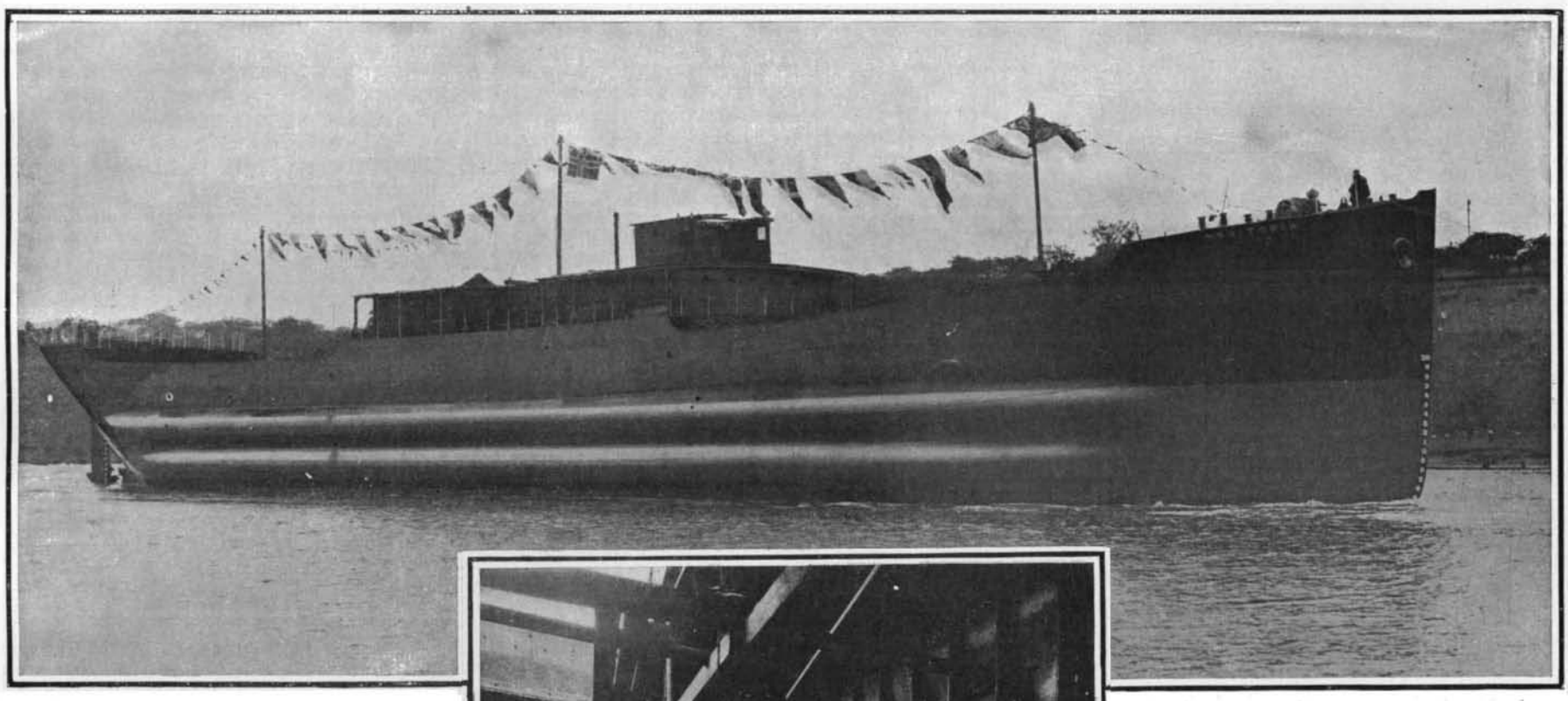
CORRUGATED SYSTEM OF SHIP CONSTRUCTION.

