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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

MAXIMUM LOAD DUE TO CROWDING.

It certainly does seem rather late in the day to discover that the assumed maximum load on bridges, platforms, and floors, due to a crowd of people, is much greater than our engineers have been accustomed to suppose. In designing any bridge or framed structure that will be subjected to varying degrees of loading, it is customary to assume a certain maximum amount which can never be exceeded, and then so proportion the structure that when this maximum loading occurs, no part will be strained beyond a certain predetermined amount, usually stated as so many pounds to the square inch of section. Evidently the ability of a structure to stand well up to its work, supposing that all the subsequent calculations of the design are correct, will depend upon the accuracy of this assumed maximum loading. In the case of a bridge, the principal sources of stress are the weight of the structure itself, commonly known as the dead load; the weight of the moving loads, such as trains, vehicles, and pedestrians, commonly known as the live load; the loads due to wind pressure; and, lastly, the irregular changes of form in the structure resulting from variations of temperature. A few weeks ago we commented editorially on the fact that the wind stresses that have hitherto been assumed for frame structures were too large, particularly in the case of bridges of great length, and roofs or buildings presenting very large areas to the wind. That was one of the rare instances in which engineers have erred on the side of caution. It now seems that in the case of platforms, and floor surfaces which are liable to be very heavily crowded, the assumed unit of loading has been altogether too small; and in proof of this, we direct attention to the experiments of Mr. L. J. Johnson, professor of engineering at Harvard University, which are described in another column of the present issue. It is shown very clearly, in these experiments, that in the case of floors, platforms, and bridges, that are liable to be heavily congested with a crowd of people, the assumed loading of say from 50 to 100 pounds per square foot is really much smaller than the loading that may actually occur. It is probably the suspicion of this fact that has caused the bridge department of this city to close such structures as the Brooklyn Bridge and the Williamsburg Bridge to foot passenger traffic, whenever there was any public event, pageant, or what-not, in their vicinity which would lead to their being densely crowded.

The danger, however, does not lie in these important structures, so much as in the numberless stairways, foot-bridges, and platforms that lead to the great centers of traffic in our larger cities, of which the most notable instances, perhaps, are to be found in connection with the approaches to the terminals of the Brooklyn Bridge on both sides of the river. Mr. Johnson has found that the weight per square foot due to a crowd of people may be as high as 181.3 pounds, and that it may easily and frequently reach the figure of 160 pounds. Now there is a foot-bridge leading from the Fulton Street and Brighton Beach Railway terminals to the main terminal of the Brooklyn Bridge, which is some 18 or 20 feet in width and nearly 150 feet in length, that is liable, at times, to be crowded quite as densely as was the platform on which Mr. Johnson determined the load to be equal to over 180 pounds to the square foot. It is an interesting question, which we commend to the engineer who designed that structure, as to how far his assumed loading agrees with the maximum loading as determined in these experiments at Harvard University. There are doubtless many other similar foot-bridges, stairways, etc., in various parts of the country of which the question might be asked with equal pertinence.

ROJESTVENSKY.

Never, surely, in the history of naval warfare did the fortunes of his country depend so absolutely upon a single man as do those of the Russian empire upon Rojestvensky and the fleet which he has taken into the China Sea. Strategically considered, the present stage of the Japanese war is critical and dramatic to the highest degree. Both by sea and by land the Russian forces have been subjected to an unbroken series of disastrous defeats. Save for a pitiful remnant of three badly-battered ships at Vladivostock, the once powerful Pacific fleet of Russia has ceased to exist. Her great armies, gathered from all corners of her empire, commanded by her picked generals, lavishly equipped with the best implements of modern warfare, have suffered three overwhelming defeats, and the shattered remnant is being driven back steadily before the resistless wave of Japanese invasion.

And now, at the eleventh hour, when the whole world, friends and foes alike, is telling Russia that the game is lost, she launches into the very heart of the conflict her last despairing forlorn hope, in the person of Admiral Rojestvensky with his travel-worn fleet of something less than half a hundred ships. At the present writing this fleet is steaming directly along the frequented trade routes, with no effort at concealment, and with an evident determination to seek out the thrice-victorious Togo and try conclusions in a desperate fight to a finish.

Whatever may have been said about the Baltic fleet—the haste with which it was gathered, its oft-delayed start, its terrible blunder among the fishing fleet in the North Sea—the whole world must join in giving the Russian admiral his full meed of praise for steaming straight for his powerful enemy at the close of his 17,000-mile voyage which is no small accomplishment in itself. The task before him is truly appalling. With half a hemisphere between him and a home port; with a veteran and tried fleet of the enemy guarding the only avenues of approach to the one remaining Russian port far to the north; with that port blockaded and its entrances heavily mined; with no friendly harbor nigh at hand to which he can retire to recover from the stress of a hard-earned victory, or shelter after a disastrous defeat; it must be admitted, in all fairness, that what Rojestvensky has done and is aiming to do, has been well done, and is being attempted in a manner truly heroic.

It would be a rash prophecy to declare that in the impending battle victory must necessarily fall to the Japanese fleet. Matters are not as they were when the determination was first taken to dispatch a second fleet to the Pacific. Since that time at least one, and probably two, of the Japanese battleships have been lost beyond recovery, and it is quite possible that Togo can oppose but four battleships to the seven battleships under Rojestvensky—and it is battleships that decide, and ever will decide, the fate of a naval campaign.

