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, MARCH 4, 1899.

AIR BUBBLES.

It is greatly to be regretted that the inception of such a great industry as that of the automobile carriage in this country should be hampered by the sensational methods adopted by some of its so-called promoters. We refer to the omnipresent Autotruck Company, which, under the magic spell of certain names notorious in the more spicy periods of the political history of our city, still continues to enlarge on paper the sphere of its proposed operations. We have scarcely had time to grow familiar with the Air Power and Autotruck companies, with their capitalization of $10,000,000 or more, and their intention to "control the trucking interests" of the city, before we are told that "Richard Croker is about to cross swords with the Third Avenue Railroad Company by fitting out a line of omnibuses driven by compressed air," etc. It is also added incidentally that "the Autotruck Company proposes to run stages similar to those proposed for Fifth Avenue, in Chicago and in Los Angeles, Cal.," yet we doubt if anyone has yet seen a street autotruck, and even the company cannot say more than that "orders for the construction of these vehicles have been given."

LIMITATIONS OF THE AUTOTRUCK.

We think it is extremely unlikely that the autotruck, if it should ever get beyond the precincts of Wall Street, will succeed in displacing entirely the horse-drawn truck. For certain conditions of our city trucking it would be an immediate and absolute failure; as for instance, in a snowstorm like the last, in which Mr. Croker's autotrucks would be even more helpless than Mr. Vreeland's trolley cars have proved to be.

The weak spot in the autotruck would lie in the fact that the measure of its tractive force would be determined by the adhesion of the driving wheels, and in the greasy condition of the streets on which heavy hauling is done, the adhesion would be very small indeed. If a 5-ton autotruck attempted to cross the well lubricated paving of West Street or Water Street with a full load, not all the $10,000,000 of vaporous capital of the air company, if put into the motors, could budge it an inch.

If the driving wheels should chance to drop into one of the multitudinous holes with which the Metropolitan Street Traction Company, having got in its wires, has strewn our thoroughfares, it would stay there until the discarded horse could be brought around to drag its discredited competitor from the pit.

ELECTRICITY AS A THAWING AGENT.

If the statistics were gathered of the number of houses that are burned down every winter, as the result of attempts to thaw out frozen pipes by the perilous methods ordinarily practiced by the householder, the results would be decidedly sensational. To Prof. R. W. Wood, of the University of Wisconsin, great credit is due for showing that a frozen water pipe may be thawed out by the expedient of running through it an electric current of the proper strength.

In the present case a stretch of 300 feet of pipe between a house and the street main was solidly frozen. One wire was attached to the pipe in the cellar, and the other to a faucet across the street. The flow of the current was down the service pipe, along the main, and by way of the frozen pipe to the connection in the cellar. It was only necessary to heat the pipe to sixty degrees, and it is stated that within twenty minutes there was a full head of water in the cellar. The apparatus employed was planned by Prof. Jackson, and is being used with great success, two houses at a time being relieved thereby from their water famine.

It is evident that while electric thawing avoids the obvious risks of thawing out by hot coals or similar applications of heat, it has dangers of its own, and should only be applied by an expert workman. The theory of electric thawing is that the current in flowing through the metal meets with a resistance which raises the temperature of the pipe. The temperature will depend, other things being equal, upon the sectional area of the pipe, and care should be taken that there is no considerable reduction of the size of pipe at any point between the electric terminals, since there would be an immediate overheating due to the reduced area which would be a source of danger. The current used would not have to be as large as might be supposed, the coefficient of electrical resistance being, for instance, twelve times as great for lead as for copper. With proper precautions the process is not dangerous, and the saving in the way of excavation and plumbing will be very considerable.

COST OF THE BOSTON SUBWAY.

The figures of the cost of the Boston Subway, as given in the fourth annual report of the Boston Transit Commission, are very gratifying to the friends of the proposed rapid transit tunnel in New York. It was estimated in 1894, before work was begun, that the cost of the subway would be $5,000,000. Now that the work is completed, a close estimate places the total cost at $4,250,000, exclusive of the cost of certain alterations called for by legislation in 1897. It is not often that engineering works cost less than the estimate, and we do not call to mind any case where works of this magnitude have not somewhat exceeded the estimate.

There are no special difficulties or uncertainties connected with the construction of the New York underground scheme which afford reason to expect that it would cost more than the estimates. The work would all beof a kind with which engineers are familiar, and, indeed, if the funds for construction were furnished as fast as the engineers could use them, and a big force of labor were engaged simultaneously along the whole route, we think it is likely that the tunnel could be built for something less than the estimate of $30,000,000.

COMPARATIVE MERITS OF THE PANAMA AND NICARAGUA CANALS.

In our recent comparison of the advantages and disadvantages of operation in the two proposed canals across the isthmus, we omitted to draw attention to one or two features which would have more or less effect upon the commercial success of the canals, should both be built. We refer to the question of favorable winds as affecting the amount of sailing tonnage that would seek either route, and to the yet more serious question of the curvature of the canals as affecting both steam and sailing vessels. It is in favor of Nicaragua that for ten months of the year there are steady trade winds, which would enable sailing ships to reach either terminus without the assistance of tugs except in entering the artificial harbors. In the latitude of Panama, on the other hand, there are long periods of calm which might render somewhat lengthy towing necessary. While the objection counts for something, it is not so serious as might be supposed, for the reason that the deep sea sailing tonnage forms a very small and rapidly diminishing proportion of the total tonnage. In fact, it is probable that by the time either canal is finished, the tramp steamer will have completely ousted the sailing ship from the long distance carrying trade.

