ships of the armored class, either battleships or cruisers. Japan indeed is the only nation that is building protected cruisers on any considerable scale; a fact which may be largely explained by the excellent work which was accomplished by this type of vessel in her war with China. The rapid growth of the Japanese navy is one of the most remarkable naval events of the last decade of the century. The new shipbuilding programme provides for four battleships, six first-class and three second-class cruisers together with several smaller vessels, and all of the ships are being pushed to completion with as little delay as possible. The progress of the United States navy is described under a separate chapter written by Lieut.-Commander W. H. Beehler, of the navy, which will naturally be of extreme interest to all Americans. Lieutenant Beehler traces the growth of the navy from the time of the Civil War to the present day. The administration is outlined at considerable length; then follows a description of the personnel, with tables giving the rank and total numbers of the various officers with their rates of pay, whether at sea or shore duty, or on leave or waiting orders. The same is done with regard to the chief petty officers and the various grades of seamen and other subordinates.

The chapter explains in detail the means by which apprentices enter the navy and the course of training which they subsequently undergo, and this part of the article renders in condensed form a considerable amount of information which is not easily accessible to the public. Considerable attention is paid to the navy yards and stations and the private shipbuilding yards, while the last few pages of the article are devoted to description of the latest ships that are now being constructed for the navy.

The succeeding chapter, by G. S. Clarke, is devoted to the Spanish-American war. It contains excellent plates of Manila Bay, the island of Cuba, Santiago Harbor, and of the coast to the westward of Santiago, along which the running fight between the Spanish and American ships took place. There are also plates showing the number and location of the hits made on Admiral Cervera's fleet, and a few small diagrams illustrating the method of disposing our warships during the blockade of Santiago. The whole chapter of over fifty pages forms one of the best compendiums of the Spanish-American war that has yet appeared, and the lessons of the war as drawn by the author are conservative and just and in the main agreeable to the expert estimate of these events as generally made throughout the world.

The chapter on recent warship construction, written by the editor, assisted by Captain Orde Browne, is perhaps one of the most valuable in the whole work, and the table published on page 176, showing the comparative qualities of eight of the latest first-class battleships in the world, will form a subject of interesting study for every one who follows closely the subject of warship construction. The battleships taken are the "Formidable" and the "Duncan," of 15,000 and 14,000 tons displacement respectively, of the British navy; the "Iéna," 11,870 tons displacement, of the French navy; "Kaiser Friederich III.," 11,130 tons, of the German navy; the Russian "Petropavlovsk," of 10,960 tons displacement; the Italian "Benedetto Brin," of 12,564 tons; the United States "Maine," 12,500 tons; and the Japanese "Shikishima," of 14,850 tons displacement. Accompanying this table is another showing the energy of gun-fire per minute for each ship. The largest vessel in point of dimensions is the "Benedetto Brin," which is 413½ feet long, by 27 feet draught, and has the enormous beam of 78 feet. Evidently her model must be exceedingly fine, as she displaces only 12,564 tons as against 15,000 for the shorter and narrower and shallower British ship "Formidable." The Italian ship has the thinnest armor, only 6 inches on the belt; she has the most powerful fire energy, the total amount being 600.745 foot-tons per minute. The "Iéna" has the smallest energy, 431,423 foot-tons. With new guns and smokeless powder, the "Maine" is estimated at 560,513 foot-tons, or about the same as the Japanese "Shikishima." The fire energy of the British ships is, as usual, relatively less than that of the others, being for the "Duncan" class 489,706 foot-tons per minute. This is compensated, however, by the high speed of 19 knots with natural draught, which would be equivalent to about 21½ knots with forced draught.

