

THE SUPERPOSED TURRETS OF THE
"KEARSARGE."

It is safe to say that no recent design in warship construction has produced such a widely extended and earnest discussion as that which forms the subject of the first page illustration of this issue. When it was first made public it was met with a storm of adverse criticism from the conservative element among naval officers, both of the line and staff; though it is only fair to say that the opponents of the double turret were to be found chiefly among the officers of the Construction Department, the obvious military advantages of the double turret commending it at once to the men who will carry our ships into action.

It is not our intention in the present article to enter into any extended statement or discussion of the advantages or disadvantages of the system, but rather to make clear to our readers the great ingenuity and skill with which the construction department has given practical expression to the daring suggestion of Lieut. Strauss, that four guns of the main battery should be installed in a two-storied turret, the 8-inch guns above and the 13-inch guns immediately beneath them.

The credit of the original design, undoubtedly, belongs to the gentleman named, whose idea received sanction and encouragement from Admiral Sampson, at the time chief of the Bureau of Ordnance, with which department Lieut. Strauss was connected.

When the matter came into the hands of the Bureau of Construction, several important recommendations were made and adopted, including the use of the oval balanced turret, which was coming into general use in European navies at that time, and the use of electricity for turning the turret, elevating the guns, and working the ammunition hoists. The many new features involved in these turrets, and the utter lack of precedent in the navy, rendered the details of the design a very complicated and difficult problem. That these were very aptly worked out by Naval Constructor Woodward, who, as superintending constructor, was in immediate charge of the work, is evident from a study of the drawings and proved by the success of the recent gunnery trials of the "Kearsarge."

The illustration on our front page is a vertical section through the "Kearsarge," taken on the center line of the vessel, and it affords a view of the complex structure of the vessel throughout its whole height from the keel to the roof of the upper gun emplacement. At the bottom of the section is seen the deep vertical keel plate which may be said to form the backbone of the vessel, whose height shows the depth between the outer and the inner bottom. The space between the inner bottom and the 3-inch protective deck is devoted to the magazines and handling rooms, the 8-inch ammunition being located above that of the 13-inch guns.

The handling room, so-called because it is the compartment into which the shells are brought and placed in the hoists to be carried up to the guns above, communicates through watertight doors with the magazines. The powder charges are contained in copper cylinders which are arranged neatly in racks in various compartments which lie immediately around the handling rooms, communication being had by way of watertight doors, while the other doors lead into similar compartments where the projectiles are stored. A system of overhead trolleys runs from the various magazines into the handling rooms, by means of which the powder and shells may be picked up from the racks and carried to the cages of the ammunition hoists. There are four of these hoists, two to each turret. Two of them start from the center of the 13-inch handling room, and slightly on either side of the vertical axis of the turret, and extend upwardly in an easy curve to the rear of the breech of the two 13-inch guns, there being, of course, one hoist to each gun. The hoisting is done by means of electrical motors, operating wire ropes, which lead through a system of pulleys up to the breech of the guns and thence down to the ammunition cage. The cage travels upon a curved plate-steel trackway, as shown. The arrangement of the ammunition rooms and handling rooms of the 8-inch ammunition is generally similar to that for the 13-inch guns, a plate steel trackway, smaller in size, but similar in general appearance and construction to the 13-inch hoists, running from the handling room up to the breech of the 8-inch guns, the cage being similarly raised by means of a wire rope operated by electrical motors. The 8-inch trackways pass between the hoists of the 13-inch guns, and the matter has been so carefully worked out, that in spite of predictions to the contrary, there is no interference between the two sets of hoists.

The protective deck, which in the "Kearsarge" is 3 inches thick, is indicated by the full black line above the 8-inch magazines. It slopes from the forward end of the amidship rapid-fire battery downward and forward to a junction with the massive structural work of the ram bow into which it is worked. Immediately upon it is built up the great circular wall of the barrette, which raises from this deck to project a few feet above the main deck of the vessel. The forward portion of it is 15 inches in thickness, but the sides and the rear, owing to the fact that they are flanked by a wall

