Scientific American.

ESTABLISHED 1845

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

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

NEW YORK, SATURDAY, JULY 17, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1124.

For the Week Ending July 17, 1897.

Price 10 cents. For sale by all newsdealers.

IMPROVEMENT OF THE ENTRANCE TO NEW YORK HARBOR.

There is a growing conviction among those who are interested in the welfare of the Port of New York that it is imperative that something be done to improve the entrances to the harbor. At present, entrance is made through a thirty-foot channel which is partly natural and partly artificial. This is known as the main ship channel, and the minimum depth of thirty feet is only maintained at the cost of continuous and very expensive dredging. From the thirty-foot line outside Sandy Hook it runs in a westerly direction for about six miles to a point about a mile and a half inside the Hook, where it turns abruptly to the north.

This sharp turn is a source of anxiety and danger to shipping, especially in foggy weather; moreover, the dredged channel is subject to continual silting up by the matter which is washed into it from Raritan Bay; and furthermore, its width is not sufficient to allow safe navigation when a large number of incoming and outgoing ships are meeting in the channel. To the east of the main channel are the Swash channel, the East channel and the Coney Island channel. These are considerably shallower and are used by ships of lighter draught than the large ocean-going boats.

The latest plan of the many which have been proposed for the improvement of the harbor entrances proposes to abandon the present main channel and dredge out two separate and shorter channels to the eastward, on the line of the present East and Coney Island channels. The East channel lies to the east of Romer Shoals, a permanent bank which intercepts the silt coming out of Raritan Bay, and affords a natural protection to this channel. It has a depth of thirty feet for about three miles of its length, and only about two miles would have to be dredged out to open a thirty-foot channel clear through to the sea. The proposed Coney Island channel would extend from Norton's Point to deep water and necessitate about four miles of dredging. The dredging in the new channels would be carried down to a depth of thirty feet, and as they would both be protected from silt by the Romer Shoals, it is reasonably supposed that there would be no difficulty in maintaining the required depth of water.

The advantages of having two separate channels for outgoing and incoming ships are many and obvious, and chief among them would be the lessened risk of collision. It has been pointed out that, if a modern liner, with her two hundred yards or more of length, were to be sunk across the present channel, the Port of New York would be practically shut up until she could be floated or the wreck removed. The possession of an alternative channel would remove this possibility, as, with proper care, the remaining channel—in case of such obstruction—could be used by both outward and inward bound ships.

Now that the question of improvement is being actively agitated, it would be well to consider the advisability of adopting a greater depth than thirty feet as the minimum that shall be maintained from the docks to the sea. The rapidly increasing size and draught of the latest ships is already taxing the capacity of the present channels. The big freighter Pennsylvania is reported to have left for Europe on a recent trip drawing over thirty-one feet of water, and it is morally certain that the large profits which will be realized from this class of vessel will lead to their being built in increasing numbers and probably of increasing size. If, as the engineers predict, the new channels will not be subject to silting up, it would be practicable to maintain them at say a thirty-three or thirty-four foot depth without any material increase in the cost.

THE THIRD RAIL SYSTEM IN ENGLAND.

The latest addition to the system of underground railways in London will probably rank as the most important of all these lines before it has been very long in operation. It will be known as the Central London Railway, and, starting from the busy Liverpool Street Station in the City, it will run by way of Holborn and Oxford Street, along the northern side of Hyde Park to Shepherd's Bush, a distance of six miles and a half through the busiest part of London. The road will be about sixty-five feet below street level, and will be carried in two separate and parallel tunnels—a similar plan to that adopted in the Southwark underground railway in the same city. Each station will be served by two elevators and two stairways.

The new undertaking will have especial interest for this country, from the fact that the electrical equipment of the road itself and of the extensive system of elevators by which it will be served will be furnished by American firms.

The third rail equipment will be put in by the representatives in England of the General Electric Company—the British Thomson-Houston Company. It will be similar in its general outlines to that which was employed by the General Electric Company on the New York, New Haven and Hartford Railway, and illustrated in the SCIENTIFIC AMERICAN for June 12 and 26.

