

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 Monthly (Established 1855)..... 2.50
 Scientific American Export Edition (Established 1873)..... 5.00
 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, New York.

NEW YORK, SATURDAY, MARCH 12, 1904.

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.

THE DARLINGTON APARTMENT HOUSE DISASTER.

The fatal disaster to the Darlington Apartment House, in which, at the present writing, over fifteen persons are known to have lost their lives, is one more of those ghastly tragedies which seem to be necessary to stir up the public conscience to the point at which it sets resolutely about the removal or correction of some menace to the security of life and property. The stolid inertia of public opinion can be overcome apparently only when life is sacrificed by wholesale. Then we wake up; demand reforms; and to some extent get them. For proof of this it is not necessary to go beyond a radius of a quarter of a mile from the spot where they are at the present moment taking out the unfortunate victims of willfully careless tall building construction. Not much more than a stone's throw away is the site of the Windsor Hotel tragedy, the inmates of which offered their lives as the purchase price of a thoroughly drastic investigation of the question of fire-escape conditions in this city. Matters are better now than they were before the Windsor Hotel fire. At least, we hope they are. Within a stone's throw of the Windsor Hotel site one may climb down into the tunnel of the New York Central Railroad Company, and on the easterly walk thereof, he will see the deep scars on the brickwork, which were made as the wreck of a coach, in which some score of unfortunates were crushed out of existence, was driven forward by the colliding engine. It needed apparently the sacrifice of twenty prominent business men of this city to set in motion the public sentiment which, in its turn, is bringing reforms in railroad management which will abolish forever the likelihood of a similar disaster.

The pile of wreckage with its entombed victims on West Forty-sixth Street teaches nothing new. Long before the falling of the building it was suspected that a considerable amount of "jerry" work was being done on the "bastard" steel structures, which are being run up continually in this city. We use the term "bastard" advisedly; for a structure that extends ten stories in height and depends for its rigidity upon the lugs and flanges of miserable, little, rectangular, cast-iron columns, has no rightful claim to the reputation for strength and security that goes with the term "steel construction." It was merely a question of time before on one or other of these structures a disaster such as this occurred. Buildings of the type of the Darlington are built purely for speculative purposes, and not a pound of material nor five minutes of time is going to enter into or be spent upon the construction of such buildings, more than is absolutely required by the laws of the Building Department. Moreover, the evidence of the building inspectors proves that in the case of this building, and doubtless of many others like it, there is a persistent effort to evade those rules of construction and erection which have been framed by the Building Department for the purpose of preventing just that very kind of disaster which has now happened. Unfortunately for the poor wretches who went down in the wreck, a flaw in the Building Department laws renders it impossible for the inspector to immediately stop construction on discovering faulty work. The law's delay between the making of such protests by the inspector and the stopping of the work is such that a contractor has some two weeks' grace before an injunction can be served.

As to the immediate cause of the wreck, it will be difficult to pronounce definitely until something more than a superficial examination can be made; but speaking broadly, it may be put down at once to faulty construction. It took but a single glance at the building by a representative of the SCIENTIFIC AMERICAN to satisfy him on this score. The cast-iron columns showed where they had been broken off, the seemingly inevitable blowholes. The maximum thickness of the shell of these columns at the street level appeared to be no more than the minimum allowed in any cast-iron column used throughout the whole building,

There is a sudden decrease in the section of the cast-iron columns of the front wall of the building from 10 or 12 inches at the street level to 6 inches on the first floor. What this line of columns had been reduced to by the time it reached the tenth floor is a matter of interesting conjecture. The connections appeared to have been all bolted, not a rivet being visible in the wreck of the iron and steel work.

We are of the opinion that the cause of the collapse was the lack of proper sway-bracing to keep the structure in its true perpendicular position, coupled, probably, with eccentric loading. The crying evil of cast-iron column work, especially in a building of this kind, where the bending moments are very severe, is, that the whole work of resisting the bending, or what might be called shutting-up stresses of the steel and iron skeleton, is thrown upon the cast-iron connections at the columns, and upon the bolts by which the floor systems are tied to these columns. If the building is properly sway-braced as it goes up, and is stiffened by carrying up the brickwork and by putting in the concrete or tile floors close upon the heels of the erecting gang, the stresses upon these connections may be kept down within safe limits; but where, as in this case, the haste, carelessness, ignorance, or greed of the contractor led him, in direct defiance of the warnings of the Building Department, to carry the steel and ironwork up far in advance of the brickwork, etc., and without putting adequate sway-bracing in this lofty work, it becomes easily possible for the stress upon the cast-iron connections to exceed the breaking strength, and precipitate a disaster.

The lessons to be learned are, first, that the building inspectors should be given the necessary authority to stop work on the instant, or at least within an hour or two, of their discovery of faulty and dangerous construction; and, secondly, that the limit of the height of building in which cast-iron columns are permissible should be greatly reduced, especially for that class of structure which is put up merely for speculative purposes.

REPORT OF THE ARMY BOARD AS TO THE USEFULNESS OF THE LAKE TYPE OF SUBMARINE BOAT FOR COAST DEFENSE.

Some weeks ago, in our issue of December 26, 1903, we published an account of the submarine torpedo-boat "Protector," designed by Mr. Simon Lake. At that time the vessel was lying at Newport, R. I., awaiting trial by a naval board, but owing to ice in Narragansett Bay on January 12—the day set for the beginning of the trials—the board temporarily abandoned its work. A week later, with the water and weather conditions even more trying, an army board put the vessel through a series of maneuvers of a most convincing nature. The immediate result of the military examination of the vessel was an official report recommending the purchase of five submarines of the Lake type. That report, in turn, was referred to the General Staff of the army, and the General Staff has now added its confirmation to the recommendation of the examining board.