of 5½ inches of side armor on each side of the vessel, are only 12½ inches thick. Immediately behind this armor is a backing of oak timber, which in its turn is backed up by the heavy steel framing of the barrette. Within the barrette, and at a height of about 8 or 10 feet above the protective deck is a massive circular track upon which is carried, and upon which rotates, the massive double turret, the rollers upon which the turret turns being clearly shown in the engraving. Just inside of the circle of rollers and bolted to the circular table on which the track is placed, is a large circular rack which is engaged by the turning gear with which the turret is operated. The power for turning the turret is supplied by two 50-horse power electric motors which are located below the floor of the 13-inch turret. These motors revolve in the same direction, both driving through bevel gears a horizontal shaft which runs across the turret. The shaft carries at one end a right-hand and at the other end a left-hand worm, each of which engages with a worm wheel at the top end of a vertical shaft. At the lower end of the vertical shaft of each of the worm wheels is a pinion which meshes with the circular rack inside the barrette, thus driving the turret.

One 20-horse power motor is located under the central girder of the turret for the operation of each of the 13-inch ammunition hoists, the arrangement being shown in the illustration. Each 8-inch ammunition hoist is worked by a 6-horse power motor, and there are also special motors for elevating the 13-inch guns and for working the rammers which are located to the rear of the breech of these guns. There is also a system of electrically-driven ventilators, for blowing the gases out of the bores of the 8-inch and 13-inch guns after firing.

It will be noticed that whereas the front wall of the 13-inch turret lies within the circle of the barrette, the rear wall extends several feet beyond it. This is due to the fact that the section is taken on the longer axis of the turret, which is elliptical in shape, this form being better suited to the movements of the gun crews, reducing the unoccupied space at the sides and giving more space to the rear of the guns where it is needed. The elliptical turret is otherwise known as the balanced turret, the weights being so adjusted that there is practically no excess of load on any part of the turntable. The front walls of the turret are 17 inches in thickness, decreasing to 15 inches at the sides and rear.

The 8-inch turret is located somewhat to the rear of the center of the 13-inch turret, and is placed immediately upon the 3-inch steel roof of the latter; its front wall is 11 inches and its side and rear walls are 9 inches in thickness. The 13-inch turret is provided with three sighting hoods, one shown in section immediately in front of the 8-inch turret, and one being placed on either side of the 8-inch turret. It was feared that when the 8-inch guns were fired trouble would be experienced in these sighting hoods from the blast and the flame of the gases, but in the trials recently carried out off Old Point Comfort it was found that these hoods were tenable at all times.

The test of the "Kearsarge" above referred to was carried out for the purpose of determining whether the structure of the ship, and more particularly of the double turrets, could sustain the heavy strains which would be set up when the guns were fired, and especially by firing the four guns simultaneously. Both batteries of the double turrets and those of the rapid-fire guns amidships were tried under all possible conditions, and the results proved to be eminently satisfactory, both to Admiral Sampson and Captain William M. Folger, who is in command of the "Kearsarge." The results of the trial can best be given in Captain Folger's report to the Navy Department in which he says: "The double turret was thoroughly tested and is an assured success both from military and structural standpoints. There was no interference between the planes of the guns, or inconvenience from blast or smoke. The structure, tested with the simultaneous discharge of three guns is amply strong to withstand the united shock of the four guns of either turret. Only the absence of a suitable device for the simultaneous discharge of all the guns prevented the final test. Both pairs of 8-inch guns were tested in simultaneous firing." In a subsequent test made a few days later, all four guns in both turrets were discharged simultaneously in broadside, without any harmful results to the structure of turrets or ship, or undesirable effects upon the stability.

A \$20,000 Prize for a War Automobile.

The Emperor William, of Germany, who it is well known takes a keen interest in the latest inventions and improvements which are applicable to military operations, has been studying the question of applying the automobile in military service, and evidently considers that it will be of great value, as he has decided to award a prize of \$20,000 for the vehicle best adapted to the purpose. A number of experiments have been recently made in this direction, and it is after considering the favorable results of these tests that the decision to award the prize was taken.

Automobile News.

The Automobile Club, of America, will have a race on April 14, rain or shine, for a cup presented by M. Léonce Blanchet, of the Automobile Club of France. The race is to be of fifty miles over a course which has not been decided upon. There must be at least two people in each carriage, and the carriage itself must be driven by a member of the club; tricycles are barred. A diploma will be given to the first three drivers to finish.