The conductor will consist of an insulated third rail, placed on the ties between the main rails. The service will differ from that on the New Haven line, however, in that the trains will be hauled by separate electric locomotives, whose general appearance will conform to the well known heavy locomotives which are being used in the Belt line tunnel, at Baltimore. On the New Haven line, it will be remembered, the motor cars have full accommodations for passengers. The change is made to accommodate the reduced clearance of the tunnels. Equally interesting will be the extensive elevator equipment. There will be forty-nine in all, and they will be of the well known double drum Sprague type. Their capacity will be 100 passengers per trip, or a load of about 15,000 pounds.

It is very gratifying to note that the whole of the electrical equipment of such an important work in the capital city of the world has been secured by two American firms, and the fact is a direct tribute to the high character of electrical work in this country.

THE MOORE SYSTEM OF VACUUM TUBE LIGHTING.

The Moore system of electric lighting by means of vacuum tubes has received very material benefit from the inventor's latest improvement, which consists in the use of a rotary current interrupter in place of the vibrating current interrupter which he formerly used. With the latter it was only possible to obtain about 6,000 breaks a minute; but with the rotary device it is possible to obtain as many as 50,000 breaks in the same time. The rotator consists of a revolving commutator which carries a series of brushes. The segments are arranged on the periphery of a rotating cylinder which is inclosed in a vacuum tube together with the armature of the motor which drives the commutator cylinder. On the outside of the tube are placed the field magnets which influence the armature. The substitution of the rotator for the vibrator enables a number of tubes to be operated together, whereas formerly it was necessary to provide a vibrator for each tube. There is also the advantage that for a given volume of light the consumption of electrical energy is much less than it was with the vibrating device.

THE ARMOR PLATE COMPROMISE.

It must be confessed that the so-called armor plate compromise seems to give the manufacturers pretty much everything they have asked. At any rate, it has shown the absurdity of the attempt to limit the rate which should be paid for armor to "$300 per ton of 2,240 pounds." It will be remembered that this price was rejected by the Bethlehem and Carnegie Companies, and that the subsequent increase to $400 per ton failed to meet with favorable consideration. As a last move the Naval Committee has agreed to fix the price at $425 per ton, and a provision has been incorporated in the General Deficiency bill which will cover the necessary appropriation. Action of some kind had to be taken, for the three battleships for which the armor is to be provided had advanced to a stage of construction where the government ran a serious risk of having to pay heavy penalties for delay in furnishing the armor.

It looks like a distinct concession to the manufacturers that the turrets have been changed from the elliptical to the cylindrical type. We presume this was done because of the greater ease and cheapness of manufacturing the plates for a cylindrical turret. This change may be acceptable to the maker, but it is a positive loss to the ships. The elliptical turret is lighter for its efficiency than the older type and gives a better distribution of weight.

THE INACCURACY OF ARTILLERY FIRE.

If we turn from the official lists of the guns carried by the navies of the world and look at the records of gun practice in these very navies and with these same guns, the effect is almost comical and certainly very surprising—so greatly are these terrific engines of war robbed of their power by the hands of unskillful gunners. According to some figures quoted in the Naval and Military Record, the artillery practice in the English navy—or a part of it—during 1896 was, to put it mildly, shockingly bad. Thus we are told that the Sanspareil, a sister ship to the ill-fated Victoria, fired seven shots from her huge 110 ton guns, every one of which missed the target. Now this giant gun is credited with awful powers of destruction, and on the proving grounds a test shell did actually tear a hole big enough for a man to creep into through a target of steel, wood, and stone, 42 feet in thickness.

Of what value, however, are these monsters if they cannot be made to shoot straight? The Benbow, which also carries two of these guns, fired six shots, all of which missed the target. The next size of guns, 67 tons, made better practice, scoring six times out of thirty-one shots; though this, in all conscience, was a pitiful exhibition. When we come to the antiquated muzzle loaders it is not surprising to learn that twenty-four shots from the guns of the Inflexible and the Dreadnaught failed, every one of them, to reach the mark. One would have looked for better results, however, from the smaller calibered 10 inch guns of the Thunderer and Sanspareil; but out of thirty-three shots fired by these ships, only two reached the target.

