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 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, New York.

NEW YORK, SATURDAY, DECEMBER 24, 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.

A GREAT PUBLIC IMPROVEMENT.

The opening of the new Chicago subway, which is scheduled to take place next January, provides that city with a system of transportation for freight which will not only prove of immediate relief, and great business utility, to Chicago, but must in the long run react favorably upon other great cities where the congestion of street freight traffic is already a serious problem, and promises to become an intolerable burden as the years go by. The Chicago subway, as planned, has a total length of 60 miles, of which 22½ miles have been completed and are shortly to be opened as stated above. The road will be used strictly for the haulage of freight, and for this service the road, when fully equipped, will be provided with several thousand cars and 150 electric rack locomotives, the locomotives being small in size, and depending upon a rack rail in the center of the track for securing the necessary tractive effect. The new subway is designed to take the place of the horse-drawn trucks in the transportation of freight from the many freight depots to the doors of the various business houses, where the merchandise will be unloaded directly from the cars of the subway to the basement floors. Not only so, but the coal for power purposes and the ashes will be brought and removed from the basement in the same way. A special type of car has been built for the subway, of dimensions suitable to the section of the tunnel, and capable of carrying a load of 15 tons. The subway is constructed in two sizes. The main lines which extend below the principal streets of the districts served are 11 feet 2½ inches in width and 12 feet 6 inches in height, while the branch lines which serve the intersecting streets are 6 feet in width and 7 feet 6 inches in height.

Now here is the practical realization of a scheme which has frequently been suggested as the best solution for the crowded freight traffic of the busiest portions of New York city. The district in Chicago that will be most richly benefited is a section less than two miles square, in which is included all of the great freight stations, and in this section is located the principal shopping district. A freight system applied to New York would involve the construction of trunk lines below the streets bordering the East and North rivers, with a system of feeder lines running below the crosstown streets to serve the business houses. Such a system would not only serve to relieve the too narrow cross streets of the slow-moving and bulky trucks that incumber them and so badly congest traffic, but it would mean the clearing from the sidewalks of the mass of freight which now incumbers them and renders the progress of the foot passengers not merely exasperatingly slow, but, as several fatal accidents have shown, positively dangerous.

A CANARD AND ITS REFUTATION.

That was a stupid canard which was cabled recently from England, to the effect that the turbines of the new transatlantic steamer "Victorian" had failed on trial to give the expected results. As a matter of fact, the turbines were not even in the ship at the time the cable was published. In view of this attempt to prejudice the reputation of the coming prime mover, the recent publication by the British navy of the results of a series of comparative trials of identical cruisers fitted with reciprocating engines and turbines is very timely, for they show that so far from there being any indications that marine turbines will be a failure, there is every reason to expect that they will prove a success so brilliant as to relegate the reciprocating marine steam engine, at least as the motive power of high-speed vessels, to the limbo of outbuilt and discarded mechanisms.

Now this is a pretty strong statement; but our readers will agree that it is justified by the extraordinary results attained in the first authentic and absolutely fair competitive trial of turbines against reciprocating engines as given below. It happened in this way: There have recently been built for the British navy four cruisers of 3,000 tons displacement, 9,000 contract horse-power, and 21¾ knots contract speed. The vessels were identical in everything except the engines, which in three of the cruisers were of the reciprocating type, and in the fourth—the "Amethyst"—were of the well-known Parsons turbine type. The ships recently completed a series of very exhaustive trials carried out by the trained experts of the British navy, under conditions that preclude any possibility of error, and render the remarkable results secured authentic and reliable. The trials were executed in periods of 24 to 36 hours of continuous steaming, and at speeds of from 10 knots to the maximum of which the respective vessels were capable. At a speed of 14 knots the water and coal consumption and the general economies of the two types were about the same. As the speed fell below 14 knots, the reciprocating engine showed proportionately better results, but from 14 knots upward the turbines proved to be on every point of comparison superior. As the maximum speed was reached, the turbines proved so greatly superior as to render the reciprocating engine by comparison a costly, clumsy, and relatively very inefficient machine. We herewith append a table showing comparative results at the maximum speed at which the two types could be driven:

COMPARATIVE EFFICIENCY AT MAXIMUM SPEED.

	Reciprocating Engines.	Turbine Engines.
Displacement of ship, tons.	3,000	3,000
Maximum speed	22.24	23.63
Maximum horse-power	9,600	14,000
Horse-power, per ton weight	18 3	26.0
Coal, per horse-power per hour	2.65	1.74
Radius in miles at 20 knots	2,140	3,160

We must confess that while we were prepared to see the turbine show the better results, we were altogether unprepared for the amazing superiority indicated by these figures. Regarding the performance at lower speeds, mention should be made of the fact that in the reciprocating engines, the exhaust steam from the auxiliaries (representing at low speed about one-fourth of the total steam drawn from the boilers) was turned into the receivers of the low-pressure cylinders, an arrangement which, as was shown in our recent article on the trials of the cruiser "Pennsylvania," conduces to high economy. In the present trials no such provision was made for the turbine engines; and it is the opinion of the naval engineers that when this has been done the "Amethyst" will compare favorably with the other boats, even at speeds below 14 knots. A study of the details of this test shows that when running at 20 knots the turbine ship required 30 per cent less coal and steam than the others; at 18 knots the saving was about 20 per cent; at 16 knots about 10 per cent; while at 14 knots the consumption was about the same. The gain of more than a knot and a quarter per hour when the engines were being pushed to their limit is particularly important when it is borne in mind that the air pressure in the boiler rooms was only 1.7 against as high as 2½ inches in the other ships; for this of course means that there is considerably less wear and tear on the boilers. It should further be mentioned that, for cruising at low speeds, the "Amethyst" was fitted with an extra set of turbines, which would not be necessary in merchant ships, which always run at about their maximum speed. Therefore the horse-power per ton weight of machinery would, if this had been a merchant vessel, have been even higher than the 26 horse-power shown in our table. At 18 knots the turbine required about 3 pounds less steam per horse-power per hour; at 20 knots, 5¼ pounds; and at full power, from 7 to 8 pounds less steam, or a reduction of over 30 per cent. So with the coal consumption, although at 10 knots it was 3.22 pounds as against 2.56 pounds in the reciprocating engines, at 14 knots it was about the same, at 18 knots it was 20 per cent less, at 20 knots 30 per cent less, and at full power the turbine engines demanded 1 pound per horse-power per hour, or 40 per cent, less than did the reciprocating engines.