The interest of the shipping world has been aroused by a new departure from the ordinary lines of ship construction, as exemplified in the steamship "Monitoria," which recently left the Hylton shipyards of Messrs. Osbourne Graham & Company of Sunderland. This vessel of 3,300 tons marks a new development in shipbuilding design, being built upon what is known as the Monitor or corrugated system. For several years past experiments have been carried out by the Monitor Shipping Corporation of Newcastle-on-Tyne, to determine the best method of increasing the longitudinal strength of a ship without any corresponding increase of weight. To this end the underwater part of the hull between the light and load lines was corrugated for almost the entire length of the vessel. Continued investigation and experiment resulted in ascertaining the definite form of this corrugation, and at last it was resolved to test the system practically in a full-sized vessel. The Ericsson Shipping Company, of Newcastle-on-Tyne, undertook to build a craft on these lines, and the "Monitoria," now on her first trip, was the outcome. The vessel measures 279 feet in length by 40 feet 1½ inches normal extreme breadth, increased by the Monitor projection to 42 feet, with a molded depth of 20 feet 7½ inches.

In the accompanying illustrations the forms of construction of the corrugation are clearly shown. The shell plating is swelled out in two places on either side longitudinally, the curve being somewhat flat, and the upper and lower edges curving gradually into the flat side of the normal vessel. The main frames measure 8 inches by 3 inches, and the depth of the corrugation is 11½ inches at the crown. Plain angles are attached to each main frame and a corrugation gusset plate at each frame. There are no side stringers.

The very important result is obtained in this design that the projections give considerable increase in the hogging and sagging strength, so that the stress on the material is reduced at both keel and gunwale. The construction of the sides of the ship with these corrugations is rather an addition than a vital alteration of the main structural system, and it can be applied to any type of steamship. The builders claim that the extra cost is slight; and the dead weight carrying capacity is increased from three to four per cent. The coal bill is reduced from 12 to 15 per cent for the same speed; or, if the coal consumption is maintained as before, the speed of the ship with the extra dead weight is increased from 0.25 to 0.5 knot according to the size and class of the ship.



These corrugations increase the stiffness and longitudinal strength of the vessel.

THE "MONITORIA"—A CORRUGATED SYSTEM OF SHIP CONSTRUCTION

THE GABET WIRELESSLY-CONTROLLED AUTOMATIC TORPEDO.

On Wednesday, June 23rd, experiments were made with the wirelessly-controlled torpedo of Gabet, to which reference has already been made in these columns. In the experiments on the banks of the Seine endeavors have been made to control the torpedoes from a small boat about 100 meters (328 feet) distant from them, containing a plant for producing Hertzian waves.

The torpedo motor was started and stopped at will, and the rudder turned in every direction at the will of the man in the boat.

The improved Gabet torpedo consists mainly of a large cylinder terminating in two cones and forming the lower part of the apparatus. Some distance above, about 1.5 meters (5 feet), there is another similar cylinder, only smaller and intended to float. The lower shell is 9.5 meters long (31 feet).

The two tubes are fastened together by a series of very strong steel tube frames. Besides these two other shafts, rather large in diameter, start from the lower body, extend beyond the float, and form two rather short, vertical masts. Each one of these carries an acetylene light. They are connected by a copper wire.

Let us now examine the parts composing the lower shell, which is the most important. It is divided into several compartments, having each its particular use.

The first compartment is situated in the fore part of the lower shell. It contains the explosive charge and controls a warhead similar to the warheads of all present-day torpedoes, which produce the explosion of the charge instantly on contact with a hard body, such as the hull of a vessel.

While all ordinary torpedoes carry only 70 to 100 kilos of explosive (154 to 220 pounds), the Gabet can take 900 kilos (1,980 pounds) with correspondingly greater destructive effect.

The Gabet torpedo contains an internal-combustion motor operated by gasoline, a decided novelty. Compressed air as now used in torpedo motors may supply powerful engines, but the radius of action is very

Launching the improved Gabet wirelessly-controlled torpedo.

The wave-transmitting apparatus set up in a small boat.

THE GABET WIRELESSLY-CONTROLLED AUTOMATIC TORPEDO.

limited. The speed of torpedoes thus operated reaches 30 knots, or about 50 kilometers an hour.