Even with the 4·7 inch quick firer the united efforts of two cruisers and three gunboats required the expenditure of 174 shots to score on the target nineteen times. Some of the ships, of course, made much better practice; the Imperieuse, for instance, scoring twenty-two hits in twenty-seven rounds.

Although these figures will come as a great surprise, they are in strict agreement with the experience of all modern sea fights. There was a great disparity between the number of hits and the number of rounds fired in the last naval battle of any note—the fight between the Japanese and Chinese fleets at the Yalu; and, indeed, the whole history of naval warfare goes to show that it would be wiser to arm a ship with a few guns well served than load her down with a massive armament which is liable to be worthless on account of the poor marksmanship of its gunners. The great success of our ships in single combat with the enemy in the war of 1812 was due to the superior marksmanship of their gunners. It is urged that practice with modern guns is very costly, the price of one shot from a 110 ton gun being set down at $70; but the obvious reply to this is that it would be good policy to put the value of one or more guns into powder and shell for practice, rather than render the whole battery useless for want of capable marksmen.

THE FUTURE OF THE MOTOR CAR.

It is quite possible to overrate the significance of the failure of the two recent motor car competitions in England—those of The Engineer and of the Motor Car Club. The fact that many of the motor car builders failed to enter these competitions does not warrant the conviction that they have failed to produce a more or less satisfactory machine. The most we can suppose is that these firms did not consider that at this stage of their work there was anything to be gained by entering a stringent public competition. Moreover, it must not be forgotten that in the case of The Engineer's competition a large number of competitors asked for an extension of time—a fact which gives reason to believe that the half dozen machines which did put in an appearance by no means represented the number of bona fide concerns or individuals who are at work on the problem.

It is quite possible that the wonderful rapidity with which, in these days, a useful invention is developed from a crude idea into a practical shape with a positive commercial value has made us a little too exacting. We are intolerant of delay, and when, as in this case, the problem is full of difficulties peculiar to itself, we are apt to condemn it as impracticable, because it is not perfected with the usual rapidity. A correspondent writing to Industries and Iron regarding the recent competitions draws a very pertinent comparison between them and the celebrated Rainhill locomotive trials of seventy years ago. The comparison is well to the point, for the locomotive industry in 1829 was as much or more in its infancy than that of the motor car is to-day. It is pointed out in the first place that "had the establishment of the locomotive system depended on the leading engineers, it would have been swamped at the beginning." Again, it is noted that Stephenson was not afraid to enter for the competition, though two of the judges had formally reported against locomotives. The competition, moreover, was fully carried out, though only four engines entered and only one was capable of going through with the trials. Lastly, it does not appear that any engine was (or was likely to be) disqualified because, in the opinion of the judges, it was à priori unfit for its work, but only if it failed on actual trial to do the work required.

The above comparisons are well drawn, and in any future contest of the kind better results would undoubtedly be obtained by making the terms broad and simple. It is evident that in this matter we must learn to "walk before we can run," and the statement is true whether it be applied to the question of appearance, weight, size, noise, smell, speed, cost or any other of the qualities which go to make up a perfected motor car. The recent competitions have proved that the perfected car, considered as a commercial product and something more than a mere toy, has probably yet to be built—at least as far as Great Britain is concerned; but there is no cause to believe that satisfactory progress in the construction of such a car is not being made. There were about sixty-five years of interval between Stephenson's Rocket and the Queen Empress of the Scotch Express, or No. 999 of the Empire State Express, and we are still improving on the locomotive. With this comparison in mind, it is safe to say that among the certainties of the future are a motor car which shall be light, strong, swift, durable and cheap, which, as a means of banishing the noise and unsanitary filth of horse-propelled vehicles from our streets, and as a means of transportation for freight and passengers in country districts, will be as indispensable to the everyday life of the race as are the steam locomotive and the electric car of our day.

THE Paris Exhibition in 1900 will be the first in which all nations of the world, 54 in all, will be officially represented.—Uhland's Wochenschrift.

THE EVOLUTION OF MODERN SCIENTIFIC LABORATORIES.