The examining board was composed of officers of the artillery corps, which now has control of the country's submarine coast defenses. These officers were Major Arthur Murray—senior officer of the School of Submarine Defense at Fort Totten, N. Y.—and his associates, Captains Charles J. Bailey and Charles F. Parker. These officers had likewise been detailed to watch the trials and performances of the submarines now in the navy, but they did not find those boats susceptible of military adaptation for coast defense. The "Protector," on the other hand, seemed to augur well for such service, and her performance on the day of trial, as well as the well-known sea-going record of the craft, are substantiation.

The military aspect of the question is summed up in the following particulars cited by the board; and, in passing, it may be said that this military view of the field of usefulness of the Lake submarine is quite coextensive with the widest field of service now contemplated by the navy.

FOR DEFENSE.

First: To take the place of fixed mines, by lying adjacent to the forts and attacking vessels attempting to reduce the works or to run past, particularly in important channels where it is impracticable to plant mines, owing to deep and rough water, extreme width, or the swiftness of currents.

Second: To supplement fixed mines, by attacking vessels approaching the mine fields or those which have crossed them.

Third: To lie outside mine fields for scouting or picket duty, keeping in telephonic communication as hereafter described.

Fourth: To pick up and to repair defective cable joints, junction-boxes, etc.

FOR ATTACK.

First: To run past the forts, and to attack vessels within the harbor.

Second: To drag for, pick up, and to cut multiple

and branch cables on the bottom, or mine cables leading to buoyant mines or buoys.

Third: To sweep the channel, two submerged boats being connected by a light cable extending across all or a part of the mine field.

To a very large extent, the board's attention was centered upon the diving compartment. This compartment is located in the bow of the craft, and is separated from the crew-space lying immediately abaft by an air-lock; and both the diving compartment and the air-lock are fitted with air- and water-tight doors. The compartment is fitted with a connection to the low-pressure air system, and provided with a telephone communication with the living space, and a hydro-pneumatic gage with two hands, one of which registers the pressure of the water outside—due to depth—and the other the air pressure in the compartment. At the bottom of the compartment is an iron door, which can be opened outward. To open the door, the air-lock doors are first closed, and compressed air is admitted into the compartment until the gage hands indicate unity of air and water pressures. The door is then unfastened and allowed to swing open, thus giving, in clear water with the boat on the bottom, a good view of the sea bed.

This compartment provides for:

1. Mine cable cutting; or else repair of, or the burying of, mine cables and junction-boxes.
2. A channel for telephonic communication with the shore when the boat is on picket duty.
3. A way of escape for the crew, in case of the total disablement of the boat.

The board, remarking upon the ability of the "Protector" to run under gasoline propulsion with only the observing instrument and sighting-hood above water, said: "By reason of an automatic induction valve in the top of the sighting-hood, admitting air for the gasoline engines and excluding spray and water, the engines may be used in this condition of submergence; and this fact gives to the boat a large cruising radius at comparatively high speed, and renders it likely that under many conditions of sea, light, and weather, the craft may get within torpedo range without being seen, in the event even of the total disablement of her electrical equipment. In this condition, of course, the omniscope would be housed, and the sighting-hood, of a neutral color, could be discerned only with great difficulty. This ability of the boat to run under gasoline propulsion almost entirely submerged assumes considerable importance when it is considered that the elements most liable to disability in the submarine boat of to-day are the storage battery and the electrical equipment."

The following quotation from the board's report gives the experience of its members:

The board was on board from 10:15 A. M. to 4 P. M. of January 19, 1904. From about 12 M. to 3 P. M. the boat was submerged, and from 12:40 to 2 P. M. the board was in the diving compartment, observing its operation and that of grappling for a cable.

No discomfort was experienced under the air pressure in the diving chamber, and the remaining part of the interior was quite as comfortable as any surface boat of its size would have been. Lunch was cooked and served while submerged.

PROGRAMME.

1. Proceeded from Fort Adams (Newport, R. I.) some three miles up Narragansett Bay in cruising condition, using engines.
2. Passed from cruising to awash condition, housing all external fittings, except a wooden mast installed for the naval test.
3. Continued surface run in awash condition.
4. Passed to submerged condition by filling ballast tanks.
5. Maneuvered on the bottom of the bay, by using storage batteries and motors to propel the boat.
6. Filled diving chamber with compressed air, opened door in bottom, and, with a grapnel, picked up a telephone cable by moving slowly over its approximate position.
7. Passed from submerged to awash, and thence to cruising condition, and returned to Fort Adams by a surface run, using storage batteries and motors.

In passing from the submerged to the awash condition, it was found that an ice floe had drifted over the boat, which, on rising, broke through the floe and emerged with its deck completely covered with some eight inches or more of ice, which remained on deck while passing to the cruising condition. It was also found that the wooden mast above mentioned had been broken by the ice while the boat was maneuvering under it.

The weather was very cold (zero), the bay full of ice, and it would have been difficult to have chosen more adverse conditions for the test.

CONCLUSIONS AND RECOMMENDATIONS.

For Defense.

The board believes that this type of submarine boat is a most valuable auxiliary to the fixed mine defense, and, in cases where channels cannot be mined owing