Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, DECEMBER 17, 1898.

UNSUSPECTED PERIL IN ELEVATORS.

The recent shocking elevator accident in the United States Fire Insurance Company's building, William Street, New York, which resulted in the death of the secretary of the company, Walter H. Griffin, the serious injury of Thomas W. Cauldwell, a director, and minor injuries to the other occupants of the car, has opened the eyes of the public to an unsuspected but very grave peril in one of the most common forms of elevator.

Since the epidemic of elevator accidents which visited this city last year, when such noted structures as the American Tract Society building, the Waldorf-Astoria Hotel, and the General Post Office were the scenes of more or less serious breakdowns, New York has been comparatively free from disasters of this kind. The accidents of that period were of such a nature that the cause was easily ascertained, and the lessons which were learned have been put to good account by both the builders and operators of this class of machinery.

The United States building accident, however, is of an entirely novel kind, nothing like it, as far as we can learn, having happened before. It has served to show that there are some contingencies that may escape the most careful safeguarding against accident, and it teaches us that in elevator-work involving the constant movement of heavy suspended weights through vertical distances measured by the hundreds of feet, it is well to provide even against those breakdowns which are apparently, in the nature of things, impossible. In the present case the car containing eight people had descended to the ground floor, and the occupants were commencing to leave the car, when several 100-pound weights became detached from the counterbalance cage at the top of the shaft and fell through the full height of eleven stories upon the roof of the car.

The elevator is of the Otis overbalanced electric type, so named because the weight of the car is overbalanced by counterweights, which are attached to the car by wire ropes that pass over pulleys located at the top of the shaft. The counterbalance weights travel in a vertical guideway at the side of the elevator shaft, and they are placed in two cages or stirrups, placed one above the other, with a space of a foot or two between them. Each cage is hung by its own separate ropes. The upper cage contains the weights that counterbalance the car, and its ropes run directly up over the top pulleys and down to the car. The lower cage contains the counterweights for the live load (passengers), and its ropes pass by the car counterweights over a top pulley and down to the back of the winding drum. A winding rope also passes from the front of the drum, over a top pulley, and down to the car.

The object of the counterweights is to relieve the strain on the car hoisting ropes, due to the sudden starting and stopping. Thus we may state a typical case in which the empty car weighs 2,000 pounds and its counterweight acting on the car 1,500 pounds, while the live load provided for is 2,000 pounds, counterweighted by 1,500 pounds acting on the back of the winding drum. It is evident that the greatest deadweight to be overcome by the electric motor is never over 1,000 pounds. The motor, when the car is empty, will have to lift 1,000 pounds excess of counterweight, and when the car is full will have to lift 1,000 pounds excess of live load. In the normal condition of working, when the car is half full, the car and load will about balance the combined dead and live load counterweights.

The car is arrested at the top and bottom of the shaft by means of an automatic catch on the motor, which switches off the current at the proper moment. It seems that the catch was out of place by an amount equivalent to two or three feet of travel of the car; so that on this particular occasion, instead of the motor stopping when the car reached the bottom, it continued to wind up the lower case of weights, which, as we have stated above, was attached through its ropes to the drum. The lower cage was lifted in the groove until it struck the upper cage, which it carried up with it until the top edge of the upper cage brought up against an iron beam of the overhead grating of the shaft. The continued pull of the rope caused the lower cage to crush and bend open the vertical bars of the upper cage, thereby allowing the loose weights which it carried to fall out and down the shaft.

It should be explained that the cages consist of a solid top and bottom weight connected by two vertical rods. The space between these weights, which are fixed, is filled in with loose weights (used in adjusting the overbalance of the car), which are held in place by notches at their ends which embrace the two vertical rods, above mentioned, of the carriage. The vertical rods were only expected to be subjected to a tensional strain, and sprung open at once when they were compressed between the upper grating and the lower car acting under the pull of the motor.

