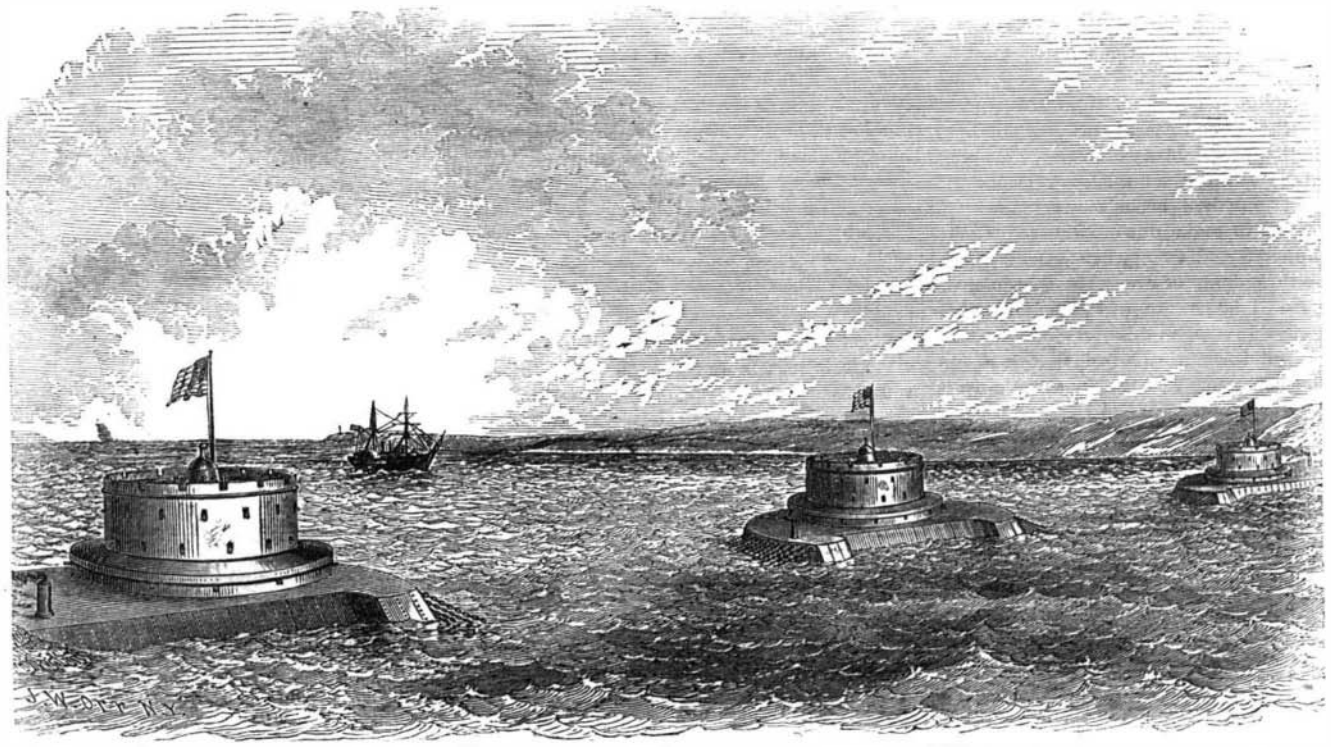
OUR NATIONAL DEFENSES.

It is quite time some change for the better was inaugurated in our fortifications on land and water. While nearly every system of attack and defense that can be named has sustained important modifications, singularly enough, land fortifications, or their equivalents, stationary forts, whether on land or in the water, have remained almost without improvement. if it were an iceberg. Ships *have* run by forts unharmed. Forts Jackson and St. Philip, on the Mississippi, below New Orleans, being cases in point; and the shore batteries thrown up at various points along the Potomac and other rivers, during the present rebellion, may be also instanced as evidences of the impunity with which fixed artillery can be defied by vessels. These are indisputable facts that cannot be gainsaid.

