nection between the banks of the Seine; to modify or rearrange the buildings remaining from the preceding expositions; to preserve, as far as possible, the beautiful planted grounds of the city of Paris upon the site set apart for the Exposition of 1900; and to assure, also, as far as possible, an exact, methodical and rational classification.

To our regret, we cannot enter here into a detailed description of the prize projects, and still less, publish a host of original details, new conceptions and ingenious and grand ideas found in a large number of those that came afterward and do their authors honor.

We shall be content, following in this the magistral selection of the jury of awards, briefly to describe the three projects that were awarded the first prize and that appear to have responded to the main idea of the great enterprise that is preparing. Their "artistic mean," if it be permissible to express ourselves thus, well gives the image of the future exposition, and our readers, in looking at our engravings, will be able to obtain a preliminary idea of it. These projects are, as we have said, those of Messrs. Girault, Henard and Paulin. We shall take them in alphabetical order.

Mr. Girault's Project.—Mr. Girault, using the power accorded him by the general programme of the exposition, has suppressed all the structures remaining upon the Champ de Mars, with the exception of the Machinery Hall, of 1889, and the Eiffel Tower. These two grand structures will well symbolize, in 1900, the art with which the engineer and architect were able to appropriate metal in the age of iron and steel that will have just passed. Nothing will be easier, moreover, if it be desired, than to rearrange the interior of the vast nave of the Machinery Hall and to "embellish" the Eiffel Tower in order to give it an architectural aspect. The 300 meter tower, which it would have been costly to demolish, is the joy and the admiration of visitors who come from every quarter of the globe. From its summit, it will be possible not only to contemplate the completed Exposition of 1900, but also to see it constructing and rising like an immense fairy scene. Were it to regard it only from this view point, it would be just and rational to preserve it. In the center of the Eiffel Tower, Mr. Girault has arranged a large and beautiful cupola and two great monumental greenhouses for horticulture on each side. This is the "embellishment" of the tower, and it is certainly well conceived.

Mr. Girault preserves also the Palace of Industry, of which he modifies the approaches and gives it a monumental porch. This latter will serve as a secondary entrance to the exposition, the main entrance of which will be situated on Place de la Concorde.

In his project, this able architect has, with special care, anticipated a general classification of the members of a same group in the special palaces in whose center would be found the retrospective centennial exposition. He would thus furnish its visitors with elements of instruction such as have not as yet been seen grouped in any exposition, and this certainly is a very happy idea.

Mr. Eugene Henard's Project.—In his project Mr. Henard has preserved the Machinery Hall of the Exposition of 1889 and the Palaces of Fine and Liberal Arts erected upon the Champ de Mars. What characterizes his very beautiful and very imposing project is that the Machinery Hall would become the Hall of Fetes of the Exposition. The "hit," to use the common expression, would be a colossal dome 100 meters in diameter and 200 in height. The Champs Elysees would be connected with the Esplanade des Invalides by a three-arched bridge 100 meters in width.

Mr. Paulin's Project.—In Mr. Paulin's project, which is very sensible and very moderate in its conceptions, it is the Seine that serves as the principal motif. Its banks, converted into gardens, would offer the visitors varied recreations, specimens of structures of all countries, and suspended gardens. As the river would serve not only as an axis, but also, in a manner, as an entrance to the exposition, a monumental bridge would be constructed at the height of the Palace of Industry and its approaches would be provided with great triumphal arches.

Mr. Paulin proposes the preservation of the Eiffel Tower, the Machinery Hall, and the Palace of Industry, but he would annex to the latter a gallery parallel with the Seine, and a vast central rotunda having an access near Place de la Concorde, with a grand vestibule and monumental stairways.

Such are the broad lines of the three projects that obtained the highest awards from the jury. What will the exposition of 1900 be? Every one is already asking this question with curiosity.

It would be necessary in truth to be more advanced than Mr. Bouvard himself and than Mr. Picard in order to answer this question, for it is certain that the general and definite plan, in course of elaboration, will borrow from the various prize projects all that they possess of the seductive, and that these different elements will be fused together in order to form a majestic and homogeneous whole.

As to the general impression, we will doubtless find a certain resemblance between the new exposition and that of 1889, since the preservation of the Eiffel Tower and the Machinery Hall materializes the souvenirs of 1889 in a grand and indelible manner.

