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, NOVEMBER 4, 1899.

COMPARISON OF NEW YORK CABLE, ELECTRIC, AND HORSE CAR LINES.

The extensive and excellently managed system of the Metropolitan Street Railway Company of this city affords opportunity for a valuable comparison of the relative cost of operation of the systems of traction by horse, cable, and electricity. In keeping with the broad-minded spirit which has characterized the management of the company's affairs, the annual statistics of the cost of operation of its system are regularly published for the benefit of the public, which is thus put in possession of data that cannot fail to be of great value in solving the problems of transportation with which our great cities are confronted.

On the thirtieth of June last the company had in operation 113·4 miles of horse railway track, 25·3 miles of the cable system, and 82·1 miles operated by the underground electric system. The table given below is a summary of the operating expenses per car mile for each system, and the figures given possess unusual value from the fact that the three systems are all operated under one management, and in the same city, and the results obtained, therefore, are not vitiated for purposes of comparison (as is so often the case) by dissimilar conditions of location, wages, cost of supplies, and methods of operation.

CABLE ROADS.

	Cents.
Maintenance of way	4·69
Maintenance of equipment	1·13
Power	2·39
Transportation	8·43
General expenses	1·35
Total per car mile	17·99

ELECTRIC ROADS.

	Cents.
Maintenance of way	0·68
Maintenance of equipment	1·17
Power	1·77
Transportation	7·06
General expenses	1·27
Total per car mile	11·95

HORSE CAR ROADS.

	Cents.
Maintenance of way	0·99
Maintenance of equipment	0·42
Power	6·69
Transportation	8·24
General expenses	1·62
Total per car mile	17·96

The most surprising feature in this comparison is the high cost of operation of the cable system. It has long been known, of course, that the electric was much the cheaper system to operate of the two, but that the cable road expenses should actually exceed those of the horse car roads is quite unexpected and calls for explanation. This is to be found in several facts, one of which is that the extraordinarily heavy traffic on the cable roads, where at times cars are run under a headway of only ten seconds, led to excessive wear of the cables, which was aggravated during the blockade of the electric roads in the snow storms of last winter, when the cable lines were kept in almost continuous operation. During this trying period a new cable would last only a little more than a week, and, as a matter of fact, the renewals of the cables alone during the year amounted to 2·30 cents per car mile. Another cause of the high cost of maintenance of way is found in the fact that the company, having in view the future substitution of electric for cable traction, is incurring heavy expenses in keeping up old equipment, which, but for the coming change, would have been replaced by new material. On the other hand, the cost of operating the horse car lines has been brought to its present relatively low figures partly by the economies resulting from the consolidation of these lines under one management and partly by the great reduction which has taken place of late in the cost of feed and general supplies.

The excellent showing made by the electric roads is very gratifying. The low cost of the maintenance of way is, of course, due somewhat to the fact that the tracks and underground construction are new, and have not had time to show much appreciable deterioration; although there is in the underground trolley no element so subject to wear as is the wire cable of the older system; indeed, the permanence, the absence of wear and tear, in the underground construction is an excellent feature of the system, which goes far to offset its heavy first cost.

In regard to the cost of power of the electrical roads it should be mentioned that it includes some items which are due to a short crosstown horse railway line which so joins several electric lines as to necessitate its being considered a part of the electric system. If these items are excluded, the cost of electric motive power is found to be 1·57 cents per car mile in 1899. When the company's new 70,000 horse power power-station is in full operation, a further reduction of these figures will occur.

The percentage of operating expenses to passenger receipts for the three systems was 69·8 per cent for the horse, 50·8 per cent for the cable, and 38·3 per cent for the electric roads. In estimating their relative efficiency, however, it must be borne in mind that there is one important element left out of the above comparison which renders the superiority of the electric system even more striking—we refer to the comfort and dispatch with which the enormous passenger traffic on the electric lines is managed. The long, eight-wheel cars which are in almost exclusive use on the trolley roads are not only more commodious and smoother in their running than the cable cars, but they are run at a much greater speed.

There is one serious drawback to travel on the electric roads which cannot, however, be charged either to the system or the management—these roads are greatly over-crowded. The only possible remedy for this lies in the provision of other lines of travel, which will relieve the surface roads of the long-distance passengers and leave them to take care of the short-travel traffic. Such a provision can only be made by the construction of the rapid-transit tunnel road; and we are glad to note that the Metropolitan Street Railway Company is in favor of the construction of the tunnel as being the only and obvious solution of the present over-crowded condition of the surface roads.

WIRELESS TELEGRAPHY IN THE ARMY AND NAVY.

Among the many experts who were present upon the "Grande Duchesse" during the yacht races to watch the operation of the Marconi system of wireless telegraphy (described and illustrated in our last issue) were representatives of the United States army and navy, and preparations are now being made for giving the system a practical test by both arms of the service. We understand that the signal corps of the army is about to carry out a series of experiments in Washington in connection with the new automobiles which were recently built for the War Department. The experiments are to be made in the country around Fort Myer. An automobile wagon equipped with a set of Marconi sending and receiving apparatus will be dispatched several miles from the fort, and when it reaches its destination it will send a balloon into the air which will carry a vertical wire to the proper height corresponding with the distance over which the messages are to be sent. Another set of apparatus with a vertical wire will be installed on an automobile, which will be stationed at the fort.