It is said that an Alsatian company will purchase ground to the extent of \$10,000 at Sablon, near Metz, for the purpose of establishing a bicycle and automobile factory. The company will besides furnish light and power to the communes of Montegny and Sablon. A large milling company of Metz have recently procured from Paris an automobile for heavy traction, known as the "train Scotté," operated by steam. It is similar in design to the type adopted by the French army for the artillery and engineering service, and has the boiler and engine mounted in front, with a space in the rear to carry merchandise. It is built to give 27 horse power and carries normally 10 to 12 tons of freight at a speed of 6 to 7 kilometers per hour. It appears that a new order for four of these automobiles is to be placed by the Metz company.

A new company has been formed at Bordeaux, called the Bordeaux Automobile Transportation Company, which will carry freight over a part of its route upon heavy automobiles of special construction. This company has been formed in connection with the Automobile Courier and Transportation Company. Its principal object is to transport, between Bordeaux and Mazamet, the sheep's hides brought to that port from America and Australia, and on the return trip to bring the wool and leather produced at the latter point to Bordeaux, from which it is shipped to Antwerp and Liverpool. To carry out the system proposed by the company, the hides will be unloaded from the transatlantic steamers into freight boats, which will pass up the Garonne to the lateral canal and the Canal du Midi to the Point Rouge. From there they will be transferred to the automobile wagons, which will travel over the national route to Mazamet, thus delivering the hides directly to the merchants of that district. The route passed over by the automobiles will be about 41 kilometers. The company estimate that four or five automobiles will be sufficient, on a basis of 12,000 tons annually.

The question of the use of automobiles in the French army is now occupying considerable attention. In connection with this subject, an interesting address was recently delivered at Lyons, by Lieut. Humbert, of the 121st Infantry, in which, after passing in review the different systems, electric, petroleum, etc., he showed the advantages and disadvantages of each type for military use and indicated what should be the qualities of a vehicle designed for this service. He shows, that the automobile will render a very important service in the colonies, in providing for the rapid supply of military posts and detachments, and describes the system of military automobiles which the government has recently put in action in Senegal. A similar system is now in consideration for Madagascar, which will cover the route between the port of Tananarive and Tananarive. On account of the difficulties of the route, the railroad which is to connect the coast with the interior has not yet been finished, and the automobile system will render great service in the construction of the road and besides will establish direct and rapid communication between Tananarive and the coast for the transportation of voyagers as well as for the postal service.

Mr. John Scott Montagu has recently given an interesting address before the Automobile Club, of Great Britain and Ireland, in which he brings out the condition of automobile affairs in England. He comes to the conclusion that although the automobile is greatly appreciated by the public, the slowness with which it is adopted is due in part to the flagrant violation of the rules by many of the owners, and besides, to the inferior quality of the machines now made in England. He considers that the constructors should study the question more carefully with regard to the needs of actual service, and should design motors which are more powerful and at the same time cheaper. In regard to the question of legislation, he thinks that the House of Commons regards the automobile with a more favorable eye than it did a year ago, and that if the persons interested do not press the matter with undue haste, there is no doubt that legislation will be secured which will be advantageous and will favor the development of the sport and the industry. In this connection it will be interesting to remark that the Prince of Wales has recently ordered a phaeton of the Daimler type, petroleum system, of about six horse power. This will no doubt start a favorable movement among the clubmen and amateurs of sport in London and other cities, similar to that which has made such rapid progress in similar circles in Paris and elsewhere on the Continent.