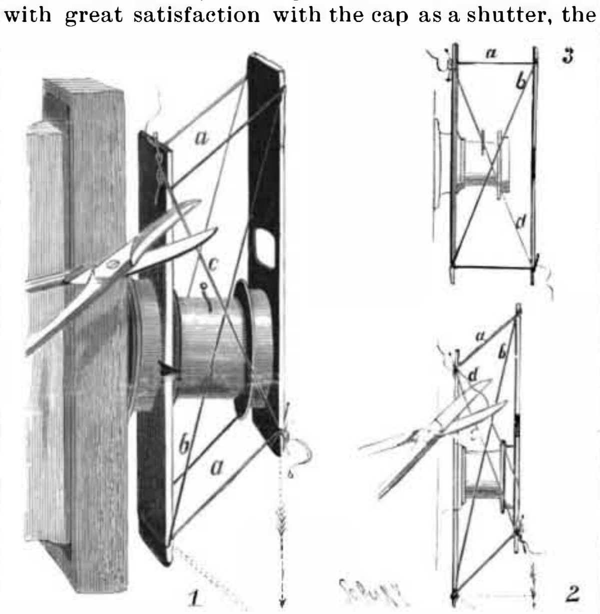
But the extension of the exposition upon the two banks of the Seine will give it a character of evident innovation. The wide perspective opened, too, within the limits of the exposition, from the Palace of Industry to the Esplanade des Invalides, will present to the visitors an unexpected spectacle. It serves as a motive for the construction over the Seine of a bridge that will remain after the exposition and take a place among the beautiful things that may be admired at Paris.

Finally, the relatively wide area accorded to the exposition will permit its organizers to establish the classification of the products with a clearness and a method that have been wanting in our universal expositions since the remarkable one of 1867, which, thanks to the work of the learned Le Play, was a model of its kind. The visitor will therefore be able not only to be more easily amused and entertained, but also instructed, and this is a quality that ought to be essentially possessed by such a great enterprise, the mission of which, in a manner, is to summarize the industrial, artistic and scientific progress of an entire century.—La Nature.

A SIMPLE CAMERA SHUTTER.

BY GEORGE M. HOPKINS.

During last summer's vacation, the writer, while in the mountains enjoying the scenery and trying to survive an acute attack of photographia, received a superb lens ordered some time previously, but the shutter was not yet completed. The lens was used with great satisfaction with the cap as a shutter, the



A SIMPLE CAMERA SHUTTER.

only difficulty being that of overexposure and the occasional loss of a subject requiring an instantaneous exposure. When, however, a desirable snap shot subject presented itself, an instantaneous shutter became a necessity, and hence the invention of an exceedingly simple shutter for the emergency.

This shutter, which is here illustrated, has been used since its first application to the camera, notwithstanding the adaptation of the fine shutter belonging to the lens.

Two oblong pieces of pasteboard box, four hair pins, four common pins, a long thin rubber band, a piece of black velvet, and a piece of thread constitute the materials, and the time required for making the apparatus was twenty minutes.

In the center of one of the pieces of pasteboard was formed an aperture to fit over the threaded end of the lens tube, and in the center of the other oblong piece of pasteboard was formed a wide transverse slit, and a piece of black velvet was attached to one side of the pasteboard and carried over the edges around the slit. In the absence of other forms of wire four hair pins, a, were straightened, the ends of each one bent at right angles in the same direction and inserted in opposite edges of the pasteboard above and below the lens tube. Two of the common pins were inserted in the front of the lower part of the movable portion of the shutter, from opposite directions, forming a cleat for the reception of the piece of thread, and in a similar way two pins were inserted in the stationary pasteboard. A slender rubber band, b, was stretched around diagonally opposite ends of the pieces of pasteboard within the wire arms, a, and was prevented from slipping by the ends of the arms which entered the pasteboard.

This shutter was set by raising the front part so as to bring the lower imperforate portion against the front of the lens tube, thereby shutting off the light, then bringing the thread, c, already attached to the cleat on the stationary part, around the cleat on the movable part. The exposure was made by cutting the thread by means of a pair of scissors as shown in Fig. 1. The focusing was done while the shutter was held open by another thread, d, having a loop in it, which was slipped on the front cleat as shown in Fig. 3.

To make a slightly prolonged exposure the thread, c, which held the shutter closed, was cut first as shown in Fig. 2. The looped thread, d, which held the shutter open was cut immediately after it, the time elapsing between cutting the first and second threads being the time of exposure. The rapidity of the shutter is increased by adding another rubber band.

