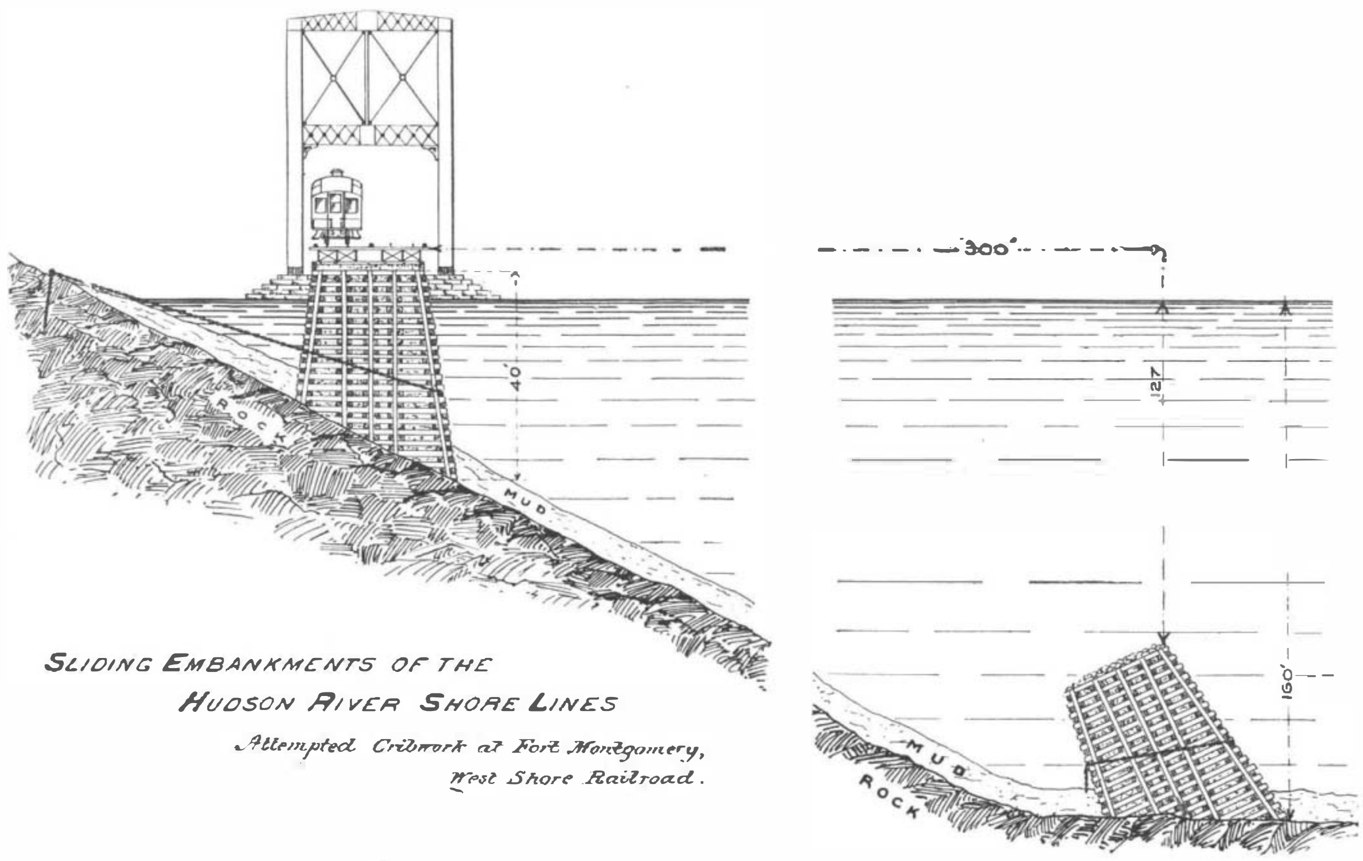
THE SLIDING EMBANKMENTS OF THE HUDSON RIVER SHORE LINES.

BY ARCHIBALD A. SCHENCK, MEM. A.S.C.E.

The recent loss of a train of the New York Central Railroad, north of Highlands, has drawn the attention of the traveling public to the river embankments of the two roads running along the Hudson River shore lines, the New York Central Road on the east shore and the West Shore Road on the west shore. Everything below the surface of the water being invisible, the imagination is given full play, and every embankment between New York City and Albany is likely to be the subject of uneasy inquiry by the poorly informed traveler.