Dr. William H. Welch, Professor of Pathology in the Johns Hopkins University, delivered an interesting address at the opening of the William Pepper Laboratory of Clinical Medicine at Philadelphia. The address was afterward published in the Johns Hopkins Hospital Bulletin. In brief he said that at the present day the systematic study and advancement of any physical or natural science, including the medical sciences, requires trained workers who can give their time to the work, suitably constructed workrooms, and equipment with all the instruments and appliances required for special work, a supply of the material to be studied and ready access to more important books and journals containing special literature of the sciences. All of these conditions are supplied by a well equipped and properly organized modern laboratory. Such laboratories are, with partial exception of the anatomical laboratory, entirely the creation of the present century and for the most part of the last fifty years. They have completely revolutionized during the past half century the material conditions under which scientific work was prosecuted. Dr. Welch then goes on to deplore the fact of the lack of monographic treatment of the general subject of the historical development of the scientific laboratory. He then refers to the state-supported institutions for study at Alexandria under the early Ptolemies and to the study of anatomy under the Hohenstaufen Frederick II. He then mentions the researches of Vesalius and Amos Comenius.

Methodical experimentation in the sciences of nature was definitely established by Galileo and was zealously practiced by his contemporaries and successors in the seventeenth century and was greatly promoted by the foundation during this century of various societies, such as the Accademia dei Lincei and the Accademia del Cimento in Italy, the Collegium Curiosum in Germany, the Académie des Sciences, and the Royal Society in England. Much of the classical apparatus still employed in physical experiments was invented at this period.

There existed in the last century cabinets of physical apparatus to be used in demonstrative lectures, but they were very inadequate, and suitable rooms for experimental work scarcely existed. It was not until about the middle of the present century that we find the beginning of the modern physical laboratory. Lord Kelvin, then William Thomson, established a physical laboratory in the University of Glasgow about 1845, in an old wine cellar of a house. It was as late as 1863 that Magnus opened in Berlin his laboratory for experimental physical research. Since 1870 there has been a rapid development in the splendid physical institutes which are the pride of German universities.

Humbler and more picturesque was the origin of the chemical laboratory. This was the laboratory of the alchemist seeking the philosopher's stone. One cannot read without combined feelings of wonder and pity of the incommodious, forlorn and cramped rooms in which such men as Scheele and Berzelius and Gay-Lussac worked out their memorable discoveries. It was the memory of his own experience which led Liebig, immediately after he was appointed professor of chemistry in Giessen, in 1824, to set about the establishment of a chemical laboratory. Liebig's laboratory, opened for students and investigators in 1825, is generally stated to be the first public scientific laboratory, although this is not quite correct. It is certain that Liebig's laboratory is the one that had the greatest influence on the subsequent establishment and organization of not only chemical laboratories, but public scientific laboratories in general. Its foundation marks an epoch in the history of science and scientific education. This laboratory proved to be of great import to medical science, for it is here, and by Liebig, that the foundations of modern physiological chemistry were laid.

In 1824 Purkinje succeeded in establishing a physiological laboratory, which, therefore, antedates by one year Liebig's chemical laboratory in Giessen, although it cannot be said to have exercised so great an influence upon the organization of scientific laboratories in general as did the latter.

Of modern physiological laboratories, the one which has exerted the greatest and most fruitful influence is unquestionably that of the late Prof. Ludwig, in Leipzig. To-day every properly equipped medical school has its physiological laboratory. This department is likely to hold its place as the best representative of exact experimental work in any medical science.

The first pathological laboratory was established by Virchow, in Berlin, in 1856. Virchow's laboratory has been the model as regards general plan of organization for nearly all pathological laboratories subsequently constructed in Germany and in other countries.

The first to formulate distinctly the conception of pharmacology as an experimental science, distinct from therapeutics and closely allied by its methods of work and by many of the problems of physiology, was Rudolph Buchheim. This he did after going to Dorpat in 1846; for in 1849 he established a pharmacological laboratory in his own house and by his private means. Later this laboratory became a department of the university and developed most fruitful activity. Buchheim's laboratory was the first pharmacological laboratory in the present acceptation of this term.

