

IMPROVED CALIPERS.

To facilitate the proper aligning of shafts in a line of shafting, the calipers shown in the accompanying illustration have been devised and patented by Fred A. Thompson, of Eureka, Wis. Fig. 1 is a plan view showing the use of the device with the shaft in section, the calipers indicating the distance from the center of the shaft to an auxiliary guide line, and Fig. 2 is an inverted plan view. The device comprises a main frame provided with angular guide arms, the frame having a rest adapted to be seated on the surface of the shaft, caliper arms being fitted to slide on the angular guide arms, and a block being held to slide on the frame: links connect the block with the caliper arms, to bring their points in contact with the surface of the shaft at opposite points and at right angles to a radius at the point of contact of the rest with the shaft. After the desired adjustment is made the several parts are locked in place by screwing up the clamping screw. The frame is provided with a graduation, not shown, reading the diameter of the shaft on which the calipers are placed, and is read by a pointer or mark from the guide block, to indicate the distance from the center of the shaft to the guide line.

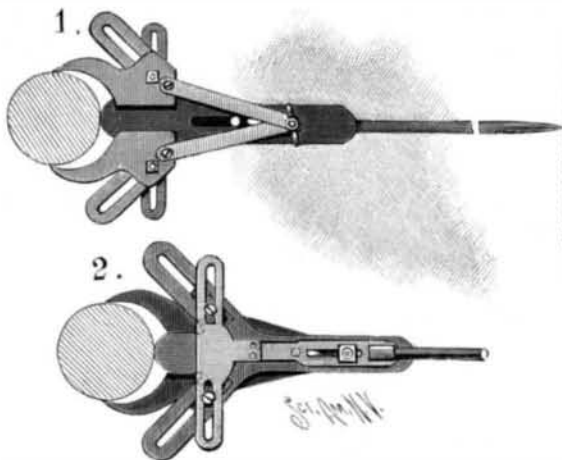
SPANISH DESTROYERS AND TORPEDO BOATS DESTINED FOR CUBA.

We present an illustration which will be of special interest in view of our present critical relations with Spain. It represents several of the destroyers, torpedo boats and torpedo gunboats which are destined for service in Cuban waters.

The first division, which includes the torpedo boat destroyers "Pluton," "Terror" and "Furor," and the torpedo boats "Rayo," "Halcon," and "Azor," is under the command of Fernando Villaamil. The second division will consist of the torpedo boat destroyers "Osado," "Audaz" and "Proserpina" (which are about completed by the builders at Glasgow) and the torpedo boats "Ariete," "Habana" and "Barcelo."

These boats are the pick of the Spanish torpedo flotilla. They represent the very latest developments in torpedo boat design, and one of them, the "Ariete," was at one time the most notable vessel of its kind in the world. This little craft is a torpedo boat proper as distinguished from the later destroyers. She was built to the order of the Spanish government in 1887, by Thornycroft, of London, and on her trial trip broke all existing records by maintaining a speed of 26.1 knots per hour. This was considered phenomenal at the time, and remained for several years the record speed for a steam vessel; indeed, it was not until such large vessels as the "Havock" and "Hornet" made their appearance in 1893 that her performance was surpassed.

same horse power but two knots less speed. Their armament is the same, but they carry an additional torpedo tube. These boats were built by Yarrow, of London, in 1887. The "Habana" was built by Thornycroft, in 1887. She is a small boat of 59 tons displacement, has two torpedo tubes and has 21.3 knots speed. The "Barcelo" was built by Normand, well known as the inventor of the boiler which bears his name and by the successful torpedo craft which he has turned out. She is of 66 tons displacement and 19½ knots speed and

**THOMPSON'S CALIPERS.**

carries two torpedo discharges. All of these boats are designated as first class and are comparable in speed and equipment with similar boats in other navies.