SCIENTIFIC AMERICAN

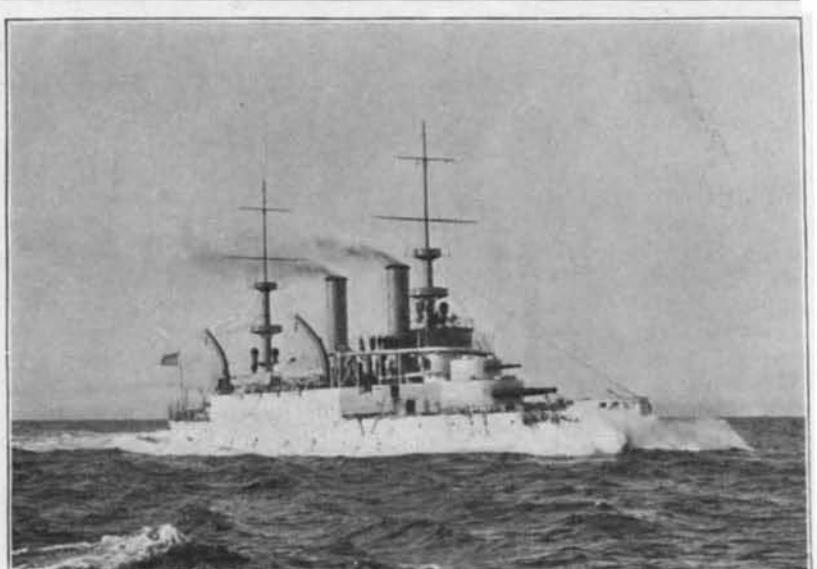
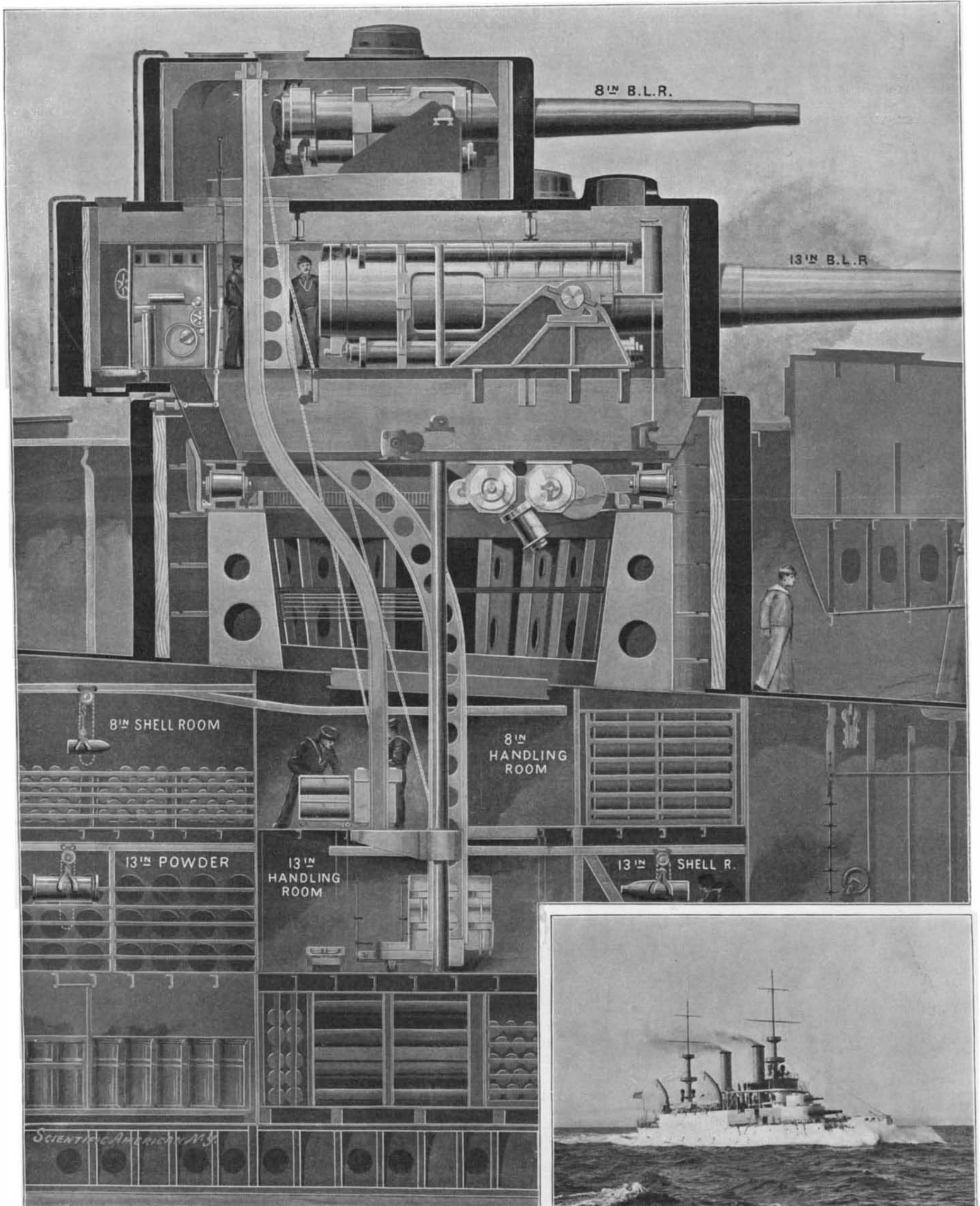
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The "Kearsarge" on her Trial Trip. From a Photograph copyrighted 1899 by N. L. Stebbins.