There is very little of either road that comes near the deep water, and where it does so, the places demanding especial care are few in number. It is, of course, vital that these few should receive careful attention.



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Attempted Cribwork at Fort Montgomery, West Shore Railroad.

The two conditions that create dangerous embankments, namely, a deep channel and its close proximity to a rocky shore line, exist chiefly through the Highlands, from Peekskill on the south to Cornwall on the north. There is only one portion of the Hudson shore line outside of the Highlands where a deep channel bears closely against a rocky shore and affects railway construction. This extends along the west shore from a point about opposite New Hamburg to a point a short distance north of Poughkeepsie. North of this place and south of Peekskill the channel bears against mud flats of ample extent for safety wherever the railways are close to the river. The writer is not familiar, from personal examination, with the West Shore line north of New Hamburg, except as he visited it twice during construction of the West Shore Road.

The first "deep hole" encountered by the West Shore Road, running southward from Cornwall, is at Storm King. The next is at Rose's, opposite Cold Spring, some distance north of "Target Hill." The third is just south of West Point dock. The fourth is at Cranston's. The fifth is south of Fort Montgomery, between Negro Creek and Popolopen Creek. The investigations made during construction of the West Shore Road were probably unequaled in any railway construction as to expenditure both of time and money for engineering service. A hydrographic party was employed for many months under the writer's direction, with a special assistant and engineer force, and a capable boat's crew. The examinations included not merely soundings to determine the slope of the bottom, but numerous borings with rods at great depths, to determine the slope of the solid rock surface underlying the sediment of the river bottom. Wherever in the original location the line had been placed too far out and the rock embankment (no other material being used at the deep holes) had slid out, its course and location after the slide were traced and noted upon the charts and sections.

At the first deep hole, at Storm King, the line was moved in upon the solid rock at enormous expense, giving an immense depth of cutting on the upper side.

At deep hole No. 2, at Rose's, a similar treatment was given to the trouble, but the rock not being so high, the construction work is not so apparent.

At deep hole No. 3, south of West Point dock, the deep water ran parallel with a long straight cliff, instead of surrounding a rounding point, as at Rose's and Storm King, and it was finally decided to cut a ledge upon the solid rock along the whole extent of this cliff and place the line upon a solid basis, although this involved great waste of excavated rock, which could not be taken endwise and utilized.

Deep hole No. 4, at Cranston's, was an exceedingly difficult place. The cliffs are very high and steep; the channel was very close and deep, bearing in against this cliff formation sharply. It was a triple difficulty. North of the northerly or highest cliff the line was moved in until part of the roadway was on the original ground out of water, and the rock filling was massed at this point, being carried northward from the rock cut. Great care was taken to have the excavated rock go northward into the deep hole, instead of having it blown sidewise into the river and wasted. Special inspectors of rock were appointed to see that this was done.

On the other two portions of this deep hole, No. 4, substantial bridge spans were introduced, although the solid rock had to be cut out at the inner corners of the spans in some places to admit of their erection. These spans can be seen from the opposite shore. Many travelers on the New York Central Road wonder why they are there.

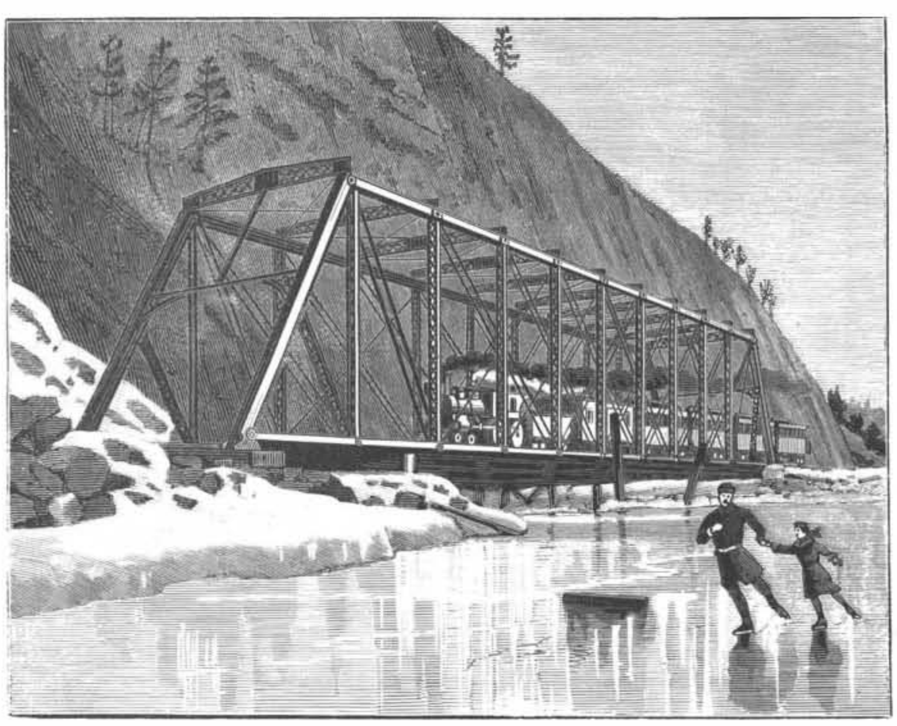
Deep hole No. 5, at Fort Montgomery, is a double hole, lying on each side of a large rock cut. North of the cut, the deep hole was "fought," as at Cranston's. The writer's judgment was in favor of a span here, but no north abutment could be secured except at very great expense for underwater foundations, the rock filling already put in making such work doubly difficult.