Filter Beds.

Considerable attention has been directed of late to the purification of water in large quantities by means of artificial filter beds. A number of these filters are being tested in various parts of the United States and their use promises to become general. The use of unfiltered water, it is generally recognized, tends to spread dangerous germs, and the importance of some convenient and economical means of supplying pure water can hardly be overestimated.

The filter beds situated at Ilion, New York, will serve to illustrate the general form of the artificial filters now in use. The water to be filtered in this case is supplied by a small stream which is dammed up and conducted to a storage reservoir. Before filtering, this water passes through a fountain which serves to aerate it. It is thought that this oxygenates the water, so that it will permit of sufficient nitrification in the filter beds without necessitating from time to time the aeration of the pores of the filter. The filter is arranged with an underdraining consisting of two courses of bricks laid dry. The lower course is placed end to end and forms lines which run at right angles to the main collecting drains. The space between these lines is equal to the width of one brick. These spaces are covered with the second course of bricks, and over this is spread six inches of pea gravel, and over this in turn a layer of sand thirty inches thick, of a uniform grade throughout. The water passes through this filter into the collecting channels formed by the first course of bricks, and is then collected in a clean water basin for distribution.

A filter of a slightly different form was opened in 1893 in Lawrence, Mass. In this case the filter measures two and one-half acres, and filters 5,000,000 gallons of water a day. It is arranged in a number of beds, each of which has a depression in the center which makes it possible for the water to rise gradually over the sand. The depth of the sand in these beds is five feet, and in the depressions a fine rgrade of sand is used to equalize the filtration for all parts of the bed. Artificial filter beds of the same general form have also been introduced at Poughkeepsie, Hudson, and Mount Vernon, N. Y.; at Nantucket, Mass., and elsewhere.

Some very satisfactory results are also obtained, it is claimed, by rapid or mechanical filtration with the use of coagulants. In this method, a rapid stream of water is furnished for several hours, and the filtering sand is washed by the disturbance created by reversing the current until the water which comes from the sand is perfectly clear. Several processes of carrying on mechanical filtration have been patented, and companies have been formed to fill contracts for constructing such filters. The filtration of drinking water is a necessity in many parts of the country, and it is to be hoped that filters of some form may in time come into very general use.

Primitive Fire Engines.

The oldest known fire engine for pumping water is probably the one mentioned in the Spiritalia of Hero, about 150 B. C. This engine, it is said, was contrived with two single-acting pumps with a single beam pivoted between the two for working the plungers. The streams of water united in a single discharge pipe and passed up a trough having an air chamber, and out of a nozzle which might be turned in any direction as desired. Fire engines appearalso to have been used extensively by the early Romans, who furthermore organized regular fire brigades.

In the early part of the sixteenth century a fire engine known as a "water syringe" was introduced, which, in a measure, resembled the modern forms of fire engines. This was mounted on wheels and the water was pumped by levers. This form of engine was very generally used in Germany. In England about the same time large brass syringes were used. These held several quarts of water and were operated by three men, two of them holding the syringe at each side with one hand and directing the nozzle with the other, while the third operated the plunger. It was necessary, after having discharged the water from the syringe, to refill it from a well or cistern near the fire or from buckets. The syringes were later fitted to portable tanks of water. The first successful fire engine was probably the Newsham engine, and this was the pioneer of manually operated fire engines. The pumps in these engines were built on many different designs, but in most cases they were operated by levers. Fire engines similar in form to the Newsham engine were in use up to the year 1850.

Indian Funeral Trees.