TEST OF THE SUPERPOSED TURRETS OF THE UNITED STATES BATTLESHIP "KEARSARGE."—[See page 230.]

Science Notes.

The American water hyacinth which is not infrequently an obstruction to navigation, in southern rivers has been successfully killed on the Melpomene Canal, New Orleans, by a chemical spray.

There are now employed on the relief works of the famine districts of India 4,810,000 persons, and the distress caused by the famine is increasing in extent and severity and the prices of food are very high.

Some old quarries of Oriental alabaster have recently been discovered in the neighborhood of Monte Amiata, near Siena. It now seems very probable that the beautiful columns of that material in the interior of the Cathedral of Siena came from those quarries. The quarries are about to be worked.

The limiting percentages of acetylene and other gases in air which are explosible are as follows: Acetylene, 3 to 82; hydrogen 5 to 72; carbon monoxide 13 to 75; ethylene, 4 to 22; and methane, 5 to 13. This gives acetylene a wider range of explosive proportions than any of the other gases mentioned.

Prof. Henry S. Pritchett, superintendent of the Coast and Geodetic Survey, has resigned his place to accept the presidency of the Massachusetts Institute of Technology of Boston. He was the youngest superintendent that the Coast Survey has ever had, and he has been one of the most capable.

Several New South Wales lepers have been treated by a leprosy serum method devised by Dr. Juan de Dios Carrasquilla, of Bogota, and said by him to have been successful in a hundred cases. The Australian doctors, however, have been unable to detect any improvement, and the disease is still making progress.

Dr. William P. Wilson, Director of the Philadelphia Commercial Museum, and William Harper, Chief of the Bureau of Information of the same institution, have gone to San Francisco to assist the promoters of the Pacific Commercial Museum. A museum on the Pacific coast can do a great deal of good for the commerce of the country. It will, undoubtedly, divert much of the trade of Australia and the Orient on the Pacific coast.

Two French chemists have discovered a process by which rubber may be obtained from the *Landolfia* vine which grows wild, and luxuriantly in all parts of Africa. The process of tapping the *Landolfia* is impracticable, as the flow of rubber hardens too quickly. By the process of MM. Arnaud and Verneuil the vine is crushed in hot water, by which means all the rubber which it contains is extracted.

The Ways and Means Committee of the City of New York has recommended that \$60,000 be appropriated to enable the State to acquire the James Hall scientific collection and library. It represents the accumulations made by the late Prof. James Hall during his entire active life in science and covers a period of seventy years. The palæontological collection is one of the most remarkable in the world.

George Peabody gave between the years 1862 and 1873 the sum of \$2,500,000 for the building of model tenements for the London workmen. They have added to the fund since that time from rents and interest \$3,956,000, making the total \$6,456,000. The number of rooms provided for workmen is 11,367 which are divided into 5,121 dwellings, which are occupied by 19,157 persons. The average rent of each dwelling last year was \$1.21 a week, and of each room 30 cents.

Secretary Gage has asked the House of Representatives to appropriate \$200,000 additional to the fund to prevent the introduction and spread of epidemic diseases. The Surgeon-General of the Marine Hospital Service reports that on account of the continued and increasing danger from plague, medical officers have also been stationed at the fruit ports of Central and South America to guard against yellow fever. The Consulates at Yokohama, Kobe and Hong Kong also have medical officers. Three hundred thousand dollars was previously appropriated and this sum is almost entirely exhausted.

Mr. W. Stratonoff, of the Observatory of Tachkent, has been engaged for some time in trying to determine the magnitude of the star which is to be found in the center of the annular nebula of the Lyre. In the period of four years, from September 5, 1895, to September 15, 1899, he has taken a number of photographs of this remarkable star, by using a good telescope having 0.83 meters opening of objective, with exposures varying from 30 to 90 minutes. By comparing its brilliancy with that of thirty of the neighboring stars whose magnitude is known, this astronomer has found several values which range from magnitude 9.5 to 13.1. The result obtained with a series of very long exposures was doubtful, but on the other hand, those obtained with exposures varying from 22 to 83 minutes have given a magnitude equal to 11.6. An exposure of ten hours gave 10.4, and one of twenty hours, 13.6. Mr. Stratonoff considers that this star is the result of a condensation of a part of the nebula; and finds that a long exposure diminishes the contrast which exists between the central condensed part and the exterior and less luminous matter.