This is the first instance on record of an accident of this character, and it teaches a very plain lesson, which the makers, not only of this, but of all forms of counterbalanced elevators, should make haste to act upon. The counterweight cages should at once be changed so as to render the spilling of the loose weights an impossibility. Either a bolt should pass down through every weight or the cage should be made of stout sheet iron or wire netting. Although it has taken nearly a score of years to reveal the existence of this peril, the terrible consequences of such an accident render it the duty of every maker and owner of such elevators to make the slight changes which are necessary to safeguard the public in future.

It is needless to say that the accident emphasizes the necessity for frequent and rigid inspection; for it was the misplaced automatic stop that was the immediate cause of the disaster.

FORTHCOMING IMPROVEMENTS IN UNITED STATES NAVAL ORDNANCE.

The present fiscal year, 1898-99 promises to be an unusually important one in ordnance development in the United States navy. As a result of the reports received from the various ships which were actually engaged in battle during the past summer, a number of important changes will be made in guns and mounts and in the make-up of the ships' batteries The 13-inch gun will give place to an improved type of 12-inch gun as the main armament of battleships, and a more powerful 6-inch gun will become the standard weapon for the arming of the main rapid-fire batteries. The 12-inch gun will be a weapon of much greater power than the present type, as installed on the "Iowa," and there is good reason to believe that the wire-wound system, which is in very successful use in the British navy, will be used in this and in the 6-inch gun. For the present, however, it is premature to announce the use of this system as a settled fact. The new 6-inch gun will have a velocity of 3,000 feet per second. This enhanced velocity will be effected by an increase in weight and length, but no change will be made in the present specifications for projectiles. The other conspicuous change will be the general substitution of 3-pounder guns on the heavier ships for 1-pounders. The 3-pounders may even be expected to largely displace 6-pounders, particularly on the smaller vessels. It is not generally known that the 3-pounder gun has a longer range than the 6-pounder. It is a fact, however, which is due to the employment of a proportionately larger amount of powder behind the 3-pounder shell.

The actions at Manila and Santiago have confirmed the lessons taught at Yalu that 1-pounder guns have a questionable value on board battleships and heavy cruisers. The range of these guns is deemed too limited. The action at Santiago was fought out at ranges, generally speaking, beyond 3,200 yards. The 1-pounder guns have their sight bars cut for only 3,000 yards.

The demand just now is for heavier guns in the secondary batteries of battleships, and in the United States navy provision is being made to supply pieces of 12-pounder and 14-pounder calibers. The 12-pounder was adopted several years ago in the British navy and is a favorite weapon. It not only finds a place in the batteries of battleships and heavy cruisers of that service, but is mounted on vessels of the torpedo-boat destroyer class. The battery arrangement on this last mentioned class is one 12-pounder and four 6-pounder guns. The United States destroyers of the Porter type, mounting four 1-pounder guns, make a rather light showing in comparison.

The new 14-pounder gun will have a muzzle velocity of 3,000 foot-seconds. For small vessels of too light construction to mount 4-inch guns in the extremities, the new 14-pounder is deemed an ideal weapon.

Assurance is given from a high quarter that all secondary battery guns for the United States navy of the 3-pounder and 6-pounder types will hereafter be built on the semi-automatic principle. The Maxim-Nordenfelt mechanism appears to be the type hit upon. The right to use this principle has been acquired by our naval authorities.

The manufacture of projectiles for secondary battery guns has been carried to that point where there is little difference in the cost of common shell and armor-piercing shell. This statement applies particularly to 3-pounder and 6-pounder projectiles. In consequence of this fact, armor-piercing shell, it is announced, will be issued exclusively from now on for the lighter calibers. The armor-piercing projectiles in calibers below the 4-inch carry explosive charges.

The Maxim-Nordenfelt automatic guns, which were installed in large numbers on board United States ships at the breaking out of the war, did good service, but, from the individual reports of officers, there were a good many instances of jamming at the outset. When the volute springs were well set up and the cartridge cases properly squared, the guns could generally be depended upon to run a belt out without stop, but there was more than one instance of cartridge cases pulling apart from the shells. The ammunition used was of English make, and the opinion has been quite freely expressed that in manufacture it was not up to the best American make. As a prominent ordnance official has expressed it, however, "When these guns did work well, they were ideal." The policy now is to make the 1-pounder guns of longer barrel and heavier. A rate of fire of 250 shots per minute is counted upon.