The most important feature, however, to the naval architect and the student of tactics and strategy, is the greatly increased radius of action due to the economy of the motive power. The "Amethyst" type of cruiser carries 750 tons of fuel under normal conditions; and at 18 knots the turbine ship with this supply could travel 3,600 miles as against 2,770; at 20 knots it could travel 3,160 as against 2,140 miles, while at the remarkable speed of 23.63 knots, the "Amethyst" could steam 1,620 miles as against 1,420 miles for the vessel carrying reciprocating engines and making only 22 knots an hour.

Experience has shown that the larger the units in which the turbine is built, the greater are the economical results obtained. Therefore it is reasonable to expect that the 18-knot "Victorian" of the Allan Line, and in a still greater degree the 25-knot liners of the Cunard Company, will show a speed and economy that will greatly surpass even the extraordinary results obtained in these naval trials.

Further testimony of the efficiency of the turbine for deep-sea work is afforded by the successful voyage of the steamship "Loongana," which made the journey from Glasgow to Australia in 30½ days. The details of this trip are found elsewhere in the present issue.

THE CRISIS OF THE RUSSO-JAPANESE WAR.

That the crisis of the Russo-Japanese war should have come and gone without producing so much as a ripple of excitement in the columns of the daily press, is a curious commentary upon the popular estimate of the relative importance of naval events in the Far East. The very columns that were filled with lengthy telegraphic accounts of the torpedo attack of last February, which, after all, merely opened the war, now, in the very hour of the crisis of the war, can find no more than two or three inches of space to record the destruction, in one fell blow, of Russia's naval power in the Far East, and the sounding of the death knell to any reasonable hope of the ultimate success of Muscovite arms.

We showed in a recent article that the defense of Port Arthur, which really meant the defense of the Port Arthur fleet, was the key to the present situation; for it meant the protection and preservation intact of this fleet until it could join hands with the approaching reinforcements under Rodjesvensky. Hence the terrific attacks on 203-Meter Hill, the possession of which by the Japanese would afford implacements for heavy naval guns, capable of commanding the anchorage of the battleships and cruisers that constituted the powerful remnant of the Port Arthur fleet. Unquestionably the struggle for this position marked the crisis of the present war. Had it proved impregnable, Japanese command of the sea, with every thousand leagues of advance of the Baltic fleet, would have become increasingly imperiled, and the command of the sea once lost, the capitulation of Oyama's Manchurian armies (cut off from their base of supplies) would have been merely a matter of time. The Japanese, once in possession of this hill, lost no time in dragging their heavy naval batteries into position, and then commenced what must go down into history as one of the most tragic disasters of any great naval war. There at anchorage lay six modern battleships and cruisers, the very flower of the Russian Asiatic navy, and each representing a money value of from four to six million dollars. Upon the distant hill was a battery of high-powered modern guns, whose gunners, getting the range to a nicety, proceeded to sink the ships in detail. It took but a few hours to send property of a total value of over $30,000,000 to the bottom, and then for several days the high-explosive shells were rained pitilessly upon the helpless ships until they were wrecked beyond any possibility of salvage. The sunken vessels are the battleship "Retvizan;" the battleships "Pobieda" and "Peresviet," sister vessels to the "Osliabya," now forming part of the Baltic fleet; and the battleship "Poltava," sister to the "Petropavlovsk," which, it will be remembered, was sunk early in the war with Admiral Makaroff on board; the fine armored cruiser "Bayan;" and the protected cruiser "Pallada." The "Sebastopol," sister to the sunken "Poltava," being in drydock, escaped the Japanese shells, but was subsequently sunk by Togo's torpedo flotilla at her anchorage outside the harbor.

Now that the Russian fleet has been destroyed, Admiral Togo can send his battleships to Japan for drydocking and general overhauling, leaving his smaller cruisers to maintain the blockade, and prevent the sending in of supply ships. He will have ample time to get his fleet into absolutely first-class condition ready for the advent of the Baltic fleet—that is, if it ever arrives. For the conviction must now begin to force itself upon the Russian Admiralty that the four modern and two old battleships, and the two still older armored cruisers of the Baltic fleet, will be no match for the four battleships and eight armored cruisers, all of the very latest type, which they will have to confront and sweep out of the way, if they are to break down the sea power of Japan and isolate her Manchurian armies from their base.

Were the personnel of the opposing fleets of equal skill, daring and general efficiency, the advantage in material would still lie with the Japanese; but having in view the necessary rawness of the hastily improvised crews of the Baltic fleet, and the lack of *morale* shown in the North Sea incident, it is not conceivable that they can win any victory over the veterans of the Port Arthur blockade, trained and hardened as they will be by more than twelve months of arduous campaigning.

The command of the sea, then, is assured, by all of the laws of probability, to the Japanese, and Russia must now bend her energies to the prosecution of the