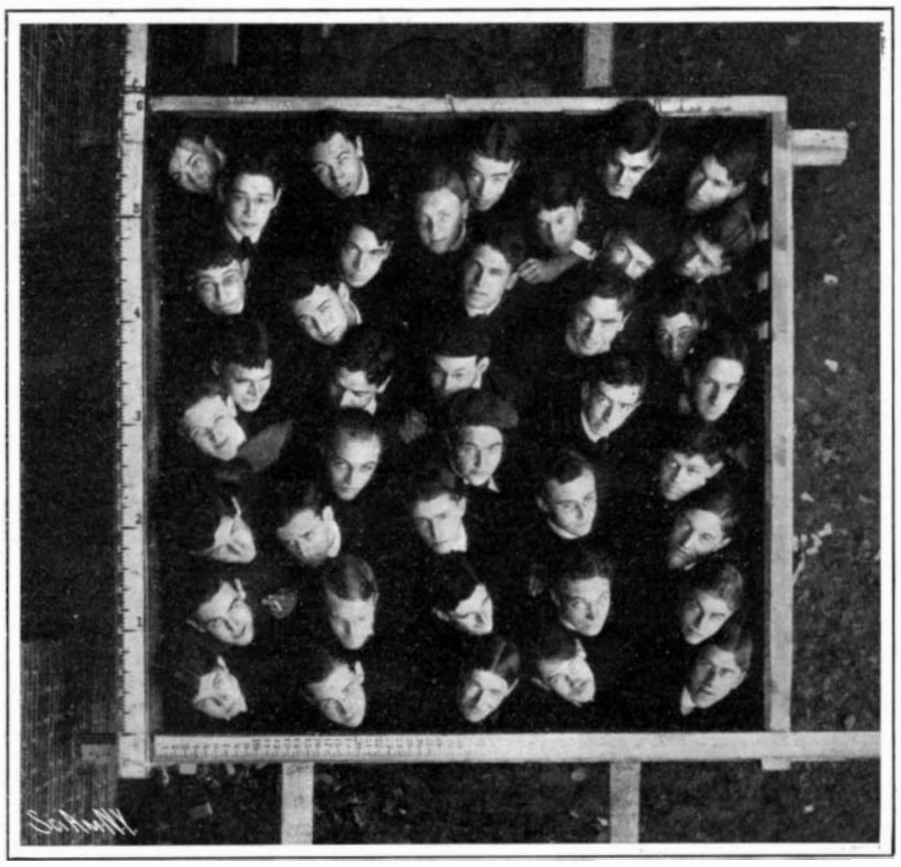
In obtaining this data, a box 6 feet square, provided with a gate at one side, was built, and a certain number of men, whose separate weights had been carefully taken, was placed within it. By dividing the aggregate weight of the men by the number of square feet within the box, the load per square foot was determined. In the first case eleven men were placed inside the box whose average weight was 154.6 pounds. This gave a load per square foot of 47.2 pounds, which is 2.2 pounds more than the loading that has been assumed in the designing of some floors, platforms, and bridges. That this loading does not represent the weight of an average crowd is proved by the fact that, when the men were lined up side by side around the walls of the box, they only covered three sides of it. Twenty-eight men of an average weight of 167.7 pounds were found to be equivalent to a load of 130.4 pounds per square foot.

In the early experiments, when the men were allowed to stand facing in various directions, a maximum result of 156 pounds per square foot was obtained; but since, in crossing a bridge, or in a packed assembly hall, all the people face one way, the experiments were continued in order to determine how much a crowd of this kind would weigh, and a result of 176.4 pounds per square foot was obtained. On studying the photograph it was evident that the maximum had not been reached, and ultimately forty men, averaging 163.2 pounds, were placed in the box, with the result that a maximum load of 181.3 pounds per square foot was obtained. The men, all of them undergraduate students of engineering, ranged in weight from 119.6 to 203.1 pounds, twelve of them weighing less than 150 and ten more than 175 pounds.