There is a marked tendency in the latest ships to reduce the thickness of the armor and spread it over a larger area of the ship's side. In the British vessels of the "Formidable" class the belt is 9 inches, and the side armor above the belt is 9 inches. In the "Duncan" class it has been reduced to 7 inches; in the "Iéna" the belt is 13¾ inches, and the side armor 4¾ to 3 inches thickness. The "Kaiser Friederich III." has a maximum thickness of 11¾ inches in the belt; it has no side armor above the belt. The "Petropavlovsk" has a 15¾-inch belt; the "Benedetto Brin" has a 6-inch belt and 6-inch side armor above it; the "Maine" a 12-inch belt, with 7-inch side armor; and the "Shikishima" has a 9-inch belt and 6-inch side armor. All the ships carry 6 inches of armor for the protection of the secondary battery, except the "Maine" and the "Iéna," the former having 5½ inches for this battery, and the French no protection beyond that afforded by shields. The 5½-inch side armor of the "Maine" is, however, continuous, while the 6-inch armor on many of the other vessels is placed only upon the casemates. Looking the comparison over carefully, we have every reason to be satisfied with our own "Maine," which we think stands as the best all-round fighting ship in the table. We cannot but feel, however, that she would be greatly improved if Krupp steel was substituted for the Harveyized armor, and the weight so saved were allotted to a battery of four 8-inch rapid-fire guns, these four to take the place of four of the 6-inch rapid-firers in the present battery.

In the chapter on coast fortifications the author divides the ports of the British empire into three classes: commercial ports, naval or dockyard ports, and supply ports or coaling stations. He does not believe in the extensive fortification of commercial ports as such, and would confine the erection of strong fixed defenses to the naval dockyards and the coaling stations. Regarding commercial ports, defended by mine fields, protected by rapid-fire batteries, with the fields so arranged that the mines could be kept permanently in place, or so that whole system of mines could be laid down in a short time, the author considers that the former method would be impossible because intolerable, as shown by the inconvenience experienced by New York in the late Spanish American war. It is considered that to carry out the second of the above named methods would "require an amount of time which would more than suffice to assemble the armed defenders whose presence would secure the place against hostile molestation far better than obstructed channels or fixed batteries." Whatever may be the case with regard to Great Britain, the writer is mistaken in his estimate of the situation at New York, where a very effective system of mines was laid down in a comparatively short period of time and would, we believe, have proved an effective safeguard to the city had we confronted a more energetic and formidable foe. Moreover, the mines were laid long before our volunteer army was in a position to take the field. Under our present system it is evident that submarine mines must constitute for many years to come the most effective defense available for our maritime cities.

THE AUTOMOBILE TRIP FROM CLEVELAND TO NEW YORK.

The first attempt in this country to use a standard automobile carriage on a continuous high speed trip of several hundred miles must certainly be considered a triumph for the new form of locomotion. The Winton carriage which left Cleveland on Monday, May 22, reached New York at 5:30 P. M. on Saturday, May 27, having covered the whole distance of 707·4 miles in the actual running time of 40 hours and 4 minutes. This is an average running speed of 17½ miles an hour, and in view of the fact that long stretches of the road were in a poor condition, and that some sections are spoken of as being disgraceful in the extreme, this is a highly creditable performance. The fastest average for a continuous run was made between Cleveland and Buffalo, where the distance of 218 miles was covered in 11 hours at the rate of a fraction under 20 miles an hour. The carriage weighs 1,700 pounds, and is driven by a 6 horse power motor. It is made in three different sizes; and good illustrations of the type appeared in the recent automobile number of the SCIENTIFIC AMERICAN.

The fastest speed for a long-distance journey was that accomplished by the winning carriage in the recent automobile race from Paris to Bordeaux, when a petroleum-driven carriage covered the distance of 353 miles in 11 hours 43 minutes and 20 seconds, an average speed of thirty miles an hour. This was a truly sensational performance, but there are circumstances which bring it within the limits of comparison with the Cleveland-New York journey. For it must be borne in mind that the Paris-Bordeaux roads are of the very finest surface throughout, and the vehicle, unlike the Winton carriage, was a special racing machine equipped with a fourteen horse power engine.

By sacrificing everything to power it is quite possible to build an automobile that will cover a straightaway mile at the rate of 60 miles an hour; and it has recently been reported from Europe that this speed has been attained more than once. These sensational speeds however do not interest the public so much as the question of maintaining a high average speed with motor-carriages of the standard make. The recent trip from Cleveland to the eastern seaboard proves that economical and speedy long distance automobolism will be within the reach of the public in the near future.

PHOTOGRAPHY IN RELIEF.