Engineering Notes.

The railroads of East and West Java, says The Engineer, have recently been united, so that one can now travel from one end of the island to the other in two days.

A new invention provides for an arrangement by which turning on a faucet anywhere in the house starts the gas burning under a coil of pipe, thus providing hot water at any hour.

Dr. Michaelis, an Austrian authority on cements, considers that a mixture of Portland cement volcanic tufa and granulated blast furnace slag is better than Portland cement alone where structures are to be exposed to salt water.

A special mortar has been used in the German technical schools for powdering certain chemicals which must be handled with care. The mortar is provided with a flanged edge, and a skin of rubber is fitted over it. The rubber is not tightly drawn, and there is an opening in the center through which the pestle passes. The rubber skin keeps off poisonous vapors and injurious dust, and facilitates the pounding of hard brittle materials such as caustic alkalies.

In the Reichstag on March 29, in a debate on the management of State railroads, the Prussian government was taken severely to task on the subject of the antiquated system of couplings now in use in Prussia, a system which has occasioned many accidents. The Prussian Minister of Railways, replying to criticisms, stated that the government had heard of the satisfactory experiments on the Bavarian railroads with the American automatic coupler and would agree to undertake similar experiments during the coming summer.

The Swedish match industry has increased during the last year, in spite of European and Japanese competition. The original Swedish safety match is regarded as safer and cheaper than those manufactured elsewhere. The Swedish industry, however, will soon suffer from the want of wood. The injudicious cutting down of trees has produced the usual effect, and the destruction of slow-growing trees has not been accompanied by reforestation, and has all but exhausted the stock of trees, so that the wood has now to be very largely imported from Russia and Finland. In 1898, 975,000 cubic feet of this wood came from St. Petersburg, Riga and Libau. Russia has now begun to manufacture safety matches herself, and export duties have been put on the timber.

The Cricket Ground at Sydney, Australia, has been lighted with acetylene gas and it has been very successful. Three thousand lights are in use. Suspended over the racing track are 163 shades, under which are a number of burners, the shade, of course, keeping off the wind and rain. Shades are attached to light angle iron supports 15 feet from the track and 16 feet apart. The pipes are 8 miles in length, and run from the outside right over the track to the inside and have to be suspended by very thin supports in order that the public's view will not be interfered with. The lights are practically steady, and gas is furnished by three batteries of generators. It is found that the light has no straining effect upon the eyes of the spectators, and in addition the colors sported by the contestants present their natural hue.

The effects of the great dynamite explosions at Avigliana, near Turin, on January 16, have recently been described by Dr. M. Baratta, says The Engineer. About 400 kilos of nitro-glycerine and 12,000 kilos of dynamite and gun-cotton were blown up. The first and stronger explosion, though it lasted little more than a second, presented three maxima of intensity, due probably to the successive explosions of magazines a hundred meters from that in which the nitro-glycerine was stored. Owing to the situation of the manufactory, the zone of greatest damage was very small; that in which windows were almost totally destroyed extended to a distance of 5½ kiloms.; doors and windows were made to rattle as far as Crescentino, 60 kiloms. distant; and the sound of the explosion was heard at Pavia, 140 kiloms.; Varzi, 145 kiloms.; and Lugano, 160 kilometers.

A Cleveland engineer has invented a machine for the automatic manufacture of steel balls. The machine automatically forms and polishes steel balls, which are entirely spherical, at the rate of 65,000 a day. Cubical pieces of hot steel, each of which is to be made into a ball, are fed into the top of the machine, one at a time. The principal parts of the machine are a cone of steel 2 or 3 feet high, and a cover of steel which fits over it. In the face of the cone is a groove that winds around it from the top to the bottom, growing smaller as it nears the bottom. There is another groove on the inner surface of the cover that matches that in the cone. The cone is kept whirling all the time, and when a piece of steel is put in at the top, it is worked downward through the spiral groove, which rolls it on all sides and in all directions, and drops it out of the bottom of the machine, a perfect sphere of steel. The fibers of the steel are not cut, but instead, are packed together even more tightly than when cut from the rod.