A competent and careful observer of the test which resulted in a load of 176.4 pounds per square foot, declared that, in his opinion, the congestion did not differ much from that of the crowd on the local drawbridge after football games; and this statement was borne out by the testimony of the men themselves.

In the discussion before the American Society of Civil Engineers, Mr. Theodore Cooper had given 45 pounds per square foot as the weight of the most densely packed crowds on the New York elevated trains. Those of us in New York who have experienced the crowding on these trains during rush hours will agree that the loading on the platforms and the cars must be nearer the 181.3 figure than the 45 pounds of Mr. Cooper's estimate.

We entirely agree with Mr. Johnson in his conviction that crowds of 167 pounds per square foot are entirely likely, and that from 130 to 140 pounds must be commonly reached in all places where people congregate standing.



These 40 men, averaging 163.2 pounds in weight, gave an average loading of 181.3 pounds per square foot.

MAXIMUM POSSIBLE LOAD ON BRIDGES AND PLATFORMS.

DISAPPEARING COAST-DEFENSE GUNS.

One of the lessons that the present war has served to emphasize very strongly, is the necessity for giving the greatest protection possible to the gun detachments. On land the question of the efficiency of artillery fire has resolved itself very largely into the question of invisibility. Such is the accuracy of the modern gun, so reliable are the means for finding the range, that when once a battery has been located, unless the cover is particularly complete, the silencing of the guns follows almost as a matter of course; and in the majority of cases it is the gunners, rather than the guns, that have been destroyed.

This question of invisibility is particularly important in the construction of fortifications and the emplacement of their guns. When the important scheme of defense drawn up by the Endicott board was determined upon, it was decided to make extensive use of the Buffington-Crozier system of disappearing guns, which is called after its inventors. The idea had received considerable attention in Europe previous to its adoption here, and was not, therefore, by any means in the nature of an experiment. The design which was then adopted, and has since been followed with only minor modifications, is probably the most satisfactory type of disappearing gun carriage in use at the present time.

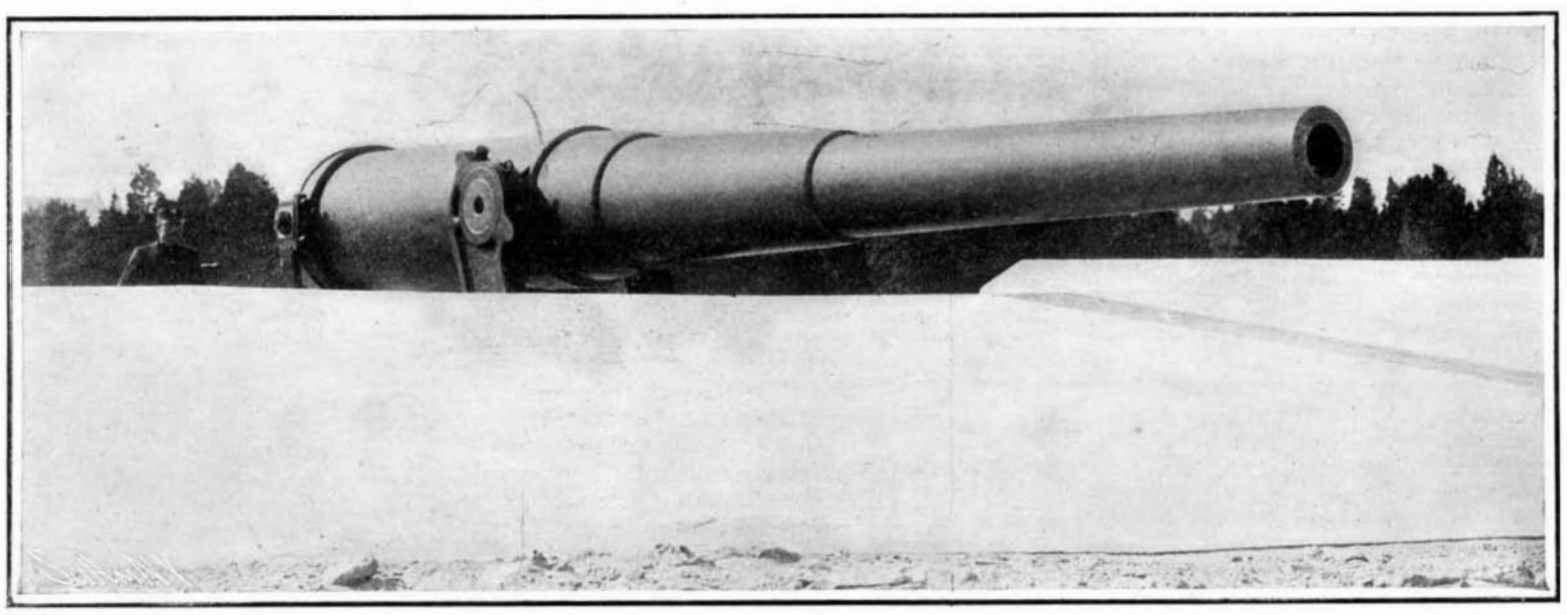
The principal methods of mounting seacoast guns are the casemate, the barbette, and the disappearing mount. In the casemate system the gun fires through an opening in the masonry or metal wall of the fort, and may, or may not, be protected by a shield. This is a very complete system of protection; but it has the disadvantage that the arc of fire is generally somewhat limited. A gun mounted *en barbette* is so placed that though part of its mount is below the parapet of the fort, the gun and upper part of the carriage are constantly exposed to the direct observation and fire of the enemy. In this form of mounting the greater part of the gun detachment is exposed to direct fire. In the disappearing system, on the other hand, the mount is entirely below the parapet and fully screened from observation. The gun itself lies also below the parapet during the operations of loading and training, and the whole of the gun detachment is also similarly sheltered.