A remarkable specimen of the red cedar was recently unearthed by the opening of the Metzgar Indian Mound, on Deer Creek, near Yellow Bud, in Ohio. A large bed of ashes, a quarter of an inch in thickness, covered a space of about ten feet by six. Near the edge of this ash bed a large log was found. It was about five and a quarter feet in circumference, and as sound as if buried but a few years ago. The side branches had been cut away from the log, and one of the scars was so perfect that the marks of the stone axes used in the work are plainly discernible. There are no cedar trees now growing nearer than ten miles from that immediate neighborhood, and none were there growing when the early settlers came, so that the trees must have disappeared from there long ago in the past, or the improbable alternative accepted that the log was brought from a long distance. Evidence was furnished that the log was originally about eighteen feet long. Right beneath the log was a skeleton of a human being. A small pen had been made of small cedar saplings, arranged in the form of a tepee around the large log. The skeleton was about two feet below the original surface of the ground, and the earth forming the mound over the skeleton had a depth of about thirty-four feet from the summit. The earth to form the mound had evidently been brought in baskets by manual labor, as the "dumps" in some cases, formed by different tinted materials, could be distinctly seen. The circumstances favorable to the preservation of the cedar log had evidently aided in preserving the skeleton, and it is possible the size of the log had some relation to a distinguished personage. The body had been laid straight under the log, with legs extended and arms at the sides. Around each wrist were two bracelets, made of native copper, and several hundred shell beads were around the neck and on the chest. It is believed that the dry ashes with which the body had been covered, in addition to the great depth from the surface, had aided in preserving the log as well as the human remains. Even traces of hair were found around the skull, as well as dried and shriveled portions of the brain were found, while rude cloth and matting, as well as buckskin, put over the corpse before the ashes, were in a fair state of preservation. As the use of the cedar log would seem to have been a matter of choice, it opens a new field for speculation as to the possibility of the tree having had some special significance in the funeral ceremonies of the Mound Builders. A section of the log has been secured for the museum of the Academy of Natural Sciences, of Philadelphia—the exploration, indeed, having been made under the auspices of that body.

Painting Carriage Bodies.

Here is what an experienced man writes in Varnish: My subject is white lead. I have been experimenting with it for some time, and am fully convinced that it should be used very sparingly in the painting of a carriage body, and more especially as a putty. You naturally ask why?

What is white lead? It is a corroded metal, which is capable of being brought back to its original state, but with a loss of its weight, thus proving that it has not lost its metallic property of expansion and contraction.

How can we prove this? Let us make a white lead putty taper two inches long, one and a half inches at the large end and one inch at the small end. Let it get perfectly dry, then have it turned accurately and fit a brass ring to the large end when the putty is at a temperature of 30 degrees. Then raise it to 90 degrees and attempt to pass it through the ring. You will find that you cannot do it, thus proving that white lead putty expands at no uncommon change of temperature.

What are its adhesive qualities? Very little in itself. It is unlike glue or other resinous substance, which penetrates the fiber of the wood and in a manner clinches itself, but like the brick to the mortar, is held by absorption.

How can we prove this? Paint a thin board with three coats of white lead mixed with oil and turpentine (or brick is still better). When perfectly dry place it under an exhaust pump, and you will find that the white lead coats will part from the wood or brick.

Now, I need not tell you how we usually paint a carriage body, but we do not first coat it with lead and then freely coat it with a matter which has no expansive quality, except when subject to intense cold, and which contracts by heat. We here find that the element which expands the under coats contracts the outer ones. Is it any wonder that our paint cracks and peels off, or that our putty protrudes and shows? Or can you tell me of a varnish that we can expect to be capable of resisting the laws of nature?

THAT delectable and piquant fruit variously known as the shaddock and the grape fruit was first made known to Western palates by a certain Captain Shaddock, who was in the East Indian trade. Why the Florida fruit growers should have named it the grape fruit is a mystery we have never seen explained.

SHIPS OF THE NEW UNITED STATES NAVY.

In August, 1882, Congress approved an act to complete the double turreted monitors and for the construction of a 6,000 ton protected cruiser. This act was so vague that it was not until March 2, 1883, that Congress appropriated $1,300,000 to begin the construction of four ships. With these ships the new navy was born, and each year since it has been added to until we have now a naval list of nearly a hundred ships in commission, ready to be commissioned or building.

Among this number are five double turreted and thirteen single turreted monitors, six battle ships, one coast defense ship, twenty-five cruisers, one dynamite cruiser, one harbor defense ram, one naval school ship, eight gunboats, six torpedo boats (including one ram and one submarine), one survey and one dispatch boat, besides many vessels of smaller build and efficiency, serving in different capacities where they are respectively stationed.

Of the enumerated vessels, the six battle ships, eighteen cruisers, six gunboats, five torpedo and one dispatch boat, the naval school ship Bancroft, the harbor defense ram Katahdin, the dynamite cruiser Vesuvius and the coast defense ship Monterey, are built of steel.

The eighteen armored monitors, one cruiser, two gunboats, the survey steamer Ranger and the ram Alarm are of iron, while the old wooden ships include six cruisers and the store ship Mohican.

