Correspondence.

Heavy Rapid-Fire Guns.

To the Editor of the Scientific American:

I have read with interest a recent letter from a correspondent in your valued paper in which the batteries of our new armored and protected cruisers are contrasted unfavorably with those of similar craft in the Italian and Japanese navies. The same correspondent adds that no such criticism applies to the armament of the new battleships. So far as the number and weight of the guns is concerned this last statement is doubtless true. In this respect the ships of the "Pennsylvania" class seem rather overgunned than otherwise. A question arises, however, concerning the comparative efficiency of the eight 8-inch guns which form a part of these batteries. These are all listed officially as "breech-loading rifles." I have noticed, however, that all guns of this caliber in foreign navies are classed as "rapid-fire guns," while there are no guns of this classification in our navy above the caliber of six inches. On the other hand the Scientific American has stated that all of the guns in our new battleships are to have the improved Weling breech mechanism, which will presumably make them as efficient as any. The question that arises is this: Is the difference between the new 8-inch "breech-loading rifles" of our navy and the 8-inch "rapid-fire guns" of foreign navies merely one of nomenclature, or is it true that we are still clinging to the old slow-fire principle in guns of this caliber despite the fact that this practice has been universally abandoned in foreign countries? I request that the Scientific American furnish its readers with an answer to this question. A. C. Reiley.

2682 Broadway, New York.

[The new 8-inch naval gun is entitled to be called a rapid-fire weapon. It embodies the rapid-fire features which are found in the European rapid-fire pieces of the largest caliber.—Ed.]

Quartz Fibers with the Electric Arc.

To the Editor of the Scientific American:

Quartz fibers of small and uniform diameters fit to be used for galvanometer suspension or cross hairs in telescopes or transits can be made only with the aid of heat of sufficient intensity to liquefy the quartz. The usual source of heat is the oxyhydrogen blowpipe, but it quite often happens that this apparatus, with its cumbersome gas cylinders, are not at hand when the fibers are most needed, with the result that the experimenter or observer often contents himself with a spider-web cross hair or a suspension of unspun silk, which are both unreliable and short-lived. The writer has found this quite unnecessary if an ordinary electric arc is accessible. The arc is preferably provided with a hand-feed, but the ordinary automatic feed may be so adjusted as to give a gap of about one-fourth of an inch. A crystal of transparent quartz should now be brought near to but not within the zone of incandescent gas, and held in this position till it is thoroughly heated. If heated too rapidly the crystal will chip and the fragments be thrown about with violence. After heating, the crystal may be brought in contact with the incandescent spot on the lower carbon and a piece about the size of a kernel of wheat melted off. This should be seized with a pair of forceps and drawn out to a length of about half an inch as it is removed from the carbon. Another piece of quartz similar in size is now melted on the carbon, and after it has become quite liquid the quartz already melted should be brought in contact with the bead and quickly withdrawn. If the movement is rapid and the direction of the pull is not such as to draw the thread across the column of heated gas, a very fine fiber of uniform diameter will be the result. Much depends upon the quickness with which the fiber is drawn out, and any scheme to increase this will improve the results.

If the operator stands on a well-insulated platform there need be no fear of the current.

Marinette, Wis. Clarence W. Eastman.

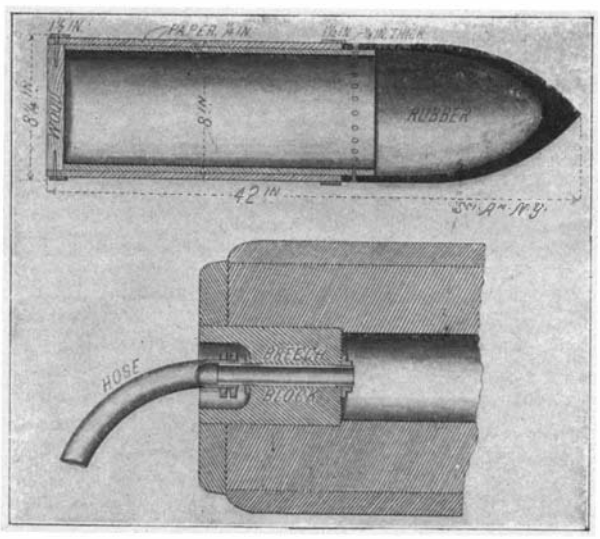
[The experimenter is warned against trying this experiment on a lamp placed on a circuit having more than 100 or 200 volts E. M. F.—Ed.]