A very sharp swing inward was therefore given the line, a swing that travelers would object to less if the increased safety were fully understood. South of the rock cut a very heavy two-truss span was built.

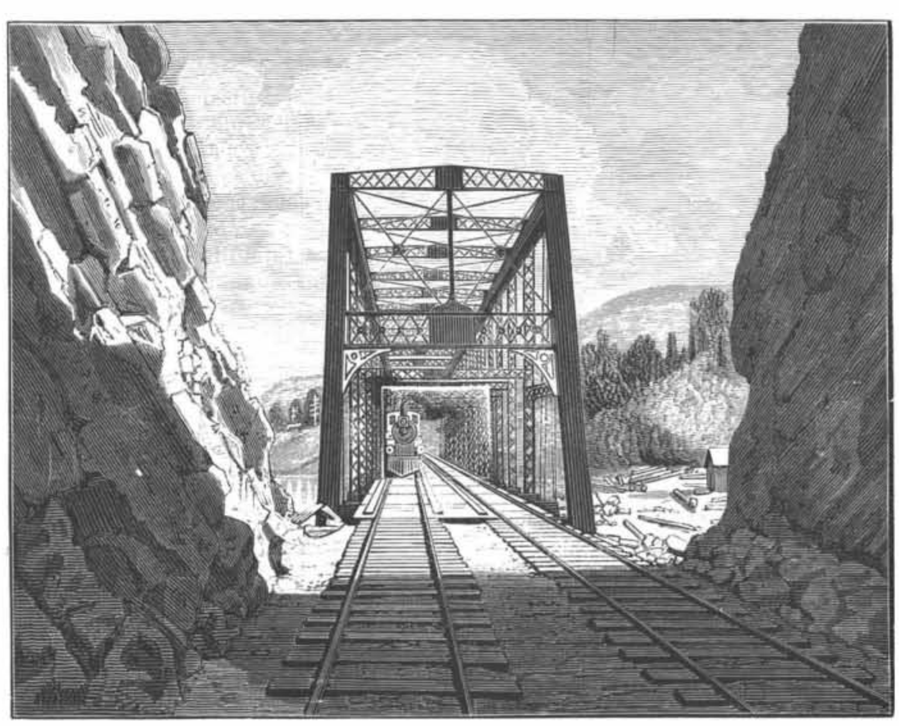
At first the attempt was made to "fight" this hole. Repeatedly the rock filling was made almost across the bight, and repeatedly it went out "like a shot." Then a crib was attempted. It was completed, heavily anchored to the rock inshore by five enormous chains and by anchors running vertically down several feet into the rock. It, too, went out and slid into 160 feet of water, at a distance of 300 feet from shore. The traveler need have no uneasiness about this most difficult deep hole. The train carries him over it on a steel span of ample strength, resting on abutments cut out of the solid rocks along their entire width.

Looking across to the east shore, we note that in general where the difficulties exist on the west shore, the east shore is safe with ample bermes and easy underwater slopes. There are no records extant as to what examinations were made when the present railway was constructed, or what the engineers in charge knew of the conditions, but the alignment of the railway shows that they were wide awake to the difficulties at these three places. At each of them the line was swung abruptly inward.