While foreign nations are employing high explosives to a large extent in naval shells, the policy in this country appears to be in favor of the retention of black powder charges. The latter can be depended upon to fire woodwork, and the action of one of these shells when bursting between decks is more diffusent than in the case of a high explosive charge. It was the black powder in the American shells which so early in the fight at Santiago set the Spanish ships on fire.

The reports from the various ships show that premature explosion of shells in the guns was not an infrequent occurrence during the war. The 5-inch gun of one vessel is said to have been badly scored by one of these happenings. On the "Manning" there were two instances of premature explosions in action, one a 4-inch shell, the other a 6-pounder, but the guns were not even marked. In squadron action before Santa Cruz del Sur a shell from a leading ship burst about 100 feet ahead of the "Manning," showing that the trouble in Commander Todd's fleet was not confined to one vessel. On the other hand, the action of the shells on striking on shore was not, according to later discoveries, always certain. Shells were picked up both at Daiquiri and about Santiago which had failed to detonate. In the case of the Maxim ammunition, the shells would often explode on striking the water. The "Manning" had occasion, when attached to Commander Todd's squadron, to use her Maxims on some thatched huts in the vicinity of Niquero, and it was found that the shells exploded with regularity, even when brought up by these light obstructions.

The attention of the ordnance officials has of late been directed to insuring a greater certainty of action in the fuses of all naval shells, and information at hand is, in effect, that the new fuses are more sensitive, while still possessing a good factor of safety. The trouble occasioned by shells exploding prematurely is ascribed to the doing away with burster bags. So long as the interior of the shell is given a smooth, lacquered surface, these accidents will doubtless be obviated. The rule now is to crowd as much black powder into a projectile as its interior space will hold. The idea is to obtain as great a mine effect as is possible.

Brown prismatic powder is now a thing of the past. Large contracts for the new smokeless powder are at present being filled, and it is confidently asserted in ordnance circles that there will soon be a sufficient supply on hand to fit out every ship in service. It takes at least one month to commence the delivery of smokeless powder, once a contract has been signed, and in these days of quick wars it is imperative to have a large reserve stock on hand.

The fear is expressed by many leading naval officials that the people will conclude that because this war was so easy, it will always be easy, and that it makes little difference what class of *materiel* the country has on hand or how much of it. The present policy of Commodore O'Neil, the Chief of Naval Ordnance, is to stock up the navy yards with liberal supplies of ordnance outfits; but as this costs money, the attitude of Congress has to be reckoned on.

The war with Spain has not only tended to ordnance changes, but to radical innovations in the preparation of ships for battle, and new regulations based upon the experiences of the past summer are promised shortly. From what can be learned, it is proposed to strip ships down hereafter as they have never been stripped before. Woodwork is to be torn out in ruthless fashion, and in those ships where the officers' living quarters are placed well up above the waterline, stateroom bulkheads, closets, and furniture are doomed to go. It is even a question if bunks will be retained. The recourse, in the event of taking out bunks, is hammocks.

There are certain articles carried on the decks of warships which are very convenient, such as chests and lockers, but in time of action these appurtenances only serve as so much fuel for flames. The new rule will be to mark in plain letters "Overboard" all fittings not essential to the working of a battery and which serve only to give off splinters. It is expected that opportunity will be afforded for ships to stow the greater part of their loose furnishings at the navy yards

before hostilities break out, but if vessels are brought to action without previous opportunity for preparation, the "overboard" practice will be in order.

The action at Santiago brought home more forcibly than any other battle the great danger from fire in time of battle, and forthcoming instructions, it is announced, will lay special stress on precautions to be taken. Not only must hose be led out to every part of a ship, but care must be taken to protect the hose as much as possible from destruction by shell. On several of the Spanish ships hose led along deck was cut to pieces by 6-pounder shell.