A new extensometer has been designed by Mr. H. T. Bovey, for determining the longitudinal extension or compression of any given length of a horizontal beam loaded transversely. It was recently described in the Transactions of the Royal Society of Canada, and consists essentially of two parallel overlapping steel bars, the opposite ends of which rest by knife blades against two points on the specimen to be measured. Between the faces of the two bars is a small roller carrying a mirror. An extension or compression of the specimen causes relative motion of the bars rotating the roller through a small angle, which is readily observed by means of the mirror, the reading being effected by means of an ordinary telescope with cross hairs.

SHELL PRACTICE IN CITY ARMORIES.

In the large Armory of the Thirteenth Regiment, Brooklyn, there are mounted complete working models of three types of coast-defense guns, a 12-inch mortar, an 8-inch disappearing rifle, and a 4-inch rapid-fire gun, which were built especially for the Armory by the Bethlehem Steel Company at a cost of $25,000. They are perfect working models, and the dimensions, form, and functions of every part are exactly the same as in the army guns installed in coast fortifications, the only difference being that the models, which are built chiefly of wood, are very much lighter than service pieces, and, of course, cannot be fired with powder charges. But since the traversing and elevating mechanism and the mechanism of the breech of the gun are of metal and identical in design with the service gun, it follows that the gun detachments secure the full benefit of drill with the actual guns in handling these models.

It occurred to Lieutenant Kingsley L. Martin, who is one of the civil engineers in charge of the construction of the new East River Bridge, that the value of the gun drill, to say nothing of its interest, would be greatly increased if the weapons could be arranged to fire dummy shells at actual targets in the Armory. Powder was impracticable for three reasons: First, that there would be danger of cracking the thin cast-iron linings which are inserted in the dummy guns to carry the rifling; secondly, that the concussion and noise of the discharge would be undesirable and dangerous to the glass windows and lighter structures of the Armory; thirdly, that no projectile that would withstand the shock of powder discharge could be made so light as not to injure the Armory floor when it fell. Accordingly, with the sanction and encouragement of Colonel David E. Austen, commanding officer of the Regiment, Mr. Martin designed and had built the plant which forms the subject of our illustrations. Compressed air was selected as the substitute for powder most suited to the case. This was furnished by an electrically-driven, direct-connected compressor with an automatic governor. The air is stored in a series of flasks and in the large 6-inch main which runs around the building below the galleries, at a pressure of 130 pounds to the square inch. The compressor runs until the desired pressure is reached, when the governor cuts off the current. When the gun is fired the resulting drop of pressure, acting through the governor, starts the compressor and renews the supply of air.



DETAILS OF DUMMY SHELL AND COMPRESSED AIR ATTACHMENTS AT BREECH OF 8-INCH GUN.

The compressed air is led into the powder chamber through the breech-block in the manner shown in our illustration. The mushroom head and the spindle were removed from the breech-block and a 2-inch pipe threaded at its ends was introduced in place of the spindle, and an air-tight connection made by screwing up a pair of flanges tightly against the front and rear faces of the breech-block. To the outer end of this pipe a length of fire-engine hose was attached by means of a couple of clamps, the other end of the hose being connected to the compressed air main. When the order to fire the gun is given, a quick-opening gate valve admits the air instantly to the gun.