A new method for producing reliefs by the aid of photography has been devised by M. Lemac, who in this manner has produced fine medallions from living persons. His process has been described at a meeting of the Société Française de Photographie as follows:

The model, which it is not necessary to powder or treat specially, is placed in front of a black background, presenting the profile to the camera. Two plates are successively taken, avoiding all displacement of the model between the two exposures. For these the source of light should have as small dimensions as possible, a cartridge of powdered magnesium being preferred; this should be maintained in a plane perpendicular to the axis of the objective and slightly nearer the latter than it is to the model. During one of the poses the model is lighted about three-quarters in front, and for the second, three-quarters to the side. Negatives are obtained on films, which are then placed exactly over one another. In this way the most salient points of the face are represented by an intense black, these having received the maximum of light in one or the other exposure; the less lighted portions are gray, and the hollows, having been each time more or less in shadow, appear as transparent places in the negative. With this combination a print is made upon a paper which permits of easy retouching, such as platinum paper. This print is then retouched in order to bring out the hair and drapery. If letters are desired on the medallion, these are drawn with Chinese white or India ink, according to whether they are to be raised or depressed in the medallion.

The outline of the plaque or medallion is traced in India ink, according to the shape desired. This proof in black and white is then reproduced to the desired size, giving a negative from which are made the proofs in relief.

For low reliefs, proofs are made on a sheet of bichromated gelatin in the usual way, but to obtain high relief, one proceeds in the following manner: A thin layer of gelatin is flowed upon a sheet of a spongy substance which swells easily in water. The gelatin is sensitized with bichromate, and after drying, is exposed under the negative last obtained, and then submitted to the action of water, which washes out the portions shielded from the action of light, causing depressions, while the unexposed and impermeable parts are swelled out by the action of the water, thus producing a high relief, which corresponds to that of the model. Upon the relief so obtained fine plaster of Paris is flowed, and the hollow mould obtained is retouched. This constitutes the final mould for the reproduction of proofs. This process is not difficult to carry out by one accustomed to photographic manipulation; the time occupied in retouching the black-and-white print as well as the plastic mould is not more than one hour for a medallion-head of natural size.

THE BIRTH-RATE IN EUROPE.

Scientists and statisticians of France have been for some time occupied with the question of the decrease of the birth-rate in that country. This naturally leads to the investigation of the birth-rate of the other countries of Europe, in order to find out whether France is the only country going down the scale. For this purpose the tables published by Signor Bodis, a prominent statistician of Italy, are of value; these tables have in fact been made the base of various investigations as to the movement of population. Below is the order in which the countries of Europe are classed in decreasing series, according to their mean birth-rate:

1. Russia in Europe	12. England and Wales
2. Hungary	13. Scotland
3. Servia	14. Denmark
4. Roumania	15. Norway
5. Austria	16. Belgium
6. German Empire	17. Sweden
7. Italy	18. Switzerland
8. Spain	19. Greece
9. Finland	20. France
10. Portugal	21. Ireland
11. Holland	

Thus we find that Russia has the largest percentage of births, and France and Ireland the smallest.

To find out whether in any of these countries the birth-rate is on the increase or decrease, the figures for each for different years are examined, and we thus find that in all except five the movement of natality is on a decrease more or less rapid. M. Vauthier, analyzing the figures obtained by Signor Bodis, draws the following conclusion as to the diminution of the number of births:

The country of Europe in which the decrease is most striking is England, including Wales, whose coefficient of decrease is 0·306 per 100; Scotland, whose mean birth-rate is nearly the same, decreases but 0·027 per 100; and Ireland, whose birth-rate is much smaller, decreases only 0·0233 per 100. Somewhat after England and Scotland, but before Ireland, are found Holland and Germany, having a coefficient of decrease of 0·0244 per 100, followed closely by Belgium (0·0239). Then, passing by Greece (0·0209), one reaches France, whose natality decreases annually by 0·0179 per 100. After France comes Russia (0·0158), Sweden (0·0147), Switzerland (0·0128). Last are found, having less than 0·01 per 100, Denmark (0·0078), Austria (0·0077), Pomerania (0·0033) and Hungary (0·0024).

As to the countries in which the birth-rate is on the increase, we find the following series: Italy, by 0·0083 per 100; Spain, by 0·0040; and lastly Servia and Norway, with coefficients of 0·0017 and 0·0012 per 100, being thus nearly stationary.