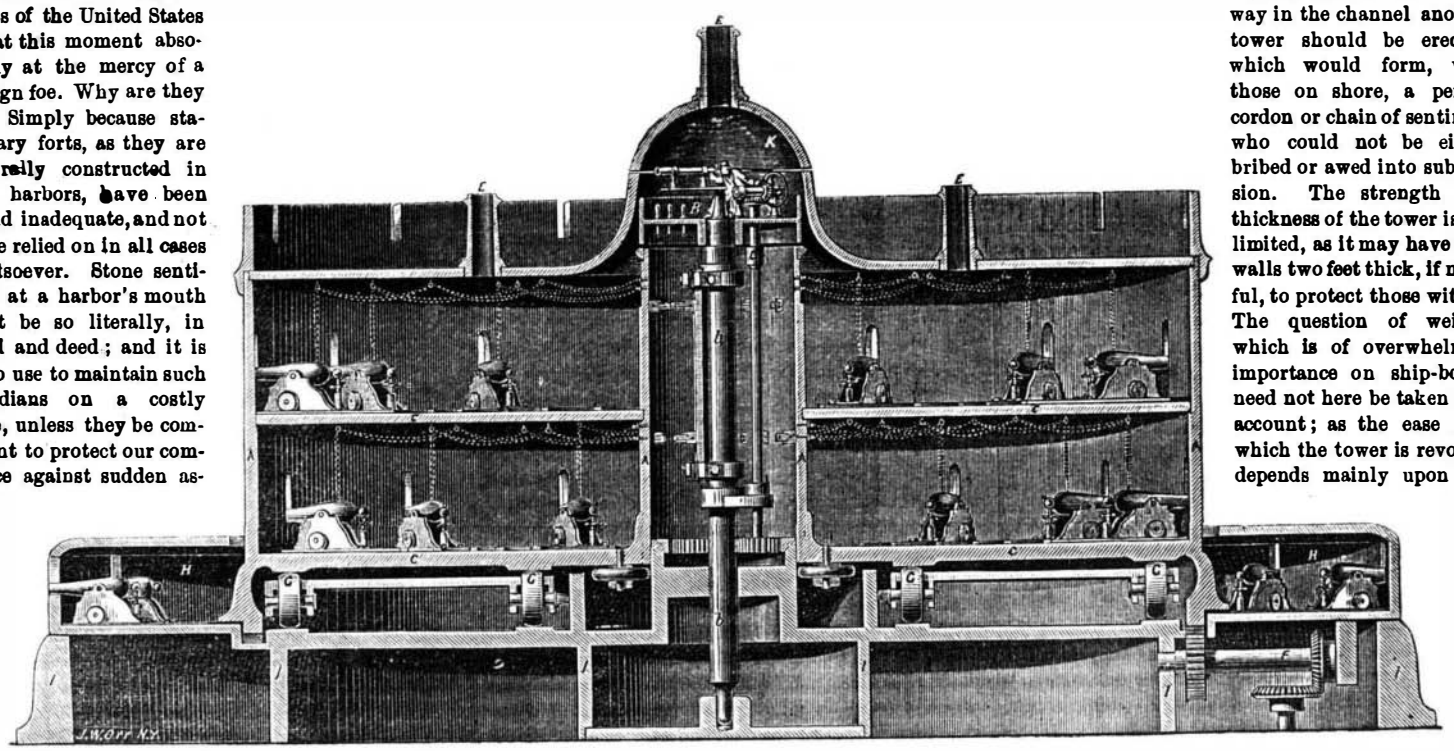


More particularly at this juncture, when governments all over the earth are increasing their offensive power, should we consider the best means of enforcing respect and insuring our own safety. *Already the French Government is illustrating these plans of Mr. Timby's, and discussing the advantages likely to ensue from their adoption; shall we then, with whom the invention first originated, be backward in initiating a system which is unquestionably of the utmost value?*

Thickness of wall, convenience of design, as regards access, and economy of space, arenot considered as improvements vital and radical; and the ports of the United States are at this moment absolutely at the mercy of a foreign foe. Why are they so? Simply because stationary forts, as they are generally constructed in our harbors, have been found inadequate, and not to be relied on in all cases whatsoever. Stone sentinels at a harbor's mouth must be so literally, in word and deed; and it is of no use to maintain such guardians on a costly scale, unless they be competent to protect our commerce against sudden assault; and have power to stop all intruders rushing in from the highway of nations, the ocean, to plunder and destroy. A granite fort can stop an iron-clad, or any other ship, provided the fort's artillery is powerful enough, and that the shot therefrom strike the enemy. But, if these conditions remain unfulfilled, the fort is as useless for purposes of defense as