The indications of the underwater difficulties on the east shore are few, and appear to bring down to a very small figure the number of places that appear to have given uneasiness in the original construction. They also show that the engineers on the original construction of the New York Central Road were keenly alive to the work of avoiding dangerous construction. Wherever there is any marked and unusual deviation



BRIDGE BELOW COZZENS' HOTEL—SPAN 200 FEET.



BRIDGE AT FORT MONTGOMERY—SPAN 290 FEET.

from a normal location of the line of road, we can find some good reason for it.

The construction aimed at on the West Shore Road at the deep holes was rock fill of sharp rock from the excavations. This construction has three advantages over a protected earth filling: 1. The sharp rock, by its sharpness and weight, gets a grip of the mud bottom, and the mud slope, however much lubricated by the water, has little or no effect as a smooth surface in sliding the mass out into the river. Where rock fills went out during construction, it was generally, as nearly as could be ascertained, because of the mud layer in which the rock fill had obtained a grip being too weak to sustain the increasing weight. The rock fill did not so much slide on the top of the mud as did both rock fill and mud layer upon the underlying rock.

2. The rock fill requires no protective wall. It is stable in itself and cannot be overthrown or eaten away by the water.

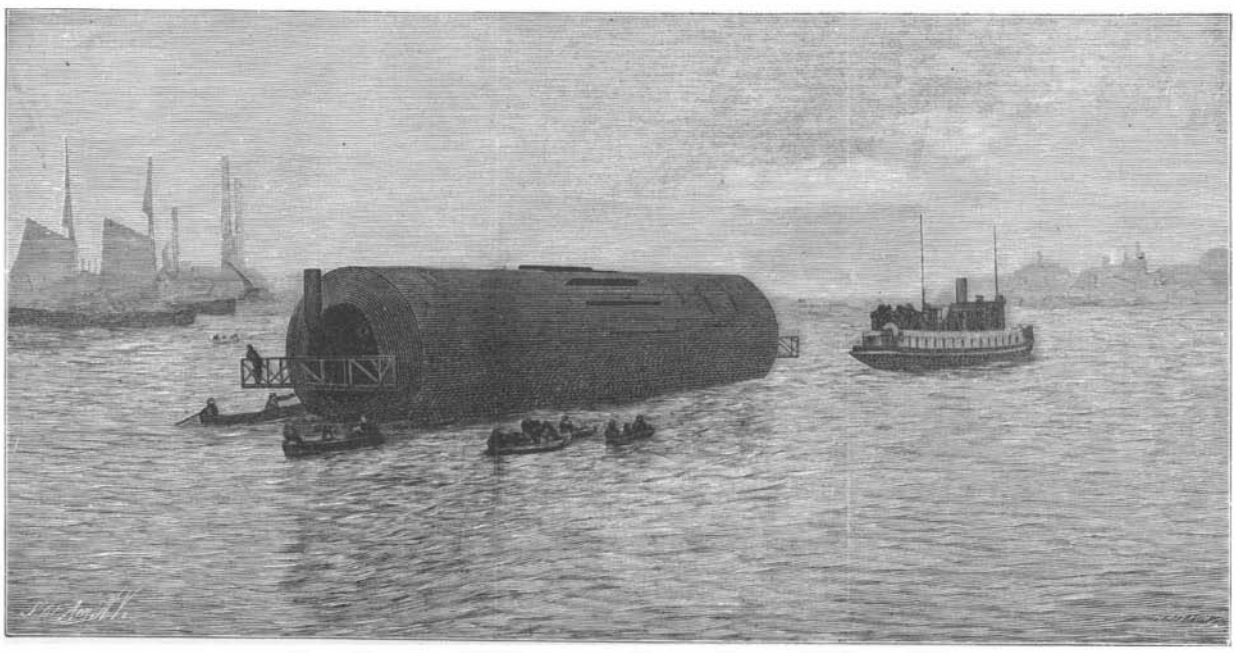
3. The interstices are in time gradually filled by the river deposits, and the whole cemented together into one mass. A rock fill grows more stable with age.

Where such a fill cannot be carried by the underlying mud slope, this is shown promptly during construction. With each month that it remains in place, it settles more into the mud, because more cemented together, and increases in staying power.

The writer's object has been to show the limited extent and number of the difficult places. It is for the company and not the writer to define the cause or causes of the accident at Highlands, so far as the original construction and location are concerned. A test of nearly half a century with ordinary conditions, and of half a dozen years with modern heavy trains, would seem to be almost a final test.