The ships are divided into four classes: (1) Armored, including the battle ships, monitors, cruisers and coast defense ships; (2) unarmored protected vessels, including cruisers, gunboats and dispatch boats; (3) unarmored ships of iron; (4) wood, comprising vessels of the old navy.

The illustrations on other pages will give our readers a fair idea of the appearance and the proportionate sizes of forty of these new vessels, the earliest built vessels being shown on the page to the left, and those of later construction on the right hand page.

The first class battle ships Massachusetts and Oregon, on page 200, are each of 10,231 tons displacement, 9,000 indicated horse power, developing a speed of 16 knots to the former and 16·8 knots to the latter. In armament these two ships are precisely the same, carrying four 13 inch, eight 8 inch and four 6 inch breech-loading rifles, sixteen 6 pounder and four 1 pounder quick fire, and four Maxim guns. The second class battle ship Texas has a speed of 17 knots with 8,600 indicated horse power and a displacement of 6,300 tons. She mounts two 12 inch and six 6 inch breech-loading rifles, twelve 6 pounder, four 1 pounder quick firing and four Maxim guns.

Of the protected cruisers, the Chicago has a displacement of 4,500 tons, a speed of 15 knots and 5,000 indicated horse power. Her battery contains four 8 inch, eight 6 inch, and two 5 inch breech-loading rifles, four quick fire and eight Maxim guns. The Baltimore has a displacement of 4,413 tons and indicated speed of 19·2 knots furnished by engines of 10,750 indicated horse power. Her battery has two 8 inch and six 6 inch breech-loading rifles, four 6 pounders, two 1 pounder quick fire and seven Maxim guns. The Philadelphia, with the same displacement as the Baltimore of 4,413 tons, has made 19 knots with 10,500 indicated horse power. She mounts twelve 6 inch breech-loading rifles, four 6 pounder, four 1 pounder quick fire and 7 Maxim guns. The San Francisco has displacement of 4,083 tons, a speed of 19·5 knots and engines of 10 500 indicated horse power. She carries twelve 6 inch breech-loading rifles, four 6 pounder quick fire and seven Maxim guns.

The Atlanta and Boston have each a displacement of 3,189 tons. The Atlanta has a speed of 15·4 knots, attained by 3,511 indicated horse power; the Boston requiring 3,780 indicated horse power to attain a speed of 15 knots. On both of these ships the batteries are the same, consisting of two 8 inch, six 6 inch breech-loading rifles, six quick fire, and six Maxim guns.

Of the unprotected cruisers, the Minneapolis has developed a speed of 23·073 knots, with engines of 21,000 indicated horse power. Her displacement is 7,475 tons, she carries one 8 inch and two 6 inch breech-loading rifles, eight 4 inch rapid fire, twelve 6 pounders, eight 1 pounder quick fire, and four Maxim guns.

The Cincinnati and Raleigh are government productions, having been built, the former at the Brooklyn navy yard, and the latter at the Norfolk yard. They are of 3,183 tons displacement, 10,000 indicated horse power, and a speed of 19 knots each. The Cincinnati carries one 6 inch and ten 4 inch breech-loading rifles, two 6 pounders, two 3 pounder quick fire, and four Maxim guns. Mounted on the Raleigh are one 6 inch breech-loading rifle, ten 5 inch rapid fire, eight 6 pounder, four 1 pounder quick fire, and two Maxim guns.

The gunboat Yorktown, one of the first four ships authorized, has a displacement of 1,700 tons, an indicated horse power of 3,400, develops a speed of 16 knots, mounts a battery of six 6 inch breech-loading rifles, four 6 pounder quick fire and five Maxim guns. After building and commissioning the next two gunboats Machias and Castine, they were found to be too topheavy in a seaway. To rectify this defect it was decided to lengthen them. Accordingly the two vessels were cut in two amidships and rebuilt, thus righting the blunder originally made. In these two vessels there is but one point of difference, the Machias having a speed of 14·5 knots from 1,600 indicated horse power engines with a displacement of 1,050 tons, where the Castine makes but 14 knots with the same horse power and displacement. In armament the two vessels each carry eight 4 inch rapid fire, four 6 pounder, two 1 pounder quick fire and two Maxim guns. The Petrel is of 890 tons displacement, has a speed of 13 knots, engines of 1,300 indicated horse power, a battery of four 6 inch breech-loading rifles, three 3 pounder quick fire and four Maxim guns.