The strength of this flotilla, of course, lies in its brand new destroyers. The destroyer is an enlarged torpedo boat provided with sufficient size and power to enable it to keep the sea with a fighting fleet—something that the torpedo boat cannot do. In the course of the English naval maneuvers it was soon discovered that the high speed of the torpedo boat was strictly a fair weather speed, and naval constructors realized that greater weight, size and power were necessary to render these little craft serviceable anywhere outside of sheltered waters. At the same time the enormous increase in the torpedo boat flotillas of other European navies necessitated some defensive action against them, and it was resolved to build a fleet of vessels of from 300 to 400 tons displacement, armed with powerful guns, which would be capable of running down and destroying torpedo craft. Hence the name "destroyers."

Of the three which are in active service, the "Furor" and "Terror" were launched in 1896. They are 220 feet

fires a 3-inch shell weighing 12 pounds with a velocity of 2,200 feet a second, which is capable of penetrating 8 inches of iron at the muzzle; so that it can be seen that one of these boats could annihilate a torpedo boat as soon as it had run up within range.

Of the other four destroyers, one, the "Pluton," is already in service, and the other three, the "Audaz," the "Osado" and the "Proserpina," will sail at an early date. The "Pluton" was illustrated in the SCIENTIFIC AMERICAN of December 25, 1897. These four are identical in all respects and they have the characteristic of being considerably the largest destroyers in the world, being of over 100 tons greater displacement than the latest English boats of this type. Their speed, however, is not so great by 2 knots. The particulars are as follows: Length, 225 feet; beam, 22½ feet; draught, 5.8 feet; displacement, 400 tons; speed, 30 knots; horse power, 7,500; coal capacity, 100 tons; and complement of men, 70. They carry two torpedo discharges and their armament is identical with that of the "Furor" class.

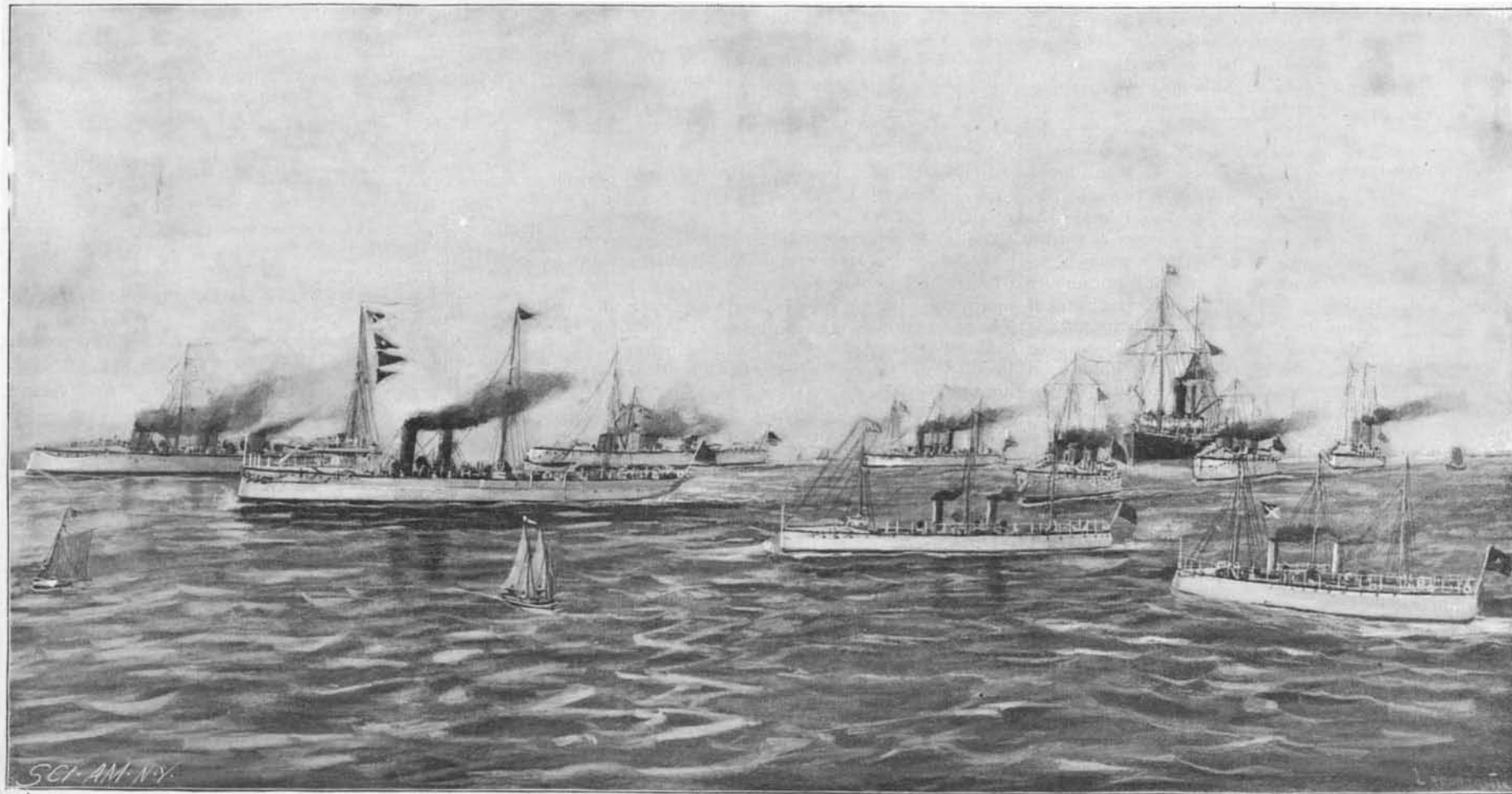
In bringing these boats over the Atlantic everything will be done to guard against accident and disablement in heavy weather, especially in the case of the smaller boats. The guns will be unshipped to reduce top weight and provide additional coal carrying capacity for the long journey.