The carriage is of what is known as the front-pintle form, and its general construction is as follows: The gun is carried, by means of its trunnions, upon the upper ends of a pair of massive rocking levers, one on each side of the gun, which are themselves pivoted at their mid-length to the top sliding gun carriage. At the opposite end of these levers is suspended by means of a pair of rods a massive lead counterweight, which is sufficient, when released, to depress the outer ends of the two levers, which, pivoting at their center on the top carriage, serve to raise the gun to the firing position. Near the breach of the gun are pivotally-connected a pair of elevating rods, which coact with the trunnion levers in steadying the gun and keeping it in its proper relation to the carriage, as it is raised or lowered. The top carriage is formed with two hydraulic cylinders, one on each side, in one piece of gun iron. In each cylinder are two throttling bars of steel, which pass through notches in the piston, and serve to regulate the size of the orifices for the flow of the liquid past the piston, and present an increasing resistance to the recoil of the gun. The action of the system in recoiling is such that no matter at what elevation the gun may have been fired, it will have practically the same inclination to the horizontal, about seven degrees, when in the loading position.

The racer is of cast steel, and the base ring of gun iron. The base ring is fastened to the platform with a large number of heavy holding-down bolts. The traversing of the gun is accomplished by means of cranks operated by hand, and the elevation by means of elevating hand-wheels, mounted on a shaft passing through the mount, upon which are pinions of bronze, gearing into spur-wheels of cast steel. On the shaft with these are pinions of bronze, which gear into elevating racks attached to the lower end of the elevating rods.

When the gun is in the lowered position, it will be evident that all the operations of sponging, loading, traversing, and elevating may be carried through without exposing any of the gun detachment, except the man at the telescopic sight, whose head will be exposed above the line of the parapet. The breech of the gun in the lowered position is always at a predetermined height above the platform, so that when the ammunition is brought forward on its truck, it is at just the right height to be thrust from its tray into

(*Continued on page 322.*)



This view shows how little of the mount is exposed.

DISAPPEARING 10-INCH BREECH-LOADING RIFLE, IN THE FIRING POSITION.