The naval experiments are to be carried out between the battleship "Massachusetts" and the armored cruiser "New York," both of which will be fitted with a vertical wire reaching from the masthead to a suitable operating room below, the installation being exactly similar to that described in our last issue. It is proposed to make these experiments very exhaustive, and an attempt will be made to duplicate and even exceed the performance of Mr. Marconi, who recently communicated between British warships engaged in the late autumn maneuvers which were at the time eighty miles distant from one another.

AERIAL NAVIGATION.

We regret to see that aerial navigation has recently claimed another victim, whose death was due to causes precisely similar to those which brought to an untimely end the experiments of the late Herr Lilienthal. Lieutenant Pilcher of the Royal Navy, the latest victim, had been for many years an earnest student of the subject of aerial navigation. His line of investigation was similar to that of Lilienthal and was directed to the development of the soaring machine. The aeroplane to which the accident occurred consisted of a light framework of bamboo and steel wire which carried about 170 square feet of sail. It was provided with the usual rudder for maintaining equilibrium and steering. A machine of this kind is intended to be started from a slight elevation, and with proper manipulation of the rudder and adjustment of the weight it is possible to soar for a considerable distance. The peril of these soaring machines lies in their liability, if the weight of the body be not properly swung or the rudder properly controlled, to take a sudden dive earthward. It was a mishap of this kind that killed Lilienthal, and the death of Lieutenant Pilcher was also due to his losing control of the vertical movement. These accidents emphasize the fact that the art of balancing on widely extended areas of sail, while it is performed automatically by a bird, can only be acquired by man as the result of much practice, and control even under normal conditions can only be maintained by the strictest watchfulness. It can readily be understood that a peril which is ever present in quiet air becomes imminent should the aeroplane be struck by a sudden and unsteady gust of wind. It must be confessed that the late tragedy seems to prove that the era of safe artificial flight is yet a long way off.

STABILITY OF THE "NEW ORLEANS" AND THE "ALBANY."

In our issue of July 1, we commented at some length upon the sensational rumors regarding the instability of the "New Orleans," which, emanating from the Washington press, were taken up and elaborated by the press of Philadelphia and other shipbuilding centers. As we pointed out at the time, inquiry at the Brooklyn navy yard, where the inclining experiments on the "New Orleans" were made, showed that these statements were based upon a misconception or a misunderstanding of the report of the inclining tests.

In the determination of her stability in light condition, the vessel was considered stripped of all consumable weights and was placed in the most unfavorable condition possible. She was entirely emptied of coal, water, and stores, the coal representing a lightening of 800 tons and the water of 220 tons. Not only were the boilers and tanks emptied of water, but all water was removed from the double bottom. The ammunition, representing 120 tons, was also removed, and neither the crew nor their supplies were on board. Indeed, the ship was put into a condition which, if she were upon the high seas, would constitute her a derelict.

When this process of stripping was completed, a certain number of cast-iron blocks of known weight were shifted across the deck, and from the angles of inclination of the ship so obtained the metacentric height, or stability, was calculated. The results showed that when the "New Orleans" is absolutely empty, she has a negative metacentric height of 0·48 foot, or about 5¾ inches; which means in lay phraseology that she would not, in this condition, float upon an even keel, but would take a slight list, until by immersing a fuller waterline, she found sufficient bearings. Now there is in this nothing unusual. It occurs whenever an ocean liner is absolutely empty, and provision is made in all merchant steamers, as in the "New Orleans," for correcting the list by introducing water ballast into the double bottom of the vessel. The inclining experiments showed that when the "New Orleans" is fully equipped for sea, with all coal, ammunition, and stores on board, she has a positive metacentric height of 1·7 feet. Advantage was taken of the recent visit of the "New Orleans" to dry dock, preparatory to her voyage to the Philippines, to subject her again to a series of inclining tests, which showed practically the same results as those of last June.

In the report which was made to the Bureau of Construction and Repair, at Washington, it was suggested that whenever the ship at sea was approaching the light condition, because of depletion of her bunkers, ammunition, or stores, it would be advisable to introduce a certain amount of water into her bottom tanks. There is nothing new in this suggestion; it has been made before with regard to other ships of our navy, and as a matter of fact the "Philadelphia," which has considerably less metacentric height than the "New Orleans," has to keep water in her double bottom all the time to give her the desired stability.

Unfortunately, in transmitting the report of these tests of the "New Orleans" to the Secretary of the Navy, the bureau at Washington made the following comment: "This at once marks her as a *dangerous vessel*, requiring great care, when in service, on the part of the commanding officer." It is a matter of great regret, both upon the part of the officers who have commanded this fine vessel at sea and the officers of the construction corps, that such an unfortunate misconstruction should have been put upon the results of the inclining experiments. These gentlemen do not consider the "New Orleans" to be "dangerous;" ridicule the suggestion that she is untrustworthy; and they regret that any such impression should have been gathered from what was an ordinary routine inclining test, such as is carried out upon every new vessel of the United States navy.

In this connection it may be mentioned that tests of the "Albany," sister ship to the "New Orleans," which have been made at the Armstrong works, where the "Albany" is completing, show that in the empty condition she has a positive metacentric height of 1·22 feet and a metacentric height when fully loaded of 2·69 feet. The difference in the results as found in the two vessels may be accounted for by the fact that the "Albany" was short of her full weight by an estimated amount of 321 tons, and that other estimated weights