THE LATEST ROLLER BOAT.

It is difficult to account for the inspiration which has led such men as M. Bazin in France and Mr. Knapp in Canada to attempt to make vessels travel a rolling, instead of a gliding, motion. Wherever the inspiration may have come from, its results, so far, have not been encouraging. The Bazin boat picked up the water with its wheels and sunk itself to the hubs with a persistence which looked like an indignant protest against the attempt to take a ship from its native element and make it move over, instead of through, the sea. The water clung so tenaciously to the wheels that they failed altogether to rotate with speed commensurate with the odd twenty or thirty knots an hour which had been freely predicted; and when, in despair, the inventor placed more powerful motive power in the boat, she sank so deeply as to put record-breaking speed out of the question.



THE TRIAL TRIP OF THE KNAPP ROLLER BOAT.

Though the Bazin boat was a failure, it did not deter Mr. Knapp from a costly experiment in the same direction. In looking at his boat, as shown in the accompanying illustration, it must be admitted that, while the roller boat idea was old, the present application of it is decidedly novel.

Mr. Knapp abandoned the idea of making the wheels separate from the boat, if such it could be called, and formed the boat and wheels in one; so that the boat may be said to do its own rolling.

The vessel consists of a huge cylinder 22 feet in diameter and 110 feet long, the ends tapering somewhat suddenly to a diameter of 15 feet. The ends are open and through them admission is gained to the interior of the "ship." At each end of the cylinder is laid a series of steel tracks, which extend in a complete circle entirely round the shell to which they are firmly bolted. Upon each set of tracks is mounted a platform, the platform being carried on flanged wheels, which enable it to maintain a level position during the rotation of the outer shell. On each platform is located a separate boiler and engines, the engines being geared to the supporting wheels. The smokestacks will be noticed protruding from the ends of the cylinder.

Now it will be seen from the foregoing description that, if the cylinder were held stationary, the engine platforms would revolve. On the other hand, if the platforms are stationary, the cylinder will revolve. When the engines are started, the platforms begin to climb the inside of the shell, and the shell being free to revolve, the platforms roll the shell around beneath their wheels. On the outside of the shell are bolted 16 paddles or floats, 15 feet long and 8 inches deep, which are not placed radially to the cylinder, but are slanted so as to hold the water and drive the cylinder forward over the sea.

The boat carries two large tail boards, or rudders, which are located one on each side below the platforms.

The trial trip was made on October 21 at Toronto, where the boat had been constructed, at Polson's shipyard. Our illustration shows the marine curiosity as it was being towed out to the trial course. When the engines were started, the inventor and builder, who elected to watch the experiment from the deck of a ship of normal construction, had the satisfaction of seeing the cylinder make six revolutions a minute, and slowly forge ahead over the water. The speed was six miles per hour, and though the boat rolled, its trials did not give any reason to expect that the marine greyhounds of the future will move over instead of through the sea.

Science Notes.

Prof. J. A. Brashear has just completed the second photochronograph, which he has made for the government, for testing the velocity of cannon balls. The new apparatus has many improvements over the old one and has met all the expectations of the government experts. But one lever is used to fire the gun, start the tuning fork to vibrate, open the main shutter, and release the electric connections which throw a beam of light on the photographic plate, which rotates 1,500 revolutions per minute.

M. Porché has recently submitted to the Paris Academy of Sciences a method of overcoming the difficulty of keeping the subject still while taking a radiograph. He proposes to use a fluorescent screen, and, instead of taking a radiograph directly on the plate, to photograph the shadow on the screen. An extremely sensitive plate is required, and this plate must be protected from all other rays emanating from the Crookes tube except those which actuate the fluorescent screen. The results depend essentially on the rapidity of the sensitive plate.