It is manifestly very dangerous to shut in a gasoline motor in a confined space or nearly so, as is the case here, where communication with the outer atmosphere takes place only through the upper part of the foremast.

Ventilation is effected by means of a large blower, situated aft, between the motor and the chamber containing the storage batteries. The precautions taken seem sufficient to dispel all fear of serious accidents.

The motor is located in the compartment aft of the torpedo. It is therefore entirely separated from the explosive charge, with which it cannot communicate by any manner whatever.

The torpedo used for the present experiments develops 30 horse-power. It has a motor with eight cylinders arranged in V shape. But the compartment is large enough for a 300-horse-power multiple-cylinder motor, which is necessary to impart to the torpedo the estimated speed of 20 knots, or about 36 kilometers an hour.

Regarding weight, every necessary margin is allowed, since the torpedo can carry 1,800 kilos (3,960 pounds) of ballast under present conditions, that is to say, with a 30-horse-power motor. This ballast represents the difference between the weight of an electric motor with its storage batteries and the weight of the internal-combustion motor developing this power.

Gabet expects to attain a 10-knot speed with the 30-horse-power motor which he will use in his preliminary trials, before putting in the 200-horse-power motor, on which he relies to obtain the 20 knots that he considers sufficient speed.

Endeavors have been made to obtain for this dirigible torpedo all the advantages that could be had on a real vessel. In particular, it was sought to fit it with the means for maneuvering and altering the speed. This problem seems strangely difficult of solution. The trouble has been overcome by using a reversible screw, with which it is only necessary to turn the blades so as to diminish their effectiveness on the water: this promptly reduces the speed. By this means a propeller is obtained that acts as well moving forward as backward when given the same speed of rotation.

There was another great difficulty to surmount before this screw could be used. The power exacted from the motor varied considerably with the speed. It became necessary, therefore, to find a way of reducing the power developed by the motor and of providing against its running away as the resistance of the propeller tended to diminish.

To attain this end the spark is retarded as the speed of the torpedo is reduced. The motor speed is thus gradually changed by the variation of the pitch of the screw. This variation of pitch of the propeller has been availed of to act upon the timer of the motor.

For that purpose the pitch-controlling mechanism has been connected with the timer by a jointed rod, so that the spark advance is at its maximum when traveling full speed forward or backward. The pitch-controlling mechanism is also connected to the throttle valve, in order to simultaneously diminish, in certain proportions, the volume of gas admitted.

The third compartment of the torpedo contains a small storage battery. This is not intended to drive the torpedo, but to operate a relay that helps maneuver the boat under the influence of the Hertzian waves acting on special devices.

The compartment back of the explosive charge contains the Hertzian controlling instruments. They are sufficiently effective to act even at as great a distance as 8 to 10 kilometers (5 to 6 miles) from the transmitting station. This distance is a convenient one at the present time, for warships get into action at least at 7 or 8 kilometers (about 4 miles) away.

We have said that the two masts of the torpedo carried acetylene lights. These serve to show the position of the torpedo at every moment, and indicate clearly every change in its course.

It is absolutely necessary to know what is going on inside the torpedo and what influences may act upon it. For although the receiving instruments of the Hertzian waves have been made as perfect as possible, they may come under the influence of other waves than those sent from the transmitting station. In this case, the torpedo would obey other agencies and would deviate from its course.

To remedy this serious objection lanterns have been disposed about to flash signals in such a manner that the operator, placed on shore or on a ship, may recognize the nature of the directions received by the torpedo. In short, every time the torpedo receives waves registered by its instruments, the lanterns show signals to indicate the direction of the torpedo. If these signals lead the operator to believe that the waves come from the enemy, he does what is necessary to rectify the course of the torpedo, and he nullifies the disturbing waves.

We presume that the wireless control of the torpedo remains as we have previously described it. The reader interested in that phase of the construction is referred to Scientific American Supplement No. 1650.

THE "ZEPPELIN III." AIRSHIP AND ITS TRIP TO BERLIN.

The large photographs of the latest Zeppelin dirigible reproduced on our frontispiece this week give an excellent idea of this new leviathan of the air, which made its first long-distance flight from Friedrichshafen to Berlin a little more than a month ago.