What, then, is required to render our forts impregnable, and to seal them against any possible surprise occurring through the enemies daring, or from the protection afforded by the darkness of the night? Simply a system of defense that is, so far as human skill and the ingenuity of the present age can devise, absolutely impassible. These conditions are already fulfilled; and the erection of such a fortress might be commenced to-morrow, with the certainty of its accomplishing the end desired. When the Armstrong gun was introduced, and the Whitworth and Blakely guns were brought forward, the Powers that be, at home and abroad, naturally became alarmed; feeling that, for such weapons, there must be found some new shield and buckler, or else the question of superiority would be very quickly decided by the Napoleonic maxim that victory lies with those who have the greatest guns. Hence, after much discussion, came iron-clad ships; and now these having been measurably a success, we must endeavor to repel this latest invention of modern warfare.

Among all the ingenious plans proposed for the object alluded to—national defense—there is none that ranks higher, in our estimation, than that which is the subject of this article. Mr. Timby's invention, as is well known, consists of a revolving tower, adapted to either ship or shore. The unimpeachable value of the tower as an extraordinary means of resisting assault, and providing offensive power, has been amply proved; and the people owe him all the advantages which have accrued to us through its instrumentality. It being admitted that our ports are not in a desirable condition to arrest vessels striving to enter our harbors with malicious intent, it remains for us only to awaken from our apathy, and set to work without delay to remedy the evil. The plan of defense proposed by Mr. Timby, is to erect, at suitable points on either shore strong foundations; on these should be placed the revolving iron-clad towers. Midway in the channel another tower should be erected, which would form, with those on shore, a perfect cordon or chain of sentinels, who could not be either bribed or awed into submission. The strength and thickness of the tower is unlimited, as it may have iron walls two feet thick, if needful, to protect those within. The question of weight, which is of overwhelming importance on ship-board, need not here be taken into account; as the ease with which the tower is revolved depends mainly upon the size and proportions of the running gear below, on which it rests. As the diameter of the tower increases, the strength of the walls must, of course, be augmented. Mere strength and power of resistance in the turret, however, is only a question of mechanics; and any emergency can be fully met and overcome, in this respect, by the resources of science. The



most remarkable feature is the extraordinary capacity of the revolving fortress to annihilate every floating thing that comes within range of its guns. The rock of Gibraltar is an impregnable natural monument; but it would be of very little advantage to the English if its strength consisted in bulk alone. So with the towers; two mountains standing midway in the channel would not appal the soul of the most timid Chinese mariner; but let these mountains belch forth fiery storms of lead and iron, and woe betide the adventurous craft which shall approach, even though trebly clad in the heaviest mail, always providing the shot hit the mark at which they are aimed. This is by no means generally the case. Various causes conflict with the taking of a true and unerring aim in ordinary forts; not the least of which is the unpleasant feeling on the part of the gunner that some shot, inimical to him alone, may enter the open port through which he is sighting his weapon, and deprive him of his head; his aim is consequently hurried and uncertain; and too often the discharge of cannon is merely

"Sound and fury signifying nothing."

We have the fullest proof of this in the history of the present struggle. Tuns of powder and shot have been wasted in firing at passing vessels; but there are very few, if any, instances on record where the gunners who blockaded the Potomac ever hit anything except the river, or the opposite shore. History is full of similar instances; and it is roughly computed that but one shot in about seven hundred ever takes effect! If the certain arrival of every shot at the destination intended could be assured, the cost of war would be reduced enormously; for, following the report of every gun would come the conviction that the enemy had received a vital blow, and that his destruction could soon be accomplished. So far as mechanical ingenuity can provide and foresight penetrate, this greatly desired consummation is within the capacities of the revolving fortress proposed by Timby. The following explanation and engraving will fully illustrate the plan of the inventor, and, we think, convince all that the conception is a correct one.