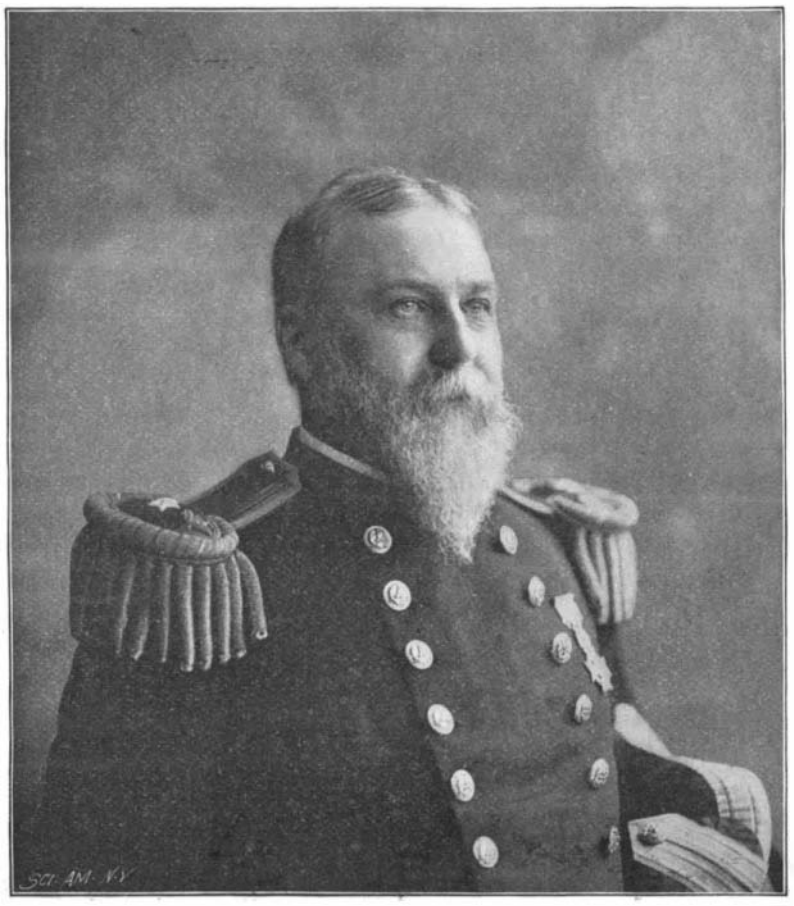
In the matter of carrying small boats in time of action, the naval authorities, it is understood, will leave it largely discretionary with the commanding officers, but the opinion is hazarded that naval captains, as a rule, will strip down to two or three boats. During the civil war the practice sprang up of dropping the small boats clear of the ship on going into action, and the same practice was observed to some extent in the Spanish war. On the larger vessels a steam cutter and a couple of pulling boats, say a whale boat and launch, constituted the outfit. It is contended that, in a prolonged artillery duel between ships, any boats carried in the cradles will be shot to pieces. There will be the danger arising from splinters, to say nothing of adding to combustible material. Even if the boats are not set on fire, they will probably be so badly damaged as to make it impossible to use them. The instructions, it is said, will suggest that commanding officers encourage their men to rely upon life preservers.

The war color for warships which most nearly approximates to the horizon and rocks has been found to be a dull gray, with a yellow shade. LIEUT. G. L. CARDEN,
Ordnance Officer, U. S. S. "Manning."

CHIEF CONSTRUCTOR PHILIP HICHBORN.

When we consider the brilliant naval victories of Manila Bay and Santiago, we are apt to forget the labors of those who made the success possible. The truth of the matter is that the victories were gained months and years previously in the draughting rooms in the State, War and Navy building at Washington. We do not wish to discount in any way the bravery and skill of the line and engineer officers who navigated and fought the ships with such success. At the same time the bureau chiefs and their subordinate officers who toiled all through the spring and early summer, buying new vessels, converting them from peaceful to warlike use, making and shipping supplies and attending to all of the manifold wants of an enormous fleet of 312 vessels, should not be forgotten. The good work accomplished by the Bureaus of Yards and Docks, Equipment, Navigation, Arms, Construction and Repair, and Steam Engineering, will ever remain one of the most pleasing and satisfactory remembrances of the war.