Electrical Notes.

The new motor fire engine of the Paris Municipality is doing excellent work. It rendered valuable assistance at the Trianon theater fire, and at the St. Ouen spirit warehouse fire. The engine carries six men, and travels at the rate of thirteen miles an hour.

Viennese telephone girls are required to change their clothing and wear a uniform when on duty in order that the dust which they bring in with them will not interfere with the instruments. The costume is a dark skirt and waist with sleeves, striped black and yellow, the national colors.

The hardened end of a steel bit or chisel broke off in a bore hole at a depth of 990 feet in a place in Germany, and this obstruction prevented further boring of the hole because all the diamonds wore away. The following plan was hit upon to remove it. A soft steel bar, 5 feet in length and 2.7 inches in diameter, was covered by a single winding of India rubber tape, and magnetized by the current of a small dynamo driven by a portable engine employed for the work of boring. The steel bar was let down magnetized into the hole and when it reached the bottom the current was switched through the conductor enclosed in the rope for letting down and drawing up. On the first day that this method was employed the piece of steel was drawn up to the surface, so that the boring could be resumed.

The committee in charge of that section of the Paris Exposition relating to sports and physical exercises has under its jurisdiction the boat races which will take place on the Seine. These include a number of interesting events, one of which is a series of races between mechanically propelled boats of all kinds, such as steam, electricity, compressed air, petroleum, etc. Two races have been set apart for this class; these will take place near Paris on June 23 and 24. The boats are divided into four sections according to their length, this ranging from 6½ to 15 meters or over. In each section, the boats, even though possessing different types of motors, will run together, but a prize will be awarded to the winning boat of each class, steam, electricity, etc. On the first day a distance of 50 kilometers will be covered, and the prizes will range from 1,000 to 2,500 francs. The distance for the second day has been fixed at 15 kilometers, with prizes from 300 to 600 francs; the prizes will take the form of objects of art, medals, etc. The rules to be observed as those of the Helice Club of France, and engagements should be sent before June 15, to the president of the club, the Count de Faramond, 14 Rue Vaneau, Paris.

In some fluorescent screens used for Roentgen ray work, notably those made of Sidot's zinc sulphide, a certain time effect is observed at each operation. The bones of the hand are not visible at once on the screen. They gradually separate out from the flesh. This effect is only partially due to a change in the radiation impinging upon the screen. We know that a "hard" tube gives more decided radiographs, and the effect might be attributed to the hardening of the tubes while in action. But, on the other hand, a gradual and distinct brightening of the screen is observed, which is quite independent of any change in the radiation and is unaccompanied by any change of color or of chemical constitution that could be discovered by any means at present available. J. Precht has studied the time effect both in sulphide and in platino-cyanide screens. He finds that the time required for a good development of the radiosopic picture is on the whole shortest at the highest discharge potentials. It varies from a few seconds to a minute. The most obvious explanation lies in an allotropic modification of the substance of the screen, as postulated by Becquerel for radium rays. But the author puts forward an emission hypothesis of Roentgen rays.—J. Precht, *Ann der Physik*, No. 2, 1000.

The London Electrician says that one of the most extraordinary magnetic anomalies is presented by the province of Kursk, in Russia. At the invitation of the Imperial Russian Geographical Society, the French Minister of Public Instruction sent Prof. Moureaux to make a magnetic survey of that region. Taking the town of Kursk as a base, Prof. Moureaux made excursions to 109 different stations in the province. The plateau between the Plota and Solotinka Rivers extends over an area of about 2 square miles. In this restricted area the declination was found to vary from 34° E. to 96° W., and the inclination from 48° to 79° values which correspond respectively to the normal inclinations in Morocco and Spitzbergen. But the most remarkable abnormality is to be found in the intensity, which yielded horizontal components varying from 0.50 to 0.59, and vertical components exceeding 0.97. The observations have since been continued by Prof. Leyst, of Moscow, who found a point near Kotchetowka where the dipping needle points vertically. There is nothing observable in the surface conditions of this region to explain its magnetic characteristics. It is a rolling country, covered with a very fertile black soil reposing upon cretaceous rock. No iron has been found down to depths of 600 feet below the surface.