The coast defense double turreted ship Monterey has a displacement of 4,048 tons, a speed of 16 knots, engines of 5,400 indicated horse power.

Mounted in her two turrets are two 12 inch and two 10 inch breech-loading rifles, with a lighter battery of six 6 pounder, four 1 pounder quick fire and four Maxim guns, mounted on the superstructure and in the fighting top.

The harbor defense ram Katahdin carries but a light secondary battery of four 6 pounder quick fire guns. She has a displacement of 2,050 tons, a speed of 17 knots, and engines of 4,800 indicated horse power. The dynamite cruiser Vesuvius has a displacement of 725 tons, a speed of 21 knots, and engines of 3,200 indicated horse power. She was designed to throw 600 pound charges of dynamite from her 15 inch pneumatic guns, which are supplemented by three 3 pounder rapid fire guns. The torpedo boat Cushing is of 116 tons displacement, has engines of 2,500 indicated horse power, and a speed of 22·5 knots per hour.

Among the vessels shown on page 201, the Iowa stands first with a displacement of 10,286 tons, indicated horse power of 11,000 and a contract speed of 16·5 knots. When ready for active service the Iowa will carry a battery of four 12 inch and eight 8 inch breech-loading rifles, six 4 inch rapid fire guns, twenty 6 pounder, six 1 pounder quick fire and two Maxim guns. The Indiana, now nearing completion, is one of the three heaviest vessels which at present are on the naval list. She has engines of 9,000 indicated horse power, a speed of 16 knots and a displacement of 10,231 tons. In armament and construction she is the counterpart in every particular of her sister ship Massachusetts. Her battery will have four 13 inch, eight 8 inch, and four 6 inch breech-loading rifles, sixteen 6 pounder, six 1 pounder quick fire and four Maxim guns. The second class battle ship Maine has a displacement of 6,648 tons, a speed of over 17·7 knots, and engines of more than 9,000 indicated horse power. She has four 10 inch and six 6 inch breech-loading rifles, with a secondary battery of twelve 6 pounder, four 1 pounder quick fire and four Maxim guns. The cruiser Brooklyn, now on the stocks, is an improved model of the New York. She is to have a speed, according to contract, of 21 knots, to be of 16,900 indicated horse power and have a displacement of 9,250 tons. Her batteries will be eight 8 inch breech-loading rifles, twelve 5 inch rapid fire, twelve 6 pounder and four 1 pounder quick fire, four Maxim guns and two light or field pieces.

The New York has a speed of 21 knots, triple expansion engines of 16,000 collective indicated horse power, and a displacement of 8,150 tons. Her armament consists of six 8 inch breech-loading rifles, twelve 4 inch rapid fire, eight 6 pounder, four 1 pounder quick fire, and four Maxim guns. The Newark has a displacement of 4,083 tons, an indicated horse power of 8,500, driving her at the called for speed of 19 knots. In armament she is inferior to the Chicago, carrying twelve 6 inch breech-loading rifles, four 6 pounders, quick fire, and nine Maxim guns. The Charleston has a displacement of 3,730 tons, engines of 7,500 indicated horse power at a contract speed of 17 knots. Mounting batteries of two 8 inch and eight 6 inch breech-loading rifles, four 6 pounder, two 3 pounder quick fire, and eight Maxim guns.

In the Marblehead and Montgomery the government contract calls for two ships of the same dimensions and armament, with displacements of 2,000 tons, engines of 5,400 indicated horse power, driving the ships at a speed of 18·3 knots. The batteries of these two ships comprise two 6 inch breech-loading rifles, four 4 inch rapid fire, four 6 pounder, three 3 pounder quick fire, and two Maxim guns.

The Concord and Bennington are similar ships in all but their displacement, the latter being 1,750 to the former's 1,700 tons displacement, with indicated horse powers of 3,400 and called for speed of 17 knots. In armament these two ships are identical, mounting six 6 inch breech-loading rifles, four 6 pounder quick fire, and five Maxim guns.

The Columbia has a displacement of 7,475 tons, engines of 21,000 indicated horse power and a speed of over 22 knots. She is probably the fastest cruiser in the world. In armament the Columbia and Minneapolis are identical, carrying one 8 inch, two 6 inch breech-loading rifles, eight 4 inch rapid fire, twelve 6