The subject of our sketch is Commodore Philip Hichborn, Chief Naval Constructor, U. S. N. A great deal of the hardest work which was done in the navy in the preparation of vessels for active service during the war was accomplished by the bureau over which Commodore Hichborn presides, and we have already, on another occasion, given an outline of the volume of work performed, and the results of the blockading fleets and the fighting speaks for the quality of work performed.



COMMODORE PHILIP HICHBORN, CHIEF NAVAL CONSTRUCTOR, U. S. N.

Commodore Philip Hichborn was born at Charlestown in 1839, and graduated from the Boston High School in 1855. He then entered French's Mercantile College and graduated from it in 1859. At the age of fifteen he acted as assistant secretary to Admiral T. H. Gregory, the commander of the Boston navy yard, and a year later he was indentured to the government as shipwright apprentice. During his apprenticeship of five years he successfully mastered every detail of the shipwright's trade, so that he has a knowledge of not only the modern, but the old system of shipbuilding. In recognition of his merit, Secretary Toucey ordered that he should receive a course of theoretical training, and he made remarkable progress in ship designing and calculations in another two years' course of theoretical training under Prof. Molle. In 1861 Mr. Hichborn obtained a position as carpenter of the clipper ship "Dashing Wave," bound for San Francisco. The voyage was a tedious and tempestuous one of some one hundred and fifty days. The third mate became ill, and Mr. Hichborn was required to act in his place, and he performed the duties of that officer with remarkable success. Upon arriving in San Francisco he worked for the Pacific Mail Company and the California Steam Navigation Company, and then once more entered into the employ of the government at Mare Island. He had various positions at this yard, and in 1862 was appointed master shipwright, which was a very responsible position for a man twenty-three years of age, for he had at times the direction of over one thousand men. Two years later he declined the position of Assistant Naval Constructor, but in 1869 he made application for appointment, and in May of the same year, after passing a severe examination, he was appointed as Assistant Naval Constructor, U. S. N., with the relative rank of Lieutenant. The training Mr. Hichborn had received in the yard and drawing office made the performance of his new duties comparatively easy. In 1870 he was sent to Portsmouth, N. H. A farewell ball and procession were given in his honor at Vallejo before he left. At Portsmouth Mr. Hichborn passed years of fruitful experience in building and repairing vessels. In 1875 he received his commission as Naval Constructor, having passed a competitive examination at the navy yard, in which he succeeded in distancing all his competitors. In December, 1875, he reported for duty at the Portsmouth navy yard. At this time the yard was being abandoned and the machinery stored and prepared to be transported to the new yard at League Island. A large share of this important work devolved upon Mr. Hichborn. He was always a strong advocate of the natural advantages of the island as a steel shipbuilding yard for the navy, and during the nine years he was on duty there he did all in his power to put it in condition for government work. He completed and repaired a large number of vessels at this yard.

In 1880 he was selected as a member of the first Advisory Board, from the organization of which was given the first impulse to naval reconstruction. In addition to his regular duties at the yard, he had charge of the completion of the "Terror" and "Amphitrite" and superintended the launching of these vessels. In 1884 he was selected by the Secretary of the Navy for special duty in Europe, and, in accordance with the orders of the department, made a tour of the dockyards of Europe, and upon his return he submitted a valuable report to the department, which is considered a standard work upon the subject. In November of the same year Mr. Hichborn was ordered to the Navy Department at Washington as assistant to the Chief of the Bureau of Construction and Repair, and also as Naval Constructor at the navy yard, Washington. He was also a member of the Board of Inspection and Survey. The duties of these very responsible positions, which he performed simultaneously, were rather trying, but his professional knowledge, sound judgment, and executive ability enabled him to perform the duty of these offices with great satisfaction to the department. Since his appointment as a member of the Advisory Board, in 1881, he has been prominently associated with matters affecting designing and construction of our new naval vessels. Mr. Hichborn was appointed Chief of the Bureau of Construction and Repair in September, 1893, and he now holds the relative rank of Commodore while he occupies this office. His position is comparable to that of the Chief of Naval Construction in England. He was reappointed for a second term on September 7, 1897. He redesigned the armorclad "Terror," converting her from a single turret monitor of doubtful utility into a double barbette turreted coast defense vessel of a very formidable type. These highly efficient barbette turrets were unanimously approved by the board of the Bureau Chiefs and have since been adopted for the "Amphitrite" and "Monadnock" and other vessels. Mr. Hichborn is a member of a number of societies devoted to the interest of shipbuilding, and he has devoted much time to literary work, chiefly upon subjects of a professional nature. His advocacy of sheathed ships is gaining in favor among men in the navy. He has also given great attention to life saving apparatus. His practical and inventive genius has contributed many valuable improvements in shipbuilding, such as the utilization of steel bitts as ventilators. In conclusion, it may be said that professionally Mr. Hichborn is always kind and sympathetic in his treatment of his subordinates and is ever ready to recognize their merit. He is a thorough master of his profession, and has won the respect and confidence of his men, and, without requesting it, he has at all times received the full measure of praise from the various Secretaries of the Navy as the result of his excellent management and executive ability.