There can be no question that the Baltic fleet has been greatly underestimated by the general public, partly because of the North Sea incident, and partly because of the widely-circulated rumor that this was a "scratch fleet," composed of obsolete vessels. As to this last, nothing could be farther from the truth. Four of the battleships are absolutely new. They are an improvement upon the "Czarevitch," which, it will be remembered, stood for hours the concentrated attack of Togo's battleships, without having any of her big guns silenced or the structural efficiency of her hull seriously impaired. These four ships are probably able to stand a severer hammering, and are more difficult to sink by gun fire than any ships afloat in the world to-day. The "Borodino," "Orel," "Alexander III.," and "Suvaroff" mount, among them, sixteen 12-inch, 40-caliber guns, which, being absolutely new, are good for a muzzle velocity of 2,600 feet per second. The Russians use capped projectiles, and with these the gun is capable of penetrating 12 inches of Krupp steel at 5,000 yards and 15 inches at 3,000 yards. If Admiral Togo is to sink these ships, or so cripple them as to have them at his mercy, he will have to fight at a range so near that the Russian ships cannot fail to place their shells with considerable effect upon his vessels. In addition to these battleships there is the "Osliabia," built in 1900, which carries four 10-inch guns, capable of penetrating 10½ inches of steel at 5,000 yards and 13 inches at 3,000 yards. All of these vessels have a trial speed of 18 knots an hour, although, of course, they are just now much slower because of foul bottoms. The other two battleships, "Sissoi Veliky" and "Navarin," mount between them eight 12-inch, 35-caliber guns, capable of penetrating 8½ inches of Krupp steel at 5,000 and 11 inches at 3,000 yards. Their speed is two knots slower than that of the other battleships. The four Japanese battleships (or five, as the case may be) mount between them either sixteen or twenty 12-inch guns of about the same penetrative power as the Russian pieces. With the exception of the "Mikasa," however, they are protected by Harveyized armor, of considerably less resistance than the Krupp steel on the latest Russian ships. In battleships the Russians have undoubtedly a preponderance of power.

It is to be borne in mind, however, that Japan possesses eight or seven (one is reported to have been lost) very effective armored cruisers, any one of which is more than a match for the two old armored cruisers "Nakhimoff" and "Donskoi" of the Russian fleet. They mount, between them, thirty-two guns of 8-inch caliber, and they are protected by 6 to 7 inches of Krupp armor. It is scarcely likely, however, that these ships will be placed in the first line of battle, within range of the 12-inch guns of the Russian fleet; and with the possible exception of the Italian-built "Kasuga" and "Nisshin," they will probably be held in reserve until it is seen how the fight between the battleships is going. Should Togo be able to draw the sting from the Russian battleships, and seriously cripple them, his armored cruisers would close in to assist in delivering the *coup de grace*.

The Russian fleet includes several fine protected cruisers of between 3,000 and 6,000 tons displacement, and a few torpedo boats. If Rojestvensky should by any chance elude Admiral Togo and effect a junction with the armored cruisers at Vladivostock, his fleet would be greatly strengthened, and his chances of success enhanced; but that is a remote possibility.

So much for the *materiel* of the fleet; and it must be admitted that, judged on this basis, the second Pacific squadron is a menace to Japan's command of the sea, so serious as to make it possible that a victorious peace may be snatched from her grasp in the very moment of its attainment. But when we come to consider the other elements of efficiency, such as the condition of the ships, the familiarity of officers and crews with their vessels, the skill of the gunners, and the general *morale* of the whole fleet, it must be admitted that the advantages lie very greatly with Japan. The Japanese are familiar with the sound and the shock of battle. The Russians, who doubtless have been doing much target practice during their six months' cruise, are accustomed merely to the discharge of their own guns—they know nothing of the awful crash of bursting shell; the rending of steel plating; the sight of shattered limbs and all the hideous carnage of a 'tween decks that is being swept by the enemy's fire. It is one thing to aim at a floating target during the quiet routine of a cruise, and another to aim at a target that is making the deck upon which one stands a veritable shambles. Rojestvensky leads his fleet to what the world, perhaps unjustly, considers to be at best but a forlorn hope; whereas the Japanese steam into battle flushed with all the confidence and self-possession born of an unbroken succession of victories. Rarely did two contending fleets fight with such stupendous consequences hanging upon the result. Should Japan win, she will reap the fruits of a series of victories that is without parallel in the history of the world, and move at a bound to the front rank as a world power. Should Rojestvensky, by crushing the enemy, obtain command of the seas, and cut off Oyama and his armies from Japan, he will have wrested victory from defeat, and saved to Russia an empire that has all but fallen from her grasp.

RADIUM ON METALS.

M. Bronislas Sabat recently made a series of experiments in M. Curie's laboratory as to the action of radium rays on the electric resistance of different metals. The rays were obtained with the strongest preparation of radium in the laboratory, namely, a bulb containing 0.2 gramme of pure radium bromide. Thin wires of the different metals were rolled around paper tubes in order to form a resistance coil, and the radium bulb was placed in the center of the tube. The rays of the radium thus act upon the wire. As an example, an iron wire which started with a resistance of 4.64 ohms, at once rose to 4.66 under the first action of the rays, and after five minutes' action rose to 4.68, which is the maximum effect. After removing the radium, the wire comes back to the original resistance in a few minutes. For iron, this gives a difference of 0.776 per cent. In the case of a platinum wire of the same diameter (0.1 millimeter) he finds 0.257 per cent. For German silver, it is but 0.092 per cent. Bismuth shows 0.284 per cent. The variations depend upon the size of the wire and the absorbing power for the rays, etc. A certain increase of resistance is thus found at once, and before the heat is communicated from the radium. The greatest variation of the resistance sometimes goes beyond the point which would be reached by the heat sent from the radium alone, and it is probable that the metals absorb the rays (principally the β-rays) and these are transformed to heat, raising the temperature of the metals and then changing their electric resistance. This action is analogous to the absorption of the cathodic rays by metals. The β-rays give a smaller heat effect, however, as they are absorbed by the metals in a less degree than the cathode rays.