The larger vessels shown in the cut are the "Destructor" and the "Transatlantico." The former is a torpedo gunboat of 458 tons displacement; 3,800 horse power and 22½ knots speed. She is armed with three 5-inch guns, four 6-pounders and four machine guns, and she carries three torpedo tubes. The Spanish navy is strong in this class of vessel, a large number of gunboats of from 500 to 800 tons having been built for service in the Cuban and Philippine waters.

Our illustration is reproduced from La Ilustracion Española y Americana.

The Current Supplement.

The current SUPPLEMENT, No. 1159, contains many papers of more than usual interest. "Tests of the Synchronograph on the Telegraph Lines of the British Government" is an important paper which supplements the series begun in SUPPLEMENTS No. 1114 and 1115. It is profusely illustrated with maps and diagrams. The "Diesel Heat Motor" is an important paper dealing at considerable length with the interesting motor shown in last week's SCIENTIFIC AMERICAN. The battleship "O'Higgins," which, according to rumor, has been purchased by Spain, is illustrated and described. "The Russian Petroleum Industry" describes the production of refined petroleum on the Caspian Sea. The article is ably written and is profusely illus-

**SPANISH TORPEDO FLEET DESTINED FOR CUBA.**

The "Ariete" is 147½ feet long and of 97 tons displacement. She has 1,600 horse power and carries an armament of four 3-pounder rapid-fire guns. She is provided with two torpedo tubes. The "Rayo" is a sister boat to the "Ariete," was also built by Thornycroft, but is credited with half a knot less speed.

Of the other torpedo boats, the "Azor" and the "Halcon" are larger boats of 108 tons. They have the

long, 22 feet beam and 5½ feet draught, with a displacement of 380 tons and a speed of 28 knots. They have twin engines of 6,000 horse power and bunker capacity for 100 tons of coal. There are two torpedo tubes and the complement of men is 67. The armament is heavy—too heavy according to the ideas of our own designers—consisting of two 12-pounder rapid fire guns, two 6-pounders and two 1-pounders. The 12-pounder

trated. There is also an excellent formula for papier maché, which is so often desired by our readers. For a full table of contents see page 178.

THERE were 31,110 students matriculated at German universities the past winter semester, an increase of 1,000 over last year. The largest increase is, as usual, in the law faculty.