Preparations are being made to observe the total eclipse of the sun on January 22, 1898, which will be best seen in India, says The English Mechanic. On the coast, in the vicinity of Bombay, the duration of the total phase will be a little more than two minutes, and the time available for observations decreases to a hundred seconds as the central line is followed through Bengal to the Northwest Provinces. The meteorological conditions will probably be more favorable in the neighborhood of Bombay, and the majority of the most suitable stations will be reached from the west coast, though some of the observers will probably go to Calcutta as a starting point for Buxar and Ghazipur. Sir J. Norman Lockyer and Mr. Fowler will, it is stated, be stationed near Ratnagiri, on the Bombay coast, while the astronomer royal (Prof. Turner) and Dr. Common will take up a position where the shadow track crosses a point on the Great Indian Peninsular Railway. Mr. Newall will go to Wardha by the railway from Bombay to Nagpur, and he will use a large slit spectroscope for determining the speed of rotation of the corona. The Southern Mahratta Railway offers free passes to all observers, and the other railways will make considerable reductions in the fares. The length of the path across India is about a thousand miles, and the width of the shadow fifty miles, so that there is ample opportunity for observation, even in the short time of approximately two minutes. The observations made by the professional or official observers will be made in relation to the results of previous eclipse expeditions; but any observations made independently will obviously be of considerable value.

High Tension and High Altitudes.

"Alpine misadventure is a wide word, and includes victims to pathological conditions unrecognized by the victims themselves, whose sudden fall into a crevasse or mountain torrent is set down to 'loss of balance,' 'misplaced footing,' or one or other of the many mishaps besetting the mountaineer, when syncope due to cardiac lesion was the real cause. In August, 1894, The Lancet pointed out this 'error in classification,' when Baron Paccoy, who had for two days been acting as guide to the Queen of Italy, stumbled and fell into a crevasse on the Lyskamm, not, as was at first thought, by inadvertence in walking, but by instantaneous heart failure occurring at the dangerous spot in question. May not this account for the strange disappearance of Mr. Cooper at Zermatt, now being investigated at the instance of our Foreign Office by the cantonal authorities? May he not have fallen into the Visp when suddenly overtaken by the syncope not unusual in a septuagenarian beside a rushing, brawling mountain stream? The hypothesis is well worth entertaining, strengthened as it is by the circumstances under which, on Sunday, July 11, the burgomeister of a Westphalian town met his death on the Furka Pass. This gentleman, with his wife and a young Italian officer as compagnon de vöyage, left Andermatt on the morning of that day for the Rhone Glacier. Everything went well till they came within sight of the object of their journey, when the burgomeister, rising in the carriage to get a better view, had barely uttered, 'Oh! C'est magnifique!' when he dropped down dead. The great altitude, the rarefied air, the high tension—conditions inseparable from Alpine ascents—were too much for a 'chronic sufferer from weak heart,' and he collapsed accordingly. Now, had this syncope occurred at a difficult spot of the Rhone glacier itself, had it supervened on the edge of a crevasse into which the victim fell, would not the incident have been classified as 'accident due to misadventure'—to one or other of the merely pedestrian risks encountered by every Alpine climber? The whole question opens a series of considerations very gravely present to the Swiss medical faculty, in view of the multiplication of such engineering enterprises as the Jungfrau Railway, for example, which will shortly be 'ballooning' passengers of all ages and bodily conditions to a height of over 12,000 feet above the sea level. At a congress of the said faculty, held some time ago at Arona, the perils and the precautions incidental to such railway development were fully discussed, and an impressive warning was given to the traveling public not to venture on rapid ascents above the snow line without previous sanction on the physician's part. To no section of that public is the warning more immediately addressed than to the British, who, after the exhaustion of the London season or a nine months' spell of work, professional or other, are found thronging every Swiss mountain inn, and in sheer holiday exultation qualifying by every kind of imprudence for some such fate as comes under the all too elastic heading of 'Alpine misadventure.'"—Lancet.

Operating Warship Turrets by Electricity.

On November 5 a trial was made of the electrical equipment for the turning of the large turrets of the United States cruiser Brooklyn, at the Brooklyn navy yard, which was very successful. The trial lasted two hours. The great turrets were moved in all directions, rapidly and at slow speed, and so accurately that the guns could be quickly trained on the target, much easier than with compressed air or hydraulic power. The apparatus is so simple and works so satisfactorily that the turrets of the battleships Kearsarge, Kentucky, Illinois, Alabama and Wisconsin are to be equipped with the same mechanism. The power is derived from the dynamos used for the electric lighting of the ship.

A Silver Medal Awarded to the Scientific American at the Brussels Exposition.

We take much pleasure in announcing that a silver medal has been awarded to the SCIENTIFIC AMERICAN display at the Brussels International Exhibition. Notification of the award was sent to the United States Consulate by Mr. Thomas Wilson, Commissioner General of the United States to the Exposition, and was promptly forwarded to this office by Colonel George W. Roosevelt, the present consul.