The start of this memorable journey occurred at 4:35 A. M. on August 27th. The airship started against a light northeast wind. Besides Engineer Durr and young Count Zeppelin (the nephew of the inventor), only three mechanics were carried. The crew was reduced to but five men because of the uncertain weather and in order to reduce the weight carried as much as possible. The airship arrived at Ulm at 6:45 A. M., having made the 80 kilometers (49.7 miles) in two hours and eight minutes, at an average speed of about 23.3 miles an hour. This speed was maintained up to Heidenheim, a place located on the frontier of Wurtemburg and Bavaria, which was passed at 7:30 A. M. Soon after Gingen was reached. The airship remained here about an hour and described circles, while all the time it was fighting against the contrary wind blowing from the direction of Wurtemburg. Soon after Engineer Durr sent a telegram stating that the airship would be forced to land at Nuremberg, on account of a cracked cylinder in one of the forward motors in the forward car. On account of this mishap, the speed was reduced considerably, the airship finally arriving at Ostheim, near Gunzenhausen, 21¾ miles from Nuremberg, at 11:45 A. M. At this point a broken propeller—which was immediately replaced by an old one that was carried on board—made it necessary to land. Advantage was taken of the landing to renew the water ballast. After a delay of 2½ hours, the airship started again at 2:10 P. M. for Nuremberg, which was reached at 4:45 P. M. A landing was effected against a strong wind. Before landing the dirigible described several circles, in order to give the 120 soldiers of the Fourteenth infantry regiment time to make preparations for anchoring it. When the airship alighted, the crowd broke bounds, and it was feared that they would damage it. Fortunately, however, this fear was not realized.

The start from Nuremberg was made the following day at 2:15 A. M. At 4 A. M. it passed above Bayreuth, where it was buffeted by the wind for three hours. Engineer Durr dropped a card at 7 o'clock stating that all was well on board. At 8 o'clock the airship, still battling against the wind, returned to Bayreuth. It then resumed its journey, but was able to make a mean speed of only 14 kilometers (8.7 miles) an hour. It passed Munchberg at 9:40, Hof at 10 o'clock, and Plauen at 12:10 P. M. It was making only 30 kilometers (18.64 miles) an hour. Werdau was passed at 1:45 P. M., and although the wind had completely died out, the speed of the airship grew less and less. It was hoped that it would reach Leipzig by 10 P. M., when another accident occurred. One of the blades of the propellers broke, and it was only with the greatest difficulty that the airship was able to reach Bitterfeld. It arrived at this place at 6:45 P. M., having been driven from Eilemburg by a single motor. A successful landing was effected.

Repairs were made during the night, and the next morning at 7:30 A. M. the airship left Bitterfeld in a heavy fog. The fog dissipated rapidly, however, and when the airship arrived above the Tempelhof parade ground at Berlin at 12:30 P. M., the weather was clear. The Emperor and the other members of the royal family were on hand to receive Count Zeppelin, who had gone aboard his airship at Bitterfeld. Emperor William introduced him to Orville Wright, and this meeting of the two champions of the heavier-than-air and the lighter-than-air type of flying machine was decidedly novel. The landing of the airship occurred above the parade ground at Tegel, after it had first performed evolutions above the Tempelhof parade ground and afterward flown over the city of Berlin. One of our photographs shows the airship above the city, and the other shows it just before alighting.

The return voyage was started at 11:30 P. M. the same day. The airship followed the Wittenberg-Juterbog railway line for a considerable distance, when it again met with another accident, due to the breaking of a propeller. The blade tore through the envelope of the airship, and punctured one of the balloons. The accident happened near Bulzig, about 60 miles from Berlin, and with the aid of some farmers, the airship was immediately brought to land in a field near the railroad track. The speed up to the time of the accident was extremely slow, and barely reached 20 kilometers (12.43 miles) an hour. Count Zeppelin was not on board at the time of this accident, he having returned to Friedrichshafen by rail. The airship was obliged to remain at Bulzig for nearly three days. It was not until 10:53 A. M. on the morning of September 5th that another start was made. Ulm was passed at 7:45 P. M., and Biberach at 8:25 P. M. The airship finally arrived at Friedrichshafen at 9:30 the following morning after a continuous voyage of 22 hours and 37 minutes. The average speed maintained from Bulzig therefore was only 14.3 miles per hour.