The second cut on the preceding page represents a section of the battery, or revolving tower, and the several parts are here explained. The main structure, A, of the battery, is provided with a central or inner platform, B, on which the commander of the tower stands; this revolves independently of the main tower by means of the gearing, D. The decks or floors, C, are those on which the guns are mounted, and E, are ventilators through which are discharged all the smoke and gases caused in working the guns. In the foundation walls of the tower may be seen the gearing, F, which, through the medium of the rollers, G, causes the tower to revolve; and which is driven by a steam engine erected within a bomb-proof. The casemates, H, at the foot of the tower, also contain guns which are used independently of those in the tower. Down below these the walls, I, form a subterranean chamber, in which stores of all kinds may be placed. These are, in brief, the principal features. The dome-shaped roof, K, affords a shelter and protection to the commander who sights and fires the guns. The whole battery is thus literally under the control of one man; and, after the guns are loaded, they are fired by him through the agency of a galvanic battery; the current passing through the conductors depending from the roof or floor to each gun.

Let us now examine this feature, by far the most important in the revolving fort. Here are sixty guns, we will assume, that are to be brought into service. In ordinary forts, although the full complement of artillery may far exceed this number, the whole of them are not serviceable, by reason of the character of the work—that is, stationary. With the revolving fort and its peculiar arrangement, every gun can be fired once in a minute, or oftener, if required; depending only upon the rate of speed at which the tower revolves. Absolute accuracy in the flight of the shot is insured, so far as science can guarantee, by the certainty with which the cannon can be brought to bear on the enemy, guided by the telescope of the commander. The engraving shows this personage in the act of sighting, through the peepholes in the dome. As the tower revolves independently of the commanders platform, each gun is discharged at the precise moment when it arrives under the electrical conductor depending from the roof; and it will be seen that, as the flight of the shot to its mark does not depend in the least upon the skill in gunnery of a number of different persons, excited and eager with the heat of battle, much greater execution must ensue than when the reverse obtains. How many shots could an iron-clad vessel receive from guns discharged with such accuracy as is here attainable, before she would be obliged to succumb? Scarcely would the tower have revolved once ere the foe would go to the bottom with all on board; or else, exercising that discretion which is the better part of valor, 'bout ship, and tell the tale of her discomfiture to unwilling ears. As the tower revolves once a minute, 180 guns—supposing there are three tiers of sixty each—could be discharged at every turn; and, if these guns were Admiral Dahlgren's, of 15-inch bore, 32 tuns of iron might be hurled at every revolution of the tower; an amount of ballast which would interfere with the sea-going qualities of any ship that ever floated. No vessel in the world ever carried such a broadside, or could be made strong enough to resist the terrible execution which would be sure to follow therefrom. And though we must not suppose that the enemy will be idle, yet his responses would avail but little, and the chances of his dismounting a gun would be very slight indeed. As the tower rotates, each gun is loaded, after firing, on the safe side, or that opposite the fighting face of the tower, which is continually changing its aggressive front, and the exposure of life and limb thus greatly lessened. Of course the commander in the turret is not silent, but by a telegraph directs each officer to elevate or depress his gun, as may be required to suit the distance from the foe, although this duty must be done at times under exposure.

So far we have considered only a single tower; but when we have a cordon of revolving forts extending across our harbors, Mr. Timby proposes to stretch between the two a gang of heavy chain cables, in the manner shown in the engraving on the preceding page. These chains pass in through hawse-holes in the foundation of the tower, and are sustained by metallic buoys capable of carrying nine-tenths of the cables weight below the surface. These chains do not in the least interfere with the channel way, as they are slacked away the moment danger disappears; and, resting quietly on the bottom, permit pacific vessels to enter as they please. The object of these chains is to detain the enemy under fire; for, when he arrives at them, should he be foolish enough to run his ship against such a barrier, he will find the converging fire of two revolving forts bearing upon him with a deadly accuracy of aim from which there is no escape. We need not dilate upon the effect which will follow; nor is it necessary for us to pursue this subject through interminable columns. Very few unfavorable criticisms can be presented against the plans herein detailed, which Mr. Timby has been engaged for the past 22 years in perfecting. Were such fortifications as those proposed erected at the entrance of our harbors, we might dismiss all fears of invasion; defying alike hostile ships and those who sail them.