GLAZED BOOK PAPER BAD FOR THE EYES.

The effect of glazed papers on the eyesight has recently occupied the attention of some German doctors. One authority examines the causes of the changes in the general reading and writing habits of the nation, and explains that in the earlier part of the century the old rag papers then in use, both for writing and printing purposes, were mostly of a dull gray or blue color, and were coarse-grained, so that thick letters had to be used by writers with quill pens or by printers on their old slow presses. With the introduction of more modern fibers, paper received a smoother surface, steel pens could be employed, and the printing paper could travel over quicker printing presses. The fashion for brilliant colors and elaborate typesetting has been carried to such a state of perfection that a reflection is often created which could never arise from the rougher surface. Now, what is the effect upon the reader's eye? In the old books or letters, with a mild and soothing light, the surface contrasted easily from the thicker and darker type or writing characters; now the highly glazed surface offers reflections of the light which, with the more elaborate and thinner type, produce a lot of shades and lights that are most trying to the eye. The paper has often to be turned in various directions to be seen more clearly in order to distinguish the gray (or, may be, other shades) of the type from the shining white of the paper. This is similar in effect as to the result of trying to decipher writing in the dusk. An experiment would soon prove this. Take an old edition, say, of Shakespeare, and a new magazine on highly glazed paper, and compare the sensation in the eye after half an hour's reading. The doctors, therefore, propose that the public inspectors of schools should order the use of sanitary paper for the eyes, by which they mean that a glazed or highly polished surface should be avoided, and the colors chosen should rather be gray or light blue, but no white, and in fact, no brilliant colors at all. The type should be clear and simple, and not too thin. The children, whose eyes require protection, and through them the parents, should be taught to demand their favorite books and papers to be printed in the right style, and the excesses of a falsely guided taste should be avoided. It is suggested that a few years of such policy would soon improve the eyesight.—Invention.

RADIOGRAPHY AND THE PHYSIOLOGY OF THE HEART.

M. Bouchard, at a recent meeting of the Academy of Sciences, reported some observations he had made upon the thoracic organs by means of the X-rays. Among other things he has been enabled to assert the existence of a marked dilatation of the auricles when the intra-thoracic blood-pressure is raised during inspiration. This condition is artificially brought about by endeavoring to inspire with the glottis shut, and is naturally brought about by the violent inspirations during a paroxysm of whooping-cough. M. Bouchard has also discovered that a clear horizontal space exists during forced inspiration between the shadow of the heart and that of the diaphragm, but during normal inspiration there is no space visible. This phenomenon, which is remarkable considering that the diaphragm and the pericardium are attached to one another, is explained by M. Bouchard in the following way. During the forced descent of the diaphragm in a large inspiration the inferior surface of the heart is in contact with the diaphragm to a very limited extent. The pericardium tucks itself into the space existing between itself and the heart, forming in front and behind a gutter into which in turn the pulmonary tissue is packed, thus forming a layer of tissue much more penetrable by the X-rays than those which make up the heart and the diaphragm.—Lancet.