The first projectiles used were cylindrical with flat heads, but for the future, pointed heads of molded rubber, of the kind shown in our illustration, will be substituted. In the earlier projectiles, the body was made of rubber belting for the 8-inch and of leather for the 12-inch gun, the heads and bases consisting of cup leathers. The 4-inch shells were paper tubes with wooden disks at the ends and a felt rifling band. The new 8-inch shell, shown in our engraving, consists of two cylinders of paper each one-quarter of an inch in thickness, with a disk of wood at the base, and with the overlapping pointed rubber head riveted to the inner cylinder, as shown. As we have already stated, the guns are fitted with a half-inch liner, in which the rifling is cut. The rifling band in the case of the dummy shells consists of a strip of felt or leather, and it was found that this answered admirably.

In a recent trial of the guns, the gun crews were taken from the Third Battalion of the Regiment. Base lines and stations had been previously established, and the azimuth, plotting-board, and range-finder were used in getting the proper elevation, etc., just as they would be in actual service. The stations were connected by telephone and also signal flags, wielded by members of the signal detachment of the regiment, were used as a means of communication. Twenty shots were fired from the larger guns and twenty from the 4-inch rapid-fire gun, the majority of which were hits; and this in spite of the fact that the target was moved and the angles frequently changed. Encouraged by the success of the installation, Colonel Austen is endeavoring to secure an appropriation of $1,000 for a permanent equipment.

A. L. Barber's Steam Turbine Yacht.

Up to the present time, the turbine has been applied to only four vessels by European shipbuilders—first to the torpedo-boat destroyer "Turbinia," then to the destroyers "Viper" and "Cobra," belonging to the British navy, and, lastly, to the passenger steamer "King Edward," which was finished on the Clyde in July, 1901, and used as an excursion boat between Glasgow and Campbelltown during the summer. This vessel is 250 feet in length between perpendiculars, 30 feet in molded breadth, and 17 feet 9 inches in depth, molded to promenade deck. In nearly all respects she is similar to the usual modern type of river or coasting pleasure steamer, only slight changes having been introduced to suit turbine machinery, which consists of three separate turbines driving three screw shafts. The speed obtained by the "King Edward" was about 20 knots.

The first order received by any British shipbuilder for a turbine yacht has come from an American—Mr. A. L. Barber of New York. Messrs. Ramage & Ferguson of Leith are building this yacht to the design of Messrs. Cox & King, of London. She will be 252 feet 3 inches on the water line (about 300 feet over all) with 32 feet 6 inches beam and a molded depth of 21 feet.

The turbine machinery will not be materially different from that of the "King Edward," in which the high-pressure turbine is placed on the center shaft, carrying one propeller, and the two low-pressure turbines each drive one of the outer shafts, each of these shafts carrying two propellers. In the exhaust ends of each of the latter are the two astern turbines, which are in one of the low-pressure motors, and operate by reversing the direction of rotation of the low-pressure motors and outside shafts. When the vessel is going ahead, the steam from the boilers is admitted to the high-pressure turbine, and after expanding about five-fold it passes to the low-pressure turbines, is further expanded in them twenty-five fold, and then passes to the condensers, the total expansion ratio being estimated at 120-fold. It is said that at 20 knots the revolutions of the central shaft are 700 and of the outer shafts 1,000 per minute. Only the outer shafts are used when going alongside of a wharf, and the steam is admitted by suitable valves directly into the low-pressure motors or into the reversing motors on each side of the vessel.

The yacht will have an indicated horse power of 2,500. As to the speed expected to be obtained, the designers will say no more than it will not be less than 16 knots. In regard to the coal consumption of turbine engines per indicated horse power, as compared with ordinary engines, there seems to be some uncertainty. In this respect the "King Edward" on her trips last summer was fairly economical, but this test is hardly a satisfactory one in arriving at the probable coal consumption of a turbine yacht, for the "King Edward" ran continuously at high pressure from Glasgow to Campbelltown and return, whereas a yacht on a cruise will steam at varying rates of speed.

This turbine yacht will be completed in about ten months.

The Current Supplement.

The front page of the current Supplement, No. 1369, is devoted to a brief account of the Victor Hugo centenary at Paris. Chemists will find an interesting article on the stratification of hydrogen by Sir William Crookes. The new Bermuda floating dock is fully described and pictured. John Meikle discourses interestingly on "A Bit of 'Ancient' History of the Isthmian Canal Problem." Among other articles may be mentioned a description of the Prince Regent Theater at Munich; the machinery of the Wagner Siegfried performance; and the "Padlocks of Indian Chests." Prof. S. P. Langley and F. W. Very describe the cheapest form of light, which happens to be that of the insect *Pyrophorus noctilucus*.