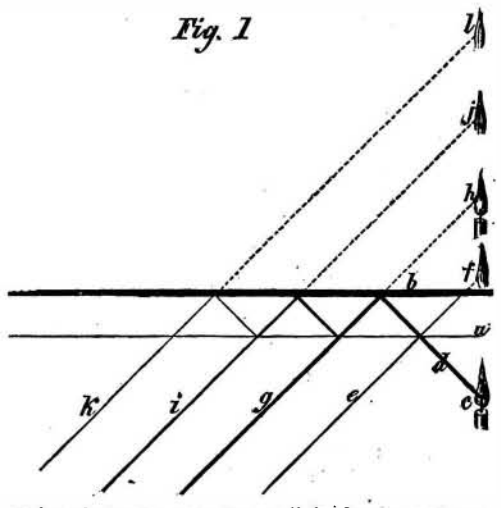
Permanency of Photographs.

The Paris correspondent of *The Photographic News* (London) states that, at a late meeting of the Paris Photographic Society, M. Davanne presented two photographic pictures, on paper which had been submitted to the test of exposure in two exhibitions (1861 and 1862), and which showed no signs of fading or alteration whatever. This, then, may be accepted as a satisfactory proof that photographs, when carefully prepared, are permanent; for the pictures in question were submitted to the severest test to which photographs are ever likely to be exposed, the conditions being every variation of light, heat, moisture, &c., and they remain as fresh and pure as at first. It was also remarked that photographs are more liable to change when kept in a portfolio than under glass exposed to luminous action. A sulphurized proof, if kept in a perfectly dry place, remains for a very long time without exhibiting any signs of alteration, while in a damp place change is immediately evident. Thus, a photograph carefully framed is much better sheltered from humidity than when kept in a portfolio.

THE OPTICS OF A LOOKING-GLASS.

When a beam of light, from a candle or other body, strikes a looking-glass, a small portion of the light is reflected from the front surface of the glass; but the principal portion passes through, and is reflected from the smooth surface of metal at the back. A looking-glass is as truly a metallic mirror as those which were anciently made of polished silver. The office of the glass is simply to hold the amalgam of tin and mercury in place, and to give it a finely polished surface. It answers this purpose admirably, as it permits the use of an exceedingly thin sheet of metal, and gives a surface so smooth that the metal is absolutely invisible.

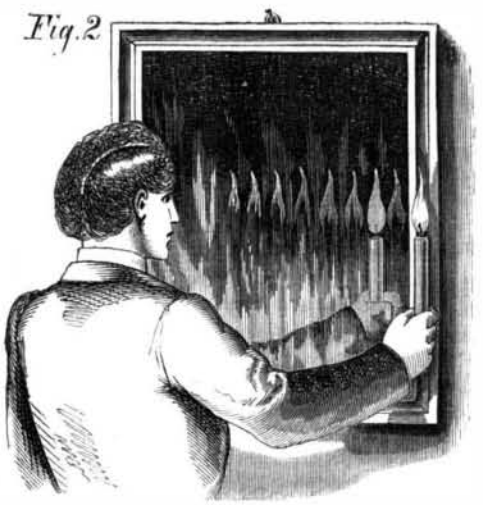
Fig. 1



It is only by the reflection of light from rough surfaces that any non-luminous objects are visible. Were all surfaces as smooth as that of the amalgam on the back of a good looking-glass, the eye would perceive nothing anywhere but a confused glitter.

When a beam of light from a lamp or candle strikes a looking-glass at an acute angle, a sufficient portion is reflected from the front surface of the glass to form an image of the lamp or candle; and if the eye is placed in the right position to receive the reflected ray, the image will be perceived. Even in this case, however, the principal portion of the beam will pass through the glass, and will be reflected by the metal at the back, forming a brighter image than the first; and this second image may be seen at a greater depth within the glass.

Fig. 2



The accompanying diagram illustrates the subject. *a*, is the front surface of the mirror, and *b*, the metal sheet at the back; *c*, is the candle, and *d*, the beam of light issuing from it. As this beam strikes the front surface of the mirror, a portion is reflected in the direction *e*, and if this ray is received by an eye, an image of the lamp will be seen at *f*. The ray reflected by the metallic surface is represented by the line, *g*, and the image of the candle formed by this may be seen at *h*. This image is brighter than the first, in proportion to the larger amount of light reflected from the front surface of the glass.

If the angle is sufficiently acute, as the ray, *g*, emerges from the glass, a portion of it will be reflected inward, against the metal back, and will rebound outward at *i*, forming a third image at *j*, fainter than that at *h*.