The medical science which was the latest to find domicile in its own independent laboratory is hygiene. To Pettenkofer belongs the credit of first establishing such a laboratory. In 1872 he secured under the Bavarian government the concession for a hygienic institute. This admirably equipped laboratory was open for students and investigators in 1878. By this time Koch had begun those epochal researches which added to the discoveries of Pasteur and introduced a new era in medicine.

It is apparent, from the brief outline which has been presented, that the birthplace of these laboratories, regarded as places freely opened for instruction and research in the natural sciences, was Germany. Such laboratories are the joy of German universities. By their aid Germany has secured since the middle of this century the palm for scientific education and discovery.

To the small number of existing well equipped chemical laboratories, the William Pepper Laboratory of Clinical Medicine is a most notable addition. It is the first laboratory of the kind provided with its own building and amply equipped for research in this country, and it is not surpassed in these respects by any in foreign countries. It is intended especially for investigation in the training of advanced students. It is a most worthy memorial of the father of its founder.

TEST OF THE BUFFINGTON-CROZIER DISAPPEARING GUN CARRIAGE.

The Buffington-Crozier disappearing gun carriage was recently tested with satisfactory results in the presence of General Alger, Secretary of War; General Flagler, Chief of Ordnance; and General Ruggles, Adjutant-General of the Army. The test was made during a visit of inspection by the secretary which included the government reservation, the mortar battery, gun emplacements and the buildings under construction for the garrison of Fort Hancock.

An illustrated description of this form of gun carriage was given in the SCIENTIFIC AMERICAN of March 14, 1896, to which the reader is referred. The article referred to shows an 8 inch gun mounted on a Buffington-Crozier carriage at Fort Wadsworth. The carriage which was tested at Sandy Hook carries a 12 inch gun weighing 116,000 pounds, the carriage itself weighing 350,000 pounds. The charge of powder weighs 475 pounds and the projectile 1,000 pounds.

The carriage is of the front pintle form. The weight of the gun is carried upon one end of a pair of massive cast steel levers, which are pivoted at their center and carry at their lower end a huge compensating balance or counterweight, weighing 150,000 pounds. When the gun is loaded and sighted the unlocking of a latch releases the levers and the counterweight descends into the pit in the center of the gun foundation, and raises the gun above the parapet of the fortification. The carriage has a rise of nine feet, which brings the gun up over the parapet on a plane sloping down toward the inside of the fortification at an angle of 7 degrees. The gun was fired with this elevation and the projectile struck the water about six and a half miles out to sea. The recoil of the gun is about four feet, and as the momentum of the gun is equal to that of an express engine with a train of ten Pullman cars running at fifty miles an hour, it can be understood what has to be done to arrest all this in a space of four feet.

The momentum is absorbed by the effort of raising the 150,000 pound counterweight as the gun sinks back to the loading position and by the resistance of the recoil cylinders on either side of the gun carriage. These cylinders are filled with oil, and a pair of pistons are caused to travel through them as the gun recoils. The pistons are perforated with slots through which work stationary bars of variable cross section. The area of the passage between the bars and the slots is so graduated that the shock of discharge is distributed throughout the four feet of recoil, the gun being brought gradually to rest.

The 12 inch gun carriage that was tested at the proving grounds was only temporarily in position, and when it is erected in its proper emplacement it will be protected by a massive wall of concrete and earth or sand.

As one of the results of Nansen's north pole expedition, we see a number of similar undertakings planned by several individuals. First, a Frenchman, the engineer Andree, expected to fill his balloon on the 20th of June, in Sweden. From Spitzbergen the two French aeronauts Godard and Surcouf expect to depart, also by balloon, for the north pole, in the summer of 1898. The same season also Nansen's ship, the Fram, is once more to set sail under Capt. Sverdrup, the same who so successfully took command of the vessel on the last occasion. Nansen himself will be engaged in the working out of the results of the scientific researches made on the last expedition, and so will not be able to join this. Finally, a journey toward the north pole from the northern part of Greenland is planned by Engineer Peary.—Monatschrift für Offentlichen Baudienst.