After the "Zeppelin III." had been repaired, an effort was made to sail it to Hergentheim, 120 miles from Friedrichshafen, to take part in the maneuvers; but the repairs were not finished in time, and the airship was unable to reach its place until the maneuvers were over. Considerable excellent work was done, however, by the "Gross II." military dirigible at these maneuvers. This dirigible was able to reconnoiter from a great height and to send messages to the rear. Emperor William was greatly pleased at the work done by this airship at the maneuvers.

The "Zeppelin III." is the largest and most powerful airship which Count Zeppelin has yet built. It has two 150-horse-power motors, each of which drives, by means of belts, two two-bladed propellers. These are located one on each side of the airship about a third of the way up from the bottom. They are held upon brackets projecting out from the rigid frame. The driving of the propellers by belts is a new arrangement, as heretofore they have been driven by shafts and bevel gears. The stabilizing fins near the rear end are somewhat different from before, there being two upon each side placed above the center horizontal line of the airship. The up and down steering is accomplished by quadruple horizontal rudders on each side of the airship at the front and at the rear. Besides this, water ballast is carried in a long tank connecting the two cars.

It is planned to use this airship for carrying passengers in different cities in Germany in the near future.

The Current Supplement.

The opening article of the current Supplement, No. 1761, discusses the San Salvatore mountain railway of Italy. Beautiful views of this picturesque road are published. The classification of chemical elements, in the light of Mendelejeff's great generalization, and in the light of the electronic theory, is considered by Prof. H. E. Armstrong in a thoughtful paper. A critical *résumé* of Prof. Wood's experiments with rotating liquids used as mirrors is presented. A perpetual clock is described by Charles E. Benham. A new system for the electrical transmission of pictures is described by Dr. Robert Schoenhoefer. Prof. Albert F. Ganz's paper on recent electrical progress in the artificial lighting field is concluded. The great rise which is announced in the price of India rubber tires directs attention once more to the various and conflicting problems presented by the wheels of motor cars. These are critically considered. Prof. William H. Pickering presents his view of the origin of meteorites, and advances the theory that meteorites are of terrestrial origin. The disappearance of the Bosgoslav Islands is described. Sir Norman Lockyer, the well-known English astronomer, has made a special study of the astronomical value of ancient temples. The result of his researches is presented in an article entitled "The Uses and Dates of Ancient Temples."

The Death of Robert Hoe.

Robert Hoe, senior member of the well-known firm of R. Hoe & Co., printing-press manufacturers, of New York city, died in London on September 22nd, at the age of seventy. Mr. Hoe was for years the head and front of the extensive business founded by Robert Hoe in 1803. His devotion to the enormous enterprise with which his name was connected, was exhibited not only in an administrative capacity, but also in the suggestion of many improvements in printing presses. His invention of the rotary multi-color and half-tone web presses, now found in every newspaper and job printing plant, is perhaps his most important contribution to the printing art. Mr. Hoe was the author of several books, most of them dealing with printing. Among them is a history of the development of the printing press from the time of Gutenberg down to the present day.

The railway from the Piræus to the Turkish frontier (246 miles) may be said to be practically completed, the section from Bralo to Larissa having been opened to traffic since October last, and trains now run in twelve hours from Athens to Larissa. The construction of the final section of 28 miles to the frontier is in an advanced state. There remains, then, in order to release Greece from the isolation which she is the last of European States to suffer, but 70 miles between the frontier and the nearest station on the Ottoman railway system. There appears no indication, however, of any disposition on the part of the Ottoman government to facilitate the construction of the junction line, and it will be regrettable if the reformed government of Turkey continues to oppose a project so evidently appertaining to an era of civilization and progress.