Engineering Notes.

The semi-annual report of the London and Northwestern Railway shows a decrease of working expenses amounting to £32,809, and an increase of receipts of £39,270. According to the report, this result is to be attributed largely to the adoption of American methods of haulage and to the use of American engines. The heavier engines used resulted in a saving of 329 trains between certain points.

The report of the workings of the German canals states that there are 8,650 miles of inland waterways open to traffic. In 1900 nearly seven million tons of goods were conveyed to Berlin by the canals, and eight and a half million tons to Ruhrort. The Elbe has been made navigable for 550 miles. The canal between the Elbe and the Trave has been completed at a cost of five million dollars.

The recently organized National Bridge Company of Pennsylvania has secured a 40-acre site for its new plant at Colonia, on the Pittsburg and Lake Erie Railroad about twenty miles from Pittsburg. This plant will have a capacity of six thousand tons of structural steel per month, and after the bridge department is in working order, a steel-car plant with a capacity of twenty cars a day will be put into operation. The main building will be of steel frame construction and will be 200 feet wide by 550 long.

English and American capitalists are to build a railroad which is to run from Eureka, Humboldt County, Cal., to Weiser, Mont., to connect with the Northern Pacific. Eureka is a town of 10,000 in a county without a railroad. The proposed line will open this part of California, traverse the redwood country and the southeast corner of Oregon, cross Idaho and finally merge into the Northern Pacific. The road, it is claimed, will open a territory containing about 250,000 population at present, and capable of supporting a million, but now without proper traffic facilities.

Baron d'Estournelles de Constant of France has been on a tour of the United States with a view of securing some data about the industrial schools of this country, and to bring about better industrial relations between the people of the two countries. His government has practically decided to establish a school in this country where French youths can be sent for instruction in American methods, and this institution will be located in Philadelphia. The Baron also wants to encourage the sending of American students to the schools of his country, and he thinks the exchange of knowledge or practice thus brought about would be very beneficial to the interests of both countries.

Orders for machinery from South African mining companies have not been as plentiful since the little misunderstanding between John Bull and Oom Paul, but now there are unmistakable signs of renewed interest and activity among the operators, and the indications point to an early revival throughout that section. One of the most notable orders with Westinghouse, Church, Kerr & Co., is for two 1000-kilowatt Westinghouse-Parsons turbo-generating sets for the De Beers Consolidated Mines, Limited, for shipment to South Africa. This equipment will furnish current for a power transmission system in the De Beers mines, and it is expected that it will mark an important departure.

Mr. Ralph Noble, the electrical engineer of the Morgan-Gardner Electric Company, of Chicago, has invented a special electrical coal-cutting machine to suit the peculiar "longwall" system of mining practised in the English coal mines. The object of this particular machine is to undercut the coal. The first work of the miner is to cut under the seam so that it can be blown down. It is hard and wasteful work. As the miner must cut in some distance up the seam, a certain amount of coal is turned into slack by working upon it. The Morgan-Gardner electric machine undercuts to a depth of 6 feet a space of 4½ inches in height, and 3 feet 9 inches wide, without any waste whatever. The machine skids back automatically when it has cut its full length, and is reset for the next section in less than a minute. It cuts 242 square feet in an hour, doing the work of fifteen men. After a section is cut in this way holes are bored by electric drills and the coal blown down. Such machines can only be used when the "pillar and stall" system of mining is carried on. The new machine invented by Mr. Noble for use in England undercuts the face of the coal when the seam is sixty or seventy yards wide, after the manner of a reaping machine. It costs from $1,500 to $2,000. The machine is also used for cutting roadways, and in one of the English mines in which it has been installed, it is at present used in cutting out a band between two seams of coal, which otherwise could not be moved without great waste. The use of the machine involves a saving of from 12 cents to 36 cents per ton of coal mined, according to the thickness of the seams. It thus enables many mines with small means, which are now disused, to be worked at a profit.