In laying out a ship canal, the curvature is one of the most important questions for consideration. In view of the ever-increasing length of ocean steamships, it is desirable to make the canal as straight as possible. If, owing to the nature of the country, curves are necessary, they should be "easy," that is to say, their radius should be large. When a large ship passes up the Manchester Ship Canal, she has to be assisted by a tug at her head and one at the stern to enable her to make the turns. This is tedious, costly and full of risk. The smallest curve at Panama will be four times as easy as that of the Manchester Canal in England, and double as easy as those of the Kiel Canal in Germany.

The curvature of the Nicaragua Canal has not been determined, but for about 50 miles of its course down the San Juan Valley it must necessarily be very sharp, even after the waters of the river have been dammed. The approximate curvature of the river channel shows a total length of curvature in the valley of 39·6 miles. The curves of the Panama Canal are of 8,200 feet radius or over, while the river channel at Nicaragua has six curves of 700 to 1,500 feet, 15 of 1,500 to 2,500, and 21 curves of 2,500 to 3,000 feet. Although the Ochoa dam will widen the channel, it will be difficult, even with costly excavation in cutting away the spurs of the hills, to reduce the curvature to the extent necessary for easy navigation.

MASONRY VERSUS WOODEN DRY DOCKS.

There is a growing conviction among naval men that the United States should cease to build wooden dry docks and in future construct all of its docks of masonry. The principal argument in favor of wooden structures is, or used to be, the smaller first cost. While a timber dock could be built for from $400,000 to $600,000 according to its size, a similar masonry structure used to cost from two to three million dollars. This of course was an extravagant figure, but seems to have been unavoidable under the plan of periodical appropriations by Congress, which caused the work to extend over long periods with much consequent waste of time and money.

The recent bidding for a stone drydock at Boston brought out the welcome fact that a masonry structure can be built for a moderate increase of cost over one of timber. The cost of the dock will be about $1,000,000 whereas the timber dry dock (known as No. 3) at the Brooklyn navy yard cost between $600,000 and $700,000, and in the two years of its existence it has cost for repairs $171,000.

Prof. W. L. Cathcart, of Columbia University, in a paper on the subject read before the American Society of Civil Engineers, gives some significant figures regarding the cost of repairs on the two types of docks, in which it is shown that the least average annual expenditure for repairs and maintenance was $230 per year for the stone dock at Mare Island, while the highest expenditure was that upon the Brooklyn navy yard wooden dock, above mentioned, which averaged $85,500 per year. A comparison of three stone docks, those at Boston, Norfolk, and Mare Island, shows an average yearly expenditure of $1,558, while the average on four timber docks at New York, League Island, Norfolk, and Port Royal, was $13,364. Commodore Endicott, Chief of the Bureau of Yards and Docks, stated that a timber dock has to be practically rebuilt in from twenty to twenty-five years, the experience of the navy all tending to prove that the masonry dock is superior in practically every respect.

THE FASTEST VESSEL AFLOAT.

Until the new and large torpedo boats of the "Turbinia" type, now building at Newcastle, England, have been completed, the credit of having turned out the fastest vessel will belong to a German yard. The "Hai Lung," built by Schichau, of Elbing, for the Chinese navy, is credited with having made a run of 18½ knots at an average speed of over 35 knots an hour. The builder states that the highest speed realized during the run was 36·7 knots or 42·26 miles per hour. The best run of the "Turbinia" for a mile is 35 knots, so that the Schichau vessel has a substantial lead.

The most remarkable feature of this boat next to her speed is the fact that she is fitted with reciprocating engines. At the time the "Turbinia" made her phenomenal speed, it was popularly supposed that it was entirely due to her new form of motor. In great part no doubt it was; but there is reason to believe that the excellent steam-raising qualities of her boiler contributed in no little degree to the result. Relatively considered, the performance of the "Turbinia" was more meritorious, for the reason that she is only a 40 ton craft, while the Schichau boat is of 180 tons displacement, or four and one-half times larger. The new and enlarged "Turbinias" will be full sized torpedo boats, and for this reason it is likely that they will surpass the "Hai Lung" by a considerable margin of speed. Just what the excess will be is a matter which is exciting much speculation in naval quarters.

FLASHLESS RAPID-FIRE GUNS.

It is reported that the new French rapid-fire gun invented by Colonel Humbert gives no flash or sign of fire. If this be true, the French have made an advance in artillery second only in importance to that which marked the introduction by them of smokeless powder. In the operations around Santiago, the only means by which our men could locate the position of an enemy's piece was the flash. If this should be removed, the art of war, especially on land, will become more difficult than ever, for a masked battery of smokeless and flashless guns would be positively undiscoverable. The only description of the gun that has come to hand is rather obscure; but it would seem that an attempt is made to cool the larger portion of the gases below their flash point before they are allowed to reach the open air. The rate of fire has reached a maximum of twenty shots per minute. To accommodate the increased expenditure of ammunition it is proposed to reduce a single battery from five to four guns and increase the number of ammunition wagons.

RAILS AND TIE-PLATES.

One of the most useful improvements ever introduced on American railroads is the tie-plate. Before its invention the life of a wooden tie, especially if the tie was of soft wood, was frequently limited to the time it could withstand the cutting of the rail into its upper surface. Wear, due to this cause, was always considerable, and as the weight and frequency of trains increased, it became excessive.

In earlier days it was supposed that the material of the tie gave way by crushing; but of late years it has been believed that it is the wave-like movement, set up in the elastic rail by the wheels of the cars, that acts with an abrading effect upon the fibers of the wood. If this is the true explanation, no amount of widening of the base of the rail will prevent it from cutting into the tie.

The interposition of the tie-plate (a square plate with stiffening ribs on its under side) between the base of the rail and the tie has proved wonderfully effective in preventing this cutting action. The longitudinal ribs of the plate sink into the tie, and keep tie and plate in a fixed relative position; the rail spikes