Science Notes.

In County Mayo, Ireland, a wooden boat believed to be nearly 2,000 years old was recently dug up by some laborers. The boat, beautifully carved from the trunk of a tree, is of oak, 46 feet long, and in a perfect state of preservation. So hard is the wood that the hatchets of the men scarcely left an impression. Provision will be made to receive the relic in the Dublin Museum.

The Imperial Health Department of Germany, which numbers among its counselors some of the most distinguished scientists, has lately considered the possibility of exterminating rats throughout the empire. It is the object of the health department to mitigate the danger from the spread of contagious diseases. Dr. Robert Koch, the eminent bacteriologist, has been commissioned to devise a plan of getting rid of the rat pest in the east port-towns.

Dr. F. W. Hutchinson, the well-known English scientist, is at present making a series of balloon ascents from London and vicinity with a view to determine the nature of the bacilli inhabiting the upper regions of the atmosphere. The microbes are collected by means of sterilized gelatine plates, prepared from seaweed by a Japanese process, and exposed at different altitudes. So far the results have been satisfactory, and many hitherto unknown germs have been discovered.

The work of gathering specimens for the public conservatories of New York city, in Bronx Park, is proceeding at a rate that cannot but arouse satisfaction. The collections in the older houses, and a considerable number of plants grown during the year in the propagating houses on the eastern side of the Botanical Garden, will partly stock the large additional space. Nevertheless, several thousand more specimens are needed for the new houses. To obtain some of these, three expeditions have been organized. Dr. McDougal has gone to Arizona to secure cacti and succulents; Dr. Britton may go to Cuba in order to gather certain tropical species; and Mr. Nash will go to Europe in April in order to arrange for some exchanges for the Botanical Gardens.

The London Lancet is doing splendid work in its laboratory for the public health of Great Britain, and it has been considering that the postage stamp is not too unimportant for its attention. Blood-poisoning has, without a doubt, been traced to licking an infectious postage stamp as a cause, and the chances of a postage stamp becoming infectious are obviously abundant. This year it was decided to revert to red as the distinguishing color of the penny stamp. On examination it is found that one of the innocuous aniline reds was used, which is peculiarly resistant to atmospheric action or to the action of moisture. Strong acids disturb it but little. The adhesive material is dextrine or British gum in all cases.

Children of wealthy parents are to be the subjects of food experiments by scientists in a splendidly equipped home known as the Chicago Hospital School for nervous and delicate children, at 5201 Drexel Avenue, says the New York Medical Journal. Only the well-to-do can afford to send their children to the school. The home can accommodate only fifteen children, and has more applications than it can fill at the present time. An annex is to be established soon, and the effects of food on the brain and body are to be studied under the direction of Dr. John M. Dobson, when he returns to Chicago from Boston, where he is understood to be conducting further researches in the subject. All conventional ideas of a school are to be disregarded at the hospital school. There will be no desks; and nothing to suggest an institution will be allowed. The idea of working out such a problem originated with Dr. John M. Dobson, dean of Rush Medical College. The hospital school is affiliated with Rush College.

Some twenty years ago a German engineer who was surveying for a railway in Asia Minor heard that a large marble statue had come to light in what is known now as the town of Bergama. He soon became convinced that owing to the largeness of the remains it formed a part of the representation of the battle of the gods which took place on the heights of Pergamon. Further investigations proved this to be the case, and Herr Humann conducted the explorations between 1878 and 1886 upon the spot where he made his first find, the Prussian government providing the means. Much of the magnificent temple and altar which were erected on the Pergamon height between the years 197 and 159 B. C. had disappeared under the combined influences of the weather and vandals. Some larger portions and small fragments were conveyed to Berlin, and now a special museum has been opened for the reception of these magnificent specimens of Hellenic art. The building in shape and size resembles the original altar with its frieze. The gigantic figures have been set up in their former order, and every possible fragment has been utilized.

Electrical Notes.

A charter has been given to Boston capitalists to build an electric line from Toronto to Cornwall and a line from Brockville through Smith Falls to Ottawa, in all about 350 miles. The fund for this purpose will be $8,000,000, and the work will be pushed to an early completion.

In order to facilitate the handling of mill products and supplies an electric railway has been built entirely encircling the Carpenter Iron Works at Reading, Pa. The track is twenty-four inch gage and is laid to reach all the departments of the works as well as coal piles and railroad sidings. There are two electric locomotives weighing 10,000 pounds each and capable of a speed of six miles an hour with a draw pull of 1,200 pounds. The line is equipped with a variety of cars suitable for the work required.

In a recent number of the Electrical Review, Prof. Trowbridge describes some interesting experiments which he made with the electric spark in water. He states that it is possible to produce a brilliant discharge in carefully distilled water, provided a high electro-motive force is employed. He has found 500,000 volts with a large capacity suitable for the purpose of spectrum analysis. The electrodes were platinum wires inserted in long glass tubes and placed an inch apart. It was necessary to have an additional spark gap outside the liquid. Prof. Trowbridge states that the light of the spark produced under water is of brilliant whiteness, resembling that of an inclosed arc-lamp.

A scheme is being promoted for the purpose of constructing a railway upon the monorail system between Edinburgh and Glasgow. The plans have been prepared and the route mapped out, and these have as a preliminary been submitted to the Board of Trade. The distance between the two cities is 49 miles by the most direct route possible, and the distance will be covered in 29 minutes, or at a relative speed of 117 miles per hour. A service of six trains per hour both ways will be inaugurated. At present the two cities are connected by the North British and Caledonian system, and the service is about hourly each way, the fastest train covering the distance in 65 minutes. An immense traffic passes between the two cities.

An instrument for indicating and recording the approach of thunder storms is in use at St. Ignatius College, Cleveland, Ohio. The apparatus comprises a relay, a sounder, a coherer, two condensers, a choking coil, two batteries of two and four dry cells, a clock with recording cylinder, and a copper collector fixed to the tower roof. The action of the storms upon the recorder is as follows: If, at some distance from the receiving station, there is a violent discharge of electricity within a cloud, the electrical oscillations it occasions will impinge upon the collector on the roof and close the coherer circuit. The waves, however, pass the coherer without obstruction, thereby building bridges for the battery current in this circuit. The relay in the coherer circuit is energized, and closes the recorder circuit in the usual manner.

In a recent issue of the Tramway and Railway World, Mr. Magrini Effren of Turin shows how rapid and extensive has been the development of electrical traction in Italy. The first electric tramway put down in Italy dates back to 1890. The line runs from Florence to Fiesole. Genoa and Milan followed in 1893. Two years later the Eternal City itself saw the advent of the electric tramway. Turin, Naples and Leghorn and other cities are now included in the list. Water power instead of steam is used at the generating stations, in many cases. While the railways, as a rule, have adopted a conductor rail, the use of overhead wires for the tramways is quite general. The latest development is the Lecco and Sondrio Railway, about which so much was heard at the recent arbitration proceedings regarding the system of electric traction for the Metropolitan and District Railways of London.

Several severe experiments have recently been made in Christiania with a new electro-magnetic gun invented by Prof. Birkeland. The electric connection between the battery and the gun is made in less than a second by the aid of a current breaker. The feature of this weapon is that no noise accompanies its firing. In the trials the electric spark was first seen, followed by a loud report, which was caused by the impact of the projectile, a one-pound shell, on a wooden target, which was penetrated. The gun works magnetically. The shell is drawn out of the bore and not, as hitherto, impelled by gunpowder. The use of magnetism as a motive power, according to Prof. Birkeland, will enable 1,000-pound shells to be hurled much further than by the old-fashioned methods. This is by no means the first gun with which attempts have been made to fire shells by magnetic means, but no electro-magnetic gun has yet succeeded in fulfilling the requirements which were claimed for it, so that Prof. Birkeland's further experiments will be followed with great interest.